Book Reviews*

Handbook of Practical Organic Microanalysis. By S. Bance (formerly Head of Microanalysis Laboratories, May & Baker Research Institute). Ellis Horwood Limited, England. 1980. Distributed by John Wiley & Sons. 206 pp. $58.95.

An initial bookstore "thumb through" gave this reviewer a negative impression of this volume. The reviewer's experience covers the same time span as that of the author, so it appeared that a more thorough book could have evolved. Old, out-of-style methods are described in some detail, as well as procedures for the use of certain automatic elemental analyzers, the lattern instruments described in such detail that it seemed superfluous when this information could be gleaned from the manufacturer's own manual. Even then, for example, the older Perkin-Elmer 240 is described, which would be of limited interest at the time of this publication as these models could be upgraded or superseded by newer, more foolproof and computerized models.

A more critical examination of the book was then made by reading the introduction completely and relating the information therein to the title, "Handbook of Practical Organic Microanalysis". The author does describe briefly how micromethods were started and that this volume would cover his version of recommended methods that have proved to be reliable over a long period of time in his laboratory. In this regard he has done a decent job, even though it could be questioned as to why another book of this type was necessary. Perhaps ten other reviewers would have chosen other procedures to recommend.

Some of the detailed comments in various instructions, such as "Undo nuts on connector fitting (CARE-HOT)" seem to be quite unnecessary. Also, "a barometer and a thermometer should be available for use to calculate the weight of the volume of nitrogen obtained, the temperature and pressure at which it was measured have to be taken into account". Such instructions show clearly that the volume is for a technician type with limited background and experience. But still, other books have already been available for some time which do the job quite nicely.

Arthur W. Spang, *Spang Microanalytical Laboratory*

Scaling Concepts in Polymer Physics. By Pierre-Gilles de Gennes (Cornell University and l'Ecole de Physique et Chemie, Paris). Cornell University Press, Ithaca, New York. 1979. 320 pp. $38.50.

Pierre-Gilles de Gennes reminds me of the late Peter J. W. Debye. He is a master who possesses deep physical insight and is capable of conveying his latest fascination—the "Scaling Concepts in Polymer Physics"—in a unique and lucid manner which few authors can duplicate. The book has been reviewed by theoretical physicists[1,2] and has received immediate attention and acclaim among polymer physicists. Therefore, it may be interesting to comment on how a physical (polymer) chemist should view such an important contribution.

The book aims to reduce the barrier between recent field theoretical concepts and experimentalists in polymer science. de Gennes writes in a deceptively simple style emphasizing on the main line of thought, the concept of scaling, and systematically ignoring numerical coefficients which are specific to a given polymer in most formulas. Based on dimensionality and physical arguments, equations are often presented to the reader in order to demonstrate how the mind of a brilliant scientist works. The book is not intended as an introduction to the new polymer theory which has made notable advances in describing limiting universal laws applicable to static and dynamic properties of polymer chains in solutions and melts. It is meant to render a physical understanding of the concepts, not the computational details. Even the title, "Scaling Concepts in Polymer Physics", is appropriate because it delivers what de Gennes sets out to do. The book, including the Preface, should be read more than once and savored slowly, with frequent reflections and much thought!

The reader should pay attention to the Notation explained on p 26 and simplifications, such as the footnote on p 29, where Boltzmann's constant k_B is unity.

The analogy between polymer statistics and phase transitions was first discovered by de Gennes. The distillation of physical facts into universal power laws and the resultant exponents are reminiscent of critical phenomena. One should be aware of the limitations of universality when it is applied to real polymer chains of finite length, especially in marginal solvents.

The book covers (A) static conformations and (B) dynamics of polymer chains including (C) theoretical methods, which briefly discusses self-consistent fields and random-phase approximation, relationships between polymer statistics and critical phenomena, and an introduction to renormalization group ideas. The main thrust has been on static conformations, perhaps because of earlier availability of small-angle neutron scattering experiments. With recent improvements in the techniques of photon correlation spectroscopy and of time-resolved small-angle X-ray scattering using synchrotron radiation, further advances, especially in polymer dynamics and phase transitions, are likely to occur. All scientists interested in the field, experienced or beginning, experimentalists or theorists, cannot afford to be without a copy.[1,2]

(1) J. L. Lebowitz, *Science*, **208**, 1140 (1980).
(2) M. A. Moore, *Nature (London)*, **286**, 190 (1980).

Ben Chu, *State University of New York at Stony Brook*

Chemical Structure and Bonding. By R. L. DeKock (Calvin College) and H. B. Gray (Cal Tech). Benjamin/Cummings Publishing Company, Menlo Park, CA. 1980. xi + 491 pp. $21.95.

This well-designed text is the descendant of earlier books on molecular orbital theory and structure and bonding by Harry Gray. The level is appropriate for upper level undergraduate and first-year graduate students in the structure and bonding course. The book is organized into seven chapters, each containing worked-out examples and exercises with a good selection of questions and problems plus references for further reading.

The book begins with a review of the discovery of atomic structure and the development of quantum mechanics. Results of the solution of the Schrödinger wave equation for the hydrogen atom are presented and extended to describe many-electron atoms. Atomic electron configurations, atomic energy states, and term symbols are rather thoroughly developed. Chapter 2 introduces the concepts of covalent and ionic bonding, polar molecules, electronegativity, and the geometry, symmetry, and topology of molecules. Lewis diagrams and the valence-shell electron-pair repulsion model are used to predict the geometries of small molecules. Chapter 3 covers the valence-bond and hybrid-orbital models of electronic structures. Hybrid-orbital pictures are developed for a number of simple molecules. Multicenter σ bonds in boranes and delocalized π bonds in benzene are described. Chapter 4 presents molecular orbital theory of diatomic molecules. Molecular orbital and valence-bond wavefunctions of H_2 are compared. Bond energies and bond lengths are correlated with bond orders for diatomic molecules. Molecular orbital energies are used to interpret photoelectron spectra. In Chapter 5 the molecular orbital model is extended to interpret shapes and photoelectron spectra of small polyatomic molecules. Frontier orbital theory is used to explain proton affinities and symmetry rules for chemical reactions. Chapter 6 features several models of the electronic structures of transition-metal complexes. Relative stabilities of complexes are discussed in terms of hard and soft metal ions. Ligand field theory is used to describe the bonding and spectra of complexes. The MO theory of π complexes is outlined. The angular overlap method is used to explain shapes of complexes. The final chapter covers bonding in solids and liquids.

Much of the material contained in this book can also be found in any good general chemistry textbook such as the one by Dickerson, Gray, and Haight. A teacher can never be certain how much of this introductory material the student remembers from earlier courses, but much of it could have been omitted. For example, Ruthurford's scattering experiments and the Bohr model of hydrogen are widely if vaguely known and their cursory review here offers nothing to the development of concepts in later chapters. I was disappointed that orbital symmetry classifications were not introduced in Chapter 3 and then used in that and later chapters for labeling molecular orbitals. Without symmetry labels orbital correlation diagrams for molecular geometry and reactivity are difficult to understand. In fact, some of these labels are used without explanation in Chapter 6 to specify electron configurations. One of the strengths of the book is its use of molecular orbital theory to explain molecular spectra, an area in which molecular orbital theory is clearly superior to other qualitative valence models. Throughout the book there are many simple examples in which the mathematics of elementary quantum mechanics is used to obtain results relevant to chemistry. The book would be an excellent choice as a text for a one-semester course in structure and bonding.

Benjamin M. Gimarc, *University of South Carolina*

*Unsigned book reviews are by the Book Review Editor.

Advances in Transport Processes. Volume I. Edited by A. S. Mujumdar (McGill University). Wiley Eastern Limited, New Delhi, India. 1980. 263 pp.

This book is divided into five chapters. Chapter 1 is concerned with blood flow in the human body. The author points out the complexity and the need of studying blood flow in modern engineering sciences. The fluid flow, heat transfer, and mass transfer in developing and fully developed pipe flow are reviewed. The chapter is clearly written and well organized. It is a good reference for both beginners and amateurs in the field. Chapter 2 discusses two-phase flow involving a gas and a non-Newtonian liquid. The chapter contains a collection of references on the subject and presents a comparison between the Newtonian and the non-Newtonian two-phase flows. Chapter 3 gives a review of mass transfer in electrochemical systems. The writing is lucid and the material is well organized. A minor drawback is that some of the symbols are not defined in the text and this might present some difficulty to the readers who are not familiar with the subject. Nevertheless, the chapter contains a large collection of empirical equations obtained with the limiting current technique, and would serve as a useful reference for the people working in the area. Chapter 4 is concerned with the numerical methods for solving viscous flow problems. The methods of finite differences and finite elements are discussed. The stability, convergence, and suitability of various numerical techniques in solving the Navier-Stokes equations were compared. Chapter 5 deals with mixing of viscous fluids. The concepts and criteria of mixing are discussed. The experimental results concerning the pattern of fluid flow, the residence time, the mixing rates, and the power consumptions are reviewed for both Newtonian and non-Newtonian fluids. We were very pleased to read the book.

C. Y. Cheng and D.-T. Chin, *Clarkson College of Technology*

Annual Review of Biophysics and Bioengineering. Volume 11. Edited by L. J. Mullins (University of Maryland), William A. Hagins (National Institute of Arthritis and Metabolic Diseases), Carol Newton (University of California, Los Angeles), and Gregorio Weber (University of Illinois). Annual Reviews Inc., Palo Alto, CA. 1982. x + 494 pp. $22.00 (U.S.A.); $25.00 (elsewhere).

Biophysics poses physical questions about the nature of living matter. Chemistry poses physical questions about the nature of all matter. It is not surprising, then, that much current research in biophysics is strongly chemical in nature. Eleven of the nineteen review articles in this volume deal with recent research which could be classified as chemistry, particularly physical chemistry, of biomolecular systems. New applications of spectroscopic methods to problems in molecular structure and dynamics are emphasized, with novel magnetic resonance techniques playing the starring roles. Five articles describe clinical methods, particularly new radiation techniques for diagnosis and treatment of disease. Three articles deal with research on the physical properties of cells.

In their preface, the editors acknowledge the problem presented by the substantial diversity of subject matter encompassed by the title of this volume. They state, "...we are seeking reviews that will help the reader unfamiliar with a particular field to obtain a reasonable level of understanding...rather than encyclopedic coverage of the literature". Accordingly, the reviews tend to be short and selective in their coverage. Typically, though not always, about half of the literature cited is dated within the past five years. Several authors have taken care to cite other recent reviews of related material. A list of related articles appearing in other current "Annual Reviews" volumes is helpfully provided.

Jon Applequist, *Iowa State University*

Vapor-Liquid Equilibrium Data Bibliography. Supplement III. Edited by I. Wichterle, J. Linek, and E. Hála. Elsevier Scientific Publishing Company, Amsterdam and New York. 1982. viii + 322 pp. $109.25.

This volume covers the literature published from January 1979 through 1981 and presents the data in computer print-out form.

Origins of Clinical Chemistry. The Evolution of Protein Analysis. By Louis Rosenfeld (NYU Medical Center). Academic Press, New York. 1982. XVIII + 36 pp. $38.

Dr. Rosenfeld's book describes the origins of a part of the field of clinical chemistry, namely the origins and the development of the studies of proteins from their beginnings at the dawn of the 19th century to the present era of laboratory endeavor. The book contains ample interesting, cultural, and historical facts including the personal data of many pioneering scientists, who left their permanent imprints on the investigation of protein nature. In addition, the many reproductions of paintings and pictures of well-known scientists and laboratory equipment of old times contribute considerably to the interest of the book.

The book is not only written for those involved in the fields of clinical chemistry, biochemistry, immunochemistry, clinical pathology, and immunology but also for pure chemists who will find many culturally and historically important and interesting issues discussed here.

The book is divided into 19 chapters; the first four chapters include a discussion of the concept of proteins and its historical aspects, the collodial state as studied by M. Faraday, J. Tyndall, T. Graham, and others, the origins of organic chemistry, and the development of methods for nitrogen determination. Chapters five through seven deal with the history of protein classification, detection, and fractionation. The histories of non-specific tests (refractometry, viscosimetry, etc.), colorimetry, and photometry are the content of chapters eight and nine. The development and construction of the ultracentrifuge by T. Svedberg in the twenties is described in the tenth chapter. The next three chapters are devoted to the history of electrophoresis from the early experiments of the nineteenth century and include the Tiselius's moving boundary electrophoresis studies, then proceeds to the recent techniques of zone electrophoresis employing filter paper, cellulose acetate, agarose gel, and other stabilized media. The history of the immunochemistry of proteins and the modern application of immunochemical methods are found in chapter fifteen. At the end of the book, two chapters concerning proteins in urine and cerebrospinal fluid are presented and their historical studies in health and disease are described along with a chapter on the history of blood coagulation, namely on fibrinogen transformation. The book closes with a chapter on the important development of radioimmunoassay in the fifties.

The book is attractive in appearance and contains a number of useful references which will be welcomed by more deeply interested readers. For the future edition, it would be helpful if the name and subject indexes were separate. The index of names deserves more attention and considerably enlargement. The book is written in readable language and certainly also deserves to be brought to the attention of readers outside the English-speaking countries. The price of the book is moderate and it should be found in the library of an educated chemist.

Karel Kithier, *Wayne State University*

Annual Review of Materials Science. Volume 12. Edited by R. A. Atuggins, R. H. Bube, and D. A. Vermilyea. Annual Reviews Inc., 4139 Camino Way, Palo Alto, CA. 1982. 444 pp. $22.00.

This volume contains seventeen reviews under the rubrics: Experimental and Theoretical Methods; Preparation; Processing, and Structural Changes; Properties and Phenomena; Special Materials, and Structure. There are author and subject indexes, and cumulative indexes for Volumes 8–12.

Chemical Education in the Seventies. Edited by A. Kornhauser, C. N. R. Rao, and D. J. Waddington. IUPAC CTC, 1981; distributed by Pergamon Press, Oxford and New York. x + 325 pp. $11.50 softbound.

This book is a collection of reports from a large number of countries from all parts of the world, describing the state of chemical education in primary and secondary schools, universities, and training programs in industry, together with comments on the interaction of chemistry and society in the respective countries. These are narrative essays, and give a more integrated view than do tables and lists of institutions and programs, and add flavor and insight.

General and Synthetic Methods. Volume 5. A Specialist Periodical Report. Senior Reporter G. Pattenden (University of Nottingham). The Royal Society of Chemistry, London. 1982. xiii + 439 pp. £59.00.

This volume reviews contributions to methods of synthesis of organic compounds published in 1980. In five chapters, "all possible interconversions between the major functional groups" are reviewed. Another chapter deals with applications of organometallic compounds in synthesis, two more chapters cover "developments in the synthesis of saturated and partially unsaturated carbocyclic and heterocyclic rings", and a concluding chapter is devoted to "trends and developments in strategy for design and synthesis". There is also a list of reviews, and a full author index. References are given at the bottom of the page on which they are cited, a pleasant convenience.

Kirk-Othmer Encyclopedia of Chemical Technology. Third Edition. Edited by M. Grayson and D. Ecroth. John Wiley & Sons, New York. 1982. xxvi + 1010 pp. $165.00.

This volume finishes the "P's", from powder coatings to pynrole and derivatives, with essays on such topics as power, printing, propylene, proteins, pulp, pyrodine, and pyrotechnics. Only three essays are found under "Q": quaternary ammonium compounds, quinoline and isoquinoline, and quinones. The first part of the "R's" covers subjects from radiation curing to recycling and includes radioactive tracers, rare-earth elements, rayon, and reactor technology.

Some subjects are new with this edition, and one can be excused for being surprised to find essays on programmable pocket computers, recording disks, and recreational surfaces, for example. The essay on the

first of these appropriately includes detailed illustrations of application to chemical problems, such as distillation. The essay on recording disks is more general, but fits rigid disks and floppy disks into perspective with gramaphone records, and presents the essential information on their construction, capabilities, and use. That on recreational surfaces is mostly concerned with athletic facilities from football to wrestling, and is quite use-oriented.

An unusual feature of this volume is a table of half-lives and radiation emitted for selected radioisotopes, of no less than 87 pages.

This volume displays the careful selection of contributors, high quality of production, and editorial attention to detail that is found in previous volumes (there is, however, an unfortunate slip on page 819 involving pentavalent carbon).

Organic Electronic Spectral Data. Volume XVIII. 1976. Edited by J. P. Phillips, D. Bates, H. Fever, and B. S. Thyagarajan. John Wiley & Sons, New York. 1982. xiii + 1053 pp. $105.00.

Ultraviolet-visible spectra of pure organic compounds are reported in this volume in the form of numerical wavelengths and extinction coefficients. The only other data given are the identification of the compound by empirical formula and name, the solvent, and the literature reference. This spare presentation, even so, is enough to fill this rather large book solely out of the literature reports for one year, 1976. It is the result of the collecting and processing efforts of six chemists. No index is needed for a volume such as this, for the entries appear in formula-index order. No count of the number of spectra in this volume is given, but the magnitude of the task can be appreciated from the fact that the eighteen volumes so far published contain over 400 000 spectra. A further volume is in preparation.

The Enchanted Ring, The Untold Story of Penicillin. By John C. Sheehan (MIT). The MIT Press, Cambridge, Massachusetts. 1982. xvi + 224 pp. $15.00.

"A number of books and many popular articles have been written about the history of penicillin and those who had a part in it. Most of them begin with Fleming's discovery and terminate with the introduction of penicillin into clinical medicine by Florey and his colleagues more than ten years later. More often than not, the authors have no personal knowledge of what happened, and the reliance of some of them on hearsay has led to fantasies that bear little resemblance to the facts. The task of the serious historian here has not been an easy one, for irreconcilable differences of opinion between the main characters became apparent at an early stage. Thus it has never been possible to present the history of penicillin in a way that would have been pleasing to all concerned."

The foregoing is from Sir Edward Abraham's interesting foreword to Professor Sheehan's interesting and informative American version of the penicillin story. Surprisingly, such an account has not appeared previously; not surprisingly, some of the new information available from contemporary documents and from Professor Sheehan's own records is certain to continue controversies concerning who did what and when.

On the one hand, Sheehan is more generous to Alexander Fleming than were Florey and Chain, or current writers. On the other hand, Sheehan is somewhat laconic concerning Norman Heatley's 1941 discovery, while seconded to the Northern Regional Research Laboratory of the U.S. Department of Agriculture in Peoria, Illinois, that corn steep liquor is an excellent nutrient for *Penicillium*. But, unknown to Heatley and the British, patents were being filed on the process by Heatley's American collaborator.

Twenty years later, the Reviewer recalls, Beecham introduced ampicillin under the name "Penbritin", to emphasize that primacy in penicillin chemotherapy had returned to Britain. And we now learn that, near the end of his life, Robert Robinson wanted to write a book on penicillin "to put the Americans in their place".

A major portion of "The Enchanted Ring" presents a first-hand description of how the chemistry of penicillin was uncovered, from the realization *in the third year* of the oft-troubled Anglo-American collaboration that the compound contains sulfur, to the arguments relating to the proposed beta-lactam structure, to a patented synthesis which, according to its inventor Karl Folkers, afforded "probably the lowest possible yield an organic reaction ever gave", but later became the subject of ballyhoo and controversy. Sheehan's discovery and development of the carbodiimide coupling procedure, and the importance of this reaction in his celebrated rational total synthesis of penicillin, are all recounted.

With dozens of laboratories now engaged in chemical syntheses related to β-lactam compounds, it is useful to be reminded of the faith and tenacity exhibited during Professor Sheehan's eleven-year commitment to a single research objective, when most of his peers had given up on the problem, and funding agencies were no longer interested.

The final section of "The Untold Story of Penicillin" describes Sheehan's ultimately successful twenty-three-year struggle with Beecham concerning patent rights to processes for the preparation and acylation of 6-APA, the penicillin nucleus. Academic researchers, in particular, will find this glimpse into the intrigues of the real world both fascinating and frightening. Toward the end, so called *inter partes* tests were conducted, with Beecham attempting to demonstrate that Sheehan's synthesis of 6-APA would not work. The demonstration, also attended by A. K. Bose, convinced Sheehan that Beecham's experiments had been "planned and rehearsed" so as to lead to the wrong isomer. Sheehan realized that these experiments "were designed by someone who was a real expert in penicillin chemistry", and he has often speculated on "who might have been the mastermind". By the same token, the organic community will speculate on the identity of Sheehan's "sympathetic colleague at MIT (who) turned out to be secretly working for a patent adversary".

"The Enchanted Ring: The Untold Story of Penicillin" is eminently readable. The book can be recommended to any reader who wishes an American organic chemist's view of one of the great scientific discoveries of this century. It is good to know that spirited competition and controversy are not the sole province of molecular biologists.

Saul Wolfe, *Queen's University*

Mass Spectrometry of Priority Pollutants. By B. S. Middleditch, S. R. Missler, and H. B. Hines (University of Houston). Plenum Press, New York, NY. 1981. xii + 308 pp. $29.50.

This book reports the electron impact mass spectra, in both bar graph and tabular form, of 112 organic priority pollutants; for the remaining two, 1,2-diphenylhydrazine and *N*-nitrosodiphenylamine, which decompose on gas chromatography, the mass spectra of the decomposition products, azobenzene and diphenylamine, respectively, are reported. For each entry the CAS name and registery number, the EPA ions, the Registery of Toxic Effect of Chemical Substances (ROTECS) and Merck Index references, and a comprehensive list of synonyms are given. The individual entries are supplemented by appendices which tabulate the eight most prominent ions in each spectrum by order of molecular weight, base peak, second peak, and third peak. A comprehensive index including all the synonyms is given. This compilation of data should prove useful as a practical reference for all mass spectrometrists who deal with organic priority pollutants.

A. G. Harrison, *University of Toronto*

Organic Trace Analysis by Liquid Chromatography. By J. F. Lawrence. Academic Press, New York. 1981. xii + 288 pp. $34.00.

Trace analysis of organic compounds is one of the most difficult areas of analytical chemistry to describe concisely and systematically. Consequently, there are no good comprehensive sources to which an apprentice may turn and obtain an accurate introduction to the chemical principles and analytical techniques that must be employed at the trace level. This book attempts to make this task more manageable by focusing only on trace analytical procedures that include high performance liquid chromatography. It bridges the gap between fundamentals of basic chromatography and practical considerations which must be made when separating and detecting minute quantities of materials.

The relative space that the author allots to individual topics coincides nicely with the relative importance of the topic. For example, the chapters on detectors and derivatization methods, chapters 5 and 7, respectively, are the longest in the book; each occupies 19% of the pages. These topics are generally treated lightly in other books on liquid chromatography even though sensitivity is often the limiting factor for LC methods.

The chapter on detectors describes all commonly used detectors from those that are non-selective and relatively insensitive to those that are more specific and sensitive. It is, as is the entire book, well organized, with an initial discussion of general detector requirements followed by sections on specific detectors. Practical hints are provided throughout this chapter and the book. Also, specific problems are identified that are uniquely applicable to trace analysis. For example, the author points out that in the practice of trace analysis, the mobile phase often contains traces of fluorescent impurities which can produce a background signal that, when amplified, contributes to detector noise.

The chapter on derivatization methods details a wide variety of pre- and postchromatographic chemical reactions that can be used to modify a sample for more sensitive and/or selective detection. Unfortunately, the easy reading style, which is present throughout most of the book, disappears periodically in this chapter to be replaced by a style which is prevalent in April review issues of *Analytical Chemistry*; "So-and-so did this to that, then whats-his-name did that to this,", etc.

Chapter 8, Sample Extraction and Cleanup, and Chapter 10, Applications, are the next longest chapters in the book. It is refreshing to see

such emphasis placed on sample extraction and cleanup procedures. The author does an exceptionally good job of placing a myriad of manipulation procedures into perspective for the novice trace analyst. Although the author states, "The selection of samples for a determination can be as important as the analysis itself", he virtually leaves out any discussion of sample collection methods. This chapter may be one of the best concise summaries of sample handling techniques available but it still is not comprehensive enough to do justice to the importance of this part of any analytical procedure.

The weakest portion of the book is the chapter on method development and routine analysis (Chapter 9). It discusses methods for choosing the best chromatographic system, analysis time, interfering peaks, qualitative and quantitative approaches, compound confirmation, automation, and the integration of LC with other analytical techniques. It does all this in only 4% of the book. Needless to say the explanations are superficial.

Chapters on pumping systems (Chapter 2), sampling techniques and injection ports (Chapter 3), chromatography columns and packing materials (Chapter 4), and chromatography theory (Chapter 6) take up about 24% of the book. They are not particularly unique to trace analysis and most of the information in them is available from other sources.

Perhaps the most important chapter in the book is Chapter 1 in which the general topic of trace analysis with respect to liquid chromatography is considered. Although it uses only 6% of the text, it provides an excellent overview of the difficulties facing the trace analyst. Here one gets a broader picture of the trace organic method with a discussion of the advantages and limitations of LC.

In general, this book is a good introductory source for the beginner for it precisely covers many instrument designs and analytical procedures and provides a good source of references on each subject discussed.

Herbert H. Hill, Jr., *Washington State University*

Separation and Preconcentration Methods in Inorganic Trace Analysis. By J. Minczewski (Warsaw Technical University), J. Chwastowska (Warsaw Technical University), and R. Dybczyński (Institute of Nuclear Research, Warsaw). Ellis Horwood Limited, Chichester, England, and John Wiley & Sons, New York. 1982. xi + 543 pp. $95.00.

The stated objectives of this book are to provide general information considered by the authors indispensable in handling traces as well as to provide illustrative applications aimed to facilitate a search for the relevant literature. In this context the authors have succeeded in providing a detailed text with valuable material in it for analytical and radiochemical chemists. Basic background is concisely and clearly presented and more than 3000 literature entries provide a wealth of guiding elements for those looking to solutions to specific problems. The fundamental problems and working techniques common to trace analysis are covered with due consideration to specific aspects such as sampling, contaminations from atmospheres, types of laboratory vessels and containers, reagents, and the volatilization of chemical species. Specific techniques covered in the book are: precipitation and coprecipitation, volatilization, liquid–liquid extraction, and ion-exchange and reversed-phase partition chromatography. Because of the relatively more important role played by these separation approaches, emphasis is found on liquid–liquid extraction and ion-exchange chromatography.

Overall the book is very well written (the contribution of an excellent translation by Mary R. Masson, University of Aberdeen, should be recognized here) and practically error-free. The book is an addition to the Ellis Horwood Series in Analytical Chemistry and the Editors of the series (Drs. R. A. Chalmers and M. R. Masson, University of Aberdeen) are also to be complimented for this contribution to the literature on separation and preconcentration of inorganic species at low concentration levels.

Horacio A. Mottola, *Oklahoma State University*

The Handbook of Environmental Chemistry. Volumes 1–3. Edited by O. Hutzinger. Springer-Verlag, Berlin and New York, NY. 1980. Volume 1, Part A: 258 pp. $57.90. Volume 2, Part A: 307 pp. $57.90. Volume 3, Part A: 274 pp. $57.90.

"The Handbook of Environmental Chemistry" edited by Dr. O. Hutzinger has appeared as a three-volume set with future additions promised for each volume. Volume 1, Part A, is entitled The Natural Environment and the Biogeochemical Cycles and consists of several chapters which focus on the fundamental properties of The Atmosphere, The Hydrosphere, Chemical Oceanography, Chemical Aspects of Soil, The Oxygen, Phosphorus and Sulfur Cycles, Metal Cycles, and Natural Organohalogen Compounds. The depth of coverage is variable but clearly sufficient general background for most environmental science students. Specialists in specific environmental areas, e.g., air pollution, would clearly require more in-depth knowledge of the atmosphere than is covered in this volume. The final chapter of Volume 1, Part A, Natural Organohalogen Compounds, is interesting and informative but would be better suited for a Handbook of Natural Products.

Volume II, Part A, is entitled Reactions and Processes and deals with several important environmental processes including modelling, transport, absorption, and photochemical and microbial degradation pathways. These chapters are primarily written by research specialists and provide excellent background for environmental science research specialists and students. The Laboratory Microecosystem chapter should have been expanded to include more data which illustrate the utility (and drawbacks) of this type of modelling. A major omission in this volume is the lack of a chapter on mammalian metabolism of xenobiotics.

Volume 3, Part A, entitled Anthropogenic Compounds covers only a small fraction of the pollutants of major interest. Clearly expansion and updating of this volume in the series is warranted. This Handbook will make a useful contribution in unifying a somewhat diverse scientific field; however, future volumes should include coverage of several topics (e.g., classes of pollutants, mammalian metabolism, and analytical methods) which are important areas of Environmental Science.

S. H. Safe, *Texas A&M University*

Environmental Problem Solving Using Gas and Liquid Chromatography. By R. L. Grob (Villanova University) and M. A. Kaiser (E. I. du Pont de Nemours & Co.). Elsevier Scientific Publishing Co., Amsterdam, The Netherlands, and New York, NY. 1982. xii + 240 pp. $59.00.

Many environmental problems today must be solved chromatographically, so that a book of this title would appear to fulfill a real need of the analytical community. The subject matter is so vast, however, that separate books could be written on the subjects of sample handling, gas chromatography, and liquid chromatography in environmental analysis. In this fairly short monograph, the coverage of each of these topics is quite varied. The instrumental aspects are treated at a relatively low level, though occasionally the use of certain terms in the chapters on GC and HPLC presupposes a reasonably advanced knowledge on the part of the reader. On the other hand, the chapters on sampling (outside the laboratory) and sample treatment (inside the laboratory) are detailed and generally very useful.

Since the instrumental aspects have been well treated in several texts while sample handling is commonly ignored, this emphasis is certainly understandable. To offset the brevity of the text, over 1000 references are listed. The authors have tried to tabulate as much information as possible, but unfortunately the data are often incomplete. For example, Table 5.6 lists the properties of five common detectors; immediately below this table the helium detector, which was not included in the table, was discussed. Later in the same chapter, analytical methods for representative compounds are tabulated and several detectors (AFID, HECD, PID) are listed with no mention in the text. A more detailed comparison of the strengths and weaknesses of detectors would have been useful; in particular GC-MS is hardly mentioned in spite of its preeminence in environmental analysis.

The treatment of HPLC is more cursory than that of GC. No indication of the relative importance of different separation mechanisms is given. This is particularly evident for reverse phase chromatography which is inexplicably absent from a flow diagram of the modes recommended for LC separations and rarely mentioned in the text.

Despite these criticisms, this book should still be recommended to people actively involved in environmental analysis because of its excellent treatment of sample handling; instrumental aspects are covered better in several other texts.

Peter R. Griffiths, *University of California*

Flame Retardant Polymeric Materials. Volume 3. Edited by M. Lewin, S. M. Atlas, and E. M. Pearce. Plenum Press, New York and London. 1982. x + 283 pp. $35.00.

The pervasive use of polymeric materials, from coatings to plastic components to fibers and textiles, in technologically advanced societies has brought with it problems in the prevention of fire and the avoidance of toxic smokes. The five chapters in this book address some of these problems, specifically in connection with polyolefins, smoke inhibition in general, flammability (parameters and evaluation), and analysis of polymers and their degradation products.

Plastics Polymer Science & Technology. Edited by M. D. Bayal. John Wiley & Sons, New York. 1982. xi + 945 pp. $150.00.

This book, with its curiously unpunctuated title, is devoted to the physical rather than the chemical aspects of its subject. The first of its seventeen contributed chapters is a general overview; the next eight chapters deal with materials science, and include such subjects as molecular weight distribution, mechanical behavior, and surface properties. The last eight chapters are concerned with product technolgy, and include rheology, processing, environmental resistance, etc. Each chapter is stated to be self-contained; each one begins with a detailed table of

contents, which is not only an aid to quick reference, but is more convenient to the user than the common alternative of placing it all in the forepages. There is a subject index, somewhat short for the scope of the book. It is unconventional in having entries consisting only of adjectives (e.g., "brittle"), and in having no sub-entries. The latter feature leads to many entries that are nearly unusable because of the large number of undifferentiated page references following them. For example, the entry "crystallinity" is followed by no less than 47 page citations! Attention to one of the chapters on indexing in the many available authors' guides would have produced a more helpful retrieval tool.

Environmental Chemistry. Volume 2. Senior Reporter: H. J. M. Bowen. Royal Society of Chemistry, London, England. 1982. 286 pp. $33.00.

This volume is designed for readers who wish to have a good, thorough review of advances in environmental inorganic Chemistry. (Volume 1 (1973) in this series emphasized environmental organic chemistry). This second volume, a review of the literature published up to mid-1980, focuses on inorganic chemicals and covers the general areas of the atmosphere, hydrosphere, soils, and human diets.

Under the topic of atmospheric inorganic particulate matter, methods of sampling and analysis, and the physical and chemical composition of particulates are reviewed in addition to the transport and removal of particulates.

In Chapter 2, the elemental content of human diets and excreta is reviewed. Advances in ingestion, absorption, and excretion-oriented studies are outlined. A very helpful tabulation of recent data for the elemental contents of diets and urine in mg/day is also presented and constitutes a basis for a review of inputs, outputs, deficient concentrations, and oral toxicities in which the elements are subdivided according to their position in the periodic table. An extensive review (110 pages) of the elemental constituents of soils is found in Chapter 3. Here the geochemistry, weathering, and mobility characteristics as well as soil content are described as a function of elemental groupings or position in the periodic table.

A broad overview of the subject, mycotoxins, appears in Chapter 4. Although the author has exercised some degree of selection and simplification on the topic there seems to be sufficient references provided for the reader to obtain further background reading when required. In Chapter 5 the occurrence, distribution and chemical speciation of some minor dissolved constituents in ocean waters is reviewed and deals primarily with advances, since 1975, in the knowledge of trace elements in ocean water at a concentration below 1 mg/L. Studies on chemical speciation appear in the review where they relate to open ocean waters.

In summary, the authors of this review have accomplished their goal with pertinent literature references. The writing style is such that the topics are reviewed in an informative fashion rather than a mere repetition of facts common to most reviews, and enables the book to be read with pleasure. An author index is another attractive feature. This book deserves a place on the bookshelf of those engaged in environmental Chemistry.

Eugene F. Barry, *University of Lowell*

Catalysis. Volume 5. Edited by G. C. Bond and G. Webb. The Royal Society of Chemistry, London. 1982. vi + 395 pp. £48.00.

This volume of the Specialist Periodical Reports reviews the recent literature up to mid-1981 under the editorship of a new team. Most of its ten chapters are concerned with bringing traditional subjects up to date. The term "catalysis" is taken to mean "heterogeneous catalysis", but there is a whole chapter devoted to Homogeneously Catalyzed Insertion Reactions that is largely concerned with industrial processes such as the Fischer-Tropsch synthesis, hydroformylation, and olefin metathesis. Two quite new subjects are also reviewed; Catalysis of Reactions Involving the Reduction of Nitrogen Oxides, much concerned with automotive emissions, and Characterization of Catalysts of Electron Microscopy. Another chapter surveys the timely subject of Coal Hydrogenation Catalysis.

As usual in this series, there is no subject index, but the table of contents is quite detailed.

Organic Reactions. Volume 28. Edited by W. G. Dauben. John Wiley & Sons, New York. 1982. vii + 347 pp. $39.50.

The three chapters of this volume are devoted to reactions that have been known for so long that they may be regarded as classic: the Reimer-Tiemann reaction; the Friedländer quinoline synthesis; and the aldol condensation.

The Reimer-Tiemann reaction of sodium phenoxides with chloroform (reviewed by Wynberg and Meijer) proceeds by attack of dichloromethylene, and produces not only hydroxybenzaldehydes but also cyclohexadienones and products of ring expansion. Pyrrole rings are expanded to pyridines. Owing to low yield it has seen only modest use. The Friedländer synthesis (reviewed by C.-C. Cheng and S.-J. Yan), in which *o*-aminobenzaldehydes or *o*-aminophenyl ketones are condensed with a carbonyl compound having an α-methylene group, complements the Shraup, Combes. Doebner-Miller, Pfitzinger, and Niementowski syntheses for quinolines, and has seen extensive use. The aldol condensation (reviewed by Mukaiyama) has taken on new significance in synthesis since the development of methods for directing the site of reaction by use of various metal enolates as well as boranyl and silyl derivatives of enols. It is this aspect that is emphasized in the third chapter.

The characteristic style and quality of the previous volumes in this series are well maintained.

Emulsion Polymerization. By I. Piirma (University of Akron). Academic Press, New York. 1982. xii + 454 pp. $58.00.

The industrial application of emulsion polymerization is far ahead of its theoretical understanding. This situation has arisen for two reasons: first, because most of the work in this field has been done in industrial laboratories where the principal concern was to place industrial observations into a workable scientific framework; and second, because of the success and acceptance of the initial theory by Smith and Ewart. Unfortunately, in this regard, the Smith–Ewart theory fits so well for the most common case, that of the copolymerization of styrene and butadiene, and is so simple in principle, that all other emulsion polymerizations have been forced to fit within this model. It is now known, however, that important aspects of the Smith–Ewart theory do not apply in many cases, including the concepts of nucleation and the mechanism of particle formation, the predictions of particle size, and molecular weight distributions, the single radical concept, and the application of this theory to the polymerization of polar monomers of relatively high water solubility.

This overall survey of the present state of understanding of emulsion polymerization contains twelve chapters on a variety of important subjects involved in the kinetics and mechanisms of emulsion polymerization reactions and the formation and stability of polymer latices, as well as discussions of practical aspects of the application of emulsion polymerization systems. For the former, considerable attention is devoted to the formation and stability of polymer particles and to the kinetics of multi-radical polymerization systems and their effect on molecular weight distributions. Practical aspects include the choice of the emulsifier, reactor design and control, effect of additives on the formation of monomer emulsions and polymer dispersions, and radiation-induced emulsion polymerization. The coverage is comprehensive by experts in the field, and the book contains both an excellent overview and a detailed discussion of the current understanding of this important scientific and industrial subject.

R. W. Lenz, *University of Massachusetts*

Carbocationic Polymerization. By Joseph Kennedy (University of Akron) and Ernest Maréchal (Université Pierre et Marie Curie). John Wiley & Sons, Inc., New York, NY. 1982. xx + 510 pp. $75.00.

This masterly survey of the field of carbocationic polymerization by two of its leading practitioners is a welcome contribution to the literature of polymer science. To quote from the authors' Introduction, "We start by asking, in Chapter 1, why carbocationic polymerizations? What is so special about this science? We find some unique answers in the fields of chemistry, structure–property relationships and technology. In the next chapter we define terms, describe basic concepts, and lay down foundations to be built on when we turn to the discussion of mechanisms. In Chapter 3 we proceed to phenomenology to acquaint the reader with what carbocationic polymerizations are by examining monomers, initiators, co-initiators, and solvents. The next, long chapter (4) concerns the chemistry of mechanisms of the important elementary events: initiation, propagation, chain transfer, and termination. In Chapter 5 on kinetics, an attempt is made to combine these mechanistic steps and kinetic expressions are examined. The following chapter on copolymerization and reactivity starts with comprehensive compilation and evaluation of all monomer pairs copolymerized by carbocationic initiation and proceeds to a discussion of experimental and theoretical determinations of reactivity. A review of relative reactivity relations is given and the influence of experimental parameters on reactivity is examined. In Chapter 7 carbocationic step-growth polymerizations are discussed. The following chapter examines in detail the chemistries leading to recently developed sequential (block and graft) copolymers. Chapter 9 is devoted to macromolecular engineering and a glance toward the future. We conclude that the time for tailoring physical–mechanical–chemical properties by carbocationic techniques (i.e., macromolecular engineering) has arrived and develop a framework for the synthesis of new sequential, functional, telechelic polymers. The book ends with a survey of industrial processes employing carbocationic polymerizations currently in use".

The chapters include thoughtful and critical discussion of the topics cited, as well as extensive tables of carefully selected data. The inclusion

of a good deal of physical organic chemistry, in particular the use of the Winstein spectrum of ion pairs to interpret reactivity and molecular weight distribution, indicates that this volume will be highly interesting to those studying carbenium ion mechanisms in nonaqueous solvents. Much historical background is given, as well as many suggestions for future research and the outlook for further progress.

The authors, themselves heavy contributors to the field of cationic polymerization, are in a position to present an authoritative overall treatment. Their literary style is very readable, and the volume is attractively presented.

I strongly recommend this volume as the best treatment of carbocationic polymerization yet available.

H. K. Hall, Jr., *University of Arizona*

The Chemistry of Soil Processes. Edited by D. J. Greenland and M. H. B. Hayes. John Wiley and Sons, Chichester, New York, Brisbane, and Toronto. 1981. viii + 714 pp. $101.00.

This is the second of a two-volume series by the editors on soil chemistry. The first volume entitled "The Chemistry of Soil Constituents" dealt with "static" aspects of soils while this volume is concerned with "dynamic" processes. The distinction between the two is somewhat arbitrary and a different arrangement of topics may have been better from the standpoint of the researcher interested in a specific area of soil science and unable to afford both books (price of the present volume alone is $101.00). Be this as it may, the two volumes represent the most comprehensive coverage available on soil chemistry. The editors have succeeded admirably in their stated goal of providing a coherent account of soil chemistry.

"The Chemistry of Soil Processes" contains twelve chapters by sixteen highly qualified soil scientists. An overview (Chapter 1) is followed by chapters on mass flow and diffusion (Chapter 2), precipitation (Chapter 3), cation exchange (Chapter 4), anion and ligand exchange (Chapter 5), and adsorption (Chapter 6). Although not apparent from the titles, the next three chapters fall within the realm of biological properties, namely, oxidation and reduction (Chapter 7), transformation of metals (Chapter 8), and the fate of plant and animal residues (Chapter 9). The final three chapters cover the fate of fertilizers (Chapter 10), heavy metals (Chapter 11), and pesticides (Chapter 12). Subject matter of the book is broader than the title suggests in that five of the twelve chapters are peripheral to soil chemistry. In addition to the three chapters on biological processes, Chapter 2 deals with physical properties and Chapter 10 with soil fertility.

The book is handsomely bound and relatively free of errors. As with most multiauthored volumes, individual chapters vary somewhat in readability, depth of coverage, and suitability of the illustrations. Over-all, the quality of the book is excellent. An extensive bibliography is provided with each chapter. The book is highly recommended as a reference source for graduate students and researchers in soil chemistry but is probably too detailed for most undergraduate students.

Frank J. Stevenson, *University of Illinois*

Electronics for the Modern Scientist. By Paul B. Brown, Gunter N. Franz (West Virginia University, Morgantown), and Howard Moraff (Cornell University, Ithaca, N.Y.). Elsevier Scientific Publishing Co., Amsterdam and New York. 1982. $29.95.

This textbook is designed for college juniors and seniors but would be very useful for anyone using electronic equipment. Topics covered are circuit elements, impedence and network analysis, transistors, signals and systems, analog design using integrated circuits, digital devices, waveform generation and signal conditioning, digital signal processing, principles of radio frequency electronics and electromagnetic radiation, and transduction. Problems, examples, references, and an index are included.

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

From Genetic Experimentation to Biotechnology. The Critical Transition. Edited by William J. Whelan and Sandra Black (University of Miami, Florida). John Wiley & Sons, New York. 1982. xx + 266 pp. $39.95.

This book is directed toward molecular biologists, biochemists, biotechnologists, the pharmaceutical industry, the petrochemical industry, major chemical industries with an interest in biotechnology, the genetic engineering industry, and members of the university community who may be contemplating an industrial affiliation. The papers are organized under five headings. Following an introduction, objectives and methods in genetic experimentation are discussed. This section includes such topics as gene expression in heterospecific hosts, experimental manipulation of the mammalian embryo, and new trends in genetic engineering in the Soviet Union. Patterns of industrial developments of basic science findings include discussions of science in the marketplace and product development. Section four is devoted to commonality and conflicts of interest between academia and industry. The final section is concerned with social and proprietary interests in genetic experimentation. Among the topics covered are secrecy, patent policies, government regulations, and biotechnology from an international viewpoint. References and an index are included.

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

Metal Ions in Biological Systems. Volume 14. Inorganic Drugs in Deficiency and Disease. Edited by Helmut Sigel (University of Basel, Switzerland). Marcel Dekker, Inc., New York. 1982. xxi + 360 pp. $57.50.

This collection of papers makes a significant contribution to the growing literature concerned with the behavior of metal ions in biological systems. It will provide interesting and informative reading for biochemists, physicians, and nutrition specialists. Six chapters are devoted to discussions of zinc, iron, copper, gold, and lithium. Drug–metal ion interaction in the gut, metal ions and chelating agents in antiviral chemotherapy, and complexes of hallucinogenic drugs complete this volume. Of particular interest is the evidence for the anti-inflammatory action of copper compounds which tends to justify the folklore use of copper bracelets and rings for combating arthritic diseases. References and an index are included.

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

The Chemical Industry. Edited by D. Sharp and T. F. West. Ellis Horwood Publishers, West Sussex, England. 1982. 643 pp. $95.95.

This book includes 45 papers presented at a conference marking the 100th year of the Society of Chemical Industry (London). The papers, mostly British, represent a kaleidoscope ranging from historical discussions of the chemical industry to challenges for the future. Chief topics include past and future trends, education and research, environmental factors, marketing, trends in raw materials, process engineering and control, and new developments in organic, physical, and biological chemistry.

Papers are in general well written, basic, and intended for the nonspecialist. However, because of the heterogeneous nature of the material, the book is not suited for a text, nor is it a good discussion of today's chemical industry. This book is recommended only as a general interest book for chemists or chemical engineers.

R. H. Stephenson, *University of Connecticut*

Fourier Transform Infrared Spectroscopy. Volume 3. Techniques Using Fourier Transform Interferometry. By John R. Ferraro (Loyola University) and Louis J. Basile (Argonne National Laboratory). Academic Press, New York. 1982. viii + 215 pp. $29.00.

This third volume of a continuing series on Fourier transform (FT) infrared (IR) spectroscopy consists of five chapters (by different authors) dealing principally with innovations in instrumentation and measurement techniques. G. Horlick, R. H. Hall, and W. K. Yuen present a very well-written account of interferometric spectroscopy in the UV–visible spectral region, with special emphasis on simultaneous multielement determinations by flame emission, inductively coupled plasma emission, and atomic fluorescence spectrometry. The special problems associated with FT spectrometry in the UV–visible are considered, the FT technique is compared with more "conventional" analytical procedures for simultaneous multielement determinations, and example analytical applications are described.

L. A. Nafie and D. W. Vidrine discuss "double modulation" FT spectrometry, wherein the transmittance signal is itself modulated at a frequency higher than the Fourier components (e.g., by rapid alternation of the IR beam between two samples). A mathematical treatment of the measurement advantages of the procedure is followed by discussions of instrumental details and a detailed treatment of an important specific application of the principle (vibrational circular dichroism).

D. W. Vidrine offers a discussion of photoacoustic FTIR spectrometry of solid and liquid samples. The chapter contains virtually no discussion of the theory of the photoacoustic effect (which is perhaps just as well), but presents a reasonably complete treatment of the influence of relevant measurement parameters and a nice sampling of present and anticipated future applications of photoacoustic FTIR.

In an amorphously tilted chapter, Techniques Used in FTIR Spectroscopy, K. Krishnan and J. R. Ferraro deal with a congeries of optical procedures, including reflection and emission, far-IR, microsampling techniques, interfacing FTIR with gas chromatography, and photoacoustic FTIR (treated in less detail than, and redundantly to, the preceding chapter). Computer techniques (spectral subtraction and removal of interference fringes from spectra) also are discussed. None of these topics is treated in detail, but the chapter can serve as a useful overview, and a lengthy list of references to more detailed discussions is included.

The remaining chapter (FTIR Spectroscopy in the Study of Catalysts, by C. L. Angell, actually the first chapter in the book) appears rather

out of context with the other chapters. Though a brief discussion of experimental techniques is presented, the bulk of the chapter discusses the FTIR spectra of species adsorbed on metal and zeolite surfaces. Though probably of less general interest than the others, this chapter serves as a useful example of the ability of FTIR spectrometry to generate useful spectra of very difficult samples.

Although FTIR spectroscopy has begun to assume the status of a mature analytical technique, this volume demonstrates clearly that innovative measurement approaches based upon interferometry continue to emerge. The production of the book is excellent, the index is accurate and reasonably complete, but the reference citation format is very annoying. Those persons interested in innovations in interferometric spectroscopy or extensions of the FT technique to other regions of the optical spectrum should find this book of considerable value.

E. L. Wehry, *University of Tennessee (Knoxville)*

The Physics and Chemistry of Liquid Crystal Devices. Edited by Gerald J. Sprokel (IBM Research Laboratories). Plenum Press, New York. 1980. xi + 348 pp. $42.50.

This book is of considerable value to those interested in the research and development of liquid-crystal (LC) electrooptical devices. It consists of 24 papers from the timely Symposium on the Physics and Chemistry of Liquid Crystal Devices held at the IBM Research Laboratory in San Jose, CA, February 7–8, 1979. The papers, which are well written and well edited, are organized under the categories of (1) physics, (2) LC devices, and (3) LC materials. The major emphasis is on research related to alpha-numeric displays, especially the twisted nematic type, and the use of multiplex addressing signals. There are also good papers on analog displays (Penz; Shanks), on guest/host, dye/phase change displays (Scheffer and Nehring), and on a projection storage display using a laser addressed smectic LC cell (Dewey). Some areas not covered in the book are television rate electrooptical devices (photoactivated light valves, active element matrix displays, etc.) and the use of cholesteric LCs for thermal indicating devices.

Six of the papers are on LC surface alignment issues and technqiues, including papers of particular interest on tilt angle measurements (Birecki and Kahn), on anchoring properties and temperature effects (Shimoda et al.), and on computations of dynamic effects in twist cells (Berreman). Six other papers deal primarily with the multiplexing of twisted nematic cells, including ones on the ultimate limits of direct matrix addressing (Kmetz and Nehring), on LCs for displays (Toriyama et al.), on material properties (Birecki and Kahn), and on optical characteristics and a fluorescence-activated display (Baur). The papers on LC materials include an excellent description of analytical techniques such as HPLC, GC/MS, etc., used to identify components in complex mixtures (Hubbard), and a review of various types of LC components used in mixtures (Castellano and Harrison). Also of note are papers on the synthesis of cyclohexanecarboxylate esters (Sheley et al.), on the preparation of LC diesters (Cox), and on molecular structure effects on mesomorphism (Griffin et al.).

J. David Margerum, *Hughes Research Laboratories*

Biological Events Probed by Ultrafast Laser Spectroscopy. By R. R. Alfano (The City College of The City University of New York). Academic Press, New York, NY. 1982. xiv + 443 pp. $59.00.

The development of pulsed-light activation of photochemical reactions in chemistry and biology has been dramatic. As conventional methods struggled to approach the nanosecond regime, they were leap-frogged by a conceptually novel technique that took us into and then beyond the picosecond (10^{-12} s) time. In the last sentence, "us" applies to scientists from two camps: Physics and Biology. Physicists and instrument designers have joined with biochemists and biophysicists to produce time-resolved kinetic descriptions of ultrafast biological events that previously, often with uncomfortable assumptions, could only be calculated or estimated indirectly. In the past 10 years or so, these collaborative efforts have given new impetus to studies on early events in photosynthesis and vision, and to probing other biochemical systems in which photoexcitation yields sequences of events (light energy transfer, photo-isomerization, photo-dissociation, mechanisms of de-excitation) descriptive of the molecular system being studied. This book covers the application of ultrafast laser techniques to biological problems with substantial sections on photosynthesis and vision as well as chapters on the photo-dissociation reactions associated with hemoproteins and on the photochemical transformations on the constituents of DNA.

An able editing job has been done by Dr. R. R. Alfano. He appears to have taken care in selecting and guiding his contributors, and Dr. Alfano has provided a book that will be of considerable value as a meeting ground for scientists from both camps. For physicists there is ample introductory information about the biology of the systems that demand their ultrafast techniques; for biologists there is, in addition to instrumental concepts and a variety of analytical methods, a full and welcome coverage of the potential dangers and the analytical benefits that arise in using very intense light activation.

Both the biological and the ultrafast laser spectroscopy research fields are moving at a rapid rate; however, despite this, Dr. Alfano, his contributors, and Academic Press have done a creditable job to give a representative and as current a view of each area as is possible.

P. Leslie Dutton, *University of Pennsylvania*

Radiation Chemistry of Hydrocarbons. Edited by G. Földiák (Institute of Isotopes of the Hungarian Academy of Sciences, Budapest, Hungary). Elsevier Scientific Publishing Company, Amsterdam. 1981. 476 pp. $95.00.

This text constitutes Volume 14 in the series "Studies in Physical and Theoretical Chemistry". Following a preface and introduction, the first chapter (I. György and L. Wojnarovits) describes the basic processes of hydrocarbon radiolysis and details experimental techniques for investigating radiation chemistry (37 pages with 256 references). The next five chapters describe the radiation chemistry of aliphatic alkanes (I. György, 105 pages with 497 references), cycloalkanes (L. Wojnarovits, 70 pages with 251 references), aliphatic alkenes and alkynes (Gy. Cserêp, 90 pages with 265 references), cycloalkenes (Gy.. Cserêp, 39 pages with 88 references), and aromatic hydrocarbons (M. Roder, 70 pages with 263 references). The final chapter by the Editor (3 pages) gives an overview of both old and new hydrocarbon radiation chemistry in terms of instrumentation developments, trends in industrial utilization of radiation chemistry, and the theoretical basis of radiation processes. A subject index is provided.

Literature coverage is extensive through 1977 with some references from 1978. The authors have chosen to present much tabulated numerical data and many figures displaying experimental results (147 tables and 67 figures). Undoubtedly this factor alone makes the text a valuable reference source, while also providing the reader with sufficient data to critically examine the methods of interpretation provided in the individual chapters. The compilation of experimental results in this fashion also makes it abundantly clear which areas have never been studied and which have been abandoned when the results seemed inexplicable.

Although it was once believed that radiation chemistry would be utilized industrially in hydrocarbon cracking and isomerization processes, this has proved not to be the case. The more industrially attractive area of applying radiation chemistry to polymerization processes is not included in this text. Accordingly, it may be that this book has summarized an area in which potential practical applications will never now be realized. In terms of our fundamental understanding of the structures and modes of reaction of hydrocarbons, however, this text provides a needed data source.

The translators of this volume (Z. Paál, I. Györky and L. Guczi) have presented a very readable book with few incongruities appearing—the pun on p 470, for example, comparing radiation chemistry with using a steam hammer to crack nuts, appears to have lost something in translation. The highly specialized nature of the subject material in this book and its cost will undoubtedly restrict purchases to libraries and active workers in radiation chemistry. The authors deserve congratulations on compiling this massive data source.

Julian A. Davies, *University of Toledo*

Viscosity of Polymer Solutions. By M. Bohdanecky and J. Kovar (Polymer Science Library. 2. Edited by A. D. Jenkins). Elsevier Scientific Publishing Co., New York. 1982. 285 pp. $83.75.

This well-executed treatise will be valuable to those beginning research on the viscosity of polymer solutions as well as those more familiar with the field. The author index, comprising 672 name entries, is indicative of the scholarship devoted to the work—the majority of references are from the period 1950–1980. The work is presented in four chapters: Introduction, 22 pp, 43 refs; The Intrinsic Viscosity at Zero Shear-Rate, 143 pp, 361 refs; The Viscosity of Polymer Solutions at Finite Concentrations, 54 pp, 170 refs; and the Shear-Rate Dependence of Viscosity, 45 pp, 143 refs. The authors have adhered to what has become widely used nomenclature, but have included a comprehensive glossary of symbols. The text is augmented by 199 well-chosen illustrations, and subject matter is readily located with the index.

Fundamental concepts of polymer chain conformation and the hydrodynamics of polymer solutions in simple shearing flow are discussed in the Introduction. These concepts are exploited in the second chapter in theoretical treatment of the intrinsic viscosity for a variety of chains, e.g., rigid rods, wormlike chains, linear, branched and ring-shaped random coils, coils with excluded volume, and others; comparisons with experiment are included. A substantial portion (97 pp) is devoted to discussion of the methods to extract conformation and thermodynamical data from the dependence of the intrinsic viscosity on parameters such

as chain length, solvent, and temperature—the limitations of these methods are discussed. Treatment of the dependence of the viscosity on concentration in the third chapter is divided into three concentration regimes: dilute solutions, for which virial expansions might apply; moderately concentrated solutions, which are discussed in terms of empirical representations; and concentrated solutions, for which intermolecular entanglement interactions are dominant, along with the effects of concentration on local mobility. The discussion is limited (with minor exception) to the behavior of flexible chain polymers. A short discussion of the viscosity under conditions of phase separation and transition is also included. The chapter on the dependence of the viscosity on shear rate includes discussion of the intrinsic viscosity and the viscosity of concentrated solutions. With the former, both flexible chains and rigid asymmetric particles are discussed, with most attention given to the several contributions to nonlinear behavior with flexible chains. The contribution of the entanglement interactions to the shear-rate dependence is emphasized with concentrated solutions.

G. C. Berry, *Carnegie-Mellon University*

Topics in Bioelectrochemistry and Bioenergetics. Volume 3. Edited by G. Milazzo (Instituto di Chimica della Facolta di Ingineria, Rome, Italy). John Wiley & Sons, New York. 1980. 362 pp. $80.00.

This is the third in a series of books, each of which consists of several chapters written by experts in the field, with the stated purpose of showing the advantages obtained by attacking biochemical problems using electrochemical techniques and to encourage collaboration between electrochemists and biochemists.

The first chapter, entitled Activation Energy: Nature, Detrmination, Significance, fails to deal with the thesis subject as it applies to biologically important electrochemical reactions. The first 60 pages are devoted to an elementary summary of kinetics and some electrochemical methods, both of which are adequately covered in standard texts. The remainder deals with the electrode reaction mechanisms of several biologically important types of molecules. The most recent reference is from 1975, and the majority are from the sixties.

The second chapter discusses Macrocyclic Ion Carriers, a topic of potential biochemical significance. Much of the material on the stability of complexes of macrocyclic ion carriers will be very useful, but it is hard to understand how the reduction of alkali metal complexes at −2.0 V will be of much biological importance. Again, too much space is devoted to descriptions of polarography and related methods.

The third chapter is a remarkably compact (50 pages) summary entitled Mitochondria: A General Survey, which will serve the important objective of providing an up-to-date entry into the literature of the title subject. It is authoritative and readable.

Implantable Electrodes are the topic of the fourth chapter, which discusses the materials, electrode reactions, and cell configurations necessary for construction and implantation of electrically active devices such as cardiac pacemakers. The author gives clear illustration of the compromises made and the problems solved in finding biologically inactive materials and in identifying electrode reactions with nontoxic products.

Vascular homeostasis is the complex set of biological phenomena that maintain the fluid integrity of the blood. The implantable electrodes discussed in the previous chapter are examples of electrochemical devices that can destructively disrupt blood flow by causing clotting or other problems. The majority of the chapter is devoted to applications that describe both electrochemical and biological results in conjunction.

The final chapter presents an introduction to the methods of nonequilibrium thermodynamics as applied to membrane potential measurement and interpretation. It should be useful to many investigators, though the presentation is marred by rather awkward English style.

Larry B. Anderson, *Ohio State University*

Inorganic Chemistry. By A. G. Sharpe (Cambridge University). Longman, Inc., New York, NY. 1981. xv + 682 pp. $58.00 (hardcover); $25.00 (paper).

This is a fine book by a respected author. Its 27 chapters accurately cover all the major topics of fundamental inorganic chemistry in a terse but readable English style. Each chapter ends with a selection of problems and key references for further reading. Answers to numerical problems and a good index are valuable features. The text itself is unusually well cross-referenced and carefully (though not lavishly) illustrated. The print format is compact. The development of the subject is supported by coverage of structure, thermodynamics, and kinetics. An unusual feature is that nuclear chemistry (with good examples of its application) is to be found in Chapter I. Considerably more factual material is presented than in "Basic Inorganic Chemistry" (Cotton and Wilkinson, Wiley, 1976) or "Modern Inorganic Chemistry" (Lagowski, Dekker, 1973). I am not sure that a comfortable place presently exists for any of these books in the undergraduate American college curriculum, and the use of Sharpe's book in the customary one semester of undergraduate work would have to be selective. I particularly enjoyed reading Chapter 21 (Kinetic Aspects of Transition Metal Chemistry) and Chapter 23 (Organometallic Compounds of the Transition Metals) which are among the best concise presentations of these topics that I have seen. The integrated coverage of industrial processes is balanced, appropriate, and a welcome relief from standard fare.

Geoffrey Davies, *Northeastern University*

Organometallic Chemistry. Volume 10. Edited by E. W. Abel (University of Exeter) and F. G. A. Stone (University of Bristol). The Royal Society of Chemistry, London. 1982. xviii + 464 pp. $77.00.

Volume 10 continues this excellent series of Specialist Periodical Reports and provides essentially complete coverage of the literature for year 1980. There has been no significant change in organization from previous volumes (although the topic of organometallic compounds in biological chemistry has been omitted—the literature on this area for 1980, along with that for 1981, will be provided in Volume 11). Under the Senior Editorship of E. W. Abel and F. G. A. Stone, some sixteen "Reporters" provide the necessary coverage in the following chapters: Group I: The Alkali and Coinage Metals (J. L. Wardell); Group II: The Alkaline Earths and Zinc and its Congeners (J. L. Wardell); Group III: Boron (K. Smith and W. E. Paget); The Carbaboranes, including their Metal Complexes (J. B. Leach); Group III: Aluminum, Gallium, Indium, and Thallium (P. G. Harrison); Group IV: The Silicon Group (D. A. Armitage); Arsenic, Antimony and Bismuth (J. L. Wardell); Metal Carbonyls (J. A. Conner); Organometallic Compounds Containing Metal-Metal Bonds (B. T. Heaton); Substitution Reactions of Metal and Organometal Carbonyls with Group V and VI Ligands (D. A. Edwards); Sigma-Bonded Organometallic Compounds of Transition Elements of Groups IIIA to VIIA (D. J. Cardin and R. J. Norton); Complexes Containing Metal-Carbon σ-Bonds of the Groups Iron, Cobalt, and Nickel (S. D. Robinson); Hydrocarbon–Metal π-Complexes (J. A. S. Howell); π-Cyclopentadienyl, π-Arene, and Related Complexes (W. E. Watts); Homogeneous Catalysis by Transition-Metal Complexes (C. White); Diffraction Studies of Organometallic Compounds (I. W. Nowell). While the length of individual chapters reflects (and is a useful barometer of) the research activity in that particular area, it is noteworthy that the last chapter in the book is the longest, has 730 references, and covers the diffraction studies of more than 800 compounds in the title area. The volume has a total of over 3500 references and there are extensive, subdivided bibliographies at the ends of ten of the sixteen chapters. There is a 38-page, triple-column Author Index; the Table of Contents is provided in sufficient detail that it can function as a kind of Subject Index. Literature coverage also includes a listing of Reviews.

As with previous reports in this series, the prose is spare and often seriously compressed; the pages have lean borders. This is basically a no-nonsense book, devoted to complete coverage with minimum supplementary comment. It achieves these goals admirably.

J. H. Stocker, *University of New Orleans*

Electrons and Valence. Development of the Theory. 1900–1925. By Anthony N. Stranges. Texas A&M Press, College Station, TX. 1982. xii + 291 pp. $28.50.

The history of science is a discipline in its own right, and a scholar in that field might reasonably expect his work to be judged on accuracy, on new historical facts reported, and on new relations revealed between these facts. I am not qualified to do that. However, the history of science has a value that extends outside its own area. On first learning science, much is taken on faith. Only later is there a little time to consider whether other interpretations of the facts might work as well or how they might fail. It is impossible to be sure all formulations have been considered, but a study of the history of science does provide an interesting and coherent way to examine many of the possibilities. It is from this point of view that Professor Stranges' book will be discussed.

"Electrons and Valence" is concerned primarily with the first quarter of this century. Thus it starts after the development of organic structure theory in the nineteenth century, for which good historical descriptions are available, and ends with the introduction of quantum mechanics. The familiar work of G. N. Lewis is described as well as less well-known proposals such as the electromers of Fry and Parson's magneton theory. J. J. Thomson is famed as the discoverer of the electron, but I was surprised to learn of his further important contributions to atomic structure. His 1000-electron model of the hydrogen atom was proposed for valid reasons, then dropped after his later research countered these reasons.

The book lists various descriptions of the chemical bond, but does not always make clear what they were designed to explain and why they were advanced. It is of course possible that these things were never clear to anyone. In an epilogue outside the main body of the book, the author

mentions some quantum mechanical results. He clearly and correctly discounts the idea that the chemical bond is caused by magnetic interactions between paired electrons, but his statement that electron pairing is due to exchange energy would perhaps better be modified to say that both pairing and exchange are the result of electron indistinguishability. But these are minor criticisms. Professor Stranges' book is a pleasure to read and gives a welcome introduction to this important and relatively neglected time in the history of chemical bonding.

L. J. Schaad, *Vanderbilt University*

Nonequilibrium Thermodynamics and its Statistical Foundations. By H. J. Kreuzer. The Clarendon Press, Oxford University Press, New York. 1981. xxi + 438 pp. $69.00.

This excellently written monograph treats a wide range of topics in both nonequilibrium thermodynamics and nonequilibrium statistical mechanics. The author begins with phenomenological descriptions, notably the Onsager reciprocal relations and the hypothesis of minimum entropy production, discusses the question of stability, and considers chemically reacting systems (including those which show oscillations) and the Benard convection problem as examples.

Microscopic methods are also dealt with in some detail. As the question of irreversible behavior has produced an enormous literature, the author wisely presents a clear description and treatment of most of the modern approaches to doing calculations, stressing the physical interpretation of the basis of each approach, as opposed to giving large quantities of non-derived results. The major approaches treated in the text include the BBGKY heirarchy and its applications, the quantum mechanical equivalent of this theory, linear response theory, and master equations.

Relative to most texts, the author has visibly spent a considerable amount of time thinking about the problems at hand. Thus, the usual errors in comments on the symmetry of the stress tensor of a fluid are replaced with a correct treatment of the relations between non-symmetric stresses and the existence of internal angular momentum in polyatomic molecules. Similarly, in examining quantum calculations within the canonical (as opposed to microcanonical) ensemble, the existence of mixed states which are not eigenfunctions of the energy is not swept under the carpet, as is often done.

A final chapter discusses the problem of irreversibility: the apparent discrepancy between the microscopic laws of motion, which do not give a direction to time, and the macroscopic behavior of observable systems, in which one observes apparently time-irreversible behavior. The author takes the view that the macroscopic phenomena are truly irreversible, while microscopic phenomena are truly reversible, and examines how one might get from one sort of behavior to the other.

George D. J. Phillies, *University of Michigan*

Colloidal Dispersions. Edited by J. W. Goodwin. The Royal Society of Chemistry, London. 1982. vii + 217 pp. $15.00.

This volume presents the papers given at a Review Symposium on Colloid Science held at the University of Bristol, England, in September 1981. The emphasis was on presenting an overview of what is already known, not on new results. The contributors have succeeded; the volume is suitable for any chemist interested in an introduction to the physical properties of colloid solutions. Authors include J. Th. G. Overbeek, D. Tabor (surface forces), J. Lyklema (electrical double layers), D. H. Everett (adsorption onto colloids), D. H. Napper (stabilizing colloids with polymers), P. N. Pusey (light scattering), R. H. Ottewill (neutron scattering, concentrated solutions), and J. W. Goodwin (rheology).

George D. J. Phillies, *University of Michigan*

Interpenetrating Polymer Networks and Related Materials. By L. H. Sperling (Lehigh University). Plenum Press, New York. 1981. xi + 265 pp. $35.00.

This book gives an overview of the synthesis and properties of interpenetrating polymer networks (IPN's) as seen by one of the major researchers in that field. Much information is given on such topics as synthesis of IPN's and related materials, their morphology and glass transition behavior, their tensile, dielectric, impact, and other applications-related properties, and their actual and proposed applications. These applications include use as reinforced elastomers, sheet molding compounds, dental fillings, noise-and-vibration-damping materials, coatings, and adhesives. Each chapter ends with an extensive list of references, and many chapters also include a list of books for suggested further reading. The volume as a whole ends with an annotated bibliography containing approximately 260 articles and patents. All in all, this book provides a valuable overview of the subject of IPN's.

However, the more general chapters in this book, especially the one on phase separation and mechanical behavior of multicomponent systems, contain a number of naive statements and oversimplifications. On page 12, the erroneous statement that "demixing occurs because the Gibbs free energy of mixing changes sign, from negative to positive, as molecular weight increases" is not redeemed by a footnote that purports to explain and ammend this statement. Further discussion of miscibility in this Chapter remains naive and somewhat erroneous. For example, the comment that enthalpy of mixing is usually positive for nonpolar molecular species (on page 13) can easily be negated by reference to the literature, e.g., G. Delmas, D. Patterson, and T. Somcynsky, *J. Polym. Sci.*, **57**, 79–98 (1962), in which negative enthalpies of mixing were observed for mixtures of polyisobutylene with many alkanes. Other discussions are oversimplified in ways that appear misleading, e.g., the effect of block copolymer molecular weight on mechanical behavior on pp 24–26 and the miscibility of the different blocks in a block copolymer on p 111. The words "poor mechanical properties" are used throughout this book without explanation.

Different polymers are referred to throughout this book by abbreviations such as SAN, PMMA, SBR, etc., without explanation. These are well-known abbreviations to polymer scientists and engineers, but will be unknown to readers from other disciplines. A table explaining these abbreviations appears on p 39, but is not referred to elsewhere in the book. It would have been useful to have this table either at the front of the book or at the back as an appendix.

This book can thus be recommended as an excellent summary of work on the synthesis and properties of IPN's, but the more general explanatory material is presented in a naive and oversimplified manner so that other sources should be consulted on these subjects.

Sonja Krause, *Rensselaer Polytechnic Institute*

Electroanalytical Chemistry—Basic Principles and Applications. By James A. Plambeck (University of Alberta). Wiley-Interscience, New York, NY. 1982. xix + 404 pp. $35.00.

This book is an ambitious effort to bring together, at the introductory level, many of the theoretical and experimental aspects of electrochemistry. The subjects covered range from the introduction of electrical concepts, units, and instrumentation through the study of coupled chemical reactions. Trying to cover such a breadth of subjects in a reasonable space is quite a difficult task, but the author is generally successful in his attempt. His sequence of presentation is appropriate to the subject matter and the table of contents is well articulated.

The book has three parts: Basic Information and Equilibrium and Non-Equilibrium Electroanalytical Techniques.

The first part is a compendium of basic information relating to electrical concepts, measurements, and instrumentation. In addition, it includes a brief treatment of electrochemical cells, conductance, and electrode kinetics. This part is generally adequate with some exceptions. When talking about operational amplifier circuits (page 20, Figure 1.4), the author makes some misleading comments regarding the non-inverting input. In addition, the section on electrode kinetics would have benefited greatly by including a few diagrams.

Part two includes areas such as measurement of potentials, use of ion selective electrodes, and potentiometric titrations. I found this section concise and well written.

In part three the author introduces a wide variety of electroanalytical techniques such as coulometry, polarography, and voltammetry among others. The treatments were generally good, but the lack of figures in some instances (e.g., when talking about coupled chemical reactions) made the reading somewhat difficult. Some of the nomenclature (e.g., double potential step chronoamperometry vs. cyclic chronoamperometry) is rather confusing.

Overall, I believe the author is generally successful in his attempt to bring together a wide variety of aspects relating to electrochemistry. This book would be adequate for an undergraduate level course in electrochemistry or as part of an instrumental analysis course with emphasis on electrochemistry.

Héctor D. Abruña, *University of Puerto Rico*

Mass Spectrometry for Chemists and Biochemists. By M. E. Rose and R. A. W. Johnstone (University of Liverpool). Cambridge University Press, New York, NY. 1982. xiii + 307 pp. $49.50 hardbound; $19.95 paperback.

With the passage of the years since publication of texts by Biemann, by Beynon, and by Budzikiewicz, Djerassi, and Williams, there has been a growing need for a comprehensive introductory text on mass spectrometry addressed to the organic chemist and biochemist. This deficiency has been met, in part, by some excellent books which cover a portion of this field, notably McLafferty's book on interpretation of spectra, Williams and Howe's text on organic ion chemistry, and Levsen's readable treatment of the physical basis of organic mass spectrometry. Rose and Johnstone's book is pitched at an appropriate level and its coverage is good but, in spite of its merits, it is unlikely to fill this gap.

The first third of the book covers instrumentation, ionization methods, data systems, gas chromatography/mass spectrometry, liquid chromatography/mass spectrometry, and derivatization reactions used to prepare samples for mass spectrometry. This material is presented in a concise and largely qualitative fashion. The last third of the book is a treatment, at a similar level, of structure elucidation by mass spectrometry, with a good presentation of both rules for fragmentation and examples of worked structural problems. The remaining pages deal with quantitation, alternative ionization methods, metastable ions, and the theory of mass spectra.

The book appears to be largely free of errors; indeed the material dealt with has appeared in similar form in many places and one could wish that a fresh approach might have been found. The main difficulty however, can be ascribed to the subject itself and not to the authors. Developments in mass spectrometry are occurring so rapidly that important aspects are not adequately covered here. These include ionization methods such as secondary ion mass spectrometry and fast atom bombardment, negative ion formation and fragmentation, Fourier transform mass spectrometry, and mass spectrometry/mass spectrometry. The authors have made important contributions to mass spectrometry through the Chemical Society's "Specialist Periodical Reports" series. Here they provide a work which will be adopted for courses on mass spectrometry and as a means of pointing the organic chemist to the subject.

R. G. Cooks, *Purdue University*

Principles of Geochemistry. By Brian Mason (Smithsonian Institution) and Carleton B. Moore (Arizona State University). John Wiley & Sons, New York. 1982. vi + 344 pp. $29.95.

As the authors state in their preface, this book is intended to be an introduction to geochemistry for undergraduate and graduate students in chemistry or geology. They have attempted to cover the entire field of geochemistry in only 327 pages. In the sense that the book contains chapters on the atmosphere, the biosphere, the hydrosphere, metamorphism, sedimentation, magmatism, etc., they have indeed covered the entire field. They have kept the book short by keeping the discussions at an introductory level and giving very brief attention to certain topics that the instructor might feel are important. For example, there is an excellent discussion of the history of the evolution of the earth's atmosphere but only one paragraph on the greenhouse effect and only one sentence about the ozone layer. (They apparently missed Hart's computer model of the evolution of the atmosphere; *Icarus*, **33**, 23–29 (1978). In the chapter on sedimentation and sedimentary rocks there is a good discussion of the formation of evaporites, some discussion about trace metals in shales, and almost nothing about limestones.

Unfortunately, the chemistry is weak in places. The structure of water, pH, colloids, and redox potentials are covered more thoroughly (and more correctly) in most general chemistry textbooks. For example: (1) The special properties of water are ascribed to its dipolar nature rather than its dynamic network of intermolecular hydrogen bonds. (2) pH is defined in terms of the concentration of H^+ rather than its activity. (3) The sign convention used for redox potentials is taken opposite to that recommended by the 1953 IUPAC Stockholm convention. (4) The statement that humus colloids are "probably albumins" is incorrect; they are definitely not albumins. (5) Adsorption is described as being of two types, van der Waals and chemical adsorption. Coulombic attraction and hydrogen bonding should be included.

Overall the book reads easily and contains much useful information about geology (less so about chemistry). It would be a good choice for a textbook for a one-semester or one-term course in geochemistry. Chemistry students with an interest in the environment should be encouraged to take such a course or to read this book to gain perspective and to expose them to the vocabulary, outlook, and problems of geologists.

Dennis Barnum, *Portland State University*

Halogenated Hydrocarbons: Solubility-Miscibility With Water. By A. L. Horvath (Imperial Chemical Industries, Ltd.). Marcel Dekker, Inc., New York. 1982. xxvi + 889 pp. $125.00.

The author set out to survey the solubility and miscibility of halogenated hydrocarbons in water and he has done an admirable job of meeting his goals. There are some fifty million possible halogenated hydrocarbons containing up to six carbon atoms. An exhaustive search of the literature and many other sources has resulted in 143 tables of solubilities in water, 69 tables of water solubilities in these solvents, and many tables showing mutual liquid/liquid solubilities. There are also many tables in the appendices containing data on physical properties of the halogenated hydrocarbons. Where temperature-dependent solubility data are available, the author provides smoothing equations for the data. There is a good description about how the author selected and evaluated his sources. The comprehensive discussion of the theory of solubilities in these systems is excellent, as is the discussion on empirical correlations. One good feature of this book is the examples the author gives of how he critically evaluated the data that are presented in the tables. The author sometimes uses four significant figures for percentage errors where no more than two would be reasonable. This is an excellent volume and the care spent in its preparation shows.

Rubin Battino, *Wright State University*

Biological Electrochemistry. Volume I. By G. Dryhurst, K. M. Kadish, F. Scheller, and R. Renneberg. Academic Press, New York. 1982. xi + 549 pp. $74.00.

This volume contains a series of reviews of the electrochemistry of several classes of compounds of biological importance. The subjects covered are as follows: quinones, catecholamines, phenothiazines, ascorbic acid, purines, vitamin B_{12}, and a large chapter entitled simply proteins. This last chapter includes topics as varied as protein adsorption on electrodes and redox chemistry of iron–sulfur proteins. The chapters are generally comprehensive and quite well written.

The discussions also are not restricted to redox chemistry under physiological conditions. For example, the chapter on quinones contains a significant discussion of general quinone redox chemistry in nonaqueous solution. Similar considerations can be found in many of the other chapters.

The classes of compounds dealt with in the first six chapters have been studied extensively. There are nonetheless many cases where questions regarding electrochemical properties remain. In these instances, the authors have been sufficiently critical in their reviews that these questions are plainly illustrated.

In summary, this book covers, lucidly and in detail, six very important areas of interest to both biological and nonbiological electrochemists. It covers in less detail a large number of other topics of biological nature. Finally, it is assumed that since the book is entitled "Biological Electrochemistry. Volume I" other volumes will be forthcoming. Such a series as this will be a valuable reference source to people with interests in redox processes involving biologically relevant compounds.

C. Michael Elliott, *Colorado State University*

Introduction to Alkaloids, a Biogenetic Approach. By G. A. C. Cordell (University of Illinois, Chicago). John Wiley & Sons, New York, Chichester, Brisbane, and Toronto. 1981. xvi + 1055 pp. $150.00.

In a concise and well-written monograph, Geoffrey A. Cordell has categorized the known classes of alkaloids on the basis of their biogenetic origin and biosynthetic pathways starting from simple amino acids, acetate, or terpenoid units. Included are purines and steroidal pseudoalkaloids not derived from amino acid precursors.

Discussion of the occurrence, synthesis, biosynthesis, spectroscopic properties, chemistry, and pharmacology of the important alkaloids is preceded by introductory chapters reviewing the history, detection, isolation techniques, and enzymes involved in their formation. Miscellaneous groups of alkaloids which could not be classified in accordance with the principles elaborated, such as amphibian alkaloids, alkaloids from marine sources, mushrooms, polyamines, macrocyclic peptides from higher plants, and mytansinoids are discussed at the end.

Diversion from the classical term "alkaloids" allowed the inclusion of a variety of alkaloidal substances originating from microorganisms (benzodiazepine alkaloids, diketopiperazines, pyrrolnitrin, anthramycine, isolated and synthesized at Roche, Nutley) and plant pigments. Even when questioned by purists, this extension seems appropriate and educational.

Cordell's presentation of what is to be known about alkaloids through 1977 with pertinent literature references at the end of each chapter makes reading interesting and stimulating. This monograph will not only be useful to graduate students, but also to scientists interested in natural products chemistry. It is commendable that the author does not depreciate similar treatises which discuss individual groups of alkaloids either in more depth or regarding their annual progress. "Introduction to Alkaloids; a Biogenetic Approach" is one of the most comprehensive and useful text on alkaloids available to date.

Arnold Brossi, *National Institutes of Health*

Mathematical Techniques in Crystallography and Materials Science. By Edward Prince (National Bureau of Standards). Springer-Verlag: New York, Heidelberg, and Berlin. 1982. vi + 192 pp. $22.50.

According to the author, this little book was designed not to be "a textbook, but a reference book—a *vade mecum* for active research workers". The result is a compendium of useful information, distilled to a concentration that omits lengthy and tedious proofs.

There are nine chapters (133 pp): Matrices, Symmetry of Finite Objects, Symmetry of Infinitely Repeated Patterns, Vectors, Tensors, Data Fitting, Estimation of Uncertainty, Significance and Accuracy, and

Constrained Crystal Structure Refinement, plus seven appendices (54 pp), the last of which is entitled Some Useful Computer Programs, a bibliography (1 p), and an index (4 pp).

This book is written in a somewhat breezy style and is suprisingly easy to read. The choice of topics, in the nine chapters, according to the author, was determined by two criteria: to material that, over the years, he "had to learn or look up frequently", or to things that he "frequently explained to other (sic) colleagues". The result of this eclecticism is the disappointingly small size of this book, which could easily have been twice as long (and cost twice as much?). I was particularly piqued by the compression in Chapter 9 where the author discusses constrained refinement but does not tell the reader how to do it, and by the brevity of the last appendix, which should have expanded to a degree such the reader would be told exactly the data to be input and what to do with it in order to come up with libration-corrected bond lengths. Nevertheless many crystallographers and materials scientists will find this book useful.

I think that it is worthwile to repeat here a footnote in the Significance and Accuracy chapter where Prince discusses correlations and unnoticed systematic errors: "An observation, generally attributed to Enrico Fermi, is that nothing resembles a new phenomenon so much as a mistake". Of course, although many of us have been saying more or less the same thing for decades, perhaps less succinctly, this observation should be printed in large letters and prominently displayed over the desks of every editor and referee of scientific journals.

Jerry Donohue, *University of Pennsylvania*

The Excited State in Chemical Physics. Part 2. Edited by J. W. McGowan. John Wiley & Sons, New York. 1981. xi + 609 pp. $60.00.

This book constitutes Volume 45 in the well-established series "Advances in Chemical Physics". It consists of six chapters on gas-phase spectroscopy. They involve various mixes of theory and experiment. The first chapter consists of a review (about 20 pages) of the basic concepts of electron spectroscopy and energy transfer, followed by a consideration of experimental methods. About half the chapter consists of an application of these ideas, primarily to rare gases, but with some discussion of N_2, CO, and (briefly) CH_4. The second chapter concerns ion–neutral interactions with an extensive discussion of chemiluminescence. The third chapter gives a brief discussion of the calculation of potential energy surfaces and extensive display of such surfaces (or curves) for a variety of diatomic molecules. The fourth chapter is primarily a discussion of experiments on collisional energy transfer and the quenching of electronically excited atoms by molecules. The fifth chapter concerns spontaneous ionization in slow collisions. The theory of penning ionization is reviewed and applied to experimental results on atoms and monatomic ions. The final chapter concerns molecular beam studies of scattering of metastable noble gas atoms. The theory is briefly reviewed and applied to a variety of symmetric and asymmetric systems.

The authors are experts in their areas. The emphasis is on experimental results and their interpretation. While the authors differ somewhat in the degree to which they present the theoretical background, a graduate student engaged in research on gas-phase spectroscopy should be able to follow any of these articles. The intellectual level is high and the articles appear to be up to date, although readers of this review should be aware that the writer is not an expert in the field.

The book will be of considerable interest and value for gas-phase spectroscopists. Those of us interested in condensed phases will be disappointed that no discussion of the excited state as a probe of condensed phase interactions is included.

H. G. Drickamer, *University of Illinois*

Stress Analysis of Polymers. 2nd Edition. By J. G. Williams (Imperial College of Science and Technology). John Wiley & Sons (Halstead Press), New York, NY. 1980. 360 pp. $77.95.

The first five chapters (The Analysis of Stress and Strain; Time Independent Behaviour; Time Dependent Behaviour; Problems Involving Bending; Problems with Axial Symmetry) are very minor revisions of the earlier (1973) edition. The earlier Chapter 6 (which treated stress functions and fracture) has been replaced by two totally rewritten chapters entitled Stress Functions and Fracture Mechanics.

The first three chapters treat the fundamentals of continuum mechanics in a traditional manner. Mathematical concepts which may be unfamiliar to some of the readers (e.g., LaPlace transforms) are developed and described. The clear stepwise development of the requisite mathematics is a particular strong point of these chapters. The author has also chosen to avoid matrix and tensor representations in these early chapters which causes the treatment to be longer than necessary, but this should make the text available to a much wider audience.

Although there are no citations to the research literature within the text, each chapter is concluded with a brief bibliography which typically includes the classical review articles in the field. A detailed index facilitates location of specific material and/or subjects.

The book will be of limited value to current practitioners in the field but does provide a clear, concise, and well-written introduction and survey to those scientists and/or engineers with little or no background in performing stress calculations on polymeric materials. It could be used alone as a self-study textbook or as the primary textbook in a course emphasizing engineering properties of macromolecular systems; unfortunately, the price will probably prohibit this latter use.

Philip L. Kumler, *State University of New York. College at Fredonia*

Comprehensive Treatise of Electrochemistry. Volume 3. Electrochemical Energy Conversion and Storage. Edited by J. O'M. Bockris, B. E. Conway, E. Yeager, and R. E. White. Plenum Press, New York. 1981. XXII + 540 pp. $55.00.

The canvas of modern electrochemistry is very vast, complex, and cross-disciplinary. Three of the most prominent masters (J. O&M. Bockris, B. E. Conway, and E. Yeager) who have each contributed creatively to huge chunks of this canvas have now collaborated (together with another colleague, R. E. White) to orchestrate a multivolume effort describing the complete story of modern electrochemistry.

The fundamental *scientific* importance of electrochemical energy conversion and storage is that one escapes the limitations of the Carnot cycle (nothing personal against the thermodynamicists here!). The pivotal *technological* position of this mode of energy conversion and storage is that this is the *only* logical way of energy manipulation in future industrial societies which would be based almost entirely on electricity. The *pedagogical* value of exploring this body of knowledge lies in the fact that it provides a means of understanding some important interactions of physics and chemistry in relation to problems whose significance can be readily grasped by the student.

The book opens with an inspiring chapter (Electrochemistry and the 21st Century) by Prof. Bockris, in which a convincing case is made that electrochemical events constitute the basis of most important transformations in energy, environment, materials, and biology. Thorough discussions of the principles of electrochemical energy conversion (B. V. Tilak, R. S. Yeo, and S. Srinivasan) and storage (K. Kordesh) are followed by a series of valuable chapters on *primary* batteries: introduction (M. Barak): Leclanchē systems (A. Kozawa); alkaline manganese dioxide batteries (K. Kordesh); mercury dry cells (S. Ruben); lithium batteries (M. L. Kronenberg and G. E. Blomgren); and solid batteries (J. H. Kennedy). The focus in the rest of the book is on secondary batteries, i.e., the true electrical storage units. Detailed and authoritative reviews of various secondary batteries are given in the next six chapters built around: introduction to secondary batteries (J. McBreen); high temperatures (E. J. Cairns), lead–acid (D. Berndt), nickel–cadmium (F. von Sturm), silver–zinc (F. von Sturm), and vehicle propulsion battery systems (E. J. Cairns and E. H. Hietbrink). The book closes with an essay on hydrogen economy by Bockris, similar in conviction to the opening chapter.

The authors of various chapters are recognized experts and most of them have done a very competent job in reviewing their respective areas. It is inevitable that there be some redundance, and/or a lack of clear consensus as to the future of various competing fuel cell and battery systems, as in this volume. There is, on the other hand, just about the right blend of basic theory and descriptive detail.

Despite its obvious merits, this volume does lend itself to a degree of criticism. Was it really necessary to devote so much space to primary batteries? Would it not have been better to use some of these pages on newer aspects of secondary batteries, e.g., intercalation systems and emerging concepts based on polymeric electrodes and electrolytes? And, finally, no book on electrochemical energy conversion and storage is complete without meaty sections on photoelectrochemical aspects. It is realized, however, that all these concepts have gained importance only in the last few years, i.e., roughly the time elapsed between the planning and the appearance of this book.

In conclusion, this book is an authoritative source of valuable information on conversion and storage of energy by electrochemical means. It would also be of immense value to non-electrochemists wishing to learn something about this important area of science.

Ashok K. Vijh, *Institut de recherche d'Hydro-Quēbec*

Progress in Surface Science. Volume 9. Edited by S. G. Davison (University of Waterloo). Pergamon Press, New York and Oxford. 1981. 269 pp. $93.00.

The high quality of this excellent series is maintained in Volume 9, which consists of seven review papers having a good balance of theory and experiment. Muscat and Newns give a critical analysis of the theoretical aspects of chemisorption on metals and a discussion of the Anderson model. Surface studies using the vacuum microbalance are detailed by Czanderna and Vasofsky with 556 references. An extensive

listing of the different systems studied by this technique is contained in nine tables. Flytzani-Stephanopoulos and Schmidt give an account of the morphology and etching processes of macroscopic unsupported metal catalysts in unreactive and reactive gases. This chapter contains a number of quality electron photomicrographs. Materials related aspects of the electrophotographic process of Electrofax layers with emphasis on the electrical and surface properties of ZnO are presented by Kiess. Ultraviolet photoemission measurements of molecular adsorption on single crystal metal oxides are summarized by Henrich. Studies of transition-metal compound surfaces with use of surface analytical techniques are reviewed by Langell and Bernasek. The surface structure and composition of model transition metal compound surfaces are emphasized. The final chapter by Puszkarski is a review of the present status of the theory of magnetic surface states by spin wave resonance and experimentally observed effects. The author index for all cited references and the subject index are quite useful. This volume will be necessary reading for anyone concerned with both the theoretical and experimental aspects of the characterization of solid surfaces and of the interaction of gas molecules with surfaces.

James P. Wightman, *Virginia Polytechnic Institute and State University*

A Dictionary of Chromatography. Second Edition. By R. C. Denney. John Wiley & Sons, New York, NY. 1982. 229 pp. $39.95.

This book is a dictionary of the terms utilized in the very broad and rapidly growing field of chromatography. The author has made an excellent attempt of employing symbols and equations which are in common use in the United States and Europe. Amazingly, the terms defined or elucidated represent an excellent compromise between the trivial and the very specialized. In addition, 506 references are provided and are typically associated with the original work on a given technique. As a result, there is an abundance of references cited from the literature of the fifties and sixties.

The pertinent equations underlying and employed in chromatography are presented with all parameters defined. Schematic diagrams of all major or commonly used instrumental components for a chromatograph are illustrated. However, there are some noticeable omissions of graphic illustrations associated with instrumental items which have become very popular within the last 5 or 10 years. Although defined, such examples include fluorescence and electrochemical detectors in HPLC and the split/splitless injector pioneered by Grob. This reviewer feels that these devices certainly deserve the same graphical coverage as a planimeter and a transport detector. No mention is made of fused silica as a column material in high resolution gas chromatography.

The author states in the Introduction that this book is not intended for the person who considers himself or herself an expert in the theory and practice of chromatography. This reviewer agrees and projects that a so-called expert would find this book to be trivial. On the other hand, a novice to the technique of chromatography would find this book to be extremely helpful. The price of the book seems a bit high for a personal acquisition but can be strongly recommended for university, corporate, and research libraries.

Eugene F. Barry, *University of Lowell*

Matrix Isolation Spectroscopy. Edited by A. H. Barnes, W. H. Orville-Thomas, R. Gaufrès, and A. Müller. D. Reidel Publishing Co., Dordrecht, Holland/Boston/London. 1981. 605 pp. $69.50.

This book is based on a series of lectures given at a NATO Advanced Study Institute. The aim of most of the chapters is a readable introduction (with references) to various aspects of the matrix isolation technique rather than an exhaustive review. The book should be of interest to a general audience of chemists and spectroscopists.

Matrix Isolation is a technique for making a sample where the molecule studied is isolated by diluting it in an inert solid (the matrix) at low temperatures. This book provides a good, up to date description of many of the sometimes disparate fields where this method of sample preparation has been useful. The articles range from introductory descriptions of some traditional uses of matrix isolation, such as the trapping of transients, to some very good reviews of current work on, for example, the structure and the laser photochemistry of metal carbonyls, by J. J. Turner.

The book is arranged in three sections: techniques, matrix effects, and applications. Within the techniques section, the elementary chapters are good; however, for the basics, the books by Moskovits and Ozin or the one by Hallam is probably more coherent than this multiauthor introduction. The chapter on relaxation processes by H. Dubost is very good. Chapters on Mössbauer spectroscopy and magnetic circular dichroism give an idea of the richness of the applications of the matrix technique.

The chapters on matrix effects present a good selection of topics. However, they will be most useful to those actively engaged in using the matrix isolation technique, since, in the trade, matrix effects all too often means those observations which cannot be easily explained.

Applications of matrix isolation are well described. Especially interesting is the chapter on the spectroscopy of small metal clusters by D. M. Kolb. Use of the technique to study conformational equilibria and hydrogen bonding is also described.

Most of the chapters of this work succeed in being useful introductions to their topic. I recommend you at least peruse this book for a flavor of the wealth of applications of the matrix isolation technique.

James S. Shirk, *Illinois Institute of Technology*

Kirk-Othmer Encyclopedia of Chemical Technology. Third Edition. Volume 20. Edited by M. Grayson and D. Eckroth. John Wiley and Sons, New York. 1982. xxvi + 981 pp. $165.00.

This volume covers thirty subjects, from Refractories to Silk. Among them are four elements (rhenium, rubidium, selenium, silicon), several processes (reverse osmosis, refrigeration, reprography, sampling, sedimentation), some important classes of materials (resins, rubber, sealants, semiconductors), two more or less non-chemical subjects (regulatory agencies, research management), and a subject alliteratively and enigmatically titled "separation systems synthesis" (it has to do with devising chemical engineering processes for separation of chemical components). The entry "Reprography" is one that everyone can relate to, for it succinctly tells how to understand your office copier and all its friends and relations. As usual in this series, the articles are reviews so written as to make a bridge from academic to industrial outlooks. The contributors are mostly from industry. Editorial control maintains a consistently high standard.

Light Scattering in Solids. II. Basic Concepts and Instrumentation (Topics in Applied Physics. Volume 50). Edited by M. Cardona and G. Güntherodt. Springer-Verlag, Berlin, Heidelberg, and New York. 1982. xiii + 251 pp. $45.00.

This book is one in a series of four which treat light scattering in solids. It consists of four chapters of which two and three appear especially valuable: the former because it contains a simple collection of the basic theoretical formulae of importance in resonance phenomena, and the latter because it treats the recent existing techniques of multichannel detection. Cardona has authored Chapter 2 and Chang and Long have written Chapter 3. Vogt's chapter on coherent and hyper-Raman techniques also has both a first-principles treatment of coherent effects and a discussion of recent work in the particular field of hyper-Raman effects. The introduction to the book touches upon the highlights of light scattering ranging from surface-enhanced Raman scattering, through layer materials and superconductors, to spin-dependent effects and semiconductors. The book is written well and does what it sets out to do.

V. M. Kenkre, *University of Rochester*

The Architecture of Solids. By G. E. Bacon (University of Sheffield). Wykeham Publications (London) Ltd., Crane, Russak & Co. Inc., New York. 1981. viii + 180 pp. $16.50.

Wykeham books are written as collaborative projects between a research worker (Bacon in the present case) and a teacher (Noakes in the present case). Much effort has clearly gone into this little book to make it understandable to a large audience. It succeeds in being informative and catching, but is limited as a result of its being written in a language which is largely non-mathematical. This reviewer did not find the chapter on the physical properties of crystals especially effective. On the other hand he did find the treatment of magnetic structures lucid and that of disorder and defects very readable. The overall impression is of a competent book to serve as an introduction in high schools.

V. M. Kenkre, *University of Rochester*

Applications of Lasers to Chemical Problems. Edited by Ted R. Evans (Eastman Kodak Company). John Wiley & Sons, New York. 1982. xi + 291 pp. $55.00.

After 20 years and thousands of papers on the building and uses of lasers, the novice research student would like an overview of the type of lasers that have been developed, their frequency, region of utility, power, and uses. Volume XVII of the Weissberger series, "Techniques of Chemistry", serves this purpose. With 660 references to primary and review articles, this volume should be the starting point for every chemist's entrance into laser-induced chemistry.

A well written, succinct first chapter by Jack Wilson on Laser Sources discusses the theory, subsequent development, and safety guides for both the gas and solid-state laser devices. Included in this section are the ranges, power, and auxillary equipment needed to do an experiment.

The second chapter by John C. Wright on the Application of Lasers in Analytical Chemistry is a goldmine of information and clever techniques. It contains over 30 different spectroscopic analytical methods

initiated or revitalized because of the discovery of the laser. The main thrust of this section is the development of coherent Raman spectroscopies; CARS, CSRS, BOXCARS, HORSES, and RIKES.

Chapters III and IV, written by Ted R. Evans and A. M. Ronn, are devoted to apparatus and techniques of photochemistry in UV–visible and infrared regions, respectively. The triumphs, pitfalls, and limitations of laser techniques in synthesis and kinetic mechanistic studies are dealt with at length.

The overview presented by Ronn in the fourth section could have better served as the introduction to the entire volume as it encompasses much of the general information, dreams, and problems that laser technology has elucidated over the years.

This reference book was written with the knowledge that there would be many advances in this active and volatile field by publication time. This attitude on the part of the authors is both positive and forward looking.

Irving Lipschitz, *University of Lowell*

Extended Linear Chain Compounds. Volume 2. Edited by Joel S. Miller (Occidental Research Corporation. Plenum Press, New York. 1982. xvi + 515 pp. $55.00.

J. S. Miller's series is timely and is devoted to the active field of linear chain compounds. The contributions in this volume have varied style and content: There are chapters treating the structural aspects of TTF and TTT, as well as chapters describing the theoretical basis for the electronic properties of polymers in general and for the optical properties of one-dimensional solids. Two articles stand out in particular: an excellent exposition of the analogies and connections between two-dimensional and one-dimensional materials coauthored by Dines and Marrocco and an extremely lucid overview of the electronic structure of semiconducting polymers written by Duke. The volume is a useful addition to the library of any solid-state physicist or chemist interested in polymeric and related solids.

V. M. Kenkre, *University of Rochester*

Analytical Methods for Pesticides and Plant Growth Regulators. Volume XII. High-Performance Liquid Chromatography of Pesticides. By James F. Lawrence (Food Research Division, Health Protection Branch, Health and Welfare, Canada). Edited by Gunter Zweig and Joseph Sherma. Academic Press, New York, NY. 1982. x + 246 pp. $35.00.

With the rapidly increasing availability of high performance analytical liquid chromatographs, HPLC is fast becoming the method of choice for quantitative determination of most compounds incapable of gas chromatographic analysis. Application of HPLC to pesticide analysis was treated to some extent in Volumes VII and XI of this series, but this volume collects, brings up to date, and adds to the information previously available. It covers the HPLC analysis of insecticides and acaricides (Section I: 29 compounds), fungicides (Section 2: 17 compounds), herbicides and plant growth regulators (Section 3: 42 compounds), and rodenticides (Section 4: 6 compounds). Trade names, chemical names, and structural formulae are given for the 94 compounds in the above categories, all of which may be encountered in the environment. In each case a general reference is given for the compound. This is followed by specific HPLC analytical data, usually including a review of methods and procedures for extraction as well as data on column dimensions, stationary and mobile phases, flow rates, detectors, etc. In many cases further information is presented on column cleanup, calculations and quantitation, elution times, percent recoveries, and recorder tracings. Also included are sections on the analysis of *mixtures* of compounds such as carbamate insecticides, organophosphate insecticides, fungicides, phenoxy acid herbicides, triazine herbicides, and urea herbicides. An extensive (184 reference) and up-to-data bibliography is included. This book is well organized and clearly written and will prove invaluable to anyone engaged in the determination of these compounds in the environment.

Dwight F. Mowery, *Southeastern Massachusetts University*

Meteorites, a Petrologic—Chemical Synthesis. By Robert T. Dodd (State University of New York, Stony Brook). Cambridge University Press, Cambridge, England. 1981. xi + 368 pp. $69.50.

This book is in every way an exceptional one—in all but one, exceptionally good. Just as the subtitle indicates, the author (a petrologist with chemical leanings) attempts to synthesize all pertinent petrologic and chemical information into a coherent picture of the origin and evolution of meteorites. In this, he succeeds very well.

In each chapter (Introduction; The chondrites: chemistry and classification; Carbonaceous chondrites; Ordinary chondrites; The enstatite chondrite—achondrite association; Time and processes in the evolution of chondrites; Differentiated meteorites: iron meteorites, pallasites, and their associates; The eucrite association; Unassociated differentiated meteorites; Source objects and parent bodies), Dodd summarizes the evidence, discusses the interpretations, and then chooses among them. Often, the data are not compelling and, where this occurs, Dodd freely admits that his choice of an interpretation may be biased—a refreshing attitude. These choices are as soundly based as any would be and all are clearly laid out for the reader.

The book is extremely well written at both the student and professional level. I have lent my copy to my own undergraduate and graduate research students for their comments and these have been uniformly favorable. I have used it myself to review specific genetic arguments. Each chapter has a list of 10^1 specific references and there is a very complete up-to-date reference list totaling 30 pages at the end of the book. The book is well-illustrated and the photomicrographs (which are a test of the reproduction quality) are very clear. Clearly, a book of this length cannot include all that one would wish—particularly in an area like cosmochemistry that is developing so rapidly. Dodd has left out some areas not germane to the thrust of this book but lists these and cites general references which review them. All in all, even if there were a competitive volume (which there is not), "Meteorites" would constitute an excellent introduction to the subject and I do recommend it.

Where then is the exceptionally bad aspect? The price. Were it not for this I would choose "Meteorites" and a volume on nucleosynthesis and planetology (of which there are several) as complementary texts in the senior-level Cosmochemistry course that I teach. At this price, I cannot do so. I had delayed my review hoping that Cambridge University Press would have the foresight to publish a version selling for ≤$25—thereby markedly increasing sales possibilities. They have not yet done so and I cannot, in good conscience, require students to buy "Meteorites". I recommend it therefore to libraries, professionals in the field, and the occasional oil or other millionaires interested in learning what meteorites teach us of the origin and evolution of solid, solar-system objects.

Michael E. Lipschutz, *Purdue University*

Macromolecular Chemistry. Volumes 1 and 2. Specialist Periodical Reports. Edited by A. D. Jenkins and J. F. Kennedy. The Royal Society of Chemistry, London. Volume 1: 1980. xx + 484 p. $108.00. Volume 2: 1982. xviii + 425 p. £59.00.

With "Chemical Abstracts" readily accessible, it is not difficult for a macromolecular chemist to compile a list of recent publications related to any research topic. However, one needs other sources in order to obtain well-organized information that provides both background and perspective. The new series of "Specialist Periodical Reports" published biennially in "Macromolecular Chemistry" aims at meeting this need. These two volumes describe macromolecules in the form of synthetic polymers such as plastics and fibers and biological polymers such as proteins, enzymes, and nucleic acids.

Volume 1 reviews the literature published during 1977 and 1978, Volume 2 that during 1979 and 1980. As stated in the introductory chapter of Volume 1, the more global subjects, such as polymerization chemistry, are treated in each volume while certain special topics, such as specific techniques for characterization, are reviewed at intervals. The 20 chapters in Volume 1 include the following topics: chain reaction polymerization (co-ordination complex polymerization*, cationic polymerization, anionic polymerization, radical polymerization, template polymerization*, emulsion polymerization, electrochemical polymerization); step growth polymerization; copolymerization and multicomponent polymerization reactions*; polysaccharides and glycoproteins; natural polymers (proteins and enzymes; nucleic acids); inorganic polymers; configurations; nuclear magnetic resonance spectroscopy; neutron scattering studies; polymer crystallization; characterization of synthetic polymers; thermodynamics of solutions and mixtures*; engineering and technology; reaction of polymers (polymer modification); polymer degradation; catalysis by macromolecules; biomedical applications of polymers; and computer applications. Volume 2, which contains 19 chapters, drops several topics (those marked with an asterisk) and adds the topic of plasma polymerization. Each chapter was written by one or more experts. Continuity was maintained by having many reporters write on the same topic in both volumes.

A commendable feature of this series is its paradigm formulated by the two senior reporters: "Each chapter opens with an introduction which is specialized with respect to the contents of the chapter and outlines the context of the chapter particularly for those not completely familiar with the subject treated". For example, the chapter on chain polymerization (Volume 1) begins by describing the development of Ziegler-Natta catalysts in two stages: their startling discovery in 1953 and the emergence of the second generation catalysts in 1972. This gives the reader a vivid impression of how momentum was generated in this area of research. The chapter on the thermodynamics of solutions and mixtures opens with a general overview of the area and calls attention in each main section (e.g., the section on theoretical aspects) to the central problem

involved. Current theories in attacking the problem are reviewed along with the classical approach.

Overall, the coverage is comprehensive and systematic. The authors treated the subjects in depth and their presentations are clear and concise. Although basically intended for investigators of polymer chemistry and polymer physics, these reports are of great value to biochemists and molecular biologists as well. Research workers in the area of proteins, enzymes, and nucleic acids frequently express a desire to learn about recent developments in synthetic polymers. They will find satisfaction in these reports. In the academic community, this series is worthy to lecturers for updating notes. If the introductory remarks of each chapter are expanded to include more detail, these reports can be adopted as required texts in a graduate course.

S. F. Sun, *St. John's University*

Elementary Organic Stereochemistry and Conformational Analysis. By B. A. Marples (University of Technology, Loughborough, UK). The Royal Society of Chemistry, London. 1981. iii + 82 pp. £5.00.

This book is No. 34 in the series of Monographs for Teachers, but—at least on the American scene—would appear most suitable as a supplemental book for an advanced undergraduate or a beginning graduate student. The book is slim, but the topics are well chosen and the presentation is knowledgeable and competent. Only the first chapter is concerned with general stereochemistry; in addition to standard undergraduate textbook topics, it touches on symmetry principles, deals at some length with prochirality, and gives a number of examples of stereochemical nomenclature. The remaining four chapters cover conformation: concepts, physical methods of conformational analysis, and conformation and reactivity in cyclic and in acyclic systems. Here many important topics are dealt with despite the limited space, some of them not routinely found in elementary texts, such as the Hill equation and the importance (or lack thereof) of H/H repulsions, the effect of phase on the conformation of dipolar molecules, the difference between conformationally biased and conformationally locked molecules, the preferred E_2 elimination of diaxial over diequatorial trans substituents, the Curtin-Hammett principle, and a number of others. There are a few random original references in the book (apparently to observations or explanations which the author considered particularly novel or unusual) plus some general references to a dozen or so advanced textbooks and monographs in the field.

The book is a good buy and is recommended reading for any chemistry undergraduate in his junior or senior year who wants to prepare himself for graduate work in chemistry or biochemistry, as well as for any graduate student who needs some extra help with stereochemistry. In German I would characterize it as "klein aber fein".

Ernest L. Eliel, *University of North Carolina*

Advances in Heterocyclic Chemistry. Volume 31. Edited by A. R. Katritzky. Academic Press, London and New York. 1982. ix + 350 pp. $68.00.

Four of the six chapters in this volume are on subjects not before covered in this series. 1,2-Dithiole-3-thiones and 1,2-Dithiole-3-ones, by C. T. Pederson, brings the subject up to 1980 from 1965; the earlier literature has been covered in reviews published elsewhere. Azocines are reviewed from their beginning, along with their fused-ring derivatives, the various benzazocines, by H. D. Perlmutter and R. B. Trattner. A chapter on Dewar heterocycles, by Y. Kobayashi and J. Kumadaki, is an account of recent photochemistry leading to heterocyclic analogs of "Dewar benzene". A chapter on Cyclizations under Vilsmeier Conditions, by O. Meth-Cohn and B. Tarnowski, brings together widely scattered information involving the reactions of tertiary amides and acid chlorides, typically phosphoryl chloride, one aspect of which is the well known Vilsmeier-Haack formylation reaction.

The other two chapters build on earlier reviews in this series. Quinolizines are reviewed from about 1965 by G. Jones, and furan chemistry is reviewed from about the same time, in the second part of a two-part treatment that began in Volume 30.

If only all of the authors would state when they closed their search of the literature!

Introduction to High Performance Liquid Chromatography. Second Edition. By R. J. Hamilton and P. A. Sewell (Liverpool Polytechnic). Chapman and Hall, London and New York. 1982. 248 pp. $29.95.

The first edition of this text was published in 1977, but it does not appear to be well known in the United States. It is an introduction to HPLC, not a compendium on the subject. The eight chapters are devoted to introduction, theory, equipment, stationary phases, mobile phases, chromatographic development, preparative HPLC, and applications.

The book is an exceptionally well written, concise but thorough, discussion of HPLC. In keeping with its introductory nature, relatively few references are given, perhaps 12–20 per chapter, and most of them are from before 1977 or so. Nevertheless, coverage of the various concepts and techniques is good. The line drawings illustrating equipment and modes of operation are excellent. The discussion is lucid and easy to follow.

The applications chapter is divided into pharmaceuticals, biochemicals, food chemicals, industrial chemicals, inorganics, and miscellaneous. The references are quite recent, and this section is said to have been greatly expanded from the original edition.

Only two faults are apparent. The list of suppliers is tucked in on page 83 after the first short table on bead packings. Many other tables are given using, presumably, the same listing. This is not clear, and the addresses of the suppliers are not given. The listing does, however, include suppliers from the whole World, with many from the United States. Second, one would suspect that an introductory book would have a bibliography of important books and review articles. This does not.

In conclusion, the book is a first-rate introduction, and a copy should be available in laboratories where much HPLC is carried out. It can be used to introduce new researchers to the method and refresh the memories of the rest of us. I would recommend, however, that individuals would be better off with a copy of Snyder and Kirkland [L. R. Snyder and J. J. Kirkland, "Introduction to Modern Liquid Chromatography". Second Edition. John Wiley & Sons, Inc., New York, 1979].

James M. Bobbitt, *University of Connecticut*

Reversed-Phase High-Performance Liquid Chromatography, Theory, Practice, and Biomedical Applications. By Ante M. Krstulović (Manhattanville College) and Phyllis R. Brown (University of Rhode Island). John Wiley & Sons, Inc., New York. 1982. xi + 296 pp. $35.

This book, despite its name, is an introduction to high performance liquid chromatography (HPLC) with a bias toward biomedical and clinical chemistry. It consists of a short introduction followed by chapters on basic theory and terminology, instrumentation, columns and column performance, separation mechanisms, ion association techniques, strategy for developing an RPLC analysis, spectroscopic and chemical characterization of peaks, chemical derivatization, quantitative analysis, and selected biochemical/biomedical applications.

The authors describe their book as the first one dedicated to reversed-phase liquid chromatography (RPLC). (A reversed-phase chromatogram is one in which the less polar phase is stationary and the more polar phase moves.) Since the vast majority of HPLC has been done in a reversed-phase mode, the title seems to have been chosen to attract attention rather than to describe the material.

The book itself, however, seems to be a good one. The section on theory is concise and easy to follow. The drawings and general format are excellent. The chapter on development of a strategy includes a good description of the problem of sample preparation in biomedical work, but promises more than it delivers in respect to the chromatography itself. About one-fourth of the book is devoted to biomedical applications with almost 300 references, almost all of which are prior to 1978.

Beginning students in biochemistry, clinical chemistry, and toxicology will find the book useful and pertinent. For most general analytical chemists, Snyder and Kirkland [L. R. Snyder and J. J. Kirkland, "Introduction to Modern Liquid Chromatography", Second Edition, John Wiley & Sons, New York, 1979] is still recommended.

James M. Bobbitt, *University of Connecticut*

Prostaglandins: Organ- and Tissue-Specific Actions. Modern Pharmacology-Toxicology Series. Volume 21. Edited by S. Greenberg (University of South Alabama), P. J. Kadowitz (Tulane University), and T. F. Burks (University of Arizona). Marcel Dekker, Inc., New York. 1982. 448 pp. $59.50.

The ubiquitous nature of the prostaglandins and the multitude of biological activities they possess leaves even the most dedicated researcher grasping to keep up with this rapidly expanding field. Volume 21 in this series provides a timely and up to date review of pertinent literature essential to an understanding of the complex pharmacological interactions of prostaglandins with various tissues and organs. Emphasis is placed on the effects of these highly active agents on smooth muscle and their involvement in the maintenance of cardiovascular homostasis. Also included are discussions of cerebral vasospasm, the central nervous system, and gastrointestinal electrolyte balance.

Geared to the pharmacologist, this book does not provide the chemist with any discussion of the vast prostaglandin chemical literature. In addition, discussion of the many synthetic prostaglandin derivatives and their relative biological activities is spotty. Nevertheless, chemical researchers in the field will find the book useful in obtaining a better overall grasp of the various biological activities of the natural prostaglandins, while students and researchers in biologically related fields will find the book interesting reading and an invaluable reference on prostaglandin

pharmacology.

Duane Venton, *University of Illinois at Chicago*

Light Scattering in Solids. Volume III. By M. Cardona (Max-Planck-Institut für Festkörperforschung) and G. Güntherodt (Universitat su Köln). Springer-Verlag, Berlin. 1982. X + 265 pp. $44.00.

This monograph is Volume 51 of the "Topics in Applied Physics" series and a continuation of Volume 8 of the same series. It presents several recent results in the area. Included are chapters on light scattering from graphite intercalation compounds, from electronic and magnetic excitations in transition-metal halides, and from superionic conductors, Raman studies of phonon anomalies in transition-metal compounds, Brillouin scattering from opaque materials, supported films, and central modes, and resonant light scattering mediated by excitonic polaritons in semiconductors. Each chapter in this volume is probably so specific so as to be of little value to researchers outside of the field; however, the range of topics covered is broad enough so that the volume should be of general interest.

Scott L. Whittenburg, *University of New Orleans*

Advances in Chemical Physics. Volume XLIX. Edited by I. Prigogine and Stuart A. Rice. John Wiley and Sons, New York. 1982. 688 pp. $85.00.

The eight articles in the 49th volume of "Advances in Chemical Physics" truly involve current research areas at the interface between chemistry and physics. Although rather diverse in scope, the topics naturally divide into two classes: *structure and phase transitions* in condensed matter and surfaces, and *dynamics*, including chemical instabilities, time-resolved spectroscopy, and reactive and nonreactive molecular dynamics. The chapter in Nonequilibrium Phase Transitions and Chemical Instabilities, by D. Walgraef, G. Dewel, and P. Borckmans, even bridges the gap between these two classes, using the language and experience of condensed matter phase transition theory to explore the analogues in chemical instabilities.

There are two excellent articles focusing on emerging experimental techniques. One by Graham R. Fleming discusses Applications of Continuously Operating Synchronously Mode-Locked Lasers, while that by E. W. Plummer and W. Eberhardt summarizes the recent progress in use of Angle-Resolved Photoemission as a Tool for the Study of Surfaces. Michael Baer contributes a review of the history and methodology of Quantum-Mechanical Approximate Treatments of Three-Body Reactive Systems. The reader should be wary of sign errors in equations 2.12, 2.14, 2.14′, 2.16, and 2.17. There is a particularly well-organized and well-written chapter on the Generator Coordinate Theory of Nuclear Motion in Molecules, in which L. Lathouwers and P. van Leeuwen outline the application of this approach, originally developed to describe collective motive in the nucleus, to improve on the adiabatic approximation for molecular dynamics. The purely formal treatment whets ones appetite for numerical application to systems for which accurate nonadiabatic solutions are known, i.e., H_2^+ and H_2, as well as to characterization of emerging experimental results in high resolution spectroscopy. Stuart Solin has contributed a timely critical review of Graphite Intercalation Compounds which is useful to both expert and the curious general reader.

Overall, the quality of the chapters is high, and the focus is on giving a flavor of emerging areas in chemical physics.

John P. McTague, *Brookhaven National Laboratory*

Contemporary Heterocyclic Chemistry. By G. W. Newkome (Louisiana State University) and W. W. Paudler (Portland State University). John Wiley and Sons, New York. 1982. x + 422 pp. $39.50.

This book is a comprehensive overview emphasizing heteroaromatic compounds and intended for "advanced undergraduates as well as graduate students", and to "be used as a reference text by researchers...". The content is organized about the concept of "π-excessive" and "π-deficient" systems; as presented, these terms are essentially congruent with five-membered and six-membered heteroaromatic systems. The concept is based on calculated π-electron densities, using benzene, having one π-electron per carbon, as the reference level. This is an interesting approach, but it leads to some contradictions, such as in thiophene, which is classified as π-excessive, although it has an average density (0.97) of *less* than one π-electron per carbon.

The book starts out on the right foot with a chapter on nomenclature. Unfortunately, it stumbles here by initially presenting replacement nomenclature, which is given second place in IUPAC recommendations, and then confusing it with Hantzsch-Widman names. The latter are introduced as rules for indicating state of hydrogenation or unsaturation, whereas they are actually a system for indicating ring size and the number and nature of heteroatoms; "oxazole" is identified as a "common name", whereas it is an archetypal Hantzsch-Widman name. Fusion nomenclature is presented incompletely, overlooking the essential rules for selecting the base ring (e.g., benzofuran instead of furanobenzene), and the fusion prefix for the thiophene ring is given incorrectly as "thiopheno" instead of "thieno". Owing to this neglect, one finds (p 8) an example named incorrectly "1,2-dihydro-1-oxathiopheno[2,3-*f*]-naphthalene" instead of thieno[2,3-*g*]-2*H*-benzo[2,3]pyran. Students will clearly be given a bad start.

Syntheses and reactions make up the main content, and a large amount of information is given with a mercifully limited set of leading references, with many reviews covering both classic and recent methods. Yields are often given, commendably, although they are erratically set either below the product or with the reagents over the arrows, where they may be confused with concentrations or amounts. Many examples of synthetic routes to alkaloids and drugs are shown. Properties are not taken up in the body of the text. Instead, there are appendixes with tables of spectroscopic properties, "pK_a data" (actually, pK_a's of BH^+), and calculated atomic electron populations. It is useful to have this information conveniently accessible, but other fundamental data are lacking; boiling and melting points and solubility are overlooked, and the reader is not told, for example, that pyridine is miscible with water but pyrrole is not, that thiophene has a boiling point almost the same as benzene, and that carbazole is a solid.

Structural formulas are prolific, and set boldly and clearly. They unfortunately show a pervading indecisiveness about N-oxides, which are represented (pp 248–255) in five different ways, two of which are correct. The index is thorough, and includes many names of drugs, but is flawed by more than its share of spelling or other errors (some of which reflect errors in the text), such as "syndnone", "Tschichibabin", "lysergic acid (LSD)", "cobaltacenes", "isopyrrazoles", "diazabaskette", and one extraordinary entry, "γ-thiolactones, ??". Although this book has many good features, it does not seem as ready for students as it should be.

Solubility Data Series. Volume 9. Ethane. Edited by W. Hayduk. Pergamon Press, Oxford and New York. 1982. xxi + 263 pp. $100.00.

This is a volume of the IUPAC series, and except for the fore-pages, consists of tabular entries of critically compiled data, including not only the results but also the variables examined, the method, sources of materials, estimated error, and references. The solvents considered range from water and aqueous solutions to alkanes, alcohols, and even hydrogen sulfide. There are separate indexes for systems, authors, and registry numbers.

Solubility Data Series. Volume 10. Nitrogen and Air. Edited by R. Battino. Pergamon Press, Oxford and New York. 1982. xiv + 570 pp. $100.00.

The general remarks for Volume 9 apply here as well. The fore-pages are unusually extensive, and include an extensive treatment of the Sechenov salt effect. The tables include data for biological fluids as well as pure compounds. A separate section is devoted to solubilities at high pressures. The task of compilation was evidently done with great thoroughness.

Annual Reports in Organic Synthesis. 1981. By L. G. Wade, Jr., and M. J. O'Donnell. Academic Press, New York. 1982. xiii + 498 pp. $26.00 (softbound).

The many users of the previous eleven volumes of this series will know what to expect: new reactions of potential synthetic application presented pictorially, with little or no text, in an organized fashion. It is designed for quick scanning, and gives the essential features of catalysts, reagents, and yields, leaving the meat to be retrieved by consulting the original references given, once the reader's interest has found a "hit". This year's volume contains a larger number of references than before, without an increase in size, owing to strict attention to concise presentation. This book is an outstandingly good buy for the organic chemist.

Carbohydrate Chemistry. Volume 13. A Specialist Periodical Report. Senior Reporters: J. F. Kennedy (University of Birmingham) and N. R. Williams (Birkbeck College, University of London). Reporters: B. E. Davison, I. M. Morrison, R. J. Ferrier, A. C. Richardson, D. M. Sturgeon, and R. J. Sturgeon. The Royal Society of Chemistry, London. 1982. xiv + 746 pp. $154.00.

Volume 13 of this series covers the carbohydrate literature from January 1979 through December 1979. The growth in the size of Volume 13 over previous volumes reflects an increase of activity in the field of carbohydrate chemistry in recent years. In line with this increased activity, the authors plan to publish Volume 15 as two books, corresponding to Parts I and II of the present volume.

Part I comprises less than one-third of the book and covers the chemistry of mono-, di-, and trisaccharides and their derivatives in 23 chapters. The chapters are divided along the lines of recent volumes and include

free sugars, glycosides, ethers and anhydro sugars, acetals and ketals, halogeno and amino sugars, miscellaneous N derivatives, S, P, deoxy, branched-chain, and dicarbonyl sugars, sugar acids and lactones, inorganic derivatives, and alditols and cyclitols. Part I also includes chapters on the chemistry of carbohydrate-containing antibiotics and nucleosides. A cursory discussion of physical methods of analyzing carbohydrates is included in three chapters on NMR spectroscopy, physical methods of analysis, and separatory and analytical methods. An all too brief, but exciting chapter on stereospecific synthesis from carbohydrates is the final chapter of Part I.

Part II, entitled Macromolecules, constitutes the larger portion of the book and includes eight chapters on general methods of analysis, plant and algal polysaccharides, glycoproteins, polypeptides, animal polysaccharides, enzymes, glycolipids, gangliosides, and chemical synthesis and modification of oligosaccharides, polysaccharides, glycoproteins, enzymes, and glycolipids. The chapters on enzymes and the chemical modification of macromolecules are nearly 150 pages each which attests to the tremendous activity in these two fields. Both of these chapters make extensive and effective use of tables to categorize and reference the material. The chapter on chemical modification of macromolecules is primarily a discussion of immobilization techniques and their applications.

The book contains 1300 references in Part I and 2700 references in Part II, a fact which underscores the value of the book as a primary reference. While not all-encompassing, the authors have chosen important and interesting articles to review. A particularly salient feature of the book is the excellent blend of both basic and applied chemistry of carbohydrates. The most noteworthy advances and a list of the review articles that appeared during the year are discussed at the beginning of each chapter. Cross-references are used throughout the book to help the reader find all the pertinent information about a subject. This reference will be of immense value to food, energy, pharmaceutical, and biochemical researchers as well as to organic and carbohydrate chemists.

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Nuclear Magnetic Resonance and Its Applications to Living Systems. By David G. Gadian (University of Oxford). The Clarendon Press, Oxford University Press, New York. 1982. x + 197 pp. $29.95.

Written with the biologist and clinician in mind, this book describes recent advances made in the application of NMR techniques to living systems, and as well provides the necessary orientation and background for those wishing to find out more about the full scope and limitations of the NMR methods we now read about in newspapers, magazines, and the like. It may be surmised that a further aim of the book is to aid in bridging whatever gap remains between the traditional practices of medicine and biology and the evergrowing throng of biological NMR enthusiasts. To these ends, Gadian's book succeeds admirably, and it should be a welcome and necessary addition to medical libraries as well as the bookshelves of biologists, clinicians, and practicing NMR spectroscopists.

Gadian's book preserves a particularly tasteful balance between a description of state of the art NMR techniques, on the one hand, and the biological problems which can be approached and solved, on the other. This is achieved at surprisingly little compromise to rigor, although certain of the discussions (that of imaging in particular) do retain an element of blackbox character, which is, perhaps, unavoidable in a book of this nature. Under any circumstances, though, the interdisciplinary spirit which pervades the book is most welcome.

The first chapter provides a brief introduction to NMR spectroscopy, followed by a series of chapters illustrating in overview fashion the types of information currently obtainable from NMR studies of living systems. These studies fall into three broad categories: (i) more or less traditional pH, ion-binding, kinetic, and relaxation time measurements, with the added feature that the sample is alive and the measurements are performed noninvasively; (ii) ^{31}P, ^{13}C, and ^{1}H NMR studies of cell and tissue metabolism; and (iii) metabolic studies of whole animals and ^{1}H NMR spin-imaging. These first sections of the book illustrate the truly significant advances that have been made in NMR of living systems. Among these, one has to mention the ability to determine intracellular pH with use of ^{31}P NMR, the noninvasive measurement of phosphorus-containing metabolite concentrations in diseased and normal human muscle, which appears superior to the traditional needle biopsy methods, and the spectacular recent progress in ^{1}H NMR spin-imaging, which now provides pictures comparable to CT X-ray scanning, but with the possibility of additional tissue contrast via relaxation time differences. One slightly disappointing feature of this first part of the book is that the ^{1}H NMR spin-images of human subjects do not do full justice to the quality of the best current results coming out of the Nottingham, UCSF, Oxford, and other NMR labs; had it been possible to include some of these most recent images, the relevance of the book to clinicians would be even greater. However, this is probably inevitable in any description of such an important and fastmoving area of research.

Having whetted the appetite of the reader for NMR through a series of illustrative examples, the author devotes latter half of the book to NMR theory, instrumentation, and various practical subjects. The explanations of NMR theory and Fourier transformation in particular are quite clear, and are to be recommended. In addition, some of the discussions are not to be found in standard NMR texts, such as the final chapter on probe design, which is particularly welcome.

In general, the writing style of the author is lucid and elegant, and to be admired as a model for scientific clarity of presentation. The author seems to have a particular knack for explaining fairly sophisticated concepts in clear and intelligible terms, through the use of analogies and, well, just plain English. Thankfully, medical jargon is used sparingly and in a manner which does not require inclusion of a separate medical glossary. The index seems adequate for a book of this length, although some of the medical terminology does not seem to have found its way here. The author and publisher are to be complimented for producing an attractive volume which describes succinctly an important new subspeciality of NMR.

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Separation Procedures in Inorganic Analysis. By Roland S. Young. John Wiley & Sons, New York. 1980. viii + 475 pp. $59.95.

Classical inorganic analysis is almost synonymous with schemes of elemental separation. Instrumental methods such as atomic absorption and X-ray fluorescence have provided other means of achieving analytical selectivity. However, few analyses can be done without some kind of sample pretreatment or cleanup procedure and many analyses require specific chemical separations to eliminate interferences or concentrate the element of interest before an instrumental determination. Furthermore, of course, separation remains of prime importance in the preparation and purification of elements and their compounds.

In general, this book follows the format of a classical elemental separation scheme. For each naturally occurring element (or group of closely related elements) from aluminum to zirconium, a corresponding chapter presents at least one and often several schemes to separate the subject element from all other elements in almost any sample. It is easy to find a separation method for any pair of elements by scanning through either of the two chapters. An elementary knowledge of classical separation chemistry is usually enough to find the appropriate subsection. Later chapters extensively reference methods given in earlier chapters. A great deal of information is presented in a very condensed form. Simple or obvious separations are given as well as the more sophisticated or obscure. Many separation methods suitable for preparative work or metallurgy are also mentioned. Literature references to specific methods or elements are given with each chapter. These are mostly to the secondary literature before 1975.

The topic of this book is very precisely defined to be chemical methods for the separation of the elements. Within the topic area the author has been quite thorough. There is no discussion of related topics such as the general chemistry of the elements or laboratory techniques to carry out the separations. Separation at trace concentrations and separations of radionuclide elements are not specifically included.

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