

bond are unknown so far. It should be mentioned that Bchl b obviously provides a structural link between Bchl a and phycocyanobilin.²⁰ Both chromophores can be derived from Bchl b, the former by hydrogenation of the ethylidene group, the latter by oxidative fission of the macrocycle at the α -position.

(20) H. L. Crespi, *Biochemistry*, 7, 2232 (1968); A. Gossauer and W. Hirsch, *Tetrahedron Lett.*, 1451 (1973).

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Book Reviews*

The Origins of Life on the Earth. By STANLEY L. MILLER (University of California, San Diego) and LESLIE E. ORGEL (Salk Institute, La Jolla). Prentice-Hall Inc., Englewood Cliffs, N. J. 1973. x + 229 pp. \$10.95 (cloth); \$5.95 (paper).

The title of this book may not lead the reader to expect the amount of detailed chemistry that is in it, especially if he is a theologian or philosopher. The book is for undergraduate students in sciences who have had at least some organic chemistry, and preferably some physical chemistry as well, and for people in general whose background includes substantial knowledge of these subjects. There are orienting chapters on theories of the formation of the solar system and on historical geology, as well as a chapter on the possibilities of extraterrestrial life, but the bulk of the book deals in nearly undiluted form with chemistry, from prebiotic syntheses of simple molecules to biochemical evolution.

It is refreshing to have the authors admit in the very first sentence that "it must be admitted from the beginning that we do not know how life began," and, four pages later, "The origin of the solar system is almost as hard to discuss as the origins of life." However, the reader is likely to forget these admonitions after the authors have plunged forthrightly into the unknowable and the undiscussable, supported by an impressive array of figures, tables, equations, diagrams, and structural formulas. The result is a useful review of the present state of scientific speculation and evidence on the subject, the value of which is enhanced by the combination of a succinct presentation with a large amount of specific information, and good, selected bibliographies embellished with helpful annotations. The viewpoint is that of the scientific establishment, and such dissident voices as that of Velikovsky are not seriously considered. A shortcoming is the possibility of inaccuracies that could be seriously misleading, even though they appear to be only typographical. On page 47, for example, the ratio of $[\text{NH}_3]/[\text{NH}_4^+]$ is stated to be 0.06 at pH 80 (*sic!*), surely a degree of alkalinity not even approached on primitive earth, and p_{NH_3} over 1 M NH_3 solution is given as 1.4×10^2 atmospheres, instead of 1.4×10^{-2} .

With this caveat, the book can be recommended both to precocious students and curious established scientists as an introduction to a subject of perennial fascination, and a source of lots of factual data to chew on.

Practical Fluorescence: Theory, Methods and Techniques. By G. G. GUILBAULT (Louisiana State University). Marcel Dekker, New York, N. Y. 1973. xi + 664 pp. \$29.50.

For two decades the monographs "Fluorescence and Phosphorescence" by Pringsheim and "Fluoreszenz Organischer Verbindungen" by Förster have been the books students and scientists have turned to for reviews of fluorescence research. At the time when those books were written (1949 and 1951), it was possible to discuss the topic comprehensively in 300 pages. With the advent of the photomultiplier tube in the early fifties, the field of fluorescence and phosphorescence began to grow rapidly. Now it is a truly formidable task to try to cover all aspects of this highly diversified subject in a single textbook.

The book by Guilbault, which is divided into 16 chapters, emphasizes the practical aspects of luminescence, in particular, analytical

applications. Chapters on instrumentation and measurement techniques describe the practical problems encountered. A chapter contributed by E. L. Wehry discusses the effects of molecular structure and environment on fluorescence. Except for two chapters on the fluorescence of inorganic materials (mainly chelates) and atomic fluorescence flame spectrometry, the book deals with organic substances: assay of organic compounds; fluorescence in enzymology; extrinsic and intrinsic fluorescence of proteins; chlorophyll fluorescence and photosynthesis; fluorescent indicators. In addition, phosphorescence, chemiluminescence, and electrogenerated luminescence of organic compounds are discussed in separate chapters. Two others treat analysis on solid surfaces, and forensic and environmental analysis.

Since the possibilities for artifacts are numerous in fluorescence measurements, the detailed description of experimental difficulties is very useful for the scientist entering this field. An extensive list of references at the end of each chapter, which covers the literature well until 1971, makes it easy to dig more deeply into a particular subject. Although the topics discussed in the various chapters are certainly important, one can think of others of equal interest; for example, I did not find anything on scintillators and optical brighteners. But, in general, the book provides a very good overview of the field of fluorescence and phosphorescence. While the treatment may be too diversified for the student, it will appeal to the scientist seeking acquaintance with this powerful technique.

K. H. Drexhage, *Eastman Kodak Company*

Conduction in Low-Mobility Materials. Edited by N. KLEIN (Technion, Haifa), D. S. TANNHAUSER (Technion, Haifa), and M. POLLAK (University of California, Riverside). Barnes and Noble, New York, N. Y. 1972. xiv + 464 pp. \$32.

This book constitutes the proceedings of the Second International Conference on "Conduction in Low-Mobility Materials" held in Israel in April 1971. The various papers presented were organized around seven themes: Transition Metal Oxides; Low Mobility Transport Theory; Amorphous Semiconductors; Selenium Compounds; Switching Processes; Organic Materials; and Ionic Crystals and Liquids.

The contents consist of review articles and some original contributions, both of theoretical and experimental nature. The emphasis in many of the papers, fortunately, is to discuss experimental findings with a clear aim to examine various aspects of the theory. In general, the papers are of a high standard. The "Discussions" of various papers are not included here, thus diminishing somewhat the value of this otherwise important volume. This book would be of interest to investigators in the field of solid-state science in general and semiconducting materials in particular.

Ashok K. Vijh, *Hydro-Quebec Institute of Research*

A Workbook of Electrochemistry. By J. O'M. BOCKRIS (The Flinders University) and R. A. FREDLEIN (The University of New Castle, Australia). Plenum Press, New York, N. Y. 1973. ix + 177 pp. \$9.95.

Modern electrochemistry, as a broad multidisciplinary science having vital in-puts from theoretical electrostatics, solid-state physics, chemical kinetics, heterogeneous catalysis, and interfacial phenomena, has come of age only in the last couple of decades or so. Recently, several books of expository nature that explain the immense impact of "New Electrochemistry" have appeared. None

* Unsigned book reviews are by the Book Review Editor.

of these books, however, addresses itself to the crucial matter of problem-solving; the above volume fulfills this vacuum eminently.

There are twelve chapters dealing with problems chosen from the fields of ionic solutions, double-layer phenomena, electrode processes, and electrochemical technology. In every chapter, the problems are graded in the order of increasing difficulty. The emphasis is on teaching the conceptual foundations of the field rather than developing galloping numerical skills, although the latter also receives a serious attention. The answers to about 35% of the problems are provided together with the main steps needed to arrive at the solutions. The book would be useful not only to students but also, and more so, to instructors who may have gaps in their education as far as problem-solving in electrochemistry is concerned.

One must pause, however, to reflect on the utility of having a separate book on problems in electrochemistry. It would have been much more useful to have these contents included, at the end of appropriate chapters, in a standard textbook (e.g., Bockris and Reddy). That would have perhaps allowed a more intimate interaction of the ideas of electrochemistry with their numerical manipulations in problems touching a variety of areas.

Ashok K. Vijh, *Hydro-Quebec Institute of Research*

Solid State Chemistry and Physics: An Introduction. Volume 1. By PAUL WELLER (State University College, Fredonia, N. Y.). Marcel Dekker, Inc., New York, N. Y. 1973. xi + 500 pp. \$26.50.

The text is intended for students in physics, metallurgy, and chemistry at the senior or first-year graduate level. There are seven contributing authors. In Part I P. F. Weller gives an introduction to the principles of solid state science. As a prerequisite, all a student needs is a basic course in, say, physical chemistry. The references are sufficiently comprehensive to lead to a more detailed study. Part II, on crystallography, is written by L. Suchow. This is really a review of chemical bonding concepts, Pauling electronegativity values, and crystal systems. The notation and experimental procedures for X-ray diffraction measurements are presented. As a prerequisite, the student needs an experimental physical chemistry laboratory course or equivalent. The references are adequate but less comprehensive than in Part I. B. L. Crowder does an excellent job in presenting the bonding models of solids in Part III. The prerequisites are the same as for the first two chapters. J. H. Perlstein does equally well in presenting the electrical properties of solids and the methods used to measure transport properties. After repeating concepts already introduced in the previous chapters, such timely topics as statistics of electrons and holes, energy bands and molecular orbitals, charge transfer complexes, hopping conduction scattering mechanisms in semiconductors, and superconductivity are presented in a brief but clear manner. J. J. Steger discusses the magnetic properties of solids. His presentation is at a higher level than the previous chapters, but a student can manage with an introductory knowledge of quantum mechanics. P. H. Kasai reviews the concepts of magnetic resonance in solids. The prerequisites are the same as for the previous chapter. Unfortunately, no references are given here. In the last section, Part VII, J. D. Axe has presented a very clear and also excellent introduction to the optical properties of solids. The exercises (or problems) are very useful. The degree of sophistication is highest in this chapter, and the student requires stronger foundations in quantum mechanics.

In summary, the book will be an excellent introduction for the student of the above interdisciplinary fields.

J. V. Acrivos, *Stanford University*

Interpretation of Mass Spectra. Second Edition. By F. W. McLafferty (Cornell University). W. A. Benjamin, Inc., Reading, Mass. 1973. xix + 278 pp. \$7.50 (paper), \$15.00 (cloth).

The first edition of this book was used many times by the author as a text in a popular short course on the interpretation of mass spectra. In this new edition, much of the earlier work has been rewritten, and a good deal of new material has been added. This reflects the growth of organic mass spectrometry. As the book's main purpose is "to teach chemists how to obtain molecular structure information from mass spectra," it achieves this objective very well.

The inclusion of a large number of unknown spectra, the solutions to these unknowns, and the reasoning involved in each solution should be very helpful to test the reader's understanding of the material presented.

It is noteworthy that the author continues to emphasize the use

of natural isotope abundances for the determination of elemental formulas. It seems to this reviewer that this technique may be overemphasized.

The chapter on ion fragmentation mechanisms does an excellent job in describing types of reaction mechanisms. It contains valuable material for beginners as well as experts. A new chapter on mass spectra of common classes of compounds is added. This chapter is not intended to be comprehensive, but rather to "illustrate how the mechanisms can be applied to particular compounds." Another new chapter describing the theoretical aspects of unimolecular ion decomposition reactions, such as the quasi-equilibrium theory, $P(E)$ and $k(E)$ functions, and thermochemical energy relationships, is of great value in helping students to understand the fundamental principles of the origin of mass spectra.

Though some typographical errors were noted by this reader, fortunately they are obvious and should not mislead the reader from understanding the content of the book.

Professor McLafferty is a pioneer in the field of mass spectrometry. He has used his expertise in the subject and his experiences in teaching and writing to make this book very suitable for self-study or classroom use. I highly recommend this book to any chemist or scientist who wishes to become familiar with or skilled in the interpretation of mass spectra.

Paul H. Chen, *Philip Morris Research Center*

Physics of Electrolytes. Volume 1. Edited by J. HLADIK (University of Dakar). Academic Press, New York, N. Y. 1972. xiii + 516 pp. \$34.00.

"Physics of Electrolytes" is a collection of articles on solid electrolytes and transport processes associated with them. Apparently a second volume covering other subjects will complete this editor's treatment of the subject.

The first four chapters are concerned with solid electrolytes and electrodes. The first two by Hladik are general discussions of "The Solid State" and "Solid Electrolytes." Only an optimist would attempt to cover such broad subjects in two brief chapters. Obviously the depth in which these subjects can be treated is not great and some work not discussed. For example: Hladik quotes A. F. Wells on the mixed character of bonds in solids, but fails to discuss the recent work of J. C. Phillips on partial ionicity of bonds in crystals. When discussing the electronic structure and molecular properties of alkali halides, there is no mention of the work of Robert L. Matcha. These chapters might serve as an introduction to the subject but do not satisfy the dust cover's claim that this book is a "basic source work for reference . . ." for those engaged in research in these fields.

The remaining authors had a much less ambitious task set to them. Each discussed work in their own areas of research. All produced interesting and competent articles. Some emphasize a special interest rather than providing an even treatment of their subject, but that is only natural and an advantage in such a collection. A few of the subjects have been treated in other recent collections. For the record, the other chapters are: "Theory of Crystalline Solid Electrolyte Solutions," by F. K. Fong; "Nuclear Microanalysis," by G. Amsel. Section B contains seven articles: R. J. Friauf on the "Basic Theory of Ionic Transport Processes"; F. Beniere on "Diffusion in Ionic Crystals, and Transference Numbers in Ionic Crystals"; "Electrical Conductivity" by A. Kvist; "The Ionic Conductivity of Whiskers" by E. Hartmann; "Ionic Transport in Glasses" by K. Hughes and J. O. Isard; and "Transport Phenomena in Ion-Exchange Membranes," by E. Riande.

The enigma remains as to why a book costs £11.00 in the United Kingdom and \$34.00 in the United States.

W. J. Fredericks, *Oregon State University*

Chemical Technology: An Encyclopedic Treatment. Volume VI. Barnes & Noble, New York, N. Y. 1974. xxiv + 686 pp. \$42.50 (\$35.00 by subscription to series).

This latest part of the projected eight-volume work is devoted to wood, paper, textiles, plastics, and photographic materials. The emphasis of the overall work is on the economic application of modern technological developments, and, accordingly, one can expect substantial amounts of information that is not chemical. The section on wood, for example, has parts devoted to "Species of wood" and "Woodworking," as well as "Wood as a chemical raw material."

The presentation is necessarily succinct, in view of the great breadth of the subjects included, but it still manages to be both readable and informative. There is some suspicion that the coverage may not be everywhere up to date. For example, in the discussion

of manufacture of gummed paper, it is implied that postage stamps are always provided with gum arabic, whereas, in fact, polyvinyl alcohol has been used on a large scale for several years in some major countries.

It is not disclosed who wrote the various chapters, but the examples presented and the nomenclature used have a strongly British slant. Since many technological materials are most familiar by their trade names, this might lead to occasional difficulties of recognition, but the editors seem to have been aware of this, and have, for example, used both of the alternate terms Dacron and Terylene. In other areas, however, indexing leaves something to be desired. For example, there is no entry in either the index or the table of contents for "Polaroid" or "Land," yet the Polaroid-Land photographic process is treated, albeit briefly. This book is nevertheless a valuable reference work.

NMR Spectra of Simple Heterocycles. By the late T. J. BATTERHAM (The Australian National University). Wiley-Interscience, New York, N. Y. 1973. xvii + 540 pp. \$37.50.

This is the second volume in the series "General Heterocyclic Chemistry" edited by E. C. Taylor and A. Weissberger (the first was on Mass Spectrometry). The subject is the first decade (1960-1970) of heterocyclic nmr, a period that saw the amassing of much information and the beginning of its classification and understanding. It was also a period during which attention was almost exclusively confined to proton nmr of heterocyclics. This book is not only a carefully organized compendium of published data on chemical shifts and coupling constants, but it includes critical interpretations and evaluations of the information. The author had a sharply analytical mind and the self-discipline to restrain unsupported speculation. The result is a work that is not only a reliable and valuable reference, but also a source of instruction.

The shifts are quoted uniformly on the τ scale, which the author admits in the introduction can be seen in retrospect not to have been the best choice, but which was a reasonable and defensible one at the time (perhaps five years ago) when the choice had to be made. In any event, readers can be grateful that comparisons have been made easier by the uniformity introduced. This book is an exception to customary practice with respect to citing references, for authors' initials are omitted. This is certainly unfortunate and will be particularly regretted by all the Browns, Johnsons, Wongs, Meiers, etc.

The scope of the work is broader than the title word "Simple" might indicate, for it includes rings of three to eight members, of as many as four heteroatoms, and heterocycles of phosphorus, arsenic, selenium, tellurium, boron, and silicon. Polynuclear systems are limited to two nuclei: indoles, purines, quinolines, etc., but not carbazoles, acridines, etc. The amount of material included represents a remarkable accomplishment, and the book is a scientific legacy that should find long and extensive use.

Organic Chemistry of Life. Introductions by M. CALVIN and W. A. PRYOR. W. H. Freeman and Co., San Francisco, Calif. 1973. xii + 452 pp. \$12.00 (\$6.95 paperbound).

This is another in the series of collected articles from "Scientific American" and is as well produced and illustrated as its predecessors. The editors state that it is "designed for use as supplementary reading both for the first college course in biochemistry and for the sophomore course in organic chemistry." The scope can be gathered from the four headings under which the papers are grouped: Biological Regulators; Macromolecular Architecture; Cellular Architecture; Chemical Biodynamics. Eight pages of bibliography are appended, and there is a four-page subject index.

Organic Reactions. Volume 20. Edited by W. G. DAUBEN (University of California). John Wiley & Sons, New York, N. Y. 1973. ix + 494 pp. \$22.50.

There are four chapters in this volume; they cover synthesis of cyclopropanes by means of the Simmons-Smith reagent, sensitized photooxygenation of olefins, 5-hydroxyindoles by the Nenitzescu reaction, and reduction of aromatic nitro compounds by means of sulfides and polysulfides (Zinin reaction). The selection is a pleasant mixture of the old and the new.

An experimental innovation is being tried out in this volume, in the form of microfiche supplements in a pocket inside the back cover. They amplify the information given in the tables for the first chapter by giving the details in the working abstracts of the original papers as used by the authors. If this experiment is successful, tables in subsequent volumes could be confined to listing compounds and yields, with experimental details appearing only in

microfiche. Although the editor apologizes for the inconvenience to readers without easy access to a microfiche reader, he really did not need to. A small magnifying glass (more powerful, however, than a simple reading glass) is sufficient to make the microfiches legible. The test of use will produce a better basis for judgment, but this innovation appears to be useful enough to be continued. This volume as a whole is, of course, an indispensable part of a working organic chemist's reference library.

Protein-Protein Interactions. Edited by R. JAENICKE and E. HELMREICH. Springer-Verlag, New York, N. Y. 1972. vii + 464 pp. \$24.80.

This volume contains the proceedings of the 23rd Colloquium der Gesellschaft für Biologische Chemie, held in Mosbach/Baden in April, 1972. All text is in English and is typeset; there are many figures and photographic illustrations. The categories of subdivision of the papers are: Quaternary Structure of Proteins, Approaches for Determining Protein Complexes; Heterologous Protein Interactions; Muscle; Multienzyme Complexes; Antigen-Antibody Interactions; Self-Assembly; and Intercellular Interactions. There are discussions, three introductory papers, and a conclusion, but no index.

Solid/Solid Interfaces. Faraday Special Discussion No. 2. The Chemical Society, London. 1973. 228 pp. £5.00.

This soft-bound volume contains the papers of a discussion held at the University of Nottingham in September, 1972, under the chairmanship of Professor J. W. Linnett. Each paper is presented as a journal article, complete with date of receipt and abstract. There are six pages of general discussion and a list of contributors, but no index.

Toxicants Occurring Naturally in Foods. Second Edition. By NATIONAL RESEARCH COUNCIL SUBCOMMITTEE ON NATURALLY OCCURRING TOXICANTS IN FOOD. National Research Council, Washington, D. C. 1973. vii + 624 pp. \$10.50.

The appearance of this new edition only seven years from the first one reflects the greatly increased interest in health factors and the many advances in knowledge that this interest has sparked. In this volume there are 26 contributed chapters, for the most part each devoted to a particular class of substance, such as nitrates, plant phenolics, estrogens, etc. The tone is technical rather than popular, and nearly all factual data are documented with references. Full structural formulas are given where known, and they are presented with a minimum of errors.

This book is fascinating reading and is not a little unsettling. Who, for example, would not have his pleasure a little dampened upon learning that pickled herring contains 3000 μg of tyramine per gram, and that even honey may make one violently ill if the bees have gathered it from mountain laurel? On the other hand, organic chemists looking for new problems will find much sustenance here, and forensic chemists and those associated with the food industry should find this book a valuable work of reference.

A Guide to Molecular Pharmacology-Toxicology. Parts I and II. Edited by R. M. FEATHERSTONE. Marcel Dekker, New York, N. Y. 1973. xiv + xv + 811 pp. Part I, \$32.50; Part II, \$30.75.

The preface points out that no thread of continuity among the various chapters was intended. The volume is more a collection of essays than comprehensive review articles. Chemists are likely to find a greater amount of familiar material in this book on pharmacology-toxicology (especially Part II) than they might expect, particularly if they are physical chemists. Intermolecular forces and interactions, nmr and esr, CD and ORD, and molecular orbital theory are covered in some detail. These portions are not likely to capture the attention of a large segment of pharmacologists. The volume is not primarily a "how-to-do-it" book, most chapters being more theoretical than practical.

Certain areas are emphasized to the exclusion of others. For instance, anesthetic gases are discussed in at least five separate chapters. Cholinergic systems are discussed somewhat repetitively. The volume becomes a narrow guide to molecular pharmacology-toxicology, omitting several important topics of current interest in molecular pharmacology and dealing relatively little with toxicology. This two-part book is presented as Volume 1 of "Modern Pharmacology, A Series of Monographs and Textbooks." Additional volumes are said to be in preparation; perhaps some of the omitted topics will be covered in later volumes.

Some chapter titles do not adequately reveal the contents. For example, a chapter on the use of genetic variants in molecular

pharmacology does not discuss animal models like spontaneously hypertensive rats or genetically obese or diabetic mice but rather strains of *E. coli*. A chapter on isolation and characterization of pharmacological receptors has a sizable section devoted to acetylcholinesterase, an enzyme that is the subject of another chapter as well.

These comments have focused on some things that "A Guide to Molecular Pharmacology-Toxicology" does not do. In general, the things that it does, it does well. The chapters mostly are clearly written, and some of them contain useful compilations of data, references, and illustrations. Perhaps the shining example of the latter is the chapter on ultrastructural contributions to molecular pharmacology. I'd recommend looking at the book before buying it on the basis of its title or table of contents. If it has the content you're looking for, you probably will not be disappointed with the quality.

Ray W. Fuller, *The Lilly Research Laboratories*

Organometallic Chemistry. Volume 2 (Specialist Periodical Reports). Edited by E. W. ABEL (University of Exeter) and F. G. A. STONE (University of Bristol) and 14 other contributors. The Chemical Society, London. 1973. xvi + 612 pp. £13.00.

This is the second volume of an excellent series published by the Chemical Society which annually reviews the literature in organometallic chemistry. The Society views these annual surveys as "critical in-depth accounts of the progress in their areas by acknowledged authorities, which usually appear less than twelve months after the period of literature coverage." The present volume, which covers the literature for the calendar year 1972, admirably lives up to expectation. It will be an invaluable source of information for any chemist interested in the field of organometallics.

There are several outstanding features of the book which should be commented upon in general. The literature coverage is thorough and references are drawn from a wide selection of journals. There is an adequate balance between theoretical and synthetic papers and papers dealing with physical measurements. Research results of special significance to the area being reviewed are discussed at sufficient length to bring out their importance. Extensive use is made of structural formulas and projection diagrams of molecular structure. This latter point is a great help to readers unfamiliar with certain areas of organometallics. Some chapters, such as that on the Group III elements, contain a selected bibliography in addition to the references covered in the text.

The first third of the book reviews the organometallic chemistry of the main group elements I through V. Chapter 3 is devoted entirely to a review of the literature of boron chemistry. The remainder of the volume deals with organo-transition metal chemistry. Chapter 8, written by the senior editors, covers the significant trends in metal carbonyl chemistry. The rapidly expanding field of organometallic compounds containing metal-metal bonds is well reviewed in Chapter 9 followed by a survey of substitution reactions of metal and organometal carbonyls with group V and VI donor ligands.

Chapter 12 thoroughly covers the area of metal-carbon σ bonds. Three chapters deal with transition metals π -bonded to organic ligands. Chapter 16 supplements these by reviewing substitution reactions of hydrocarbon-metal π complexes. Homogeneous catalysis is an area of active research and the literature for 1972 is reviewed in Chapter 18.

The last chapter of this volume is of special interest since it reviews X-ray and electron diffraction studies of organometallic compounds. Section 2 is a very handy tabular listing of compounds and structural data. This is followed by cross-reference tables which list compounds by metal and by ligand. The editors use the final section of this chapter to discuss in some detail those structural studies which they consider of special significance. Again, the extensive use of projection diagrams is of immeasurable help in following the discussion.

This volume will certainly serve as a valuable aid to condensing the rapidly increasing number of research publications in the field of organometallics.

Victoria Graves, *University of Texas at Austin*

Excited States of Proteins and Nucleic Acids. Edited by R. F. STEINER (University of Maryland) and I. WEINRYB (Squibb Institute for Medical Research). Plenum Press, New York, N. Y. 1971. xiii + 487 pp. \$28.00.

With the availability of high-quality commercial spectrofluorimeters, fluorescence spectroscopy has moved from the hands of a few specialists into many biochemical laboratories. Today many

nonspecialists utilize fluorescence spectroscopy, and to a lesser extent phosphorescence spectroscopy, in investigations of molecular structure and intermolecular interactions. In spite of this increasing utilization of luminescence methods in biochemistry, relatively few detailed reference works concerning the application of these methods to biochemical problems have appeared. "Excited States of Proteins and Nucleic Acids" is such a work.

This book is a multiauthor volume. A brief introductory chapter by R. M. Hochstrasser on the theoretical basis of luminescence is followed by a three-part chapter on experimental techniques with contributions from E. P. Kirby, E. T. Meserve, and E. Kuntz. Hochstrasser's chapter is quite concise, but relatively thorough. Anyone with a minimal knowledge of modern spectroscopic theory should have little difficulty understanding the material that is presented. The chapter is well referenced, which should be helpful to those who might desire a more detailed exposition of the theoretical principles involved. The chapter on experimental techniques appears to be a concise but relatively complete survey of instrumentation and techniques for the measurement of fluorescence and phosphorescence, and the direct measurement of fluorescence lifetimes.

The third chapter, which concerns the fluorescence and phosphorescence of nucleic acids, is by J. Eisinger and A. A. Lamola. These authors have made important contributions to research in this area, and the material presented in their chapter is an excellent review of the current status of the field.

The remainder of the book is concerned with the luminescence of amino acids, polypeptides, and proteins. There are chapters on fluorescent conjugates of proteins with small molecules by W. B. Dandliker and A. J. Portmann, the luminescence of amino acids by the editors, Weinryb and Steiner, and a concluding chapter on the luminescence of polypeptides and proteins by J. W. Longworth. These chapters are well written, and for the most part the choice of subject matter is excellent.

The only serious flaw that this reviewer could find in this otherwise admirable book is in the index. The index is so brief as to be virtually useless, which detracts from the utility of the book as a reference work. Nevertheless, this is undoubtedly the best work in the area of the application of luminescence methods to molecules of biological significance since the monograph by Konev. Thus, it is recommended for any researcher with an interest in the luminescence of biological macromolecules. It is unfortunate that the price of this volume will keep it out of the libraries of most students.

Thomas M. Hooker, Jr., *University of California, Santa Barbara*

Macromolecular Reviews. Volume 6. Edited by A. PETERLIN, M. GOODMAN, H. F. MARK, S. OKAMURA, and B. H. ZIM. Part D—**Journal of Polymer Science.** Interscience Publishers, New York, N. Y. 1972. iii + 342 pp. \$14.00.

The present volume continues to maintain the excellent quality of the previous numbers in the series. With the increasing amount of technical literature it has become a well-recognized fact that even senior scientists and technologists are no longer able to absorb the entire flow of papers, particularly those outside of their immediate field of interest. There is therefore always an acute demand to have this knowledge brought up to date and to learn about entirely new concepts as they are developed. This is the aim of *Macromolecular Review* series, and the editors were always skillful in choosing the subjects to be treated in.

The sixth volume contains five critical reviews on different topics in polymer science, as follows.

The first article is signed by H. G. Cassidy (Electron-Transfer Polymers—Oxidation Reduction Polymers) and is limited to artificial redox polymers. After a general review of synthesis of electron transfer polymers, the author discusses their properties and some theoretical aspects of the subject.

In the following review (Raman Spectroscopy of Biological Molecules), S. L. Koenig surveys the recent development achieved in the study of amino acids, imino acids and related compounds, as well as of oligopeptides, synthetic polypeptides, proteins, polynucleotides, nucleic acids, and carbohydrates, using Raman spectroscopy as a method of investigation. The author, himself a well-known contributor in the field, did an excellent job in presenting this material.

The next article concerns with stereoselective and asymmetric selective polymerization of epoxide, episulfide, and *N*-carboxy- α -amino acid anhydride compounds (T. Tsuruta: Stereoselective and Asymmetric Selective, or Stereoelective, Polymerizations). If excellent reviews on the stereospecific polymerization or optically active polymers are available, the present review is the

first which focuses stereoselective and stereoelective polymerization of various types of monomer with detailed cross references.

Polymerization of vinyl ketones (A. R. Lyons), the subject of the fourth review, is well handled by the author who made a full description of the matter.

The last article concerns with growing active centers and their reactivities in "living" anionic polymerization of styrene and its derivatives (H. Hirohara and N. Ise). However, the material is based almost entirely on author's work, who undoubtedly contributed to the elucidation of the subject.

The book ends with a cumulative index of Volumes 1-6.

The reviewer recommends this volume to anybody active in the polymer field.

Ioan I. Negulescu, *University of Massachusetts at Amherst*

Symmetry and Its Applications in Science. By A. D. BOARDMAN, D. E. O'CONNOR, and P. A. YOUNG (University of Salford). Wiley/Halsted, New York, N. Y. 1973. xiii + 305 pp. \$14.95 (paper).

The purpose of this book is to provide an elementary self-contained text on the role of symmetry in physical problems. It is aimed at science students, particularly those reading physics, chemistry, electrical engineering, and metallurgy. The book may also be of interest to mathematics students requiring a text on the application of group theory. The authors have tried to present the subject in such a way that it is unencumbered by rigorous proofs. All the necessary mathematical background is contained in Appendix A. However, since many applications involve quantum mechanics, it is assumed the reader has a basic knowledge of this subject.

The first three chapters of the book (Basic Group Theory; Group Representation; and Basis Vectors, Basis Functions and Quantum Mechanics) contain the basic group theory needed to understand the applications found in the following chapters. The chapters containing the applications (Crystal Symmetry; Tensors and Symmetry; Energy Bands in Solids; Molecular Vibrations and Normal Modes; Molecular Orbitals; and Symmetry of Atoms) may each be studied independently of each other as all the necessary steps are repeated. The solutions to problems are given in the last fifty pages of the book. Unusually detailed explanations of every step in the theory or calculation are given.

Because of its comprehensive character, "Symmetry and Its Applications in Science" would be an excellent reference to give to a student who is starting graduate work in one of the areas of the already cited fields and needs a short volume to be introduced to this subject.

Ioan I. Negulescu, *University of Massachusetts at Amherst*

Gas Chromatography in Inorganics and Organometallics. By G. GUIOCHON (Polytechnic College, Paris) and C. POMMIER (Polytechnic College, Paris). Ann Arbor Science Publishers, Inc., Ann Arbor, Mich. 1973. x + 332 pp. \$20.00.

This book is a revised translation from the original French edition, and it represents a complete and well-organized treatment of this important topic. Work from over 1000 literature references is reviewed.

The first two chapters provide a brief but thorough treatment of theoretical concepts and experimental methods used in gas chromatography (GC). While these two chapters are not intended to supply a complete theoretical background, they do provide a great deal of essential information for readers unfamiliar with the subject. Chapter III is devoted to GC of inorganic gases (oxygen, nitrogen, ammonia, carbon and nitrogen oxides, rare gases, and many more). This section should be very useful to those who intend to monitor inorganic fixed gases in, for example, air pollution studies. A serious spelling error occurs in the running title of Chapter III (Inorganic Cases). Chapters IV-VI are devoted to GC of halogens, metallic and nonmetallic halides, and hydrides. Much of the discussion in these three chapters centers on the special and sometimes severe problems encountered when attempting to elute such reactive compounds on GC columns.

In Chapters VII and VIII the authors treat the two most widely investigated areas in inorganic GC, *i.e.*, organometallics and metal chelates. Thorough coverage is given to many different classes of metal π -complexes and metal β -diketonates. An informative, referenced index for GC of metal chelate systems appears at the end of Chapter VIII; unfortunately, the relative volatilities for these compounds are not listed.

The authors discuss GC of isotopes, analytical, and nonanalytical applications in the final three chapters. Some of the ideas pre-

sented here are projections of possible future applications of inorganic GC. An index of cited compounds appears at the end of the book. An analytical nomenclature error, which is repeated throughout the book, is the use of the term "Analysis of A, B, C" rather than "Analysis for A, B, C."

The authors have not only written an excellent and complete review of this important area of research, but they have also added their own critical comments and ideas throughout the book. This book should prove to be indispensable to all workers doing or planning research in the area of gas chromatography of inorganic materials.

Hans Veening, *Bucknell University*

The Alkaloids, Chemistry and Physiology. Volume 14. Edited by R. H. F. MANSKE (University of Waterloo). Academic Press, New York, N. Y. 1973. xvii + 610 pp. \$42.50.

"The Alkaloids"—Manske has become as indispensable to this generation as Henry—"The Alkaloids" was to the last as a source book on plant bases. Whereas Henry was able to summarize all-about-alkaloids between the covers of a single book, Manske and his contributors in twenty-five years have had to publish fourteen volumes to keep up with an ever expanding literature.

This latest volume up-dates past reports on alkaloids related to steroids, oxindoles, oxoaporphines, phenylethylisoquinolines, as well as alkaloids grouped by class according to botanical sources, *viz.*, Mitragnyna, Picralima, Alstonia, Cinchona, Elaecarpus, Lycopodium, Cancentrine, Securinega, and a miscellaneous or unclassified group. There is an overlap in treatment resultant from such rough divisions in a multi-authored work, but the reader is the gainer because of the different contexts in which the overlaps have occurred.

Emphasis is on stereochemical detail and total synthesis rather than isolation, structure elucidation, or chemotaxonomy. The reader will be impressed by the unending variety and diversity and complexity among alkaloid structures and must wonder the reasons for this biosynthetic effort on the part of plants. He will not find the answers by reading this volume, or anywhere else for that matter, nor will he learn much about physiology of alkaloids although this has always been a subtitle.

It is unfortunate that the price, although good value these days for 610 pages, will keep it off many worthy shelves.

William I. Taylor, *International Flavors & Fragrances (IFF-R&D)*

Stereochemistry and Its Application in Biochemistry. By W. L. ALWORTH (Tulane University). John Wiley & Sons, Inc., New York, N. Y. 1972. xi + 311 pp. \$16.95.

The beginning biochemistry student readily accepts the fact that biochemically catalyzed processes are stereospecific and that an enzyme is able to discriminate between enantiomeric forms of substrate molecules. In contrast, there is difficulty in understanding an enzyme reaction that differentiates between chemically like and paired groups of a single substrate molecule. This book deals with this phenomenon in considerable depth and detail.

The author begins with a systematic review of the fundamentals of molecular symmetry. He then develops the concepts of reflective and rotational molecular symmetries, diastereomeric and enantiomeric interactions and chiral and prochiral configurational nomenclature.

The idea of a three-point enzyme-substrate attachment according to Ogston gives a good picture of the differentiation process involved in the citric acid reaction in the TCA cycle. The author maintains, and rightly so, that the Ogston concept does not explain the reaction mechanism completely. It must be an inherent lack of symmetry in the citric acid molecule that is recognized and exploited by the enzyme. From considerations of its molecular symmetry, citric acid lacks symmetry of the rotational class.

Additional examples of classic metabolic reactions involving enzymatic differentiation of chemically like and paired groups are described and analyzed. They include reactions in the tricarboxylic acid cycle, in the pyruvate metabolism, in the sterol biosynthesis, and in the ketose-aldehyde interconversions. More recent observations of this type of enzyme discrimination are also included.

This book offers the advanced student in biochemistry a detailed and rigorous analysis of a specific area in biochemical stereospecificity. This is not generally found in beginning biochemistry textbooks. It affords better insight and understanding of this important phenomenon in biochemistry.

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