

mycin II, m.p. 220–235° (dec.), pK_a 5.5 and 8.5, $[\alpha]^{25}_D + 16^\circ$ (in cellosolve), *anal.* Calcd. for $C_{22}H_{21}N_2ClO_7$: C, 57.32; H, 4.56; N, 6.08; Cl, 7.70. Found: C, 57.30; H, 4.62; N, 5.81; Cl, 8.02.

The infrared absorption spectrum of II shows no bands from 5 to 6 μ (amide carbonyl at 6.0 to 6.1 μ) thus eliminating the presence of a phthalide, other lactones, and any non-conjugated ketonic groups. The ultraviolet absorption spectra in 0.1 *N* sodium hydroxide exhibits maxima at 230 (E 25,500), 272 (E 37,200), 345 (E 6,440) and 445 $m\mu$ (E 11,000) and in 0.1 *N* hydrochloric acid at 227 (E 26,500), 277 (E 44,000) and 445 $m\mu$ (E 8,250).

The aromatization of ring C by the loss of the water is not only shown by spectral changes but also by the failure of the compound to form 5-chlorosalicylic acid on alkali fusion (all previously discussed C_{20} and C_{22} compounds do give 5-chlorosalicylic acid) yet ring D is found to be unaffected since on alkaline peroxide oxidation 5-chloro-6-acetylsalicylic acid is obtained.

Dimethylamine and ammonia (with loss of carbon dioxide) are eliminated from II as from other C_{22} compounds.

It is unlikely that rings B and A are affected since optical activity persists after the acid treatment.

When 48% hydriodic acid is used in lieu of hydrochloric acid for the elimination of water from I there is produced deschloroanhydroaureomycin (III), m.p. 225–226° (dec.), pK_a 's 6.0 and 8.6 $[\alpha]^{25}_D + 24^\circ$ (in cellosolve), *anal.* Calcd. for $C_{22}H_{22}N_2O_7$: C, 62.00; H, 5.15; N, 6.57. Found: C, 61.88; H, 5.36; N, 6.02. Anhydroaureomycin, II, also forms III on heating with hydriodic acid.

The absorption spectra and chemical properties of II and III are very similar.

Since the removal of the chlorine atom from II changed only its first pK_a (5.5 to 6.0), this acid

function is represented by the 1,8-dihydroxynaphthalene portion of the molecule.

Not only is ring C established as a six-membered ring but also the steric relationship of the hydroxyl group at carbon 11 and the hydrogen at carbon 11a is indicated to be *trans*.

Ring B of aureomycin cannot be seven membered. Each carbon of ring A in aureomycinic acid carries at least one substituent. The γ -butyric acid group must be *para* to the carboxamide and the closing of ring B to form a seven-membered ring would then involve one of the ketonic carbons. Such an involvement would destroy the acidity of the β -diketones of ring A.

The infrared spectra of iso-aureomycin shows a band at 5.80 to 5.85 μ which demands a six rather than a five membered ring for B.

The difficulty of eliminating dimethylamine or water from the A and B rings suggests that the dimethylamino group at 1 (or 4a) the hydroxyl group at carbon 4a (or 1) and the hydrogen at carbon 12a may be a *cis,cis*-configuration. The relationship of the configuration at carbons 11 and 11a to those at carbons 1, 4a and 12a cannot be stated at this time.

Further work is in progress to establish unequivocally the position of the dimethylamino group in aureomycin.

The independent and quite dissimilar methods of proof of structure for aureomycin and terramycin³ tend to substantiate the structures of these two compounds.

(3) E. A. Hochstein, *et al.*, *THIS JOURNAL*, **74**, 3708 (1952).

LEDERLE LABORATORIES DIVISION
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BOOK REVIEWS

The Enzymes. Chemistry and Mechanism of Action. Volume II, Part 1 and Part 2. By JAMES B. SUMNER, Laboratory of Enzyme Chemistry, Cornell University Ithaca, New York, and KARL MYRBACK, Institute for Organic Chemistry and Biochemistry, University of Stockholm, Sweden (Editors). Academic Press, Inc., 125 E. 23rd Street, New York 10, N. Y. Part 1—1951. Pages xi + 790. 16.5 × 23.5 cm. Price, \$14.80. Part 2—1952. Pages xi + 791–1440. 16.5 × 23.5 cm. Price, \$14.00.

Reviews of Volume I, Parts 1 and 2 of this encyclopedic presentation of the important aspects of the chemistry and mechanism of action of the enzymes appeared recently in *THIS JOURNAL* [74, 284 (1952)]. Volume II, Parts 1 and 2, composed of thirty-five chapters, has now appeared. This comprehensive survey of the present knowledge in this field is now complete in two volumes, four parts, seventy-eight chapters, 1743 pages. Each chapter is on a well defined specific topic and is written by one of the seventy-five authorities who contributed to the work.

Volume II continues the same high quality of organization and presentation as shown previously. Although the reviews naturally reflect to some extent the individuality of the respective writers, there is a remarkable degree of uniformity and a minimum of unessential repetition for a work shared by so many individuals. The editors have unquestionably fulfilled their aim expressed in the introduction to the first volume "to gather and sift available knowledge and present it in an orderly fashion," for the use of those interested in advancing the field of enzymology. Time was ripe for undertaking this tremendous task. The available information in this field has become too extensive for even an expert to obtain it from the original literature; the number interested in enzymes has expanded far beyond biochemistry into all the allied fields in chemistry and biology, and the subject, while still changing rapidly, has reached a stage sufficiently definitive to be summarized on a broad basis.

These volumes, as was pointed out by a previous reviewer, will be valuable not only for reference but as a source of in-

formative reading for those in the field, those preparing for the field and those in allied sciences interested in the organization and function of cells.

Twenty-one topics are reviewed in Part 1 of Volume II and include chapters on Theory of Oxidation-Reduction, Thermodynamics and Mechanism of the Phosphate Bond, Transphosphorylating Enzymes of Fermentation, Dephosphorylation of Adenosine Polyphosphates, Aldolase and Isomerase, Keto Acid Decarboxylases, Amino Acid Decarboxylases, Desulfinate, Codehydrogenases I and II and Apoenzymes, Succinic Dehydrogenase, Hydrogenase and Hydrogenlyase, Flavin-Containing Enzymes, The Iron-Containing Enzymes. A. Cytochromes, The Iron-Containing Enzymes. B. Catalases and Peroxidases. "Hydroperoxidases," The Iron-Containing Enzymes. C. The Enzyme-Substrate Compounds and Mechanism of Action of the Hydroperoxidases, Copper Oxidases, Oxidation of Amino Acids, Oxidation of Amines, Lipoxidase or Unsaturated-Fat Oxidase, Enzymes in Luminescence, Oxidation of Organic Sulfur, Anaerobic Glycolysis, Respiration, and the Pasteur Effect, Yeast and Mold Fermentations.

The following fourteen topics are treated in Part 2, Volume II: Bacterial Fermentation, Enzymes in Detoxication, Urea Synthesis, Peptide Bond Synthesis, Enzymatic Synthesis of Glutamine, Synthesis of Acetylcholine. Choline Acetylase, Oxidative Assimilation by Microorganisms, Enzymatic Mechanisms of Carbon Dioxide Fixation, Carbohydrate-Fat Conversion, Photosynthesis in Green Plants, Bacterial Photosyntheses, Nitrogen Assimilation, Tumor Enzymology, Enzyme Technology.

It is impossible to write an evaluation, even briefly, of individual chapters. In general, they are well organized, complete, clearly presented and adequately documented. The reviews cover work and cite references reasonably completely up to 1950.

Although the indexes seem to be adequate, they might have been more conveniently arranged. The work is indexed by volume. However, the index appears only in Part 2 of each volume, thus making it necessary to search for the index and to use the books in pairs. A cumulative index would make the work more usable as a reference.

The editors and contributors are to be congratulated on an arduous task well done. Thousands of colleagues will be thankful for their planning and efforts.

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OTTO A. BESSEY

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A History of Chemistry in Canada. Compiled by C. J. S. WARRINGTON, Development Dept., Canadian Industries, Ltd., and R. V. V. NICHOLLS, Dept. of Chemistry, McGill University, for The Chemical Institute of Canada. Sir Isaac Pitman and Sons (Canada), Ltd., Toronto, Canada, 1949. x + 502 pp. 15 × 23 cm. Price, \$6.00.

This informative book is concerned not with the history of chemistry as such in Canada but rather, in its first part, with the applications of chemistry to the manufacture of chemical substances themselves and their use in many industries, and in its second part, with the teaching of chemistry in colleges and universities, and its dissemination by chemical journals and governmental agencies. More specifically, the first 360 pages describe the origin and development of chemical and related industries in Canada; the next 32 pages are devoted to chemistry in the Canadian public services; and the last 95 pages to the history of Canadian colleges and universities and the instruction in chemistry which they have provided and to the history of Canadian journals of chemistry.

The main part of this book is therefore concerned with the history and present status of the chemical industries of Canada. Not only are the individual industries discussed, but often leading individual firms in these industries are described. This is accomplished in a factual and objective manner. The general problems that these Canadian chemical industries face are especially interesting because, as compared with similar industries in the United States, they must adjust themselves, on the one hand, to relatively smaller domestic markets and to the threat of imports from mass-producing countries, and, on the other hand, to the exploita-

tion of the export market available to industries in the British Empire under Empire Preference.

The magnitude that some of these Canadian industries have attained will impress the reader in the United States in spite of the publicity that the Canadian metal and petroleum industries have enjoyed on account of their recent extraordinary growth.

The United States reader will also find the chapters on the Canadian colleges and universities especially interesting. These institutions have been influenced both by the older universities in Britain (and France) and by the nearer and more accessible American institutions. Denominational influences have also been operative with both the attendant advantages and disadvantages with which we are familiar here. These chapters also bring out the close affiliation and cooperation over many years of many eminent Canadian professors of chemistry with American institutions and American chemical societies, as is illustrated, for instance, by such men as Lash Miller of the University of Toronto, T. Sterry Hunt, and many years later, Harold Hibbert, both of McGill University.

I have noticed but two deficiencies in this book. Statistical data are lacking in the description both of the chemical industries and of the colleges and universities. Even more serious is the complete absence, other than a table of chapter headings, of any index either of subjects or of persons. These deficiencies, particularly the latter, greatly limit the convenience and utility of the book.

ARTHUR B. LAMB

Principles of Geochemistry. By BRIAN MASON. Department of Geology, Indiana University. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. ix + 276 pp. 16 × 23.5 cm. Price, \$5.00.

This appears to be an excellent introduction to geochemistry as a subject. The coverage is comprehensive, the presentation lucid, and the relative emphasis of the various parts of the subject wise and appropriate. It is a pleasure to notice that the latest developments in chemistry and physics are recorded insofar as they bear on the subject. The author has no special thesis, but attempts to present the subject as a whole. It is beyond the reviewer's competence to judge whether some of the material which should have been omitted has been included or whether some serious omissions have been made. The author's restraint and good judgment in presenting the difficult problems of the abundances of the elements are noteworthy.

The reviewer, having little direct knowledge of the field as a whole, was impressed with the enormity of the subject and the great events which seem to be imminent in the field. The advances of the last 50 years constitute more than half of the contents of the book, and it leads one to speculate what appearance a text in geochemistry will have a century from now.

Another impression the reviewer received was that geochemistry, like several other relatively new fields, is demanding the joint efforts of several disciplines and is serving to retard the strong current toward specialization which has been so marked in the sciences in the last generation. In this field specialization is unavailing. The chemist without geology or the geologist without chemistry or physics is so seriously handicapped as to be helpless. It may be that the development of borderline fields like geochemistry will serve once again to broaden the interest and knowledge of the natural scientists so that the undiscovered territory between the sciences will be explored. Geochemistry seems, at least as Mr. Mason has presented it, to involve all branches of physics from nuclear through classical electromagnetism, everything in chemistry except the chemistry of the rarest and most exotic elements, a good part of astrophysics insofar as it is involved in the genesis of the planetary system, and major portions of the broad field of biology. The reviewer was impressed to learn how important living processes may have been in the transformation of the surface of the earth from its origin to its present condition; the great quantity of limestone and its biological origin, the possibility that atmospheric oxygen is of biological origin, and several other world-wide features of the earth's surface at present might be cited in this regard.

A distinguishing characteristic of Mr. Mason's book is its freedom from speculation and special pleading for particular

theories. He has written more in the spirit of a text book than of a special treatise, and it appears to the reviewer that it would serve as an excellent text for a course in geochemistry.

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W. F. LIBBY

Polymerisations-Kinetik. By L. KÜCHLER, Göttingen Springer-Verlag, Berlin W 35, Germany. 1951. viii + 287 pp. 16 × 23.5 cm. Price, DM 36.60.

Progress toward understanding of the mechanism of polymerization reactions has been fairly steady during the past several decades, but it is only in the last five years that a coherent and inclusive picture has emerged. Consequently, and since there have been no other modern summaries of the general kinetics of polymerization (though the special subject of copolymerization has been treated in a recent book and a noteworthy review) the appearance of the present monograph by Küchler is timely. Since the presentation is scholarly and well-balanced, it is also important.

The content of the book is restricted to the scientific principles of polymerization kinetics, as distinct from their technological applications, and in general the viewpoint is that of the physical chemist. The introductory section of 29 pages is composed of two parts, the first a description of the common synthetic polymers and their various structural features, and the second a concise summary of the principles of chemical kinetics. There follows the principal section of 220 pages, which treats of addition polymerization under the following chapter headings: I. Experimental Methods. II. Formal Kinetic Treatment of Polymerization Reactions. III. The Free-Radical Mechanism (including copolymerization and emulsion polymerization). IV. The Ionic Mechanisms. The final section of 27 pages deals in more cursory fashion with polycondensations.

Citation of the original literature has been carried through 1950 and is very thorough. The references are given alphabetically at the ends of chapters or subchapters, thus obviating a general author index. A glossary of symbols and an ample subject index conclude the volume.

The general organization of the topics seems excellent, as does the author's selection of numerical and graphical examples from the literature. There is no evidence of the insularity that apparently infects even some Western scientists. The reviewer's high opinion of this work, however, derives from his perusal of certain sections dealing with subjects that demand sound physical exposition and critical judgment. It is quite clear, for example in the paragraphs on thermal polymerization, the nature of the termination step, or the mechanism of emulsion polymerization, that the writer has not merely transcribed the statements of others but has digested them and then presented his own considered synthesis.

The chief sin of omission would seem to be neglect of the kinetics of polymer degradation. This was perhaps because of space limitations, but even a brief description of the depolymerization studies by Melville, Dainton and others would greatly have improved the focus of the general picture.

In summary, this book is strongly recommended to all students and practitioners of polymer chemistry to whom the rather high price (about \$8.50) and the language are no great obstacles.

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BOOKS RECEIVED

August 10, 1952–September 10, 1952

JOHN M. BLATT AND VICTOR F. WEISSKOPF. "Theoretical Nuclear Physics." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. 864 pp. \$12.50.

E. A. GUGGENHEIM. "Mixtures—The Theory of the Equilibrium Properties of Some Simple Classes of Mixtures, Solutions and Alloys." Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. 1952. 270 pp. \$8.50.

DALLAS T. HURD. "An Introduction to the Chemistry of the Hydrides." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. 231 pp. \$5.50.

PAUL KISLIUK AND CHARLES H. TOWNES. "Molecular Microwave Spectra Tables." National Bureau of Standards Circular 518. U. S. Government Printing Office, Washington 25, D. C. 1952. 127 pp. 65 cents.

J. LODDER AND N. J. W. KREGER-VAN RIJ. "The Yeasts, A Taxonomic Study." Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1952. 713 pp. \$19.80.

J. MURRAY LUCK (Editor), HUBERT S. LORING AND GORDON MACKINNEY (Associate Editors). "Annual Review of Biochemistry." Volume 21. Annual Reviews, Inc., Stanford, California. 1952. 781 pp. \$6.00.

MAURICE PESEZ AND PIERRE POIRIER. "Methodes et Reactions de L'Analyse Organique." Volume I: Methodes de L'Analyse Generale. Masson et Cie, Editeurs, 120 Boulevard Saint-Germain, Paris-VI^e, France. 1952. 276 pp. 1.800 fr.

E. H. ERICH PIETSCH (edited by). "Gmelins Handbuch der Anorganischen Chemie." Eighth Edition. Verlag Chemie, G.M.B.H., Weinheim/Bergstrasses, Germany. "System No. 27. Magnesium." Part A 4. 1952. Pages 483–818. \$23.81. "System No. 3. Sauerstoff (Oxygen)." Part 2. 1952. Pages 83–300. \$15.48. "System No. 17. Arsen (Arsenic)." 1952. 475 pp. \$33.33. "System No. 41. Titan (Titanium)." 481 pp. \$27.20.

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LEON VELLUZ (edited by). "Substances Naturelles de Synthèse—Preparations et Methodes de Laboratoire." Volume IV. Masson et Cie, Editeurs, 120 Boulevard Saint-Germain, Paris 6^e, France. 1952. 165 pp. 1.800 Frs. (Broche); 2.200 Frs. (Cartonne toile).

KATHARINE WAY, GLADYS FULLER, MARION WOOD, KARIN THEW AND ALICE JURGENS. "Nuclear Data—A Collection of Experimental Values of Half-lives, Radiation Energies, Relative Isotopic Abundances, Nuclear Moments, and Cross Sections." Supplement 3 to National Bureau of Standards Circular 499. U. S. Government Printing Office, Washington 25, D. C. 1952. 66 pp. Price, Circular 499 + 3 Supplements — \$4.25.