Book Reviews

Coherence and Correlation in Atomic Collisions. Edited by H. Kleinpoppen (Institute of Physics, University of Stirling, Stirling, Scotland) and J. F. Williams (Department of Pure and Applied Physics, Queen's University, Belfast, Northern Ireland). Plenum Press, New York and London. 1980. xiv + 700 pp. $59.50.

This volume in the series "Physics of Atoms and Molecules" represents the proceedings of a workshop on coherence in atomic collisions and is dedicated to Sir Harry Massey, a distinguished pioneer in atomic collision theory. The contributions are of generally high quality, but because the average length of each contribution is 13 pages, the material is probably accessible only to those already working in the field. The 55 contributions, however, give a remarkably complete overview of the new area of coherence and correlation in collision-excited atoms. All contributions are refreshingly directed toward the goal of understanding the dynamics of atomic collisions; there are no contributions whose main purpose is to provide cross-section data for application to plasma, atmospheric, or astrophysics. It is this feature, as much as the emphasis on coherence, that gives unity to this otherwise diverse collection of papers.

The primary data of atomic collisions, or indeed the collisions of most microscopic systems, are conventionally expressed in terms of cross sections for specific processes. Cross sections normally involve averages over many unresolved eigenstates and thus do no provide a complete description of collision-excited states. A complete description is more commonly given in terms of dimensionless density matrix elements, and this volume deals only with experimental measurements of those density matrix elements which are not conveniently expressed in terms of cross sections.

In any inelastic collision, the size, shape, and circulation properties of electron charge clouds change. Coherence and correlation data deal with the shape and circulation of electron clouds while cross sections for exciting atomic and molecular systems, since they have dimensions of $(\text{length})^2$, reflect sizes of atomic species, in first approximation. Shape and circulation of electron clouds relate closely to excitation mechanisms and are measured by polarizations and angular distributions, including angular correlations of decay products. Approximately two thirds of the papers deal with anisotropy of collision-excited atomic states. Other papers discuss correlations of primary and secondary electrons, post-collision interactions, excitation in strong fields, etc. The editors have done a valuable service in bringing together in one volume these diverse contributions so that one can see just how much has been learned about collision dynamics by the study of correlation properties. Unfortunately it is necessary to read each of the contributions carefully to determine what new physical insights have emerged in order to form an overall picture of what contributions these types of measurements have made to the understanding of atomic dynamics. The novel insights are surprisingly numerous and varied, although they tend to be obscured by detail. Accordingly, this is a useful volume for specialists already in the field, but it is not suited to the needs of advanced graduate students or others interested in finding out what coherence and correlation in atomic collisions is all about. Many of the articles do reference the original literature extensively, but again, a close study of the text is required to determine which of the references provide the background needed to understand the notation and concepts.

Even though the emphasis is on understanding atomic dynamics at the fundamental microscopic level, the general reader, especially those interested in applications to molecular physics, will find something of interest. Many of the techniques employed are proving useful for studies of molecular structure. The (e,2e) experiments measure, ideally, the Fourier transforms of atomic and molecular wave functions. The first five papers introduce the experimental aspects of this subject and give extensive references to the appropriate literature. Paper two, by A. Giardini-Guidoni et al., is one of the longest and provides a compact review of (e,2e) measurements and theory. The fourth paper, by Erich Weigold, on (e,2e) experiments in atomic hydrogen, nicely complements paper two. Since the wave functions of atomic hydrogen are known exactly, these measurements test only the theory of (e,2e) experiments. This series of five papers gives a clear indication of the wide applicability of such measurements and the limitations of present theory.

Scattering with optically pumped atoms as targets provides a means of measuring excited-state potential curves of diatomic molecules. The short paper by R. Düren discusses this application briefly, and H. W. Herman and I. V. Hertel discuss scattering with optically pumped targets more comprehensively, emphasizing the importance of the anisotropy of such targets. These two papers indicate that excited-state potential-function determination by collisions is timely. They, and the articles referenced, represent a point of departure for future work.

The proceedings bring together various papers of high quality on correlation in atomic collisions. The papers are brief, but valuable for the specialist. I personally found something new and interesting in virtually all of the articles. With the possible exception of the group of papers on (e,2e) experiments, this collection cannot be recommended as an introduction. A subsequent monograph in the "Physics of Atoms and Molecules" series, *Density Matrix Theory and Applications*, by Karl Blum provides the necessary background and is recommended as preparatory reading for the workshop proceedings.

Joseph Macek, *University of Nebraska*

Topics in Current Chemistry. Volume 86. Spectroscopy. Edited by M. J. S. Dewar (University of Texas), Klaus Hafner (Technische Hochschule Darmstadt), Edgar Heilbronner (Univërsitat Basel), Shô Itô (Tohoku University), Jean-Marie Lehn (Universitatê Strasbourg), Kurt Niedenzu (University of Kentucky), Charles W. Rees (Imperial College, Kensington), Klaus Schafer (Universität Heidelberg), and George Wittig (Universität Heidelberg). Springer-Verlag, Heidelberg, West Germany; New York, N.Y. 1979. 287 pp + Author Index to Volumes 26–86. $73.70.

Volume 86 of this well-known series narrows the scope of the subject with four reviews focusing on the areas of ultraviolet and photoelectron spectroscopies.

The first article, Simple Polyatomic Molecules in the Vacuum Ultraviolet, by M. N. R. Ashfold, M. T. Macpherson, and J. P. Simons begins with a discussion of the nature and types of transitions observable in the vacuum ultraviolet and progresses to an in-depth look at the spectroscopy and related photochemistry of eight selected series of polyatomics, from water to acetonitrile. Covering the literature until March 1978 and containing over 300 citations, the article serves both as a fine reference and as an informative introduction to the new reader.

The chapter by Camille Sandorfy on Ultraviolet Absorption Spectra of Organic Molecules is the shortest contribution in the volume. The initial sections, which are meant as an introduction to the less specialized reader, give a brief background on Ryberg vs. valence-shell transitions in the region of the spectrum from 6 to 10 eV. Although the remainder of the chapter uses only a limited number of specific examples to discuss UV spectra that arise from transitions of σ-electron lone-pair electrons and both lone-pair and π electrons, it has the flavor of a brief survey rather than an essay in-depth on the subject matter. Unfortunately, the number of typographical and minor grammatical and spelling errors tend, at times, to distract the reader.

The chapter titled Some Aspects of the Photoelectron Spectroscopy of Organic Sulfur Compounds, by Rolf Gleiter and Jens Spanget-Larsen, confines itself primarily to surveying the PE literature of organic compounds containing sulfur bonded to one or two carbon atoms, e.g., sulfides and thiocarbonyls. Beginning with a brief yet descriptive explanation of the technique of photoelectron spectroscopy, the review continues by analyzing and interpreting the PE spectra of various sulfur compounds and, in some cases, their N, Se, Te, or O isoelectronic homologues. Application of the technique of variable temperature PE is also briefly considered. The review concludes with a comprehensive tabulation of the photoelectron data, as known until 1978, for more than 100 sulfur compounds, many of which are not explicitly treated in the text, making this article an informative and concise reference source.

Written in the same style as the previous contribution, Photoelectron Spectra and Bonding in Small Ring Hydrocarbons by Rolf Gleiter again offers the reader a terse but descriptive account of the PE literature of such systems as cyclopropane, cyclobutane, and bicyclobutane compounds and cubane and its derivatives. The data are graphically discussed primarily in terms of the interplay between molecular geometry and the energy of the radical-cation state. This article culminates in an extensive table on the PE spectroscopic data amassed on small-ring hydrocarbons within the 10 years from 1968 to 1978 and serves as a thorough and excellent reference source.

Overall, this volume should be of interest to anyone concerned with the interplay between spectroscopy and photochemistry in the systems discussed.

Judith C. Giordan, *Dartmouth College*

Annual Reports on NMR Spectroscopy. Volume 11B. Edited by G. A. Webb (University of Surrey). Academic Press, London and New York. 1981. vii + 502 pp. $99.50.

In Volume 11B, L. Stefaniak, G. A. Webb, and M. Witanowski continue their excellent work of the past decade in reviewing the nitrogen NMR literature. The years covered are 1977 to late 1980; the book includes 133 pages of text followed by 337 pages of tables and 499 literature references. The tables are footnoted as to whether the data are ^{14}N or ^{15}N; if ^{15}N, labeled or natural abundance; spectrometer frequency; original sample reference used; conversion used (if any); etc.

Theoretical calculations of nitrogen nuclear shieldings and nitrogen coupling constants are discussed and compared with experimental data. Other sections include relaxation phenomena, standards used in calibrating nitrogen NMR spectra, and experimental techniques. In addition to pulsed Fourier transform techniques and continuous-wave methods, which were also treated in Volume 7, the experimental technique section of Volume 11B includes double-resonance methods, nitrogen NMR in nematic phases, solid-state nitrogen NMR, and chemically induced dynamic nuclear polarization.

Seventeen pages are devoted to a discussion of ^{15}N coupling constants to ^{1}H as well as to other nuclei including ^{13}C, ^{15}N, ^{31}P, ^{19}F, and ^{195}Pt. Recent advances such as the cross-polarization techniques used to obtain ^{15}N coupling constants from natural abundance ^{15}N spectra are discussed.

The largest portion of the text relates to nitrogen shielding in ammonium ions, anilinium ions, aniline derivatives, amides, azides, aryl and aliphatic amines, and other nitrogen-containing compounds. The ^{15}N spectra of many biologically important molecules are reviewed, including alkaloids, bleomycin, gramicidin S, nucleosides and nucleotides, amino acids, peptides, polypeptides, and related structures. Nitrogen shieldings from *N*-acetyl derivatives of amino acids were used to make a complete assignment of the nitrogen shieldings in oxytocin. Separate ^{15}N resonances are obtained for the *E* and *Z* isomers of unsymmetrically *N*-disubstituted amides; although the chemical shift differences are small, it is evident that ^{15}N NMR resonance is an extremely sensitive probe of molecular structure.

Once again, G. A. Webb et al. have produced an invaluable reference work.

Laurine A. LaPlanche, *Northern Illinois University*

Mitochondria and Microsomes—in Honor of Lars Ernster. Edited by C. P. Lee (Wayne State University), G. Schatz (University of Basel), and G. Dallner (University of Stockholm). Addison-Wesley Publishing Co., Reading, Mass. 1981. xvi + 811 pp. $34.50.

This book is a most appropriate tribute from friends and colleagues to Prof. Lars Ernster on the occasion of his 60th birthday. The work encompassed in 20 reviews on mitochondria and 10 on microsomes covers the wide range of interests in the published studies by Prof. Ernster and his co-workers over the past 30 years. The editors have done an admirable job in collecting a festschrift which, despite the diversity of authors, adheres to a uniformity of purpose to provide an adequate background and to accentuate the highlights of the broad field of organellar membrane biochemistry.

Commencing with a brief biographical sketch and a short history of the biochemistry of mitochondria, E. C. Slater sets the stage for the first part—chiefly dealing with mitochondrial energetics and functions. It is interesting to note that two topics that until recently usually had been considered as footnotes are now in the forefront: mitochondrial biogenesis and the mitochondrial genome, summarized ably by Geoff Schatz and by Ron Butow and R. Strausberg, respectively. Another "nontraditional" topic on thermogenic mitochondria is developed in intriguing fashion by Olov Lindberg, adding each piece of data and clarification in a logical sequential construction of his "thermogenin" model for a futile proton cycle. Subsequent chapters deal with the more traditional analysis and reconstitution work upon inner membrane components concerned with electron and energy transfer. Depending upon the predilections of individual authors, they render a comprehensive account of the methods, research findings, and theories of oxidative phosphorylation and mitochondrial transport. Some of the veteran mitochondriacs involved include Peter Mitchell, Efraim Racker, Britton Chance, Martin Klingenberg, Albert Lehninger, and Paul Boyer. The first part concludes with a brief but "exquisite symphony" on the evolutionary ancestry of mitochondria and their present-day procaryotic counterparts by Herrick and Margareta Baltscheffsky.

Part two, dealing with microsomal membranes, is introduced by a "limited history" by Philip Siekevitz, with special reference to contributions from Ernster and co-workers on electron-transport components and their induction, themes that are elaborated upon further in ensuing chapters from laboratories of Minor Coon, S. Orrenius, G. Dallner, C. DeDuve, Ron Estabrook, and O. Hayaishi. Overviews on the concepts of membrane biogenesis and enzyme induction by Sabatini and colleagues and by De Pierre et al. provide an excellent orientation and framework for those discussions.

In general, the standards of presentation are high and reflect the flavor and state of the art in this area of organellar metabolism. I would have liked to see more diagrams and illustrative material interspersed in the text (such as Estabrook's delightful cartoon of the microsomal membrane "Sea"). The cover gives a somewhat misleading promise of some ultrastructural treatment of the subject. Some of the articles may be a bit specialized for the general reader, but taken together they constitute a very complete summary for advanced students of membrane biochemistry and bioenergetics in eucaryotic organisms.

William C. McMurray, *University of Western Ontario*

Introduction to Polymers. By R. J. Young (Queen Mary College, London). Chapman and Hall, London. 1981. viii + 331 pp. $38.00 hardcover; $22.95 paperback.

This book is probably one of the most inadequately titled books ever published; an (unwieldy) alternative title might have been Introduction to Polymer Synthesis, Polymer Characterization, Polymer Structure, and the Mechanical Properties of Polymers. Following a short introduction dealing with definitions, four major chapters are devoted to the synthesis, characterization, structure, and mechanical properties of polymers. As is stated in the Preface, "The book is designed principally for undergraduate and postgraduate students of Chemistry, Physics, Materials Science, and Engineering who are studying polymers. An increasing number of graduates in these disciplines go on to work in polymer-based industries, often with little grounding in Polymer Science...". This book would serve admirably to fill the gaps in the education of individuals of any of the above-mentioned disciplines in that it completely spans the polymer field from synthesis to utilization of polymers.

Although the length of the book precludes coverage of any of the chosen topics in depth, the coverage that is achieved is remarkable; e.g., the kinetics of step-growth, copolymerization, and reactive intermediate processes are discussed in the chapter on synthesis; the characterization chapter includes, among others, sections on light scattering, viscosity, and gel permeation chromatography; the structure chapter provides a good overview of the crystallization of polymers and of the factors responsible for the production of amorphous polymers; the final chapter interrelates polymer structure and properties such as viscoelasticity, stress yielding, and stress fracturing.

The numerous examples presented in the text are unreferenced, although suggestions for further reading are provided. The mathematical derivations presented are rigorous and complete, i.e., all assumptions, approximations, etc. are discussed. No errors of significance appear in the book.

More complete coverage of specific areas of polymer science can be found in standard texts; the uniqueness of this book is that it cogently fuses together many diversified areas of polymer science. I would highly recommend it for chemists, physicists, and engineers who are engaged in research and/or education.

John Jacobus, *Tulane University*

Electron Capture, Theory and Practice in Chromatography. Edited by A. Zlatkis (University of Houston) and C. F. Poole (Wayne State University). Elsevier Scientific Publishing Co., Amsterdam and New York. 1981. xii + 429 pp. $76.50.

The electron capture detector, a mere 20 years after its introduction, has had a significant impact not only on gas chromatography but also on the entire fields of environmental chemistry and biomedical studies. The remarkable selectivity and sensitivity of this detector have given researchers the necessary tool to study such problems as the threat of fluorocarbons to the ozone layer and the contamination of various biological systems with minute traces of pesticides.

Any detector sufficiently sensitive to quantify 10^6 molecules in a 1-cm^3 sample of gas is bound to demand an unusual degree of sophistication from the analyst. This volume, the 20th in the "Journal of Chromatography Library" series, provides complete coverage of the most recent developments in the use of this detector. From a personal reminiscence by James E. Lovelock, the developer of the ECD, through an extensive treatment of the applications to which it has been put, the book covers both ECD theory and practice. Calibration methods, vital for a detector prone to nonlinear behavior, are covered as well as the preparation of derivatives to sensitize various compounds to the ECD. Several chapters cover applications of the detector in environmental analysis of pesticides, dioxins, and halocarbons. Relative responses of the detector to various classes of compounds, as well as the temperature dependence of these responses, are discussed. The extension of the use of the electron capture detector to a broader range of compounds by the doping of the carrier gas with electron-attaching molecules such as oxygen or nitrous oxide is thoroughly covered. This technique provides an increase in the detector

response to numerous compounds that undergo ion–molecule reactions with the negative ions formed from the carrier gas.

The final chapters cover the use of related techniques including negative ion atmospheric pressure mass spectrometry and plasma chromatography, as well as the use of the ECD in liquid chromatography. This volume should be read by any chromatographer who reports results from this powerful but temperamental detector. It will provide the increased insight that can circumvent difficulties.

Barbara B. Kebbekus, *New Jersey Institute of Technology*

Structural Order in Polymers. Edited by F. Ciardell and P. Giusti (University of Pisa). Pergamon Press, Elmsford, New York. 1981. X + 247 pp. $70.00.

This book contains the main lectures of the IUPAC International Symposium on Macromolecules held in 1980 in Florence. It is unusual in two respects. First, it does not contain a contribution from Giulio Natta, the man who shared the Nobel Prize in Chemistry with Karl Ziegler in 1963 for their work in stereoregular alkene polymerizations. Professor Natta died the year before the symposium was held. Herman Mark does provide a short account of Natta's life and work which serves as an excellent preface to the book.

The second unique characteristic of this collection is the breadth and depth of the individual articles. The authors include many of the pioneers and world leaders in the field of ordered polymers, and their reviews contain both historical and scientific summaries of the developments of the last 20–30 years. This leaves the reader with an unusually complete understanding of both the research and the researchers of the past and present in the area of ordered polymers.

The book contains three main parts. The first on Stereospecific Polymerization of Olefins and Diolefins provides excellent and up-to-date coverage of the mechanisms, morphology, and even commercial development of stereoregular polymers. The second deals with Constitutional and Configurational Order in Synthetic Polymers and Biopolymers and includes papers on polylactams, polynucleotides, proteins, polymer blends and liquid crystals, and techniques of solid-state investigations. The last section concerns Polymers Tailored to Specific Purposes and contains papers describing the importance of polymer structure to blood compatibility and prostheses, photochemical reactions in the presence of polymers, activity of immobilized enzymes and cells, and performance of synthetic membranes.

This collection is recommended reading for all chemists, both academic and industrial. For those familiar with polymer science it provides the historical perspective needed for understanding modern developments. For those who know little about polymers, this book gives a readable introduction and overview to the field that is priceless.

Lon J. Mathias, *University of Southern Mississippi*

The Principles of Ion-Selective Electrodes and of Membrane Transport. By W. E. Morf (Swiss Federal Institute of Technology, Zurich). Elsevier, Amsterdam. 1981. xi + 433 pp. $83.00.

As Volume II in a new series, "Studies in Analytical Chemistry" (E. Pungor, W. Simon, and J. Inczedy, Eds.), this monograph provides a comprehensive review of fundamental theories relevant to ion-selective electrodes (ISEs). While numerous other books on ISEs have appeared recently, this one offers the most complete look at the underlying principles by which useful analytical measurements can be made with such devices. The book is composed of 15 well-written chapters separated into two distinct sections. Part A covers the theory of membrane potentials and membrane transport in general while Part B details the potentiometric response and selectivity mechanisms of particular ISE types.

In Part A, the author begins by clearly stating the basic assumptions that must be made in order to derive equations relating observed membrane potentials (for any membrane) to cation or anion concentrations. From this foundation, the concepts of membrane boundary potentials and membrane diffusion potentials are evolved and final practical solutions to the membrane potential equations are given. The theory and significance of liquid-junction potentials are also examined in a separate chapter. Many ISE users often ignore such potentials but the author clearly documents how large analytical errors can easily result from liquid-junction problems. General membrane transport theories, e.g., Nernst–Planck model, Schlogl, etc., as well as ion–flux relationships for bulk and bilayer membrane transport, are discussed in the remaining sections of Part A. A useful summary chapter at the end of Part A offers the reader an overview and a quick reference source for the key equations and concepts relevant to membrane potentials and transport phenomena.

In Part B, detailed discussions on the various ISE types are given. These include sections on solid-state, glass, liquid-membrane (neutral carrier and ion-exchanger based), gas-sensing, and enzyme electrodes. These chapters concentrate on the potential determining mechanisms and the factors influencing selectivity for each class of ISE. Once again, key equations are derived and explained. In addition, data presented in tables and figures correlate experimental ISE results with theoretical predictions (e.g., with regard to selectivity coefficients, etc.). A chapter dealing with the dynamic response times of ISEs in general is also included.

On the whole, in view of the complexity of the subject matter, the author of this book has done an outstanding job in presenting the material in a well-organized and easy-to-read manner and thus it is suitable reading for scientists in several disciplines. The cost of the book is somewhat excessive considering its photo-offset preparation; however, this monograph is a much needed addition to the ISE literature and ISE researchers will find it a valuable addition to their reference collections.

M. E. Meyerhoff, *The University of Michigan*

Trace Analysis. Volume 1. Edited by James F. Lawrence. Academic Press, Inc., New York. 1981. ix + 331 pp. $39.50.

The preface of this book defines it as the first in a multivolume publication intended "to bring together detailed applications of analytical chemistry to the detection, identification, and quantitation of trace quantities of substances in many different sample types". The overall scope of this editorial effort is not found in this first volume, which is arbitrarily dedicated to some topics in liquid chromatography. As such, the title "Trace Analysis" conveys the impression of an encyclopedic work on the subject that is not reflected in the first volume and does not seem likely to be so in the forthcoming ones.

The phrase "trace analysis" is loosely used to refer to the identification and determination of chemical species present in very small but unspecified concentrations. This obviously imprecise definition is interpreted by some as referring to concentrations expressed in parts per million (ppm) and by others as concentrations in parts per billion (ppb) levels. Chromatography is inherently a very suitable analytical approach to handle very low concentrations. This fact and the dramatic recent increase in interest in liquid chromatography seem sufficiently strong reasons for choosing this technique as the subject of this first volume. This would seem all right if the series were named Selected Topics in Trace Analysis; a qualifying subtitle, such as Recent Trends in Liquid-Liquid Chromatography, would guide the potential user. The general title of "Trace Analysis" raises expectations that are not met by the book.

The five chapters are critical reviews covering for the most part recent work in selected areas of liquid–liquid chromatography. The first review [by Jeffery A. Graham] and the last chapter [by Hamish Small] are dedicated respectively to organic and inorganic species in aqueous samples. Both are useful summaries of high-performance liquid chromatography and ion chromatography. The second review is a good account of electrochemical detection—the detection approach responsible in great part for the impetus that liquid chromatographic systems have witnessed in the past 10 years or so. The chapter is authored by K. Brunt, who has included some detectors developed in the area of continuous-flow sample-processing systems. The separation and determination of metal species, covering normal- and reversed-phase, ion-exchange, ion-pairing, liquid–liquid partition, steric exclusion, and complexation resins, is the topic of the third review, by R. M. Cassidy. The fourth review in this volume is devoted to the liquid chromatography of mycotoxins and is authored by Peter M. Scott. It is a very good and comprehensive review on the topic, but one cannot help but ask: why mycotoxins and not other chemical species?

In summary, those interested in good reviews on the topics listed above have a useful source in these five articles; those looking for a definite work on trace analysis rationally evolved from the first volume will be disappointed.

Horacio A. Mottola, *Oklahoma State University*

Lasers in Chemical Analysis (Contemporary Instrumentation and Analysis). Edited by Gary M. Hieftje (Indiana University), John C. Travis (National Bureau of Standards), and Fred E. Lytle (Purdue University). The Humana Press, Clifton, NJ. 1981. xviii + 310 pp. $39.50 ($49.50 foreign).

This book is a collection of articles edited and enhanced from lectures presented at the ACS Division of Analytical Chemistry 1979 Summer Symposium. The book is organized into four sections: Lasers and Laser Optics, Methods Based on Absorption of Laser Radiation, Methods Based on Laser-Induced Fluorescence, and Lasers in Analytical Instrumentation. The first section is designed to be tutorial and is aimed at readers having little familiarity with lasers and laser-related phenomena. It contains chapters on laser fundamentals (F. E. Lytle), tunable lasers (M. J. Wirth), pulsed lasers (J. M. Harris), and nonlinear optics (J. C. Wright). Most of the articles in subsequent sections are more specialized and range in nature from research papers to comprehensive reviews. Included in Section Two are chapters on the optogalvanic effect (J. C. Travis and J. R. DeVoe), laser multiphoton ionization mass spectrometry (D. A. Lichtin, L. Zandee, and R. B. Bernstein), and thermal lensing

spectroscopy (R. L. Swofford). Section Three includes a survey chapter by J. C. Wright (which probable should be the first chapter in this section rather than the second) and articles on atomic fluorescence spectrometry (S. J. Weeks and J. D. Winefordner), matrix isolation molecular fluorescence (E. L. Wehry, R. R. Gore, and R. B. Dickinson, Jr.), analysis of drugs in biological fluids (N. Strojny and J. A. F. deSilva), determination of organic pollutants (J. C. Brown, J. M. Hayes, J. A. Warren, and G. J. Small), and trace analysis of nonfluorescent ions in the solid state (M. V. Johnston and J. C. Wright). The final section contains only two articles, one on laser-based detectors for liquid chromatography (E. S. Yeung) and the other on lasers and analytical polarimetry (A. L. Cummings, H. P. Layer, and R. J. Hocken).

I found this book interesting, informative, and easy to digest. With the exception of the first chapter, the book is essentially nonmathematical. In my opinion the first section succeeds in accomplishing the authors' aim of providing basic instruction for the novice. The first chapter by Lytle is particularly valuable in this regard. However, it contains a number of errors, some of which might be sources of confusion to the reader (e.g., problems concerning "transmittance" vs. "reflectance" in the treatment of oscillator gain and loss, Part 4.1). The chapters by Wirth and Harris give a brief but reasonably complete coverage of available laser devices. The chapter by Wright offers a delightfully clear qualitative explanation of a host of nonlinear optical phenomena, including second harmonic generation, sum and difference frequency generation, and the "exotic" Raman processes (CARS, CSRS, HORSES, Raman gain and loss spectroscopy). The chapters in Sections Two–Four include several good reviews and surveys. I especially enjoyed the articles on the optogalvanic effect by Travis and DeVoe (Chapter 5) and the determination of organic pollutants by Brown et al. (Chapter 12). Many of the other chapters in these sections can be categorized as standard research papers or laboratory progress reports. These articles tend to be narrower in scope and some deal with methods which the authors admit are likely to remain of rather specialized application in analysis. However, even these chapters contain useful information of more general appeal. For example, several authors discuss techniques of time-resolved spectroscopy, which are important in a wide range of experiments employing transient excitation.

"Lasers in Chemical Analysis" does not treat several promising new analytical techniques, including photoacoustic spectroscopy (not necessarily a "laser" method), laser-induced breakdown (or laser-spark) spectroscopy, and remote sensing methods. Also, I think that Section One would have benefited from inclusion of a chapter on detection instrumentation (e.g., gated detectors, transient recorders, multichannel array detectors, etc.—all useful in the aforementioned methods of time-resolved spectroscopy). Nevertheless, this book should be a real asset to workers trying to get acquainted with this exciting field, and even experts should find a few of the articles interesting and valuable reading.

Joel Tellinghuisen, *Vanderbilt University*

The Combustion of Organic Polymers. By C. F. Cullis and M. M. Hirschler. The Clarendon Press; Oxford University Press, New York. 1981. x + 420 pp. $59.00.

This is an attempt to bring together polymer combustion information from disparate communities—those with a physics orientation vs. those with a chemistry orientation. The appeal to disparate communities most probably explains the first chapter of the book, which deals on an elementary basis with the structure and properties of polymers. The subsequent chapters are extensive reviews of polymer combustion hazards with primary emphasis on test methods, fundamental studies on physical and chemical mechanisms, and attempts to inhibit combustion.

An appendix dealing with the flammability of a number of specific polymers is a valuable addition. This appears to be a thorough review and is recommended to those working in this area of research and development. The reader should be aware that references do not appear to go much beyond 1978 and that a number of references are to reviews and not to primary sources.

Eli M. Pearce, *Polytechnic Institute of New York*

Water in Polymers. ACS Symposium Series. No. 127. Edited by Stanley P. Rowland (Southern Regional Research Center). American Chemical Society, Washington, D.C. 1980. ix + 597 pp. $48.00.

This important monograph brings vividly to mind Joel Hildebrand's somewhat acerbic statement, when explaining the differences between current transport theory and his own theories, that "published papers and books contain models of liquids with 'liquid lattices', 'clusters', 'monomer-dimers', 'cells', 'cages', and 'significant structures' all picked out of the sky to furnish adjustable parameters" (preface, "Viscosity and Diffusivity", 1977). Whether or not one agrees with Hildebrand, it becomes obvious from this new compilation of papers that the postulation of models is still very much in vogue.

In the past we have been treated to a number of theories of water structure including the Bernal–Fowler postulate, Pauling's dodecahedral cage model, Frank and Wen's flickering cluster model, and Eyring and Marchi's significant structure approach. Strong introductory chapters in this book deal with the structure of water in a statistical–mechanical manner that emphasizes thermodynamic considerations.

In an unusual approach, the effect of a solute on the dynamic properties of the water molecule is examined. Two variations are used: the thermal behavior of dispersions of small water droplets in polymeric media as opposed to the behavior of bulk water, and the influence of solute polarity/nonpolarity as it affects the mobility of adjacent water molecules. The older assumption that water/hydrocarbon interaction is by dispersion only is held to be in error as is the assumption that structural perturbations at the interface are negligible. A structural picture of the polymer/water interface based on a potential-distortion adsorption model is suggested.

Subsequent sections deal with biological polymers in interaction with water. Using cage and cluster models for the description of water structures in proteins, the investigation of the mobility of water in fixed matrices is delineated. Newer test methods include the use of nuclear magnetic resonance and neutron crystallography. NMR data exhibit unexpected cross-relaxation interactions between solute and solvent protons; the data on neutron crystallography are extensive and should prove useful. A third testing procedure uses differential scanning calorimetry, and a number of thermograms are shown together with a proposed hydration model.

The last chapters in this symposium series give it its unique character. These chapters deal with aqueous interactions and the performance of synthetic polymers, a subject not usually covered in a book on water. Because of the variety of man-made polymeric systems now available to the chemist/chemical engineer, the studies are, of necessity, specific. However, test methods are, for the most part, standard and should be applicable to other synthetics. Most of the testing involves thermodynamic properties such as glass transitions, and interesting data on the effect of water on Tg for such systems are given, together with explanations of the failures likely to occur in the test materials in the presence of water.

This monograph should be of interest to polymer scientists working with either natural or synthetic materials. The first two sections dealing with the structure of water and with the microinteractions of water with polymers are particularly impressive. While test methods in subsequent sections are sometimes empirical, new interpretations of older methods and suggestions for the use of new instrumentation make this a welcome addition to the literature.

S. Margaret C. Willoughby, *University of Texas at Arlington*

Computational Theoretical Organic Chemistry. Proceedings of the NATO Advanced Study Institute, Menton, France, June 29–July 13, 1980. Edited by I. G. Csizmadia (University of Toronto) and R. Daudel (Centre de Mécanique Ondulatoire Appliqué). D. Reidel Publishing Company, Dordrecht, Holland. 1981. viii + 426 pp. $55.00.

This book contains 20 papers that progress from theoretical aspects of available computational techniques to applications of these techniques to problems of interest in organic as well as other areas of chemistry. The first paper is introductory and attempts to dispel some of the myths and anxiety associated with computational theoretical chemistry. Several basis sets are defined and compared and contrasted in the second article. The following three papers discuss single- and multi-configuration SCF methods with the emphasis on full and approximate CI calculations. Computational methodology, objectives, and strategy as well as an error analysis of various CI techniques are among the topics covered. Several analytical approaches utilized to calculate ground- and transition-state geometries, reaction paths, and vibrational frequencies of open- and closed-shell molecules are presented in the subsequent five articles. The 11th and 12th papers deal with Perturbational Molecular Orbital procedures in terms of their theoretical and conceptual aspects as well as applications of PMO analysis. Additional chemical applications of the methods presented in the preceding papers are described in the next seven articles. Results of computations on the rotational barriers, Rydberg photochemistry, structures, reactions, out-of-plane bending coordinates, and effect of solvation on the relative stability of excited states of various species are reported and analyzed. The last paper contains several projects suggested to the participants in the Advanced Study Institute to enable them to gain some experience in applying computational theoretical chemistry techniques.

For the most part the papers are well-written, but occasionally an author's poor English makes understanding the material more difficult. In addition, the authors have assumed that the reader has a fairly rigorous background in quantum mechanics. Any reader without this background will find some of the discussions and most of the mathe-

matical derivations in the methods papers hard to follow. Although several of the articles that present applications of these techniques are quite long, they are interesting and varied and indicate some appropriate uses of these methods and ways in which theoretical results are analyzed to elucidate and predict experimental results. A further very useful guide to computational strategy can be obtained from those papers on methods that include an analysis of the technique's strong points and drawbacks.

Overall, I feel this book is worthwhile reading for anyone interested in computational theoretical chemistry, since it offers an overview of current research areas in this field and points out the material that must be understood to make a contribution to this field. The book contains a voluminous number of references that can be utilized to increase the reader's background. Proficiency in this topic then can be furthered by carrying out some of the projects suggested in the last paper.

Carol A. Deakyne, *College of the Holy Cross*

Biological Energy Transduction: The Uroboros. By Ronald F. Fox (Georgia Institute of Technology). Wiley-Interscience, New York, NY. 1982. vii + 279 pp. $32.95.

This remarkable book presents both a highly useful and yet a concise account of the major developments in molecular biology and biophysics over the past few decades and an interesting, but admittedly speculative, scheme as to the molecular origin and evolution of an "uroboros" or self-regenerating system. The book is clearly organized into three parts: biochemical thermodynamics, energy transduction in organisms, and origins and evolution. The first part (Chapters 1–7) provides a very clearly written and well-unified description of elementary biochemical reactions, membrane phenomena, and various self-assembly processes from a statistical thermodynamics viewpoint. This section is very nicely presented with a number of well-analyzed examples; the coverage varies somewhat in depth, but in general it is simultaneously straightforward and rigorous. Useful annotated reference lists are provided for each chapter throughout the book. The second section (Chapters 8–12) focuses on energy transduction in molecular biology. Good descriptions of photosynthesis and the various metabolic pathways are presented, followed by a chapter on molecular cybernetics. The formation of biopolymers is discussed in great detail with special emphasis on free-energy considerations. This leads naturally to a discussion of cooperative multienzyme complexes and finally to energy transduction in ATP synthesis via "chemiosmosis" in biomembranes. These first 12 chapters stand alone as a highly useful summary of the current state of affairs in molecular biology. This part of the book is certainly to be recommended as a text in a variety of courses ranging from advanced undergraduate (perhaps physical or biophysical chemistry) or graduate levels. It is also to be recommended to the casual reader wishing to update his or her knowledge of this rapidly developing area.

The third section of the book (Chapters 13–15) presents a brief but provocative approach to the origins and evolution of life. The hypothesis set forth is that energy transduction within spontaneously self-assembled membrane-like microspheres could have been the key step in development of a primitive energy metabolism leading to polymer synthesis and subsequently to a primitive "uroboros". Some rather elaborate schemes for evolution of the genetic code and differentiation of DNA and RNA functions are developed and there is some discussion of other approaches to molecular evolution. Unfortunately, the coverage of different approaches discussed here is not comprehensive; for example, the important recent work of Kuhn (cf. H. Kuhn and J. Waser, *Angew. Chem.*, **93**, 495–575 (1981)) that relates closely to many of the ideas presented is not mentioned. Nonetheless the third section is valuable and stimulating.

This book should be of special utility for chemists due to its contents, the high level of the writing, and the fact that it presents molecular biology to some extent from the point of view of physics. The title may be, perhaps, a bit of a liability for the book in terms of circulation; while "biological energy transduction" is almost too broad but clear, the term "uroboros" is hardly a household word among chemists.

David G. Whitten, *University of North Carolina*

Silicon in Organic Synthesis. By Ernest W. Colvin (University of Glasgow). Butterworths, London. 1980. xi + 348 pp. $39.95.

This excellent monograph reflects an emphasis by the author "on the concept of silicon as a 'ferryman', mediating the transformation of one wholly organic molecule into another. For this reason, most of the more silicon-oriented areas of organosilicon species and sila-heterocycles are not discussed". Within this framework, the literature coverage is thorough (through June 1980), some of it provided in the 1–4-page addenda to six of the book's 21 chapters. While the coverage is suitably broad and genuinely merits the monograph title, two chapters (Silyl Enol Ethers and Silyl Ketene Acetals, 90 pp and 254 ref; Vinylsilanes, 40 pp and 99 ref) are disproportionately longer, reflecting current interest and activity. Equations and illustrations are plentiful and crisply done; the expository writing is commendably lucid. The author adopts a strongly mechanistic approach and, wherever the data permit, has evaluated rather than merely reported the research involved. The book has an extensive index. Chapter one Physical Properties of Organosilicon Compounds provides a concise and useful introduction to those less familiar with the field. This monograph can be strongly recommended as the one of choice to anyone interested in the areas covered.

Jack H. Stocker and Henry F. Hauck, *University of New Orleans*

Advances in Electrochemistry and Electrochemical Engineering. Volume 12. Edited by H. Gerischer (Fritz Haber Institute) and C. W. Tobias (University of California, Berkeley). John Wiley & Sons, New York, NY. 1981. x + 361 pp. $39.50.

This series of monographs began to appear in 1961 to publish authoritative reviews in the area of electrochemistry and electrochemical engineering. The current volume contains four chapters contributed by experts in their respective fields. The first two chapters convey the importance of recently developed concepts of unusual electrochemical phenomena, whereas the latter two chapters are concerned with today's electrochemical technologies. Four reviews included in the present volume are the following: J. Willig, Electrochemistry at the Organic Molecular Crystal/Aqueous Electrolyte Interfact (98 references, 111 pages); J. Koryta and P. Vanysek, Electrochemical Phenomena at the Interface of Two Immiscible Electrolyte Solutions (129 references, 63 pages); S. Trasatti and W. E. O'Grady, Properties and Applications of RuO_2-Based Electrodes (209 references, 84 pages); and T. R. Beck and R. T. Ruggeri, Energy Consumption and Efficiency of Industrial Electrochemical Processes (56 references, 91 pages).

The first contribution reviews the recent development made in the field of organic insulator electrodes. Topics such as electronic energy levels at the interface, charge injection, injection kinetics, and rate of electron transfer of organic insulator electrodes are reviewed in a logical sequence. This field and the electrochemistry at semiconductor electrodes have received much attention since the early period of the last decade. The second chapter treats another unusual electrochemical phenomena at the interface of two immiscible electrolyte solutions. The investigation on the polarization of two immiscible electrolytes has not been so active, but the phenomena may serve as a simple model for membrane electrochemistry. The chapter on RuO_2-based electrodes deals with dimensionally stable anodes (DSA) with their physical properties, electrocatalytic properties, and industrial applications discussed. The DSA is an industrially important ruthenium oxide electrode heavily used in chloroalkali industries and has begun to receive attention from various research groups including the authors of this chapter. The last chapter presents energy balances of industrially important electrochemical processes. Electrochemical processes for the production of aluminum, chloroalkali, sodium perchlorate, sodium and magnesium metals, and ethylene oxide are treated employing mostly the National Bureau of Standards (NBS) data. This chapter is the first such endeavor in a monograph to the current reviewer's knowledge. Thus far, most of these types of data have been available only in contract reports as authors point out.

In general, this volume maintains the high standards in its thorough and authoritative reviews as in previous volumes. Some figures in a few of the chapters are not labeled clearly and some captions are missing. The book should be welcomed by the electrochemical community, beginners and researchers alike, for each chapter's timeliness. The only suggestion of the current reviewer for future volumes is that reviews on similar subjects be grouped together in a volume.

Su-Moon Park, *The University of New Mexico*