alkyl group to nitrogen as is observed with simple alkyl complexes. The fragmentation of cobalt β-oxygen substituted σ-alkyl complexes has been reported to occur in preference to migration.[16] Similarly, oxidation of **5** does not generate any N-alkyl complex **4**. Treatment of **11** with heat or light gave traces of the ketone **12** consistent with homolytic cleavage of the Co–C bond.[17] In the presence of triflic acid **11** gave a high yield of the alkene but no oxygen-containing products.

In parallel with the iron system described above, reduction of **11** (Na/Hg/DME) gave epoxide **9** (>90%) with a trace of alkene. However, the yield of alkene increased with time since under the reductive conditions the cobalt(I) porphyrin can be alkylated by the epoxide[18] to give **11** which can then be reductively cleaved generating alkene at the expense of epoxide (Scheme II).

The metallocycle **1** is an alternative way of representing the σ-alkyliron porphyrin **5**. Metal alkyls can be deprotonated to carbene complexes,[19] and we suggest that the novel chemistry described by Groves et al.[4] can be alternatively explained by the chemistry described above for σ-alkyl metal complexes.

We suggest that the first step in the deuterium exchange reactions[4] could involve electron transfer from the olefin and N-alkylation of the subsequent cation to give a β-hydroxy-*N*-alkylporphyrin.[6c] We note, again, that deuterium exchange during the enzymic reaction occurs *only under reducing conditions*, a condition where N→Fe alkyl migration can occur.[11,12,20] Castellino and Bruice[2] describe the transition states needed for N-alkylation; this and the subsequent migration of the alkyl group to iron will be more favorable with very small substrates (this may explain why even butene-1 shows little and hexene-1 no deuterium exchange[4]). Cleavage of the Fe–C bond could then give epoxide and alkene, both labeled if exchange occurs with the σ-alkyl complex.

Acknowledgment. This work was supported by the United States National Institutes of Health, GM 29198, and the Natural and Engineering Research Council of Canada.

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*Book Reviews**

Electroanalytical Measurements in Flowing Liquids. By K. Štulík and V. Pacáková (Charles University, Prague). John Wiley & Sons: New York. 1987. 290 pp. $77.95. ISBN 0470-20875-9.

The stated intention of this text is to bridge the gap between analytical flow measurements and pertinent electroanalytical methodologies, with emphasis largely on laboratory practice rather than industrial monitoring. However, it should prove useful both to those with interests in lab analysis and separations, e.g., the growing use of LC-ED (liquid chromatography–electrochemical detection), and to industrial practitioners with flow detection/measurement problems. The contents are organized in six chapters with copious references to up-to-date electroanalytical flow techniques and developments.

Chapter One introduces general terminology and discusses the advantages/disadvantages of segmented flow analysis (SFA), continuous flow analysis (CFA), and flow–injection analysis (FIA). Electrochemical techniques are categorized without detailed theoretical discussion; however, extensive references are given to books that describe modern electrochemical methods. The chapter concludes with some references to industrial analysis problems and automation. Chapter Two briefly treats the theory of electroanalytical flow measurements, first by outlining detector signal criteria, next by giving a summary of classical hydrodynamic principles and general aspects, and finally by providing a section on analyte zone dispersion. These first two chapters attempt only an introductory treatment to hydrodynamic engineering. In Chapter Three, the design and operational parameters for particular electrochemical flow detectors are covered with greater emphasis on practical aspects. Included are on-line ISEs (ion-selective electrodes, including ISFETS), voltammetric and coulometric detectors and their maintenance in a reproducibly active state, cell design considerations, and conductometric and high-frequency impedance detectors. Chapter Four continues with valuable practical details of pumps, instrumentation for gradient elution HPLC, sample introduction techniques, reservoirs, mixers, reactors, and temperature control. The final two chapters cover general analytical methods and a compilation of selected applications, respectively. Methodology includes calibration, direct measurements, titrations, electrochemical pre-concentration techniques for stripping analyses, spectroelectrochemical methods of photochemical derivative formation (abbreviated to HPLC-hν-ED), the use of enzymes, and a section describing the applications and advantages of electrochemical immunoassays. Finally, broad ranges of applications for biologically important substances, drugs, metals, organometallics, pesticides and environmental pollutants, etc., are categorized by using the various representative flow/electrochemical methods. Overall, although the condensed presentation is not especially readable in parts, the book is jam-packed with information of value to biochemists, chromatographers, electrochemists as well as industrial analytical chemists. Its authors are to be commended for their timely extensive survey and coverage of the literature of these topics.

Robert J. Gale, *Louisiana State University*

Metal–Support Interactions in Catalysis, Sintering, and Redispersion. Edited by Scott A. Stevenson, J. A. Dumesic, R. T. K. Baker, and Eli Ruckenstein. Van Nostrand Reinhold Catalysis Series. Van Nostrand Reinhold Company: New York. 1987. xii + 315 pp. $62.95. ISBN 0-442-21160-0.

This book is introduced as the first in a series that would consider specific topics in catalysis. It treats in detail the phenomenon of strong metal–support interactions (SMSI) and the thermodynamic basis for the sintering and redispersion of supported metal particles. The book is divided into two sections of nine chapters each. Section I (Metal–Support Interactions: Discovery, Characterization, and Implications) is made up of contributions by several authors. However, Stevenson, Baker, Dumesic, G. B. Raupp, and S. J. Tauster contribute to eight chapters. Section II (The Role of Interactions and Surface Phenomena in Sintering and Redispersion of Supported Metal Catalysts) is written in its entirety by E. Ruckenstein. The two sections complement each other, and the entire volume provides a perceptive and balanced account of metal–support interactions.

Section I is written in the coherent fashion of a lengthy review article. Data from the literature up to 1985, on the interaction of group VIII metals with reducible oxides, are summarized in the form of very clear diagrams. The section begins with an historical introduction, followed by a review of how SMSI manifests itself in chemisorption studies. The authors then consider how SMSI complicates the task of catalyst characterization. Data relating to the nature of the reduced support are reviewed, and the interrelationship between the support, the particle size distribution, and particle morphology is discussed. The results of catalytic studies are discussed in detail, with special emphasis on the fact that SMSI often improves activity or selectivity for CO hydrogenation, whereas hydrogenolysis reactions are suppressed. The longest chapter of the section is devoted to a critical analysis of the various models for SMSI. Most emphasis is placed on the decoration model, and the possible role of electronic perturbation at the oxide–metal perimeter. In an 8-page summary of the section the authors emphasize that the dynamic nature of SMSI makes the phenomenon a difficult one to study experimentally, and that critical pieces of information remain unknown. The entire section is written in such a well thought out and balanced style that it transcends the domain of SMSI and will provide many ideas for experiments on metal–support interactions.

In Section II of the book, Ruckenstein considers how metal–support interactions determine the changes in small metal particles that occur on

*Unsigned book reviews are by the Book Review Editor.

pretreatment and during catalytic reaction. The treatment draws heavily from the theoretical and experimental work of Ruckenstein and coworkers. Mechanisms for sintering and redispersion are presented in mathematical detail. The author shows that mechanisms for sintering should take into account both the migration and coalescence of crystallites and the emission, migration, and capture of single atoms. The phenomena of spreading and wetting, as determined by the interfacial energies, are shown to influence both of the above mentioned mechanisms. A distinction is made between global and direct Ostwald ripening. Results obtained in the authors laboratory, using TEM on the sintering in H_2 and O_2 atmospheres of Pd, Ni, and Fe/Al_2O_3 model systems are discussed in detail. The author repeats a warning, voiced in Section I, that some important structural information may not be detectable in electron micrographs, in this case the existence of two-dimensional films around the crystallites. In general, Section II may provide some interesting ideas for the application of STM in studies of sintering and redispersion. The section concludes with a model for SMSI, which closely matches that proposed in Section I. Overall, Section II deals with dynamic aspects of the metal–support system, and thus it is an excellent complement to Section I.

The book may be recommended without hesitation to all who are interested in supported metal catalysts.

Peter McBreen, *Laval University*

Computer-Supported Spectroscopic Databases. By Jure Zupan (Boris Kidrič Institute of Chemistry, Ljubljana, Yugoslavia). John Wiley and Sons: New York. 1986. viii + 165 pp. $49.95. ISBN 0-470-20730-2.

"Spectroscopic data banks, either computerized or not, in many respects resemble icebergs. In both, the public (or the users) always see only a small (but the most shiny) part.... The larger they grow, the more dangerous they become if approached from the wrong direction." So opens the Zupan-edited book on spectral databases. And the problem described is important. While most scientists recognize that the elucidation of structure by database searching is not free from errors, it is also clear that automated searching is used by many practicing spectroscopists, perfect or not.

The book has eight chapters, each written by different authors, on different aspects of databases. The first three chapters describe the structure of some spectroscopic databases. C. A. Shelley describes the Kodak spectroscopy network as an example of one approach to a spectroscopy database. DuBois and Sobel describe the importance of artificial intelligence and the problems of data banks as compared to expert systems. Jure and Zupan contribute a chapter on the hierarchical ordering of spectral databases. They argue that the ordering should be performed on the basis of whole spectra, not selected features. The next four chapters describe databases that are derived from spectra obtained on a specific type of instrument: IR, Mass Spec, or NMR. Somberg discusses Bruker's IR databank. The next chapter is written by Passlack and Bremser, who present an information system that has 17000 IR spectra and is cross-linked with the BASF ^{13}C NMR library. Heller describes the rigorous evaluation procedure for mass spectra to be included in the NIH/EPA system. Sasaki presents the results of his work linking ^{1}H and ^{13}C NMR spectra.

In the last chapter Hippe discusses the potential utility of artificial intelligence in the overall structure elucidation process.

Zupan's book is not for the generalist, or even the occasional database user, but it is aimed toward the people who are compiling data, structuring databases, and writing expert systems. If you lean this way, you should take a serious look at this book.

Scott R. Goode, *University of South Carolina*

Analytical Isotachophoresis. By P. Boček, M. Deml, P. Gebauer, and V. Dolník (Czechoslovak Academy of Sciences). VCH Publishers: New York. 1987. viii + 237 pp. $110.00. ISBN 0-89573-477-X.

This book provides the important reminder, in the midst of the current surge of interest in capillary zone electrophoresis, that the capillary format has been in use for approximately 25 years for isotachophoretic determinations. The authors form the nucleus of a group in Brno that has been one of the leaders in the development of capillary isotachophoresis (ITP). The stated aim of the book is to provide its audience with an understanding of the theory, instrumentation, and applications of the technique. Each of these areas is treated in moderate depth, thereby making it an appropriate introduction for the novice in the field. In accord with such an audience, much of it is written in a style that is easy to read and comprehend, with important points often being reiterated where helpful. Many practical hints and valuable tidbits of information, which can be of great value to the beginner, are included. Adequate references are provided for those seeking greater detail.

The text is divided into 11 chapters, the first three of which are introductory in nature, presenting the history of the method, a general introduction to electrophoresis, and fundamental electrophoretic concepts. In the subsequent three chapters, the authors proceed through a general introduction of capillary ITP, its use for analysis and a discussion of useful electrolyte systems. A chapter on instrumentation is followed by a mathematical description of the method, with the ensuing two chapters discussing special systems and methods, and practical aspects of ITP analysis. One unfortunate result of this organization is that specific subjects are often treated in several places in the book. For example, the reader interested in the use of potential gradient detection will find information in Chapters 4, 5, and 7 on the subject. This situation is alleviated somewhat by the presence of much detail in the Table of Contents. The final chapter presents a good overview of the use of capillary ITP for the analysis of a variety of compounds in body fluids such as carboxylic acids, organic bases including purines and pyrimidines, amino acids, peptides, proteins, nucleotides, nucleosides, and inorganic ions. Other matrices that are discussed comprise foodstuffs and environmental, agricultural, and industrial samples. This chapter includes an extensive reference list.

Richard A. Mosher, *University of Arizona*

Measurement, Statistics, and Computation. By David McCormick (Manchester Polytechnic) and Alan Roach (Paisley College of Technology). John Wiley & Sons: New York. 1987. xx + 760 pp. $42.95. ISBN 0471-91367-7.

This book, part of the Analytical Chemistry by Open Learning series, is a tutorial on elementary statistics applied to analytical chemistry. It is intended to be used for self-study by practicing analytical chemists and technicians who wish to develop an understanding of the elementary aspects of practical statistics. Topics covered include accuracy and precision, significant figures, the normal distribution, treatment of outliers, small sample and the estimated of mean and standard deviation, comparisons of means and standard deviations, simple linear regression, correlation, and quality control statistics. The treatment is practical rather than theoretical; no mathematics beyond high-school level is assumed and derivations are few. The book is written in a rather breezy, light-hearted style, with many carefully chosen numeric examples to illustrate important concepts and calculation methods. Calculations are illustrated with a series of simple computer programs written in BASIC, suitable for use with programmable hand-held calculators and low-end home computers.

Several more advanced topics are not covered in the book: analysis of variance, multivariate regression, experimental design, and optimization. The treatment of computer use is a bit old fashioned, being limited to elementary BASIC programming. Unfortunately, no mention is made of spreadsheet programs, even though they are now widely used by laboratory personnel for data handling and computation.

On the whole, this book is very well suited to its stated objectives.

T. C. O'Haver, *University of Maryland*

Polarography and other Voltammetric Methods. By Tom Riley (Brighton Polytechnic) and Arthur Watson (Paisley College of Technology). John Wiley & Sons: New York. 1987. xix + 283 pp. $24.95. ISBN 0471-91395-2.

This is another volume in the excellent ACOL (Analytical Chemistry by Open Learning) series of self-teaching texts. As such, it requires comment on two levels: (1) does it adequately cover the subject matter and (2) is the subject matter, indeed, presented in a self-teaching manner? The answer to the latter question is, simply, yes. This volume, as can the others in the series, can be used to obtain a basal understanding of polarography without the aid of an instructor.

The answer to the former question is a different matter, however. The major deficiency in the text is that it does not include a description of some of the more modern voltammetric techniques, most notably square-wave voltammetry and voltammetry at microelectrodes. However, the authors do a very credible job of introducing and describing simple electrochemical apparatus and electrode phenomena, with particular emphasis placed on the dropping mercury electrode. The only want here is a lack of discussion of electrocapillary phenomena, albeit, with modern instrumentation which does not depend simply on gravity flow to deliver mercury, this is not a major consideration. Good information is presented on the shapes of polarographic waves under various conditions (i.e., heterogeneous kinetics, etc.), as well as a sound discussion on obtaining experimental information from the recorded polarogram. The coverage of normal pulse and differential pulse methods is somewhat brief, however, as is the discussion of stripping voltammetry. As mentioned above, though, the book truly suffers from the absence of information on square-wave voltammetry, and other more recent developments. A plus for the book, however, is a chapter discussing the relative position of polarography and voltammetric techniques in the overall spectrum of methods available to the analyst.

All in all, this volume is quite good and would be useful as a first introduction to voltammetric techniques for the unacquainted professional and for the advanced student. It is not, but does not pretend to be, an exhaustive, scholarly text, but a hands-on, "nuts and bolts" approach to the subject, and in that respect, it succeeds admirably.

Towner B. Scheffler, *The University of South Florida*

Microbiology in the Developing World. Edited by E. J. Dasilva (UNESCO), Y. R. Dommergues (BSSFT Laboratory, Nogent sur Marne), E. J. Nyns (Bioengineering Department, University of Louvain), and C. Ratledge (Department of Biochemistry, University of Hull). Oxford University Press: Oxford, New York, and Tokyo. 1987. viii + 444 pp. $59.95. ISBN 0-19-854719-6.

Thirty-three authors have contributed to this important addition to the literature on technology for developing countries. Topics that are included are the following: nitrogen fixation in tropical agriculture, biotechnology in arid land and in integrated rural development, microbial bioinsecticides, marine biotechnology, fermented foods, protoplast fusion and regeneration of Streptomyces, biogas production in China, fermentation technology and its impact on culture and society, and alcohol production. The list continues with chapters devoted to single-cell protein, algae and sewage treatment, biodeterioration, the MIRCEN program, principles and options for biotechnology for developing countries, computers, bioinformatics, and patent developments. An index is included. The editors state that this volume should be seen as a complement to the new scientific periodical The MIRCEN Journal and as an illustration of world-wide activities and not as a definitive text. It will be very useful to anyone interested in biotechnology and developing countries. It is typeset and well illustrated.

M. C. W. Smith, *Ann Arbor, Michigan*

Basic Biotechnology. A Student's Guide. Edited by Paul Prave, Uwe Faust, Wolfgang Sittig, and Dieter A. Sukatsch. VCH Publishers: New York. 1987. x + 344 pp. $29.95. ISBN 0-89573-646-2.

This book was designed as a student text book. It provides the basis for a comprehensive course in biotechnology.

Part 1, titled Biotechnology-History, Processes, and Products, includes chapters devoted to the development of biotechnology, processes using mixed and pure cultures, basic research, processes, the importance of biotechnology, and literature.

Part 2 describes the fundamentals of biotechnology. Topics included are the biology of microorganisms and genetic procedures for strain improvement, the metabolism of microorganisms, plant and animal cell culture, bioreactors, biological regulation and process control, and product recovery. Literature and a subject index are included. This book is typeset and includes a large number of excellent illustrations.

M. C. W. Smith, *Ann Arbor, Michigan*

The Biotechnology Directory. 1988. Products, Companies, Research, and Organizations. By J. Coombs and Y. R. Alston. Stockton Press: New York. 1987. xviii + 500 pp. $150.00. ISBN 0-935859-13-6.

The authors define biotechnology not only as an alternate term for industrial microbiology and genetic engineering but include aspects of animal and human health care, waste and pollution management, advanced plant breeding, enhanced oil recovery, mineral leaching, diagnostics and analytical equipment, biosensors, biomass energy systems, and so on. This book covers activities related to biotechnology in western Europe, North America, Brazil, Australasia, and Japan. It is divided into three parts: One is devoted to international organizations and information services, two describe government organizations, associations, and societies, while three includes companies, research institutes, and university departments. Part three includes sources for equipment, chemicals, and cultures. Also included are indices for organizations, buyers guide, buyers guide classification, an advertisers index, and a product, research, and services buyers guide.

This book brings together an enormous amount of information and will be a valuable resource for anyone working in biotechnology.

M. C. W. Smith, *Ann Arbor, Michigan*

Nitrosation. By D. L. H. Williams (Durham University). Cambridge University Press: Cambridge and New York. 1988. x + 214 pp. $49.50. ISBN 0-521-26796-X.

Nitrosation may be brought about by a variety of reagents, including nitrous acid, oxides of nitrogen, alkyl nitrites, etc., and it may take place at various elements, but especially at carbon or nitrogen. Its history goes back to the first half of the 19th century; interest in it experienced a revival beginning in the 1960's, owing to concern about nitrosamines and the action of contaminants in the atmosphere on material of all kinds. The time thus seems ripe for a book on the subject.

This book treats the subject from both synthetic and mechanistic aspects. The coverage is representative rather than comprehensive, and the presentation is comparative and critical. The result is to give the reader a good feel for the subject; understanding is not overwhelmed by descriptive fact (and vice versa). The introductory chapter treats the reagents involved in nitrosation. Two chapters each are devoted to nitrosation at carbon and at nitrogen; one of the latter deals with rearrangements of nitrosamines and the behavior of nitrosamines as nitrosating agents. Nitrosation at oxygen and at sulfur occupies two chapters; the final chapter is titled "Nitrosation involving metal complexes". Except for nitrosamines (a special case) and alkyl nitrites, the products of nitrosation are not discussed for themselves.

The preface is dated September 1986, and a few 1986 references can be found. However, not all significant earlier references are included; among these may be mentioned the 1985 (Third) edition of Saunders' *Aromatic Diazo Compounds*, by Saunders and Allen (Edward Arnold: Baltimore). The index of just 2 pages is not really adequate. Nevertheless, this is a useful, helpful book that should find substantial use in academic, governmental, and industrial libraries.

Nitrile Oxides, Nitrones, and Nitronates in Organic Synthesis. By K. B. G. Torssell. VCH Publishers: Weinheim and New York. 1988. xii + 332 pp. $59.95. ISBN 0-89573-304-8.

This is a book in the Organic Nitro Chemistry Series; it is subtitled Novel Strategies in Synthesis. The emphasis is on 1,3-cycloaddition reactions to produce heterocycles, which may themselves be used in synthesis of nonheterocyclic compounds.

The first chapter is a general introduction and includes some details about the chemistry of isoxazoles, isoxazolines, and isoxazolidines. The next three chapters are devoted to the general chemistry of the three classes of compounds in the title. The last chapter is more than half the book, and it presents applications of the foregoing classes of compounds in synthesis. The organization is largely according to the type of product (e.g., furans, 2-amino alcohols, β-lactams), but there are sections on processes, such as 1,3-carbonyl transposition and cycloaddition of oximes.

Structural formulas are plentiful and good. Many tables of useful data are included. Nomenclature is generally accurate, although it is a pity to see the "-oline" terms for five-membered heterocycles (e.g., isoxazoline) used with the long-disapproved use of a single cipher to locate the double bond, instead of Δ with superscript.

The bibliographies are very large (735 references in Chapter 5). An addendum of 39 pages, subdivided according to chapter, summarizes material published between December 1985 and August 1987. A true author index (26 pages) dwarfs the 6-page subject index.

Phenothiazines and 1,4-Benzothiazines. Chemical and Biomedical Aspects. Bioactive Molecules. Volume 4. Edited by R. R. Gupta. Elsevier Science Publishers: Amsterdam and New York. 1988. xxii + 992 pp. ISBN 0-444-42967-0.

This comprehensive work is roughly half about the chemistry and half about the pharmaceutical aspects of phenothiazines and benzophenothiazines. There are 16 internationally contributed chapters. Phenothiazine began its "career" in the 19th century in connection with dyestuffs. In the 1950's, the properties of aminoalkyl phenothiazines in the treatment of a wide range of ills, especially psychoses, became recognized, and exploration of phenothiazine chemistry accelerated.

In this book, synthesis, reactions, spectroscopic properties, crystal structures, structure–activity relationships, biochemical and biological effects, etc., are reviewed at length. Structural formulas are helpfully numerous, and much information is given in the extensive tables. The chapters are prolifically referenced, and there is a true (and therefore lengthy) author index. The subject index is extensive and well designed.

The chemistry of phenothiazines was reviewed 20 years ago in Volume 9 of *Advances in Heterocyclic Chemistry* (edited by Katritzky and Boulton). The present book not only brings the subject up to date but provides the biochemical and pharmaceutical coverage that could not be included in the 1968 review. Only two chapters did not materialize to complete the planned coverage: metabolism and nonbehavioral actions and their therapeutic implications.

Spectroscopic Methods in Organic Chemistry. Fourth Edition. By Dudley H. Williams (Churchill College, Cambridge) and Ian Fleming (Pembroke College, Cambridge). McGraw-Hill Book Company (UK) Limited: London. 1987. xii + 246 pp. £25.00. ISBN 0-07-084166-7.

This book is the fourth edition of a long-standing text on the spectroscopy of organic compounds. It is intended to serve as a textbook for a first course on the subject as well as a reference source for practicing organic chemists. Spectroscopic methods covered include ultraviolet–visible (UV–vis) spectroscopy, infrared (IR) spectroscopy, nuclear magnetic resonance (NMR) spectroscopy, and mass spectroscopy (MS). The emphasis is primarily on spectra interpretation. The fourth edition

differs from the third edition (1980) primarily in its increased and updated coverage of NMR and MS techniques, which have changed substantially in recent years.

The opening chapter, on UV–vis spectroscopy, is very traditional and somewhat outdated. It is especially troublesome that electronic transition energies are said to be a measure of orbital-energy differences rather than state-energy differences. Additionally, *isosbestic point* is given the limited definition as "a point common to all curves produced in the spectra of a compound taken at several *pH values*". There is no coverage of "charge-transfer" transitions, and the important use of UV–vis methods in the characterization of matrix-isolated species or in time-resolved spectroscopy is not mentioned. Despite its shortcomings, this chapter is well written and does adequately discuss the common $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$ transitions of organic compounds (including coverage of the Woodward rules, etc.).

IR spectroscopy is covered in chapter two. Sample preparation and basic instrumental operation procedures are discussed. The use and advantages of Fourier-transform IR are covered, and a qualitative discussion of selection rules, including a brief account of Raman spectroscopy, is provided. Explanations and tables of the characteristic group absorption frequencies are included along with a set of nine interpreted IR spectra. This chapter is instructional, and its well-organized tables of data should make it a handy reference for the practitioner.

Chapter three concerns NMR spectroscopy and is the most extensive in the book. Mathematical descriptions of the various NMR experiments are kept to a minimum—the emphasis is on spectral interpretation and on structure elucidation. Topics covered include the following: the chemical shift, spin–spin coupling, common ^1H–^1H splitting patterns, line broadening and environmental exchange, and new techniques in FT–NMR spectroscopy (i.e., spin decoupling, difference NOE, COSY, NOESY, DEPT). The chapter ends with a plethora of useful chemical shift and coupling constant tables. This chapter successfully introduces the reader to modern NMR techniques without becoming too technical.

Mass Spectrometry is covered in chapter four. About equal time is given to discussion of modern instrumental design and ionization methods as to coverage of basic ion-fragmentation patterns and spectral interpretation. Again the presentation is qualitative, involving little math. A table of common fragment ion composition ends the chapter.

The final chapter contains a short discussion of how one integrates the various spectroscopic methods for purposes of final structure elucidation. There are four solved structural problems and a set of twelve unworked problems.

In general, this work accomplishes its goal of introducing the beginning student to the solving of organic structural problems through spectroscopy and provides him with a handbook of tables necessary to put his new knowledge into practice. Because the material is covered in a primarily qualitative manner and because other more specialized spectroscopic methods such as microwave spectroscopy, X-ray diffraction, electron-spin resonance, solid-state NMR, and optical methods utilizing polarized light are not discussed, some instructors may find this text more suited to an advanced undergraduate course than to a graduate course. In whatever course this text is used, there will likely be a need for an additional source of structural problems.

S. C. Blackstock, *Vanderbilt University*

Naturally Occurring Quinones. III. Recent Advances. By R. H. Thomson (University of Aberdeen). Chapman and Hall: London and New York. 1987. ix + 732 pp. $299.50. ISBN 0-412-26730-6.

This book is an extensive review of developments in the structure and chemistry of quinones from 1971, when the second edition of this compilation appeared, until 1985. The source, isolation, synthesis, physical and chemical properties (particularly key ^1H NMR data), and some biological activity data are catalogued. Noteworthy are cross references to the previous edition to minimize repetition of previously reported information.

The review is comprehensive, beginning with simple benzoquinones and proceeding through naphthoquinones and anthraquinones to the anthracyclinones. Two other chapters cover more complex polycyclic quinones. Botanical and zoological indices are provided, along with an appendix listing references to new quinones reported in 1985 and 1986.

The book is well-organized and exceptionally well-written. The illustrations are nicely prepared and laid out. Errors are virtually nonexistent; the only one detected was the use of the same structure for two different numbered compounds (see **234** and **235**, p 200).

Quinones are increasingly prominent as pharmacologically active natural products and drug candidates. They also have a long history as plant pigments. This treatise is the definitive review of this field and will, therefore, be useful to a wide range of organic chemists and scientists from various subdisciplines in biology. While its high cost may preclude its inclusion in many personal libraries, it should be present in every industrial, academic, and government library.

John H. Cardellina II, *National Cancer Institute*

Synthesis and Separations Using Functional Polymers. Edited by D. C. Sherrington (University of Strathclyde) and P. Hodge (University of Lancaster). John Wiley and Sons: New York. 1988. x + 454 pp. $118.00. ISBN 0-471-91848-2.

This volume is a sequal to the popular reference "Polymer Supported Reactions in Organic Synthesis" by the same editors published in 1980. Several of the chapters are updates of chapters in the 1980 book; others are completely new topics. This volume is a good companion volume to the original, as it updates the large amount of work done in this field since the publication of the first volume. The editors also provide a list of references for recent symposia related to this topic.

The first chapter, "Synthesis and Structure of Polymer Supports" (A. Guyot, 120 references), is an update from the 1980 volume. This chapter is devoted to advances in the design of the solid supports used in reactive polymers. Mostly concerned with cross-linked polystyrene, this chapter discussed bead size, cross-link density, porosity, swelling, and mechanical and thermal properties. "Organic Reactions Using Polymer-Supported Catalysts, Reagents or Substrates" (P. Hodges, 351 references) discusses the advantages, preparation, and characterization of various polymeric reagents. The author also comments on synthetic considerations and present selected examples. The third chapter "Polymer-Bound Transition Metal Complex Catalysts" (P. E. Garrow and B. C. Gates, 105 references) is an update from the 1980 review that discusses the attachment of homogeneous catalysts to an insoluble polymer support. Synthesis, characterization, performance, and stability of these systems are reviewed. Chapter Four is well described by its title, "Design and Industrial Application of Polymeric Acid Catalysts" (H. Widdecke, 61 references). "Polymeric Phase Transfer Catalysts" (M. Tomoi and W. T. Ford, 147 references) is another update from the 1980 book. This review is mostly concerned with triphase systems in which the polymer is not soluble in either of the solvents. The author describe the synthesis, mechanistic considerations, and experimental design of these systems. The sixth chapter, "Properties of Polymeric Rose Bengals-Polymers as Photochemical Reagents" (D. C. Neckers, 24 references) describes the use of immobilized Rose Bengal photosensitizers as singlet oxygen generators. In "Polymeric Models of Reactive Biological Systems" (H. J. Van Den Berg and G. Challa, 82 references) the authors discuss the design and synthesis of polymers that mimic a variety of enzymatic systems. The eighth chapter, "Polymers in Affinity Chromatography" (L. Jervis, 213 references), describes support materials and coupling reactions for use in affinity chromatography. The author also provides references for specific ligands and their uses. The chapter entitled "Use of Chiral Polymers for the Separation of Enantiomers" (W. H. Pirkle and G. S. Mahler, 69 (many multiple references)) is self descriptive, and the authors describe techniques involving ligand exchange, natural polymers, chiral synthetic, and polymer supported chiral stationary phases. A chapter on "Polymeric Ligands in Hydrometallurgy" (A. Washawsky, 134 references) reviews the design, synthesis, and application of polymer-supported chelating agents for aqueous and metal ions. The final chapter, "A Wider Perspective of Polymer Supports and Reactive Polymers", by one of the editors (D. C. Sherrington, 204 references), is divided into three sections: new morphologies for solid supports, new reactive polymers for attachment of reactive ligands, and example of new applications for polymeric reagents. The volumes index appears to be relatively complete.

As a whole this book seems a worthwhile acquisition for anyone involved in this field or with the first volume as an introduction to functional polymers.

Jeffrey H. Glans, *Allied-Signal Inc.*

Coagulation Kinetics and Structure Formation. By H. Sonntag and K. Strenge (Zentralinstitut fur physikalische Chemie Akademie der Wissenschaften der DDR). Plenum Press: New York and London. 1987. 194 pp. $55.00. ISBN 0-306-42298-0.

For the most part, I enjoyed reading this little monograph authored by Hans Sonntag (Chapters 1–3) and Klaus Strenge (Chapter 4). The principal topics treated in the work are colloidal particle interactions, colloidal particle diffusion, kinetics of coagulation, and coagulation–structure formation. This is a difficult area for a small book because of the inevitable comparisons between it and the coverage afforded by Kruyt. I would expect most workers in this field to continue to use *Colloid Science* for its extensive treatment of the classic investigations carried out prior to World War II. And I would anticipate that Professor Lyklema's revision would continue to be the dominant reference in this area in the future. Nevertheless, *Cogulation Kinetics and Structure Formation* does have some strengths.

I particularly liked the discussion of reversibility and the energetics

of breakage in Chapter 3. As a chemical engineer concerned with the behavior of large aggregates in water- and wastewater-treatment processes, I would like to see increased emphasis placed upon study of structural characteristics of higher level aggregates; perhaps because of this interest, I appreciated the treatment of the rheological behavior of structured dispersions. I was not as impressed with the description of instrumental methods employed in the study of coagulation kinetics, however. It struck me as incomplete and out of date. Finally, I must also admit that I was mystified by the discussion of computer simulation of structure formation. Coverage of Monte Carlo methods was limited to papers by Vold and by Sutherland—there was no discussion of developments in simulation in the 1980's and fractal geometry was not even mentioned. These are glaring omissions in my opinion.

In summary, although I liked certain aspects of this book, it will not dislodge *Colloid Science* from my bookshelf. I view *Coagulation Kinetics and Structure Formation* as valuable supplementary material, but not as a principal source of information.

Larry A. Glasgow, *Kansas State Univeristy*

Recommended Reference Materials for the Realization of Physicochemical Properties. Edited by Kenneth N. Marsh (Thermodynamics Research Center, Texas A&M University). Blackwell Scientific Publications Inc.: Palo Alto and Oxford. 1987. x + 500 pp. $76.50. ISBN 0-632-01718-X.

This volume is the product of the International Union of Pure and Applied Chemistry (IUPAC) Commission on Physicochemical Measurements and Standards and the IUPAC Subcommittee of The Physical Chemistry Division on Physicochemical Measurements and Standards. It suggests primary, secondary, and working reference materials to be used in the measurement of physicochemical properties. Chapters discuss appropriate reference materials for measurement of the following: density, surface tension, viscosity, pressure–volume–temperature, distillation-testing of columns, relative humidity of air, temperature, enthalpy, thermal conductivity, electrolytic conductivity, permittivity, potentiometric ion activities, optical rotation, optical refraction, reflectance, wavelength and transmittance, and relative molecular mass. The information in each chapter has been included only after critical evaluation by the chapter collator(s). In addition, comments have been solicited from appropriate IUPAC bodies and national standards laboratories. Some of the recommendations have been published previously in the *Journal of Pure and Applied Chemistry*.

Each chapter begins with a succinct introduction that summarizes the state-of-the-art techniques for measuring a particular property, the theory behind the measurement, and the expected uncertainty. Following are sections dedicated to specific reference materials. These include information on the physical property to be measured, the range over which the material is to be used, the physical state of the material within the range, sources of supply and/or methods of purification, and, in some cases, information on the effect of impurities and other factors affecting the precision of the measurement. In addition, pertinent physicochemical data, generally in the form of references to the original works, are supplied for each reference material.

I found this book to be instructive, extremely well-organized, and very up-to-date. It is arranged so that with minimal time and effort one can be familiarized with the most effective method of measurement and obtain literature and reference materials to calibrate the necessary equipment. This book is a valuable reference text for experimentalists in all scientific disciplines who are involved with the measurement of physicochemical properties.

Donald L. Hall, *Virginia Polytechnic Institute*

Principles of Descriptive Inorganic Chemistry. By Gary Wulfsberg (Middle Tennessee State University). Brooks/Cole Publishing Company: Monterey, California. 1987. xviii + 461 pp. $35.35. ISBN 0-534-07494-4.

In his Preface, the author states that the book "covers the basic principles of inorganic chemistry and the main properties and reaction chemistry (*descriptive chemistry*) of inorganic elements and compounds". Further, he states that "it is written at a level appropriate for students in their *first full semester* of undergraduate inorganic chemistry ...". Thus, the book is suitable for an elementary course in inorganic chemistry as recommended by the ACS Division of Inorganic Chemistry. In general, the author has been successful in his aim of bringing a more organized approach to descriptive chemistry for the student in the earlier part of the chemistry curriculum.

The book is not a conventional approach to descriptive chemistry where the chemistry of the elements is covered by periodic groups. Instead, as the author states, "the text focuses at one time on *one particular reaction or property type of one class of inorganic compounds*". Thus, after a very brief review of some basic principles in Chapter 1, Chapters 2 through 4 cover acid–base and precipitation reactions of metal cations and oxo anions, ionic solids, and oxides and polynuclear oxo anions. Chapter 5 focuses on oxidation–reduction reactions, and Chapter 6 takes up the properties of the elements (such as heats of atomization; properties of allotropes; atomic radii; elemental catenation; ionization energies and electron affinities; and a thermochemical analysis of redox reactions). Chapters 7 and 8 are devoted to acid–base theories, and Chapters 9 and 10 cover halides, nitrides, and sulfides and then organometallic compounds, respectively. Finally, Chapter 11 looks at the theoretical basis of some of the principles discussed earlier, and Chapter 12 discusses some nuclear chemistry.

A unique aspect of the book is Chapter 13, where the author presents experiments that are correlated with the text. For example, Experiments 1 and 2 explore some properties of metal cations and oxo anions and illustrate the material in Chapter 2.

Other learning aids incorporated in the book are "Study Objectives" and "Exercises" at the close of each chapter. (There are answers to selected Exercises in an Appendix.) Furthermore, within each chapter there are well-placed "Example" questions with "Solutions". (These would have been more useful, however, if they had been set aside from the text in a box or similar device.)

One topic covered very well in the book is the concept of Pourbaix diagrams (often called predominance diagrams, $E°$–pH, or pE–pH diagrams). Such diagrams are well-used later to explain the aqueous chemistry of a number of elements and their compounds.

Practical applications of the principles described are also abundant (cf., the discussion of environmental redox reactions in connection with the section on Pourbaix diagrams). In some chapters specific sections have been devoted to such topics. For example, in Chapter 2 there is a discussion of common forms of elements in the aqueous environment and in biological systems. In Chapter 4 there are discussions of the "Practical Uses and Environmental Chemistry of Volatile Oxides and Oxo Acids" and of the "Uses of Metal Oxides". Chapter 5 has sections devoted to "Explosives ..." (with appropriate notes on safety) and "Industrial Processes for Extracting Elements from Their Ores".

Coordination chemistry is introduced in Chapter 7 in the context of the Lewis acid–base concept. (As a result, the discussion of coordination compounds themselves is very brief; a more complete discussion of the topic will require the use of supplementary material). Indeed, this chapter represents one of the problems in writing a book where chapters are devoted to reaction types; that is, there is a range of topics not presented in a conventional order, and some expected topics are not covered in depth. Chapter 7 begins by describing the terminology of coordination compounds and then turns to a brief description of such compounds in biochemistry and industrial catalysis. Following a very brief discussion of VSEPR theory, the chapter then returns to coordination chemistry to discuss types of ligands, the chelate and macrocyclic effects, and the nomenclature of coordination compounds. The final sections of the chapter describe non-aqueous solvents and the Drago–Wayland approach to the thermodynamics of acid–base reactions.

The author is to be congratulated for writing an interesting book with a novel approach to inorganic chemistry. However, as illustrated by Chapter 7, the unconventional order of topics, and lack of depth in some cases, could make the book difficult for some instructors to use in the classroom. If it is used, the unique organization of the book will mean that instructors will have to reconsider their approach to descriptive inorganic chemistry, a fact that may represent a worthwhile goal in its own right.

John C. Kotz, *State University of New York*

Graphite Fluorides. By N. Watanabe, T. Nakajima, and H. Touhara (Kyoto University). Elsevier Science Publishers: Amsterdam and New York. 1988. xi + 263 pp. $107.25. ISBN 0-444-42885-2.

Graphite Fluorides is Volume 8 in the Elsevier series of research monographs, *Studies in Inorganic Chemistry*. The contents deal mainly with contributions to the field by Professor Watanabe and his colleagues, thereby limiting the scope of the book, but these contributions are far-ranging and deal with many aspects of the subject. Included are treatments of surface, structural, and electrical properties as well as the preparation, stoichiometry, and applications of these interesting materials. The text is very readable, the editing is conscientious, and few typos and errors remain. The book is profusely illustrated with plots and figures, which greatly aid in understanding the textual material for which they were chosen.

The first chapter is a review of the role of graphite fluorides in the "anode effect" observed when carbon anodes are employed in electrochemical fluorination. Some of the earlier work from Prof. Watanabe's group is cited along with more recent findings concerned with the effects of lithium fluoride and small amounts of water on the anodic overpotentials in HF/KF melts. The stage being set, there follows an extensive

discussion of the preparation and characterization of the various graphite fluoride phases (in particular, $(CF)_n$ and $(C_2F)_n$) arising from treatment of a variety of carbon materials with fluorine over a wide range of temperatures. The authors illustrate how techniques such as ESCA, solid-state NMR, electron microscopy, and X-ray diffraction have been brought to bear on the characterization of structural and chemical changes during fluorination of carbon and the identification of final products resulting from these processes. A review of the surface properties of the graphite fluorides is next. Contact angles of various liquids on graphite fluorides are compared with those on other materials such as PTFE and PE, and the implications of the extraordinarily low surface energy of graphite fluorides are examined. The following chapter deals mainly with "fluorine adsorbed active carbon" and the decomposition reactions of $(CF)_n$ in the presence of several gases (O_2, Cl_2, N_2) as well as under vacuum and by photolysis. ESCA, DTA, TA, IR spectroscopy, and X-ray diffraction techniques are applied in following the kinetics and identifying the products.

The last section (four chapters) is mainly concerned with applications of the graphite fluorides and includes a significant amount of fundamental research results as well. An interesting chapter on the electrochemistry and reactions involved in the lithium-graphite fluoride battery is followed by a review of the Watanabe group's recent work on the fluorination of aluminum surfaces by elemental fluorine in the presence of graphite which, remarkably, results in deposition on the metal surface of a clean, oxide-free, fluoride film covered by $(CF)_n$. A review of the superior lubricating properties of graphite fluorides is then presented, and the book concludes with an excellent treatment of graphite intercalation compounds of fluorine.

This monograph is clearly designed to serve as an entree to the field of graphite fluorides despite its focus on the work of a particular group. It is written with the authority of those who have made outstanding contributions to our understanding of graphite fluorides over a 25 year period and should be on the shelf of any researcher who is interested in this field.

Ronald E. Noftle, *Wake Forest University*

The Chemical Physics of Solid Surfaces and Heterogeneous Catalysis. Volume 5. Surface Properties of Electronic Materials. Edited by D. A. King (University of Liverpool) and D. P. Woodruff (University of Warwick). Elsevier Science Publishers: Amsterdam and New York. 1988. xiv + 474 pp. $208.00. ISBN 0-444-42782-1.

This excellent book provides a unique treatment of the current status of chemical physics research on the surface properties of electronic materials. The unique feature of the book is that it gathers the important results from a wide range of sophisticated surface analysis techniques that have developed over the past 20 years, summarizes these results with regard to preparation and characterization of single-crystal solid surfaces and their adsorption behavior, and then interrelates these seemingly disparate phenomena in a coherent picture of the current level of understanding of these technologically important materials. As a result, this book provides an accurate, useful and comprehensive summary of the state of the art of chemical physics research on the surfaces of electronic materials through 1986. The level, completeness, and clarity of presentation will make this book an indispensable reference for surface scientists working with electronic materials.

The first chapter introduces the reader to electronic materials, with obvious emphasis on the semiconductor group; it provides the fundamentals of phenomena such as surface states, interfaces, and crystal growth along with the major surface techniques used for probing them. Chapter 2 concentrates on the bulk silicon structure and its surface reconstructions. The degree to which the Si(100)(2×1), Si(111)(2×1), and Si(111)(7×7) reconstructed surface structures are understood and characterized is clearly presented. Compound semiconductor surfaces are treated in Chapter 3, with emphasis on atomic and electronic structure. It provides a comprehensive overview of both the experimental determination and theoretical prediction of the atomic geometries and electronic structures of compound semiconductors, such as GaAs, InSb, ZnS, AlP, etc., along with their interfaces and adsorbate structures. Chapter 4 treats adsorption phenomena on semiconductor surfaces, including atoms and molecules from the gas phase, semiconductor overlayers (heterojunctions), and interfaces with metal atoms. Details of the adsorption of H_2, O_2, H_2O, and halogens on the elemental semiconductors Si and Ge are considered in Chapter 5; these are the adsorption systems that are best characterized and documented. In Chapter 6 the adsorption and reactions of metals (noble and refractory) with silicon along with the characterization and properties of their interfaces are considered. Molecular beam epitaxy is introduced in Chapter 7 with emphasis on the growth kinetics and dynamics of GaAs. Chapter 8 is concerned with all aspects if Si-MBE based technology, including other Group IV elements as well. MBE is extended in Chapter 9 to deposition of insulators, metastable phases, and II-VI compounds. Chapter 10 reviews dry etching processes and the means by which surface chemical bonds are broken and new product bonds are formed.

This is an essential book for both students and researchers involved with semiconductor surfaces. The refreshing presentation in terms of consolidation of results on semiconductors from all important surface science techniques provides an excellent starting point for students entering the field as well as a valuable reference for established researchers. The material has been carefully edited for clarity of presentation, consistency of nomenclature, and broad coverage of the subject without duplication. In summary, the book provides an excellent treatment of a timely subject. I highly recommend it to surface scientists involved with semiconductors.

J. Wayne Rabalais, *University of Houston*

Medicinal Chemistry: A Biochemical Approach. Second Edition. By Thomas Nogrady (Concordia University, Montreal). Oxford University Press: New York and Oxford. 1988. xvii + 514 pp. $32.50. ISBN 0-19-505369-9.

With the advent of molecular biochemistry and pharmacology, the biochemical mechanism of therapeutic agents has become increasingly important in drug research. This new trend is clearly reflected in the subtitle of this textbook on medicinal chemistry. This book is a slightly expanded version of the first edition, which was published only 3 years ago. It provides a reasonable coverage of the vast area of medicinal chemistry and a general description of some basic biochemical and biophysical methods commonly used in drug research. A total of eight chapters cover the physicochemical principles of drug action, theories and characterization of receptors, drugs acting on neurotransmitters, hormones and nonmessenger targets, drug metabolism, and principles of drug design. In an effort to keep up with the rapid developments in biochemistry and medicinal chemistry in recent years, the author has updated several chapters and added some very brief discussions on the dynamics of membrane receptors, newer receptor modulators, transmembrane signal transduction, prodrug concepts, and selective drug delivery. In some cases, recent advances are highlighted by the inclusion of a few 1986–87 references in the list of selective readings.

It is somewhat disconcerting that this book has a higher than average number of errors in chemical formulas and diagrams. In addition to those inherited from the first edition, some new ones have also appeared. A glaring example is the confusion in the legend of the phosphatidylinositol cycle (Figure 2.12. on page 88). Other oversights and inaccuracies are exemplified on page 335. The standard nonsteroidal antiinflammatory drug indomethacin is inexplicably described as having no effect on cyclooxygenase, and the active metabolite of sulindac is identified incorrectly. The lack of discussion on recent developments of immunomodulators appears to be a deficiency of this book. Another disappointment is that, in the light of molecular structures published for many membrane receptors in the past few years, the description of some old schematic and conceptual receptor models in the first edition could have been modified. One gets the impression that, perhaps for the sake of timeliness, this new edition was put together somewhat in haste.

On the whole, this moderately priced overview of medicinal chemistry is well organized and highly readable. Critical readers may find some of the statements overly simplified or not quite up to date. Nevertheless, it should be useful as an introductory book or a quick reference for medicinal chemists.

T. Y. Shen, *University of Virginia*

Carbohydrate Chemistry: Monosaccharides and Their Oligomers. By Hassan S. El Khadem (The American University, Washington, D.C.). Academic Press, Inc.: San Diego. 1988. x + 256 pp. $44.95 (U.S.). ISBN 0-12-236870-3.

Recently I commented that "for some years there has been a need for a concise text" on the topic defined by this title (JACS, in press). Remarkably, we now have in one year, two books designed to fill this gap. "Modern Carbohydrate Chemistry" by R. W. Binkley (Dekker, New York, 1988) and the book currently under review will compete for the same audience. Both books should be successful and this sudden embarrassment of choice will come as a great pleasure to those who teach this subject. No doubt the price differential ($90.00 versus $44.95) will be relevant in reader selection.

The El Khadem book is stated to be "primarily intended for use by undergraduate and graduate students enrolled in chemistry, biochemistry and pre-medical curricula. It is also intended for students in the colleges of arts and sciences, pharmacy, agriculture, and medicine who are engaged in research in the fields of carbohydrates and natural product chemistry. Its format fills a gap between large, multivolume reference books designed mainly for research and elementary, sometimes superficial books." I agree with the author that he has properly targeted this gap

and opine that he has done so successfully.

The first three-quarters of the book deals with monosaccharides. This section begins with about 90 pages of discussion of structure, configuration, and conformation, treated in a relatively conventional manner and followed by a 10-page discussion of nomenclature. The elementary, but vital manipulations involved in conversion of formulae from 3-D open chain to projection to Haworth to ring conformation are covered concisely and understandably. The next section on physical properties used in structure elucidation is particularly welcome in a book of this nature. The discussions of NMR, mass spectrometry, and optical rotation are particularly useful and up-to-date. The section occupies only 32 pages and as a result the explanations are very intensive and may cause problems for students who have not met such methods in any detail before. However, we should hope that curriculum planners normally ensure that students taking a course in carbohydrate chemistry would already have successfully completed a good grounding in chemistry, especially physical and organic and hopefully including spectrometric methods. A few more tables of numerical values would have helped to illustrate the uses of the methods, although one admits that there are good references in the book to recent reviews with such information. The monosaccharide section concludes with "Reactions of Monosaccharides", a particularly good section, occupying 90 pages.

The second major section of the book, comprising the last quarter of the volume, is directed toward "Oligomeric Saccharides: Oligosaccharides and Nucleotides". The description of structural methods is well handled. The biochemists might be offended by the sparse five lines of text devoted to the enzymatic methods which have been so extensively used in this area, but this is after all a book on carbohydrate chemistry.

There are several particularly refreshing features to this book. The bibliography of reviews will be very helpful to many readers and is reasonably up-to-date and well selected. The listing of commercially available monosaccharide derivatives is an excellent idea, obviously carried out with some unstated minimum cost basis, which will be useful to new people in this field. Also it is particularly refreshing to see figures from modern physical methods such as MS, NMR, IR, X-ray, used to illustrate the chemistry almost from the first page. These will not always be comprehensible to the students but in many cases they may have a useful "excitement" function. Many of the chapters end with set problems which are answered in an appendix. These problems are well selected and will definitely assist the student in his understanding of the text.

The book is recommended for its stated target audience, provided they have a good grounding in chemistry, especially organic and spectrometry.

G. N. Richards, *University of Montana*

Physical Properties and Thermodynamic Behaviour of Minerals. Edited by E. K. H. Salje (Cambridge University). D. Reidel Publishing Co. (Klumer Academic Publishers): Dordrecht, Holland, and Boston. 1988. XXIV + 707 pp. $144.00. ISBN 90-277-2656-6.

This volume is the proceedings of a NATO ASI conference of the same name held at Cambridge in the summer of 1987. Most of the articles are concerned with phase transitions in minerals, particularly with those that involve order–disorder changes, polytypes, and modulated structures. The authors include both experimentalists and theoreticians. For example, discussion of experimental methodology and applications are given for Raman spectroscopy by Bismayer, birefringence by Glazer, NMR by Putnis, calorimetry by Navrotsky and by Salje, magnetochemistry by Coey and Ghose, visible spectroscopy of Langer, and Mössbauer spectroscopy by Seifert. Presentations on basic theoretical aspects of phase transitions are given by Heine, McConnell, and Carpenter and molecular dynamics and other simulation techniques for solids are discussed by Dove, Price, and Parker and Catlow. Most all the writing is quite good with clear and concise explanations of the basic theoretical and experimental approaches. Much of this work has appeared in other volumes but the article on Raman spectroscopy by Bismayer, birefringence by Glazer, and magnetic ordering by Coey and Ghose seemed new, at least to this reader. As many as half a dozen of the articles are the best current review articles in their fields. This is a volume that is certainly desirable for library purchase.

John A. Tossell, *University of Maryland*

Nuclear Environmental Chemical Analysis. By J. Tolgyessy (Slovak Technical University) and E. H. Klehr (University of Oklahoma). John Wiley and Sons: New York. 1987. 185 pp. $64.95. ISBN 0-470-20834-1.

Nuclear Environmental Chemical Analysis represents an attempt to provide a summary of a very important field in analytical chemistry: analysis of environmental samples using nuclear methods. Both topics, environmental sampling and nuclear methods, should provide enough material for several books. Unfortunately, the authors have spread themselves quite thin by limiting their book to 185 pages and, in doing so, they fail to present a coherent description of either topic.

Environmental sampling is limited to a discussion of the sampling devices used. Several types of water, sediment, and airborne particulate samplers are discussed and pictures for each are provided. Sample handling and storage is discussed only in the most general terms. What is lacking is a significant discussion of systematic errors such as trace-element contamination from reagents and tools. No mention is made of the use of clean rooms, although they are commonly used.

In discussing nuclear methods, the authors fail to adequately explain the instrumentation or the methods of data collection. Their preface states, "We believe this to be the first book in the literature which describes *all* known nuclear analytical methods which are or may become useful". It is surprising that instrumental techniques such as prompt γ-ray activation analysis, Compton suppression, liquid scintillation, and coincidence counting are not noble enough techniques to be considered "useful". They are commonly used techniques.

The limitations in this book may stem from its not being focused toward a particular audience. It does not seem to be designed as a comprehensive review or a critical review and it is not a tutorial. A newcomer to the field of nuclear methods is likely to be confused or not to understand how an experiment is carried out after reading this book. *Nuclear Environmental Chemical Analysis* is not be be recommended to either the beginning or the advanced analytical, environmental, or nuclear chemist.

Craig A. Stone, *National Institute of Standards and Technology*

Patterson and Pattersons. Fifty Years of the Patterson Function. Edited by Jenny P. Glusker, Betty K. Patterson, and Miriam Rossi (Institute for Cancer Research). Oxford University Press: Oxford and New York. 1987. xx + 727 pp. $49.95. ISBN 0-19-855230-0.

The genesis of this volume was a 3-day symposium in Philadelphia in November 1984, to celebrate the 50th anniversary of the discovery and publication by Arthur Lindo Patterson of his famous method for determining crystal structures. However, the volume is much more than the usual casually edited reprinting of symposium contributions. It consists of four main sections: a 42-page introduction designed to serve as background for those unfamiliar with the Patterson function (Lindo Patterson, who died in 1966, is the only one who never referred to his F^2-Fourier series by that name); the ten principal symposium presentations (252 pages), including not only the discussion after each paper, but interjected comments and repartee as well; 27 contributed papers of varying length (290 pages), organized into Methods, Applications to the Biological Sciences, and Homometrics; and a final section (104 pages) that includes a biography of the remarkable, humorous, warm, and generous man whose insight was being celebrated, a list of his publications, and 26 personal reminiscences that will make it clear why everyone who came in contact with him respected, admired, and loved him. The volume concludes with a reprint of one of his papers that would otherwise be almost unknown and inaccessible, and an excellent index.

The editors have supplied introductory paragraphs giving brief information about every contributor to this volume except themselves. The book is marvelous for browsing and will appeal particularly to those interested in the impact of crystallography on structural chemistry and structural biology, and to the historian of science seeking some insight into the way scientific advances arise. The introduction has three didactic sections written by the editors, to explain the concept underlying the Patterson function and its applications, illustrated with specific examples. It also gives excerpts from Patterson's letters to his future wife at the time he was developing the method and anecdotes by Harker, Pauling, Beevers, and Lipson, all of whom played a part in the early application and development of the method. The principal papers, presented by a stellar cast, including Pauling, Hodgkin, Phillips, Sayre, Dunitz, Dickerson, Jeffrey, and others, cover a wide spectrum. Some are predominantly expositions of applications. Others are valuable reviews on topics such as new methodologies for imaging structures at the molecular level, protein structure and function, DNA-binding drugs, DNA-protein interactions, revised thinking about hydrogen bonds, the use of crystallographic data bases in chemical studies, and electron density. Pauling presented a memorable account of his early experiences in structure analysis and Hodgkin a lucid and charming review of her use of the Patterson method in many landmark structural studies that span four decades. The personal reminiscences are especially revealing, full of entertaining stories and tidbits (such as Eddie Hughes's discovery of what he called "Bragg's Second Law", from Sir Lawrence himself).

The volume also includes Patterson's oft-cited but hard to find 12-line unpublished paper, "On the symmetry of the wheaks produced by the Bucessera", in which he strove to follow an editor's admonition to save space and spoofed the trend toward jargon and acronyms. It was set in type for *Acta Crystallographica*, because the science was impeccable, but

it was withdrawn because it had been so compressed that few readers would have made any sense of it (a full translation is provided). Unfortunately, "wheaks" is not included in the otherwise comprehensive index, but those who wish to find this gem should see pages 617–8, and also pages 26–7.

Many of the contributors emphasize that the Patterson method is still of enormous value, and not only in macromolecular crystallography. Even in these days of the triumph of so-called "direct methods", more than a third of the papers published in a typical issue of *Acta Crystallographica* acknowledge the use of Patterson functions in solving the structure. The most powerful and successful recent program for structure solution in the often difficult intermediate realm (a few hundred atoms in the asymmetric unit) combines Patterson search techniques and direct methods.

I found few errata, and none that are substantive; one minor shortcoming is that some of the figures (in Part II especially) have inadequate legends. This is the first volume in a projected series on Crystallographic Symposia, recently established by the International Union of Crystallography and Oxford University Press. It sets a standard that will be hard to match in content, tone, and organization. Editors of symposia in any field would do well to study it carefully.

K. N. Trueblood, *University of California, Los Angeles*

Chemometrics: a Textbook. By D. L. Massart, B. G. M. Vandeginste, S. N. Deming, Y. Michotte, and L. Kaufman. Elsevier Science Publishers: Amsterdam and New York. 1987. 464 pp. $85.25. ISBN 0-444-42660-4.

Chemometrics is a relatively new area of chemistry that focuses on applying advanced statistical and mathematical techniques to analysis of chemical data. It includes tasks that we experimentalists do when analyzing data, even though few of us are familiar with the field of chemometrics. This book makes it very clear that we could benefit by learning about the methods that are available, particularly as the relentless computerization of science makes the methods conveniently accessible. Indeed, as the amount of information we can obtain from chemical instrumentation continues to soar, it will become mandatory to use advanced data analysis methods to be competitive experimentalists. One of the best ways to learn about chemometrics is to get ahold of this book.

This book is written in a style that encourages learning and understanding. Each mathematical or statistical method is succinctly developed. Simple examples are used to build an intuitive grasp of when the methods are appropriate. Numerical examples are usually worked as concrete illustrations of the method's application. References are provided for each topic that guide the reader to more complete treatments. The style is succinctly tutorial and does not assume any more mathematical background than an undergraduate science major would possess.

The book is suitable for almost anyone who would like to become better acquainted with statistical methods of data analysis. There are numerous examples that would be familiar to clinical chemists, environmental scientists, research managers, production managers, physicians, as well as almost any other brand of chemist. Although it is not appropriate to summarize all the topics covered in the book, selected examples should provide a sense of the contents. The first third of the book builds basic statistical background. It includes significance tests, bias evaluation, variance analysis, calibration procedures with and without heteroscedasticity (variance uniformity along a calibration), information theory, and cost-benefit analysis. The next fifth covers the important techniques that an experimentalist typically uses to analyze data. Those include univariate linear and nonlinear regression and multivariate linear regression analysis; autocorrelation, autoregression, covariance, and correlation methods; and Fourier transform and deconvolution and smoothing methods. The next tenth deals with experimental optimization methods. These sections deal with experimental response surface models, factorial experimental design, and simplex optimization methods. The next fifth of the book deals with pattern recognition, classification methods, principal component and factor analysis, and supervised pattern recognition. They address the question—What parts of a large quantity of data contain the most reelvant information to sort results into groups? These groups might include meteorite classification, sources of environmental pollution, geographical origins of olive oils, or diagnosis of abnormal thyroid function. The final tenth of the book treats the decision-making process where one must choose the procedures that optimize the data collection and then act on the experimental results. What is the optimum blend of instrumental resources and personnel? Should one adjust manufacturing parameters as a result of the latest analyses? How certain must one be of a decision before making a decision that affects a company's prestige and earnings or a person's well-being or life? Queueing theory, operations research, cost analysis, and prediction theory are examples of the decision-making methods employed in the book to answer such questions.

Although the authors did an excellent job of presenting the field, the publishers deserve less praise. It is difficult to navigate around the book without constantly referring to the table of contents. Figure and equation numbers are reset to one in each chapter. There are no chapter indicators on any but the first page of a chapter. Consequently, it is frustrating to find the table, figure, or equation referenced in a different chapter, a task that is frequently required by the nature of the book.

This book is not likely to make you an expert in chemometrics but it will give you an appreciation for the field. You will learn the fundamentals behind a method and will gain insight to its strengths and weaknesses and when to use the methods. It gives you a good start. It is a well-done book and one that will be valuable for anyone using experimental measurements.

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Volumes of Proceedings

Modelling of Structure and Properties of Molecules. Edited by Z. B. Maksić (University of Zagreb, Yugoslavia). Ellis Horwood Ltd.: Chicester, England. Halsted Press of John Wiley & Sons: New York. 1987, pp 355. $67.95. ISBN 0470-21010-9.

This book constitutes the proceedings of the First Yugoslav Symposium on Molecular Sciences (Zagreb, May 28–30, 1986) and is composed of 20 chapters covering the fields of "Molecular Structure" (6 chapters), the "Theory of Molecular Bonding and Chemical Reactions" (6 chapters), "Molecular Spectroscopy and the Electronic Structure of Molecules" (6 chapters), and the "Biochemical and Pharmacological Properties of Molecules" (4 chapters). The authors are not limited to Yugoslavia nor even to Eastern Europe—indeed, the lead scientific study in this book is a special feature article by Linus Pauling and Zelek Herman on the unsynchronized-resonating-covalent bond theory of metalls, alloys, and intermetallic compounds.

Mathematics and Computational Concepts in Chemistry. Edited by Nenad Trinastić (The Rugjer Bošković Institute, Zagreb, Yugoslavia). Ellis Horwood Ltd.: Chicester, England. Halsted Press of John Wiley & Sons: New York. 1986. pp 365. ISBN 0470-20289-0.

This photooffset book contains the invited and special lectures presented at the International Symposium on the Applications of Mathematical Concepts to Chemistry that was held in Dubrovnik, Croatia, September 2–5 (1985). This collection of 29 chapters contains contributions from premier chemists from the U.S., both western and eastern Europe, and Japan and includes topics as diverse as molecular mechanics, quantum pharmacology, giant atoms and molecules, nonhamiltonian dynamics, and graph theory. The volume also includes an introductory chapter by the Nobelist V. Prelog, who while describing the powerful interplay of modern mathematics and modern chemistry nonetheless concludes with Lord Kelvin's sagacious admonition. "It is as dangerous to let mathematics take charge of physics as to let an army run a government". Chemists take heed—but read this book.

Redesigning the Molecules of Life. Edited by Steven A. Benner (ETH Zürich: Switzerland). Springer-Verlag: Berlin, Heidelberg, and New York. 1987. 175 + vi. pp. $32.50. ISBN 0-387-19166-6.

This photooffset paperback is the conference documentation of a symposium entitled "Redesigning Life" (Interlaken, Switzerland, May 4–7, 1988) to bridge the "great divide" between chemistry and biochemistry. Five chapters compose this book: nicotinamide as a coenzyme (R. M. Kellogg and C. N. Visser), designing peptides and proteins—hormones to enzymes (E. T. Kaiser), altering enzyme structure by site-directed mutagenesis (W. W. N. J. Ward and A. R. Fersht), ribosymes (J. W. Szostak), and reconstructing protein evolution (S. A. Benner). Besides presenting solid bioorganic chemistry, the book invites questions that are both theoretical and theological. Reading the book has been both educational and enjoyable and so I highly recommend it to anyone interested in molecular processes and in the nature of life.