Book Reviews

The Analysis of Drugs of Abuse. Edited by Terry A. Gough. John Wiley & Sons: Chichester, England. 1991. 628 pp. $210.00. ISBN 0-471-92267-6.

Terry Gough states in the preface that this text is written for the analyst. His intent is to describe the tools available to the chemists in the field of analysis of illicit drugs. The product is a text defining the status quo of the Forensic laboratory of today, including clear discussions of the classical analytical approaches to drug identification, as well as outlining the functions of on-sight detection of smuggled drugs and the determination of drugs in urine and body fluids. Concluding the text is a chapter outlining the scientific support for Customs agents including case histories of smuggling offenses to demonstrate the use of the analytical techniques. All chapters are well referenced and the text includes both subject and author indices. This book is divided into two sections: analytical techniques and applications.

The analytical chapters include techniques common to drug analysis including chromatography (thin layer, gas, and high performance liquid), mass spectrometry, infrared spectroscopy, NMR spectroscopy, and immunoassay. With the exception of NMR spectroscopy, the theory of each of these techniques is described in clear, understandable detail. Each chapter also includes a discussion of the advantages/disadvantages and hardware options as well as a look at the anticipated users for each technique in the near future. Although the gas chromatography chapter should be updated to include more information on capillary columns, the information presented in all of the analytical chapters is current with techniques now employed in Forensic laboratories for drug analysis. An uncommon, yet welcome feature of this text is the inclusion of analysis methods for common drugs of abuse for each of the techniques discussed. Another uncommon inclusion is the chapter on the multi-technique approach for drug analysis, describing the discriminating power of the combination of screening methods (TLC, GC, UV) prior to confirmation by mass spectrometry or infrared spectroscopy. The logic of this method is the basis for most drug analyses; however, a more pragmatic approach usually prevails over the statistical method outlined.

In the applications chapters of the text, the editor includes the methods of on-sight detection, covering new techniques of drug smuggling detection, including practical examples of drug detection systems now available, as well as describing systems now in research. Drug screening of blood and urine occupies a large portion of the application section of this text. The systematic presentation includes the analytical methods employed, equipment selection, and interpretation of results and carries the samples through to the management problems of sample handling and storage, cost, quality control, and reporting. This serves as a practical guide to the administrator or manager seeking information to establish or improve a laboratory engaged in drug screening.

The text that Mr. Gough has organized will become a common reference for Forensic laboratories. It is useful for the Forensic chemist who requires a concise review on the instrumental theories before appearing in court as well as providing indepth theory to the chemist just entering the field of drug analysis. Specific examples of analysis methods for the common drugs of abuse should prove to be a useful starting point for the inexperienced analyst. In addition, this text will serve as a practical guide to the laboratory manager requiring information for laboratory expansion and equipment selection. This text set out to describe the analytical tools available to the drug analyst, and its goal is accomplished in the classical discussion of the theories and methods employed. The bonus to this text is the application of each described technique to the common drugs of abuse, making the book specific to the chemist in the field of illicit drug analysis.

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Topics in Molecular Organization and Engineering. Radical Ionic Systems: Properties in Condensed Phases. Volume 6. Edited by Anders Lund (University of Linkoping) and Masaru Shiotani (Hiroshima University). Kluwer Academic Publishers: Dordrecht, Boston, and London. 1991. vii + 496 pp. $149.00. ISBN 0-7923-0988-X.

Nearly 25 years have passed since the first attempt to summarize the field of radical ion chemistry appeared in the book *Radical Ions* edited by Larry Kevan and the late Tom Kaiser. The emphasis at that time was on the structures of stable radical ions as revealed by the relatively new technique of electron spin resonance. The ability to detect transient radical ions and to extract useful structural data from ions trapped in matrices was as yet a largely unfulfilled promise. The contributions collected together in the current volume bear forceful testimony to just how completely that promise has now been realized.

The book contains 18 chapters arranged into three sections: (I) Cation Radicals, (II) Anion Radicals and Trapped Electrons, and (III) Complex Systems. The contributions range from comprehensive reviews, such as Chapter I.3 in which Lon Knight describes what is known about the EPR of inorganic cations in rare gas matrices, to Chapters I.7 and II.6, which are essentially research papers describing recent work by Tadamasa Shida and his co-workers. Section I is the longest, containing ten chapters. Given the enormous advances made during the last two decades in methods of preparing, detecting, and characterizing radical cations, the emphasis on these species is very appropriate. For the newcomer to the field this will also be the most useful section. An introductory chapter by Bally provides a remarkable exhibition of known organic radical cation structures. This chapter and the following one by Andrews also give a good summary of how optical and vibrational spectroscopy have been used to characterize these species. The theory of the electronic structure and reactivity of hydrocarbon cations is described in several chapters. The discussion is considerably clarified by extensive use of molecular orbital pictures and energy level diagrams. Theory is nicely integrated into two chapters, co-authored by Shiotani, which also discuss various aspects of the chemistry of radical cations. The most "chemical" chapter in this section, however, is Mehnert's discussion of the current state of knowledge of the role of radical cations in radiation chemistry.

Section I also contains three chapters on topics which simply did not exist 25 years ago: ESR studies of the cations of saturated hydrocarbons, reviewed by Toriyama; optically detected magnetic resonance, reported by Trifunac and Werst; and electron spin dynamics effects, described by Anisimov.

In contrast to Section I, which describes radical cations in both liquids and solids, the radical anions and electrons discussed in Section II are confined to solid matrices. Those with a taste for high resolution EPR spectra displaying anisotropic interactions will enjoy the four chapters on anions in crystals contributed by Muto, Byberg, Box, and Shida. The chapters by Hasegawa and by Kevan illustrate, however, that much may also be learned about the structures of trapped species in disordered matrices. Also notable in this section are frequent references to the work of Ffrancon Williams and Martyn Symons who, though not contributors to this volume, have often led the way in studies of radical ions in matrices.

The final section of this book contains chapters on radical ions in DNA and in conducting polymers by Huttermann and Kispert, respectively. These complex topics are addressed optimistically by their authors and show, perhaps, wherein lies the greatest potential for growth in radical ion chemistry in the next two decades.

The publisher and editors are to be congratulated on effectively merging 18 separate camera-ready manuscripts into a coherent document. The result should serve as a readable introduction to radical ions for professional chemists, physicists, and engineers who are new to the field, as well as a ready reference for the specialist who studies these fascinating molecules.

Ronald G. Lawler, *Brown University*

Comprehensive Chemical Kinetics. Volume 31. Mechanism and Kinetics of Addition Polymerization. By Miloslav Kucera (Research Institute of Macromolecular Chemistry, Brno, Czechoslovakia). Edited by R. G. Compton (Oxford). Elsevier: Amsterdam and New York. 1992. xxiv + 569 pp. $340.00. ISBN 0-444-98795-9.

This is a most interesting and helpful book for those involved in the broad field of addition polymerization. It deals much more extensively with the mechanism and what could broadly be called the chemistry of the process rather than kinetics per se. Nevertheless, the kinetics are covered and one complete chapter out of nine is entirely devoted to this aspect.

The literature is only covered through 1987, which is adequate for most free radical processes but somewhat behind in the fast-moving fields of group transfer and cationic polymerization. This shortcoming is compensated for by the substantial coverage of the Russian and East European literature, often lacking in U.S. texts. Otherwise, the literature coverage is extensive with more than 1500 references.

The arrangement of the book is rather unusual and very effective, at least to this reviewer. There is a short introductory chapter on polymerization per se followed by a useful chapter on the types and properties

of the monomers involved in the subsequent discussions.

These follow classical treatments on initiation, propagation, and termination. However, following the initiation chapter, there is an excellent discussion concerning the active center of polymerization of all types. The chapter on propagation is very extensive and far reaching. It is a little out of date, however, with regard to the newer results obtained both chemically and by high energy radiation concerning cationic polymerization. There follows an excellent discussion in a separate chapter on transfer reactions, but it is rather short and not very current.

The separate chapter on kinetics follows and is a useful summary and discussion concerning both the rates and degrees of polymerization. A short conclusion, which is quite stimulating, completes the book.

This is a book which is inadequate in some respects mainly due to the enormous extent of the field to be covered and the newer work published from 1988 to date. Nevertheless, the book is very stimulating and well worth reading. There are many "tidbits" hidden in the various chapters, and reading this book can give rise to new thoughts and ideas concerning this broad and now well-established field. It is recommended as reading material for all who are actively interested and engaged in the field.

Vivian T. Stannett, *North Carolina State University*

Supramolecular Chemistry, an Introduction. By Fritz Vögtle (University of Bonn). John Wiley & Sons: New York. 1991. viii + 337 pp. $150.00. ISBN 0-471-92802-X.

The term "supramolecular" is defined in Webster's *Seventh New Collegiate Dictionary* as "more complex than a molecule" or "composed of many molecules". This adjective was applied to "chemistry" by Jean-Marie Lehn to describe the field of organic complexation chemistry developed over the last two decades principally by Lehn, Charles J. Pedersen, and Donald J. Cram, corecipients of the 1987 Nobel Prize in Chemistry. Like the term "host–guest chemistry", borrowed by Cram from the study of solid-state inclusion compounds, supramolecular chemistry in its broadest sense applies to the design, synthesis, and investigation of any molecular aggregates or assemblies. This book is the first to fill the need for an overview of the supramolecular chemistry of organic and metallorganic compounds in solution, in mesophases, at interfaces, and in crystalline solids.

According to the preface, *Supramolecular Chemistry* arose from a series of lectures given at Bonn University that were to be incorporated into a textbook consisting of two parts: "Fascinating Molecules in Organic Chemistry" and "Aggregation of Molecules to Supramolecular Structures". The rapid pace of research in supramolecular chemistry and the wide scope of this topic required publication of the expanded lectures in *two* volumes. This book and *Fascinating Molecules in Organic Chemistry*, both published in the German textbook series, are connected by a chapter on phthalocyanines in the latter text and by the section on bipyridine in Chapter 2 of *Supramolecular Chemistry*. The latter was ably translated by Michel Grognuz from the German version, *Supramolekulare Chemie*.

This volume does not cover the field of supramolecular chemistry comprehensively, which is neither possible nor desirable in an introductory graduate-level or advanced undergraduate textbook. The book highlights a broad range of molecular complexes, assemblies, and practical applications. The depth of coverage varies considerably from chapter to chapter. The short introductory chapter entitled "Supramolecular, Bioorganic and Bioinorganic Chemistry" is excellent but could benefit from a discussion of fundamental intermolecular interactions and general concepts (e.g., preorganization). Detailed discussions incorporating historical perspective make delightful reading on certain topics, including siderophores (Section 2.2), cryptophanes (Section 4.3.1), clathrates (Chapter 5), directed crystal formation (Chapter 6), photoresponsive host–guest systems (Chapter 7), and liquid crystals (Chapter 8). Chapter 2 (Host–Guest Chemistry with Cations and Anions), Chapter 3 (Bioinorganic Model Compounds), Chapter 4 (Bioorganic Model Compounds), and Chapter 9 (Surfactants, Micelles, Vesicles: Preorganization of Interface-active Compounds) are good introductions to each of these broad fields. Chapter 10 (Organic Semiconductors, Conductors and Superconductors), Chapter 11 (Molecular Wires, Molecular Rectifiers and Molecular Transistors), and Chapter 12 (Light-induced Cleavage of Water) successfully introduce the reader to fascinating technical achievements and to promising future applications. Biological and polymer chemistry fall outside the scope of this book, despite the central importance of intermolecular interactions to these fields. Apparently due to page limits set within the German textbook series, discussion of certain topics is largely omitted, including the chemistry of carcerands and cryptands, as well as development of organic materials with magnetic and nonlinear optical properties.

Supramolecular Chemistry contains excellent illustrations, including stereoscopic diagrams of sufficiently high quality that they can be viewed clearly without stereoscopic lenses. Author and subject indices also make the book useful for reference purposes. In this regard the placement of references can be confusing to the reader since they appear sometimes at the end of a chapter and sometimes at the end of each section within a chapter. This is only a minor nuisance, and on the whole Professor Vögtle should be congratulated for compiling this diverse volume. While numerous, often autobiographical, reviews and monographs are appearing at an astonishing rate, *Supramolecular Chemistry* is the only "single-source" to turn to for information in this field. It is as excellent a text for a graduate-level special topics course as it is a reference work for new research students, as well as experienced scientists in related fields.

Thomas W. Bell, *State University of New York at Stony Brook*

Wood and Cellulosic Chemistry. Edited by David N.-S. Hon (Clemson University) and Nobuo Shiraishi (Koto University). Marcel Dekker, Inc.: New York and Basel. 1991. 1032 pp. $195.00. ISBN 0-8247-8304-2.

The editors' intent with this book was to review, in the English language, Japanese approaches to wood chemistry research in some depth with the hope that the Japanese approach to research and interpretation of data will stimulate future research in the field. Although this goal is certainly noble, this approach results in a biased (but not necessarily bad) view of the field of wood and cellulosic chemistry. To those versed in the field of cellulose chemistry, this predilection for the Japanese point of view will be recognized and the valuable contributions of the book will be well received; those new to the field of cellulose chemistry should seek additional sources of information.

The book is organized into three major sections: Part I, Structure and Chemistry; Part II, Degradation; and Part III, Modification and Utilization. Part I consists of 8 chapters and deals with the formation and structure of wood, the structure of cellulose, and chemical characterization of wood as well as with the chemistry of lignin, hemicelluloses, extractives, and bark. Part II has 6 chapters concerned mostly with chemical, photochemical, and biological degradation of wood, lignin, cellulose, and cellulosic materials. Chapter 12 of Part II, concerning the degradation of lignin, is perhaps the best written chapter in the book. Other topics such as the source of color in wood and the pyrolysis of wood are discussed. The 7 chapters of Part III cover a range of topics including chemical modification of wood and of cellulose, characterization of chemically modified cellulose, composites, wood plasticization, adhesives, and the utilization of wood and cellulose for chemicals and energy.

Because of the broad scope of the book, the contributions are generally loosely connected and overlapping. The book would have been much better if the editors had focused on a more narrow topic range with sharply defined contributions. A specialist, e.g., a synthetic or analytical chemist, seeking recent information on developments in their specific field would be disappointed to find that only limited parts of the book are useful. Despite its massive size and scope, the book does not cover some of the most recent and important developments in the field of cellulose chemistry. A most notable omission is that of the biosynthesis of cellulose. Although the contribution of chapter 17 provides a good discussion on the characterization of chemically modified cellulose, some of the most recent developments in characterization of cellulose and cellulose derivatives, particularly related to NMR spectroscopy, are conspicuously missing.

Interdispersed throughout the book is a wonderful collection of references which make the cost of this book quite reasonable. The rich source of references and the broad scope of the book make this collection a suitable addition for the library of both the experienced practitioner and those who are new to the field.

Charles M. Buchanan, *Eastman Chemical Company*

Ion Spectroscopies for Surface Analysis. Edited by A. W. Czanderna (Solar Energy Research Institute, Golden CO) and D. M. Hercules (University of Pittsburgh). Plenum: New York. 1991. xvii + 469 pp. $110.00. ISBN 0-306-43792-9.

Surface analysis is vital to characterization of a wide variety of materials including heterogeneous catalysts, integrated circuits, and protective coatings. This book reviews surface analysis techniques in which ions are emitted or scattered from condensed phases, focusing on Secondary Ion Mass Spectroscopy (SIMS), desorption ionization techniques for mass spectroscopy, laser ionization, Rutherford Backscattering (RBS), and Ion Scattering Spectroscopy (ISS). An introductory chapter introduces the readers to the principles of the techniques, and the techniques are compared to electron spectroscopies (Auger and X-ray photoelectron spectroscopies) for applicability in a concluding chapter.

SIMS is a very sensitive surface detection technique in which a keV ion beam sputters neutrals and ions from the surface of a solid. N. Winograd and B. J. Garrison (Pennsylvania State University) have written an excellent review of the fundamentals of SIMS and how it can be used to obtain detailed chemical and structural information. A good

discussion of simulation techniques to unravel the complex sputtering yields from SIMS is provided to evaluate quantitative SIMS.

K. L. Busch (Georgia Institute of Technology) reviewed fast atom bombardment (FAB) and laser desorption techniques for liberating high molecular weight (1000–100000 daltons) from condensed phases for mass spectrometric studies. Although this is not a surface analysis technique per se, it takes advantage of the surface to allow molecules to be desorbed where it can be ionized for characterization. An excellent discussion of the problems associated with sample preparation to facilitate the desorption process is included. A brief discussion of ionization techniques and the problems associated with analyzing mass spectra for very high molecular weight species is also provided. Christopher Becker (SRI International) has written a chapter discussing photoionization processes which serves as an excellent companion. Laser photoionization processes are more selective than other ionization techniques and are thus more useful in conjunction with mass spectroscopy to unravel the complex structures of the high molecular weight species.

RBS and nuclear reaction analysis are unique in their abilities to profile atomic compositions of buried interfaces in a nondestructive fashion. L. C. Feldman (AT&T Bell Laboratories) has reviewed these techniques in which very high energy ions are scattered by nuclear collisions. The technique has been extremely useful for thin film analysis in the semiconductor industry, and a number of examples of its application are illustrated.

ISS involves the scattering of low-energy ions from a surface. It is harder to implement than electron scattering, but it is more surface sensitive due to the lower penetration depths of ions compared to electrons. E. Taglauer (Max-Planck-Institut für Plasmaphysik) has reviewed the use of ISS for both compositional analysis and structural analysis with particular emphasis on adsorbates on well-defined metal surfaces.

This book presents several excellent reviews of the topics described above. It serves well as the starting point for further study and is well documented for additional references. The chapter by Busch I found to be a very good introduction to mass spectrometric analysis of high molecular weight species, but this book is not where I would expect to find such information. The concluding chapter by C. J. Powell (NIST), D. M. Hercules, and A. W. Czanderna did compare the various techniques, but an assessment of the commercially available equipment and suitability for general use was conspicuously absent. The book serves as a good reference for surface science practitioners. I tested the text in a graduate class and found that the book had to be supplemented with additional background material.

Jay B. Benziger, *Princeton University*

The Handbook of Infrared and Raman Characteristic Frequencies of Organic Molecules. By Daimay Lin-Vien (Shell Development Co.), Norman B. Colthup (retired), William G. Fateley (Kansas State University), and Jeanette G. Grasselli (Ohio University). Academic Press: New York. 1991. xvi + 503 pp. $89.95. ISBN 0-12-451160-0.

In the past decade, infrared spectroscopy has been rediscovered by many chemists because of the availability of inexpensive, fast, sensitive FT-IR spectrometers. Because of the commercial introduction of both Raman monochromators with CCD array detectors and Fourier transform Raman spectrometers, Raman spectrometry is now likely to undergo the same renaissance. The need for users of both types of instruments to interpret their data is, therefore, greater than ever. There have been numerous books on the interpretation of infrared spectra written over the past 30 years, of which Bellamy's text, *The Infrared Spectra of Complex Molecules*, has been the most heralded. Most books that have been published on the interpretation of infrared and Raman spectra concentrate heavily on the infrared, although the excellent text by Dollish, Fateley, and Bentley, *Characteristic Raman Frequencies of Organic Compounds*, concentrated entirely on Raman spectra. The books by Bellamy and Dollish et al. were both published over 15 years ago and are now out of print. A new text on this subject was desperately needed and this new book admirably addresses this need.

The book treats the interpretation of vibrational spectra on three levels. For the novice, it contains the well-known Colthup charts for spectra/structure correlation of mid-infrared spectra together with a tabulated summary of characteristic Raman group frequencies. Both formats are useful at different times, and I felt that it might have been beneficial to also present Raman group frequencies in a Colthup chart format and infrared group frequencies in a tabular format. The body of the book contains a detailed exposition of the characteristic infrared and Raman group frequencies of a *very* wide variety of organic functional groups and is exceptionally well done. On the third level, the book had one of the finer bibliographies and I have encountered on this subject, with over 1300 references. Obviously, a huge effort went into its preparation. It is truly an academic tour de force.

A large number of both infrared and Raman reference spectra are presented in the final chapter and two of the appendices. Chapter 18 contains the infrared spectra and both parallel and perpendicular polarized Raman spectra of 121 compounds from the Sadtler collection in a format where the wavenumbers are aligned for all three spectra, making for easy comparison. The spectra are of high quality and the compounds have been selected to be representative of the classes of compounds discussed in the previous 16 chapters. To fill in some of the perceived gaps in Chapter 18, infrared reference spectra of 30 additional compounds from the Aldrich collection are shown in Appendix 1, together with the (unpolarized) Raman reference spectra of the same compounds taken from the 1974 text by Dollish et al. Finally, 20 infrared and Raman spectra of selected carbohydrates, steroids, organometallic compounds, and polymers are shown in Appendix 2.

This book achieved its goals admirably and should become the new "Bellamy" for at least the next ten years. It is strongly recommended for anyone who deals with the interpretation of the vibrational spectra of organic compounds.

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Structure and Properties of Molecular Crystals. Studies in Physical and Theoretical Chemistry. Volume 69. Edited by M. Pierrot (Université Aix-Marseille). Elsevier: Amsterdam and New York. 1991. 354 pp. $146.25. ISBN 0-444-88177-8.

The book is divided into six chapters, each of which deals with a different aspect of the structure and properties of molecular crystals. Chapter 1 presents crystallography as the primary tool for the investigation of these materials. It includes an introduction to the actual problems that arise in a structure determination, lists some sources of available data, and then describes the results of some recent applications to the study of the conformations, deformations, and reactions of organic molecules in solids. Chapter 2 is devoted to solid-state reactions, and an attempt is made to integrate the behavior of a variety of reacting systems within a conceptual framework. It is concluded that more work needs to be done to obtain "far-reaching and definitive interpretations". Chapter 3 is a very attractive review of "Intermolecular Energies and Packing Modes in Organic Crystals". The successes of the past are reviewed. The prospects for the future seem hopeful, and in the discussion the results of quantum mechanical calculations are blended with empirical studies and data available from X-ray structure determinations. Chapter 4 contains a relatively brief discussion of phase transitions and polymorphism. Displacive transitions and soft vibrational modes are described, and favorable attention is paid to the "Interface Geometric Model of Polymorphic Transformations". A strongly physical interpretation of "Organic Conductors" is the subject of Chapter 5. The theoretical analysis is applied to many examples of electrical conductors, insulators, and superconductors of low dimensionality. In addition, an effort is made to suggest rational procedures to be used in the development of new materials. In the final chapter, a very compact discussion of optical nonlinearity is presented, followed by "An oriented-gas description of the medium ..." which can be used to optimize potentially desirable behavior beginning with an analysis of molecular properties. The second problem, namely combining such information with the generation of appropriate crystal structures in order to actually produce such desirable optical behavior, is then discussed.

The typeface and type size vary from chapter to chapter. There are a large number of spelling errors and awkward grammatical constructions. These flaws do not detract significantly from the book which is a valuable, up-to-date review of the topics that are covered, as well as a source of expert critical comments and proposals for future work.

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Reaction Mechanisms of Inorganic and Organometallic Systems. By Robert B. Jordan (University of Alberta). Oxford: Oxford and New York. 1991. viii + 282 pp. $39.00. ISBN 0-19-506945-5.

This remarkably inexpensive book is appropriate for a one-semester graduate course aimed at covering inorganic reaction mechanisms for students with a range of interests. It covers the basics of chemical kinetics and applies these principles to reactions of both classical coordination complexes and organometallic compounds. Concluding chapters briefly introduce inorganic photochemistry and bioinorganic chemistry. The text is very well written, and the references are extensive, well chosen, and current through 1990 (an impressive achievement). Approximately six homework problems are included for each chapter; these are well conceived and, in a few cases, encourage the student to consult the literature.

In my view Jordan's book is comparable to those by Atwood (1985) and Gordon and Katakis (1987). Wilkin's classic has been revised (1991); it is not directly comparable in that it deals exclusively with transition metal complexes, is considerably more detailed, and would be difficult to cover in a one-semester course. I am currently using Jordan's

text in our course which attracts students from all the traditional divisions of chemistry, and am quite pleased with it. The choice of topics, the balance between organometallic and more classical systems, the thoughtful analysis of current research areas where generalities are difficult to sustain, and the inclusion of relevant data from many different types of experiments are especially noteworthy.

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Bioorganic Chemistry Frontiers. Volume 2. Edited by H. Dugas (Université de Montréal). Springer-Verlag: Berlin, Heidelberg, and New York. 1991. 252 pp. $89.00. ISBN 0-387-53365-6.

This series reviews a broad range of research in bioorganic chemistry. In this volume are "the design of artificial nucleases (Corey, Zuckermann, and Schultz), molecular tweezers (Zimmerman), hydrolytic cleavage with metal complexes (Chin, Banaszczyk, Jubian, Kim, and Mrejen), different aspects of molecular recognition (Hamilton), supramolecular assemblies and functional models of membranes and enzymes (Murakami and Kikuchi), and the concept of molecular topology (Sauvage and Dietrich)". The references for the most part are 1989 or older. There is a moderately useful index. This volume demonstrates the great scope of bioorganic chemistry by augmenting the classical area of enzyme and coenzyme mechanisms with the design of novel molecular assemblies whose combination of disparate functionalities is leading to many new research areas. The reviews capture each researcher's original conceptions as well as their future intentions and expectations. This volume makes striking use of figures that lend aesthetics to the science and thus renders Bioorganic Chemistry Frontiers most lucid and vivid.

Schultz et al. provide an illuminating overview of various approaches toward the design of new enzymes using site-directed mutagenesis and chemical modification. They describe one particular journey toward the development of artificial nucleases by tethering nonspecific phosphodiesterases to highly selective oligonucleotides to create hybrid nucleases that may eventually be capable of selectively cleaving any DNA or RNA sequence. Although recognition is limited to locally induced single stranded DNA or RNA, use of ribonuclease A provides cleavage with adjustable catalytic efficiency via site-directed mutagenesis; the cleavage rate can thus be reduced to a rate that is complementary to the rate of recognition.

Zimmerman reviews a host–guest chemist's approach to elucidating the roles of hydrogen bonding and $\pi-\pi$ interactions in molecular recognition. He treats these factors together and separately so that their cooperativity is discussed. He elegantly illustrates the necessity for π-donor–acceptor interactions in complexation of arenes and shows that a second π-interaction is less energetic than the first. I was a bit dismayed to see a review of the complexation of arenes without reference to the work of F. N. Diederich.

Kikuchi and Murakami discuss the structure of model membranes and their use in catalyzing enzymatic reactions. Unusually stable single-walled vesicles are created using quaternary ammonium, carboxylates, sulfonates, or sugars as the polar head groups, amino acids as the "hydrogen belt", and *N,N*-dialkyl chains as the lipid. The entrance of hydrophobic coenzymes and substrates into the vesicles renders these prototypes of "artificial cells" capable of catalyzing reactions such as transamination, NADH-type reduction, and enantioselective hydrolysis of esters.

Hamilton reviews the role of hydrogen bonding and π-interactions in model systems. This account is similar to, but longer and more comprehensive than Zimmerman's, and it has a greater focus on hydrogen bonding. The discussion includes the macrocyclic and nonmacrocyclic complexation of peptides, ureas, barbiturates, etc. This work provides support for the notion that van der Waals and π-interactions, which can perhaps be lumped together as "hydrophobic binding", in natural (aqueous) systems may be responsible for the majority of binding energy for drugs and substrates by receptors and enzymes, whereas hydrogen bonds may function mainly as orienting or recognition elements.

Chin et al. discuss the extraordinary utility of metalloenzyme models in elucidating the mechanism and carrying out the catalytic hydrolysis of esters, amides, nitriles, and phosphomonoesters and phosphodiesters. They elegantly show that the mechanism of hydrolysis varies with esters and that catalyst design should therefore be tailored to each ester. In one case, a rate enhancement of ten billion is obtained in cleavage of phosphodiesters.

The review by Sauvage et al. of the synthesis of catenanes and knots is an exemplary illustration of the expansive power of organic chemistry. The review begins with turn of the century notions about interlocking organic molecules, proceeds through crude early synthetic attempts, low yields, and poor characterization of catenanes, reveals recent elegant syntheses and structurally elucidated catenanes, and finishes with the mesmerizing creation of the first trefoil knot. This review recaptures the excitement of discovery and creation that is often lost in technical reports.

Experts will find this volume enjoyable. Non-experts interested in molecular design/engineering will find *Bioorganic Chemistry Frontiers* to be a welcome entrance to the diverse fields within.

John C. Sherman, *University of British Columbia*

Isotopes in the Physical and Biomedical Sciences. Volume 2. Isotope Applications in NMR Studies. Edited by E. Buncel (Queen's University, Kingston, Ontario) and J. R. Jones (University of Surrey). Elsevier: New York and Amsterdam. 1991. xi + 488 pp. $274.50. ISBN 0-444-89090-4.

This book is divided into nine chapters. Each chapter is a review article covering a specific area of application and authored by a different researcher. As is often the case in camera-ready publications, the font, style, and notation vary considerably from article to article. Each author is undoubtedly an expert in the particular field, but the editors seem to have made no special attempt to ensure uniform or comprehensive coverage of the subject matter as a whole. For example, no mention is made of the exciting new work in structure determination of larger biomolecules (10–30 kDa) using carbon-13 and nitrogen-15 enrichment combined with the latest 3D NMR techniques. Most of those actively pursuing isotopic labeling for the purpose of structure determination would consider this omission to be a significant shortcoming.

Much of the book focuses upon isotope effects on the chemical shift, including detailed theoretical considerations as well as many different experimental techniques. Tritium NMR, while not likely to be practiced by many researchers, is shown to be particularly telling in hydrogen exchange problems. Deuterium NMR has a long history of application in liquid crystal and membrane systems, where the quadrupolar coupling plays a central role in understanding the spectrum and is outlined in some detail for biologically relevant systems. The alkali metals receive what most would consider to be a slightly larger fraction of the space than usual. Those interested in complex formation, chemical exchange, and organolithium compounds will approve of the emphasis. Biosynthetic studies clearly benefit from ^{13}C labeling techniques, and examples from plant metabolism are treated in some detail.

In summary, this book will appeal to readers who are interested in the specific subject matter of one of the chapters, but some of the most recent applications in this important area are conspicuously absent.

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