

dimensional Fourier summations. Numerical examples are provided to clarify the mathematical techniques, and there is a very good discussion of the available methods for solution of the phase problem. Since, however, it is the growth of the electronic computer which has made crystallography a truly practical tool, it is unfortunate that these machines are dismissed in one paragraph and that the computational methods described are all based on hand calculations or analog devices.

The question of the accuracy of crystal structure determinations is considered next together with methods of refinement and means of estimating probable errors in bond lengths. This chapter serves as an introduction to the second half of the book, which is devoted to a very thorough discussion of organic molecules whose structures have been determined by X-ray methods. It is this part which has no parallel in the literature and which is likely to be the most valuable to workers in the field of structural analysis. Starting with simple hydrocarbons, the author proceeds through compounds of increasing chemical complexity before arriving at the results of diffraction studies on proteins and other polymeric materials. The crystallographic techniques are described when of particular interest and the implications of the results with regard to the molecular structure are discussed in detail. Particular attention is devoted to the questions of bond order in aromatic systems and of hydrogen bonding. Such a collection of results should prove of great value both to the crystallographer searching for structural analogies and to the chemist who wishes to learn more about precise molecular shapes and dimensions.

A few errors are to be found in the tables and drawings, but the body of the text is remarkably free from mistakes. The drawings are good and the discussion is highly readable.

In summary, this is a book which should be read by any chemist who has wondered what X-ray crystallography could offer for his problems, or who has considered its use and then turned away because of imagined mathematical complexities. The increasing involvement of organic chemistry with X-ray crystallography appears inescapable and the more chemists become familiar with its virtues, the sooner its benefits will be enjoyed by all.

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Radioactive Wastes. Their Treatment and Disposal.

General Editor: J. C. COLLINS, B.Sc., M.S.E., A.M.I.-C.E., Lecturer in Civil Engineering, Faculty of Technology, University of Manchester, Consulting Engineer. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1961. xxi + 239 pp. 14.5 × 22.5 cm. Price, \$8.00.

This book fulfills its stated objective—to be of value and interest to a wide range of professional people—engineers, biologists, chemists concerned with water supply and with the disposal of domestic and industrial wastes, industrial executives, health officers, factory inspectors, and students of these professions.

The disposal of radioactive wastes is one of the more troublesome problems in the development and use of atomic energy. In an admirable preface, the general editor states, "Just how the nuclear age ultimately will affect our present way of living is a question present in everybody's mind, but uppermost, perhaps, is the doubt and fear that somehow man may be affecting adversely not only his own health but, worse still, the health of his children and grandchildren. . . Environmental pollution in non-radioactive forms is all too familiar. With the growth of industry and the concentration of population that have taken place in the past half century, it is now a National problem. Only in recent years at the cost of much time and money has a start been made to bring this pollution under control. Radioactive pollution must *never* be allowed to reach such proportions and no amount of energy or expense must be spared to keep it within bounds."

The ten chapters of this book cover a wide range of topics. Three chapters are devoted to fundamental background material—the nature of radioactivity, the hazards of radiation, the measurement of radioactivity. Another chapter outlines the sources of radioactive wastes (e.g., uranium production, reactor operation, fuel element processing, the

radium industry, research establishments, hospitals, etc.). There is a short chapter on the law of radioactive wastes in Great Britain. The last five chapters deal specifically with radioactive waste treatment and disposal (including the biological concentration of radioactivity and its application to the treatment of liquid effluents). There is a 10-page glossary of terms.

In general the book is well written, and reflects a recognition that few readers will be expert in more than one or two of the disciplines which are brought together. Two minor weaknesses: in some chapters the bibliographies are skimpy and the index is not as useful as one might expect in a book of generally high quality.

Since the editor and all of the contributors to this book reside in Great Britain there is naturally emphasis on problems encountered in that country, but problems and practices in the United States receive some attention.

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Telomerization and New Synthetic Materials. By R.

KH. FREIDLINA AND SH. A. KARAPET'YAN. Translated from the Russian by Margaret F. Mullins. Translation edited by B. P. Mullins, Senior Principal Scientific Officer, Ministry of Aviation, Farnborough, Hampshire. Pergamon Press Ltd., Headington Hill Hall, Oxford, England. 1961. x + 102 pp. 14 × 22 cm. Price, \$4.50.

The title of this short work may be misleading to many since at first glance it implies a broader scope than it actually covers. It describes in a semitechnical fashion Russian work on the telomerization of ethylene and carbon tetrachloride and the conversion of the telomers into polyamide fibers, nylons 7, 9 and 11. The authors point out in their preface that only a limited knowledge of chemistry and physics is necessary, and consequently much space is given to a brief development of the fundamentals of organic chemistry, polymers, polymerization, fiber technology and fiber physics. The book is not a review as is apparent from its style and lack of documenting references, but those who want review-type information on this subject can find it easily and as up-to-date in the literature.

The translation is readable, and the book is reasonably free from typographical errors. However, the translator is not sufficiently familiar with organic chemical nomenclature or polymer chemistry to have used in many cases the accepted names and spellings for compounds and polymers.

There is little reason for the research scientist or researcher's library to purchase this book, for the information it contains can be found elsewhere in better form for their purposes.

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Fortschritte der Physikalischen Chemie. Band 6. Fortschritte in der Kinetik der Homogenen Gasreaktionen. By Prof. DR. Z. G. SZABÓ, Direktor des Institutes für Anorganische und Analytische Chemie der Universität Szeged (Ungarn). Dr. Dietrich Steinkopff Verlag, Darmstadt, Germany. 1961. xii + 239 pp. 15.5 × 23 cm. Price, DM. 40.

This slender volume was prepared with a somewhat limited objective. It is intended to provide for German-speaking readers a supplement to Schumacher's "Chemische Gasreaktionen" which was published some twenty years ago. The author disclaims any desire to provide a complete treatment such as is attempted in a number of recent books in English and in Russian. In a further effort to reduce the volume of material to manageable size, oxidation reactions, photochemical and radiochemical processes and isotope studies are excluded except when they are pertinent to a reaction under discussion.

Within these limits, a huge volume of literature is summarized competently in a small space. The discussion is

largely non-critical, although work which the author seems to consider unreliable or uninteresting is subjected to even more drastic condensation. Experimental work does not suffer seriously by this treatment, although it would have been better, for example, if all the work dealing with nitrogen pentoxide and the nitrogen oxide radicals involved in its decomposition had been brought together and discussed as a unit.

Theoretical work lends itself less well to such capsule reporting, and as a consequence is largely ignored, thus making what has been a relatively sterile twenty years appear far worse than it deserves. For example, the name of N. B. Slater is mentioned incidentally in three places, but not even one sentence anywhere attempts to say what Slater has done. On the other hand, nearly twenty pages are given to the formal mathematical treatment of differential equations as they occur in reaction kinetics. It is only fair to admit that this chapter contains 50 references to literature appearing after World War II. Chemists love to re-discover these same simple ideas, editors love to publish them and why should Szabo be expected to ignore this work which is certainly correct, certainly useful and certainly easy to understand just because it really isn't new? Slater's work, of course, is the exact antithesis to this.

On the other hand, there have been a number of papers during this period exploring from varied viewpoints the question of how much information can be derived from the rate-pressure curve of a unimolecular reaction. A number of individually simple and pedestrian efforts have in the aggregate brought about some progress in a matter of considerable interest. But not to Szabo. It is recommended to start this book on page 81, at the Experimental Part.

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Chemistry of Enzymes in Cancer. By FRANZ BERGEL, D. Phil. Nat., D. Sc., F.R.S., Professor of Chemistry, University of London, Institute of Cancer Research, Royal Cancer Hospital, London. Charles C. Thomas, Publisher, 301-327 East Lawrence Avenue, Springfield, Illinois. 1961. xi + 122 pp. 15.5 × 23.5 cm. Price, \$5.50.

The present monograph does not aim at an encyclopedic survey of the numerous enzymological studies that have characterized the search for chemical differences between normal and neoplastic tissues. The author describes briefly the Warburg hypothesis of impairment of aerobic energy-producing reactions as the cause of excessive glycolysis in tumors and the Greenstein postulate of biochemical uniformity with convergence toward a primitive non-differentiated cell type. But it is the enzyme deletion hypothesis, espoused chiefly by Potter, and its implications for the therapy of cancer that claim Bergel's main attention.

The author first reviews various investigations indicating or demonstrating enzyme deficiencies that would divert the stream of metabolism toward excessive synthesis of nucleic acids and proteins. Thus several catabolic enzymes in the metabolism of nucleic acids, pyrimidines, purines and proteins are greatly decreased or are absent in several types of neoplasms. With regard to carbohydrate metabolism in the Novikoff hepatoma, decreased glucose-6-phosphatase and fructose-1,6-diphosphatase activities and increased glucose-6-phosphate dehydrogenase activity would tend to block glycogen storage, favor glycolysis and, through energy production and altered pathways, promote formation of nucleic acids and proteins. Decreases of various lipid catabolizing enzymes, coenzymes and metal cofactors in several types of tumor also have been reported. Such alterations might also favor the anabolism of proteins and nucleic acids.

It is in the second part of the monograph that the author considers how modification of enzyme activities in cancer may be exploited chemotherapeutically. He lists four ways in which tissue enzyme activities could be theoretically altered. These are: (1) changes in enzyme biosynthesis, induced by the corresponding substrate or a chemically

related compound; (2) metabolic antagonism and inhibition, consisting usually of inhibition of enzyme activity by reaction products or compounds chemically related to the reaction products, by coenzyme or cofactor antagonists, or by compounds reacting with some site of the enzyme molecule that is essential for complete action; (3) restitution or replacement of enzymes or cofactors deficient in tumor tissue; (4) increase of catabolism of compounds leading to excessive synthesis in cancer.

Dr. Bergel then culls examples from the literature and from his own investigations which illustrate the application of these principles. Thus the enzyme, xanthine oxidase, has been reported to be greatly reduced or absent in several types of animal tumors. Haddow and his associates found that intraperitoneal injections of the purified enzyme into mice with spontaneous mammary tumors was associated with an increase in liver and tumor xanthine oxidase and with a retardation in the growth of spontaneous mammary tumors in mice. Ribonuclease previously has been reported to be decreased in various types of tumor, and, as a result of his own work, the author reports that the injection of this enzyme also causes retardation of growth of mammary cancer in mice.

The injection into tumor-bearing mice of pyridoxal phosphate and vanadium to act as coenzyme for cysteine desulfhydrase in the breakdown of cysteine represents an attempt to divert this amino acid from incorporation into protein. Still another possible application of chemotherapeutic action through enzyme mechanisms lies in the inhibition of β -glucuronidase. Evidence is at hand that β -glucuronidase is present in high concentrations in the urine of patients with carcinoma of the bladder. This enzyme hydrolyzes the glucuronides of aminonaphthols or aminophenols taken into the body or of *o*-aminophenol endogenously produced during tryptophan metabolism; the free, potentially carcinogenic *o*-aminonaphthols or *o*-aminophenols are thus liberated. Administration of glucosaccharo-1,4-lactone is designed to inhibit glucuronidase action and thus diminish the production of the carcinogenic compounds.

As Bergel himself indicates, the results which he cites do not as yet provide substantial evidence that the modification of neoplastic tissue enzyme activities, at least by the procedures described in this monograph, can effectively control tumor growth. However, the principles on which these procedures are based are closely related to some of the major aspects of current enzymological research. Bergel has offered a brief yet broad review of the status of such research in cancer and of the vistas for chemotherapeutic application. The monograph should prove of interest not only to cancer investigators, but more generally to biochemists, biologists and clinical investigators.

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Chemistry of Carbon Compounds. Volume IV. Part C. Heterocyclic Compounds. Edited by E. H. Rodd, D.I.C., D.Sc., F.C.G.I., F.R.I.C. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1960. xviii + 737 pp. 16 × 23 cm. Price, \$26.50.

In Part C of Volume IV of Rodd, the treatment of heterocyclic compounds begun in the earlier parts of Volume IV is completed. A group of fourteen collaborators have prepared chapters on such diverse subjects as phenazine dyes, nucleosides and related substances, and alkaloids as well as the heterocyclic compounds largely of synthetic origin whose structures formally place them in this part.

This reviewer can only repeat his formerly expressed admiration of the project as a whole and recommend the acquisition of the series as the best available modern summary of organic chemistry.

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