

The initial article, by G. Schmidt and M. Laskowski, presents a detailed analysis of the non-enzymatic reactions of phosphate esters, an appropriate introduction to current studies that are increasingly concerned with the mechanisms involved in enzymatic reactions. This survey then considers the classification of enzymes that attack phosphate esters. The bases for the relationships and the general properties of the phosphoesterases are clearly exposed to the readers, since these points are not obscured by elaborate descriptions of the more extensively studied enzymes. The encyclopedic nature of this treatise has been maintained by including in the survey brief mention of those enzymes that are not discussed in the later specialized chapters. The necessity for periodic revisions of general reviews of enzymology is illustrated by the finding during the short period since this chapter was written that a phosphate ester intermediate is hydrolyzed in the biosynthesis of sialic acid. Specific groups of enzymes discussed in detail are acid phosphomonoesterases, 5'-nucleotidases, alkaline phosphatases, glucose-6- and phosphoserine phosphatases, phosphodiesterases, ribonuclease and deoxyribonucleases.

W. W. Kielley has written a brief survey of the hydrolysis of anhydrides of phosphoric acids, with particular emphasis on those enzymes that hydrolyze nucleoside triphosphates. The properties of myosin ATPase and inorganic pyrophosphatases are described in subsequent detailed chapters.

The phosphorylases, enzymes that transfer groups to or from phosphate, are a relatively small group that have had a disproportionate influence on the concepts of enzyme action, as pointed out by M. Cohn. She has succeeded in augmenting the contribution of this group of enzymes to biochemical knowledge with an organization of information about these enzymes that will undoubtedly contribute much to the education of a generation of students of biochemistry and to the thinking of those already well informed. The polysaccharide phosphorylases, disaccharide phosphorylases, nucleoside phosphorylases, polynucleotide phosphorylase and pyrophosphorylases are the subjects of more intensive discussions. The recent increase in sophistication of enzymology is well exemplified by the amount of information presented about rabbit muscle phosphorylase as a chemical compound, although, as is generally true in this field, the conclusions from experiments serve primarily to raise questions, not to complete a model of the enzyme or its mode of action. Polynucleotide phosphorylase and the pyrophosphorylases are among the enzymes being studied most intensively today, and the reviews in this volume are good introductions to these enzymes and the problems of current interest. It may be noted that, with one exception, the entire literature about these enzymes has appeared since the first edition of "The Enzymes" was published.

The reactions discussed by E. Racker as cleavages or syntheses of carbon-carbon bonds have generally been considered as very different from each other, and it was a feat of no little ingenuity to include a comprehensive list of enzymes organized to show the formal chemical relationships of the reactions catalyzed. Individual enzymes of this classification considered in detail are: non-oxidation carboxylases and decarboxylases, aldolase, oxalacetate transacetylase (citrate condensing enzyme), thiolase, isocitric lyase, transketolase and transaldolase.

A chapter on isomerization reactions by Y. J. Topper is much more comprehensive than the title indicates, for the author has included all types of molecular rearrangements. None of the references to the enzymes responsible for the rearrangements is dated prior to 1951. Non-enzymatic model reactions discussed. Aldose-ketose transformations and epimerization of carbons 3 or 4 of sugar derivatives are the subjects of more complete descriptions.

A series of reactions characterized by dehydration of alcoholic compounds to form unsaturated compounds has been surveyed by Malmström. This introductory chapter considers physical properties of this type of reaction and describes four enzymes not included in subsequent chapters. The later chapters include descriptions of several enzymes that are notable for elaborate kinetic and stereochemical studies: enolase, aconitase and fumarase. Crotonase, carbonic anhydrase and hydroxyamino acid dehydrases are also described in detail.

A prime virtue of the organization employed by the editors of this treatise is the demonstration of relationships and differences among enzymes that catalyze similar reactions.

Unfortunately, the relationships selected are not the only ones that may be of value, and certain enzymes omitted from this volume bear more than casual resemblances to some of those included. For example, aspartase could well be compared with fumarase, cysteine desulphydrase closely resembles serine dehydrase, and the malic enzyme share some properties of oxalacetic decarboxylase. Presumably each of these enzymes is discussed in another context in other volumes of this series, from which few, if any, of the enzymes known at the time the chapters were written have been omitted. Although minor objections might be raised to some of the speculations included, the articles are well written summaries of the literature and even the contentious statements will undoubtedly provoke interesting experiments. "The Enzymes" is destined for arduous service wherever enzymes are studied, and widespread interest in the topics of Volume 5 will make it a particularly important reference in many laboratories.

NATIONAL INSTITUTE OF DENTAL RESEARCH
NATIONAL INSTITUTES OF HEALTH ALAN H. MEHLER
BETHESDA, MARYLAND

Biochemists' Handbook. Edited by CYRIL LONG, M.A., B.Sc., D. Phil., F.R.S.E., Senior Lecturer in Biochemistry, Physiology Department, Institute of Basic Medical Sciences, Royal College of Surgeons of England. Consultant Editors, EARL J. KING, Ph.D., D.Sc., F.R.I.C., Professor of Chemical Pathology, Postgraduate Medical School, University of London, and WARREN M. SPERRY, Ph.D., Professor of Biochemistry, College of Physicians and Surgeons, Columbia University, New York, and Chief of Psychiatric Research (Biochemistry), New York Psychiatric Institute. D. Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1961. xxii + 1192 pp. 16 X 25.5 cm. Price, \$25.00.

The "Biochemists' Handbook" is intended as a reference work containing a wide variety of numerical and descriptive data, arranged in systematic fashion. Over 150 authors collaborated in its preparation, many of them eminent authorities in their field. Some of the authors saw fit to include brief essays on basic principles in their presentations, so that part of the book has the flavor of a textbook (but at an exceedingly elementary level), rather than a reference book. Most of the contributions appear to have been written in 1957 or 1958 and many of them are therefore out of date. The subject matter is divided into six sections, as follows:

Section I (*Chemical Data*, 201 pages) contains information on isotopes, pK 's of acids and bases, spectral data, chromatography and similar chemical topics. The 40 pages on acids and bases are perhaps the best part of this section. The section on spectral data is perhaps the worst: ultraviolet and visible absorption peaks of less than 50 compounds are listed. The heme proteins are not included, and infrared data are omitted entirely. (It should be noted that the spectral properties of cytochromes are given in some detail in the Metabolic Pathways section, but the spectra of the various forms of hemoglobin appear nowhere in the book.)

Section II (*Data on Individual Enzymes*, 327 pages) begins with a brief essay on enzyme kinetics, which is followed by about 300 summaries of the physical, chemical and biological properties of individual enzymes, each about one page in length. The knowledgeable reader will find that many of the summaries do not include recent developments. The less expert reader will, however, find this section useful, although he may be confused by the fact that poorly characterized enzymes are given essentially the same emphasis as highly purified enzymes which have received intensive study. At least one important enzyme, leucine aminopeptidase, has not been included at all.

Section III (*Metabolic Pathways*, 105 pages) describes the well known routes of glycolysis, the citric acid cycle, fatty acid oxidation and synthesis, etc. The descriptions are brief, include pertinent references, and will on the whole serve as satisfactory summaries. However, hexosamine metabolism, carbohydrate interconversions, nucleic acid and protein synthesis, and other important areas are entirely omitted. One cannot avoid the conclusion that this section as well as the previous one are more adequately covered in any of several single reference works on enzymes.

Section IV (*Chemical Composition of Animal Tissues and Related Data*, 300 pages) consists of a monumental compilation of chemical analyses. There are for example no less than ten pages devoted to analytical data (sodium, potassium, total protein, soluble protein, etc.) of various parts of the eye, such as the aqueous humor (with separate columns for man, rabbit, ox, horse, etc.), the vitreous humor, the cornea, the ciliary body, etc. The remainder of this section is similarly detailed and the whole is impressive testimony to the skill and perseverance of the analyst. Whether such data are of value to the modern biochemist is another question.

Section V (*Chemical Composition of Plant Tissues and Related Data*, 124 pages) is similar to section IV, but concerned with leaves, flowers, pine cones, etc. (example: an 11-page table on tannins). No analytical data for bacteria are given, but analyses for the amino acid, purine and pyrimidine content of some viruses are included.

Section VI (*Physiological and Nutritional Data*, 65 pages) gives the chemical composition of common foods, with a minimum of elaboration, and contains articles on a few miscellaneous topics, such as the composition of tissue culture media, the effect of disease on the composition of blood, and histochemical analysis.

A major deficiency of the Handbook is that it fails to include, apart from the section on enzymes, much biochemistry on the molecular level. It is astonishing, for instance, to find no mention of *any* of the properties of hemoglobin, no reference to DNA as a carrier of genetic information, no reference to immunochemistry, etc.

It is clear from the foregoing summary that only certain portions of this Handbook contain subject matter of interest to the modern biochemist, and even these are partly obsolete. At the same time, much that is of vital interest to present-day biochemistry is entirely omitted. These reviewers cannot therefore recommend this Handbook as an important addition to a library which is already moderately well equipped with biochemical reference works. On the other hand, it should be noted that sections IV and V contain detailed analytical data which it is useful to find collected in a single volume. As these sections together comprise about 40% of the total content (*i.e.*, \$10 of the \$25 price of the book), the degree of interest in such data may well be the criterion by which an individual reader should judge the potential usefulness of the Handbook. Even for this kind of information, however, there is an alternative and perhaps better source, the "Handbook of Biological Data" (W. S. Spector, ed., published by W. B. Saunders Co., Philadelphia, Penna., 1957).

DEPARTMENT OF BIOCHEMISTRY
DUKE UNIVERSITY MEDICAL CENTER CHARLES TANFORD
DURHAM, NORTH CAROLINA EUGENE A. DAVIDSON

The Plasma State. By E. J. HELLUND, Formerly, Plasma-dyne Corporation, Santa Ana, California. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1961. 197 pp. 15.5 × 23 cm. Price, \$6.50.

The dust jacket of this book displays, as a sort of subtitle, the explanatory remark: "Summarizes all available information on highly ionized gases." Indeed, the author has attempted to give an elementary introduction to the entire field of plasma physics, including a remarkably broad coverage of existing and proposed practical applications. The treatment is essentially non-mathematical, *i.e.*, only about a dozen important relationships are expressed symbolically, some others are explained in words but most

aspects are discussed only qualitatively. Apparently, the text is meant for readers who abhor algebra and yet wish to gain an insight into this new field of science. The result, unfortunately, is very disappointing.

First of all, the vocabulary used, and much of the reasoning presented, requires that the reader has a substantial scientific background. A complete layman, I am afraid, would very soon be lost. It is doubtful, therefore, that the studious avoidance of mathematical expression really represents an advantage. Worse, however, is the fact that many of the descriptions and discussions are hard to follow and perhaps even misleading. Of course, it is extremely difficult to cover a broad subject in a short treatise without being superficial and sketchy. Anyone undertaking such a task must therefore be particularly careful in his manner of expression and it seems, to this reviewer at least, that E. J. Hellund has not been entirely successful in this matter. Several examples could be cited where the treatment is incomplete in some of its essentials and certain statements made will be recognized by the experts as actually wrong.

This is not to say that the book is entirely without merit. By and large the text is quite readable. A quick perusal, in which not much attention is paid to detail, may serve very well to give the outsider a fair impression of the nature and scope of plasma physics and may stimulate interest in some of its many applications. In the first two chapters the subject is introduced and the fundamental concepts are explained. The third chapter is devoted entirely to arc discharges as the best known form of plasmas generated in the laboratory. It includes brief descriptions of many different types of arcs, almost in the manner of an encyclopedia. Chapter 4 is entitled "Plasma Chemistry." It is a unique feature of this book in that it discusses a large number of electronic and chemical reactions that are likely to occur in various types of partially ionized gases and at surfaces exposed to ionized gases. The listing is of course by no means complete and must only be taken as an illustration of the complexity of the phenomena. Here, the author does not hesitate to make abundant use of symbolic representation of chemical reactions.

A brief summary of the controlled fusion problem and some of the major experimental approaches presently pursued is given in Chapter 5. Chapter 6, which carries the heading "Electro and Magneto Plasma Dynamics," should logically be read before Chapters 3, 4 and 5. It is concerned again with fundamental properties and the behavior of plasmas in general. It is here, for instance, that Saha's equation is mentioned, concepts such as "magnetic pressure" and "skin depth" are explained, and waves in plasma as well as the entire field of magnetohydrodynamics are very sketchily surveyed. Finally, the last chapter is made up of short discussions of an impressive variety of technical applications that are either already existing or being developed, from plasma torches for spray coating to advanced propulsion schemes for interplanetary travel. It is not clear for what type of audience this book is really intended. Perhaps chemists or engineers who have advanced to administrative positions in industry or governmental laboratories, or possibly high school teachers in science, might be interested in reading it if they wish to obtain a bird's eye view of plasma physics and its applications. But whoever they are, the readers should be warned that the contents of this book are not always accurate in scientific details. All the important material is there, to be sure, but it would be better if the book were worked over and rewritten more carefully.

UNIVERSITY OF CALIFORNIA
LAWRENCE RADIATION LABORATORY WULF B. KUNKEL
BERKELEY 4, CALIFORNIA