

## Book Reviews\*

**Thermodynamic Properties of Nonelectrolyte Solutions.** By William E. Acree, Jr. (Kent State University). Academic Press: Orlando, Florida. 1984. x + 308 pp. \$65.00. ISBN 0-12-043020-7.

In the preface the author states that his purpose for writing this book is "to assemble several of the more classical solution theories into a single reference book". He has accomplished his objective very well. This is a concise, clearly written, and valuable addition to the literature on solution thermodynamics.

The first three chapters are devoted to the basic mathematics and thermodynamics that are needed for understanding the remaining nine chapters. Chapters 4-9 contain the heart of the book. They are where the methods for predicting excess thermodynamic properties (principally excess enthalpies, free energies, and entropies) are discussed. In chapter 4, the author discusses empirical expressions for estimating multicomponent properties from binary data. Chapter 5 is devoted to a discussion of the various models for predicting excess thermodynamic properties in systems containing only nonspecific interactions. Among the models discussed are the Van Laar, Scatchard-Hildebrand, Flory-Huggins, Wilson, and the widely used universal quasichemical model, UNIQUAC. That discussion is followed by a chapter devoted to group contribution methods, including among others the UNIQUAC functional activity coefficients model, UNIFAC.

The subject of associated solutions is discussed in Chapter 7, and Chapter 8 deals with predictions of excess properties of ternary alcohol-hydrocarbon systems from binary data. Chapters 9-12 cover vapor-liquid equations, solubility of nonelectrolytes, liquid-liquid equilibria, and phase equilibria applications in chromatography. The index contains tables of solubility parameters and UNIQUAC structural parameters.

The principal audience that the book will appeal to is the chemistry and chemical engineering researchers in solution thermodynamics and the chemical engineers interested in estimating thermodynamic properties for industrial applications. Purely theoretical models of liquids and their mixtures are not included within the scope of this book. The book is designed in such a way that it would serve well as a textbook in a senior or first-year graduate course. There is a set of quite substantial problems at the end of each chapter, and answers to selected problems are in the back of the book.

As noted above, the writing style is clear and concise. I did have to choke a little in Chapter 4, however, when I came to the words *parameterizing* and *parametrized* (new also to Webster), but otherwise I enjoyed the author's crisp, uncluttered style of writing.

J. Rex Goates, *Brigham Young University*

**Potentiometry and Potentiometric Titrations.** By E. P. Serjeant (University of New South Wales). John Wiley & Sons: New York. 1984. xvi + 725 pp. \$75.00. ISBN 0471-07745-3.

I found this book to be excellent. It is well-written, complete, concise, and based on firm fundamental scientific principles. In addition, it contains a wealth of experimental data obtained over the last 30 years. I would recommend this book for use as a textbook and a reference book.

The sections on nonaqueous electrochemistry were of particular interest to me. The book contains valuable information on how to adapt classical reference electrodes to nonaqueous solutions and the major pitfalls which must be avoided. In addition, there is a plethora of tables listing the important physical constants, the autoprotolysis constants, and pK values for many acids and bases in all of the popular nonaqueous solvents.

Thomas Last, *SmithKline Beckman Corp.*

**A Time to Remember: The Autobiography of a Chemist.** By Alexander Todd. Cambridge University Press: New York. 1984. vii + 257 pp. \$29.95. ISBN 0-521-25593-7.

Lord Todd is one of the world's most distinguished organic chemists. He is also a fine writer, and he engagingly tells this story of his full life. On the book's jacket is an unusually well-done photograph of Lord Todd which captures his spirit as well as his image. The frontispiece is a picture of Lord Todd at his writing desk. These are the only two illustrations we are given.

There are many parallels in Lord Todd's life story with that of James B. Conant, the American organic chemist, whose autobiography, "My Several Lives", was published by Harper & Row in 1970. Each of these

men worked in the area of organic chemistry closely related to biology and each made important contributions to science, education, and his country.

In this autobiography, Lord Todd writes about his early days in Glasgow, his brilliant academic career, his research, his friendships, the Nobel prize which he received in 1957, and his experiences as President both of the British Association for the Advancement of Science and of the Royal Society. By writing this autobiography, where he gives us the benefit of his wisdom, Lord Todd has performed another service for the chemical profession.

David H. Kenny, *Michigan Technological University*

**A Manual of Chemical and Biological Methods for Seawater Analysis.** By T. R. Parsons (University of British Columbia), Y. Maita (Hokkaido University), and C. M. Lalli (University of British Columbia). Pergamon Press, Inc.: New York. 1984. xiv + 173 pp. \$8.95. ISBN 0-08-030287-4.

This book should be of practical value to those working in the field of biological oceanography as the chemical techniques described are restricted to elements and compounds of interest to that clientele. The biological techniques are likewise restricted. A spectrophotometer, fluorometer, microscope, Coulter Counter, and/or scintillation counter fulfill the capital equipment requirements of most methods. For nearly all the analyses indication of the statistical reliability is given.

Chapter 1 covers the determination of nitrate, nitrite, ammonia, urea, phosphate, and silicate plus the bioassay of seawater for vitamin B<sub>12</sub>.

Chapter 2 covers the determination of soluble organic material, including total dissolved organic nitrogen, dissolved free amino acids by fluorometric analysis, combined amino acids by fluorometric analysis, dissolved monosaccharides, dissolved carbohydrates, and petroleum hydrocarbons.

In Chapter 3, which deals with particulate matter, in addition to a discussion of the methods of electronic counting and sizing of particles, a method for determination of the sinking rate of phytoplankton and other particulates is given. Moreover, the following determination of particulate material is discussed: organic carbon, carbohydrate by MBTH (3-methyl-2-benzothiazolinine hydrazone hydrochloride) reagent, amino acids by fluorometric analysis, and lipids by dichromate oxidation after separation by solvent extraction.

Chapter 4 deals both with the determination of chlorophylls and their degradation products and with the determination of total carotenoids. The superiority of High Precision Liquid Chromatography, HPLC, for these purposes is acknowledged. However, the cost of equipment for HPLC puts it outside the scope of this book as a method of analysis. Spectrophotometric and fluorometric methods are given. The fluorometric methods are more sensitive but less accurate than the spectrophotometric methods. For continuous monitoring of chlorophyll concentrations from a vessel underway or from pumped samples in a vertical survey, a method is given using a fluorometer with a flow-through sample chamber. Fluorescence is recorded on a strip chart recorder. The method is neither highly accurate nor precise but useful to spot changes in concentration in vivo during a survey and is helpful to the simultaneous collection of other kinds of data.

Chapter 5 outlines the measurement of photosynthesis by the uptake of radioactive carbon. The method described does not take into account the interpretation of results.

Chapter 6 covers the direct counting of bacteria by fluorescence microscopy plus two methods of determination of heterotrophic activity by measuring the uptake of either <sup>14</sup>C labeled glucose or <sup>3</sup>H labeled thymidine.

In Chapter 7 the determination of dissolved oxygen is outlined both by a spectrophotometric modification of the classical Winkler method and by thiosulfate titration. In addition to oxygen determination this chapter also outlines a method for the determination of carbonate alkalinity and total carbon dioxide (all based on pH titration). A method for the determination of total dissolved sulfide (H<sub>2</sub>S, HS<sup>-</sup>, and S<sup>2-</sup>) based on the reaction of the sea water sample with *N,N*-dimethyl-*p*-phenylenediamine sulfate and ferric chloride in acid medium to form methylene blue is also outlined.

Chapter 8 covers counting, media, and preservatives, and Chapter 9 covers terms and chemical, biological, and energy equivalents.

The book is well referenced and seems to attain the goals given in its preface.

\*Unsigned book reviews are by the Book Review Editor.

Although on page vii the authors clearly give words of caution and direct the reader to appropriate references in laboratory safety, this reviewer would like to have seen specific words of caution given where needed in certain procedures.

James J. Markham, Villanova University

**Oxygen Radicals in Biological Systems.** Edited by L. Packer (University of California, Berkeley). **Methods in Enzymology. Volume 105.** Edited by S. P. Colowick and N. O. Kaplan. Academic Press, Inc.: New York. 1984. xxviii + 600 pp. \$67.50.

The reduction of molecular oxygen ( $O_2$  or dioxygen as it has come to be known) to water by successive additions of single electrons generates a number of highly reactive intermediates, which include superoxide ( $O_2^-$ ), singlet oxygen ( $^1O_2$ ), the hydroperoxyl radical ( $HO_2^\cdot$ ), hydrogen peroxide and its anions, the hydroxyl radical and its conjugate anion, and oxide ( $O^{2-}$ ). The chemistry of these intermediates is complex. They are generated by a variety of mechanisms and are ubiquitous in biological systems.

During the last 20 years there has been a virtual explosion in our knowledge of the chemistry and the biological significance of these intermediates, or "oxygen radicals", as they are widely designated. This increase in knowledge has followed from advances in techniques and in instrumentation in spectroscopy (especially electron spin resonance), fluorescence, high-performance liquid chromatography, and techniques for studying fast reactions. As a consequence of these developments, the role of oxygen radicals in many diseases and in the aging process has been recognized.

This book not only focuses on the state-of-the-art methodologies used in the study of oxygen radicals but it also explores the basic chemistry and biochemistry of oxygen radicals and their biological significance. The complexity of the subject matter and level of research activity are indicated by the fact that the volume contains 71 individual chapters from 122 authors and co-authors. These chapters are organized into six sections, the titles of which suggest the breadth of coverage of the subject matter: I. Chemistry and Biochemistry of Oxygen and Intermediate States of its Reduction; II. Isolation and Assays of Enzymes or Substances Resulting in Formation or Removal of Oxygen Radicals; III. Assay of Models of Biological Damage Imposed by  $O_2$  and Reduced Species; IV. Pathology, Cancer, Aging; V. Enzymes, Viral Activity, and Cell Viability as End Points for Study of Free Radical Damage; and VI. Drugs: Environmental Induction of Radical Formation and Radical Species. Since there are so many contributors to the book, it is not surprising that there is variability in style and approach in the individual chapters. However, for the most part, each chapter discusses the basic observations in the particular area of coverage, the chemistry of the individual oxygen radicals involved, and the latest experimental techniques employed in the particular studies.

This book will be of value to those individuals who would like to gain a broad perspective about the chemistry and biological significance of oxygen radicals. Researchers who are looking for experimental procedures to attack specific problems involving oxygen radicals should find this volume very useful. The efficiency with which the Editor has put together this complex volume is indicated by the fact that there are many references to papers published within the last 2 years. The index is comprehensive and well organized. There is also an author index which is a very useful feature for a volume with so many contributors.

Kenneth M. Pruitt, *The University of Alabama in Birmingham*

**Organic Reactions. Volume 32.** Edited by W. G. Dauben. John Wiley and Sons: New York. 1984. vii + 533 pp. \$54.95. ISBN 0-471-88101-5.

There are but two chapters in this volume, and one of them could have been a book in its own right: The Intramolecular Diels-Alder Reaction by E. Ciganek, and Synthesis Using Alkyne-derived Alkenyl- and Alkynyl-aluminum Compounds, by G. Zweifel and J. A. Miller. Each provides the thorough review with encyclopedic tables of published examples that is characteristic of the series.

The table of contents alone of Dr. Ciganek's chapter takes up 4 pages. He notes that the intramolecular version of the Diels-Alder remained neglected for many years, but its power for synthesis of fused ring systems has now been recognized, and nearly 750 references are cited, even though coverage is said to be incomplete after 1981. The tabulation of examples is broken down into major subtables. The last table, which has 13 subtables, is devoted to reverse Diels-Alder reactions. While this chapter was being compiled, two other reviews on the same subject appeared (Fallis, A. G. *Can. J. Chem.* **1984**, *62*, 183; Brieger, G.; Bennett, J. N. *Chem. Rev.* **1980**, *80*, 63). They provide a faster introduction to the topic, but at 52 and 35 pages, respectively, they are substantially smaller and do not contain the same quantity of tabulated data.

The chapter of Zweifel and Miller begins with the discovery by Wilke

and Müller in 1956 that dialkylalanes,  $R_2AlH$ , react with acetylenes to produce vinylalkylalanes. A substantial part of the chapter is devoted to this hydroalumination reaction and the related "carboalumination" reaction. This is followed by a review of the use of alkenyl- and alkynylalanes in synthesis, leading to alkenes, dienes, alkynes, enynes, cyclopropanes, etc.

Both chapters have experimental procedures for representative examples, and besides a subject index, the book has cumulative author and chapter/topic indexes for Volumes 1-32.

**Physical Chemistry.** By Robert A. Alberty (MIT). John Wiley & Sons, Inc.: New York. 1983. vii + 824 pp. \$29.95. ISBN 0471-09284-3.

**Physical Chemistry for Students of Biology and Chemistry.** By David Freifelder (Brandeis University). Science Books International, Inc.: Boston. 1982. xv + 767 pp. \$29.00. ISBN 0-86720-002-20.

Both of these textbooks cover most of the standard topics in physical chemistry, quantum theory, and spectroscopy, and both place a strong emphasis on biological applications through discussion, examples, and problems, but beyond these superficial similarities, these two physical chemistry textbooks are strikingly different.

The book by Alberty is the sixth and newest edition of the popular text co-authored by Alberty and Daniels until the latter's death in 1972. The overall organization of this edition is fundamentally similar to that of the fifth edition. In this edition the treatment of thermodynamics has been expanded justifying a separate chapter on Gibbs energy and chemical potential. Also the fifth edition chapter on quantum theory has been expanded and split with a separate chapter on atomic structure. The fifth edition chapter on macromolecules has been eliminated by the incorporation of this material into earlier chapters, and there are 226 new problems bringing the total number to 1040. One notable change in this edition is the adoption of the standard-state pressure of 1 bar following the IUPAC recommendation and motivated by the publication of the new "NBS Tables of Chemical Thermodynamic Properties" (1982).

This text is a veritable classic, and anyone who adopts its proven pedagogy will find little to criticize.

The second text, by Freifelder, is one of a growing genre of physical chemistry texts written "for students in biology" or "for students in the life sciences". What this is meant to imply, Freifelder explains in the preface, is that the presentation is more descriptive with an emphasis on practical application rather than on mathematical sophistication. Although a knowledge of calculus is still presumed, the consequences of this orientation are that some topics, most notably quantum mechanics and spectroscopy, are only superficially covered and other topics, as for example statistical mechanics, are omitted altogether. The presentation is purported to be more relevant to problems in biology and biochemistry; however, with the exception of a more extensive biochemical discussion of proteins and nucleic acids, this text exhibits no greater biological application of physical chemistry than the text by Alberty.

One pedagogical preference of Freifelder is to give thermodynamics a molecular foundation rather than develop the theory from macroscopic concepts as Alberty does. In this endeavor, Freifelder prefaces thermodynamics with chapters on kinetic theory and intermolecular forces. While this pedagogy has definite merits, Freifelder's approach fails because the proper foundation in quantum theory and statistical mechanics has not been laid.

There are a few additional weaknesses such as the omission of the Helmholtz free energy and its significance as a measure of spontaneity for isochoric processes. The historical development of quantum theory is inadequately described with no motivation whatsoever given for Planck's quantum hypothesis. There is also no discussion of electron spin or quantum statistics and no discussion of statistical mechanics as the bridge between quantum theory and classical thermodynamics.

In summary, this textbook fails as do many textbooks of this genre from an overcomprehensive and superficial presentation. It tries to encompass everything from a review of general chemistry and biochemistry to topics more appropriately deferred to a course on instrumental methods or molecular spectroscopy. After examining the text, one is still left with the question: "What is the relevant physical chemistry for students of biology and the life sciences?"

Gregory Born, *Florida Atlantic University*

**Surfactants in Solution.** Edited by K. L. Mittal (IBM Corp.) and B. Lindman (University of Lund). Plenum Press: New York. 1984. 2174 pp in three volumes. \$285.00. ISBN 0-306-41483-X; ISBN 0-306-41484-8; and ISBN 0-306-41485-6.

This three-volume collection contains the papers presented at the 4th International Symposium on Surfactants in Solution, which was held in Lund, Sweden, from June 27 to July 2, 1982. The following series of topics were covered: Phase Behavior and Phase Equilibria in Surfactant Solutions; Structure, Dynamics, and Characterization of Micelles;

Thermodynamics and Kinetic Aspects of Micellization; Solubilization; Micellar Catalysis and Reactions in Micelles; Adsorption and Binding of Surfactants; Reverse Micelles; and Microemulsions and Reactions in Microemulsions.

The major theme stressed throughout the work is to further understand the function surfactants perform in solution in order to exploit their capabilities. For example, the inclusion of papers which delineate the application of analytical techniques such as NMR and Neutron Scattering to determine micelle structure with work which details the use of micelles in catalysis, chromatography, and analytical detection is particularly effective in providing an overall picture of this aspect of the surfactant field to the reader.

The editors indicate that this work should appeal to both veteran and neophyte researchers. For the most part, the papers are presented at a level that is commensurate with researchers who have a well-established background in the field. Several general papers which cover subjects such as HLB, Polymerization of Organized Surfactant Assemblies, and Tertiary Oil Recovery will be informative to those being introduced to surfactants. Overall, this series is an important contribution to the literature available on the evaluation and application of surfactants in solution.

Each of the three volumes may be purchased separately. A careful study of the table of contents should provide the researcher with the needed insight to select the proper volume(s).

Neil Canter, *Stepan Company*

**Phosphorus-31 NMR. Principles and Applications.** Edited by David G. Gorenstein (University of Illinois at Chicago). Academic Press: Orlando, FL. 1984. xiv + 604 pp. \$79.00. ISBN 0-12-291750-2.

This book is the collective effort of 20 active researchers, with Gorenstein serving as editor and writing or contributing to five chapters, including the first two.

The first of the four parts to the book consists of two chapters covering chemical shifts and coupling constants. These chapters begin immediately with material specific to phosphorus; no space is wasted discussing NMR in general. The next part (13 chapters) is called Theory and Applications of Phosphorus-31 NMR to Biochemistry and occupies more than two-thirds of the book. The name of this part would have been a more appropriate title for the entire volume. Five chapters discuss enzymes or studies of enzymatic activity, six chapters cover nucleic acids, and two deal with phospholipids. The material is well balanced between theory and applications. Part three, which is labeled Future Directions, contains one chapter on two-dimensional NMR and one on the identification of diseased states. The last of the four parts is an appendix containing a 40-page table of chemical shifts and coupling constants from selected phosphorus-31 spectra.

The topics of specific chapters were well chosen so as to complement each other. Frequently the text in one chapter refers the reader to related material in another. Each chapter has a small table of contents and concludes with a reasonable number of references. A single index allows readers to find topics in any of the chapters. The large number of experimental spectra reproduced is particularly helpful. Some 115 figures in parts 2 and 3 present experimental phosphorus-31 NMR spectra of samples ranging from uncomplexed ATP to an intact human forearm. These figures, the appendix, and about 150 other figures and tables help to make the book valuable as a reference.

The book should be useful both to those seeking to learn about the importance of phosphorus-31 NMR in biochemistry and to those who already know its importance.

Richard Cornelius, *Wichita State University*

**Progress in the Chemistry of Organic Natural Products. Volume 44.** Edited by W. Herz, H. Grisebach, and G. W. Kirby. Springer-Verlag: Vienna and New York. 1983. ix + 326 pp. \$80.80.

This volume consists of four chapters. Each of the chapters reviews recent developments in different areas of natural products chemistry, and they are written by different researchers in these areas. The first chapter is concerned with the biologically active Euphorbiaceae and Thymelaeaceae plant diterpenes. This chapter emphasizes the structure, biological sources, and spectroscopic properties of these materials. It provides sufficient detail that looking up the original cited papers is unnecessary. These natural products have attracted much interest owing to the anti-tumor activity of some of them, e.g., jatrophone type, and tumor-promoting activity of others, e.g., phorbol esters. These biological activities are briefly discussed and fully referenced. The biosynthesis and isolation of these diterpenes are introduced and leading references provided. The second chapter deals with the work of Mondon's group at the University of Kiel on the unique polyterpenoid bitter principles of Cneoraceae plants. The structures of these compounds, elucidated by a combination of chemical, spectroscopic, and X-ray crystallographic studies, are discussed in detail. The next chapter concerns the monoterpenes from marine

organisms which are almost always different from those from terrestrial sources. The marine monoterpenes almost invariably contain halogen atoms, in contrast to the lack of such atoms in terrestrial monoterpenes. The structures of 101 marine monoterpenes accompanied by <sup>13</sup>C NMR chemical shifts are tabulated as well as references to their other physical properties. The biogenesis of these compounds, particularly the role of halogen, is presented. The distribution of these compounds, which is relegated to only a few marine organisms, is given in detail and their chemotaxonomic significance discussed. The elucidation of the structures of these compounds, mainly by spectroscopic (NMR and MS) but also chemical and X-ray crystallographic methods, is critically examined with the difficulties in assigning halogen regiochemistry and stereochemistry underscored. The last chapter is concerned with the much-reviewed C-nucleoside antibiotics. It is limited to the naturally occurring antibacterial C-nucleosides which only number six compounds and eschews the large number of synthetic C-nucleosides. The isolation, structure determination, synthesis, and biological activity of these compounds are reviewed. Their chemistry is presented in so far as it relates to their structure elucidation. Given in considerable detail are the chemical and biological syntheses of these materials.

Each chapter is fully referenced up to 1982. There is a detailed table of contents whose relevant part is repeated at the beginning of each chapter. There is also an index of cited authors and a subject index. The subject index, while in general useful, has some unneeded entries such as acetic acid, acetone, chloroform, Dreiding models, hexane, etc. Overall, this volume, like the others in this series, is of high quality. However, the scope and goals of the authors in this volume differ substantially as can be surmised from this review. In general, this book should be of particular value to specialists in the reviewed areas because of the wealth of detailed structures and spectroscopic parameters listed.

Richard Glass, *University of Arizona*

**Electrophoresis, A Survey of Techniques and Applications. Part B: Applications.** Edited by Z. Deyl (Czechoslovak Academy of Sciences). Elsevier Scientific Publishing Company: Amsterdam and New York. 1983. xiv + 462 pp. \$104.75. ISBN 0-444-421149.

This book is the second volume of a two-volume set on electrophoresis. Part A, "Techniques", published in 1979, dealt with the principles, theory, and instrumentation of modern electromigration techniques. Part B, "Applications", is concerned with the detailed applications of electrophoresis to many diverse categories of compounds, such as organic compounds, molecules and macromolecules of biological relevance, natural products, and inorganic compounds.

Paper electrophoresis is used to separate derivatized organic compounds. Alcohols are derivatized as 2-alkoxy-1-methylpyridinium *p*-toluenesulfonates, xanthate ions, or 2-alkyl(aryl)thio-1-methylpyridinium *p*-toluenesulfonates. Aldehydes and ketones are converted into hydroxamic acids or (4-sulfobenzyl)xanthidrazones and ( $\beta$ -carboxyethyl)-xanthidrazones. Detailed methods for derivatization of these compounds are presented in the book. Polyhydroxy compounds such as carbohydrates and their derivatives may become charged by forming complexes with other ions. They are then separated by paper electrophoresis. Carboxylic acids, steroids, steroid conjugates, amines, amino acids, and their derivatives are separated by either paper electrophoresis or isotachophoresis. Methods for separating unusual amino acids, DNP amino acids, PTH amino acids, and related compounds are also discussed.

Peptides and proteins are compounds most suited to separation by electrophoresis and are dealt with in detail. These compounds can be separated by zone electrophoresis, isoelectric focusing, isotachophoresis, or a combination of these. In addition to one-dimensional separations, paper electrophoresis and thin-layer electrophoresis are often used for multidimensional separation. Furthermore, the relative electrophoretic mobility can be used to determine the charge and molecular weight of peptides. Gel electrophoresis and electrofocusing of proteins, including membrane proteins and their receptors, steroid receptors, cell surface antigens, immunoglobulins, hemoglobins, lysosomal glycosidases and sulfatases, hemocyanins, contractile and cytoskeletal proteins, proteins of connective tissue, microtubular proteins, protein hormones, plasma proteins, and allergens, are discussed.

Affinity electrophoresis is applied to glycoproteins and glycopeptides. Lipoproteins are fractionated by agarose gel electrophoresis with emphasis on electrophoretic patterns at normal and disease states. Lipopolysaccharides are separated by discontinuous SDS-polyacrylamide gel electrophoresis. The enzymes can be isolated and purified by electrophoretic techniques in free solution or zone electrophoresis. Nucleotides, nucleosides, nitrogenous constituents of nucleic acid, and nucleic acids can be separated by paper or gel electrophoresis or isotachophoresis. The molecular weights of DNA fragments can be estimated by electrophoresis in 1% agarose gel.

Alkaloids, vitamins, antibiotics, dyes, pigments, and inorganic com-

pounds are generally separated by zone electrophoresis on paper, gel, or cellulose.

In all, this book is an exhaustive survey of the application of electrophoresis with extensive references following each chapter. Conditions for separation by electrophoresis as well as techniques for detection are given in great detail. Furthermore, over 100 tables and many figures of results are presented in the text to give examples of experimental data. This is extremely useful for readers who are trying to reproduce the experiments in their own laboratory. This book is valuable to research chemists, biochemists, pharmacologists, and scientists involved in biochemical and biomedical research.

**Chow-Eng Low, National Cheng Kung University**

**Modern Crystallography. Volume III. Crystal Growth.** By A. A. Chernov. Springer-Verlag: Berlin, Heidelberg, New York, and Tokyo. 1984. xx + 517 pp. \$59.50. ISBN 0-387-11516-1.

This book is a handy reference on the fundamental concepts and techniques of crystal growth. No previous knowledge of the field by the reader is necessary. The basic principles of the crystallization processes are systematically developed in Part 1: the thermodynamic equilibrium between a crystal and its environment, the structure of this interface, and the equilibrium shape of crystals; the principal concepts of nucleation in various bulk phases and on foreign substrates (epitaxy); growth mechanisms and experimental methods used to investigate growth processes and surfaces; effect of impurities on growth processes and the thermodynamics and kinetics of impurity trapping; mass and heat transport in crystallization and the stability of various growth shapes; an analysis of the most common growth defects including inclusions, dislocations, grain boundaries, and internal stresses; and the principles of industrial crystallization (formation of polycrystalline materials with specific properties) are some of the topics discussed in detail.

Part 2 is devoted to practical applications of crystal growth. These include crystal growth from the vapor phase by both physical (molecular beam method, cathode sputtering, gas flow crystallization) and chemical (chemical transport, vapor decomposition, vapor synthesis) methods, which are widely used for the preparation of epitaxial thin-film layers and bulk crystals so important in semiconductor technology. Several specific examples including equipment setup are discussed.

The section on crystal growth from solutions emphasizes techniques by low-temperature aqueous solutions and hydrothermal growth for which sufficient details of equipment and examples are given; however, high temperature solution (flux growth) methods are only briefly described and few examples are given.

The chapter on crystal growth from the melt presents the Kyropoulos, Czochralski, Stockbarger-Bridgman, Verneuil, and zone-melting methods, including principles, equipment, and several examples in each case.

Although some of the topics could have been expanded in greater detail, the authors state correctly that more detail can be found in the literature cited. The intended advantage of this book is that both the theories of crystal growth and all of the modern methods of growing single crystals are presented in a single volume in sufficient detail for the uninitiated.

The references are extensive and up to date through 1982.

**Martha Greenblatt, Rutgers, The State University of New Jersey**

**New Pathways For Organic Synthesis: Practical Applications of Transition Metals.** By H. M. Colquhoun, J. Holton, D. J. Thompson, and M. V. Twigg. Plenum Press: New York. 1984. xiv + 454 pp. \$59.50. ISBN 0-306-41318-3.

This monograph represents a comparative survey of transition metal mediated processes that should be useful to the organic chemist in devising the optimum synthetic approach for a particular goal. The book serves as a practical guide to the application of organometallic processes in organic synthesis.

The organization of the book is based on the structural type of the desired synthetic product rather than a listing of individual transition metals. The reactions that have been collected in this book were chosen principally for their general usefulness in synthesis. The coverage of the different transition metals is quite comprehensive, as is the range of synthetic transformations. In addition to the examples of reaction types and discussions of mechanistic types, many illustrative examples of actual experimental procedures are given. This latter aspect renders this monograph unique among similar ones and is particularly significant in view of the difficulty in finding procedures in the vast literature of organometallic chemistry.

The chapter headings in the book are as follows: Chapter 2, Formation of Carbon-Carbon Bonds; Chapter 3, Formation of Carbocyclic Compounds; Chapter 4, Formation of Heterocyclic Compounds; Chapter 5, Isomerization of Alkenes; Chapter 6, Direct Introduction and Removal of Carbonyl Groups; Chapter 7, Reduction; Chapter 8, Oxidation;

Chapter 9, Preparing and Handling Transition Metal Catalysts. There is extensive use of subheadings in each chapter which facilitates finding specific transformations. Chapter 9 includes some very useful information on apparatus and technique for handling air-sensitive compounds. Chapter 4 is one of the few reviews on the use of organometallic processes in preparing heterocycles and serves well to extend the appeal of this monograph.

The references in the book are largely pre-1980 and are collected together at the end of the book. A subject index and a compound index both are very helpful in locating specific metals or classes of compounds. Of the several books already published on the use of transition metals in organic synthesis, this monograph appears to be the most comprehensive and most practical for organic chemists. It should be a handy reference book on practical applications of organometallic chemistry in organic synthesis.

**Joseph P. Marino, The University of Michigan**

**Natural Products Chemistry. Volume 3.** Edited by K. Nakanishi (Columbia University), T. Goto (Nagoya University), S. Ito (Tohoku University), S. Natori (Meiji College of Pharmacology, Tokyo), and S. Nozoe (Tohoku University). Kodansha Ltd.: Tokyo; University Science Books: Mill Valley, CA. 1983. xii + 700 pp. \$90.00. ISBN 0-935702-14-8.

Since the publication of Volumes 1 and 2 of this series in 1974 and 1975, the field of natural product chemistry has undergone drastic changes. The state of the art of organic synthesis has advanced considerably, due largely to advances in areas such as stereocontrolled synthesis, organometallic methods, etc., and has opened new and efficient pathways for the total synthesis of natural products. Analytical methods have improved so that microgram quantities of bioactive natural products may now be isolated, purified, and identified. The field of natural product chemistry has become increasingly interdisciplinary, drawing on biology, biochemistry, pharmacology, medicine, and biophysics. The current volume serves to update the topics covered in the first two volumes and includes many new compounds. The major aim of this series remains to bridge the gap between textbooks and comprehensive treatises.

Volume 3 covers many of the same topics found in Volumes 1 and 2: Mono-, sesqui-, di- and higher terpenoids, steroids, fatty acids, carbohydrates, carboaromatics, alkaloids, and non-alkaloidal nitrogen compounds. An additional chapter on modern  $^{13}\text{C}$  NMR techniques illustrates the various data collection techniques with a spectrum of  $\beta$ -ionone for each and is accompanied by a short description. The general format of this volume follows its predecessors in that an effort is made to cover the important facets of a broad range of areas in natural product chemistry, including isolation, structural studies, synthesis, biosynthesis, and biological activity. This is accomplished with short tabulations of physical and spectral data followed by schematic presentations of synthesis and/or biosynthesis. The liberal use of structural formulas aids in fast information retrieval. A particularly useful feature is the assignment of  $^1\text{H}$  NMR resonances in many of the new compounds, as was done in the earlier volumes. While not exhaustive in each of these areas, this volume serves as a convenient and concise guide to this extremely broad field.

**William H. Pearson, University of Michigan**

**Open Tubular Column Gas Chromatography: Theory and Practice.** By M. L. Lee (Brigham Young University), F. J. Yang (Varian Instruments), and K. D. Bartle (University of Leeds). John Wiley & Sons: New York. 1984. xii + 445 pp. \$48.00. ISBN 0-471-88024-8.

During the last 10-15 years, gas chromatography (GC) in highly efficient open-tubular (capillary) column has influenced dramatically our capabilities to analyze complex organic mixtures, resolve isomeric substances, and detect relatively volatile compounds at extremely small concentrations. In connection with powerful identification techniques, such as mass spectrometry and Fourier transform IR spectroscopy, capillary GC now plays a major role in elucidating new natural products, environmentally important substances, drug metabolites, etc. Consequently, a comprehensive book on the method and its important applications comes on the market at an opportune time. The authors of this book are to be commended for providing a complete treatment of the subject while striking a good balance between the instrumental and applied aspects of the field. This book is considerably more complete and balanced than the previously published volumes on capillary GC by others.

The first two chapters (Introduction; Theory and Potential) are perhaps the weakest sections of this otherwise highly informative book. The scope, basic terms, and relation of capillary GC to other analytical methods could have been presented in a more concise manner. Those points, together with a somewhat disjointed discussion of theoretical aspects, may present difficulties in the orientation of a beginner in the

field. The discussion of theoretical aspects, done in somewhat of an unconventional manner, is not a drawback in itself (indeed, several nice illustrations of the principles are shown here explicitly for the first time), but important links between the theory and operation of open-tubular columns should have been stressed more forcefully. The value of emphasizing 30  $\mu\text{m}$  i.d. columns is somewhat doubtful, at this stage of development.

Chapters 3 (Column Technology), 4 (Instrumentation), and 5 (Practice and Techniques) are the best parts of this book. Chapter 3 provides sufficient background for a reader to understand the principles and techniques of the modern column technology and gives numerous references to the key column preparation procedures. In an effective manner, it also points out the value of column testing methods. Chapters 4 and 5 are very useful summaries of the state of the art in sampling techniques, detection, and ancillary methods of capillary GC, including a discussion of future needs and trends. Much useful information is presented here in one place, including certain crucial details of this technique-oriented analytical method as well as the necessary references.

I am not sure whether Chapters 6 (Applications: Chemical Class) and 7 (Applications: Sample Type) should have been presented separately. While they both contain a wealth of useful references, a certain overlap is evident. Perhaps a treatment of various applications, emphasizing differences in analytical utilization of the method (major-component analysis vs. trace determinations, the value of selective detectors, etc.), would have been more effective.

Overall, the authors are to be congratulated on an excellent book, representing a valuable addition to the chromatography literature. The book is highly recommended to all chemists using modern chromatographic methods in their research and routine work. Due to an increasing utilization of capillary GC in environmental and biomedical studies, workers in those fields would also benefit from reading the book.

Milos Novotny, *Indiana University*

**Asymmetric Synthesis. Volume 1. Analytical Methods. Volume 2. Stereodifferentiating Addition Reactions. Part A.** Volume 1: Edited by James D. Morrison (University of New Hampshire). Academic Press: New York, NY. 1983. xiv + 201 pp. \$32.00. ISBN 0-12-507701-7. Volume 2: Edited by James D. Morrison (University of New Hampshire). Academic Press: New York, NY. 1983. xiv + 278 pp. \$45.00. ISBN 0-12-507702-5.

In the years since the publication of the first definitive monograph on asymmetric synthesis ("Asymmetric Organic Reactions", 1971, by J. D. Morrison and H. S. Mosher), the area of asymmetric synthesis has undergone a metamorphosis from a rather exotic specialty to a rich and diversified field. With Volume 1, Morrison begins an edited multivolume treatise which endeavors to review the progress in this area since 1971.

The first volume ("Analytical Methods") concentrates on methods to evaluate the chiral efficiency of processes that produce chiral compounds. The advances in this area have been crucial to the development of new and efficient asymmetric syntheses, since a high degree of accuracy may now be obtained without heavy reliance on polarimetric methods and their inherent problems.

An introductory chapter by Morrison summarizes current methods to obtain chiral compounds in order to place asymmetric synthesis in the context of other techniques. Analytical methods are then covered in the remaining chapters: Polarimetry (including a discussion of commercially available instruments), competitive reaction methods (i.e., kinetic resolution as a method of calculating the specific rotation of pure enantiomers), isotope-dilution, gas chromatography, liquid chromatography, and three chapters on nuclear magnetic resonance (chiral derivatization, chiral solvation, and the use of chiral shift reagents).

Volume 2 of this series is the first of two volumes concerned with asymmetric addition reactions. In Chapter 1, H. C. Brown presents a detailed description of the hydroboration of alkenes with optically active boranes. Practical tips on the preparation of these reagents and their use with various classes of olefins are given. Application of the resultant organoborane intermediates to carbon-carbon bond forming reactions is also briefly presented. Chapter 2 is a related account by M. M. Midland concerning the asymmetric reduction of carbonyl compounds with chirally modified boranes and borohydrides. Similar reductions with chirally modified derivatives of lithium aluminum hydride are presented in Chapter 3 by J. D. Morrison et al., which is categorized according to the organic modifier (including pulverized newspaper). Chapter 4 (Y. Inouye et al.) covers carbonyl reductions with chiral dihydropyridine reagents. E. L. Eliel presents the addition of achiral nucleophiles to chiral carbonyl

compounds in Chapter 5. Most of the chapter is devoted to additions in the Cram-chelation mode, which are then followed by destruction of the preexisting chiral center, thereby accomplishing the transfer of stereochemical information to the new center at the expense of the original one. A useful section on the effect of reaction conditions on the stereoselectivity of these reactions is also presented. Stereochemical control by remote chiral centers is considered briefly. In Chapter 6, G. Solladié discusses the addition of chiral nucleophiles to aldehydes and ketones. The nucleophiles covered are simple organometallics used in a chiral environment, carbanions stabilized by an adjacent chiral sulfoxide group, and chiral ester enolates. K. Tomioka and K. Koga present the noncatalytic addition of nucleophiles to unsaturated carbonyl compounds in Chapter 7. These are organized into two groups: those involving conjugate additions to chiral unsaturated carbonyl compounds and those involving conjugate addition of chiral nucleophiles. The addition of organometallic reagents to chiral vinylic sulfoxides is covered by G. H. Posner in Chapter 8. While acyclic vinyl sulfoxides are considered, the majority of this section concerns 2-cycloalkenone sulfoxides. Finally, D. E. Bergbreiter and M. Newcomb round out this volume with a detailed discussion of the alkylation of chiral enamines and azaallyl metal reagents (metalloenamenes). A particularly useful feature of this chapter is a general discussion of the formation and structure of azaallyl metal reagents.

The contributions contained in these two volumes are uniformly complete and well written, helping make them essential reading for all scientists concerned with the synthesis, utilization, and analysis of chiral molecules. This timely series should do much to advance the state of the art in asymmetric synthesis.

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**Introduction to Aerosol Science.** By Parker C. Reist (University of North Carolina). Macmillan Publishing Company: New York. 1984. xv + 299 pp. \$38.00. ISBN 0-02-949600-4.

As the title of Professor Reist's book states, this is an introductory text. It presumes no prior knowledge of aerosol science and, depending on the student's background in physics and engineering, can be used in an undergraduate or introductory graduate level course in aerosol science.

Professor Reist has attempted to provide broad, elementary coverage of the area, ranging from particle motion, diffusion, coagulation, and nucleation to electrostatic charge and optical effects. Additionally, he has tried to provide necessary background information on topics such as elementary principles of fluid mechanics, apparently in order to make the text self-contained. Unfortunately, a price has been paid for this wide coverage. It is not possible to introduce these basic principles in the space available; and in my opinion, the student would not gain sufficient insight with the material presented to fully appreciate the implications of such principles on aerosol mechanics. This also seems to come through in other topical areas, for example in Chapters 14 and 15 on optical properties of aerosol. In this regard, Professor Reist is most successful in Chapters 10 and 11 on electrostatic charge behavior, an area in which he has done some research. Overall, it would have been much better to assume that the student had (or would make the effort to acquire) a basic, solid understanding in fluid mechanics, transport phenomena, electromagnetic radiation theory, etc.

Despite this drawback, Reist's book serves a very real purpose by filling a void in aerosol science education—that is, a text in the first course on aerosol science. It could be used very effectively in such a course, if it is properly supplemented with more current literature and with texts having more rigorous and elaborate treatments of many of the principles. The problems at the end of each chapter are sufficiently routine that most students will not find them challenging. But the student being introduced to the subject could benefit from doing a selected few.

Overall, the book is quite readable despite the many typographical errors, which hopefully will be eliminated in a second printing. However, there are a few choices of symbols that are surprising. Most apparent,  $\nu$  is used consistently for velocity and  $v$  for kinematic viscosity. The reverse is quite standard in the fluid mechanics literature and even in aerosol mechanics literature. Furthermore, there are several occasions where these typographical errors (e.g., a subscript on  $\rho$ ) could confuse the new student.

With these limitations aside, one being introduced to the subject would be well advised to consider obtaining this text. It provides, at an appropriate level, a good introduction to the subject of aerosol science.

Leonard K. Peters, *University of Kentucky*