Book Reviews*

Carbohydrate Chemistry. Volume 16. Part I. A Specialist Periodical Report. Senior Reporter: N. R. Williams (Birkbeck College, University of London). Reporters: B. E. Davison, R. J. Ferrier, R. H. Furneaux, and R. Kahn. The Royal Society of Chemistry: London. 1984. XI + 286 pp. £40.00. ISBN 0-85186-162-8.

Part I of the 16th volume of this series describes the chemistry of mono-, di-, and trisaccharides and their derivatives. Macromolecules are covered in Part II which is issued separately and not reviewed here. Part I is divided into the following 23 chapters: Introduction; Free Sugars; Glycosides and Oligosaccharides; Ethers and Anhydrosugars; Acetals; Esters; Halogeno-sugars; Amino-sugars; Miscellaneous Nitrogen Derivatives; Thio- and Seleno-sugars; Deoxy-sugars; Unsaturated Derivatives; Branched-chain Sugars; Dicarbonyl Compounds and Their Derivatives; Sugar Acids and Lactones; Inorganic Derivatives; Alditols and Cyclitols; Antibiotics, Nucleosides; NMR Spectroscopy and Conformational Features; Other Physical Methods; Separatory and Analytical Methods; and Synthesis of Enantiomerically Pure Non-Carbohydrate Compounds from Carbohydrates. Each chapter summarizes important developments in these areas which appeared in the literature published in 1982 and was available to the authors by February, 1983. Over 1200 references are listed and the variety of journals represented reflects the international scope of this field. An author index is provided with references to the text and to the lists of references given at the end of each chapter.

To accommodate the increasing interest in oligosaccharides, the authors have expanded the chapter on glycosides to include di-, tri-, tetra-, and higher saccharides. While the main emphasis of the chapter is on synthesis, a few references are also made to biological studies. Several procedures for glycosylation are described in the various sections of this chapter. S- and C-glycosides are also covered. The chapters on branched-, deoxy-, and amino-sugars cover recent advances in traditional synthetic approaches to these compounds as well as syntheses from non-carbohydrate precursors, an area of increasing development. Many interesting and useful reactions are described in these and other chapters in the text. The chapters on structural analysis cover the application of a wide range of spectroscopic methods to structural problems in carbohydrate chemistry and should be of general utility.

The use of camera-ready format, adopted with Volume 15, has been maintained with good results. Some modifications have been made in the presentation of structural diagrams. The chapters are well organized; each begins with a citation of recent review articles which is followed by the various sections, headings for which are listed in the table of contents.

This volume of the "Specialist Periodical Reports" will be a highly useful reference, especially to those interested in the synthesis and reactions of carbohydrates.

Robert M. Giuliano, *Villanova University*

Advances in Transport Processes. Volume III. By A. S. Mujumdar (McGill University) and R. A. Mashelkar (National Chemical Laboratory). Halsted Press–Wiley Eastern Ltd.: New Delhi. 1984. 452 pp. $44.95. ISBN 0-470-27394-1.

"Transport phenomena" refers to the physics of diffusive and convective flow of energy, as well as of the mass of bulk mixtures or the individual species within them. This timely compendium, which reviews developments in seven research areas, illustrates the enormous breadth of this subject, from fundamental scientific research to applied engineering design, and the vital role of applied mathematics in the elucidation of complex, real-world phenomena.

The editors, themselves recognized authorities, have chosen their authors well. V. V. Chavan presents a broad overview of fundamental aspects of and current research topics in the processing of suspensions and emulsions. F. B. Cheung and M. Epstein review thoroughly solidification and melting in fluid flow, from freezing in pipes to melting of icebergs. R. K. Jain states, at the start of his discussion of mass and heat transfer in tumors, that it is not meant to be exhaustive and closes 130 pages later with 750 references. To Dr. Jain's credit, this reviewer was indeed inspired, rather than exhausted.

For those particularly attuned to mathematical analysis, there are chapters by G. E. Schneider on discrete methods in heat conduction analysis and by D. Ramkrishna on "operator-theoretic" methods. Each has met the challenge of composing a readable chapter.

Finally, mass transfer with chemical reaction was similarly accorded two entries. G. Astarita and D. W. Savage present a relatively brief yet highly informative review of gas absorption and stripping, with emphasis upon large-scale CO_2 and H_2S removal from mixtures. P. Stroeve covers important developments in the analysis of transport in heterogeneous media of both biological and industrial interest.

Despite occasional lapses in the English, some apparently introduced by the typesetting, this is a lucid as well as thorough volume. It is recommended not only for those already involved and seeking an update but also for the relative outsider seeking an authoritative introduction to mathematical, physical, and design aspects of transport processes.

Jerry Meldon, *Tufts University*

An Introduction to Industrial Chemistry. Edited by C. A. Heaton (Liverpool Polytechnic). Leonard Hill: Glasgow, England. 1984. xix + 384 pp. $24.00. ISBN 0-249-44165-9.

This book is written as a basis from which students of chemistry and chemical engineering will be able to build an understanding and appreciation of the chemical industry. It is stressed that for the efficient operation of the industry the scientists and engineers must have a sound knowledge not only of the physical and chemical principles but also of the economical and environmental aspects. Besides covering diversified subjects such as sources of chemicals, the world's major chemical industries, chemical engineering, catalysts, and catalysis, this book also devotes several chapters to technological economics, organization and finance of a chemical company, environmental pollution control, and efficient utilization of energy in the chemical industry. Finally, there is a review chapter on the production of petrochemicals. The structure and nomenclature of these compounds are provided.

This book presents a concise overview of the chemical technology, integrating nicely the principles of chemistry and chemical engineering with production and economic considerations. It should be a good textbook for industrial chemistry.

Shang-Shing P. Chou, *Fu Jen University*

Laser Dyes. By Mitsuo Maeda (Kyushu University). Academic Press: Orlando, FL. 1984. x + 335 pp. $46.50. ISBN 0-12-464980-7.

As the author admits, this monograph is based on a comprehensive literature survey of laser dyes. Apart from a few pages of introductory material, the book is a series of tables of dyes categorized by structure. An important index lists the dyes according to lasing wavelength.

The experimental scientist who is in the laboratory needs to know only a few things to select a dye: Which dye is the most efficient at a particular wavelength? If scanning, which dye has the most appropriate tuning range? Is it chemically and photochemically stable? Can a nontoxic solvent be used? Is a triplet quencher necessary? While much of this information appears in the tables, it is available in a more accessible manner from dye laser manufacturers or from vendors of laser dyes. On rare occasions a useful dye might be overlooked which might appear in this book. Since new dyes appear frequently, the book will go out of date quickly, at least as far as a laser user is concerned.

The greatest utility of this work is identification of the structure of a dye given its common name. Absent is a discussion of the photophysical properties of dyes which determine the efficiency and tuning range of each dye. Brief mention is made of fluorescence quantum yield and triplet-state formation, but other important properties include absorption cross sections and spectra from excited states as well as the ground state and rate constants for decay pathways. Admittedly this information is known for only a few dyes, but it explains important trends such as the difficulty in pumping coumarin dyes longitudinally by laser, when the rhodamine dyes are efficient. The developer of dyes and dye lasers should be aware of these less obvious properties.

Gary R. Holtom, *University of Pennsylvania*

Aspartame: Physiology and Biochemistry. Edited by L. D. Stegink and L. J. Filer, Jr. (University of Iowa). Marcel Dekker, Inc.: New York. 1984. xiii + 670 pp. $79.75. ISBN 0-8247-7206-7.

This book is Volume 12 in the "Food Science and Technology Series" published by Marcel Dekker, Inc. The editors have compiled an impressive array of papers on the various biochemical, physiological, and clinical aspects of the sweetner Aspartame. The papers are divided into five sections. The first section describes the history behind the discovery of Aspartame and gives a general overview of sweeteners. The second section deals with the metabolism of Aspartame and its components, aspartate, phenylalanine, and methanol. The sensory and dietary aspects of Aspartame are covered in the third section of the book. Included in

*Unsigned book reviews are by the Book Review Editor.

this section are papers dealing with Aspartame intake projections, comparisons of taste properties of Aspartame with other sweeteners, and the role of sugar and other sweeteners in dental caries. The fourth section, entitled preclinical studies, is by far the largest section in the book. The topics which are covered in this section range from the assessment of potential urinary bladder carcinogenicity of Aspartame and its diketopiperazine derivative to the effects of Aspartame on neurotoxicity, neuropathology, and CNS development.

The final group of papers deals with studies of Aspartame metabolism in humans. Studies on both the chronic and acute ingestion of Aspartame are reported as are studies on the ingestion of Aspartame during pregnancy and lactation. Also covered are studies dealing with the ingestion of Aspartame by infants, phenylketonurics, and diabetics.

The papers are by in large concise, well written, and well referenced. In addition, the book possesses a very good index. The book should be of particular interest to scientists working in the area of artificial sweeteners.

Rodney L. Johnson, *University of Minnesota*

Problems in Inorganic and Structural Chemistry. By T. C. W. Mak, K. Y. Hui, O. W. Lau, and W.-K. Li (The Chinese University of Hong Kong). The Chinese University Press: Hong Kong. 1982. viii + 278 pp. ISBN 962-201-253-1.

The authors of this book have painstakingly compiled a large number of problems (365 in all, many with several parts) organized in ten chapters on topics representing much of modern inorganic chemistry. Detailed solutions to all problems are located at the end of each chapter.

Although this book contains an impressive number of carefully designed problems, it has some drawbacks which undermine its potential usefulness to students. The extensive use of group theory and quantum mechanics throughout the book and the excessive number of theoretical problems in the early chapters (atomic, molecular, and crystal structure) overestimate the students' preparation in mathematics and the physical theory. Most of these problems are certainly above the level of seniors and beginning graduate students for whom the book supposedly is intended. Many of the problems on molecular and crystal geometry seem to be just that—problems, with marginal benefits in the training of students in inorganic chemistry. The absence of a guiding principle at the beginning of each chapter and directions to reference textbooks make serious attempts to work these problems, even by well-parepared students, futile.

The problems in the latter chapters (crystal field theory, physical methods, reactivity, and mechanisms) are balanced and carefully organized, and more representative of a typical course in inorganic chemistry. In many cases, though, the answers appear to be too simplistic, and in a few erroneous. The heavy reliance on crystal-field theory in Chapter 5 to rationalize phenomena which have their origin elsewhere is both misleading and disturbing. For example, the instability of $[CoX_6]^{3-}$ complexes (X = Cl, Br, I) in A 5.5 is rationalized as the result of low CFSE and increased steric repulsions which cause these complexes to transform to tetrahedral $[CoX_4]^-$! This is certainly wrong on two counts: the cause (oxidative power of Co^{3+}) and the result (non-existence of tetrahedral Co(III) complexes). Similarly the statement in A 9.8 that a magnetic moment of 3.2 for a tetrahedral Ni(II) complex "is close to the spin-only value of 2.8 BM" is conceptually wrong.

On the whole, this book may be valuable to instructors as a source of supplemental problems but of little use as a self-study guide to students of inorganic chemistry.

I. Y. Ahmed, *The University of Mississippi*

Advances In Inorganic Chemistry and Radiochemistry. Volumes 26 and 27. Edited by H. J. Emeleus and A. G. Sharpe (University Chemical Laboratory, Cambridge, England). Academic Press: Orlando, FL. 1983. Volume 26: ix + 370 pp. $64.50. ISBN 0-12-023626-5. Volume 27: ix + 331 pp. $58.00. ISBN 0-12-023627-3.

These two volumes continue the tradition of presenting timely summaries of the current state of understanding of a wide variety of "special topics". Volume 26 is composed of eight contributions: The Subhalides of Boron by A. G. Massey; Carbon-Rich Carboranes and Their Metal Derivatives by R. N. Grimes; Fluorinated Hypofluorites and Hypochlorites by J. M. Shreeve; The Chemistry of the Halogen Azides by K. Dehnicke; Gaseous Chloride Complexes Containing Halogen Bridges by H. Schäfer; One-Dimensional Inorganic Platinum-Chain Electrical Conductors by J. M. Williams; Transition Metal Alkoxides by R. C. Mehrotra; and Transition-Metal Thionitrosyl and Related Complexes by H. W. Roesky and K. K. Pandey. The first chapter presents an interesting treatment of many aspects of the boron subhalides including their syntheses, physical and spectral properties, reactions, structures, bond energies, and bonding schemes. The chapter by R. N. Grimes is similarly well-written, and the author has included a number of detailed and interesting discussions relating to the carbon-rich carboranes and metallocarboranes, especially involving the factors determining the structure and stability of various molecular types, and the mechanisms for bringing about various isomer interconversions. While a non-boron chemist could not hope to assimilate the intricate details of this topic, one can still readily appreciate the interesting and unusual chemistry which is involved. The review of fluorinated hypofluorites and hypochlorites appears to be quite thorough (328 references). That this number of references is covered in only ca. 40 pages of text does lead to a contribution which appears at times somewhat over-condensed, but this chapter is nonetheless a worthwhile summary of that field. Dehnicke presents an interesting account of the halogen azides, beginning with their structural, bonding, and spectroscopic aspects. While this might seem to be a topic of limited interest, the author's treatment is concise and well-organized, and it concludes with a discussion of the large number of applications of these compounds to inorganic and organometallic chemistry, one example being the preparation of metal–nitrido complexes. The chapter on gaseous chloride complexes containing halogen bridges is also well-written and deals primarily with the structures, spectroscopy, and thermodynamics of such species, and a few practical applications. The treatment of one-dimensional platinum chain conductors is timely and interesting. A well-organized discussion of the syntheses and pertinent structural data for these compounds is presented, including the general nature of one-dimensional band theory and the relevance of Peierls' distortion and related considerations to their conductivity properties. The only deficiency in an otherwise excellent treatment is the lack of a table of abbreviations, which would greatly help the reader, given the large number of abbreviations used in the chapter. The chapter on transition-metal alkoxides by Mehrotra deals mainly with synthetic and structural information of these compounds, which should be useful to many preparative inorganic chemists. The treatment suffers slightly from the inclusion of an excess of crystallographic data (unit cells, refinement details, etc.), a somewhat obscure ligand field discussion (pp 277–278), and at least one major error in printing (p 301). The final topic, transition-metal thionitrosyls, is well treated, including discussions of NS itself, its potential bonding to a transition metal, the preparative and structural aspects of transition-metal thionitrosyls, etc. Because of the interest attracted by CO, CS, and NO ligands, this chapter is very timely.

Volume 27 is composed of seven chapters, including Alkali and Alkaline Earth Metal Cryptates by D. Parker, Electron Density Distributions in Inorganic Compounds by K. Toriumi and Y. Saito, Solid State Structures of the Binary Fluorides of the Transition Metals by A. J. Edwards, Structural Organogermanium Chemistry by K. C. Molloy and J. J. Zuckerman, Preparations and Reactions of Inorganic Main-Group Oxide Fluorides by J. H. Holloway and D. Laycock, The Chemistry of Nitrogen Fixation and Models for the Reactions of Nitrogenase by R. A. Henderson, G. J. Leigh, and C. J. Pickett, and Trifluormethyl Derivatives of the Transition Metal Elements by J. A. Morrision. The contribution by Parker summarizes a good deal of important structural, spectroscopic, kinetic, and thermodynamic data for various classes of cryptates. The interesting treatment concludes with a summary of applications for these ligands. The chapter by Toriumi and Saito presents a very readable account regarding the methods for deriving bonding electron density distributions. It was the authors' stated intention to present a general illustration of the type of results obtainable; they certainly succeeded. Topics covered include the actual deformation contours obtainable, a comparison of these to MO results, and the derivation of electron populations, net charges, and magnetic properties. The treatment of the solid-state structures of the binary transition-metal fluorides begins with Ag_2F and AgF and ultimately reaches the heptafluorides. Besides providing a lucid treatment of structural details, Edwards includes some appropriate comments on the often all-important preparative and purification details for some of the less-stable species. The treatment might have been improved slightly by the inclusion of more standard-deviation information for the bonding parameters, but overall this is not a significant problem. The chapter by Molloy and Zuckerman would also have been improved by the inclusion of more esd's for the bonding parameters. The authors do present, however, a very readable and interesting summary of the structural aspects of organogermanium chemistry. The chapter by Holloway and Laycock thoroughly summarizes preparative and reactivity aspects of main group oxyfluorides. Considering that there are over 11 references cited per page (342/30), the readability of this chapter is reasonable. The following chapter treats various aspects of nitrogen fixation, emphasizing recent work on the possible intermediate ligand states which could be present, including N_2, diazenido, diazene, hydrazido, nitrido, imido, and amido species. The syntheses and reactivities of these complexes are described, as well as pertinent mechanistic information. The final chapter deals with trifluoromethyl compounds of the transition metals, emphasizing the synthetic strategies available for their preparation. Some discussions concerning the bonding

and stability of such species are also included.

Overall, these two volumes provide much useful information and are quite well-written. While the topics covered are very diverse, many of them either cover fundamentally important areas of research or deal with compounds which are synthetically useful or structurally interesting. A fair amount of the data presented could also be used to supplement examples for inorganic chemistry classes. These volumes should be of interest to both synthetically and physically oriented chemists.

Richard D. Ernst, *University of Utah*

Atoms in Strong Light Fields. By N. B. Delone (USSR Academy of Sciences) and V. P. Krainov (Moskow Engineering Physics Institute). Springer-Verlag: Berlin, Heidelberg, and New York. 1985. xii + 339 pp. $49.00.

The advent of lasers has opened up an entirely new field of research—the study of nonlinear optical phenomena—which today is flourishing and robust. The authors of this monograph, one an experimentalist (Delone) and one a theoretician (Krainov), have written a balanced (but by no means elementary) introduction to this subject.

Of the nine chapters presented, the first four provide the theoretical underpinnings for treating the interaction between atoms and strong light fields. Throughout, the authors assume that the (one-electron) atom is isolated and that the radiation field may be treated classically. Working within time-dependent, diagrammatic perturbation theory, they then give a fairly complete discussion of the resonance and adiabatic approximations. One of the nicer features of their presentation is a heavy reliance on order-of-magnitude arguments: Thus, the reader comes away with a good physical understanding of the region of validity for the various special approximations which are made.

The basic theory is followed by a discussion of the experimental and theoretical characterisitics of laser radiation, and by a survey of a number of techniques used in studying nonlinear optical phenomena (e.g., atomic beams, one-photon and two-photon absorption, multiphoton ionization, etc.). The authors then devote a chapter to nonresonant phenomena and one to resonant phenomena. These two chapters cover a wealth of topics (including light scattering, absorption, fluorescence, and ionization) which should provide the new initiate with a solid background in nonlinear optical studies. The various phenomena discussed are illustrated by experimental results which are then interpreted by using the tools developed earlier in the book. The final chapter presents a brief selection of topics (e.g., multielectron effects) which go beyond the approximations made in the bulk of the work.

Over 300 references are provided, many to the Soviet physics literature. (In almost all cases, references to English translation journals are given in addition to the original citations). Finally, this book will be useful to anyone who desires a fundamental introduction to the study of nonlinear optical effects. It would certainly serve as an excellent text for a course at the advanced graduate student level.

G. L. Findley, *New York University*

Determination of the Geometrical Structure of Free Molecules. By L. V. Vilkov, V. S. Mastryukov, and N. I. Sadova (Moscow State University). Mir Publishers: Moscow. Distributed by Imported Publications: Chicago. 1983. 279 pp. $9.95. ISBN 26-58-3.

The words "geometrical structure" of a molecule mean different things to different people. It is not merely the arrangement of the atoms that is the concern of this slim volume but the deduction of precise values for interatomic distances from which bond lengths, bond angles, and torsion angles may be deduced. To quote from R. Hoffmann's short foreword, "there is no more basic enterprise in chemistry". The authors themselves are well-known for their structure determinations using the method of gas-phase electron diffraction. They have worked primarily on organic molecules, and this volume reflects their scientific interests and activity.

Our knowledge of the detailed structures of free, i.e., gaseous, molecules has been obtained almost entirely from the experimental methods of gas electron diffraction and microwave spectroscopy. The precision of these results has, of course, increased greatly through the years to the point where bond lengths in simple cases may now be measured to about 0.001 Å. However, along with the increased accuracy have come certain complexities that make life difficult for nonspecialists: how many know what to make of interatomic distances variously reported as r_g, r_a, r_α, r_z, and r_{av}, for example? Another problem that faces nonspecialists is where to find a convenient tabulation of structural results. This book will solve the first problem for them, and for those interested in organic and organometallic structures, the second as well. There are, of course, many other reviews concerned with these structural methods and a number of compilations of results obtained by them. References to most are found in the book.

The first section of the book, about 70 pages, is a discussion of the theory and experimental aspects of gas-phase electron diffraction and microwave spectroscopy followed by a comparison of the results obtained by each. (It is not generally recognized that the types of distance parameters determined with these methods differ slightly.) There is also a chapter of discussion on the analysis of structures by joint use of microwave and diffraction data, a process that makes use of the complementary qualities of each and leads to more accurate structures. The second section of the book, about 180 pages, is a digest of results obtained for the structures of organic and organometallic compounds grouped according to type of compound. For example, there are chapters on acyclic hydrocarbons; conjugated and aromatic hydrocarbons; alicyclic hydrocarbons; halogenated, oxygen-containing, and nitrogen-containing compounds; compounds containing elements from groups II-VII; and heterocyclic compounds. The material of these chapters is essentially factual, but interpretive discussion is offered throughout. There is an index containing about 800 compounds and a list of about 300 references to original publications, but there is no author index.

The foregoing may seem to imply that this volume is of interest primarily to nonspecialists concerned with the structures of organic molecules, i.e., to scientists not familiar with the several other compilations of structural results spanning the period from the middle 1930's to the present. Although such people will surely find the book of great value, structural chemists will also find it very useful. Certainly those with research programs that make experimental use of either microwave speectroscopy or electron diffraction will want to have it available to their research groups for its discussion of the methods and its summary of results.

This edition of the book is revised from a 1978 Russian version and includes results published through about 1981. Perhaps because of publishing delays, the valuable Landolt–Börnstein compilation "Structural Data of Free Polyatomic Molecules" (1976) is not included among the references.

Kenneth Hedberg, *Oregon State University*

The Chemistry of Natural Products. Edited by R. H. Thomson (University of Aberdeen). Blackie and Son Ltd.: Glasgow. Distributed in the USA by Chapman and Hall: New York. 1985. XI + 467 pp. $75.00. ISBN 0-216-91595-3 (USA ISBN 0-412-00551-4).

This book is comprised of nine chapters, each written by different authors, with an overall coverage of the basic areas of natural products chemistry. Topics include carbohydrates, by J. S. Brimacombe; aliphatic compounds, by E. J. Thomas; aromatic compounds, by T. J. Simpson; terpenoids, by J. R. Hanson; steroids, by B. A. Marples; amino acids, peptides, and proteins, by B. W. Bycroft and A. Higton; alkaloids, by I. R. C. Bick; nucleosides, nucleotides, and nucleic acids, by J. B. Hobbs; and, porphyrins and related compounds, by A. H. Jackson. The chapters generally stand alone as reviews of major research developments in each area during approximately the last 10 years.

All chapters are authoritatively written, with generally good coverage of the literature, with emphasis on the structure, chemistry, and synthesis of natural products with only a minor reference to biosynthesis. The predominantly British authors have reviewed recent developments which indicate the direction in which progress is being made in each area. The text is generously illustrated with structures and reaction schemes. The structures are cross-referenced to the text, and the reaction schemes contain the reagents required for each chemical transformation. Although lacking in great detail, all of the articles are quite adequate to alert interested readers to major developments and indicate whether or not they might profitably explore the subject matter more fully by using the references at the end of each chapter as an entry into the literature.

Overall the book is well written and a valuable reference source. It can be easily understood by readers with diverse scientific backgrounds and is thus a valuable resource for those who are entering the field as well as for those more experienced who wish to learn of developments in ancillary areas. This book can be highly recommended for neophytes as well as experts interested in natural products chemistry.

Edward J. Parish, *Auburn University*

Advances in Carbohydrate Chemistry and Biochemistry. Volume 42. Edited by R. Stuart Tipson (Kensington, MA) and Derek Horton (Ohio State University). Academic Press: Orlando, FL. 1984. xii + 444 pp. $65.00.

The Advances series has been indispensible for more than 40 years to almost anyone interested in the carbohydrates. Volume 42 retains the format that has been so successful in earlier volumes, again providing a judicious balance of subject matter that will have wide appeal. Each topic is treated comprehensively, so that even the reader with a peripheral interest is offered a good perspective of the overall literature on any of them.

There are seven chapters. In Chapter 1, S. J. Angyal (Australia) presents a skillful characterization of tautomeric equilibria in solutions

of the reducing sugars, one of the classical problems in carbohydrate chemistry. Three of the other chapters are concerned mainly with chemical synthesis: a critical evaluation of methods used in the synthesis of branched-chain sugars, many of which occur in antibiotics, is provided by J. Yoshimura (Japan); H. Yamamoto and S. Inokawa (Japan) describe the methodology used to create a class of sugar analogues having a phosphorus atom in place of the oxygen atom of the hemiacetal ring; and K. Antonakis (France) deals with the synthesis and biochemical implications of nucleosides that contain a keto group in the sugar moiety ("ketonuclosides").

An extensive tabulation of ^{13}C NMR data for oligosaccharides, compiled by K. Bock, C. Pedersen, and H. Pedersen (Denmark), constitutes a valuable source of reference material for the many structural studies on oligo- and polysaccharides that now employ ^{13}C NMR spectroscopy.

How the structure, biosynthesis, and physiology of the plant cell-wall are related to its constituent polysaccharides and glycoproteins is the subject of an enterprising article by P. M. Dey and K. Brinson (England), comprising almost one-third of the volume's content. Chapter 7, by A. Kaji (Japan), deals with L-arabinosidases, a class of hydrolytic enzymes acting on glycosides or polysaccharides containing α-L-arabinofuranose moieties, which complements a series of articles on glycosidases that have appeared in earlier volumes.

Each edition of Advances pays tribute to the memory of an illustrious figure in the carbohydrate field. In this volume, J. H. Pazur (U.S.A.) offers a fitting appreciation of the life and work of the late Dexter French, a pioneer in the modern development of the chemistry and enzymology of starch.

Volume 42 maintains the high standard of editing that is characteristic of Advances. Libraries, and laboratories active in research on carbohydrates, will not want to be without it.

Arthur S. Perlin, *McGill University*

Muon and Muonium Chemistry. By David C. Walker (University of British Columbia). Cambridge University Press: New York, Cambridge, and London. 1984. ix + 179 pp. $49.50. ISBN 0-521-24241-X.

The positive muons (μ^+) used in muon and muonium chemistry are obtained from the decay of pions ($\pi^+ \rightarrow \mu^+ + \nu_\mu$), where the pions are obtained by bombarding a target (e.g., Be) with high-energy protons. This scenario immediately implies that muonium chemistry (or physics) can only be practiced at a few (5–6) laboratories in the world, where intense pion and muon beams exist. Since the above reaction is due to the weak interaction, it violates parity so that the μ^+ are longitudinally polarized. The decay of the muon into a positron and two neutrinos ($\mu^+ \rightarrow e^+ + \nu_e + \bar{\nu}_\mu$) is also a parity-violating weak interaction ($\tau \sim 2.2\ \mu s$), so that the e^+ are longitudinally polarized. However, of more interest from the viewpoint of this book, parity violation also causes an asymmetry in the direction of e^+ emission with respect to the μ^+ spin direction.

The e^+ decay asymmetry allows the μ^+ spin direction and mean polarization at the instant of decay to be detected. Measurement of mean spin rotation (μSR) and polarization (muon spin relaxation) along with various microwave resonance experiments on the muon and on muonium (which may be formed when the μ^+ stops in a given material) constitute the essence of the techniques described in the book.

The author describes the theory and practice of the various techniques mentioned above. He also gives a very thorough account of the myriad applications in which the techniques have been used to obtain information of interest to chemists and to some extent to condensed-matter physicists. In addition to the above rather complete discussion, the author compares μSR with a number of other analogous techniques, particularly those involving positronium ($e^+ - e^-$) formation. The sections in which the comparisons are discussed are well done and comprise a rather valuable addition to the text.

In conclusion, I found the book interesting and informative as it relates to its major subject matter. I did notice that several statements regarding the physics of pion and muon decay, parity nonconservation, etc., were, in a technical sense, incomplete or unclear, but I did not notice any explicit errors in this regard. I am sure chemists and possibly solid-state physicists interested in μSR will find thebook useful.

Arthur Rich, *University of Michigan*

Annual Review of Materials Science. Volume 14. Edited by R. A. Huggins, J. A. Giordmaine, and J. B. Wachtman. Annual Reviews: Palo Alto. 1984. vi + 416 pp. $67.00. ISBN 0-8243-0714-9.

The science of materials incorporates large parts of chemistry, solid-state physics, metallurgy, and several engineering disciplines. This diversity is reflected both in the titles of the chapters and in the affiliations of their authors in this very useful review volume. Chapters of special interest to chemists include Wynne and Rice's chapter on ceramics via polymer pyrolysis, Lewis' remarks on photoeffects on the semiconductor/liquid interface, Murray's clear overview of polymer modification of electrodes, Clearfield's discussion of inorganic ion exchangers with layered structures, and the description of proton transport in β and β'' aluminas by Frase, Farrington, and Thomas. All of these articles were written by chemists, which demonstrates the centrality both of chemistry in the modern study of materials and of materials science as one of the most challenging and exciting areas of current chemical research.

As a typical example, the chapter on pyrolysis of polymers demonstrates the roles of monomer and polymer synthesis, chain branching, copolymerization, and pyrolysis mechanisms (all concerns of traditional chemistry) in producing ceramics with attractive density and microstructural features. This emphasis on what amounts to synthesis of solids, rather than molecules, is clearly one of the most intriguing and promising new avenues in solid-state chemistry (another example is provided by Wynne's own work, and related efforts elsewhere, on conductive polymers).

Other articles include discussions of synchrotron spectroscopy of semiconductor surfaces, pseudopotential studies of solids, itinerant electron magnetism, ion implantation, polymer fatigue, and piezoelectric ceramics. There is also a chapter on electronic properties of small particles by Kubo, Kawabata, and Kobayashi; this subject is now of real interest in connection with surface-enhanced spectroscopies.

These are not really reviews in the usual sense (they average far less than 100 references) but rather essays on current trends by leading practitioners in the field. As such, they are indicative of the excitement in the area and provide an ideal introduction to each of these topics. Most chapters also refer to more extensive reviews. This book describes quite lucidly important areas of current research and certainly merits reading by chemists interested in the solid state. The book has three disadvantages, first of which is the relatively high price, the second is the lack of an author index, and the third is that some copies are badly bound: one copy that I saw was missing pages 23–54 and contained duplicates of pages 55–86: caveat lector.

Mark A. Ratner, *Northwestern University*

Multiphoton Spectroscopy of Molecules. By S. H. Lin, Y. Fujimura, H. J. Neussner, and E. W. Schlag. Academic Press Inc.: Orlando, FL. 1984. x + 260 pp. $59.00. ISBN 0-12-450520-1.

The purpose of this book is to introduce those with an active interest in multiphoton spectroscopy to the fundamentals of the field. A brief introduction describes some of the phenomenology of multiphoton processes including selection rules, intensity dependence, and resonant absorption. The second chapter deals with theoretical treatments of multiphoton transition rates. The formalism is fairly forbidding, and the relationships between and advantages of the different methods presented merit more discussion. The useful limiting case where density matrix equations reduce to rate equations would be best covered in detail here, since this is frequently the appropriate regime for multiphoton ionization of polyatomics. An example of a rate equation treatment is presented in Chapter 4.

Chapter 3 briefly discusses several detection techniques for multiphoton absorption including direct absorption, two-photon fluorescence excitation, multiphoton ionization (MPI), and nonradiative methods. The intensity dependence and saturation behavior of multiphoton transitions are covered in Chapter 4, but AC stark effects due to high intensities and enhancements due to incoherent light sources are not covered. A comprehensive account of polarization effects in two-photon absorption concludes Chapter 4. Chapter 5 opens with remarks about nonresonant and resonant intermediate states in multiphoton absorption. The ensuing discussion of Doppler free multiphoton spectroscopy is well put together although its length seems out of proportion for a review text.

Examples of Rydberg and valence transitions which have been studied by using multiphoton techniques are given in Chapter 6. These give a nice flavor for the kinds of things that can be done with use of MPI and a few examples of multiphoton fluorescence excitation. The final chapter (seven) covers a handful of variations on the techniques discussed in the text. An excellent section on mass spectroscopic detection of MPI fragments is highlighted.

A review book on multiphoton spectroscopy is timely. This book is reasonably self-contained, but the selection of topics seems rather arbitrary and several important classes of techniques subsumed by the title are essentially omitted. There is a heavy slant toward MPI and coherent multiphoton spectroscopies such as CARS, resonantly enhanced second harmonic generation, and four-wave mixing are not covered. To some extent, this accurately represents the state of the field, but it also seems to convey the authors' biases. Even in the context of MPI, many topics of current interest are omitted, such as time-resolved MPI (Greene et al. *J. Chem. Phys.* **1983**, *78*, 3336), comparison between MPI and two-photon fluorescence spectra (e.g., Halpern et al. *J. Chem. Phys.* **1982**, *76*, 102), interference between ionization and coherent processes (e.g., Miller et al. *Phys. Rev. Lett.* **1980**, *45*, 114), and MPI in liquids. A more

balanced selection of topics might be more valuable from a pedagogical standpoint. Nonetheless, I know of no other similar text and I believe this to be a worthwhile first effort to introduce some of the aspects of multiphoton spectroscopy in chemical systems.

Lewis Rothberg, *AT&T Bell Laboratories*

Solvent Problems in Industry. Edited by George Kakabadse (Department of Chemistry, University of Manchester Institute of Science and Technology). Elsevier Applied Science Publishers: London. 1984. XI + 253 pp. $45.00. ISBN 085-334304-7.

This book is a general discussion of some of the practical problems involved with the use of solvents in industry. According to the editor, it is "largely a report of the proceedings of the European (4th UMIST) Solvents Symposium for Industry". The aim of the book is to "rationalize the relationship between solvent properties and economic use of solvents".

The book is divided into four sections: The first section deals with basic solvent properties. The concepts presented in this section are general and should already be well understood by graduate chemists and chemical engineers. One particular chapter in the section (Chapter 3) broadly outlines the reasons for selecting a solvent. This seems to be elaborated on in the second section, which is basically a listing of solvent applications in several selected industries. Unfortunately, this section is not very detailed and lacks examples. What one learns from reading this section is that beyond specific physicochemical requirements, each industry must consider availability, cost, and potential industrial health and environmental problems when selecting the proper solvent. In addition, the second section contains not very comprehensive chapters on halogenated solvent usage, moisture problems, and construction materials, which do not seem to fit the basic theme of the section. Section three is a somewhat interesting discussion of the economic aspects of solvent recovery and disposal. It falls short, however, in that it does not extend its scope beyond technology that is currently available. The aim of the last section is to discuss health, legislative, and safety aspects of solvent usage. The legislative aspects are directed entirely at United Kingdom workplace regulations and do not address legislation similarly enacted in other countries. Environmental legislation, which can have a significant impact on solvent usage, is not covered at all. Finally, health aspects are not considered beyond a general discussion of risk assessment that uses mineral fibers, not solvents, as an example.

In summary, this book is a cursory overview of the problems associated with industrial use of solvents. For use by chemists and chemical engineers, the book lacks depth in many of the sections and would benefit greatly by more examples. It may, however, be of some benefit to industrial management personnel with a limited background in chemistry.

Edward V. Sargent, *Merck & Co., Inc.*

Solubility Data Series. Volume 16/17. Antibiotics: I. β-Lactam Antibiotics. Edited by E. Tomlinson and A. Regosz. Pergamon Press: Oxford and New York. 1985. 790 pp. $200.00. ISBN 0-08-029235-6.

The importance of the penicillins and their solubilities in body fluids and solvents used in purification and administration is more than sufficient justification for the present volume, which includes not only a wide variety of penicillin salts but some cephalosporins as well. The data are presented in the critically evaluated form characteristic of the series; the compilers do not shrink from their duty of terming certain data as "doubtful" or "highly doubtful" when the circumstances so indicate. Indexes of the systems by names, and of authors and CAS Registery Numbers, are included.

Phosphorus. An Outline of its Chemistry, Biochemistry, and Technology. Third Edition. By D. E. C. Corbridge. Elsevier Science Publishers: Amsterdam and London. 1985. x + 762 pp. $157.50. ISBN 0-444-42468-7.

It was only five years ago that the Second Edition of this work appeared, but such is the rate of expansion of phosphorus chemistry that this new edition is clearly justified. It is longer by more than 200 pages than the previous edition, and it includes a new chapter, Phosphorus in Biochemistry. It is stated that it has been brought up to date to the end of 1984, but it is not easy to verify this, for there are no proper references, but only lists "for further reading". The book is reproduced from typescript, a procedure that usually gives a cheap appearance, but in the present case, a typeface of high quality has been used, and the result is not displeasing.

This is a book for both organic and inorganic chemists, as well as for others, such as chemical engineers, who have a need for more than elementary information. It is truly comprehensive and is filled with factual data, in text, equations, and tables. In addition, there are nine Appendices, which deal with the literature on phosphorus, nomenclature (a subject somewhat in disarray at present), hazards, atomic data, and properties of white phosphorus, phosphine, and phosphoric acid solutions. The result is a good book to own, or at least to be sure that it is in the library. It is a pity that its usefulness is impaired by the lack of references. As it is, one has to accept the validity of all the data on faith, and one does not know to whom to credit the work reported.

The Agrochemicals Handbook. Edited by D. Hartley and H. Kidd. The Royal Society of Chemistry: London. 1984. 39 + 844 pp. $171.00; Supplements $19.00 each. ISBN 0-85186-406-6.

This is a loose-leaf work, designed to allow new material to be inserted as it becomes available. Update pages are planned to be distributed every 6 months. The body of the work consists of separate pages for each substance, giving the structural formula, chemical and trade names, physical properties, and information on solubility, analysis, residues, action, uses, toxicity, degradation and metabolism, precautions, and antidotes. The entries are arranged in alphabetical order of the "common" names, which are those used in agriculture, and not the chemical names. An index of other names is provided.

McGraw-Hill Dictionary of Chemistry. Edited by Sybil P. Parker. McGraw-Hill Book Co.: New York. 1984. 665 pp. $32.00. ISBN 0-07-045420-5.

A dictionary is supposed to be complete and authoritative and, above all, reliable; this unfortunate production fails on all counts. If it were a car, it would have to be recalled (not at all a bad idea in this case), and if the publisher were a physician, it would be vulnerable to malpractice suits. It takes gross deficiencies to deserve such scathing comments, and they are, indeed, there.

Random spot-checking turned up the following unbelievable gaffes. Picolinic acid (which is pyridine-2-carboxylic acid, a C_6 compound) is stated to be $C_{10}H_8N_4O_5$, "also known as 3-methyl-4-nitro-1-(*p*-nitrophenyl)-2-pyrazoline-5-one" (this is actually picrolonic acid, which is not listed). Potassium bifluoride, correctly given as KHF_2, is stated to be "also known as Fremy's salt", and the entry under Fremy's salt (which is a nitroxide, $\cdot ON(SO_3K)_2$) reads simply "see potassium bifluoride". Fulminuric acid (which is α-cyano-α-nitroacetamide), is stated to be "a trimer of cyanuric acid...also known as...isocyanuric acid". It is hard to account for such errors; could it have been sabotage? Editorial insanity? How many more of them are scattered through the book?

Lesser transgressions include listing the Lobry de Bruyn–Alberda van Ekenstein rearrangement twice: once under L, and spelled correctly, and once under D, misspelled as "de Brun–van Eckstein", with a different, but identifiable, definition. Formulas are mostly empirical, and thus rather uninformative, even when it would have been almost effortless to print structural formulas (e.g., why give "C_3H_4" for allene instead of $CH_2{=}C{=}CH_2$?). Furthermore, the empirical formulas themselves are not consistent: e.g., cyanogen chloride is given as ClCN, but cyanogen bromide is shown as CNBr (the incautious reader might be led to think that a structural difference was meant).

The definitions are in many cases quite good, but too many are of the unsatisfying type that talk about the subject but avoid giving the essential feature. Particularly irritating are those cases in which an equation, such as the Einstein or the Eyring equation, is only loosely described, without giving the equation itself. There is not space here to list the innumerable omissions, such as Wittig reaction; CIDNP; Karplus equation; lime; flash chromatography; FTIR, etc. In other cases, definitions are inappropropriately restricted, such as the case of "chemical shift", one is simply referred to "isomeric shift", under which appears a definition with reference to Mössbauer spectroscopy.

The book is very clearly printed.

Progress in Analytical Atomic Spectroscopy. Volume 6. Edited by C. L. Chakrabarti; Associate Editor R. E. Sturgeon. Pergamon Press: Oxford and New York. 1985. vi + 436 pp. $132.00. ISBN 0-08-032307-3.

This book consists of six papers reprinted from the Journal of the same name, Volume 6, Numbers 1–4 (1983), and is hard bound and indexed.

Nuclear Magnetic Resonance. Volume 13. Edited by G. A. Webb (University of Surrey). The Royal Society of Chemistry: London. 1984. XLVII + 368 pp. $122.00. ISBN 0-851-86362-0.

This book should be of interest to anyone concerned with the general state of NMR as of 1982–1983. By skimming the introduction of each chapter it is possible to get a quick overview of practically every main activity in the field—no mean feat considering the enormous breadth of material to be covered. The list of 411 books and reviews appearing at the beginning of the volume is an especially welcome guide to literature on specific subjects.

With only 368 pages and over 4000 references it is not possible (nor was it intended) to present critical reviews of every subject, but the contributors have made a laudable effort to select for special mention

those topics which are of widest general interest. The two strongest chapters from this point of view are Jameson's discussion of relativistic contributions to chemical shielding and Cosgrove's summary of NMR of adsorbed species. Koch and Weingartner's chapter on relaxation makes disappointingly little mention of two-dimensional NMR studies of chemical exchange, and Khetrapal's discussion of oriented molecules omits work on neat mesogenic fluids. Morris' chapter on NMR imaging is a very useful summary of a rapidly developing field.

Unfortunately, few individuals can afford the price of this book, but no library should be without it. It provides an exceptionally broad and even coverage of modern topics in NMR.

Regitze R. Vold, *University of California, San Diego*

Biochemistry of the Essential Ultratrace Elements. Edited by Earl Frieden (Florida State University). Plenum Press: New York. 1984. xvii + 426 pp. $59.50. ISBN 0-306-41682-4.

Many elements have been found in trace quantities in biological samples. The first chapter of this book discusses the criteria for classifying an element as essential and surveys the biochemistry of all the elements. The second chapter presents the historical development of the concept of essentiality and documents the discoveries of the trace elements. The remaining chapters are each dedicated to a single element. The elements covered in this volume include iodine, fluorine, manganese, cobalt, molybdenum, chromium, selenium, vanadium, silicon, nickel, tin, arsenic, cadmium, lead, and boron. Iron, copper, and zinc are not covered since they are the subjects of other volumes in this series. Generally, each chapter is organized in sections discussing the history of the element, occurrence of the element in cells and tissues, deficiency and function of the element, metabolism of the element, and toxicity of the element. The emphasis on biochemistry vs. nutrition varies with element. This usually reflects the interests of the individual authors of each chapter. Each review has original references usually dating through 1981 or 1982. This book provides a good introduction to and review of trace element research and thus should be useful to those interested in a particular element as well as those with a general interest in the trace elements.

Karen E. Wetterhahn, *Dartmouth College*

Hazardous Metals in Human Toxicology. Edited by A. Vercruysse (Vrije Universiteit Brussel). Elsevier Science Publishing Co.: Amsterdam and New York. 1984. x + 338 pp. $73.00/Dfl. 190.00. ISBN 0-444-42207-2.

This book is Part B of "Evaluation of Analytical Methods in Biological Systems" which is Volume 4 of the "Techniques and Instrumentation in Analytical Chemistry" series edited by R. A. de Zeeuw (University of Groningen, The Netherlands).

This review is a composite of contributions from several authors. The volume is divided into two parts: a general part, chapters 1–3, and an analytical part, chapters 4–11. Chapter 1, by A. Vercruysse, briefly outlines the role of elements in human toxicology. Chapter 2, by A. Singerman (Buenos Aires), discusses exposure to toxic elements with reference to biological effects and their monitoring. The indices of exposure for lead, mercury, cadmium, chromium, arsenic, selenium, tellurium, thallium, and nickel are reviewed and evaluated. Chapter 3, by M. Stoeppler and M. W. Nürnberg (Nuclear Research Centre Jülich, G.F.R.), reviews analytical methods and approaches most commonly used in a particular bioanalytical field. A brief introduction is followed by an in-depth evaluation of digestion methods such as dry ashing at higher and lower temperature, open- and closed-system wet ashing, and tissue solubilization. The rest of the chapter is devoted to the assessment of trace analytical procedures for elemental analysis, using techniques such as atomic spectroscopy, voltammetry, nuclear activation analysis, X-ray fluorescence, mass spectrometry, and other methods for elemental determination. Each of the three chapters is well written and ends with an extensive list of references.

The remaining chapters are dedicated to a comprehesive evaluation of analytical techniques commonly used to determine trace levels of a hazardous element in biological samples. Each chapter surveys a different element. Thus, the analytical part of the book comprises eight chapters: (4) Lead, contributed by P. Grandjean (Odense University, Denmark) and N. B. Olsen (University of Copenhagen); (5) Mercury, by L. Magos (Medical Research Council, Carshalton, Surrey, U.K.); (6) Cadmium, by M. Steoppler (Institute of Applied Physical Chemistry, Jülich, G.F.R.); (7) Arsenic, by J. Savory and M. R. Wills (University of Virginia Medical Center, Charlottesville, VA) and F. A. Sedor (Duke University Medical Center, Durham, NC); (8) Thallium, by J. P. Franke (State University Groningen, The Netherlands); (9) Chromium, by Jorma Kumpulainen (Agricultural Research Centre, Jokioinen, Finland); (10) Nickel, by F. W. Sunderman, Jr. (University of Connecticut School of Medicine, Farmington, CT); and (11) Selenium and Tellurium, by O. E. Olson, D. C. Hilderbrand, and D. P. Matthees (South Dakota State University, Brookings, SD). The chapters of this part of the book are clearly written and can be regarded as a critical survey. Each chapter ends with references specifically linked to the topic in the chapter. The references cited are extensive, and for some chapters they appear to be current to 1981.

The book also points out some of the major difficulties encountered by researchers involved with the area of trace element analysis and provides the reader with sufficient background information to recognize where additional work is needed.

The human toxicology investigator who is planning work in the field of the determination of trace levels of elements in biological samples would be well advised to read this book. The volume is also recommended for researchers concerned with occupational exposure to hazardous elements. Certainly, institutional scientific libraries should not omit this publication from their acquisition list.

Alfred W. von Smolinski, *University of Illinois at Chicago*

Progress in the Chemistry of Organic Natural Products. Volume 46. Edited by W. Herz, H. Grisebach, G. W. Kirby, and Ch. Tamm. Springer-Verlag: Wien and New York. 1984. ix + 253 pp. DM 178.00. ISBN 3-211-81804-9.

As were its predecessors in the series, this is a very polished product. I found five typographical errors, three of these being in the first section. The book consists of three sections: The first, on Saponins of ginseng and related plants, by O. Tanaka and R. Kasai, the second on Diterpenoids of *Rabdosia* species by E. Fujita and M. Node, and the last on Quinazoline alkaloids by S. Johne.

The first section provides not only a very readable summary of saponins isolated from ginseng (including extensive tables) but also a useful summary of their ^{13}C spectra showing dramatic differences in the Δ values of epimers.

Differences between the Chinese drug which is alleged to prevent and cure coronary disease and the Japanese drug used as a stomachic, expectorant, and antipyretic are discussed, but there is very little pharmacology, as the authors indicate they are phytochemists. One detail provided is that the 20(*S*)-protopanaxadiol, which is common in Chinese ginseng, has a sedative action, while 20(*S*)-protopanaxatriol common in the American variety stimulates the central nervous system.

The second section discusses diterpenoids of *Rabdosia* species, the leaves of which are used for gastrointestinal disorders in Japan and as antitumor and antiphlogistic agents in China. A list of 108 diterpenoids (with structural formula) isolated from 12 Japanese species as well as 10 from China and Taiwan is given along with a list of compounds isolated from each species. Detailed chemical transformations, syntheses, and biosyntheses are discussed. A few of these diterpenoids have been found to be insect growth inhibitors, using the African army worm as a model. A relationship between bitterness and chemical structure is also discussed. Although there is an abundance of proton and ^{13}C NMR data, no mass spectral data are provided for any of the 108 compounds.

The third section contains a table of the naturally occurring quinazoline alkaloids arranged by increasing molecular formula with references to structural formula and to species where they are found. The author includes a large amount of material here by summarizing it in a very concise manner. Quinazolines produced by microorganisms are included as well as the three produced by animals (two from a millipede and tetrodotoxin from several sources). There is also a short section on biosynthesis. Two minor items caught my attention. The loss of $(CH_3)_2N$ as the major fragmentation path of vasicoline on page 182 appears very strange. Many NMR spectra are included, all of them being reported in δ, but one set is reported in τ on p 197.

The references are in alphabetical order, unlike those in the first two sections. There is, however, an author index which includes all three sections.

The book will be of most use as a reference for those working in the three areas. It will also provide stereochemical examples of ^{13}C spectra for other organic chemists and an overview to those not in the area.

James W. Wheeler, *Howard University*