however, Carpenter sins in company with a number of our British colleagues. These and similar minor errors are not any more numerous than they are in the average textbook, and they do not seriously detract from the value of a well written and informative treatise, which the student should find very useful.

The book is well printed on good paper, with numerous clear illustrations. There is a good index.

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Methods in Enzymology. vols. I and II. *Preparation and Assay of Enzymes.* Sidney P. Colowick and Nathan O. Kaplan. Academic Press, New York, 1955. xxv + 835 pp and xx + 987 pp. Illus. vol I: $18; vol. II: $23.50.

With the tremendous growth of enzyme chemistry in recent years, interest in enzymes as indicators of cellular events or as analytic and clinical tools has spread to diverse scientific fields. However, these new applications have scarcely begun. Many investigators who might have utilized enzymes in some phase of their work have either not been aware of the potentialities or have been discouraged by the vast, widely-scattered literature of enzyme methodology. The compilation of this literature in *Methods in Enzymology* provides a working handbook for the preparation of enzymes.

The two volumes reviewed here are the first in a series of four that will cover the entire field of enzyme methodology, including many ancillary subjects such as chromatographic, physicochemical and other analytic techniques. The preparation and assay of enzymes is covered in volumes I and II, while the preparation and assay of substrates and special techniques for the enzymologist will provide the subject matter for the later volumes.

It is apparent that the ambitious aims of the editors give rise to numerous problems. The problem of presenting authoritative directions has been solved by a careful choice of authors. Thus, more than 200 contributors are represented in these two volumes. Each of these has worked in at least one phase of the field he reviews and often is the original author of much of the material presented. The problem of integrating the reports of these many authors so that duplication is avoided has been approached in two ways. The first is illustrated by the organization of the series. For example, substrates that are used for more than one enzyme system are considered separately in volume III. These are then omitted from the individual descriptions, and the appropriate reference to volume III (as yet unpublished) appears. A number of general preparative procedures are also given, and these are also omitted from reports on individual enzymes. Second, the various descriptions of individual enzymes are integrated by cross references in each article to appropriate parts of other articles. These two devices, plus an excellent author and subject index, constitute one of the most attractive features of these books. Without such organization, the subject matter could hardly have been covered in the space allotted. It should be noted that this integration means that all four volumes (or at least the first three) must be available to take advantage of these features.

Volume I contains four sections, as follows: "General preparative procedures," "Enzymes of carbohydrate metabolism," "Enzymes of lipid metabolism," and "Enzymes of citric acid cycle." The first section contains a wealth of material of general utility to the protein chemist. The review by R. K. Morton on methods of extraction of enzymes from animal tissues presents an excellent series of approaches to the first question one considers in investigations involving enzymes: How is the enzyme obtained in a soluble form? The various new techniques using butanol, which were devised by the author, are a significant, original contribution to this field. Other articles, on the preparation of various cell fractions, protein fractionation by solubility, and the use of adsorbents and resins in protein fractionation, outline the general procedures available for enzyme purification. Although some of this material has appeared previously in review articles, its inclusion here is needed in order to present a complete summary of the enzyme techniques that are available. The first section ends with a useful compilation of buffer mixtures by G. Gomori.

The order in which the various individual enzymes are described in the other sections follows, in general, metabolic sequences. For example, enzymes involved in polysaccharide metabolism are followed by descriptions of the monosaccharide kinases, then by mutases, aldolase-type enzymes, and so on. Each report follows a fairly standardized form, which includes, in order, assay method, purification procedure, and properties of the enzyme. Volume II continues the description of enzymes with five sections devoted to enzymes of protein metabolism, nucleic acid metabolism, phosphate metabolism, coenzyme and vitamin metabolism, and respiratory enzymes, respectively. This is a quite reasonable order of presentation of the material.

The list of enzyme preparations covered in each field is very complete and includes enzyme activities that can be assayed but that have not yet been separated to any degree. I have prepared two enzymes using these volumes as a text. In both cases, the directions were sufficiently complete so that the purification procedure given could be used successfully. Reference to the original literature was needed on occasion. The directions given here for the preparation of enzymes, in general, are more complete than those given in other handbooks of preparative methods. The detailed description of the assay procedures is particularly helpful. In a few cases, where a large number of enzymes from different sources are described (such as amino acid decarboxylases), the directions are somewhat less detailed and the original literature must be consulted. A spot check for errors in references revealed none. A few typographical errors were found.

One hopes that succeeding volumes of the series will match the high standard set by these two books. Volume III appears to be well integrated (based on the outline given) with the first two. The outline for volume IV does not appear as promising. Some of the subject matter falls outside the scope of the first three volumes and might well be omitted.

It is regrettable that the cost of this series will keep it off the bookshelves of most students, for the series contains so much that can be applied to daily research work. One could consider it a "dictionary" of methods that is dipped into almost daily, if only to find a reference.

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Advances in Virus Research. vol. III. Kenneth M. Smith and Max A. Lauffer, Eds. Academic Press, New York, 1955. ix + 338 pp. Illus. $8.

The policy of publishing intensive reviews of rather restricted topics has been continued in volume III of *Advances in Virus Research.* However, the paper by Seymour Cohen on "Comparative biochemistry and virology" is an exception, for it ranges broadly over the virus field, including plant, insect, and animal viruses as well as bacteriophages. The emphasis is on diversity rather than uniformity, and the author closes with the well-justified warning that reasoning by analogy is a poor substitute for observation. The paper by R. E. F. Mathews and J. D. Smith on the "Chemotherapy of viruses" is not only a good review of this subject but also a good review of the biochemistry of nucleic acids. A review of "Tumor viruses" by Beard, Sharp, and Eckert is more restricted than the title would indicate, being primarily a review of rabbit papillomatosis and chicken

erythromyeloblastosis. The brief article by K. M. Smith on "Morphology and development of insect viruses" is, as might be expected, stronger on morphology than on development.

The review by Maramorosch of the "Multiplication of plant viruses in insect vectors" is a convincing presentation of the evidence that certain viruses have both insect and plant hosts. Further evidence for this conclusion is presented in the paper by L. O. Kunkel on "Cross protection between strains of yellows-type viruses." Interference between related strains of the aster yellows virus occurs in the insect host as well as in the plant host. The chief criticism that one might make concerns the editorial policy of including a review on the "Current status of bacterial transformations" by Ephrussi-Taylor in a volume entitled *Advances in Virus Research*. There has been no dearth of good reviews on bacterial transformation in recent years, and there are many neglected topics that might more legitimately be classified as virus research. In science as in politics there is often a maldistribution of press agents.

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A Symposium on Inorganic Nitrogen Metabolism: Function of Metallo-Flavoproteins. Sponsored by the McCollum-Pratt Institute of the Johns Hopkins University. William D. McElroy and Bentley Glass, Eds. Johns Hopkins University Press, Baltimore, 1956. 728 pp. Illus. $10.

The sixth annual symposium of the McCollum-Pratt Institute is reported with the very high standard of excellence that is now expected. The subject is a very involved one with sufficient exact knowledge in some aspects to afford points of departure for the more unknown parts such as the reduction of nitrite to the level of ammonia.

Four leading topics are the reduction of nitrate and nitrite, the processes of denitrification, the nature of xanthine oxidase, and the significance of metalloproteins in electron transport. The functioning of molybdenum in nitrate reduction, xanthine oxidation, and nitrogen fixation is interwoven with the agricultural observations on its essentiality for plant and possibly animal nutrition. Other topics are nitrification, nitrogen fixation, and ammonia metabolism. There are 36 articles contributed by 62 authors, covering about all that is known on the several topics except that of electron transport. Each is well bulwarked with diagrams and tabular material.

Recorded discussions are an important part of these symposia. In this instance, they are extensive (60 pages) and serve to bring out interesting parts of the topics as well as to present some original short contributions. They are unusual, too, because they do not stray far from the central theme.

Bentley Glass again has supplied an excellent summary of the symposium (63 pages) showing his capacity both as an editor and as a dispassionate student of what others find. If one has an interest in the subject but is not a research worker in any of the several aspects, he should read this summary first and thus be led back to the original works.

An instance singled out by Glass exemplifies the tone of the work. Speaking of the work of Helmut Beinert and Frederick L. Crane on fatty acid oxidation, he quotes, " 'When we proceed to "isolate" these enzymes we wreck this whole edifice and obtain the associated flavoprotein dehydrogenases as one fragment and the connecting leads, electron transferring flavoprotein and the diaphorase, as another fragment. The terminal electron-transferring system is what we flush down the drain as insoluble. . . . We are then surprised about the headaches we experience in trying to reassemble the parts.' " Glass adds on his own account, "Perhaps the most significant change in point of view in biochemistry in recent years is, in fact, the growing realization on the part of biochemists that they will ultimately have to take into account the existence of organization on the biological level."

An adornment of the time is surely the great progress that is being made in all aspects of enzymology and in knowledge of the pathways of biological reactions. No more faithful picure can be gained of this scene than from the reports of these symposia.

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The Blood-Brain Barrier with Special Regard to the Use of Radioactive Isotopes. Louis Bakay. Thomas, Springfield, Ill., 1956. 154 pp. Illus. $5.50.

This book is primarily concerned with the penetration of radioactive ions into normal and abnormal brain tissues. The book is written within the framework of the author's personal experience with the uptake of phosphorus-32 labeled inorganic phosphate; only two pages are devoted to the uptake of other ions by brain tissue. Most of the information presented was derived by the author from autoradiography of brain slices and from direct counting of brain tissue samples following the intravenous injection of radioactive phosphate. Of the 32 illustrations, 18 are autoradiographs and 12 depict the temporal and spatial distribution of phosphorus-32 following its injection into patients and experimental animals. The author has had considerable experience with the differential uptake of phosphorus-32 by brain tumors, and the section of the book that deals with this topic will be of particular interest to neurosurgeons.

The book is written loosely from the point of view of style, organization, and scientific accuracy. Permeability is treated throughout in terms of penetration rates without consideration of either the driving force or the area available for the penetration process. In addition to conceptual errors, there are numerous grammatical mistakes and typographical errors. Direct quotations from other authors are not always provided with quotation marks. The comprehensive title and chapter headings in the table of contents may be somewhat misleading. There are 12 chapters that nominally cover the history, anatomy, physiology, and pathology of the blood-brain barrier. Actually, the book deals only superficially with these topics, and the reader who seeks a scholarly presentation of the field as a whole may be better advised to read the excellent chapter on cerebrospinal fluid given in Davson's *Textbook of General Physiology*.

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Bone, an Introduction to the Physiology of Skeletal Tissue. Franklin C. McLean and Marshall R. Urist. University of Chicago Press, Chicago, Ill., 1955. xii + 182 pp. Illus. $6.

This is the first of a series of publications in *The Scientist's Library: Biology and Medicine*. The object of the series can be inferred from the following statement by Peter P. H. De Bruyn in the preface: "The authors have been asked to emphasize introductory concepts and problems, and the present status of their subjects, and to clarify terminology and methods of approach instead of limiting themselves to detailed accounts of current factual knowledge. The authors have also been asked to assume a common level of scientific competence rather than to attempt popularization of the subject matter."

The topics covered in this book are bone as a tissue; histogenesis of bone; structure and chemical composition of the bone matrix; chemistry and crystal structure of the bone mineral; dynamics of calcification; enzymes and bone; re-