

Book Reviews *

Metal Nitrosyls. By George B. Richter-Addo and Peter Legzdins (University of British Columbia). Oxford University Press: New York, 1992. xiv + 370 pp. \$59.95. ISBN 0-19-506793-2.

This book provides a comprehensive overview of the chemistry of transition metal nitrosyls. Professor Legzdins has been a major contributor to nitrosyl chemistry over the past two decades and has an excellent perspective on important contributions in the area. The book contains eight chapters. After an informative introduction and a discussion of synthesis and characterization, the authors present extensive chapters on coordination compounds and organometallic compounds. These chapters tend to be encyclopedic and are essentially enumerations of compounds and their structures. A short chapter effectively covers the limited chemistry of nitrosyl metal clusters. This contrasts with the rather extensive chemistry of the carbonyl analogues. Another short chapter covers the bioinorganic chemistry of nitric oxide. Since the literature was only covered through mid-1991, the extensive rising interest in NO chemistry and its implication in particularly important physiological functions was not included (*Science*, 1992, 258, 1862). Perhaps the most impressive chapter is that on the reactions of metal nitrosyls. The reactivities of the complexes, particularly the most recent developments in reactions and insertions of the nitrosyl moiety, are covered in an interesting manner. A final chapter briefly covers environmental aspects of nitric oxide and its atmospheric chemistry. This chapter provides a convenient source of further references.

In the past, some viewed nitric oxide as merely another toxic molecule, but in 1992 *Science* named NO as the *molecule of the year* owing to recent discoveries in neuroscience and immunology. This increased attention to the biochemistry of NO may well produce further interest in the interaction of metal complexes with NO and the reactivity of nitrosyl compounds. Fortunately, this book provides a broad survey of the field in a single volume. It will certainly be of interest to those planning to investigate the reactivity of NO in its interactions with transition metal compounds.

J. W. Faller, Yale University

Advances in Strain in Organic Chemistry. Volume 2. Edited by Brian Halton. JAI Press: Greenwich, CT. 1992. x + 268 pp. \$78.50. ISBN 1-55938-453-0.

This book provides useful and readable summaries of aspects of small-ring structure, synthesis, and reactivity. It should be appreciated for its tantalizing structures, photoelectron spectra, X-ray data, and synthetic details.

G. Szeimes contributed an exciting chapter on the preparation and characterization of the bicyclo[1.1.0]but-1(2)-enes (cyclopropenocyclopropenes!), the dehydroquadracyclanes, homocubenes, and small-ring propellanes. Included are descriptions of trapping reactions and the results of MO calculations all interpreted with the concern expressed by Woodward and quoted on p 18: "...we deplore the tendency to accept as an intermediate any species solely on the ground that it can be conceptualized, and that it is not implausible." While not mentioned in this chapter, part of the fascination of many of the structures examined is that they are at the extreme of applicability of classical mechanical methods (molecular mechanics). The large deviation from sp^2 hybridization of many of the olefinic carbons represents a formidable challenge to current force fields. The only major omissions from this chapter seem to be Borden's 3,7-bridged bicyclo[3.3.0]oct-1(5)-enes, which are so unstable they undergo a retro vinyl cyclopropane rearrangement.

Zwanenburg and Klunder coauthored a chapter that describes recent studies on the effects of strain on the chemistry of bridgehead-substituted cage compounds. The major foci are cubane, homocubane, basketane, and bishomocubane derivatives with minor emphasis on homocubanes, brexanes, and related materials. After a description of the syntheses of the carbon skeleta, the base-induced cleavage of alcohols is itemized with the stereochemistry (inversion) of protonation where available in one-bond fissions. Retro 2 + 2 reactions of cyclobutanols under basic conditions are also detailed as are thermal and acid-catalyzed cleavages. Some cage closure reactions are described, the most spectacular of which is Ganter's alkaline-induced intramolecular alkoxide addition to norbornene-like compounds.

Perhaps of greater interest to synthetic chemists is a nicely detailed chapter by Snider on intramolecular 2 + 2 cycloadditions of ketenes and keteniminium salts with olefins. Extensive reference is made to natural

products synthesis. Not unexpectedly, there is an important emphasis on conditions, yield, stereochemistry, and scope of reaction with various ketenes.

Gleiter and Spanget-Larson review the photoelectron spectra of cyclopropane- and cyclobutane-containing hydrocarbons after describing the technique. The major points made are as follows: Walsh orbitals themselves are inadequate to "explain" the PE spectra; the radial and tangential Walsh orbitals must mix; cyclopropanes, and not cyclobutanes, interact strongly with π systems; a cyclobutane acts as a better relay between π units than twisted six- or seven-membered rings; and strained sigma bonds enhance through-bond coupling between π systems. The spectra of more than 100 small-ring compounds are summarized including those of interesting materials like spiropentane, bicyclobutanes, 1.1.1-propellane, and [2.2]-paracyclophane.

Boese has provided an outstanding chapter on the low-temperature X-ray crystallographic structure determinations of small-ring hydrocarbons including various cyclopropenes, methylenecyclopropane, and spiropentane! A number of benzoannulated cyclopropenes are presented as well as a number of [2.n] rotanes and olefinic derivatives. A preamble describes the techniques, precautions, and interpretation of data, and electron density maps are sprinkled throughout.

Every library should have this volume, and many individual investigators should consider having one more close at hand.

Joseph Gajewski, Indiana University

Nanosystems: Molecular Machinery, Manufacturing, and Computation. By K. Eric Drexler (Research Fellow: Institute for Molecular Manufacturing, Palo Alto, CA). John Wiley & Sons, Inc.: New York, Chichester, Brisbane, Toronto, and Singapore. 1992. xx + 556 pp. \$42.95 (hardcover)/\$24.95 (paperback). ISBN 0-471-57547-X (hardcover)/0-471-57518-6 (paperback).

This book presents an unusual and very stimulating perspective on chemistry in that Drexler presents his investigations as a contribution to the field of "theoretical applied science", which he defines as an attempt to describe the limits of technological capabilities in terms of physical law, rather than in terms of current laboratory techniques. Since there is little in the way of peer-reviewed technical literature in this field, the major mode of formal review of the investigations presented in this book has been by the examination committee members for Drexler's recent interdisciplinary Ph.D. from MIT.

The goal of Drexler's investigations is "building complex structures with atom-by-atom control", which is also the ultimate goal of synthetic chemistry. Drexler's approach is distinguished from conventional chemistry in that complex structures are to be made by using programmable "nanoscale mechanical systems to guide the placement of reactive molecules" to about 0.1-nm precision. The objective of the book is to present a theoretical foundation for "molecular manufacturing", which Drexler also calls "molecular nanotechnology". The objective is *not* to present a detailed review of recent experimental progress in the many disciplines that converge on what is being increasingly termed "nanotechnology".

Drexler's investigations are based upon several different areas of science and engineering. His presentation and conclusions are easily accessible, aided by an excellent glossary and the uniform use of SI units. However, much of the detailed argumentation will be accessible only to those very familiar with molecular mechanics and the mathematical methods of materials science and engineering. Many of these arguments are beyond my expertise to critique, but in general they seem very carefully developed. The book is something between a textbook (for a new field) and a series of papers reporting new theoretical work (in a new field). Consequently, some sections would benefit from more detailed explanations and/or references to background material, others from more detailed justifications of conclusions. I found the background information on chemistry to be excellent but would have appreciated more background on mechanical engineering principles (which Drexler may have assumed, since his background is engineering). The book is exceptionally well written but is nevertheless in places difficult to read because the density of information and argumentation per page is very high.

Many key references are provided to lead the interested reader into the literature of the diverse fields relevant to nanotechnology; and the references are largely current as of July, 1992, but they are not intended to be complete. In this reviewer's opinion, this book achieves its goals admirably and is well worth the attention of any chemist interested in

*Unsigned book reviews are by the Book Review Editor.

thinking about how chemistry (and technology in general) might be radically different one to three decades from now.

The first part of the book explores how our current models of atomic bonding behavior can be combined with principles of mechanical engineering and applied to the design of molecular machinery (that cannot yet be constructed and tested directly). Drexler mostly uses the MM2 potential energy surface but discusses in detail its limitations and some alternative potentials. The discussion of molecular mechanics and molecular dynamics pays much attention to the various levels of theoretical approximation appropriate to considering specific features of molecular machinery. The molecular analysis provides parameters to use in a "bounded continuum" model for the preliminary engineering design of mechanical nanoscale devices without a detailed atomic specification of each device.

Two aspects of Drexler's analysis of molecular machinery differ from the more familiar use of molecular modeling techniques. First, he emphasizes the differences between applying these methods to what he terms "machine phase" chemistry and the more familiar applications to molecules in solution. Second, he emphasizes the engineering perspective of conservative design of machines with sufficient margin of error so that the machines will work, versus the more familiar scientific use of modeling to make accurate predictions. The perspective of the work as a whole is to design molecules that can be expected to behave reliably as device components, rather than to try to understand how natural molecules work.

The second part of the book applies the foundations laid in the first part to consider how molecular machines could be constructed, largely from polycyclic, diamond-like structures, or in the author's terminology, "diamondoid" structures. He starts by considering sliding surfaces, bearings, gears, etc. and then combines these small components to make intermediate assemblies, such as drive systems, pumps, and motors. These in turn are combined to make whole systems, such as mechanical computers with nanometer-scale components able, with heroic cooling methods, to deliver 10^{15} MIPS from a system one cubic centimeter in volume! Other proposed systems include the machinery capable of performing molecular manufacturing by mechanical positioning of reactive moieties, including 100-nm-scale industrial robot arms. It is further proposed to combine such machinery into kilogram-scale systems capable of producing 1 kg of product per hour, designed and manufactured to complex atomic specifications.

In the third (and briefest) section, Drexler considers how to move toward molecular manufacturing from our current technology base. Of particular interest is recent progress toward Drexler's proposal, first published in 1981, that proteins can be designed to fold into predictable structures more easily than the "folding problem" can be solved for natural proteins. Here he presents specific proposals for peptide-like molecules that would exploit the properties of nongenetic amino acids to fold more predictably. Also provocative are suggestions for improving atomic force microscopy for use both in imaging (as of proteins) and in early steps toward positional control of chemical synthesis. Several alternative pathways from current technology to molecular manufacturing are considered, at least briefly, guiding chemists and others toward a plethora of interesting problems to pursue.

James B. Lewis, *Bristol-Myers Squibb*

Sulphones in Organic Synthesis. Tetrahedron Organic Chemistry Series, Volume 10. Nigel S. Simpkins (University of Nottingham). Pergamon: Oxford, New York, and Seoul. 1993. xi + 381 pp. \$54.00 (soft-cover). ISBN 0080402844.

As stated by the author, "...the use of sulphones in organic synthesis has increased dramatically, the synthetic repertoire of sulphones having been developed to such an extent as to rival the carbonyl functionality for versatility." Although overstated, the role of sulphones in organic synthesis certainly is now sufficiently important and varied as to justify a monograph on this subject; this well-written and appealing book is especially welcome. Several features make it particularly reader friendly: (1) the clear and crisp style of writing; (2) the abundance of visually and mechanistically pleasing equations, including presentation of established or likely intermediates to help the reader understand how to get from reactants to products; (3) the inclusion of many examples of complex molecules (e.g. natural products precursors) within which the manipulation of a particular sulfone functionality is illustrated. The organization of the material within each chapter is logical and clearly indicated in the Table of Contents. The author's rationale for the sequence of chapters is less clear. Chapters include the following sulfone topics: (1) Introduction; (2) Preparation; (3) Carbanions; (4) Additions; (5) Rearrangements; (6) Cycloadditions; (7) Eliminations; (8) Cyclic Sulphones; and (9) Desulphonylation. An eight-page index is provided

and is useful. An author index would have been useful for the reader trying to follow the contributions of a particular research group. Very many literature references are provided through 1990, with some added in 1991.

Overall, this monograph is an enjoyable, informative, and thorough update on the use of sulphones in organic synthesis. It is a timely and high-quality publication. The reasonable price for the soft-cover edition should make this a popular addition to the personal library of most practicing organic chemists.

Gary H. Posner, *The Johns Hopkins University*

Recent Advances in Chemical Information II. Edited by H. Collier (Infonortics, Ltd.). Royal Society of Chemistry: Cambridge, U.K. 1993. viii + 322 pp. £47.50. ISBN 0-85186-235-7.

This book was developed from the Proceedings of the Montreux 1992 International Chemical Information Meeting in Annecy, France, on October 19–21, 1992. After a preface by the editor, there are 21 chapters concerning how modern information technology is affecting the complex areas of chemical and patent information, and how technology will increasingly affect information in other subject areas. There is a list of contributors and a short subject index.

Applications of Plasma Source Spectrometry II. By Grenville Holland (University of Durham) and Andrew N. Eaton (VG Masslab). Royal Society of Chemistry: Cambridge, U.K. 1993. x + 245 pp. £45.00. ISBN 0-85186-465-1

This book was developed from the Durham International Conference on Plasma Source Mass Spectrometry held in Durham, U.K., on September 13–18, 1992. After a preface by the editors, there are 27 papers which reflect the recent developments in plasma source mass spectrometry. There is also a subject index.

Chemical Physics of Intercalation II. NATO ASI Series. Series B: Physics Volume 305. Edited by Patrick Bernier (Universite de Montpellier), John E. Fischer (University of Pennsylvania), Siegmund Roth (Max-Planck-Institute fur Festkorperforschung), and Stuart A. Solin (NEC Research Institute). Plenum: New York. 1993. x + 404 pp. \$115.00. ISBN 0-306-44472-8.

This book was developed from the Proceedings of the Second NATO Advanced Study Institute on Chemical Physics of Intercalation held in Chateau de Bonas, France, from June 29 to July 9, 1992. After a preface by the editors, there are 47 chapters in typescript form covering three-dimensional oxides, two-dimensional classical layer intercalates, one-dimensional doped polymers, and zero-dimensional doped fullerene lattices, with treatment of hybrid systems such as polymers in layer hosts and nonporous hosts. There is a short subject index.

Particles in Gases and Liquids 3. Detection, Characterization, and Control. Edited by K. L. Mittal (Skill Dynamics, An IBM Co.). Plenum Press: New York. 1993. viii + 292 pp. \$85.00. ISBN 0-306-44485-2.

This book was developed from the proceedings of the Third Symposium on Particles in Gases and Liquids (Detection, Characterization, and Control) from the 22nd Annual Meeting of the Fine Particle Society held in San Jose, CA, from July 29 to August 2, 1991. After a preface by the editors, there are 18 papers in typescript form covering the following topics: Aerosol Transport in Turbulent Flows; Deposition of Submicrometer Particles on Surfaces; Testing Philosophy for UHP Gas Handling Components; Particle Measurement in Process Gas Stream; Filter and Filtration Efficiency; Design of Cleanroom Airflows Using CFD Analysis; Cosmetics as a Potential Source of Particulate Contamination in the Cleanroom; Particle Release from Cleanroom Operators; Particle Contamination in Plasma Processing; Characterization and Monitoring of Particles in Pharmaceutical Manufacturing; Monitoring Particles in Liquids; and Marangoni Drying. There is also a list of contributors with short biographies and a subject index.

Ion Exchange Processes: Advances and Applications. Edited by A. Dyer (University of Salford), M. J. Hudson (University of Reading), and P. A. Williams (The North East Wales Institute). Royal Society of Chemistry: Cambridge, U.K. 1993. x + 372 pp. £52.50. ISBN 0-85186-445-7.

This book was developed from the International Conference on Ion-Exchange Processes held at the North East Wales Institute in Wrexham,

U.K., on April 4–7, 1993. After a preface by the editors, there are 36 chapters organized under the following headings: Fundamentals of Ion Exchange; Ion Exchange in the Nuclear Industry; Capillary Electrophoresis; Water Treatment; Inorganic Ion Exchangers; and New Materials. There is also a subject index.

Vibrational Spectra and Structure. Volume 20. Edited by James R. Durig (University of South Carolina). Elsevier: Amsterdam, The Netherlands. 1993. xx + 352 pp. \$231.50. ISBN 0-444-89865-4.

This is the twentieth volume in a series focusing on aspects of vibrational spectroscopy: infrared, Raman, and vibrational structure in electronic transitions. The aim of the series is both to present critical summaries of recent work and to review current fields of interest. The present volume does this in five chapters: Chapter 1, Applications of matrix infrared spectroscopy to mapping of bimolecular reaction paths (Heinz Frei, 66 pp, 132 references); Chapter 2, Vibrational line profile and frequency shift studies by Raman spectroscopy (B. P. Asthana and W. Keifer, 88 pp, 91 references); Chapter 3, Microwave Fourier transform spectroscopy (Alfred Bauder, 34 pp, 192 references); Chapter 4, *Ab initio* quality of SCMH-MO calculations of complex inorganic systems (Edward Boudreaux, 48 pp, 70 references); Chapter 5, Calculated and experimental vibrational spectra and force fields for isolated pyrimidine bases (Willis Person and Krystyna Szczepaniak, 86 pp, 112 references).

The goals of the individual chapters in the text are each different, making it better viewed as a collection of five papers. Chapter 1 is a well-written, thorough discussion of utilization of the cryogenic environment to stabilize radical and even biradical species. The focus is on the contribution of this technique to the understanding of bimolecular reaction paths. The concentration is on oxygen and hydrogen transfer reactions involving photooxidation by NO_2 , O_3 , and O_2 . There is abundant discussion of the details of photooxidation of butene, ethyleneisobutene, cycloalkenes, allene, and alkynes by NO_2 . Hydrogen transfer reactions receive less attention (7 pages) and focus on complexes with acetylene.

Chapter 2 clearly delineates the motivation of studying line profiles and frequency shifts in Raman spectra. These profiles contain information on vibrational dephasing and reorientational motion that reveal inter- and intramolecular interactions. In order to dig this molecular information out of the experimentally observed line profile, the true line profile must be deconvoluted from the instrumental profile. Chapter 2 concentrates on the mathematical methods for accomplishing this. On the experimental side, the authors focus on methodologies to obtain Raman difference spectra to separate the isotropic and anisotropic parts of the line profile and to probe solvent effects on frequency shifts. The newest method in this arsenal is four channel Raman difference spectroscopy for simultaneous measurement of polarization and difference spectroscopy. The chapter concludes with several systems including solvent shifts as a probe of interactions.

Chapter 3 focuses primarily on the instrumental difficulties present in the application of FT to microwave spectroscopy. The difficulties arise due to the faster rotational relaxation time in the microwave as compared with NMR. There is a short discussion of 2D. The greatest advantage of FT microwave is its ability to detect weak transitions such as "forbidden" transitions including those in tetrahedral molecules, symmetric tops, rotational transitions in degenerate excited states, and partially deuterated molecules.

Chapter 4 is really about SCMH-MO calculations with comparative statements about *ab initio* calculations. This was easily the least satisfying chapter in the present volume. Specifically, the assumptions that are built into the calculations and the approximations that are necessary are not clearly stated. In addition, the author states that at present one must exert independent effort in deriving suitable data for input, although no criteria are given for what is "suitable" data. The result is that one is left with more questions than answers and the generality of the method is not clear.

Chapter 5 clearly states that the aim of calculations of vibrational spectra is not to predict frequencies and intensities but rather to deduce, from the experimental measurement of same, the force fields and intensity parameters. The focus of this chapter is on the pyrimidine bases, particularly those of biological importance: uracil, thymine, and cytosine. The major spectral difficulty in these substrates is the lack of symmetry. *Ab initio* calculations have difficulty predicting which tautomeric form is most stable, so it is not surprising that they have difficulty in calculating the spectra. Hence, the emphasis is on progress: this is not a finished field! Experimentally, the strong hydrogen bonding makes it difficult to obtain spectra of isolated molecules, making experimental comparisons and guides hard to come by; e.g., an X-ray of the solid would be greatly perturbed by the H bonding in that solid. The next challenge is to jump from isolated bases to those in solid or solution, not an easy task. In short,

this is a field where there are many, but very difficult problems yet to be solved. This chapter does an excellent job of outlining not only the problems but also the difficulties in solving them.

In short the five chapters of the present volume are fairly specialized but are an excellent addition to the library of anyone getting into, or thinking of getting into, one of these areas.

Mary Jane Shultz, Tufts University

Catalysis by Metal Complexes. Volume 9. Catalytic Oxidations with Hydrogen Peroxide as Oxidant. Edited by Giorgio Strukul (University of Venice). Kluwer Academic Publishers: Dordrecht, The Netherlands. 1992. ix + 283 pp. \$130.00. ISBN 0-7923-1771-8.

Catalytic Oxidations with Hydrogen Peroxide as Oxidant does a nice job of reviewing and updating the current state of research and practical application in the uses of H_2O_2 as an oxidant, particularly in organic synthesis. Chapters on various topics were contributed by experts in their fields. I found Chapters 3 (Activation of Hydrogen Peroxide by Organic Compounds), 4 (Fenton Type Activation and Chemistry of Hydroxyl Radical), and 5 (Activation of Hydrogen Peroxide by Biomimetic Systems) particularly well written and informative. Chapter 2 (Hydrogen Peroxide: Manufacture and Industrial Use for Production of Organic Chemicals) by G. Goor of Degussa gives a valuable industrial perspective on H_2O_2 , including its synthesis by the current commercial process involving air oxidation of substituted hydroquinones.

Chapters 1 and 6 by G. Strukul present some interesting information and insights but should have been reviewed by someone with a better command of English prior to publication. Some examples of sentences that should have been rewritten are "Like *t*-BuOOH or PhEtOOH, H_2O_2 is relatively stable and requires to be converted in a more active form in order to be effective as an oxidant, this is generally accomplished either with organic or with inorganic (transition metals) promoters" and "In general, it can be observed that possessing d10 transition metals no valence electrons, bond formation with the surrounding ligands (including the peroxygens) will occur only through a net donation from the latter."

The book contains numerous references to patents, review articles, and original scientific papers and is particularly up to date in the last three chapters dealing with transition metal catalysis: Chapter 6, Nucleophilic and Electrophilic Catalysis with Transition Metal Complexes by G. Strukul; Chapter 7, Peroxometal Complexes Derived from Hydrogen Peroxide. Some Applications in Organic Synthesis by V. Conte and F. Di Furia; and Chapter 8, The Use of Polyoxometalates in Reactions with Hydrogen Peroxide by C. L. Hill. It should provide useful entries to the literature to anyone interested in learning more about this developing field.

An important consideration pointed out by Hill is the desirability of carrying out oxidations in a way that minimizes waste and uses minimally toxic solvents. This is particularly important when using hydrogen peroxide, since one of its most attractive features—as pointed out by several of the chapter authors—is that only H_2O is left once the active oxygen is removed from H_2O_2 and used to do useful chemistry.

Chadwick A. Tolman, DuPont Central Research and Development

Isotopes in the Physical and Biomedical Sciences. Volume 1. Labelled Compounds: Part B. Edited by E. Buncel (Queen's University) and J. R. Jones (University of Surrey). Elsevier: Amsterdam and New York. 1991. xii + 444 pp. \$215.50. ISBN 0444891862.

Profs. Buncel and Jones have attempted to bridge the gap between Murray and Williams's two-volume treatise *Organic Synthesis With Isotopes*, which was published over 30 years ago in a format similar to that of *Organic Syntheses*. This is a monumental task considering the tremendous volume of primary literature concerning the synthesis of isotopically labeled compounds published during that time, but one that the editors have successfully achieved. Rather than follow the format used by Murray and Williams, Buncel and Jones have chosen to have a group of scientists review a specific area where isotopically labeled compounds are used. Thus the current volume includes ten chapters each dealing with a different area of interest.

In Chapter One, Filer has presented a well-annotated review (335 references) on the synthesis and applications of insecticides, herbicides, and fungicides. He has included materials labeled with ^{14}C , ^3H , ^{32}P , and ^{35}S . Although some of the references are older, most are current. Lawrie has included in Chapter Two information concerning the synthesis of isotopically labeled H_2 -histamine receptor antagonists, again highlighting

the preparation of compounds labeled with ^{14}C , ^3H , and ^{35}S . At the end of this chapter, the author has presented a synopsis of the synthesis of various labeled H_2 -histamine receptor antagonists in tabular form. Chapter Three is more specialized; Cabell has outlined methods for the preparation of tritiated steroids. He has also included sections on the HPLC and ^3H -NMR of these materials. This review is well referenced (219) and current. In Chapter Four, Salijoughian has reviewed the area of tritiated affinity probes.

These radiolabeled molecules are useful in the study of active sites of proteins and drug-receptor interactions. Prestwich presents in Chapter Five an interesting review on the synthesis and use of tritiated hormones, pheromones, odorants, and affinity labels. The labeled compounds have been invaluable in the study of olfaction and hormone actions in insects. Prof. Prestwich has included some brief experimental protocols and examples of the utility of ^3H -NMR in determining regioselectivity in the preparation of these labeled compounds. Shevchenko and Myasoedov have coauthored a review of labeled eicosanoids in Chapter Six. In view of the importance of this class of compounds, because of their diverse physiological activity, this review is timely. Again the authors have included brief experimental protocols where pertinent. Willis has outlined in Chapter Seven information concerning isotopically labeled gibberellins, although a substantial portion of the material concerns the biosynthesis of gibberellins. A chapter on the preparation of radiohalogenated biomolecules utilizing organotin chemistry by Hansen (Chapter Eight) is also timely. Radiohalodestannylation is useful not only for the synthesis of materials useful in the study of drug-receptor interactions but also in the preparation of radiopharmaceuticals for eventual use in diagnosis and drug therapy. It is difficult to imagine the preparation of these compounds in another way. The method is so facile that it enables one to prepare materials labeled with isotopes such as ^{125}I with a $t_{1/2}$ of 60 days; it also enables one to prepare materials labeled with ^{18}F , ^{75}Br , and ^{211}At with $t_{1/2}$'s of 110 min, 101 min, and 7.2 h, respectively. In Chapter Nine, Young presents an extremely well-written and thorough account of the use of enzymes in the preparation of stereospecifically labeled compounds. Chapter Ten on protein labeling reagents was perhaps the most disappointing part of this volume. It is indeed unfortunate that Bolton chose to concentrate on the radioiodination of proteins rather than labeling with other isotopes (i.e. ^3H or ^{14}C). Much of the information presented herein is available from other sources. Only 2 of his 26 references are newer than 10 years old.

This volume contains interesting and informative information which will be useful to those persons in the business of synthesizing radiolabeled compounds. Unfortunately the high cost of the volume will make it less attractive for many individuals; however, I can heartily recommend this book as an acquisition for scientific libraries.

William J. Wheeler, *Eli Lilly and Company*

Laser Ionization Mass Analysis. Chemical Analysis: A Series of Monographs on Analytical Chemistry and Its Applications. Volume 124. Edited by Akos Vertes (George Washington University), Renaat Gijbels (University of Antwerp), and Fred Adams (University of Antwerp). John Wiley & Sons: New York. 1993. xxii + 560 pp. \$95.00. ISBN 0-471-53673-3.

This is a volume devoted to detailed considerations of laser-based methods for mass analysis, including reasonably thorough coverage of the literature through the 1990-1991 time frame. It is the editors' view that laser ionization mass analysis has now matured to the point of being a practical analytical tool and that recent research breakthroughs are primarily responsible for this. Following an introductory chapter, four additional extended chapters are devoted to laser mass spectrometry equipment for organic and inorganic analysis (Chapter 2), methods utilizing low and medium laser irradiance (including direct and matrix-assisted laser desorption, applications in organic structure elucidation, and two-step methods involving multiphoton ionization) (Chapter 3), high laser irradiance methods, including laser ablation and inorganic trace analysis (Chapter 4), and laser desorption time-of-flight mass spectrometers designed for space applications (Chapter 5). With a few exceptions, the literature references are reasonably comprehensive through about 1990, with a few references to work published as recently as 1992. Chapters 4 and 5 are much less current than the balance of the book, with the majority of the references being from the mid-1980s or earlier. For the most part, this is not a serious concern within the context of the book's main emphasis of presenting the current status of theory and practical analytical applications of laser ionization mass analysis, because the topics covered in Chapters 4 and 5 are of peripheral interest in that regard. The most disappointing shortcoming of the book is section 4B, which deals with the topic of ICP-MS primarily by presenting one long table and minimal discussion, most of which deals with developments prior to 1980.

Not surprisingly, most of the discussions of analytical applications are of those developed with time-of-flight and Fourier transform mass analyzers, both of which are especially well-suited for coupling with laser ionization sources. Coverage of TOF and FTMS applications is especially thorough and is a strength of this volume. Overall, this is a well done book, which does an excellent job of summarizing developments in a very rapidly moving field, while providing adequate coverage of current research literature. It is filled with experimental details of the wide range of laser mass spectrometry experiments which have been reported and also provides useful discussions of the theory underlying those experiments. Relatively few typographical errors are present. The editors have succeeded admirably in producing a current and highly useful book on this important analytical chemistry topic and are to be commended for this outstanding contribution. People interested in laser ionization mass analysis will find this to be an invaluable reference which they will want to have in their personal libraries.

Charles L. Wilkins, *University of California, Riverside*

Biosynthesis of Tetrapyrroles. Edited by P. M. Jordan. New Comprehensive Biochemistry, Volume 19. Series Editors A. Neuberger and L. L. M. van Deenen. Elsevier: Amsterdam and New York. 1991. xii + 309 pp. \$115.50. ISBN 0-444-89285-0.

Linear and cyclic tetrapyrroles play critical roles in all aerobic and anaerobic organisms. Their biosynthesis is but one major omission covered in this monograph. Missing is a discussion on heme oxygenase which catalyzes the ring opening of heme to biliverdin, from which all other open chain linear tetrapyrroles are derived. The lack of a preface by the editor and a scientifically faulted forward by the series editor leave one to guess at the planned scope and the balance of the chapters in the book.

The first and last chapters by the editor Jordan are comprehensive, well written, thoroughly referenced, and adequately illustrated. Chapter 1 covers the biosynthesis of uroporphyrinogen III, which is the common intermediate for all naturally occurring tetrapyrroles. The first dedicated intermediate in the biosynthetic pathway is δ -aminolevulinic acid (ALA), and both routes from glycine and succinyl Co-A and glutamate, where tRNA_{glu} plays a critical role, are covered in detail. Also covered are the formation of porphobilinogen by ALA deaminase and its tetramerization to the hydroxybilane preuroporphyrinogen by porphobilinogen deaminase, which contains a unique, covalently bound, dipyrromethane cofactor. Cyclization of preuroporphyrinogen in which the head to tail condensation is reversed to give the type III uroporphyrinogen by uroporphyrinogen III synthase and particularly the mechanism of this reaction should have been discussed in greater detail. This first chapter, with 66 pages and 270 references, constitutes one-fifth of the book. The last chapter (7) covers the genes of tetrapyrrole biosynthesis. This 30-page chapter with its 225 references gives an excellent account of the genetics of all the systems covered in the preceding chapters except for that of coenzyme F430, which is briefly covered in Chapter 4.

In Chapter 2 Akhtar covers, in 33 pages, the mechanisms and stereochemistry of the conversion of uroporphyrinogen III to coproporphyrinogen III by uroporphyrin decarboxylase and its conversion to protoporphyrinogen IX by coproporphyrinogen III oxidase. Oxidation to protoporphyrin IX by protoporphyrinogen IX oxidase produces the first aromatic macrocycle which is the common precursor for all the metalated aromatic macrocycles. Insertion of iron by ferrochelatase to give heme is also covered in Chapter 2 while the insertion of magnesium and the elaboration of magnesium protoporphyrin to chlorophyll a is covered in Chapter 5 (81 pages and 492 references) by Beale and Weinstan. Chapter 5 covers in considerable detail the biosynthesis of the plant and algal photosynthetic pigments from heme including the chlorophylls and bilins such as phytochrome and phycocyanobilin. The coverage of heme biosynthesis repeats the sequences covered in the first chapter, but the emphasis on the plant and algal enzymes excuses much of this repetition. A brief discussion of algal heme oxygenase with no mechanistic considerations describes the formation of biliverdin, from which all phycobilins are derived. In Chapter 6 Smith briefly describes in 19 pages what little is known about the biosynthesis of the structurally diverse bacteriochlorophylls. While the structures of these photosynthetic pigments are now well established, principally by the author, details of their biosynthesis are scant.

Chapters 3 (38 pages) and 4 (16 pages) cover the methylated and reduced macrocycles, vitamin B₁₂ and Factor 430. In Chapter 3 Scott and Santander present an excellent description of how NMR has been used to determine the biosynthesis of vitamin B₁₂ while, in Chapter 4, Friedmann, Klein, and Thauer describe the biochemistry of the unique nickel porphinoind involved in methanogenesis.

Despite the lack of editorial control over the presentation of figures and schemes, the minimal subject index, and the lack of an author index,

which would have added greatly to the usefulness of this book, it still represents the most comprehensive collection of reviews, written by the top experts in the field, of tetrapyrrolic biosynthesis, and it will make a valuable addition to personal and library collections.

David Dolphin, *University of British Columbia*

Materials Science and Technology. A Comprehensive Treatment. Volume 4. Electronic Structure and Properties of Semiconductors. Edited by R. W. Cahn, P. Haasen, and E. J. Kramer. Volume Editor W. Schröter. VCH Publishers Inc.: Weinheim and New York. 1991. xii + 604 pp. ISBN 0-89573-691-8.

Volume 4 in this series focuses on basic concepts of semiconductor physics. It contains eleven chapters dealing with a diverse set of issues in semiconductors from band theory to defects and dislocations. Each chapter is a monograph written by different author(s) who are experts in their respective fields. This book is rich in information regarding the physical properties of basic semiconductors such as Si, amorphous silicon, GaAs, and related III-V materials.

Although Chapters 1 and 2 have a rather introductory character dealing with basic concepts of band theory and optical and charge transport properties, respectively, the remaining nine chapters deal, at a rather advanced level, with phenomena which are mostly of great interest to condensed matter physicists. For example, Chapters 3, 4, and 6 deal extensively with point defects, deep centers, and crystal dislocations, all important parameters in semiconductor performance. Chapter 11 reviews the behavior of 3d transition elements in silicon. There is also an extensive chapter on hydrogenated amorphous silicon. This chapter is comprehensive in the sense that the subject is covered from the synthesis, to analysis of the electronic structure, to charge transport properties and doping characteristics. Chapter 9 exposes the reader to quantum transport in small structures (lithographically patterned) of III-V compounds and their alloys.

The references at the end of the chapters are both numerous and recent, making it relatively easy to access the primary literature. Although the treatment of these topics is done at a considerably chemical level, the subject matter of this book clearly addresses the condensed matter physics and electrical engineering community. Perhaps this is appropriate, since the great majority of the 20 authors come from physics and engineering departments. Chemists interested in solid state aspects will find the first two chapters quite approachable, but introduction to the other subjects mentioned above will be best accomplished through more basic books. Of course, many of the problems facing semiconductor technology today, including those described in this book, require chemical solutions. Chemists involved in, or preparing to enter, this field may find the book useful in learning about current needs. However, I believe this volume will find greater use in a physics rather than a chemistry department library.

Mercouri G. Kanatzidis, *Michigan State University*

Handbook of Derivatives for Chromatography. Second Edition. Edited by Karl Blau and John M. Halket (Queen Charlotte's and Chelsea Hospital). John Wiley and Sons: New York. 1993. xxii + 370 pp. \$95.00. ISBN 0-471-92699-x.

The second edition of this book covers recent developments and advances in chemical derivatization in chromatographic methods and in analytical instrumentation. After a preface and acknowledgments by the editors, a list of contributors, and a list of abbreviations, there are 16 chapters which include coverage of the following topics: advances in silylation and alkylation; derivative formation by ketone-base condensation; colored UV-absorbing derivatives and fluorescent derivatives; and derivatization for chromatographic resolution of optically active compounds. There is an extensive subject index.

Intermetallic Compounds in Mercury. IUPAC Solubility Data Series. Volume 51. Edited by Janet G. Osteryoung (State University of New York, Buffalo), Mary M. Schreiner (Niagara University), Cezary Guminski (University of Warsaw), and Zbigniew Galus (University of Warsaw). Pergamon Press: Oxford. 1992. xxxii + 258 pp. \$99.00. ISBN 0-08-037206-6.

This book is volume 51 in a series dedicated to the preparation of a comprehensive and critical compilation of data on solubilities in all physical systems and compliments and extends volume 25 of the *Solubility Data Series, Metals in Mercury*. As with previous volumes, the arrangement of the volume is as follows: text discussing the numerical solubility information; set of recommended data with weighted averages and

estimated standard deviations; and a graphical plot of the recommended data. There are system and author indexes.

Structure-Property Relations in Polymers. Spectroscopy and Performance. Advances in Chemistry Series 236. Edited by Marek W. Urban (North Dakota State University) and Clara D. Craver (Craver Chemical Consultants). American Chemical Society: Washington, DC. 1993. xiv + 832. \$139.95. ISBN 0-8412-2525-7.

This book was developed from a symposium sponsored by the Division of Polymeric Materials (Science and Engineering) at the 201st National Meeting of the American Chemical Society held in Atlanta on April 14-19, 1991. After a preface by the editors, there are 35 chapters organized under the following headings: Fundamental Concepts in Spectroscopy of Polymers; Crystalline Polymers and Copolymers; Surfaces and Interfaces of Polymers; Spectroscopic Approaches to Polymers in Solutions and Polymer Networks; Spectroscopy and Thermally Induced Processes in Polymers; and Polymer Analysis and Surface Modifications. There are also author, affiliation, and subject indexes.

Kirk-Othmar Encyclopedia of Chemical Technology. Fourth Edition. Volume 7. Edited by Jacqueline I. Kroschwitz and Mary Howe-Grant. Wiley Interscience: New York. 1993. xxviii + 1118 pp. \$275.00. ISBN 0-471-52675-4.

This is the seventh volume of a 25-volume encyclopedia set, with four volumes being published each year. The Fourth Edition is similar in format to the earlier editions with updates to the entries as necessary and the addition of several new subjects. This volume contains 27 entries ranging from *Composite Materials* to *Detergency*. This volume does not contain an index; however, supplement and index volumes are scheduled for publication in 1998.

Handbook of Polyvinyl Chloride Formulating. Edited by Edward J. Wickson (Wickson Product Research, Ltd., Baton Rouge). J. Wiley and Sons: New York. 1993. xviii + 936 pp. \$160.00. ISBN 0-471-60182-9.

This book is a one-volume reference book covering the economics of formulating, basic statistics and design of experiments, laboratory compounding and test methods, and environmental and health concerns in formulating vinyl compounds. There are also chapters on dry blending, powder coatings, plastisol and organosol preparation, and electron beam radiation curing. After a preface by the editor and a list of conversion factors, there are 36 chapters and an index.

Synthetic Aspects of the Fluorination of Organic Compounds. Volume 16. Part I. Soviet Scientific Reviews Section B. By G. G. Furin (Institute of Organic Chemistry, Novosibirsk). Harwood Academic Publishers: Reading, Berkshire, U.K. 1991. 140 pp. \$38.00. ISBN 3-7186-5157-2.

This review, whose excellent English translation appears in book format, concentrates on three areas of synthetic organofluorine chemistry: (1) perfluorination by electrochemical means, and to a lesser extent by cobalt trifluoride, (2) selective monofluorination of diverse organic compounds with elemental fluorine, and (3) perfluorination of many hydrogen-containing organic molecules with elemental fluorine.

The author's decision to focus only on these three subjects seems justified, since it allows for much more detailed coverage, but the book consequently will appeal to a somewhat limited audience. The introductions to the three sections tend to generalize and somewhat oversimplify the theoretical background, but this does not detract from the author's primary aim to survey these synthetic methods. The numerous examples with quantitative product yield data and comprehensive coverage attest to the author's success in meeting this objective.

The section on electrochemical perfluorination illustrates very well the extensive research done on this method. Despite the variable yields, which often leave considerable room for improvement, this electrochemical technique provides access to many interesting fluorocarbons that cannot be made by other means. The second section of the review is devoted to the fascinating subject of selective monofluorination using F₂. Here Furin leads the reader step-by-step through the literature and does an excellent job in familiarizing him with a selective fluorination method that was thought impossible to control only a couple of decades ago. The third section complements the first and deals again with perfluorination of organic compounds but this time with F₂. This remains a dynamic field,

and most of the recent work and special techniques developed by Lagow and Adcock are reviewed. For the industrial chemist, it would have been helpful if the author had provided better perspective on the practical, commercial utility of these fluorination methods, but this is a minor complaint.

The impressive reference section with over 600 citations, mostly from the past decade, and the good index are indispensable parts of this interesting and worthwhile review.

Shlomo Rozen, *Tel Aviv University*

Advances in Atomic Spectroscopy. Volume 1. Edited by Joseph Sneddon. JAI Press: Greenwich, CT, and London. 1992. xii + 238 pp. \$78.50. ISBN 1-55938-157-4.

In the series introduction, the consulting editor for the series states the audience is "graduate students, postdoctoral fellows, industrial chemists, and those teaching specialized topics to graduate students." Indeed, for this group, the chapters are concise summaries of the pre-1990 literature, more advanced than that found in instrumental analysis texts, but accessible and lucid. The material in the chapters on analyte excitation in inductively coupled plasmas (K.-P. Li and J. D. Winefordner) and sample introduction (J. Sneddon) is widely available elsewhere. Green and Seltzer's discussion of laser-induced ionization spectrometry covers topics less frequently retold. G. Dulude summarizes background correction techniques in atomic absorption spectrometry, qualitatively describing and critiquing the various methods. Finally, J. Tyson reviews the coupling of flow-injection techniques with atomic spectrometry.

If one wishes to delve into the atomic spectroscopy literature of the 1980s, this volume can save some sifting through *Chemical Abstracts*. However, if one already has the widely-available treatises by either Boumans or Montaser and Golightly, only half the book has novel material. Laser-induced ionization has yet to be commercially implemented and so may be of limited interest. The chapter on background correction may be marginally useful in helping specify an instrument. Only Tyson's contribution might actually aid the practicing chemical analyst, and one can find a related review, with more extensive references and tabulations, by the same author in *Spectrochimica Acta Reviews*, 1991, 14 (3), 169-234.

Alexander Scheeline, *University of Illinois*

Studies in Natural Products Chemistry. Volume 12. Stereoselective Synthesis (Part H). Edited by Atta-ur-Rahman (University of Karachi, Pakistan). Elsevier: Amsterdam, London, New York, and Tokyo. 1993. xiv + 528 pp. \$281.25. ISBN 0-444-89366-0.

Professor Atta-ur-Rahman has once again compiled an excellent treatise on recent advances in natural product chemistry. This volume is the twelfth in an outstanding series which details the latest advances in stereoselective approaches toward the synthesis of natural products. The volume consists of eleven chapters written by prominent organic chemists. Topics include in-depth reviews on the synthesis of the avermectin-milbemycin family of antiparasitic natural products, β -lactam antibiotics, derivatives of 1 β -methylcarbapenem, taxane diterpenes, tumor-promoting diterpenes, hydroxylated indolizidine, and indolo[2,3-*a*]carbazole alkaloids. Reviews on synthetic methodology for preparing 2-amino alcohols and the stereoselective synthesis of natural products via cationic and radical intermediates are also included. Several authors summarize their work in specific areas such as the stereoselective synthesis of bicyclomycin and the macrolide antibiotics riframycin W and erythromycin A.

As with previous volumes, each contributed chapter is well written, easy to read, and rich in information and contains an abundance of high-quality reaction schemes. The references are plentiful and up-to-date (latest 1991). The volume contains a thorough subject index which makes finding a particular reaction or natural product rather easy.

This volume is highly recommended reading for those organic chemists who practice the art of organic synthesis and find it both challenging and rewarding.

Kirk L. Sorgi, *The R. W. Johnson Pharmaceutical Research Institute*

Comprehensive Organic Synthesis. Selectivity, Strategy, and Efficiency in Modern Organic Chemistry. Edited by Barry M. Trost (Stanford University) and Ian Fleming (University of Cambridge). Pergamon Press: New York. 1991. 10 202 pp. \$3510.00. ISBN 0-08-035929-9.

This is a new series consisting of nine volumes which focuses on transformations in the areas of carbon-carbon bond formation, the

introduction of heteroatoms, and heteroatom interconversions. The organization of the series is divided into two broad areas: Volumes 1-5 focus on carbon-carbon bond formations (with some introduction of heteroatoms), and Volumes 6-8 focus on interconversion of heteroatoms (with some information on the exchange of carbon-carbon bonds for carbon-heteroatom bonds). Assignment of subjects to a particular volume is somewhat arbitrary, and some subjects can be found in more than one location. For example, the ene-reaction of formaldehyde with cyclohexene represents, on the one hand, an addition to a C-C π -bond (Volume 4) and, on the other, an addition to a C-X π -bond (Volume 1). Nonetheless, with some experience, users of this impressive treatise should be able to navigate readily through the volumes to the desired subject. Further, there is an outstanding cumulative author and subject index which comprises the entire contents of Volume 9. There, for example, the dilemma posed relative to the ene-reaction is readily answered with the cumulative subject index. In addition to the index in Volume 9, each volume has its own subject and volume indices.

Volumes 1 and 2 are entitled *Additions to C-X π -Bonds, Parts 1 and 2* and are organized under the following headings: Nonstabilized Carbanion Equivalents; Heteroatom-stabilized Carbanion Equivalents; Transformation of the Carbonyl Group into Nonhydroxylic Groups; Uncatalyzed Additions of Nucleophilic Alkenes to C=X; Catalyzed Additions of Nucleophilic Alkenes to C=X; Addition-Elimination Reactions (Acylation); and Additions of Nucleophilic Alkenes to C=NR and C=NR₂⁺. Volume 3 is entitled *Carbon-Carbon σ -Bond Formation* and is organized under the following headings: Alkylation of Carbon; Coupling Reactions; Rearrangement Reactions; and Other Carbon-Carbon Bond Forming Reactions. Volume 4 is called *Additions to and Substitutions at C-C π -bonds* and is organized as follows: Polar additions to Activated Alkenes and Alkynes; Nucleophilic Aromatic Substitutions; Polar Additions to Alkenes and Alkynes; and Nonpolar Additions to Alkenes and Alkynes. Volume 5 is called *Combining C-C π -Bonds* and is organized under the following headings: Ene Reactions; [2 + 2] Cycloadditions; [3 + 2] Cycloadditions; [4 + 2] Cycloadditions; Higher-order Cycloadditions; Electrocyclic Processes; Sigmatropic Processes; Small Ring Rearrangements; and Other Transition Metal Associated Reactions.

Volumes 6-8 focus on the interconversion of Heteroatoms. Volume 6 is *Heteroatom Manipulations* organized under the following headings: Displacement by Substitution Processes; Acylation-type Reactions; Protecting Groups; Functional Group Interconversion; and Elimination Reactions. Volume 7 is called *Oxidation* and is organized as follows: Oxidation of Unactivated C-H Bonds; Oxidation of Activated C-H Bonds; Oxidation of C=C Bonds; Oxidation of C-X Bonds; Oxidation of C-C Bonds; Oxidation of Heteroatoms; and Special Topics. Volume 8 is *Reduction* and is organized under the following headings: Reduction of C=X Bonds; Reduction of X=Y Bonds; Reduction of C=C and C=C Bonds; and Reduction of C-X to C-H.

This set is an extremely worthwhile addition to the synthetic chemical literature which is expanding at such a rate that finding information in the primary sources is often very difficult. The price probably puts it out of the reach of individual collections, but it is certainly highly recommended that libraries obtain this set, as it will be more valuable than many of the primary journals.

Human Medicinal Agents from Plants. ACS Symposium Series 534. Edited by A. Douglas Kinghorn (University of Illinois) and Manuel F. Balandrin (NPS Pharmaceuticals). American Chemical Society: Washington, DC. 1993. xii + 356 pp. \$89.95. ISBN 0-8412-2705-5.

This book was developed from a symposium sponsored by the Division of Agricultural and Food Chemistry at the 203rd National Meeting of the American Chemical Society held in San Francisco on April 5-10, 1992. After a preface by the editors, there are 22 chapters organized under the following headings: Current Role and Importance of Plant-Derived Natural Products in Drug Discovery and Development; Anti-cancer and Cancer Chemopreventive Agents from Plants; Anti-Infective and Antimicrobial Chemotherapeutic Agents from Plants; and Promising Plant-Derived Natural Products with Multiple Biological Activities. There are author, affiliation, and subject indexes.