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 rediscover 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 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 nondifferentiated 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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