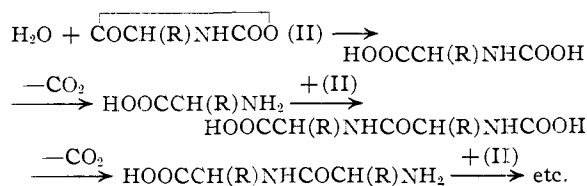


We have used an ionic chain-polymerization reaction which has been observed before inadvertently (*cf.* Leuchs and Geiger, *Ber.*, **41**, 1721 (1908); Curtius and Sieber, *ibid.*, **55**, 1543 (1922); Wesely and John, *Z. physiol. Chem.*, **170**, 38 (1927)) but whose scope and generality do not appear to have been realized hitherto. Our monomers are the anhydrides (II) of N-carboxy- α -amino acids, and the initiator is water (in the experiments described here) or any substance XH, in which H is an active hydrogen atom. The reaction proceeds in the sense



Thus, each time a new peptide link is formed by the reaction of the active center ($-\text{NH}_2$) with a monomer molecule, a new, like, active center is generated by the (spontaneous) loss of carbon dioxide from the unstable grouping ($-\text{NHCOOH}$). The products of the reaction have the general formula (I), and the value of \bar{n} is determined by (a) the supply of monomer molecules (which may be augmented after any particular value of \bar{n} has been reached), (b) the relative concentrations of monomer and initiator and (c) the relative rates of the initiation and propagation reactions.

When N-carboxy-*l*-leucine anhydride (m. p. 76.5–78°; Found: C, 53.70; H, 7.01; N, 8.70. Calcd. for $\text{C}_7\text{H}_{11}\text{O}_3\text{N}$: C, 53.49; H, 7.06; N, 8.91) and N-carboxy-*dl*-phenylalanine anhydride

(Leuchs and Geiger, *loc. cit.*) were copolymerized in ordinary reagent benzene (the very small amount of water present in the solvent serving as initiator), the solution gradually became more viscous as reaction proceeded. After two weeks at room temperature, such solutions, when cast, left optically clear, tough, mechanically stable films (Found: C, 68.6; H, 8.5. Calcd.: C, 68.6; H, 7.9). Solutions of such films in benzene had $[\eta] = \lim_{c \rightarrow 0} \frac{\ln \eta_{rel}}{c} = \sim 10$. Though it is impossible

to assign with confidence values of K and α in the equation $[\eta] = KM^\alpha$ for this high polymeric species, the use of the extreme values of the parameters for all known polymers leads to the bracketing of the average molecular weight of the film-forming molecules within the limits 1,000,000–15,000,000. Careful osmotic measurements of 0.50% and 0.75% benzene solutions of the film in the sensitive Fuoss osmometer (Fuoss and Mead, *J. Phys. Chem.*, **47**, 59 (1943)) gave values of Δh not significantly different from 0; this result indicates a minimum average molecular weight of several million.

Thus, these synthetic molecules have the structure (I), with R_i variously $(\text{CH}_3)_2\text{CHCH}_2-$ and $\text{C}_6\text{H}_5\text{CH}_2-$, and $\bar{n} \gtrsim 10,000$.¹

(1) We wish to thank Mr. H. T. Wolosinski of Polaroid Corporation and Dr. Harry F. Herbrandson of these laboratories for assistance in carrying out physical measurements, and Eli Lilly and Co. for supplies of amino-acids and support of a fellowship for one of us (C. H. S.).

CONVERSE LABORATORY
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R. B. WOODWARD
C. H. SCHRAMM

RECEIVED MAY 29, 1947

NEW BOOKS

The Photography of the Reciprocal Lattice. By M. J. BUERGER, Massachusetts Institute of Technology, Cambridge, Massachusetts (ASXRED Monograph Number 1). Published by the American Society for X-Ray and Electron Diffraction, August, 1944. 37 pp. 18 figs. 16 × 24 cm. Copies obtainable at \$1.50 each from The Murray Printing Company, 18 Ames St., Cambridge 42, Massachusetts.

In the analysis of complex crystal structures with the aid of X-ray diffraction data, it is convenient to deal with an imaginary "reciprocal lattice," in which each lattice point can be associated with a possible X-ray reflection. There is a direct correspondence between the locations of the diffraction spots on a Weissenberg photograph, for example, and the coordinates of the reciprocal lattice points. As shown by de Jong and Bouman, an X-ray photograph in which the diffraction spot pattern is a scale representation of a plane in the reciprocal lattice can be produced by making the crystal undergo the proper precessional motion. Such a photograph is somewhat simpler to interpret than a Weissenberg photograph, and has certain other advantages.

The present monograph describes the author's modification of de Jong and Bouman's apparatus, gives the basic theory underlying it, and outlines the interpretation of the resulting pictures. It is a useful addition to the literature dealing with crystal structure analysis methods.

MAURICE L. HUGGINS

Concise Chemical and Technical Dictionary. Edited by H. BENNETT, Technical Director, the Glyco Products Co., Inc., Editor-in-chief, *The Chemical Formulary; Practical Emulsions; Commercial Waxes*, etc. Chemical Publishing Co., Inc., Brooklyn 2, N. Y. 1947. xxx + 1055 pp. 15 × 23.5 cm. Price, \$10.00.

For its handy size this volume contains an astonishing amount of definitive information, although it appears to be more suited to the needs of the technical user than to those of the teacher or student. The 50,000 terms listed include many trade names, such as Vel and Dreft of recent origin, 14 varieties of Nopco and eight of Pentaryl, as well as many of purely scientific use. Mineralogy, medicine, botany and many other special fields are represented with

brief and clear definitions, and a great many simple chemical compounds are included, apparently for the purpose of listing their properties; thus five nonanols, three nonanones and eleven nonyl terms appear.

Although no one must be too critical of such a volume because of the definite need it fills, the same general fault can be found with this book as with every other available chemical dictionary, namely, that it is not complete, even in its field. Having gone this far, the Editor should be strongly encouraged to continue his efforts, broaden the scope of this work and greatly increase the number of terms covered; for in this first edition there are curious omissions. Thus A.C.S. is listed, but not A.A.A.S. American Petroleum Institute, but not American Chemical Society; and in only a narrow section such terms as labdanum, the common industrial varieties of shellac (lac), lacerol, laccal, lactokrit, various Ladenburg terms, Lagos oil and laitance, all would seem to be important enough to be included, but are not.

In addition to the definitions there are brief sections on chemical nomenclature and pronunciation, symbols, weights and measures, chemical elements, indicators, vitamins, important organic ring systems, and a few pages of addenda. Altogether the book is an important aid to the comprehension of the vast and ever growing vocabulary of chemistry.

WILLIS A. BOUGHTON

Practical Chemistry for Medical Students. By WILLIAM KLYNE, M. A., B. Sc. (Oxon), Lecturer in Biochemistry, University of Edinburgh. The Williams and Wilkins Company, Baltimore, Md., 1946. xvi + 460 pp. Illustrated. 14.5 × 22 cm. Price, \$6.00.

This book, written primarily for premedical and medical students at the University of Edinburgh, presupposes no previous knowledge of chemistry. In the space of 437 pages, it attempts to instill the habits of scientific method, and also to impart necessarily elementary information, illustrated by experiment, concerning various topics in inorganic, physical and organic chemistry.

For this purpose, it is divided into five parts, as follows: Part 1, pp. 1-22, Fundamental scientific ideas, including a differentiation between physical and biological science on statistical grounds. Part 2, pp. 23-71, Simple methods of manipulation and measurement. Part 3, pp. 72-173, General and physical chemistry; volumetric analysis. Part 4, pp. 173-293, Inorganic chemistry including reactions of common inorganic substances and identification of simple substances. Part 5, pp. 294-437, Organic Chemistry, its principles, reactions of organic radicals, classification of organic compounds, compounds of biological interest.

References to more and less advanced modern tests should help the interested student to study some of the sub-topics treated cursorily or not at all.

The ruthless, though thoughtful selection, imposed by the time available in the medical curriculum at Edinburgh has limited most of the treatment to a level lower than that presupposed by minimal admission requirements for medical schools in this country. But in a day of rapidly expanding scientific knowledge, reappraisal, selection and interpretation of the material to be taught a group of students, most of whom never will be professional chemists, but who must, however, understand the principles and basic contents of this discipline, present a challenging problem. Dr. Klyne's modest contribution may suggest a more complete solution.

RONALD M. FERRY

Structural Inorganic Chemistry. By A. F. WELLS. Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. 590 pp. Price, \$7.50.

The first part deals with those general principles and techniques which the author deems sufficient for treatment

of the individual cases found in the second part. There are chapters on atomic structure, forces between atoms, spatial arrangements, states of aggregation, crystals and experimental methods. The exposition proceeds without use of high-powered mathematics or of thermodynamics. For instance, stabilities are not connected with quantities such as those in the Born-Haber cycle, entropy change or hydration energy. Within the range of topics covered, the scrutiny of the laws of chemical combination, the search for a definition of a chemical compound, the handling of defect structures and the pages on reactions in the solid state are especially suggestive. Insistence upon evaluation of covalent radii from molecules such as hydrazine, hydrogen peroxide or fluorine brings order into a domain too often confused. From time to time, one wishes that the author had devoted more space to discussions of this sort, while saving it elsewhere through reference to standard treatises on physical chemistry.

The second part masses an imposing array of structural data around the chief non-metals and then around the metals themselves. The relative importance of packing possibilities and valence forces is consistently borne in mind. The three-dimensional impression given by numerous diagrams is enhanced by allowing lines and circles to fade out from front to back. A wealth of unsolved problems is mentioned, or else their existence is readily inferred.

The first appendix is a bibliography which follows the chapter headings. Then comes a list of two hundred papers in various periodicals, arranged alphabetically according to authors but without mention of content. There are no reference numbers in the text nor any direct clues to source material.

If the work is to be appraised in terms of its title, literally construed, it must be strongly commended. As a survey of the field, and in large measure as a reference book, it meets almost every expectation.

GEORGE S. FORBES

Practical Physiological Chemistry. By PHILIP B. HAWK, Ph.D., President, Food Research Laboratories, Inc., Long Island City, New York; BERNARD L. OSER, Ph.D., Director, Food Research Laboratories, Inc., Long Island City, New York; and WILLIAM H. SUMMERSON, Ph.D., Associate Professor of Biochemistry, Cornell University Medical College, New York City. Twelfth edition. The Blakiston Company, 1012 Walnut Street, Philadelphia 5, Pa. xiv + 1323 pp. 329 illustrations, 5 color plates, tables. 14 × 23.5 cm. Price, \$10.00.

The appearance of an up-to-date text of methods, after the last several years of text famine, should be of considerable relief to the biochemist in need of new teaching devices or for reference.

The twelfth edition of "Practical Physiological Chemistry" constitutes a thorough revision of this well-known text though "it necessarily reflects the fact that the science of biochemistry is passing through a transition period in certain major fields." Since the number of tests that have appeared in the last ten years seems of almost exponential proportions, the authors are not to be envied their task of sorting and choosing.

This new edition presents certain features which make for vast improvement over previous editions. A new typographical setting makes the reading of it much easier. Many new tables and illustrations are included which should prove very helpful. A feature not appearing in earlier editions is the inclusion of a short but carefully selected bibliography at the end of each chapter. In most instances these references are recent, extending up into 1946. The term *cubic centimeter* has been replaced by the more precise *milliliter* as a unit of liquid and gas volume. The authors did not feel it "desirable to sacrifice simplicity and clarity of presentation by replacing the common symbol H⁺ by other and possibly more correct symbols used to designate the hydrogen ion in aqueous solution,"

but elsewhere symbols, etc., are in accord with modern usage.

Newer instrumental techniques discussed include the polarograph, Barcroft-Warburg apparatus, electrophoretic separation of plasma proteins, turbidimeters, fluorimeters, a completely revised section on Colorimetry and Photometry (theory, photoelectric colorimeters, flame photometer). Spectrophotometers are discussed very briefly (too briefly for a field which appears to be of increasing importance in clinical work).

Thirty-six chapters are included in this edition, one more than the eleventh (published in 1937). All appear to have been revised to a greater or lesser degree, with the elimination of certain obsolete tests and the inclusion of new matter. Certain chapters have received special attention. "Muscle Tissue" has been expanded to include recent changes in this field. Of particular importance is a new and interesting section on "Cell Respiration," included in the chapter on "Enzymes." The chapter on "Blood Analysis" has been extensively revised and enlarged to include advances in instrumental techniques (mentioned above). "Hormones" are discussed at greater length than in any previous edition. Other than "Blood Analysis," the greatest expansion occurs in the following chapters: "Urine: Quantitative Analysis" (revised to include photometric measurements), "Carbohydrate, Fat, and Protein Metabolism" (each section has been expanded, but of interest is the discussion of the metabolism of the individual amino acids), "Inorganic Metabolism" (includes a discussion of isotopes and their use in biological investigations) and "Vitamins and Deficiency Diseases" (includes many new data on vitamins, *e. g.*, avidin, pteroylglutamic acid, etc.). For some reason, the authors have omitted any description of chromatographic techniques other than to mention their use as an "accurate but involved basis" for vitamin estimation. Although somewhat complex, a short outline of this type of analysis would have made this excellent chapter even better.

A new chapter has been added on "Antibiotics: Metabolic Antagonists." This includes a discussion of Pyocyanine, the Penicillins (with two biological tests), Gramicidin, Tyrocidine, Streptomycin and a table summarizing other antibiotics. Analogs of amino acids and of vitamins are discussed briefly (with mention of other analogs) as examples of metabolic antagonism between structurally related compounds. This chapter introduces one of the newer trends in biochemistry and is certain to be expanded in future editions.

The Appendix has been extensively revised and expanded to include many tables (and an altogether too brief a section on "Analysis of Variance").

This text should certainly be in every laboratory of biochemistry. As a class text, it should prove valuable for those particularly interested in methods, albeit somewhat encyclopedic in nature. The over-all picture is a well-done job of a very difficult task. The fundamentals are all there, and yet the new has somehow been included without obscuring these fundamentals. The wonder is that this volume could be kept within reasonable bounds.

PHILIP M. RICHARDSON

Organic Syntheses. Vol. 26. By HOMER ADKINS, Editor-in-Chief. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1946. iv + 124 pp. Illustrated. 15.5 × 23.5 cm. Price, \$2.25.

This is the annual publication of the series of recommended methods for the preparation of selected organic compounds, which will illustrate useful and practical methods of synthesis. A variety of preparations have been contributed in this volume by forty-five different collaborators in addition to members of the Editorial Board; and the table of contents is represented by thirty organic preparations and useful techniques, which should find useful application in the synthesis of new compounds of organic and biochemical interest.

This work measures up to the standard of the earlier

volumes of this series. It includes easy and tested methods for preparing different types of aliphatic esters, specific types of keto acids and improvements in handling glucoseamine and ethylene-thiamine chemistry.

A valuable feature of the book is the description of various improved techniques for applying palladium in catalytic processes which are extremely useful and practical. Also a new type of laboratory ozonizer is described which is an improvement over the ordinary technique of ozonization. Other preparations of interest are julolidine, lepidine and muconic acid; 1,5-pentanediol and pyrocyamine. The work should prove a helpful contribution to various processes calling for simplified and improved methods of organic synthesis.

TREAT B. JOHNSON

BOOKS RECEIVED

April 10, 1947—May 10, 1947

M. L. ANSON and JOHN T. EDSALL, Editors. "Advances in Protein Chemistry." Volume III. Academic Press, Inc., 125 East 23rd Street, New York, N. Y. 524 pp. \$7.50.

GIOVANNI CANNERI. "Nozioni di Chimica analitica." Nicola Zanichelli, Editore, Bologna, Italy. 505 pp.

ANSLEY J. COALE. "The Problem of Reducing Vulnerability to Atomic Bombs." Princeton University Press, Princeton, N. J. 116 pp. \$2.00.

EDWARD J. CONWAY. "Microdiffusion Analysis and Volumetric Error." Crosby Lockwood and Son, Ltd., 20 Tudor Street, London, E.C. 4, Eng. 357 pp. \$4.23.

G. MALCOLM DYSON. "A New Notation and Enumeration System for Organic Compounds." Longmans, Green and Co., Inc., 55 Fifth Avenue, New York 3, N. Y. 63 pp. \$1.75. (For review, see THIS JOURNAL, 69, 728 (1947).)

J. M. MATTHEWS and H. R. MAUERSBERGER. "Textile Fibers." Fifth edition. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1133 pp. \$12.50.

WILLIAM BUELL MELDRUM and ALBERT FREDERICK DAGGETT. "A Textbook of Qualitative Analysis." American Book Company, 88 Lexington Avenue, New York 16, N. Y. 431 pp. \$3.50.

J. A. J. PIETERS and D. W. VAN KREVELEN. "The Wet Purification of Coal Gas and Similar Gases by the Staatsmijnen-Otto-Process." (Research in Holland Series.) Elsevier Publishing Company, Inc., 215 Fourth Avenue, New York 3, N. Y. 55 pp. \$1.25.

A. R. UBELOHDE. "Time and Thermodynamics." Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. \$2.25. 110 pp.

A. J. WILDSCHUT. "Technological and Physical Investigations on Natural and Synthetic Rubbers." (Research in Holland Series.) Elsevier Publishing Company, 215 Fourth Avenue, New York 3, N. Y. 173 pp. \$3.00.

DON M. YOST, HORACE RUSSELL, JR., and CLIFFORD S. GARNER. "The Rare-Earth Elements and Their Compounds." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 92 pp. \$2.50.

"Atomic Energy Commission. Official Records. Special Supplement. Report to the Security Council." Columbia University Press, Morningside Heights, New York, N. Y. 141 pp. \$1.00.

"Philips Research Reports." Vol. I, No. 6, pp. 401-430, December, 1946. Edited by The Research Laboratory of N. V. Philips'gloeilampenfabrieken, Eindhoven, Netherlands. Articles by N. G. de Bruijn, T. Jurrijaanse, J. E. L. Köhler and C. G. Kooops, M. Gevers, K. F. Niessen. 80 pp.