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Book Reviews

Semisynthetic Proteins. By R. E. Offord (Oxford University). John Wiley and Sons, Inc., New York. 1980. xi + 235 pp. $46.75.

The purposes of this book are to consolidate technical advances in the young field of protein semisynthesis and to encourage further development. The book is intended to serve both those now working in the field and those who might come to it with special skills in classical peptide chemistry or pharmacology, synthetic organic chemistry, or protein chemistry. The objective of the technique is to employ natural proteins as much as possible as the starting materials for obtaining proteins of sequences that are not found in nature. The new products, combining natural sequence segments with artificially inserted amino acid residues, provide unique opportunities for studies of protein structure and function or for labeling molecules for metabolic studies. Two or more cleaved fragments of a protein may associate noncovalently to form a functional complex, making possible noncovalent semisynthesis involving substitutions in relatively simple segments of the complete molecule, or facilitating the apposition of residues to be recoupled in the covalent semisynthesis. The field presents special problems of solubility, and irreversible aggregation pervading all stages of group protection, cleavage, activation, coupling, deprotection, and purification.

The book is organized to deal clearly with overall strategy while concentrating on technical problems. The reader is carried through all the procedural steps that are normally required, from the formal reactions to specific detailed examples of their application complete with notes dealing with alternatives, warnings, and so on. The skillful organization of disparate material from different laboratories is impressive. Particularly valuable are the illustrations of the use of enzymes in activation and coupling as well as in cleavage stages. Two appendixes deal with characterization of products and intermediates and some common technical problems. The final chapter of the text reviews briefly the findings and implications of published work on semisynthesis. Many of the most encouraging and significant results in the field have appeared since this book was completed. We may look forward to the solution of important biological questions in which the impetus of Offord's book will play no small part.

Frank R. N. Gurd, *Indiana University*

Dynamic Heterogeneous Catalysis. By K. Tamaru (University of Tokyo). Academic Press, London. 1978. xiii + 140 pp.

Many of the techniques that have been developed to study solid catalysts must be applied under conditions far removed from those actually used in catalytic reactions. Frequently they require static experimental systems. In most cases these constraints severely limit their utility in catalysis, since catalytic reactions are obviously dynamic in nature. As the author correctly asserts, "Dynamic behavior should be studied in a dynamic manner."

For over a quarter of a century Professor Tamaru has been in the process of developing techniques that can be applied in a dynamic way by perturbing systems under reaction conditions and observing their decay back to steady state. He has treated catalytic reactions as chain reactions with the catalyst being the chain carrier. This short book gives an excellent overview of the spectroscopic approach he has taken in applying this philosophy productively in his research. As a result of his and similar studies, it is now possible to understand the detailed mechanisms of several classical catalytic reactions. These are presented in such a lucid way as to make this book useful reading for both beginners and long-time practitioners of catalytic science.

The general rules that govern catalytic reactions are clearly outlined in Chapter 1. Of primary importance is the interaction between thermodynamic and kinetic parameters. Series/parallel reaction networks are illustrated by the equilibration of water in standpipes connected by different sized tubes. His treatment of the stoichiometric number concept for determining the rate-limiting step in catalytic reactions follows this analogy and is quite easily understood. A discussion of the kinetics of chain reactions and the importance of chemical intermediates conclude the chapter.

At least one component in a chemical system reacting over a solid catalyst must be adsorbed. Chapter 2 discusses a variety of techniques that are used to study directly the chemical nature of adsorbed species as well as the mathematical equations that describe the amounts of material adsorbed at equilibrium. Schematic diagrams of equipment and sample spectra make it easy to understand the application of field emission microscopy, LEED, ELS, Auger, XPS, spectrophotometry, NMR, and ESR to investigate the nature of adsorbent–adsorbate chemical bonds.

Heterogeneous kinetics and its use to help elucidate the mechanisms of catalytic reactions are covered in Chapter 3. Langmuir–Hinshelwood equations are derived, and the Temkin–Pyzhev equation for ammonia synthesis over a doubly promoted iron catalyst is cited as a classic example of dynamic behavior during catalytic reactions. The decomposition of germanium hydride and of ammonia (over a tungsten catalyst) illustrate the kinetic equations.

The real meat of the book lies in Chapter 4 where Tamaru discusses application of spectroscopic techniques to the dynamic treatment of adsorbed species under reaction conditions. Several reactions (H_2–D_2 exchange, olefin isomerization, formic acid decomposition, water–gas shift, and methanol decomposition) over zinc oxide and magnesium oxide serve to illustrate how IR and microwave spectroscopy are successfully utilized under dynamic conditions. A heavy emphasis is placed on the use of isotopic tracers to establish how atoms in adsorbed species are replaced with atoms from the gas phase. These results give an insight into the intricate details of processes that occur on the surface during catalytic reactions.

This book is quite well written. Considering its brevity, the book does an incredible job of meshing time-tested fundamental principles with the latest in current understanding of heterogeneous catalysis. It will serve as stimulating and useful reading for both catalytic neophytes and pros alike.

Joe W. Hightower, *Rice University*

Analytical Atomic Absorption Spectroscopy. By John C. VanLoon (University of Toronto). Academic Press, New York. 1980. 337 pp. $35.00

The author states in his preface that this book is designed with the practicing analyst in mind and that theory has been presented in a fairly descriptive, nonrigorous way. In our opinions, the author has succeeded admirably in meeting these goals and has produced a reference text which should prove useful to most individuals using atomic absorption as a routine method of analysis.

Although the book is written principally for workers already familiar with atomic absorption, an introductory chapter (76 pages) describes the fundamental principals of the technique and offers useful suggestions on its practical application. The instrumental components of an atomic absorption spectrophotometer are described in detail and alternative choices for each component (i.e., flames versus electrothermal atomizers) critically appraised. An interesting section is included which establishes guidelines for selecting a commercial atomic absorption spectrometer and helpful hints are included on how solutions can best be prepared and stored for use in routine analyses.

Later chapters deal with the analysis of various samples by kind. For example, Chapter Two deals with the analysis of waters, whereas later chapters cover geological materials, organic samples, metals and alloys, air samples, petroleum and petroleum products, and metal compounds. In each chapter, a number of methods are included for specific samples of that kind and procedures for commonly determined elements are detailed. Each of the particular methods is presented in the following basic format:

Comment on the method—In this section the inadequacies of the

method and its accuracy are discussed. Possible analyte losses or contamination, the use of standard reference samples, and special precautions are covered for specific elements.

Reagents and equipment—This part lists the preparation of standard solutions and analytical reagents. It includes the make and model of equipment used and lists accessories. Suppliers of the reagents and equipment are recorded when available.

Procedure—The analytical method is given in detail and includes sample dissolution procedures, preparation of standards, operating conditions, and necessary measurements.

The book's last chapter is one with the intriguing title of Expected New Developments in Atomic Spectroscopy. Unfortunately, the chapter merely lists a number of currently important, but relatively established, procedures and offers the reader little projection into the future. However, a number of important trends are identified, including the recent application of atomic spectrometric methods to speciation studies.

Most omissions or errors in the text are of minor consequence. However, although safety is emphasized throughout and detailed instructions are given for the handling of hazardous materials such as perchloric acid, there is no mention of the difficulties and dangers inherent in employing hydrofluoric acid during sample dissolution. This acid is widely used in the described procedures for geological materials and in the total digestion of plant tissues. The most detracting feature of the book, however, is the rather poor quality of most photogaphs which were chosen to illustrate particular kinds of instrumentation. In most cases, the component being illustrated is either not indicated on the figure or is hardly visible. Errors in spelling and grammar are few enough to be discounted and, although IUPAC terms are not consistently used, the inconsistencies are unlikely to cause serious difficulty to any reader.

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The Porphyrins. Volume III. Physical Chemistry. Part A. Edited by David Dolphin (University of British Columbia). Academic Press, New York. 1978. xviii + 636 pp. $68.00.

This volume covers certain aspects of electronic and vibrational absorption spectroscopy, mass spectroscopy, and X-ray crystallography of the porphyrins.

Chapter 1 (M. Gouterman, 156 pp, 337 refs), Chapter 2 (F. Adar, 39 pp, 105 refs), and Chapter 3 (C. Weiss, 12 pp, 16 refs) are devoted to the optical spectra of porphyrins and metalloporphyrinates, the electronic absorption spectra of hemoproteins, and the electronic absorption spectra of chlorophylls, respectively. The magnetic optical activity of porphyrins (J.C. Sutherland, 21 pp, 56 refs) is covered in Chapter 4, the magnetic optical activity of hemoproteins (B. Holmquist, 20 pp, 56 refs) in Chapter 5, and circular dichroism of hemoproteins (V. P. Myer and A. Pande, 47 pp, 144 refs) in Chapter 6.

Chapter 7 (J. O. Alben, 21 pp, 57 refs) and Chapter 8 (R. H. Felton and N. Yu, 41 pp, 193 refs) deal with infrared spectra and the resonance Raman scattering of porphyrins, respectively, while the mass spectra of porphyrins are treated in Chapter 9 (H. Budzikiewicz, 60 pp, 233 refs).

Robert Haushalter, *The University of Michigan*

The Porphyrins. Volume IV. Physical Chemistry. Part B. Edited by David Dolphin (University of British Columbia). Academic Press, New York. 1979. xix + 527 pp. $47.00.

This volume covers nuclear and electron magnetic resonance spectroscopy and Mössbauer spectroscopy of the porphyrins. Chapter 1 (T. R. Janson and J. Katz, 54 pp, 175 refs) and Chapter 2 (G. La Mar and F. Walker-Jensen, 96 pp, 179 refs) cover magnetic resonance spectroscopy of diamagnetic and paramagnetic porphyrins, respectively.

ENDOR spectroscopy is treated in Chapter 3 (J. R. Norris, H. Scheer, and J. J. Katz, 35 pp, 50 refs). Four chapters are devoted to the ESR spectra of porphyrins. Chapter 4 (J. Fajer and M. S. Davis, 54 pp, 138 refs) gives an excellent account of the ESR spectra of porphyrin π anions and cations while Chapter 5 (J. H. van der Walls, W. G., van Dorp, and T. J. Schaafsma, 52 pp, 115 refs) deals with ESR spectra of porphyrin excited states. Chapter 6 (G. Palmer, 30 pp, 89 refs) contains an excellent treatment of the ESR of hemoproteins. In contrast to the thorough discussions of ESR in Chapters 4–6, Chapter 7 (W. C. Lin, 20 pp, 56 refs), which apparently was supposed to cover the ESR of all non-iron metalloporphyrinates, discusses the ESR behavior of only four metalloporphyrinates (Cu, V, Ag, and Co). In addition, most of the references for Chapter 7 are before 1970.

The Mössbauer spectra of hemoproteins and Chapter 9 (J. R. Sams and T. B. Tsin, 51 pp, 96 refs) are on the Mössbauer spectra of iron porphyrinates. Author and subject indexes are included.

Robert Haushalter, *The University of Michigan*

The Porphyrins. Volume VI. Biochemistry. Part A. Edited by David Dolphin (University of British Columbia). Academic Press, New York. 1979. xxi + 932 pp. $90.00.

This volume discusses the biosynthesis of porphyrins and chlorophyll, the chemistry of the bile pigments, as well as the clinical chemistry of the porphyrins.

Chapter 1 (R. B. Frydman, B. Frydman, and A. Valasinas, 115 pp, 327 refs) and Chapter 2 (L. Bogorad, 47 pp, 242 refs) cover the biosynthesis of porphyrins and their precursors as well as chemical syntheses of these compounds, while Chapter 3 (O. T. G. Jones, 49 pp, 196 refs) treats the biosynthesis of chlorophyll. Chapter 4 (B. F. Burnham and R. C. Bachmann, 20 pp, 105 refs) is a useful guide to the laboratory preparation of natural porphyrins by enzymatic syntheses.

The in vivo degradation of hemes to bile pigments is discussed in Chapter 5 (R. Schmid and A. F. McDonagh, 30 pp, 159 refs) while Chapter 6 (A. F. McDonagh, 121 pp, 694 refs) is an exhaustive survey of bilatrienes and 5,15-diladienes. Chapter 7 (A. Bennett and H. W. Siegelman, 22 pp, 218 refs), Chapter 8 (D. A. Lightner, 60 pp, 121 refs), and Chapter 9 (A. Gossauer and H. Plieninger, 58 pp, 227 refs) cover the bile pigments of plants, derivatives of bile pigments, and the synthesis (by chemical means) of bile pigments, respectively. The Stokvis reaction is discussed in Chapter 10 (H. von Dobenek, 10 pp, 54 refs).

The clinical chemistry of porphyrins is covered in Chapter 11 (L. Eales, 118 pp, 408 refs) and the book concludes with historical and clinical aspects of the bile pigments in Chapter 12 (Z. J. Petryka and R. B. Howe, 26 pp, 246 refs). Author and subject indexes are included.

As with most of the other volumes of this series, the inclusion of laboratory method sections greatly measures the utility of the book.

Robert Haushalter, *The University of Michigan*

General and Synthetic Methods. Volume 3. Senior Reporter: G. Pattenden (University of Nottingham). The Chemical Society, London. 1980. xiv + 382 pp. $83.00.

This survey of the literature of organic synthesis, covering primarily the literature of 1978, continues the high level of presentation and broad coverage of the first two volumes. The material is divided into eleven chapters—saturated and unsaturated acyclic hydrocarbons; aldehydes and ketones; carboxylic acids and derivatives; alcohols, halogeno-compounds, and ethers; amines, nitriles, and other nitrogen-containing functional groups; organometallics in synthesis; saturated carbocyclic ring synthesis; saturated heterocyclic ring synthesis; strategy and design in synthesis; photochemistry in synthesis (covering the literature since 1974); and a list of reviews on general synthetic methods.

This division leads to some unavoidable duplication of material and references. The omission of a subject index mars an otherwise excellent survey. The high price of the volume is a formidable barrier to sales to all except serious practitioners of the synthetic arts.

Lawrence J. Altman, *State University of New York at Stony Brook*

Spectroscopy in Heterogeneous Catalysis. By W. N. Delgass (Purdue University), G. L. Haller (Yale University), R. Kellerman (Xerox Corporation), and J. H. Lunsford (Texas A&M University). Academic Press, New York, New York. 1979. x + 341 pp. $35.00

This book describes the applications of eight types of spectroscopies to heterogeneous catalysis. After an introductory chapter largely devoted to documenting the scope of spectroscopy in catalysis, the chapter headings are Infrared Spectroscopy, Raman Spectroscopy, Diffuse Reflectance and Photoacoustic Spectroscopies, Moessbauer Spectroscopy, Electron Spin Resonance Spectroscopy, Nuclear Magnetic Resonance Spectroscopy, and X-Ray Photoelectron Spectroscopy. As stated in the preface, the intent of this book is to provide " an overview of the concepts and capabilities of a particular technique, enough theory and detail on experimental procedures to help those seriously preparing to take measurements, and examples of all proven or potentially important applications". The book does admirably well in fulfilling its intentions. Although several authors (each well respected in the field) contributed to the text, the taskmaster was apparently Jack Lunsford and this has aided in achieving a fairly uniform style and depth of coverage. Most chapters follow the format of an introduction followed by sections on theory, experimental methods, applications to heterogeneous catalysis, and conclusions. Each chapter has roughly 100 references, and there is also a subject index at the end of the book. the references appear current through 1977.

The length of the book clearly does not allow a definitive discussion of each topic. However, a balanced presentation of theory and practical considerations with adequate references to both the literature and detailed treatises should make this a useful text for workers new to the area or desiring a useful summary of the art. The examples are particularly useful in illustrating the applications of each technique. However, in

some chapters it would have been helpful to have more detailed discussions of the sensitivity of a technique and how it might vary with the nature of a sample, sample preparation, the reliability and possible pitfalls in applying a technique, the cost of an instrument, the time required to obtain a spectrum, and the relative merits of a technique vis-a-vis other methods of obtaining the same type of information.

A. Brenner, *Wayne State University*

Drug Design. Volume VIII. Edited by E. J. Ariens (University of Nijmegen, The Netherlands). Academic Press, New York. 1979. XVII + 420 pp. $42.00.

Volume VIII in the Drug Design series contains seven wide-ranging critical reviews by eminent authors relating to the theoretical and practical approaches for successful design of optimum drug systems. Chapter 1 is a comprehensive review in the area of multiple regression analysis for quantitatively correlating physical, electronic, and structural features with biological activity. As an alternative to these complex QSAR treatments, the empirical approach enumerated in the Topliss decision trees would be of considerable help to a medicinal chemist developing a new series of compounds. Chapter 2 discusses the application of computer-assisted pattern recognition approach to drug design illustrated by many examples. Chapter 4 explores receptor binding as a tool in the development of new bioactive steroids. The advantage of this technique is in that biological tests can be performed on tissue and cell cultures containing receptor sites thus replacing time-consuming customary biological testing. Some of the theories discussed in the above reviews find application in Chapter 5 on the design of synthetic sweetners. Chapter 6 builds up a predictive approach for the assessment of environmental effects of chemicals on biosphere (air, water, and soil) before they enter the environment.

The last chapter includes the properties of selective ion-binding macrocyclic compounds (primarily polyethers) which may find application in the preparation of unique drug dosage forms. This aspect of designing optimum dosage forms to achieve the most efficient biological use of known drugs is thoughtfully covered in Chapter 3—the design of controlled drug delivery systems.

It is expected that this reference work would be of considerable value to the medicinal, environmental, and pharmaceutical chemists.

O. P. Goel, *Warner Lambert/Parke-Davis*

Chemodynamics. By Louis B. Thibodeaux (University of Arkansas). John Wiley & Sons, New York. 1979. xxiii + 501 pp. $29.50.

The subtitle of this book—Environmental Movement of Chemicals in Air, Water, and Soil—is more informative than its main title, at least for chemists. The emphasis is actually upon the transport of substances across interfaces, specifically those important in the environment—land/water, land/air, and water/air. After a brief introductory chapter there is a chapter on equilibrium at interfaces followed by a chapter on transport fundamentals. Next come three chapters devoted to the respective environmental interfaces. The penultimate chapter concerns transport within single phases. The final chapter is a brief mentioning of several important chemical transport processes which were not covered in the book. Appendices contain tables of environmental and chemical data.

The author emphasizes that this is a "how to" book rather than a text in fundamentals. The concepts are succinctly set out and relationships based upon equations of continuity for heat and (nonreacting) substances are given. Though the derivations of these relationships are usually not given in detail, they are generally adequately outlined and referenced.

The references appear at the end of each chapter. They are not only to standard textbooks, but also to research papers in journals and symposium volumes published up through 1977 or 1978 depending upon the chapter. If the reader is reasonably grounded in the fundamentals of transport of heat and matter in fluid media, he will find no particular difficulty in understanding the material presented and problems treated in the book. I found the book generally easy to read because of the condensed presentation of conceptual material and the division of the text into brief sections. The author has succeeded admirably in presenting a very useful and exhaustive compendium of practical environmental transport problems and the working relationships used for solving them. Each chapter gives a number of problems for the reader to try his hand at solving. In attempting to solve a few problems, I found them to be nontrivial and reasonably instructive.

Professionals in the field of environmental engineering and science including environmental chemists will probably find the most use for this book and, indeed, will find it to be very useful. How long will it take for that volatile solvent spill to evaporate? At what point downstream will this trace substance have its concentration reduced to a certain level due to evaporation or deposition by adsorption on the stream bed? What concentrations of stack gas effluent will be present at a given location relative to the stack? These are a few of the types of problems treated. The material presented on transport phenomena is relevant to naturally occurring trace substances as well as to those introduced as pollutants. Thus, for example, scientists who wish to understand the distribution among the various "reservoirs" of the earth of trace substances in biogeochemical cycles should find the treatments of the two-resistance model of interphase mass transfer to be instructive and useful. I judge that advanced graduate students in environmental studies would also find the book of considerable value, both as a reference and a practical guide to problem solving.

Since the book does not treat chemical transformations it will undoubtedly be of limited usefulness to those scientists and engineers primarily concerned with transport of reactive substances. Examples of this type of problem are the formation of particulate sulfate in plumes containing sulfur dioxide and the changes in stratospheric ozone distributions caused by halocarbons and oxides of nitrogen.

It is to be expected that, because of limitations of knowledge and definitive laboratory and field data, application of the techniques and equations presented in "chemodynamics" provides only approximate answers. The auther is quite aware of this and conveys the message in the text as necessary.

All of the above is to judge the book positively and to recommend it to professionals in environmental engineering and science. It should also be acquired by libraries, especially because it is such a comprehensive treatment of the subject of interfacial transport, various aspects of which might be found to be relevant to almost any scientist's or engineer's work.

James P. Friend, *Drexel University*

BOOKS RECEIVED

Chemistry and the Living Organism. 2nd Edition. By M. M. Bloomfield. John Wiley & Sons, Inc., N.J. 1980. $17.50.

General Chemistry. By J. B. Russell. McGraw-Hill Book Co., New York. 1980. $19.95.

Fundamentals of Chemistry. Fourth Edition. By Brescia/Arents/Meislich/Turk. Academic Press, New York. 1980. $19.95.

Instructor's Guide to Accompany "Chemistry for Changing Times". 3rd Edition. By J. W. Hill. Burgess Publishing Co., Minneapolis, MN.

Chemistry for Changing Times. 3rd Edition. By John W. Hill. Burgess Publishing Co., Minneapolis, MN. $14.95.

General, Organic, and Biological Chemistry, Chemistry for the Living System. By James/Schreck/Bemiller. D. C. Heath & Co., Lexington, MA. 1980.

Chemistry: A Life Science Approach. By Baum/Scaife. McMillan Publishing Co., New York. 1980. $18.95.

General Chemistry. 2nd Edition. By Becker/Wentworth. Houghton Mifflin Co., Boston. 1980.

Chemistry (With Inorganic Qualitative Analysis). By Moeller/Bailar, Jr./Kleinberg/Guss/Castellion/Metz. Academic Press, New York–San Francisco–London. 1980.