

thesis of a novel reagent, which will supersede the fluorogenic ninhydrin reaction for the assay of primary amines, shall be the subject of a forthcoming report.

Acknowledgments. We thank Dr. S. Udenfriend for drawing our attention to this problem and Drs. W. Dairman and K. Samejima for providing their results

prior to publication. We also express our gratitude to Professor G. Büchi for stimulating discussions.

M. Weigle,* J. F. Blount, J. P. Teng
R. C. Czajkowski, W. Leimgruber

Chemical Research Department, Hoffmann-La Roche Inc.
Nutley, New Jersey 07110

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Additions and Corrections

The Kinetics, Isotope Rate Effect, and Mechanism of Dehydrobromination of *cis*-1,2-Dibromoethylene with Triethylamine in Dimethylformamide [*J. Amer. Chem. Soc.*, **91**, 468 (1969)]. By W. K. KWOK, W. G. LEE, and SIDNEY I. MILLER,* Department of Chemistry, Illinois Institute of Technology, Chicago, Illinois 60616.

Professor J. M. Lehn pointed out to us that the molecule we took to have the structure **5M**, $\text{BrCH}=\text{CHN}(\text{CH}_3)_3+\text{Br}^-$, was really $\text{H}_2\text{C}=\text{CBrN}(\text{CH}_3)_3+\text{Br}^-$. The former assignment of Bode's was corrected by

F. Klages and E. Drerup, *Liebigs Ann.*, **547**, 65 (1941), and confirmed by M. Ohtsura, K. Tori, J. M. Lehn, and R. Seher, *J. Amer. Chem. Soc.*, **91**, 1187 (1969). The closest analog to the Bode structure or **5E** that we are aware of is $\text{BrCH}=\text{CHN}(\text{C}_2\text{H}_5)_2$, an unstable liquid [R. Tanaka and S. I. Miller, *J. Org. Chem.*, **36**, 3856 (1971)]. The argument against the $\text{S}_{\text{N}}2$ process has been weakened, but the remaining evidence still favors the $(\text{E1cb})_{\text{ip}}$ process.

k_{-4} (rather than k_4) should appear in the denominator of eq 12.

Book Reviews

Carbohydrate Chemistry. Volume 4. By J. S. BRIMACOMBE (University of Dundee). The Chemical Society, London. 1971. ii + 275 pp. £4.00.

The fourth volume of this Specialist Periodical Reports covers the literature published in 1970 and is arranged in two parts: (1) the chemistry of mono-, di-, and trisaccharides and their derivatives; (2) the structure and physical and biological properties of carbohydrate macromolecules.

Although the first part might be of greater usefulness for the carbohydrate chemist and the chemist of natural products, the detailed and well-organized list of contents should make it extremely valuable for teachers, analytical chemists, pharmacologists, and all those scientists interested in correlating chemical structure and biological or physical properties of carbohydrates. The coverage of the literature is excellent, and the content of the papers listed is summarized in an effective manner. Schemes, formulas, and diagrammatic representations are widely used to facilitate comprehension. Chapters 22-26 inclusive afford an excellent review of the recent analytical development in the field.

Although the emphasis of the volume is defined to be "throughout on chemical rather than biochemical aspects," the second part (due to Dr. J. F. Kennedy, University of Birmingham) should be of particular interest for the biochemists who might have missed some of the recent contributions. Again, the coverage of the topics is superb and their sequence so well organized that seldom do the reporters have to break the numerical sequence of their references in order to go back to contributions already mentioned. Chapters 2 to 5 inclusive (covering Glycoproteins, Glycopeptides, and Animal Polysaccharides; Enzymes Either Active on Carbohydrates or Containing Them; Glycolipids and Gangliosides; and Chemical Synthesis and Modification of Polysaccharides, Glycoproteins, Enzymes and Their Use) should be valuable not only to biochemists but also to clinical investigators interested in inborn errors of metabolism and to students who might wish to search for or to review some of the salient contributions made to the field in 1970.

Completed in August 1971, the volume was published the following November. Although the accumulating literature in this specialistic field made it look already like a labor of Sisyphus, the knowledge that this volume will be of help to a large cross section of chemists, scientists, and students should repay the reporters of their excellent efforts.

Nicola Di Ferrante, *Baylor College of Medicine*

Spectroscopic Properties of Inorganic and Organometallic Compounds. Volume 4. Senior Reporter: N. N. GREENWOOD (University of Newcastle upon Tyne). The Chemical Society, London. 1971. xviii + 604 pp. £10.00.

This volume is the fourth in this annual review series published as a Specialist Periodical Report by The Chemical Society, London. It surveys the literature published during 1970 and is divided into eight chapters: "Nuclear Magnetic Resonance Spectroscopy" by J. R. Blackborow and K. D. Crosbie; "Nuclear Quadrupole Resonance Spectra" by J. H. Carpenter; "Microwave Spectroscopy" by J. H. Carpenter; "Vibrational Spectra: General Introduction and Definitive Spectra" by B. P. Straughan; "Characteristic Vibrational Frequencies of Compounds containing Main-group Elements" by B. E. Prater; "Vibrational Spectra of Transition Element Compounds" by B. E. Prater; "Vibrational Spectra of Some Co-ordinated Ligands" by M. Kilner; "Mössbauer Spectroscopy" by R. Greatrex and N. N. Greenwood. This arrangement differs from earlier volumes in which esr, electronic spectra, and the magnetic properties of ionic solids and coordination compounds were included. A new series on these will be forthcoming.

The coverage in these chapters is quite thorough and indicates the prodigious effort which must have been expended by each reporter. That a review covering the 1970 literature could be written and published by October 1971 is indeed commendable.

One wonders, however, about the ultimate fate of annual review-type publications. They tend to discuss individual papers in such a succinct manner that the reader really finds out nothing about

their content. Knowing of their existence, he scurries off to the library only to find out time and again that the papers are not really what he was looking for. In addition, the growth rate of material covered in annual reviews appears in many cases to outstrip the reporter's ability to keep up. Many annual reviews which began with only a few reporters now have many. Many which covered a reasonable breadth of subject material now cover many fewer topics. This is an obvious problem which many have worried about—where will it all end?

Robert Damrauer, *University of Colorado, Denver Center*

Functional Groups in Organic Compounds. By WALTER S. TRAHANOVSKY (Iowa State University of Science and Technology). Prentice-Hall, Inc., Englewood Cliffs, N. J. 1971. x + 149 pp. \$8.95 hardcover; \$4.95 paperback.

This latest addition to the Foundations of Modern Organic Chemistry Series contains three chapters. The first briefly introduces the beginning student to the various types of functional groups and then covers organic nomenclature in detail. The most important substitutive nomenclature is emphasized, but other alternate types (*i.e.*, additive, subtractive, and conjunctive) are also introduced. Numerous tables, examples, references, and problems are included. Chapter 2 covers the relationship between physical properties and molecular structure. The treatment of boiling points, melting points, and ultraviolet-visible spectroscopy is good, but that of ir and nmr spectroscopy is too brief to be meaningful to the beginning student. Chapter 3 essentially lists numerous reactions of functional groups by type (addition, elimination, substitution, acid-base, oxidation-reduction). Although the treatment is necessarily brief, the student is directed to other books in this series for further reading in greater depth. Overall, this volume is a valuable addition to an excellent paperback series. The nomenclature chapter in particular should prove to be a valuable supplement to most introductory organic texts.

Robert E. Gilman, *Rochester Institute of Technology*

Chemical Modification of Proteins. By GARY E. MEANS and ROBERT E. FEENEY (University of California, Davis). Holden-Day, Inc., San Francisco, Calif. 1971. x + 254 pp. \$12.50.

Currently, the determination of relative reactivities of proteins and the investigation and relationship between biological properties and specific residues are active applications of the chemical modification of proteins. Consequently, the authors place emphasis upon the amino acid side chains and the chemical methods used in identifying their role in the unique properties of proteins. G. E. Means and R. Feeney have developed this book for graduate students interested in the chemical alteration of enzymes and other proteins; however, any chemist interested in the chemical, physical, and biological properties of proteins will find this work helpful indeed in selecting the chemical reactions and reagents suited to his research needs. The book is divided into three major parts, the first of which contains four chapters that provide the necessary background information about the chemistry and chemical reactions of proteins. Part two is in six chapters devoted to the chemistry of the reagents and their use in the chemical alteration of proteins. The reagents are grouped into chapters according to similarity in action (acylation, alkylation, etc.), and examples of their use are illustrated in each section along with an in-depth description of the chemical methods regularly employed. Part three, as an appendix, contains selected procedures taken from primary sources to allow the reader to perform model techniques for the modification of protein side chains. This book is well written and certainly will make available the literature and state of progress in this specialized area.

Robert A. Magarian, *The University of Oklahoma*

Symmetry, Orbitals, and Spectra. By M. ORCHIN and H. H. JAFFÉ (University of Cincinnati). Wiley-Interscience, New York, N. Y. 1971. xiii + 396 pp + appendix in cover flap (11 pp). \$16.50. Supplement: vii + 220 pp. \$5.95.

The collapse of well-defined disciplinary approaches to chemistry has made it more difficult in recent years to present the subject in an orderly fashion. The authors have recognized that the three concepts of symmetry, orbitals, and spectra are common to a number of traditionally separate areas, and they have composed a text intended as a one-semester course that covers a wide range of advanced topics. Successive chapters deal with light and energy, atomic orbitals and elementary MO theory, and linear and cross-conjugated molecules and the calculation of their spectra. Chapter 5 introduces the elementary group theory necessary to understand

the classification of orbitals and molecular vibrations on the basis of point symmetry properties. The theory is applied to the phenomena of optical activity, the equivalence of nuclei in nmr spectra, and dipole moments.

Group theory then forms the basis for the following chapters on bonding in transition-metal complexes and their electronic spectra, intensities and selection rules for electronic absorption spectra, infrared spectra, the Hückel molecular orbital treatment, excited states, and the conservation of orbital symmetry. In the final chapter the authors discuss and compare molecular orbital methods beyond the Hückel MO theory. Appendix 1 contains correlations of symmetry species in different point groups, and Appendix 2 (a reprint of which is enclosed) contains character tables of various point groups. References in the text are made only to major authors; at the end of each chapter a list of general works and a problem set appear. The five-page index is very adequate.

The supplement is a softbound volume with problems from the text worked out in detail. The problems are well chosen and cover a wide range of material. Since the questions are included, the volume can be used independently.

The text is well written and very readable in spite of a great deal of mathematical content. The authors have thereby made a valuable contribution toward bridging the growing generation gap between chemists raised in the mathematical and those raised in more descriptive approaches to the subject.

G. D. Mendenhall, *National Research Council of Canada*

Modern Electrochemistry. Volume 1. By J. O'M. BOCKRIS (University of Pennsylvania) and A. K. N. REDDY (Indian Institute of Science). Plenum Press, New York, N. Y. 1971. lx + 622 pp. \$19.50.

This first of two volumes is devoted to "ionics"—the chemistry of ions in solution and of ionic liquids—covered in chapters entitled Electrochemistry, Ion-Solvent Interactions, Ion-Ion Interactions, Ion Transport in Solutions, Protons in Solution, and Ionic Liquids. Stressing the interdisciplinary nature of electrochemistry, the authors handle each topic in a pedagogically superb manner, often in lecture style, always starting at a level accessible to a novice and then gradually elevating it. Key questions are asked and answered in the text, and the correlation between mathematical symbolism and physical reality is consistently emphasized. Most chapters contain summaries and appendices for mathematical derivations. The authors have succeeded eminently in their objective of producing a teaching book of exceptional lucidity. Considering the generally high quality of this book, this reviewer was somewhat disappointed by the token treatment accorded in it to the field of ionics in nonaqueous media and by the ambivalent position which the authors project with respect to the significance of energetic properties of single ions. In the chapter on Ion-Solvent Interactions, no solvent other than water is discussed. Also the chapter on Protons in Solution fails to do justice to our present-day knowledge of proton energetics in nonaqueous media. In recent years, significant advances have been made, mainly by electrochemists, in the extrathermodynamic field of estimating the enthalpies, free energies, and activity coefficients of individual ions in a variety of solvents. Unfortunately, none of this work is discussed or cited here, not even the reviews. In this connection, the authors are inconsistent when they correctly acknowledge the significance of individual ionic heats of hydration, but fail to do so in the analogous case of the activity coefficients of single ions. Here, the emphasis suggested by the subtitle "The Activity Coefficient of a Single Ionic Species Cannot Be Measured" is unfortunate, as it is conducive to perpetuating precisely the type of stultifying effect of pure thermodynamics on progress in electrochemistry which the authors deplore. On the whole, however, this is a superbly written teaching book which should become indispensable to every serious student of electrochemistry. The 27-page subject index and the detailed table of contents cover both volumes.

Orest Popovych

Brooklyn College of the City University of New York

Spectroscopie Infrarouge. Applications en chimie organique. By MARGARETA AVRAM and Gh. D. MATEESCU. French translation from the Rumanian by ALICE-MARIE GLATZ. Dunod, Paris. 1970. 642 pp. 223 figures. 215 F.

The book is rather a treatise than a handbook since it covers all the aspects (theoretical and practical) of infrared spectroscopy.

Divided in three parts, the first one (96 pp) deals with the theory of infrared spectra: a recapitulation of the quantum theory and wave mechanics, discussing the spectra of diatomic and polyatomic

molecules. The bibliography includes 59 book titles. The notation adopted is that of Professor Herzberg in his classical "Molecular Spectra and Molecular Structure" (D. Van Nostrand Co. Inc., Princeton, N. J.), and the presentation is qualitative. The three chapters that constitute this part are important although not absolutely necessary. However, this inclusion is one of the outstanding features of the book since the theoretical background is frequently disregarded.

The second part (81 pp) is devoted to the principles involved in the design and operation of infrared spectrophotometers and also to the handling of samples and special devices. Twenty-six references (books mainly) are given. Among other aims it is intended to endow the reader with the necessary information to scan by himself the spectrograms and to choose the adequate instrument according to the special requirements of each laboratory.

In the third part (the main one, 406 pp), the infrared spectra of the organic compounds are described. These are arranged by functional groups, and the discussion is based on the electronic structure and the steric configuration of molecules. More than 1000 references are recorded, and there are indications for structural determination, purity control, and quantitative analysis. The authors emphasize the position and displacement of bands and point out the usefulness of infrared spectroscopy in the study of conformational isomers and in the solution of problems involving steric configurations.

There are three appendices which contain data on characteristic frequencies in chart form, a list of collections of spectra, and a brief qualitative description of Raman spectra.

The book is well balanced and addressed to the organic chemist interested not only in finding certain numerical information, such as a characteristic frequency, but also in reading and understanding a well-written, systematic, and authoritative book on infrared spectroscopy.

F. Sánchez-Viesca, *Universidad Nacional Autónoma, México*

Industrial Electrochemical Processes. Edited by A. T. KUHN (University of Salford, U. K.). Elsevier Publishing Co., New York, N. Y. 1971. xxiii + 632 pp. \$52.50.

The purpose of this book, as stated by the editor, is "to present a picture of electrochemical processes which have been in the past, are now, or may one day become an important part of our industrial technology." The eighteen contributors to this volume have admirably succeeded in this endeavor. Included are well-known subjects, such as the processes employed by the chlor-alkali industry, as well as topics such as the electrorefining of metals in molten salts which have not yet passed the pilot-plant stage. Other chapters are concerned with fluorine production, fluorination, water electrolysis, heavy water manufacture, electrowinning of metals, electrorefining in aqueous electrolytes, electrochemical machining, electrolytic finishing of metals, electroforming, electrodeposition of paint, and electro dialysis. Two helpful chapters on electrodes and cell design and a chapter containing economic information on electrochemical processes carried out in various countries conclude the volume. The international patent literature has been exceptionally well covered.

Since the book assumes a knowledge of electrochemical science, it should be most useful to technically trained persons who must decide whether to put a particular process into production, and those who are charged with doing so. The unusually high price is likely to discourage those with a more casual interest in the subject.

Kurt H. Stern, *Naval Research Laboratory*

Newer Trace Elements in Nutrition. Edited by W. MERTZ (U. S. Department of Agriculture) and W. E. CORNATZER (The University of North Dakota). Marcel Dekker, Inc., New York, N. Y. 1971. xiii + 438 pp. \$24.50.

The proceedings of the International Symposium on the Newer Trace Elements in Nutrition held in North Dakota are presented in this book. The introductory sessions related the history of trace metals, their interactions in nutrition, and the mechanism of action of these metals in metalloenzymes.

The second and third sessions dealt in depth with the essentiality of selenium and chromium. Interesting research on the toxicity and detoxifying effect of selenium was presented. Chromium metabolism, the glucose tolerance factor and the significance of chromium in humans, was discussed.

The study of trace elements has been hampered by a lack of experimental animal diets deficient in the element being studied and analytical techniques for measuring minute quantities of this element in animal tissues. These difficulties have been solved in the case of vanadium, nickel, and tin. The fourth session reported the research proving the essentiality of these three elements. Recent findings on the role of copper and zinc were also discussed.

The final session of the symposium described the analytical methods for measuring trace minerals in biological materials, namely, emission spectroscopy, gas-liquid chromatography, and spark-source spectrometry.

One of the most exciting and challenging research areas today is the elucidation of the role of trace elements in nutrition. This book provides an excellent review of the literature and current research in this field. It will not only be of interest to nutritionists but to biochemists, analytical chemists, and the medical profession.

Victoria F. Thiele, *Syracuse University*

Hemoglobin and Myoglobin in Their Reactions with Ligands. By E. ANTONINI and M. BRUNORI (Center of Molecular Biology of C.N.R., Rome, Italy). North-Holland Publishing Co., Amsterdam and London. 1971. xx + 436 pp. \$30.00.

Hemoglobin and myoglobin have been important cornerstones on which the edifice of molecular biology has been built in recent years. Their biological significance is closely related to their specific reactivities especially with small molecules (O_2 , CO, etc.), and this has made them model proteins for the study and understanding of ligand binding reactions. The detailed knowledge that is available of the structure of both normal and variant hemoglobins and myoglobins provides an excellent basis for the study of intimate structure-function relationships.

This book is Volume 21 of the North-Holland Research Monographs *Frontiers of Biology* (General Editors, A. Neuberger and E. L. Tatum) and appropriately comes from a laboratory that has been deeply and fruitfully involved in the study of hemoglobin over several decades. It is a capably written and comprehensive summary of current knowledge of the reactions of hemoglobin and myoglobin with ligands. In fourteen chapters, the reader is taken through a parallel presentation of the methods of preparation and properties of these proteins and of their ferrous and ferric derivatives, their structure and properties in solution, the equilibrium and kinetics of their reactions with ligands and the conformational changes resulting therefrom, and the functional properties of normal and modified hemoglobins as well as discussions of structure-function relationships and of various models and theories of ligand binding to hemoglobin. The hemoglobin variants are considered only in so far as they have bearing in considerations of structure-function relations.

The material in this book is well organized and presented directly and clearly. There is a wealth of tabulated information and useful illustrations. The references (quite a few of which are to publications in 1970) are at the end of each chapter. The indexes are adequate. This volume should be very useful to all those actively involved in, or embarking on, hemoglobin research.

F. Vella, *University of Saskatchewan*