

rial on the part of the reader. Except for reservations concerning the above-mentioned errors, it will probably fulfill the author's aim of conveying the broad fundamentals of enzyme chemistry to the beginner in a relatively painless manner. The format and printing is very acceptable, and there are few if any typographical errors.

DEPARTMENT OF BIOCHEMISTRY
UNIVERSITY OF ROCHESTER
SCHOOL OF MEDICINE AND DENTISTRY
ROCHESTER, NEW YORK ALEXANDER L. DOUNCE

Silage Fermentation. By A. J. G. BARNETT, B.Sc., Ph.D., F.R.S.E., Lecturer in Agricultural Biochemistry, University of Aberdeen. Academic Press, Inc., Publishers, 125 E. 23rd Street, New York 10, New York. 1954. x + 208 pp. 14.5 × 22 cm. Price, \$5.00.

The author has succeeded in his primary purpose "... to present to the student a review of the whole question of silage largely in relation to its interest as a subject of scientific study." Within the scope of approximately 200 pages he has presented in good form and style pertinent information relating to silos as well as to the production, physical nature, chemical composition, biochemical processes and nutritional value of silage. The coherent discussion on silo construction, silage processes and silage utilization is supplemented throughout the nine chapters by 53 tables of data, five drawings, ten photographs and thirty-five graphs.

More than 400 references to the original literature are cited with as few as 22 and as many as 92 appended to each chapter. In keeping with the author's emphasis upon silage practices and experimentation in Scotland, Finland and some other European countries only about one fourth of the references selected refer to developments in other world areas. In a section entitled Bibliography the following three companion books are listed as authoritative works: (1) S. J. Watson, "The Science and Practice of Conservation," Grass and Forage Crops (2 vols.), London, 1939, (2) S. J. Watson and A. M. Smith, "Silage," London, 1951, and (3) R. O. Whyte, "The Production and Utilisation of Silage," Aberystwyth, 1949. Three other useful treatises not mentioned by Barnett are: (1) H. E. Woodnan and A. Amos, "Ensilage," Bull. No. 37, Ministry of Agriculture and Fisheries, London, 1949 and (2) J. A. S. Watson, "Grass Drying," Bull. No. 157, Ministry of Agriculture and Fisheries, London, 1953, and (3) Grass, in the "Yearbook of Agriculture," U. S. Dept. of Agriculture, Washington, D. C., 1948. Additional research reports on grass and silage not included in the author's book have been published particularly in the bulletins of experiment stations in the Netherlands, Japan, Czechoslovakia and the United States.

An outstanding feature of the book is found in Chapters 7 and 8 where clear directions are given for sampling and drying silage and for the determination of pH, total nitrogen, soluble nitrogen, protein, protein digestibility, oil, fiber, ash, total hydrolysable carbohydrate, lactic acid, volatile and non-volatile organic acids, lignin, nitrate, nitrite, ascorbic acid, carotene, calcium, phosphate, magnesium, sodium, potassium and amino acids of silage. Chromatographic procedures are described for the determination of amino acids and volatile fatty acids.

A glossary of nine terms and five pages of index are given at the end of the book.

Present-day understanding of silage fermentation is expressed in the following statement by the author in his Introduction.

"Compared with what remains to be discovered, little is really known about the true composition of grass and the modes of biosynthesis of the different recognized components of the material. Even less is known of these matters in the case of silage because there we have the original complex state of affairs confused by not only one but many different biochemical processes. Thus, as will appear in the text, we can at this stage merely hazard a guess sometimes as to what happens during the fermentation, basing that guess on what is, perhaps, incomplete knowledge of the basic facts about the initial crop."

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CALIFORNIA
LOS ANGELES 24, CALIFORNIA M. S. DUNN

The Vitamins: Chemistry, Physiology, Pathology. Volume I. Edited by W. H. SEBRELL, Jr., Director, National Institutes of Health, Bethesda, Maryland, and ROBERT S. HARRIS, Department of Food Technology, Massachusetts Institute of Technology, Cambridge, Massachusetts. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1954. xiii + 676 pages. 16 × 23.5 cm. Price, \$16.50.

This book is the first of a 3-volume series. The editors point out in their preface that clinical manifestations of vitamin deficiencies and their treatment have not been presented in detail, as they have been covered in other publications. Methods of vitamin assay are discussed in some cases only briefly for the same reason. "The Vitamins" will provide an invaluable reference book for those concerned primarily with the chemistry and biochemistry of vitamin A and the carotenes, ascorbic acid, vitamin B₁₂ and biotin.

No single chapter has been handled in its entirety by one author; however, the volume does not suffer from undue repetition. The four chapters have 21 contributors. The extensive bibliography will be of aid to the student of nutrition who wishes to consult original papers. The completeness of the coverage is attested by the more than 500 references on vitamin B₁₂ alone. The isolation of this vitamin was announced only in 1948.

An innovation is the inclusion of sections on the industrial production of the several vitamins.

It is unfortunate that any book in the field of nutrition is unavoidably outdated by the time of publication. This volume is no exception, for most of the papers cited were published prior to 1953.

The editors are to be congratulated in enlisting the cooperation of so many outstanding contributors both from this country and abroad.

MERCK INSTITUTE FOR
THERAPEUTIC RESEARCH
RAHWAY, NEW JERSEY GLADYS A. EMERSON

Crystal Structures. Index to Organic Compounds. By R. W. G. WYCKOFF. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1954. 33 pp. 20 × 25 cm. Price (this is part of subscription to Section III).

This index to the previously issued (and reviewed^{1,2}) chapters dealing with the structures of organic compounds further enhances their value.

- (1) J. Donohue, *THIS JOURNAL*, **74**, 5554 (1952).
(2) M. L. Huggins, *ibid.*, **75**, 6089 (1953).

RESEARCH LABORATORIES
EASTMAN KODAK COMPANY
ROCHESTER 4, N. Y. MAURICE L. HUGGINS

Advances in Cancer Research. Volume II. Edited by JESSE P. GREENSTEIN, National Cancer Institute, U. S. Public Health Service, Bethesda, Maryland and ALEXANDER HADDOW, Chester Beatty Research Institute, Royal Cancer Hospital, London, England. Academic Press, Inc., Publishers, 125 E. 23rd Street, New York 10, N. Y. 1954. xi + 530 pp. 16 × 24 cm. Price, \$11.00.

The editors are to be congratulated on this, the second volume of the series, since it maintains the high aims and standards set by the first. About half of the volume is concerned with carcinogenesis and contains chapters entitled, "The Reactions of Carcinogens with Macromolecules" by Peter Alexander of the Chemistry Department, Imperial College, London, England; "The Chemical Constitution in Carcinogenic Activity" by G. M. Badger of the Chemistry Department, University of Adelaide, Australia; "Carcinogenesis and Tumor Pathogenesis" by I. Berenblum of the Department of Experimental Biology, Weizmann Institute of Science, Rehovoth, Israel; "Ionizing Radiations and Cancer" by Austin M. Brues, Argonne National Laboratory, Lemont, Illinois, and "The Role of Viruses in the Production of Cancer" by C. Oberling and M. Guerin, Institute for Cancer Research, Seine, France. The first two chapters listed are of particular

interest to chemists. Dr. Alexander does an excellent job of discussing the chemical reactions which take place between carcinogenic substances and biological macromolecules, such as proteins and nucleic acids. He does a particularly good job with the various alkylating agents such as the nitrogen mustards, epoxides, ethyleneimines and mesyloxy compounds. He also discusses the interactions of ionizing radiation and of polycyclic hydrocarbons and aminoazo compounds with tissue components. Badger, in his chapter, on the other hand, deals much more extensively with the polycyclic compounds and azo compounds. The other chapters on carcinogenesis are more biological in nature.

Two chapters deal with chemotherapy. One is an excellent review of cancer chemotherapy in general, entitled, "Experimental Cancer Chemotherapy," by C. Chester Stock of the Sloan-Kettering Institute for Cancer Research, N. Y. It covers the various methods used for assaying chemotherapeutic agents and a résumé of the most important compounds which have been studied. The other chapter is, "Some Aspects of Clinical Use of Nitrogen Mustards" by Calvin T. Klopp and Jeanne C. Bateman, of the George Washington University Medical School, Washington, D. C. The biochemists and nutritionists will be interested in the chapter entitled, "Energy in Nitrogen Metabolism in Cancer" by Leonard D. Fenninger and G. Burroughs Mider of the National Cancer Institute, National Institutes of Health, Bethesda, Maryland.

The two remaining chapters deal with biological aspects of the study of cancer and are, "The Survival and Preservation of Tumors in the Frozen State" by James Craigie, Imperial Cancer Research Fund, London, England, and "Genetic Studies in Experimental Cancer" by L. W. Law, National Cancer Institute, Bethesda, Maryland.

The convenience, for the cancer investigator, of having such excellent discussions of these pertinent topics cannot be over-emphasized.

ROSWELL PARK MEMORIAL INSTITUTE
BUFFALO, N. Y.

DAVID PRESSMAN

Paper Chromatography. By FRIEDRICH CRAMER of the University of Heidelberg. Second revised and enlarged edition. Translated by Leighton Richards, B.Sc. St. Martin's Press, Inc., 103 Park Avenue, New York 17, N. Y. 1954. xii + 124 pp. 16 × 23 cm. Price, \$5.00.

In the preface to this book Dr. Consden humorously relates the circumstances under which the first two-dimensional (or directional) paper chromatogram was born. From these uncertain beginnings a lusty development occurred and the technique has now touched most branches of chemistry and has been applied in innumerable ways in biochemistry and biology. Inevitably the need for laboratory manuals has been anticipated and a number of texts already exist. The present "practical manual" comes by way of a translation from the 2nd German edition which, in the German or Italian version, no doubt introduced many continental workers to the technique. However, the experienced user of chromatography in the English speaking countries, where the technique has already flourished, may find that it tends to recount much that is already familiar, but those about to embark upon such work will obviously find it instructive.

Since the book is more apt to be used by beginners there are some features that may seem to be regrettable. Almost every laboratory quickly assembles its own "gadgets" and an almost unnecessary stress seems to have been given to describing particular but rather obvious aspects of this "gadgetsry." These may not always appear happily chosen. It is doubtful whether "circular filter paper chromatography," which is after all only a special form of one-directional chromatography, has ever produced sufficiently distinctive results to justify directing the reader so forcibly to it. The fetish that all reagents must be applied with an atomizer spray is a relic of the past. For many purposes e.g., amino acids the reagent (ninhydrin) may be more uni-

formly and less wastefully allowed to run on the paper (dissolved in ethanol) from a modified wash bottle by touching the fine jet to the paper and drawing it repeatedly to and fro. Even in some cases dipping the paper in solution is adequate. Similarly, undue reverence seems to be given to the R_f value and far too little warning given to the errors that may be incurred by identifying substances by their position alone. The chromatographic technique is most valuable when applied to the separation of complex and often incompletely known mixtures and it is just here that the beginner needs to be warned of the many and increasingly obtrusive cases in which different substances can superimpose. A minimum of experience should enable the operator to dispense with such rigid devices as the keys shown in Figure 28 or the transparent Key "A" for sugars. It is doubtful whether the comfort in the oft repeated phrase that "a substance may be characterized by the speed at which it migrates" and "it is thus possible to separate and characterize a substance on the paper" is worth the later disillusionment that may arise if a too implicit faith is placed on such evidence alone, without recognizing that each worker must learn to evaluate the particular characteristics of his own system. This is not to discredit the technique any more than one should discard an instrument because in unskilled hands it may produce discord. Since the advances made possible by chromatography are now self evident, it is almost more necessary to dwell on the pitfalls than on the advantages. It is true that one short paragraph at the end of the introduction (page 2) sounds this warning note but it is soon lost in the account that follows.

The author traces the origin of the chromatographic technique to studies of protein hydrolysates and dwells for almost half the book on its applications to amino acids, etc. Unaccountably the selection of results cited in this field to give an idea of the scope of the method and the range of new amino acids that have been found in plants and animals seems to be quite unrepresentative. It is to be regretted, also, that the one color plate of a two-directional amino acid chromatogram is so poor. Even though made on standard solutions the resolution is unimpressive in certain regions, and the tendency of the spots to "beard" and "tail" is unduly obtrusive while the lines of "flow" seem obviously "skewed." Lacking the amides and being limited to 10 amino acids, this plate gives but a poor impression of the capacity inherent in a good chromatogram to resolve a complex mixture of nitrogenous compounds.

In use the book should not be taken too literally. The temptation to achieve facile identifications of substances in complex mixtures by slavish application of the many tables of data should be resisted. If this is done, however, it will be helpful to many who contemplate the use of chromatography by indicating something of its scope and power. By far the most interesting and helpful chapters to many will be those which, though brief, describe the application of chromatography to different classes of substances such as sugars, alcohols, nucleic acids, phenols and organic acids, sterols, etc., for these chapters describe the most useful solvent combinations and the appropriate developing reagents. Even here, however, the account is hardly infallible. Collidine figures prominently as a solvent for use with amino acids, but where this type of solvent is to be used it becomes far more effective in an appropriate mixture, say 1:3 of 2,4,6-collidine and 2,4-lutidine. Use of the heterogeneous fractions often labeled "collidine" can only lead to a distressing lack of uniformity in the chromatograms according to the source of this solvent.

Certain less familiar technical devices such as retention analysis, reverse phase chromatography, etc., are described and these will be helpful to many. A very brief reference recognizes that the techniques of paper chromatography also have applications in the separation of inorganic substances.

CORNELL UNIVERSITY
ITHACA, NEW YORK

F. C. STEWARD