probably does not exist a single enzyme-catalysed reaction in which either substrate, product, enzyme, or some combination within this triad is not influenced in a very direct and highly specific manner by the precise nature of the inorganic ions which surround and 'modify' it" (page 856).

Carefully selected modern bibliographies constitute in total nearly 100 pages, almost one-sixth of the book. The book ends with a 45 page index of which 17 pages are devoted to subject matter.

The editors and the chapter authors deserve our thanks and our compliments. As the preface states, "Even now the subject area will no longer be encompassed by two volumes and two editors." The material included is well-selected. Volume I successfully consolidates "existing knowledge for the specialist" and is admirably suited to "serve as a reference text for. . . advanced students in biology, medicine and agriculture."

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An Index of Published Infra-Red Spectra. Volumes I and II. Edited by Mrs. M. B. B. THOMAS, with some assistance from Mr. E. R. ADAMS. British Information Services, 45 Rockefeller Plaza, New York 20, N. Y. 1960. x + 805 pp. 21 × 33.5 cm. Price, $18.40 postpaid.

These two volumes are not sold separately. In the first are listed organic compounds of C_1–C_9; in the second, organic compounds of C_{10} onward plus those of undetermined structure or ill-defined composition, along with inorganic compounds. Most of the infrared spectra published up to 1957 are to be found in these volumes, and data from 1957 and succeeding years will be included in a third volume which is now in active preparation. Those who would use any index of published spectra would like to know the limiting criteria for inclusion of data, the method of listing and the information provided. These facts are well set forth in the introduction to these volumes by Dr. L. J. Bellamy, who played a role in the initiation and encouragement of the project.

The requirements for the inclusion of a reference to an infrared spectrum are "that either a fairly extensive range should have been covered at normal rock-salt resolution, or a more limited range at higher resolution." Let it be clearly understood that the present work is an index for the location of spectra rather than a compilation of actual spectra. Moreover, no reference will be listed for a reported partial spectrum, where, for example, only one or two characteristic infrared bands are mentioned. These are often extremely useful to the organic or inorganic chemist but would admittedly be almost impossible to index. A different measure of usefulness is intended for the spectra which qualify for inclusion in these volumes.

The listing of compounds is by molecular formula, which provides a convenient method of searching for a given compound. By contrast, the complementary and possibly competing book, H. M. Hershenson's "Infrared Absorption Spectra, Index for 1945–1957," Academic Press, Inc., New York, N. Y., 1959, lists compounds by name, following the *Chemical Abstracts* system, and reference only. In "An Index of Published Infra-Red Spectra," after the molecular formula entry the compounds with the same formula are listed alphabetically. The references (given *fully*, which is a blessing since no special journal code need be consulted) to a single compound are listed chronologically. The state in which the sample was studied is indicated, the spectral range covered is expressed in either wave length or wave number, as in the original paper, and the optics are given. Thus, one can determine from a glance at the listings under state, range and optics whether the original reference to a compound contains the spectral information desired. These are time-saving volumes. They will prove most useful if brought up to date regularly by the issue of additional volumes. Dr. Bellamy states in his introduction that the intention will be made possible if libraries (especially) support the venture by purchase.

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Progress in Cryogenics. Volume 3. Edited by K. MENDELSSOHN, D. Phil. (Berlin), M. A. (Oxon), F. Inst. P., F.R.S. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1961. vii + 173 pp. 16 × 25 cm. Price, $8.00.

This book is the third volume in a series intended to provide up-to-date information in the field of cryogenics. The chapters (each written by experts in their respective fields) are titled 1. Helium Liquefiers, 2. Low Temperature Heat Exchangers, 3. Novel Refrigeration Cycles and Devices, 4. Cryogenic Rocket Propellants, 5. Paramagnetic Substances for Nuclear Orientation, and 6. Dynamic Nuclear Orientation.

The first three chapters are concerned with the practical business of liquefaction methods and devices. Included are detailed and critical descriptions of commercial and laboratory-made liquefiers. The accompanying diagrams and photographs should prove useful. The third of these chapters discusses new refrigeration methods which "promise the possibility of achieving temperatures even as low as liquid helium with equipment which can be very small. . . . . and as reliable as household Freon refrigerators."

The chapter on liquid rocket propellants is brief and discusses the problems of selection, handling and measurement.

Two chapters (nearly half of the volume) are devoted to nuclear orientation. The first considers the requirements and suitability of various paramagnetic substances for nuclear orientation. The second, dealing with dynamic nuclear orientation, discusses in some detail methods, techniques and apparatus. Applications and results are given in the final section.

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The Enzymes. Second Edition, Completely Revised. Volume 5. Hydrolytic Cleavage (Part B). Phosphate Ester Cleavage. Acid Anhydride Cleavage. Phosphorolytic Cleavage. C–C Synthesis and Cleavage. Isomerization. Hydration and Dehydration. Edited by PAUL D. BOYER, Department of Physiological Chemistry, University of Minnesota, Minneapolis, Minn.; HENRY LARDY, Institute for Enzyme Research, University of Wisconsin, Madison, Wis.; and KARL MYRBÄCK, Institute for Organic Chemistry and Biochemistry, University of Stockholm, Stockholm, Sweden. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1961. xix + 645 pp. 16 × 23.5 cm. Price, $20.00.

The first edition of "The Enzymes," edited by Sumner and Myrbäck, rapidly gained acceptance as the standard reference for this field. The publication of a second edition approximately 10 years later is fully justified by the increased insight into the nature of enzymatic processes and properties as well as the large amount of descriptive information about individual enzymes published during this time. The field of biochemistry has been the recipient, or victim, of a logarithmically expanding number of reviews that omit few subjects. Nevertheless, it is a service to all to provide a comprehensive treatise that includes surveys of the entire field of enzymology by active workers in specialized areas. It is apparent that these investigators are concerned with problems of current interest, so that this edition must be viewed as a tool for the next several years, to be superseded by an even more expanded series when problems reach a more sophisticated level. It is to be hoped that eventually precise knowledge of enzyme structure and mechanism of action will permit brief statements of fact to replace the elaborate circumlocutions now required to construct images of enzymes from indirect evidence.

In Volume 5 of the present series, the editors have succeeded admirably in organizing a series of topics that are profitably surveyed in addition to being described in separate articles. The six general groupings of reactions included in this volume are the subjects of review articles of exceptional interest. The authors of these surveys have been allowed to explore many facets of their subjects, leaving the more complete descriptions of individual enzymes to the authors of more specialized articles.

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 transacetase (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 desulfhydrase 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.

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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 × 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 assays 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.