

enzymes, metal enzyme complexes and metal-complexing agents, Vallee considers in some detail the role of zinc in several enzymes, including alcohol dehydrogenase. This is a rather complete summary of the author's contributions to this field, but perhaps one which is somewhat too selective as regards over-all contributions.

K. G. Paul contributes a chapter on heme compounds in enzyme catalysis. This chapter deviates in many ways from the usual treatment of heme compounds; it is well written and makes interesting reading if only because of the dry humor that occasionally crops up. The author's discussion of technical advances in the study of heme compounds is perhaps rather superficial but on the whole this is a rewarding chapter to read.

The chemistry and selected aspects of the biological roles of vitamins K and E are the subjects of two chapters, contributed by H. Dan and E. S ndergaard (vitamin K) and P. D. Boyer (vitamin E). Both of these chapters concentrate mainly on discussing existing evidence concerning the biological role of vitamins K and E, a role that unfortunately remains elusive.

In a charming essay, Wald and Hubbard discuss the enzymatic aspects of the visual process, the material for the chapter coming mainly from the author's own investigations. The reader is disappointed in that he does not find out how enzymes act as amplifiers, a choice tidbit that is promised in the chapter's introductory comments.

The last two chapters of the book comprise a brief and concise review of the role of ascorbic acid in mammalian systems (J. J. Burns and G. Ashwell) and a short exposition on enzymatic equilibria and thermodynamics (M. J. Johnson). The latter contributions seem out of place in this volume since one would like to think that "the average biochemist who has become interested in enzymic equilibria" would have progressed further in his knowledge of these matters than this chapter will lead him.

This reviewer enjoyed reading Volume 3 (Part B) of "The Enzymes," but with the reservations expressed in the opening comments of this review.

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Biochemie und Klinik. Monographien in Zwangloser Folge.

Edited by DR. G. WEITZEL, O. Prof. f r Physiologische Chemie, Direktor des Physiol.-Chem. Instituts der Universit t T bingen, and DR. N. Z LLNER, Priv.-Doz. f r Innere Medizin, Wiss. Assistent der Mediz., Poliklinik der Universit t M nchen. Nicht-glykolytische Stoffwechselwege der Glucose. By PROF. DR. S. HOLLMANN, G ttingen. Georg Thieme Verlag, Herdweg 63, Stuttgart-N, Germany. 1961. x + 220 pp. 15.5 x 23.0 cm. Price, DM. 39.—.

The purpose of these monographs is to review critically certain subjects of biochemistry which have become important for clinical medicine. Recent developments in biochemistry have made it abundantly clear that the key to an understanding of disease processes is often to be found in metabolic abnormalities. In particular, the so-called inborn errors of metabolism have become explicable in terms of a genetic loss of a single enzymatic function. With the unravelling, in the last 20 years, of the principal metabolic pathways, the content of biochemistry has increased enormously, some say as much as 300%, and it then becomes very difficult for the non-specialist to gain a working knowledge of a new and rapidly developing field. If he turns to the large handbooks, he will often find them out of date. These monographs, by being more limited in scope, are supposed to bridge the gap between biochemistry and clinic. They are to inform the clinician of important developments which may be applicable in medicine, and they are to give the biochemist a deeper insight into clinical problems.

The present volume fulfills this purpose to a considerable degree, since it may be read with profit by representatives of either discipline. An up to date bibliography of more than a thousand references covers the existing literature up to 1960 and gives an idea of the amount of work which has been done in recent years on "non-glycolytic" pathways of glucose metabolism.

In the glycolytic pathway the carbon chain of glucose undergoes oxidation at positions 3 and 4 and yields pyruvic acid as the principal intermediate product. This pathway is mainly concerned with the production of metabolic energy. There are now two other oxidative pathways known to occur in the mammalian organism which serve more specialized purposes. One is oxidation at carbon 1 which leads to the pentose phosphate cycle and the other oxidation at carbon 6 which leads to the glucuronic acid-xylulose cycle. In both cycles the pentoses which are formed by decarboxylation can be converted back to hexoses by a series of reactions involving isomerization and group transfer. Attempts have been made to measure quantitatively the extent of these reactions in various tissues, largely by means of isotopically labeled glucose. Other topics dealt with in this monograph are the synthesis and degradation of L-ascorbic acid, the synthesis of amino sugars, the function of uridine-linked sugar derivatives, and the metabolism of L-fucose and L-rhamnose. The metabolism of these substances in microorganisms is also considered. A special chapter is devoted to the separation, identification and determination of sugars and their derivatives.

The material in this monograph is well organized and is illustrated by numerous schemes of metabolic sequences in the form of chemical formulas. Quantitative aspects of metabolism are emphasized and the tabular material is well chosen. The author shows an excellent knowledge of the field and has produced a clearly written and well balanced critical survey which can be read with profit by biochemists as well as clinicians.

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Biochemistry of Steroids. By ERICH HEFTMANN and ERICH MOSETTIG, Steroid Section, Laboratory of Chemistry, National Institute of Arthritis and Metabolic Diseases, National Institutes of Health, Bethesda, Maryland. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1960. xi + 231 pp. 16 x 23.5 cm. Price, \$5.75 (college), \$6.90 (trade).

According to the editor's introduction, this volume is the first complete book to be written on the biochemistry of steroids and supplements Fieser and Fieser's chemical treatment, "Steroids." However, the two works are quite different, both in form and utility. Whereas Fieser and Fieser is a comprehensive treatise of greatest usefulness to the expert in steroid chemistry, Heftmann and Mosettig is, as stated by the authors, a brief introductory book to fill the need for concise information about the biochemical aspects of steroids for organic chemists in the pharmaceutical industry and for students and research workers in the various fields of biochemistry, physiology, endocrinology, pharmacology and medicine.

The authors have accomplished a formidable task in correlating and condensing a vast amount of information into a compact and readable form. The book's ten chapters are arranged in a sequence following as much as possible the biogenetic relationships between the classes of steroids. The first chapter concerns cholesterol and contains an excellent summary of the current knowledge about cholesterol biosynthesis. Next are discussed the other sterols, vitamin D, the steroid sapogenins and alkaloids, the cardiac glycosides and the bile acids. In each case consideration is given to the structure and occurrence of important compounds, biogenetic information when available, physiological and economic importance and methods of analytical determination. The final part of the book deals with the steroid hormones, progestational, corticoid, androgenic and estrogenic, with a consideration of the biosynthesis, metabolism, physiological actions and methods of analysis for each class. Especially valuable is a description of the modified physiological properties of the newer synthetic analogs of the natural steroid hormones.

Trivial nomenclature is used for the most part which makes for easy reading, and where systematic steroid nomenclature is required the older conventions are employed. This practice facilitates correlation with Fieser and Fieser, but, unfortunately, it tends to prolong the time before steroid chemists and biologists uniformly employ the

standardized official nomenclature now adopted by "Chemical Abstracts" and leading scientific journals.

The authors have chosen to present their exposition without "footnotes, tables or other distracting ancillary material," and to append a list of 774 references, classified as to general subjects, from which the majority of the information presumably is derived. Although this absence of specific documentation may facilitate reading for the beginner, it constitutes a serious limitation of the usefulness of the book for the worker in the field. Not only is one unable to take full advantage of the many novel and interesting facts presented, but in the few instances where statements in the text are at variance with the impression of this reviewer (for example, that 2 α -methylcortisone is an active corticoid in any species or that androstenedione is reduced to dehydroepiandrosterone by *Pseudomonas testosteroni*), it is difficult to check the source to resolve the discrepancy.

In presenting an orientation for beginners, this reviewer has some reservation about the pedagogical tactics of the authors. The text often does not provide the neophyte with a clear picture of the more important points. For example, Chapter 5 begins with the statement that certain plants contain glycosides of C₂₇-steroids with potent "cardiac activity," but, except for scattered mention of toxicity, the meaning of cardiac activity is buried late in the chapter in a paragraph beginning "Cardiac glycosides have a bitter taste." In the chapter on estrogens, a definitive initial impression of the biological importance of these hormones is obscured by an immediate discussion of the non-steroidal substances with estrogenic activity found in certain plants. The important mammalian hormone, estradiol-17 β , is not included among the examples of estrogens given nor even mentioned until the sixth chart of the chapter where it is merely shown to be in metabolic equilibrium with estrone. In Chapter 4 one finds statements that "another interesting sapogenin is digitogenin" and that "the glycoside digitonin contains 2 glucose, 2 galactose and 1 xylose units," but, unless he consults another text, the reader does not know for sure that digitonin contains digitogenin as its aglycone.

In spite of these points of criticism, and no attempt to condense steroid biochemistry into 169 pages could possibly please everyone in every detail, "Biochemistry of Steroids" is a valuable contribution to the steroid literature.

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Comparative Biochemistry. A Comprehensive Treatise. Volume I. Sources of Free Energy. Edited by MARCEL FLORKIN, Department of Biochemistry, University of Liège, Liège, Belgium, and HOWARD S. MASON, University of Oregon Medical School, Portland, Oregon. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1960. xxv + 590 pp. 16 X 23 cm. Price, \$18.00.

Volume I of this series initiates a long needed integration of the vast store of facts and theories that have been derived from a multitude of investigations on diverse biochemical systems in the past few decades. The historical role and contemporary importance of a comparative approach to biology and biochemistry is presented very elegantly in an introductory chapter. The theme that thermodynamics constitutes a common denominator for biochemical reactions is developed in the first chapter. General concepts are explained with great clarity. The thermodynamical analysis of open systems is especially welcome since few biologists or biochemists have access to a readable account of this recently developed branch of science. The reviewer would have welcomed also some additional applications to specific biochemical systems as well as a more extensive treatment of entropy changes in chemical reactions and the relationship between entropy and information content. In subsequent chapters considerable attention is given to the energy-yielding reactions which are ubiquitous in nature. These are grouped into chapters on glycolysis, terminal electron transport, fatty acid oxidation and oxidation of inorganic substrates. The complex metabolic pathways are thoroughly analyzed and integrated into the scope of a comparative treatise. The photosynthetic reactions obviously belong here too but these are to appear in a subsequent volume. The chapters on energy-rich and onium compounds are exceptionally thorough and lucid and complement the path-

way analyses perfectly. The remaining material of the book diverges from the main theme. Although superbly discussed, the subjects of phototropism and phototaxis, vision and thermal energy utilization seem rather unrelated to free energy sources. The reactions involved in these phenomena would more appropriately be considered as triggering or control devices rather than as sources or transformers of free energy.

The reviewer feels that this volume is one of the most valuable additions to the review bookshelf and strongly recommends it to all students, teachers and research workers in biology and biochemistry.

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Field Emission and Field Ionization. Harvard Monographs in Applied Science Number 9. By ROBERT GOMER. Harvard University Press, Cambridge, Mass. 1961. 195 pp. 14.5 X 21 cm. Price, \$6.75.

A glance through the references in this monograph quickly indicates that the relevant literature is widely scattered throughout the journals of physics, chemistry and metallurgy. It seems therefore appropriate that a review be published and, according to the dust jacket, this monograph is "believed to be the first book in English" on the subjects named in its title. The first chapter is devoted to the theory of field emission, comparable in level to but considerably more detailed than treatments found in standard solid state physics texts. Chapter 2 deals with characteristics of field emission microscopes and especially the experimental aspects of attaining suitable emission tips; this useful lore for the practicing microscopist is supplemented by an appendix on the technical details of screens, tip assemblies, vacuum systems, and electronic equipment. Chapter 3 contains a discussion of field ionization ("... field emission in reverse, ... the tunneling of electrons from molecules into the tip ..."), field desorption, and their applications, such as in microscopy, investigation of potential curves in adsorption processes, and tip cleaning. Chapters 4 and 5 return to field emission for a fairly thorough discussion of the following applications: gas-solid adsorption; surface diffusion; properties of dielectric layers; molecular images; whisker growth and structure. The book closes with a second appendix on "recent work," a list of footnote references, and a complete index. It is well supplied with photographs of emission patterns, tables of relevant data, and useful working equations, and appears to be a book useful to workers involved in, or contemplating, research in the areas of field emission and ionization.

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The Chemistry of the Terpenes. By A. R. FINDER, B.Sc., Ph.D., D. Phil., Senior Lecturer in Organic Chemistry, University College, Cardiff, University of Wales. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1960. vii + 223 pp. 16 X 25 cm. Price, \$8.25.

The decision as what to include in a single volume devoted to the chemistry of terpenoids must, to a certain extent, be arbitrary. The present volume devotes 27 pages to essential oils and the general determination of structure, 86 to mono-terpenoids, 33 to sesquiterpenoids, with 29, 39 and 11 pages for the di-, tri- and tetraterpenoids, respectively. There are two final smaller sections on rubber and the biogenesis of terpenoids. This seems, on the whole, an acceptable balance.

The date of the preface is May, 1960, but no reference later than 1958 appears and those of 1956 and later constitute a very small proportion (about 4%) of the whole. In the space at his disposal the author covers adequately what may be described as classical terpenoid chemistry. The structural determination of the simpler, and some of the more complex members, and their related syntheses are clearly presented. The determination of stereochemistry receives, except with the monoterpenoids, a smaller place.