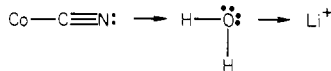


Figure 4. Plot of the ^{59}Co chemical shift δ (ppm) for $[(n\text{-Bu})_4\text{N}]_3\text{Co}(\text{CN})_6$ against the Gutmann acceptor number (AN)²⁵ ($\rho = 0.98$ for 27 points).

depletion of cobalt valence electrons, due to polarization from the cyanide ligands and the solvent molecules, leads to a small downfield shift of the cobalt resonance:



(b) For large metallic cations with low charge density and little electronic overlap, as well as for the tetrabutylammonium cation, which has no possible electronic overlap at all, Coulombic attraction results in a net diamagnetic shielding. In addition, quaternary ammonium ions, being less solvated, are more strongly associated to the $\text{Co}(\text{CN})_6^{3-}$ anion and start forming molecular aggregates in water above a concentration of ca. 50 mM.¹⁶

Despite the cobalt center being separated from the solvent by the cyanide ligands, the solvent isotope effect¹⁷⁻¹⁹ is substantial:

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a chemical shift difference of 1.05 ± 0.04 ppm is observed between H_2O and D_2O (a weaker hydrogen bond donor than H_2O ¹⁷) with the potassium salt (Figure 2). The $n\text{-Bu}_4\text{N}^+$ salt, not being fully dissociated like the potassium salt, is even more sensitive to isotope effects because its dissociation constants respond to subtle decreases in the dielectric constant²⁰ of the isotopically labeled solvent (Table I). We are even able to measure a secondary solvent isotope effect of ~ 2 ppm between CH_3OD and CD_3OD .

With protic solvents SH, a downfield shift of the ^{59}Co resonance occurs upon hydrogen bonding to the cyanide ligands and in proportion to the strength of this hydrogen bond. Thus we are able to rank solvents according to their strength as hydrogen bond donors by plotting the reciprocal of the ^{59}Co chemical shift δ against the difference between the density of cohesive energy (D_{ce}) and the internal pressure (P_i), which measures the density of hydrogen bonding^{21,22} (Figure 3). Since $\text{Co}(\text{CN})_6^{3-}$ is an overall electron donor, we have also correlated the ^{59}Co chemical shift measurements with the acceptor number (AN) for the solvent molecules, as determined by Gutmann²⁵ from ^{31}P chemical shifts for tributylphosphine oxide (Figure 4).

We shall report elsewhere other applications, ranging from accurate determination of the Dimroth-Reichardt E_T parameter,²¹ to quantitative investigation into the thermodynamics of the hydrophobic effect.

Acknowledgment. We thank Fonds de la Recherche Fondamentale Collective, Brussels, for award of Grants 2.4504.78 and 21420.D, which made possible purchase of the Bruker WP-80 spectrometer used in this study.

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Book Reviews*

Kirk-Othmer Encyclopedia of Chemical Technology. Third Edition. Volume 9 (Enamels to Ferrites). Volume 10 (Ferroelectric to Fluorine Compounds). Edited by M. Grayson et al. John Wiley and Sons, New York, 1980. Volume 9: xxiv + 902 pp. \$145.00. Volume 10: xxvi + 962 pp. \$145.00.

This well-produced series presents a selection of authoritative contributed reviews of types of substances, methods, and processes important in chemical technology. They average about 35 pages long, depending on the complexity of the subject. Volume 9 includes such subjects as enzymes (detergents, immobilized, industrial, therapeutic), esterification, ethylene, evaporation, exhaust control, extraction, fans and blowers, explosives, and fermentation. Volume 10 includes fertilizers, fibers (optics, chemical, elastomeric, vegetable), filtration, flotation, flame retardants, flavors and spices, fluid mechanics, and fluorine chemistry (the element, inorganic compounds, organic compounds), among others. The chemistry

is sound and up to date, the illustrations are clear and well selected, and the bibliographies are extensive. The balance between pure chemistry and applications is good.

A cumulative index to Volumes 5-8 accompanies Volume 9.

LASL PHERMEX Data. Volume I. Edited by C. L. Mader, T. R. Neal, and R. D. Dick. **Volume II.** Edited by C. L. Mader. University of California Press, Berkeley, Calif. 1980. Volume I: 749 pp. \$47.50. Volume II: 630 pp. \$39.50.

The title contains a pair of acronyms for the Los Alamos Scientific Laboratory Pulsed High Energy Radiographic Machine Emitting X-rays. The machine is a linear electron accelerator that produces very intense bursts of bremsstrahlung for short durations, suitable for radiography of systems in a state of rapid change. This is particularly applicable to the study of detonations and substances undergoing the effects of explosive or other sources of shock waves.

These two volumes reproduce a selection of photographs obtained by

*Unsigned book reviews are by the Book Review Editor.

this means, together with details of the experiment giving rise to them. A short description of the PHERMEX facility precedes the collection.

Solubility Data Series. Volume 4. Argon. Edited by H. L. Clever. Pergamon Press, New York and Oxford. 1980. xviii + 331 pp. \$100.00.

The Series of which this volume is a part is edited by A. S. Kertes for IUPAC. It is a most ambitious project. Volume 4 presents data for the solubility of Argon in water, salt solutions, and all manner of organic liquids. The data are presented in a manner as unified as the experimental reports permit. The arrangement of the material is nearly self-indexing, but there is also a system index of 9 pages to facilitate access.

Intercalated Layered Materials. By F. Lévy (Laboratoire de Physique Appliquée, EPF, Lausanne, Switzerland). D. Reidel Publishing Company, Dordrecht, Holland. 1979. vii + 578 pp. 150.00 DFL (\$78.00).

This volume is part of a comprehensive series of books on the physics and chemistry of materials with layered structures. It contains contributions by authorities in the field, grouped into seven articles that deal with intercalation processes and intercalates of transition metal dichalcogenides and their applications, and three which pertain to graphite intercalates. Although this volume was published in 1979, the review papers deal mostly with material published before 1977; hence the material is by now somewhat dated. The book therefore serves primarily as an excellent introduction to the general field. A large variety of topics is covered pertaining to preparative techniques, physical properties, and applications of this class of materials. In many instances, as exemplified particularly by the contribution of Professor J. V. Acrivos, a concerted effort has been made to interpret the observations in terms of appropriate theoretical models. The usefulness of the book is much enhanced by a comprehensive index of the chemical compounds and complexes that have been reviewed.

This volume is recommended to the growing community of workers specializing in the area of layered materials for an introduction and general review of the subject matter.

J. M. Honig, *Purdue University*

Standard Methods for the Analysis of Oils, Fats, and Derivatives. 6th Edition. By C. Paquot (Centre National de la Recherche Scientifique). Pergamon Press, Inc., Elmsford, New York. 1979. xvii + 170 pp. \$18.00.

This volume is published by the Commission on Oils, Fats, and Derivatives of I.U.P.A.C. and contains the standardized methods which have been approved by the commission for the analysis of oils and fats. Each of the techniques has been subjected to extensive study and comparison between laboratories, and they thus have gained wide acceptance and have a high level of reliability and reproducibility. There are more than 46 methods presented in this volume, including the principal techniques used in this field, ranging from preparation of source material to the separation and analysis of oils.

The organization of the book is very straightforward with a logical grouping of the methods. Each method is described in sufficient detail to use the technique directly. Each description includes the scope, field of application and principle of the method, required apparatus and reagents, procedure, and, when appropriate, calculations. One notable omission for each method is the use of any references. In summary, for scientists doing work in this area, this book is an invaluable reference manual of techniques.

Jan G. Jaworski, *Miami University*

Annual Reports on NMR Spectroscopy. Volume 9. Edited by G. A. Webb (University of Surrey). Academic Press, Inc., London and New York. 1979. x + 426 pp. \$57.50.

This volume continues the tradition of the series in providing well-written reviews on specific application areas of NMR spectroscopy. The first chapter on NMR spectroscopy of paramagnetic species by K. G. Orrell covers over 790 references, and updates previous reviews of the area which have appeared in the series. In addition to a brief theoretical discussion, applications to bonding, stereochemistry, solvation, exchange reactions, lanthanide shift reagents, and biological systems are covered in a comprehensive noncritical manner.

F. W. Wehrli's contribution reviews the literature since 1976 on solution NMR of the less common quadrupolar nuclei with emphasis on chemical applications. More thorough discussions of earlier data are included when such are required for clarity. The highly specialized instrumental requirements for these studies have resulted in a largely unrealized potential in the application of quadrupolar NMR to studies of relaxation phenomena.

The chapter on silicon-29 NMR by E. A. Williams and J. D. Cargioli includes excellent detailed discussions of Si-29 chemical shifts, coupling constants, and relaxation phenomena. An appendix containing an ex-

tensive tabulation of reported Si-29 chemical shifts, all referenced to Me_4Si , will be of special value to those involved in work with inorganic or organic silicon compounds.

Finally, W. McFarland and D. S. Rycroft provide a most timely review of the rapidly developing area of magnetic multiple resonance, including discussions of the theory, instrumentation requirements, techniques, and applications to chemical problems. The chapter provides a good basic introduction to an area which has great potential for providing solutions to complex spectroscopic problems.

The literature in these areas is covered through mid-1978. With its relatively thorough subject index, the book is a valuable reference resource for both academic and industrial libraries. It would be a solid addition to the personal library of the practicing NMR spectroscopist.

Paul Ronald Jones, *North Texas State University*

Physical Chemistry. By J. Philip Bromberg. Allyn and Bacon, Boston. 1980. xiv + 882 pp. \$24.95.

The appearance of so many new undergraduate physical chemistry texts over the past 3 years reflects, in part, a lack of enthusiasm among certain instructors for existing texts. Despite flaws, Bromberg's book provides an alternative with some attractive features.

The textbook is organized in 42 chapters which present topics in the order: gas laws, thermodynamics, kinetic theory and statistical mechanics, quantum mechanics, condensed states, and chemical kinetics. Macroscopic thermodynamics, which is treated as distinct from statistical mechanics, occupies about 38% of the book's volume.

Students will probably appreciate the informal style in which the subject matter is presented. The many historical notes, biographical sketches, and discussions of scientific philosophy manage to inform and entertain without interrupting the strictly scientific development. Both the text and the problems include applications to human physiology and such "relevant" issues as the energy crisis and the environment.

The level of presentation of the subject matter is generally appropriate for most undergraduate physical chemistry courses. However, the range of topics discussed is not as complete as might be hoped. Important subjects which are left almost unmentioned include Raman spectroscopy, molecular electronic absorption spectroscopy, diffusion-controlled reactions, catalysis, and application of classical trajectory or molecular beam techniques to chemical kinetics. Of course, space constraints do not permit a thorough discussion of all aspects of physical chemistry and, as the author notes in the Preface, it is better to explain a few topics well than many poorly. Nevertheless, there are those who will find the omissions to be a serious deficiency in this textbook.

Useful learning aids include some well-done sections on mathematical techniques and a good selection of problems at the end of each chapter. However, the book sometimes presents too few work-out numerical examples to illustrate use of the derived formulas. For instance, no examples are presented to demonstrate application of the Clapeyron and Clausius-Clapeyron equations in Chapter 11.

There are many instances where the material could be presented more clearly. The rationale for introducing the van der Waals equation of state and the details of the derivation would be easier to comprehend if this topic were presented after, rather than before, the microscopic derivation of the ideal gas law. This discussion of expansion work on pp 66-68 invites the reader to draw incorrect conclusions regarding the work done in an irreversible compression. The derivation of the activated complex theory rate expression on pp 831-832 assumes that reactants are in equilibrium not only with the activated complex but with the products as well and does explain why "the assumption that every activated complex that reaches the top of the energy barrier is converted into products" is inherent in the resulting formula, prior to introduction of a transmission coefficient. The treatment leading to Eq (31.93) for time-dependent transition amplitudes does not make clear at what stage the perturbative approximation has been introduced. The text fails to indicate that the Hamiltonian appearing in the treatment of the Huckel theory (p 668) is not the full molecular Hamiltonian but a model one-electron operator and that the integrals in Eqs. (33.51)-(33.53) are not over all electronic coordinates but only over the coordinates of a single electron.

In addition to the above, a number of serious errors appear in the quantum mechanics sections. On p 523, two of the three properties listed for acceptable wave functions are incorrectly stated. Pages 534-535 state and "prove" the false theorem that, if two variables can be measured simultaneously, then the operators commute (counter example: measurement of L_x , L_y , and L_z for s states of the hydrogen atom). To support the results of a perturbative calculation dealing with the effects of quartic anharmonicity, p 610 wrongly asserts that energies of the Morse oscillator "are somewhat higher than the energies of the harmonic oscillator". Time-dependent perturbation theory is derived twice (pp 611-613 and pp 857-859), each time with different sign errors. The discussion of the role of the overlap integral in bonding of H_2^+ (p 653) is incorrect.

To be fair, one must note that, although this textbook falls short of perfection, so do all others. Upon close examination, many may conclude that the deficiencies in this textbook are outweighed by its positive attributes and that it is an appropriate choice for adoption.

Kenneth G. Kay, *Kansas State University*

Hydrocarbons and Halogenated Hydrocarbons in the Aquatic Environment. Edited by B. K. Afghan (National Water Research Institute, Canada) and D. MacKay (University of Toronto). Plenum Press, New York, 1980. xiii + 588 pp. \$59.50.

This volume represents the proceedings of the International Symposium on the Analysis of Hydrocarbons and Halogenated Hydrocarbons in the Aquatic Environment, held in Ontario, Canada in May 1978. The characterization, identification, and analysis of hydrocarbons and halohydrocarbons in the aquatic environment is discussed in the 46 papers which comprise this book. State-of-the-art techniques for monitoring the distribution, incidents, biological effects, and environmental pathways of specific pollutants are detailed. Other topics include methods for isolating polynuclear aromatic hydrocarbons, chemical ionization mass spectrometry of hydrocarbons and halohydrocarbons, and detection of chlorinated phenolic compounds in drinking water. Glass capillary column chromatography techniques are discussed, as is the automatic analysis of organic pollutants via GC/MS. There are several papers which deal with the analysis of organics in sediments. Bioaccumulation and toxicology is the focus of other papers.

The 2-page index provided is far too short to be of much use. Overall, the book would be a worthwhile addition to any environmental analytical laboratory.

William C. Kuryla, *Union Carbide Corporation*

Factor Analysis in Chemistry. By E. A. Malinowski (Stevens Institute of Technology) and D. G. Howery (Brooklyn College of the City University of New York). John Wiley & Sons, New York, 1980. ix + 251 pp. \$26.25.

Fitting Equations to Data: Computer Analysis of Multifactor Data. 2nd Edition. By C. Daniel (consultant, Rhinebeck, New York) and F. S. Wood (Standard Oil Co., Indiana) (with the assistance of J. W. Gorman (Amoco Oil Co.)). John Wiley & Sons, New York, 1980. xviii + 458 pp. \$21.95.

These two books have similar aims: to allow, indeed encourage, the scientist to generate, analyze, and then understand large data sets—*chemometrics* is coming of age.

Malinowski and Howery have simultaneously written two books and a single book, simultaneously delineating and unifying the mathematical and chemical, i.e., quantitative and qualitative, features of factor analysis. While the reader is told who wrote what chapter and, indeed, how she/he may delete entire sections out of mathematical ignorance or indifference, there is no resultant loss of continuity and readability. It appears the authors are well acquainted with each other's thought processes, and seemingly as well that of the general chemist reader. The applications explicitly presented in this book are largely taken from physical and analytical chemistry, in particular spectroscopy, nuclear magnetic resonance, and chromatography. However, the last chapter chronicles applications to research questions in organic, environmental, and biomedical chemistry. Indeed, there are citations as recent as the late 70's to numerous chemical journals such as *Anal. Chem.*, *Biophys. Chem.*, *J. Med. Chem.*, and *J. Am. Chem. Soc.* Most assuredly, this book will encourage numerous future studies in the manipulation, utilization, and generation of chemical data by providing a comfortable conceptual and calculational framework.

Daniel and Wood's book is highly computationally and mathematically oriented as befits its inclusion in the "Wiley Series in Probability and Mathematical Statistics". The book appears more for chemical engineers than mainstream chemists in that the examples presented here are outside the interest and background of most chemists (e.g., the dependence of the cumulative heat of hardening of cements as a function of the concentration of the component oxides). In principle, the reader need know only a minimal amount of statistics and programming before commencing the reading of this book: there are preliminary sections on the essences of linear and nonlinear least squares, a lengthy glossary (16 pp), and careful, extensive discussions ("User's Manuals") of the input and output for their computer programs LINWOOD and NONLINWOOD. There are also comparisons of varying computer systems and configurations and information on how to acquire these programs. In practice, the reviewer suspects many chemists will find this book simultaneously incomplete and overcomplete (if not intimidating) because of the above features. Nonetheless, the courageous chemist should be able to adapt the authors' approaches to his/her research projects.

Reiterating the initial sentence of this review: *chemometrics* is coming of age.

Joel F. Liebman, *University of Maryland Baltimore County*

High Resolution NMR. Theory and Chemical Applications. By Edwin D. Becker (National Institutes of Health). Academic Press, New York, 1980. xiv + 354 pp. \$24.00.

This text, an updated version of the first edition (1969), is a treatment of NMR spectroscopic theory, instrumental techniques, and spectral analysis at the intermediate level with emphasis on applications. There are new chapters on pulse Fourier transform methods (18 pp) and contemporary developments (5 pp; studies on solids, multinuclear magnetic resonance spectroscopy, biochemical studies, and imaging in biological objects) in addition to the revised chapters from the first edition. The chapter on relaxation, now found before the one on double resonance, has been expanded considerably. The chapter on double resonance covers NOE effects in greater detail. New developments such as superconducting magnets, lanthanide shift reagents, two-dimensional FT-NMR spectroscopy, and CIDNP are also discussed. The text still emphasizes proton NMR spectroscopy although details of carbon-13 spectra have been integrated into a number of chapters. A series of problems follows each chapter, with selected answers at the end of the text. Specific and general references, a table of nuclear properties, and 40 ^1H and ^{13}C NMR spectra of unknowns (with selected answers) are also located in the back.

This book is an excellent intermediate level introduction to applied NMR spectroscopy. Researchers who use NMR spectroscopy for structural elucidation will find this book useful for its expanded list of references to chemical shift and coupling constant tabulations for various nuclei.

Louis Messerle, *University of Michigan*

Principles and Applications of Homogeneous Catalysis. By A. Nakamura (Osaka University) and M. Tsutsui (Texas A&M University). John Wiley & Sons, Inc., New York, 1980. ix + 204 pp. \$34.50.

This book discusses the title subject concisely from a broad perspective which, while emphasizing catalysis by transition metal species, includes specific acid and metalloenzyme catalysis. There are seven chapters dealing with: (i) importance, (ii) characteristic features (homogeneity, specificity, and selectivity), (iii) basic principles (kinetics, activation and deactivation, selectivity, stereochemistry, orbital symmetry, reactivity), (iv) elementary processes (general interactions, elementary reactions in transition metal chemistry), (v) mechanisms, (vi) further developments, and (vii) industrial applications. After each chapter there is a list of suggested readings and a large set of literature references (to early 1979 in some cases).

The book is directed toward advanced undergraduate and graduate students in chemistry but will be useful also to research chemists and chemical engineers. An outstanding feature of the book are the many illustrations (some of which may be too idealized) which are particularly effective in demonstrating complex stereochemical concepts such as stereoselectivity.

Louis Messerle, *University of Michigan*

Transition Metal Complexes of Cyclic Polyolefins. By G. Deganello (University of Palermo). Academic Press, New York, 1979. x + 476 pp. \$79.50.

This newest addition to the "Organometallic Chemistry" series is an extensive treatment of "metal derivatives of polyolefins containing more than six carbon atoms in a single ring having at least three carbon-carbon double bonds". Exceptions to this rule include semibullvalene and pentalene complexes. There are five chapters, each of which is devoted to a particular class of cyclic polyolefin: Cycloheptatriene and Other Seven-Membered Ring Polyolefins; Cyclooctatetraene (COT) and Ring Substituted COT Metal Derivatives; Cyclooctatriene, Bullvalene, and Related Polyolefin Metal Derivatives; Bicyclo[6.n.0]trienes and Related Polyolefin Metal Derivatives; Other Cyclic Polyolefin Metal Derivatives (cyclononatriene, cyclododeca-1,5,9-trienes, annulenes). A 16-page appendix discusses ^{13}C and ^1H NMR spectra of fluxional complexes of the type $\text{M}_2(\text{CO})_6(\eta^6\text{-polyolefin})$. The metal complexes of a particular polyolefin are ordered in terms of triad and then by increasing atomic number of the metal; transition elements are followed by lanthanides and actinides. The chemistry of each complex is organized in a logical fashion which discusses preparation and characterization, reactivity (particularly electrophilic/nucleophilic reactions on the complexed polyolefin), rearrangements of the polyolefin ligand, and catalytic applications. The text is profusely illustrated, particularly with results of X-ray diffraction and NMR spectral studies, and there are a large number of tables which summarize spectroscopic data for various derivatives. The literature coverage, with almost 900 references up to and sometimes including 1977,

appears to be fairly complete. The chapter on COT complexes (157 pp) is especially extensive.

This readable treatise will be invaluable to researchers in this active field of organometallic chemistry.

Louis Messerle, *University of Michigan*

Quantitative Analysis of Organic Mixtures. Part 1: General Principles. By T. S. Ma (City University of New York) and Robert E. Lang (U.S. Customs Service). John Wiley and Sons, New York. 1979. XVII + 366 pp. \$23.50.

In this first part of a two-part series, Ma and Lang present a volume designed to serve as: (1) a textbook for advanced students; (2) a guide for analytical laboratories; and (3) a reference volume. Although it comes closer to fulfilling the third goal than the first or second, it suffers from one major problem: it is out of date.

The vast majority of references date from before 1970 with many dating back to the 1950's when the different "chromatographies" were just developing. For example, 90% of the references to liquid chromatography have dates prior to 1970 and only six of 92 refer to applications of mixture analysis by high-pressure liquid chromatography (HPLC). The authors state, "HPLC is a recently developed technique... and is discussed in Part Two of this book". Its absence in Part One makes this volume useless as an advanced textbook. As another example, of the 30 references to mass spectrometry, 19 are pre-1970 and 12 are in obscure journals. No mention is made of the successful combination of stable isotope labeling and gas chromatography-mass spectrometry which has enabled quantitative mixture analysis to be carried out at the picogram level.

This book's utility as a reference is hindered by a poor subject index. For example, in this 4-page index, entries for amino acids, amines, carboxylic acids, titration, and many other expected subjects are missing. For some inexplicable reason, 60 pages of this volume are devoted to an author index, which must be of marginal utility at best.

Since 1970, there have been numerous reports in the literature of improvements in chromatographic separation and quantitative detection methods that allow the organic analyst to easily tackle the majority of complex organic mixtures. Unfortunately, Ma and Lang rarely reference this more significant literature.

R. D. Minard, *Penn State University*

Annual Review of Physical Chemistry. Volume 30. 1979. Edited by B. S. Rabinovitch, J. M. Schurr, and H. L. Strauss. Annual Reviews, Palo Alto, Calif. 1979. 633 pp. \$17.00.

Here we find some 20 reviews on what might be termed the "modern" aspects of physical chemistry, most notably aspects of molecular spectroscopy. Included are treatments of vibrational energy transfer, ions in noble gas matrices, applications of EXAFS, coherent transients, and multiphoton dissociation of polyatomic molecules.

Nonspectroscopic aspects are represented by reviews on such problems as dielectric relaxation, metathesis reactions, stratospheric chemical kinetics, theories of polar fluids, hemoglobin ligand kinetics, and the kinetic theory of fluids. The depth of coverage varies greatly. E. B. Wilson's discussion of molecular spectroscopy was prepared to give the broadest possible overview for a very wide audience. At the other extreme, the notation in S. Yip's review of kinetic theory of dense fluids is not readily accessible without reference to the literature. The unified index to topics and referenced authors significantly improves the utility of the volume.

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

Spray Drying Handbook. 3rd Edition. By K. Masters (Niro Atomizer Corp.). John Wiley & Sons, New York. 1979. xv + 687 pp. \$79.95.

This third edition of a book which first appeared in 1972 testifies to the widespread interest in spray drying as well as to the need for more comprehensive coverage as the technique finds its way into more and more technologies. Pollution-free drying, requiring safe operation, thermal efficiency, and improved product quality, has come into conjunction as a result of the need for a basic approach to drier design and operation.

A section on basic principles covering 154 pages includes valuable material on operating variables, terminology, heat and mass balances, and drier design. Thereafter the coverage turns to such practical considerations as atomization and droplet trajectories, evaporation of solvent from droplets, recovery of the dried product, measurements during operation, and auxiliary equipment. Completing the practical aspects is a section on applications of spray drying in the chemical, food, and pharmaceutical industries and in cleaning wastes.

One limitation is imposed by the restriction of the coverage to particulate products: scant attention is paid to spray applications leading to coherent coverage, as in spray application of coatings. Moreover, most of the applications involve aqueous solutions. Schematic drawings are

interspersed liberally with the less useful halftone pictures of equipment. Particle size histograms, psychrometric charts, and numerous simple calculations allow for self teaching of the principle, both in the basic section and in the applied sections of the volume.

The book has a scholarly air which does not appear to be overly pedantic. It is paced so that the reader who needs to understand the more quantitative aspects of how operational variables influence spray characteristics can immerse himself in these details to the extent needed; others can get a feel for the subject by skimming. The liberal use of drawings invites the reader to leave the equation derivations to the process engineer.

A patent survey covering applications is of marginal utility, for only the material being applied and the patentor are specified (along with the number and date). A glossary is included under the curious heading, nomenclature, but its utility is diminished by the absence of units. There are 435 references.

Raymond R. Myers, *Kent State University*

Contemporary Topics in Polymer Science. Volume 3. Edited by Mitchel Shen. Plenum Press, New York. 1979. xii + 340 pp. \$42.50.

The volume opens with a tribute to the late Professor Mitchel Shen, prepared by Professor Adi Eisenberg. The remainder of the volume, edited by Professor Shen before his untimely demise, includes the proceedings of the Ninth Biennial Polymer Symposium of the ACS (November 1978). Papers cover free-radical ring-opening polymerization, organophosphazenes of high molecular weight, liquid crystalline order in polymers, glow discharge polymerization, infrared and ^{13}C NMR spectroscopy, surface studies of multicomponent systems, clustering in ionomers, domain structure in block copolymers, glass transitions, polymer orientation by solid-state extrusion, and mixed enzyme immobilization by gel entrapment. The Symposium included presentation of the Division of Polymer Chemistry Award to C. S. Marvel; included here are the texts of his introduction and of the discussion following his paper on heat-stable, processable, aromatic polymers.

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

Electro-Optics and Dielectrics of Macromolecules and Colloids. Edited by B. R. Jennings. Plenum Publishing, New York. 1979. xv + 408 pp. \$42.50.

This attractively prepared book contains the Proceedings of the International Conference on Electro-Optic and Dielectric Studies on Macromolecules and Colloids, held at Brunel University in 1978. The volume is divided among theoretical advances (6 papers), absorption (6 papers), nucleic acids (5 papers), biological systems (7 papers), polyelectrolytes (6 papers), colloidal systems (6 papers), and high field effects (7 papers), the divisions opening with well-chosen quotations from the like of Goethe, Browning, Ruskin, and Winston Churchill. The presentations here largely report work done in individual research groups; one thus has a good representation of current efforts of many prominent individuals. The topic of the conference was broadly interpreted. Papers such as that of M. Matsumoto and H. Watanabe on the numerical inversion of Laplace transforms and V. A. Bloomfield et al. on computing rotational diffusion coefficients are important to a far wider audience than that to which this volume is largely directed. The volume is of primary interest to those active in the field; a graduate student generally interested in electro-optics and dielectrics needs instead a review volume.

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

Basic Chemical Kinetics. By Henry Eyring (University of Utah), S. H. Lin (Arizona State University), and S. M. Lin (National Chung-Shan Institute of Sciences and Technology). John Wiley and Sons, New York. 1980. vii + 493 pp. \$35.00

"Basic Chemical Kinetics" by Eyring, Lin, and Lin (ELL) is a rather broad treatment of a wide variety of theoretical topics generally related to reaction kinetics and dynamics. Some experimental measurements are discussed, but, in general, these discussions are limited. However, the presentation of experimental findings is skillfully interwoven with the theoretical treatments so that it complements and clarifies the theoretical concepts under discussion. The importance of modern techniques, such as molecular-beam measurements, is clearly demonstrated by this approach. Although not all-inclusive, the breadth of theoretical subjects treated is probably greater than that present in any other presently available book of comparable size. For example, the presentation contains discussions of semiempirical, valence-bond, and SCF-CI methods for obtaining potential-energy surfaces, the Woodward-Hoffmann symmetry rules, both classical and partial wave treatments of the two-body scattering problem, Lagrange and Hamiltonian mechanics, normal-mode analysis, a review of statistical thermodynamics, transition-state theory, quasiequilibrium and RRKM theories of unimolecular reactions, statistical and collision theories of bimolecular reactions, as well as discussions

of photochemical and condensed phase processes. In general, the treatment of these topics is condensed and succinct. This approach will undoubtedly be more acceptable to the research chemist than to the student, who will probably need to augment the treatment with other references.

In the Preface ELL state that the book is intended for undergraduate seniors, graduate students, and researchers. It is further claimed that the presentation is elementary and self-contained. I would not agree. Without a rather thorough course in quantum mechanics that includes some scattering theory as background, the reader will find many sections of this book very difficult to read knowledgeably. Very few undergraduates will have such preparation. Even for well-prepared students, I would not classify the treatment as "self-contained". Although the principal results are all present, there are enough gaps in many of the derivations that additional references or lecture notes will be required.

The book contains 79 problems and exercises at its conclusion that should be of value to the student. Unfortunately, 21 of these problems deal with the treatment of phenomenological rate data whose discussion occupies only the initial 21 pages of the book.

Overall, the book should be of value to research chemists and graduate students. If coupled with appropriate lecture notes and a few additional references, this book could be a valuable aid in the construction of a good graduate course in chemical kinetics.

L. M. Raff, *Oklahoma State University*

Equilibrium Thermodynamics for Scientists and Engineers. By R. W. Haywood. John Wiley and Sons, Somerset, N.J. 1980. xxv + 440 pp. \$55.00.

This volume is an undergraduate-level introduction to classical thermodynamics, based on the Hatsopoulos-Keenan Law of Stable Equilibrium and *not* on the "three laws of thermodynamics", which are here obtained as corollaries. The primary emphasis is on flow rather than on cyclic processes. The author believes this approach clarifies the notion and significance of irreversibility; the reviewer is inclined to agree. This text's very clear expository style doubtless also will be appreciated by most students.

The author limits his choice of topics rather tightly; the text's problems are drawn dominantly from engineering rather than the pure sciences. One might wish for a more extended treatment of systems of several components, further discussion of the manipulation of thermodynamic derivatives, or a systematic inclusion of external fields in the thermodynamic analysis. A good instructor may, however, always go beyond the text. This is better than the position in which one is left by the more massive undergraduate physical chemistry books, which (once away from the author's own field of research) frequently oblige one to work against the text. In all, this is a very well done volume.

George D. J. Phillips, *The University of Michigan*

Advances in Chemical Physics. Volume XLIII. Edited by I. Prigogine (University of Brussels) and Stuart A. Rice (University of Chicago). John Wiley & Sons, New York. 1980. ix + 278 pp.

The two review articles in this volume address a topic which is presently in the forefront of research in a number of areas (chemistry, biology, physics, hydrodynamics), i.e., instability in chemical reaction systems. Even though both articles are purposely limited to specific aspects of this very broad topic, they have a total of 247 references, of which more than 90% are to papers which appeared in the 1970's. This is a clear indication of the recent intense interest and work in this area of research. The timely appearance of comprehensible and comprehensive reviews covering various aspects of instabilities in chemical reactions is thus extremely useful.

The first of the papers in this volume by Bruce L. Clarke entitled "Stability of Complex Reaction Networks" certainly qualifies as being comprehensive (216 pages) but fails badly in its comprehensibility. As the title indicates, Clarke reviews and explores the criteria for stability and instability of complex reaction networks, i.e., reaction mechanisms comprised of many linear and nonlinear coupled elementary reactions. Specifically, the author sets himself two problems: (a) to find the necessary and sufficient conditions for a chemical network to be stable; and (b) to devise an efficient method of calculating the bifurcation set for steady states of an unstable chemical reaction network. As this reviewer is well aware from his own attempts in this field, this is a very difficult problem in which general results are extremely difficult to come by. As Clarke points out, "The subject matter is a highly specialized branch of mathematics..." He is also well aware of the limits to the mathematical sophistication of most chemists—including theoretical ones—as evidenced in a series of plaintive comments such as, "There is much in this chapter that would be of practical value to experimental chemists if they could only understand it" and "Few physical scientists are familiar with the n -dimensional geometry of convex sets". The fact is that this review is

addressed to a select audience of high mathematical sophistication in convex set theory, topology, graph theory, and advanced matrix analysis which (to use the generic language of the author) is isomorphic with measure zero with respect to chemists both theoretical and experimental. Professor Clarke is to be praised for this remarkable *tour de force*, but he is to be faulted for publishing it in an inappropriate medium, as are the editors for not pointing this out to him.

The article by P. H. Richter, I. Procaccia, and J. Ross entitled Chemical Instabilities is, by contrast, much more directly addressed to the chemical community, using language and mathematics more familiar to all of us. It is focused primarily on the specific topics of multiple stationary states, temporal oscillatory reactions, and formation of macroscopic spatial structures and addresses both the deterministic and stochastic aspects of these problems. This reviewer found it to be a well-organized, clear, and useful survey of these topics with a comprehensive list of references. For each of the topics considered, the authors present both the experimental data and the theories developed to account for the experimental observations. The wide variety of experimental data (chemical reactions, lasers, biological systems, nucleation) which has been referenced and discussed and the frequent reminders of the connections between the instability phenomena of chemical reactions and the effects of broken symmetries in other fields are particularly useful.

What clearly emerges in comparing these two reviews is both the need and the utility of simple models in trying to gain an understanding in this broad area of instabilities and broken symmetries. The Schlögl model, the Lotka-Volterra model, the "Brusselator" and the "Oregonator", and the simple reaction-diffusion models are, as we all know, over-simplified and not very realistic representations of chemical and physical systems. They are, however, mathematically tractable and exhibit, in spite of their apparent simplicity, many of the salient features of "real" dynamical systems. While it would certainly be desirable to have a more general "unified" theory of instabilities and broken symmetries not dependent on simple models, the attempts so far (Smale, Thom, Clarke, and others) have suffered the fate of most "unified" theories—the generality has been gained (if it has been gained at all) at the expense of contact with physical reality.

Kurt E. Shuler, *University of California, San Diego*

The Character and Origins of Smog Aerosols. Edited by G. M. Hidy, P. K. Mueller, D. Grosjean, B. R. Appel, and J. Wesolowski. Volume 9 of *Advances in Environmental Science and Technology*. John Wiley & Sons, New York. 1980. 776 pp. \$32.50.

This tome is a digest of results from the California Aerosol Characterization Experiment and describes experiments carried out in 1972 and 1973. It is divided into four major sections—I, Analytical Methods and Sampling Technology; II, Chemical Characterization; III, Physical Properties; and IV, Aerometric and Source Factors—sandwiched between a Prologue and an Epilogue. The production, with very few minor errors, is up to the usual high quality of this series. Much of the material had been previously reported to research sponsors, and most of sections II and IV has appeared in the literature (mostly in 1974 and 1975). The newer parts in section III and the Epilogue are refreshing but it is difficult to be enthusiastic about the totality of a new book, most of which was written in 1975 with little author or editorial unification. For instance, there is no attempt to discuss the differences (or similarities) between the statement on p 562 that visibility $V = 3.9/b_{ext}$ with further discussion that b_{ext} is often close to b_{scat} and on p 717 that $V = 2.6/b_{scat}$.

On the whole, the series of "Advances in Environmental Science and Technology" have indeed been advances, books to which an enquiring student should go for an up to date review, as well as a useful professional reference source. I cannot so recommend this uneven compendium.

Donald H. Stedman, *University of Michigan*

Organometallic Reviews. Journal of Organometallic Chemistry Library. Volume 9. Coordinating Editor D. Seyferth (Massachusetts Institute of Technology). Elsevier Scientific Publishing Company, Amsterdam. 1980. vii + 432 pp. \$105.00

This book, the ninth in a series containing reviews which were formerly incorporated in *J. Organomet. Chem.*, is focused only to the extent that main-group organometallic chemistry is featured. The book contains two totally different types of review, including six well-documented, comprehensive literature surveys (averaging nearly 200 references each) and seven more personalized accounts (averaging 40 references, the great majority being to the author's own work) originally presented as plenary lectures at the Fifth International Symposium on Organosilicon Chemistry held at Karlsruhe in 1978.

The literature reviews cover a wide range of topics: Formation and Reactivity of the Complexes of Carbonyl Compounds with Organoaluminum Compounds and Aluminum Chloride (Sporzynski and Starowieyski); Applications of Organomagnesium Compounds in Polymer-

ization (Malpass); Recent Advances in the Chemistry of Arsonium Ylides (Bansal and Sharma), which emphasizes the chemical reactions and synthetic applications of these novel species; The Preparation of Organotin Compounds by the Direct Reaction (Murphy and Poller); Structural Evidence of Coordination Interactions in Organic Derivatives of Mercury, Tin and Lead (Furmanova, Kuz'mina and Struchkov), which provides an interesting examination of the evidence for "secondary bonds", those intermediate in strength between covalent and van der Waals forces; and Organofluorosilanes (Pike and Koziski). The last review, the longest in the volume, is particularly valuable because of the extensive data tables (44 pages, ca. 700 entries) giving selected physical properties, spectral investigations, and references for all known (through 1977) organofluorosilanes. These reviews are, for the most part, well-written, well-documented, brief treatments of their subjects.

The remainder of the book is devoted entirely to organosilicon chemistry and includes seven "selected" plenary lectures from the symposium at Karlsruhe. The topics are: The Environmental Chemistry of Liquid Polydimethylsiloxanes (Frye); Cyclic Silanes (Hengge); Silicon as a Substituent and a Link of Heterocyclic Rings (Birkofer); Recent Developments in Silyl-Transition Metal Chemistry (Aylett); Mechanism of Nucleophilic Substitution at Silicon—The Nature of the Driving Force of Stereochemistry (Corriu); Silicon-Containing Derivatives of Carbonic Acid (Mironov); and Novel Aspects of Silicone Chemistry (Buechner). Although these articles lack the comprehensiveness and breadth of the literature reviews several provide enjoyable and instructive reading.

The book has no index, and is produced by photoreproduction from typed manuscripts. Inevitably, the quality is variable. The lack of any real editorial control also means that the writing styles and idiosyncracies of spelling and grammar are quite variable—particularly when English is not the native language of the majority of the authors.

David B. Brown, *University of Vermont*

Crystals as Giant Molecules (Lecture Notes in Chemistry, Volume 9). By A. Julg (Université de Provence, Marseille, France). Springer-Verlag, Berlin-Heidelberg-New York. 1978. 135 pp. \$9.00

The first chapter of the book treats in a lecture note fashion the concepts of molecular orbital theory, including localization, hybridization, electronic charge, and bond polarization. In a second chapter the theory is applied to crystals which are classified as those permitting a description in terms of localized orbitals, those presenting delocalized systems of finite size, and those possessing an infinite delocalized system. A treatment of band theory, which would be appropriate in the context of the book, is specifically excluded from the subject matter.

The following chapter treats the subject of net atomic charges in crystals with the use of the Mulliken population analysis and the relation between hardness, ionicity, and the polarizability of bonds, a subject on which the author has worked extensively.

Topics discussed further include the rationalization of observed crystal structures and relative stabilities of alkali halides, metals, oxides, and more complex inorganic structures, effects of the finite size of the crystal and vacancies on the electronic structure of atoms located near such discontinuities, and the external shape of crystals in terms of the surface energy of the faces.

The book contains many interesting derivations and comparisons. It would be best used in conjunction with more comprehensive treatments of the underlying theory.

Philip Coppens, *State University of New York at Buffalo*

Liquid Scintillation Counting, Recent Applications and Development. Volume 1, Physical Aspects. Volume 2, Sample Preparation and Applications. Edited by C.-T. Peng, D. L. Horrocks, and E. L. Alpen. Academic Press, New York. 1980. Volume 1. xx + 414 pp. \$27.50. Volume 2. xx + 538 pp. \$32.00.

These volumes contain the proceedings of the International Conference on Liquid Scintillation Counting, Recent Applications and Development held in August 1979 at the University of California, San Francisco. There have been significant advances in liquid scintillation instrumentation and techniques in recent years, particularly in regard to biomedical investigation and environmental monitoring. Consequently, topics presented at the conference have been separated into two books; one dealing with physical aspects and instrumentation, the other dealing with sample preparation and use of the technology. Papers in the first volume deal with scintillation physics, scintillators, quenching, advances in instrumentation, and additional applications of scintillation techniques like alpha counting and Čerenkov counting. The second volume contains papers on sample preparation, flow counting, emulsion counting, and applications such as bioluminescence, environmental monitoring and radioimmune assays. Although many papers will be useful only to those already knowledgeable in the area, other papers on radioactive standards, sample preparation, and applications of the techniques should be valuable

to more casual users of liquid scintillation counting.

John C. Drach, *University of Michigan*

Coulson's Valence. By Roy McWeeny (University of Sheffield). Oxford University Press, Oxford, England. 1980. x + 434 pp. \$45.00.

The first edition of "Valence" by Charles Coulson was published in 1952. It was designed to make appreciation of the beautiful world of quantum chemistry easy and thus accessible to all physical science students regardless of their mathematical prowess. The design was an obvious success, judging from its enthusiastic acceptance by students and teachers the world over. The second edition appeared in 1961. With the untimely death of Coulson in 1974, it seemed as if "Valence" eventually would suffer the fate of all old textbooks as science rolls forward. Fortunately, this will not be the case. Roy McWeeny has completely rewritten "Valence", bringing it up-to-date, and remarkably retaining the exciting and perspicuous Coulson style and spirit. Outdated material has been judiciously dropped to make room for modern developments. New chapters on chemical reactivity and self-consistent-field calculations and useful appendices on probabilities, angular momentum, and group theory have been added. Surely, this new volume is a worthy successor to the first two editions.

Frank O. Ellison, *University of Pittsburgh*

Annual Reports on the Progress of Chemistry. Volume 74. 1977. Section B. Organic Chemistry. Senior Reporters: J. H. P. Utley and G. P. Moss. The Chemical Society, London. 1978. xv + 471 pp. \$53.00.

This volume of "Annual Reports" consists of 14 chapters containing a total of 22 different contributions. The majority of the contributions are concerned with general interest topics (physical methods, theoretical chemistry, reaction mechanisms, heterocyclic chemistry, synthetic methods, etc.) that have regularly appeared in earlier volumes. This volume also contains sections on ultraviolet and visible spectra of bioorganic molecules, monosaccharides, insect chemistry, and tetrapyrroles that are new additions or have only appeared infrequently in the past. Some topics, such as the alkaloids, have been deleted from annual review. This is probably due to the existence of "Specialist Periodic Reports". This volume continues the excellent tradition of this series of providing an overview of the literature for both the generalist and specialist. The critical and selective reviewing of the contributors is to be commended. This approach undoubtedly aids in the readability and value of the series.

Frank W. Fowler, *SUNY at Stony Brook*

Chemistry of Free Atoms and Particles. By K. J. Klabunde (University of North Dakota). Academic Press, New York. 1980. viii + 238 pp. \$29.50.

This very readable book covers the preparations, properties, and chemistry of high-temperature species, covering most of the periodic table, with the exception of H, O, S, organic free radicals, carbenes, and halogen atoms, which are amply-covered major areas in their own right. Separate chapters deal with main groups I to VI, lanthanides and actinides, early transition metals, group VIII transition metals, and the copper and zinc triads. In each chapter occurrence, properties, preparations and chemistry of the atomic species are followed by a similar, shorter section covering halide, oxide, and sulfide derivatives. Vaporization, spectroscopic, and reaction data have been very usefully tabulated in each chapter.

Though the book is of a review nature, covering the literature to early 1979, the subject area is still small enough to have allowed for discussion of many of the specific studies that have appeared.

This book will serve as a useful introduction to and overview of this field for newcomers, as well as a review work for those already in the area.

Robert F. Gerlach, *University of Michigan*

Spectroscopic Properties of Inorganic and Organometallic Compounds. Volume 11. Chemical Society Specialist Periodical Reports. Senior Reporters: D. M. Adams and E. A. V. Ebsworth. The Chemical Society, London. 1979. xiii + 455 pp. \$80.

This volume is presented in the same format as previous volumes of this excellent review series and covers the literature for 1977. Length restrictions have resulted in some trimming of subject areas but these are well referenced to other reviews.

N.M.R. Spectroscopy by B. E. Mann (151 pp, 1693 references) is divided into sections on stereochemistry, dynamic systems, paramagnetics, solid state NMR and main groups III to VII, with sub-sectioning for individual elements. Emphasis in coverage is given to nonproton NMR. A very useful continuation from the previous four volumes is the appendix of references to papers describing the use of all nonproton nuclei, listed by nucleus.

N.Q.R. Spectroscopy by R. J. Lynch (17 pp, 90 references) includes

sections on instrumentation, main groups I, II, III, V, VI, and VII, and cobalt, copper, niobium, and molybdenum.

Microwave Spectroscopy by A. P. Cox (17 pp, 145 references) covers di-, tri-, and tetraatomic molecules and Inorganics and Organometallics with five or more atoms. Emphasis is given to work on high-resolution studies of gas phase rotational transitions.

Vibrational spectroscopy is covered in four chapters: Small Symmetric Species and Single Crystals (D. M. Adams and P. N. Gates, 23 pp, 407 references), Characteristic Frequencies of Main Group-Element-Containing Compounds (S. Cradock, 19 pp, 293 references), Transition Element Compounds (J. S. Ogden, 30 pp, 346 references), and Co-ordinated Ligands (G. Davidson, 62 pp, 419 references).

Mössbauer Spectroscopy by J. D. Donaldson and M. J. Tricker (88 pp 758 references) deals largely with Iron-57 and Tin-119 work and covers the less-used isotopes individually.

A comprehensive author index is also included.

In spite of the necessarily highly condensed nature of the text, the layout and subdivision of all chapters is such that specific information (or reference to it) is still easy to find. This volume continues the valuable contribution that this series makes to Inorganic and Organometallic chemists.

Robert F. Gerlach, *University of Michigan*

Advances in Catalysis. Volume 28. Edited by D. D. Eley, H. Pines, and P. B. Weisz. Academic Press, New York, 1979. X + 403 pp.

The five chapters covered in this volume deal with three different aspects of catalysis research. Three chapters are devoted to heterogeneous catalysis, one to homogeneous catalysis, and the final chapter to the developing area of metalloenzyme catalysis.

The article by Dr. Engel and Professor Ertl is complementary to that of Professor Eisenberg and Dr. Hendriksen. The first of these two, *Elementary Steps in the Catalytic Oxidation of CO on Platinum Metals*, stresses the use of modern surface-sensitive spectroscopic techniques to understand the dynamics and energetics of a reasonably well-understood reaction taking place on clean well-defined surfaces under controlled conditions. In this article, the adsorption of CO and O₂ on well-defined crystallographic planes of noble metals is thoroughly reviewed followed by a discussion on the dynamics and energetics of the catalytic oxidation of CO. Finally, factors influencing catalytic activity and catalyst deactivation are considered. Catalytic oxidation of CO over Pd and Pt is emphasized; however, Ru, Rh, and Ir are also considered.

In their article, Professor Eisenberg and Dr. Hendriksen consider the binding and activation of CO, NO, and CO₂ and their homogeneously catalyzed reactions. Throughout this article, parallels are drawn to the corresponding heterogeneous reactions. Following a discussion of the features of CO, NO, and CO₂ coordination in transition metal complexes, the authors consider the catalyzed reactions of CO with emphasis on the CO-H₂ reaction and the catalyzed reductions of CO₂ and NO. The authors conclude by speculating on the future directions that these investigations should take. This reviewer finds this article to be informative and very well written.

Professor Temkins' contribution entitled *The Kinetics of Some Industrial Heterogeneous Catalytic Reactions* emphasizes the mathematical treatment of reactions which take place on both uniform and nonuniform surfaces. Following an extensive mathematical review, the author applies the resulting equations to several reactions of industrial importance. The ammonia synthesis is stressed; however, the oxidation of ethylene to ethylene oxide, the carbon monoxide conversion, the phosgene synthesis, the reaction of carbon with carbon dioxide and steam, and the ammonia oxidation are also considered. This article provides the reader with an excellent review of the kinetics of heterogeneous reactions.

Metal-catalyzed dehydrocyclization reactions of alkylaromatics are discussed by Dr. Csicsery. This very important class of reactions can be catalyzed by acids or metals. Whereas the mechanism of acid-catalyzed cyclization is quite well understood, less is known concerning the metal-catalyzed cyclization reactions. In this article, emphasis is placed on the dehydrocyclization of C₉, C₁₀, and higher alkylbenzenes catalyzed by metals and by dual-function catalysts. Other topics discussed include: double cyclization of C₈ and higher paraffins, the dehydrocyclization of alkyl-naphthalenes, and the dehydrocyclization of diphenylalkanes.

The topic of metalloenzyme catalysis is reviewed by Professor Villafranca and Dr. Raushel. Since metalloenzyme catalysis occupies a relatively unique position when placed in the context of heterogeneous and homogeneous catalysis, this review is particularly welcome. In this review, the authors have chosen enzymes for which many independent experimental approaches have been utilized to obtain spatial information regarding substrate atoms, metal ions, and the various atoms pertaining to the protein that are involved in binding and catalysis. The reactions of thermolysin, yeast hexokinase, and glutamine synthetase are considered in detail.

In conclusion, I find that all of the contributions in this volume are of high quality and recommend it to those who have an active interest in catalysis.

Richard D. Gonzalez, *University of Rhode Island*

Introduction to Biological Membranes. By M. K. Jain and R. C. Wagner (University of Delaware). John Wiley & Sons, New York, 1980. xiii + 382 pp. \$29.50

This book is intended by the authors to serve as a text for an upper level or graduate course in membrane biochemistry and biophysics for students who have a background in biochemistry. The major emphasis of the book is related to membrane biophysics with a thorough quantitative analysis of the physics of lipid bilayer structure and function as they pertain to cellular activities. Thus, approximately three-quarters of the book deals with the physical properties of lipid bilayers, transport phenomena, and physical methods of structural analysis. However, currently developing areas of membrane biochemistry such as those pertaining to the structure and biosynthesis of membrane proteins and glycoproteins in normal and abnormal cells, the dynamics of secretory mechanisms, the role of membrane receptor-ligand interaction in regulation of growth and metabolism, cell-cell recognition, and intercellular adhesion are subjects that have received little attention by the authors. In summary, "Introduction to Biological Membranes" by Jain and Wagner is an adequate text for a course in membrane biophysics although if the course is intended to include a broad treatment of the biology of cell membranes and cell surface-mediated regulation, this book would not be adequate.

Edward C. Heath, *University of Iowa*

Practical Mass Spectrometry, A Contemporary Introduction. Edited by B. S. Middleditch (University of Houston). Plenum Press, New York, 1979. xii + 387 pp. \$29.50.

This book is based on an introductory course in mass spectrometry developed by the editor and the 16 contributors to the 13 chapters. It is written in a textbook format with exercises and a suggested reading list at the end of each chapter and the solutions to the exercises at the end of the book. The chapter subjects include a basic introduction to the principles of mass spectrometry and instrumentation (B. S. Middleditch), gas chromatography-mass spectrometry (GC/MS) (C. J. W. Brooks and C. G. Edmonds), selective ion monitoring (E. C. M. Chen), concentration techniques for volatile samples (A. Zlatkis and H. Shanfield), automatic data processing (R. N. Stillwell), three chapters on the organization and use of mass spectral data centers, and four chapters on applications of mass spectrometry in various fields that include environmental problems (S. R. Heller), pharmaceutical applications (A. G. Zacchei and W. J. A. Vanden Heuvel), petrochemicals (T. Aczel), and cosmochemical and geochemical studies (J. Oró and D. Nooner).

It is difficult to determine to which audience the textbook is directed. Probably because the chapters were written by different authors there are varying degrees of rigor for each chapter. The first two chapters are a basic introduction to the fundamentals of the field (electron impact, isotope patterns, fragmentation, metastable ions) with emphasis on the electron impact method and the use of magnetic sector instruments. These topics are covered at a very elementary level and in some cases simplification has produced misleading explanations. The quadrupole mass filter is given cursory mention with some unjustified opinions. Alternative methods of ionization (chemical ionization, field ionization/desorption), covered in two pages, do not do justice to these powerful techniques. The second chapter on instrumentation is a discussion of the performance and use of three commercial mass spectrometers (LKB 9000, AEI MS 50, and the H.P. 5992 quadrupole). This chapter is also written at an introductory level, highlighting some of the special features of these instruments in a descriptive language. The chapter on GC/MS is an excellent introduction to the field. It gives a good account of the basic principles, includes the different types of GC/MS interfaces, problems and limitations, and concludes with a selection of applications from recent research problems. The chapter on selective ion monitoring is a descriptive introduction to the subject which covers the essential features and includes some examples of applications. The chapter on automatic data processing contains general descriptions on how computer hardware is used for mass spectrometry. There is a considerable amount of detail using the programmer's terminology which does not seem to be appropriate for an introductory text. The chapters on mass spectral data collection are a useful reference for E.I. mass spectroscopists performing mass spectral analyses of unknown samples. The chapters on applications are written by active researchers in their fields and give good examples of the applications of E.I. mass spectrometry. This book used as an introductory text has severe limitations. It does not include many of the important developments in the field of the past decade. It lacks depth for use as a text for a graduate level course, but might be used in an

introductory practical course for the training of technicians.

R. D. Macfarlane, *Texas A&M University*

Statistical Theory and Methodology of Trace Analysis. By C. Liteanu (University of Cluj-Napoca, Rumania) and I. Rică (Hunedoara Ironworks, Rumania). Halstead Press/John Wiley and Sons, New York. 1980. 446 pp. \$91.25.

This book treats a wide range of topics related to processing of information from chemical instruments. Trace element analysis is the application assumed in most of the examples, but the procedures are of use to anyone who must contend with noisy signals. The book starts with an introduction to standard statistical methods. With this background it quickly moves to topics less familiar to most chemists. Redundancy and information content of measurements is treated, as are stability and reliability of measurement systems. There is a useful discussion of calibration curves and a very thorough discussion of the criteria for limits of detection and quantitation. A final chapter sketches current methods for improving signal-to-noise ratios by experiment design, signal measurement techniques, and post-processing methods.

The book is apparently the first synthesis of its sort aimed at chemists. Its major fault is its extremely broad coverage. Readers totally unfamiliar with the material may find the book difficult going. Results are often presented without proof. There is ample commentary, but it is not always clear. However, there are extensive literature citations provided and these may clear up most of the difficulties in the text.

The availability of inexpensive computers and (less commonly realized) of extensive software libraries makes implementation of the procedures outlined here fairly straightforward. Any chemist who must extract reliable information from complex instruments in a reasonable period of time cannot afford to ignore the techniques described in this volume.

Michael D. Morris, *University of Michigan*

Carbohydrate Chemistry. Volume 11. A Specialist Periodical Report. Senior Reporter: J. S. Brimacombe. The Chemical Society, London. 1979. xvi + 546 pp. \$95.00.

This text, the most recent volume in a definitive series, is a review of the carbohydrate literature published largely during 1977. It is the work of seven reporters and discusses over 3000 publications. The title does not fully imply the breadth of material now covered by this series. In addition to 17 chapters treating the simple mono-, di-, and trisaccharides and their derivatives, and classified by structural features and functional groups, Part I also includes three chapters on methods of analysis, separation and characterization, and individual chapters on antibiotics, nucleosides, and the synthesis of other chiral organics from carbohydrates. Part II on macromolecules comprises almost half the volume and has eight chapters covering methodology, polysaccharides of plants, animals, algae, bacteria and fungi, and chapters on glycoproteins, glycopeptides, glycolipids, enzymes, and the chemical synthesis and modification of carbohydrate macromolecules. The last chapter includes lengthy tables listing reports of the preparation of active immobilized enzymes, immunoabsorbents, materials for affinity chromatography, agarose coupled to various ligands and affinites, glycoproteins on insoluble matrices, etc.

In a book with so encyclopedic a coverage, it is inevitable that novel contributions cannot be emphasized sufficiently over trivial variations of traditional methods, and the significance of the research must for the most part be supplied by the reader. It is also unrealistic to expect, within the restraints of time and personnel, the critical in depth accounts of a year's scientific output claimed by the publisher. The review coverage is, however, as claimed, comprehensive, in fact encyclopedic, accurate, and of the high quality expected of the authorities who authored it. It is an invaluable tool for the specialist and the research community owes the authors and publisher a debt of gratitude.

C. Schuerch, *College of Environmental Science and Forestry*

The Biochemistry of Inorganic Polyphosphates. By I. S. Kulaev (Moscow State University). Translated by R. F. Brookes. John Wiley and Sons, New York. 1979. xiv + 255 pp. \$48.95.

Carbon-containing acyclic condensed polyphosphates, $(\text{RO})(\text{HO})\text{P}(\text{O})\text{O}[\text{P}(\text{O})(\text{OH})\text{O}]_n\text{H}$, e.g., ATP, play a key role in biochemistry. Not as well known is the fact that carbon-free ($\text{R} = \text{H}$) analogues of these polyphosphates are present in many microorganisms. Are these inorganic polyphosphates alternate sources of energized phosphoryl groups, $>\text{P}(\text{O})(\text{OH})_2$? What role do they play in biological evolution? These are some of the questions discussed in this monograph.

Ideally, the enzymatic reactions of organic and inorganic polyphosphates belong together in a volume on Biophosphorus. As the subject now stands, however, a separate treatment of the inorganic polyphosphates found in microorganisms is justified, since we do not have at present all the information that is necessary to integrate the nonenzymatic and the enzymatic chemistry of phosphorus compounds. To me,

the main value of this book is that it emphasizes the biochemical role of carbon-free polyphosphates, and provides access to widely scattered literature, some of it from sources that are difficult to locate. I have some reservations on its merits. The literature coverage is uneven and outdated. The book is the English edition of a monograph which appeared in Russia in 1975. Of its 848 references, only a few are to papers published after 1970, and, with a few exceptions, those citations describe research carried out by Russian investigators. The appearance in 1979 of the translation of a book first published in 1975, in a field as active as Biophosphorus, has obvious disadvantages. The inclusion of a few references to papers published in 1976 does not help very much. The reader may, in fact, draw the incorrect conclusion that he is obtaining a thorough overview of the field, at least up to that time. For example, it should be pointed out that this is not a good source of information on the activities of *Halobacterium halobium* cells, i.e., of the protein bacteriorhodopsin present in the "purple membrane".

It is now recognized that the molecular mechanisms of biophosphorus reactions are quite complicated, as illustrated by mitochondrial oxidative phosphorylation, photophosphorylation, actomyosin MgATPase in muscle contraction, the actions of the kinases, etc. Although the basic structural chemistry, and the mechanisms which operate in nonenzymatic nucleophilic displacements at 4-coordinate phosphorus, are now understood reasonably well, the factors which enter the picture when these displacements are carried out in the enzymatic active site and in the presence of certain metal ions have not been fully elucidated. This book does not grapple with these questions in a satisfactory manner. In spite of these shortcomings, and within the limitations imposed by the date at which it was written, the author has performed a real service to the biophosphorus specialist by the painstaking effort that has resulted in this monograph. His own personal contributions in this field, which have been numerous and significant, are concisely described in the book.

Fausto Ramirez, *State University of New York at Stony Brook*

Foreign Compound Metabolism in Mammals. Volume 5. Senior Reporter: D. E. Hathway. The Chemical Society, London. 1979. XV + 567 pp. \$70.

In this volume of the "Specialist Periodical Report" series, literature is reviewed that was published in 1976 and 1977 and deals with the mammalian metabolism of drugs and some other compounds. The book consists of 13 chapters. The first five of these are subject oriented and more general in scope whereas the remaining eight chapters are product oriented. Of the first five chapters, which constitute nearly 50% of the book's content, those on Drug Kinetics by P. G. Welling and on Species Strain and Sex Differences in Metabolism by J. D. Baty will be most valuable to specialists in the respective areas. The chapters on Enzymic Mechanisms of Oxidation, Reduction and Hydrolysis by P. Bentley and F. Oesch; on Enzymic Mechanisms of Conjugation by P. C. Hirom and P. Milburn; and on the Mechanism of Chemical Carcinogenesis by D. E. Hathway will also be of interest to scientists who are only marginally interested in drug metabolism. The eight product-oriented chapters review the literature on: The Effect of Drugs on the Central Nervous System by B. E. Leonard; Cardiovascular Drugs by C. Rhodes; Sympathomimetic Agents and Bronchodilators by L. G. Dring and P. Milburn; Anti-infective Agents by P. Johnson and J. D. Coombes; Prostaglandins and Steroids by G. R. Bourne and D. E. Hathway; Food Constituents by D. E. Hathway; Agricultural Chemicals by C. T. Bedford; and Industrial Chemicals by C. T. Bedford. These eight chapters are for the most part of interest to scientists who study drug metabolism. Of more general interest is the chapter on Prostaglandins and Steroids because of its review of prostaglandin metabolism, an area which has been developing rapidly over the last few years. The chapter dealing with the Effect of Drugs on the Central Nervous System seems to be misplaced in this book because it deals with the pharmacological effects of these drugs but not with their metabolism.

Altogether, this volume will be very helpful to anyone who must work his way through the recent literature on drug metabolism. This is especially true for some of the first chapters which summarize literature published in a wide variety of journals.

Horst H. Schulz, *City College of CUNY*

Topics in Current Physics. Edited by K. Cho (Osaka University). Springer-Verlag, Berlin, Heidelberg, New York. 1979. xi + 274 pp. \$34.90.

Excitons were postulated as possible excited electronic states of non-metallic solids in the 1930's by Frenkel, Wannier, and Mott. These states are characterized by bound electron-hole pairs of various types. The Frenkel exciton has the electron and hole strongly bound and very close to one another, perhaps on the same site. The Wannier-Mott exciton has the electron and hole weakly bound and thus farther apart. Frenkel excitons are found in alkali halide crystals and molecular crystals (e.g.,

anthracene) while Wannier-Mott excitons are found in covalently bound crystals with high dielectric constants. After the initial theoretical papers, and the experimental verification of the exciton states in alkali halides, there was very little activity in this field until the early 1960's. This book is a collection of papers on modern exciton physics. After a short introduction, Cho continues with a theoretical survey of the internal structure of excitons, concentrating on the effect of external stress and electric and magnetic fields in a few crystal symmetries. The next article is an elegant and complete survey of *bound* excitons in semiconductors by Dean and Herbert. These are excitons associated with and localized near a defect or impurity such as those in Si or Ge. Typically these states have a characteristic radius of 30 Å and occur near the impurities put into these semiconductors to control their electrical properties. Study of the optical properties of these states can help characterize the defects.

In the next article, Fischer and Lagois discuss surface exciton polaritons. These are surface exciton states coupled strongly to the radiation field. The theoretical description of these states arises most naturally from the solutions of Maxwell's equations at the boundary of a nonmetallic medium with dielectric function $\epsilon(\omega)$ and a vacuum. Such solutions which are surface waves are characterized as surface exciton polaritons. If, in addition, the dielectric function depends on wavevector, $\epsilon(k, \omega)$, the phenomenon of spatial dispersion is important, and the complications due to additional boundary conditions must be taken into account. Attenuated total reflection measurements which probe these effects are discussed and interpreted in this article. The final article by Yu on resonant Raman and Brillouin spectroscopies reviews the experimental studies of excitons and exciton-phonon interactions in Cu_2O , CdS , CdSe , and GaAs . After a review of the theory and experimental techniques, Yu goes on to discuss the experiments in detail. Such properties as exciton-polariton dispersion curves, exciton relaxation mechanisms, and lifetimes are measured directly.

Robert Silbey, *Massachusetts Institute of Technology*

Spectroscopic Techniques for Organic Chemists. By James W. Cooper (Tufts University). John Wiley and Sons, New York. 1980. XV + 376 pp. \$19.95.

This text is designed to introduce the advanced undergraduate and beginning graduate student to those types of spectroscopy which would be most useful in determining the molecular structure of an unknown organic substance. The techniques introduced are infrared, proton, and carbon-13 nuclear magnetic resonance and ultraviolet, mass, and Raman spectroscopy in that order.

A concise theoretical background for each type of spectroscopy is given. This is followed by practical matters on sample preparation and available instrument types. The bulk of the text is then devoted to spectral interpretation. Problems are given at the end of each section, and the answers presented with a useful discussion are given at the end of the text.

Since Cooper spent a portion of his life working for a firm which builds small computers and computer-controlled NMR spectrometers, the text rather heavily reflects (43%) his interest in this type of spectroscopy. There is a very good introduction to proton and carbon-13 magnetic resonance. The portion on Fourier-transform NMR is particularly useful, containing much information on computer-machine limitation and data manipulation. Much of this can only be found in more highly specialized texts where the average student is not apt to wander.

There is one chapter on simple Hückel molecular orbital theory with a computer program for HMO calculations in the appendix. The justification for this is said to be the calculation of electronic spectra, but the chapter on ultraviolet spectroscopy makes only fleeting reference to this. I would rather have seen more information on instrument design factors and electronics as then the text might have been used for a portion of an instrumental analysis text.

William B. Smith, *Texas Christian University*

Kinetics of Coal Gasification. By James Lee Johnson (The Institute of Gas Technology). Wiley-Interscience, Somerset, New Jersey. 1979. xiii + 324 pp. \$23.50.

This book contains six major works of James Lee Johnson and was dedicated to his memory following his untimely death in 1977. Five of the six works published in this volume are detailed descriptions of specific research investigations into several aspects of coal gasification. These five articles are well written and cover a number of different fundamental features of coal and char gasification. An outstanding review article entitled *Fundamentals of Coal Gasification* comprises over half of the pages in this volume. Current understanding and uncertainty in this area are discussed in detail and critically evaluated. This article provides an excellent, and perhaps the only available, modern comprehensive introduction in this area. This article will also appear in the forthcoming volume "The Chemistry of Coal Utilization. Volume II", Martin Elliot,

Ed., Wiley, New York.

Stephen E. Stein, *West Virginia University*

Advances in Inorganic Chemistry and Radiochemistry. Volume 23. Edited by H. J. Emelens and A. G. Sharpe. Academic Press, New York. 1980. xi + 441 pp. \$51.00

This current entry in the series maintains the quality and breadth of earlier volumes. Comprising the present volume are six reviews devoted either to complete subjects of recent development or recent advances in fields of long standing. An overview of tin chemistry is provided by A. G. Davies and P. J. Smith and includes an excellent review of the biological and environmental aspects of tin and its complexes. R. J. Lagow and J. A. Morrison describe new synthetic methods for producing trifluoromethyl organometallics; contained are sections on the use of plasma-generated radicals and metal-vapor-cocondensation reactions. Of special note are the number of very recent (1979, 1980) references cited. Metal vapor cryochemistry is covered by G. A. Ozin and W. J. Power. Included in this review are well-written and informative sections on methods of generation and identification of atomic, diatomic, and polynuclear species. Another rapidly developing area of research, graphite intercalation compounds, is reviewed by H. Selig and L. B. Ebert. This review is organized primarily by intercalating type: covalent, lamellar, and residue compounds. In volume 22 of the series, R. P. Burns and C. A. McAuliffe reviewed the transition-metal chemistry of 1,2-dithiolenes. In the present volume, with the aid of F. P. McCullough, they examine the transition-metal chemistry of 1,1-dithiolates. Finally, the solid state chemistry of thio-, seleno-, and tellurohalides of the elements is treated by J. Fenner, A. Rabenau, and G. Trageser. In general, the bibliographies are substantial and include references up to early 1979. There is a subject index covering the current volume and, in addition, a listing of contents from previous volumes in chronological order.

Harvey S. Trop, *Bell Laboratories*

Radiochemistry. Volume 3. Senior Reporter: G. W. A. Newton. The Chemical Society, London, 1977. viii + 141 pp. \$23.00

"Radiochemistry", Volume 3, is one of a series of Specialist Periodical Reports published by the Chemical Society of London that is intended to provide systematic comprehensive review coverage of progress in major areas of chemical research. For the "Radiochemistry" series, Volume 3 marks an approach change from broad coverage of many areas to in-depth review of a few select areas. In this report, four active areas of radiochemical research are reviewed. These include a chapter by J. A. Heslop of the I.C.I. Physics and Radioisotope Service on the topic of Industrial Applications of Radioisotopes, a chapter by G. Harbottle of Brookhaven on Activation Analysis in Archaeology, a chapter by D. J. Silvester of Hammersmith Hospital, London, on the preparation of Radiopharmaceuticals and Labelled Compounds using Short-Lived Radionuclides, and a chapter by B. W. Fox of the Christie Hospital in Manchester on Sample Preparation Procedures for Liquid Scintillation Counting.

The coverage of the recent literature (1973-1975) for each of the topics is thorough and extensive and numerous older references are cited where appropriate. For anyone involved in initiating research, teaching, or studying in these fields and for the practicing chemist, these articles can serve as an important well-documented reference.

William B. Walters, *University of Maryland*

Electrophoresis in the Separation of Biological Macromolecules. By Ö. Gaál, G. A. Medgyesi, and L. Vereczkey (Institutes of Nutrition, Haematology, and Blood Transfusion and the Chemical Works of Gedeon Richter Ltd., Budapest, Hungary). John Wiley & Sons Publishing Co., New York. 1980. 422 pp. \$57.75.

This book is a comprehensive outline of the principles and practices of electrophoretic techniques. The book is divided into four sections. The first section describes the theory and techniques of electrophoresis, with particular emphasis on moving boundary and various types of zone electrophoresis, filter paper and cellulose acetate electrophoresis, and electrophoresis in agar, agarose, starch and polyacrylamide gels. This section also covers the technique of isoelectric focusing and the methods used for detection of macromolecules after electrophoresis. The second section provides information on the methods used for the identification of proteins in great detail. The third section deals with the electrophoresis of nucleic acids and nucleoproteins. The last section presents the electrophoretic separation of glycosaminoglycans.

The book analyzes methods of basic importance in detail and provides critical assessment of the advantages and disadvantages of individual methods and specific techniques. A shortcoming of the book is the omission of the sensitive fluorographic detection of radioisotopes described by R. A. Laskey and A. D. Mills [*Eur. J. Biochem.* **1975** *56*, 335] and a description of Southern [Southern, E. M. *J. Mol. Biol.* **1975** *98*,

1503] and Northern [Alwine, J. C.; Kimp, D. J.; Stark, G. R. *Proc. Natl. Acad. Sci. U.S.A.* 1977, 74, 335] blot analyses for the detection and characterization of DNA and RNA, respectively. Nevertheless, the clear presentation of the methodologies, the examples, and the list of the original publications make the book a valuable reference source.

Minou Bina, *Purdue University*

Cadmium Chemicals. By Marie Farnsworth. International Lead Zinc Research Organization, Inc., New York. 1980. viii + 158 pp. \$3.00

"Cadmium Chemical" is a short monograph which conveniently condenses, mainly from various standard secondary sources, the properties of both common and uncommon cadmium compounds. The topics covered include the description of the properties of cadmium metal, its oxides, sulfides, and halides. The book includes, although less comprehensively, the properties of cadmium complexes with inorganic and organic ligands. A typical coverage of a compound includes physical properties, chemical reactions, preparation, availability, application, catalytic uses, and the like. A short coverage of the safety aspects of handling cadmium compounds is presented, drawing on fairly recent clinical literature of the relatively toxic metal. A 14-page survey of the most important patent literature covering the uses of cadmium compounds is a unique feature of the monograph.

The book is written with an admitted slant toward arousing further commercial interest in the use of cadmium. However, the monograph appears also to be a convenient source of useful data to those studying any aspect of cadmium chemistry.

Alex Avdeef, *Syracuse University*

ESR and NMR of Paramagnetic Species in Biological and Related Systems. Edited by I Bertini (University of Florence, Italy) and R. Drago (University of Illinois). D. Reidel Publishing Company, Dordrecht, Holland/Boston, USA/London, U.K. 1980. XX + 422 pp. \$50.00.

This book, reporting the proceedings of the NATO Advanced Study Institute held in Italy, 1979, contains 19 reports of somewhat uneven depth and clarity. While a few are brief research reports, others attempt to provide a thorough coverage of the background theory. The first seven chapters concern the application of NMR spectroscopy to the study of biological molecules with particular emphasis on pulse techniques and intrinsic as well as extrinsic paramagnetic shift and relaxation reagents. Many of the subsequent chapters require some familiarity with crystal and ligand field theory and deal with paramagnetism in metal containing biological systems. Special attention is given to EPR of iron in biological material and to correlations between EPR and Mössbauer spectroscopy for solving problems encountered with proteins containing many metal atoms. The difficult problem of interpreting EPR spectra of dioxygen transition metal complexes is aptly discussed in Chapter 13. An interesting and comprehensive analysis of the binding of divalent ions to tRNA is contained in Chapter 15. The last three chapters mainly concern relatively new EPR techniques with particular emphasis on nitroxide mobility in the fast as well as slow motional range.

In summary, this book is a valuable status report for scientists knowledgeable in the field, and some of the chapters are a useful introduction to some specialized areas involving paramagnetic species present in biological systems.

Albert M. Bobst, *University of Cincinnati*

Accessory Glands of the Male Reproductive Tract. Edited by E. S. E. Hafez (Wayne State University School of Medicine, Detroit, Michigan) and Elinor Spring-Mills (State University of New York). Ann Arbor Science Publishers, Inc., Ann Arbor, Michigan, 1979. Twelve Contributors. xi + 304 pp. \$30.00.

This book is the sixth volume of a series, "Perspectives in Human Reproduction". The text is divided into nine chapters which cover three general areas. Chapters one through three cover development, anatomy, histology, and blood supply. Chapters four through six deal with the functional biochemistry, pharmacological and toxicological agents, and immunology of the male accessory glands. The last three chapters review the pathological states of the male accessory glands including both non-proliferative diseases and proliferative lesions and neoplasms. The treatment of functional biochemistry is well organized and covers topics such as inorganic molecules, carbohydrates, nitrogenous molecules, lipids, proteins, enzymes, and organic acids and discusses the significance of each class. Metabolic aspects are also considered. The section on molecular aspects of control is a refreshingly simplified overview of current knowledge of hormone action in the male. The chapter on pharmacological and toxic agents summarizes current knowledge on a broad range of compounds such as antiandrogens and pesticides. The section on immunology is the least developed topic but extremely concise. Half of the text is devoted to the major pathological conditions and emphasizes the histology of these conditions including numerous illustrations and

electron micrographs as well as extensive explanations on diagnosis. These chapters are repetitive to some extent. Adequate references are provided at the end of each chapter to direct the reader to additional information.

This publication is a balanced presentation of the male accessory glands. The scope is appropriately limited. Chapters are well organized though brief in many areas. The text should serve well to introduce medical students and prospective researchers to the area. Chapters on development, anatomy, biochemistry, and immunology should be of interest to basic researchers. Moreover, the sections on proliferative diseases should serve to stimulate interest in basic research to improve treatment of these diseases.

Mary P. Carpenter, *Oklahoma Medical Research Foundation*

Euroanalysis III. By D. M. Carroll (Institute for Industrial Research and Standards). Applied Science Publishers Ltd., London, England. 1979. xvi + 429 pp. \$90.00.

The 20 chapters in this volume cover current research trends in pure and applied analytical chemistry, the appropriate uses of standard reference materials, and discussions of educational problems in analytical chemistry. The editor has achieved a consistency of style that makes each of the individually written chapters equally enjoyable to read.

In the first chapter, Irish Contributions to European Analytical Chemistry, D. T. Burns points out that the Irish chemist Robert Boyle was the first to use the term "chemical analysis" and did so in Ireland, the site of "Euroanalysis III". Are You Still Eating? Chemical Food Analysis—Fact and Fiction, by P. L. Shuller et al., describes the development of methods of toxicological trace analyses which are sensitive down to the microgram per kilogram level for arsenic, nitrosamines, and mycotoxins. The authors correctly emphasize the kind of restraint that should be exercised in interpreting any analytical data: "Although epidemiological studies have suggested that the incidence of cancer in man is strongly related to the diet—there are several reasons which at present preclude a firm answer to the question whether or not cancer is caused by the diet."

Two chapters are devoted to the use of standard reference materials, one on the development of SRM's, the other on their application to the field of clinical chemistry. Additional chapters are well-written overviews of important recent progress in electron spin resonance, atomic spectrochemical analysis, electron probe techniques, computers in spectroscopy, ion selective electrodes, electrochemical techniques, liquid chromatography, infrared spectroscopy, and electron spectroscopy for chemical analysis.

The remaining chapters cover the use of analytical chemistry in the dairy industry, earth sciences, conformational analysis, hydrocarbon analysis, environmental analysis, pharmaceutical analysis, and clinical biochemical analysis.

The volume is highly recommended for a broad understanding of recent progress in analytical chemistry.

Stanley N. Deming, *University of Houston*

Symmetry Groups, Theory and Chemical Applications. By R. L. Flurry, Jr. (University of New Orleans). Prentice-Hall, Inc., Englewood Cliffs, New Jersey. 1980. xii + 356 pp. \$26.50.

This monograph is based on material developed for a course open to graduate and advanced undergraduate students in chemistry. The text, according to the author, "should be comprehensible to anyone whose background includes secondary-school-level algebra and geometry, a minimum knowledge of the ideas of calculus, and introductory chemistry and physics..." Since group theory, if it is mentioned at all, is treated superficially or taxonomically in undergraduate texts, there is a need for a substantive introduction to the subject. The author is to be commended for this effort, and the difficulty of the task should not be overlooked in judging the result. For it is necessary, on the one hand, to confront a subject whose foundations are rigorously secured in pure mathematics, and on the other an audience guided primarily by intuition. A navigable course between these extremes may not exist.

The format follows a traditional path: six opening chapters of theory, successive chapters on quantum mechanics and radiation theory, and five concluding chapters on applications. The mathematics is handled very informally, and the author's style is discursive throughout. Exercises are incorporated into the text (some solutions are given in an appendix), and each chapter concludes with a collection of problems and a short bibliography. The text would have been considerably improved if more illustrative examples were included. For instance, the definition of a group is followed by one example: the additive group of nonnegative integers modulo 10. Furthermore, some references are quite inconsistent with the level of the book, and others ought to have been included. Hermann Weyl's recondite "Theory of Groups and Quantum Mechanics", described by some physicists as "Delphic", is cited three times, whereas

Professor Weyl's brilliant essay "Symmetry" is not mentioned at all.

There is more diversity than depth in the chapters on applications; readers interested in such matters will feel much more comfortable with F. A. Cotton's text. Inexperienced readers, armed only with introductory chemistry, physics, and calculus, can hardly be expected to emerge triumphantly from battles with tensor operators, the Wigner-Eckart theorem, and the $3-j$ symbol. On the whole, it might have been better had the author been content to instruct an inexperienced audience to the point when other texts could be profitably consulted.

There are serious difficulties with the introductory chapters. In discussing the law of composition for group elements on page 22, the author states that the product of two group elements "could be defined in terms of any arithmetical operation: addition, subtraction, multiplication, or division". The fact of the matter is that neither subtraction nor division are associative (or commutative). The same difficulty appears on page 3 where it is asserted that subtraction of vectors is associative and commutative. A most unfortunate error occurs on page 23: readers are advised that the pure rotation group is Abelian. Considerable notational confusion is created in Chapter 1 by not balancing superscripts and subscripts. In each of equations (1.10) through (1.13), and in equation (1.16), indices in one member are not balanced in the other, and the confusion is compounded through the use of subscripts and superscripts for covariant and contravariant vectors. In the same chapter, the reciprocal of a vector is described (presumably as a pedagogical device to introduce reciprocal base systems), but students will not find the idea discussed in texts on vector algebra because, as the author himself recognizes, a unique reciprocal cannot be defined. A significant historical error is repeated several times: the orthogonality relations for the irreducible representations of finite groups are incorrectly attributed to E. P. Wigner.

This book does not appear to meet the needs of the audience for whom it was intended.

Group theory is a subject of breathtaking beauty in abstraction and application; it should be treated tenderly.

P. L. Corio, *University of Kentucky*

Techniques and Applications of Fast Reactions in Solution. By W. J. Gettins and E. Wyn-Jones (University of Salford, Lancashire, England). D. Reidel Publishing Company, Dordrecht, Holland. 1979. v + 608 pp.

A NATO Advanced Study Institute in Aberystwyth in 1978 on the subject New Applications of Chemical Relaxation Spectroscopy and other Fast Reaction Methods in Solution led to this collection of 84 short—or very short—reports. Of the longer contributions, up to 14 pages each, five are by E. F. Caldin and co-workers. They include the introductory paper for the book, which surveys the methodology of fast reaction experiments, a second survey on the solvation kinetics of transition-metal ions, and a third on contributions to proton transfer from tunnelling. J. F. Holzworth and his collaborators contributed four more of the longer papers. Two are concerned with a new and highly effective laser temperature jump apparatus and one of the others with a study of the effect of noncomplexing cations on the electron exchange between highly charged anions.

About 200 pages of this book deal with the methodology of fast reaction experiments, including such novel items as the use of a synchrotron as a light source for the study of the fast decay of fluorescence polarization. About 120 pages deal with the rate processes in micellar solutions, including two theoretical papers in which Aniansson's theory of the relaxation spectra of these systems is elaborated. These are practically the only theoretical contributions in the book, contrary to the claims in the preface. About 80 pages deal with the kinetics of a variety of systems that are important in biology. The next largest groups, about 50 pages each, deal with ion pairing kinetics and proton transfer kinetics, respectively.

It is a shame that a volume such as this, which is produced photographically from copy submitted by the authors, is not available shortly after the conference. However, it will be useful to anyone who seeks to learn about the recent status of the various subfields of fast reaction studies mentioned above as well as to find entry into the earlier literature.

Harold L. Friedman, *State University of New York at Stony Brook*

Membrane Bioenergetics. Edited by C. P. Lee, G. Schatz, and L. Ernster. Addison-Wesley Advanced Book Program, Reading, Mass. 1980. xl + 609 pp. \$25.50.

This volume contains the papers presented at a conference in honor of Professor Efraim Racker, held at Cranbrook Schools near Detroit, July 1979. The theme is the structure, function and reconstitution of membrane proteins, a suitable tribute to one of the pioneers in the art of dissecting out membrane-associated enzymes and creating the necessary environment to reestablish activity. The volume is divided into sections on Components, Biogenesis, Reconstitution, and Mechanism, with more than two-thirds of the papers being devoted to the latter two categories. Although the emphasis is on electron- and energy-transfer proteins, it is by no means limited to those of mitochondrial origin. The contributions include studies on chloroplasts, bacteria, cell membranes, and artificial membranes and subjects such as ion transport, chemotaxis, hormone receptors, and neurotransmitters. The efforts of the organizers to bring together these many related areas have been well worthwhile and make this volume particularly useful as a reference for investigators both inside and outside the field of bioenergetics. Many of the articles present overviews of a particular subject with sufficiently complete referencing that there is no difficulty in finding the technical details so important in areas such as reconstitution. The autobiographical closing lecture by Dr. Racker is a delightful lesson in the philosophy of science, providing wise and witty advice for all "young" scientists.

The book does not contain the discussions after the papers (often of more value than the presentations themselves) and suffers from the usual problem of symposia volumes, that much of the material has been or will be published elsewhere. Nevertheless, it is a valuable, up-to-date collection of information and provides an excellent illustration of the effective use of "a systematic approach, intuition, and a good sense of humor"¹ in the study of membrane proteins.

(1) Racker, E. "A New Look at Mechanisms in Bioenergetics"; Academic Press: New York, 1976.

S. Ferguson-Miller, *Michigan State University*

Advances in X-Ray Analysis. Volume 23. Edited by John R. Rhodes, Charles S. Barrett, Donald E. Leyden, John B. Newkirk, Paul K. Predecki, and Clayton O. Ruud. Plenum Press, New York and London. 1980. xvii + 390 pp.

The main theme of the 1979 Denver X-Ray Conference was the field applications of X-ray fluorescence analysis. The increasing availability of portable X-ray analyzers has tremendously expanded the scope of the problems approachable by this technique, and success has spurred further refinements in instrumentation and methodology. The utilization of microprocessors and new mathematical methods has not only increased the speed of analysis and decreased instrumental bulk, but has also eased the optimization of experimental parameters to the point that analytical sensitivity and accuracy have been significantly enhanced.

Volume 23 of "Advances in X-Ray Analysis" brings us the proceedings of the conference and accurately chronicles these developments, emphasizing applications of X-ray fluorescence in environmental analysis and in the minerals industry. In addition to elemental analysis by X-ray fluorescence, the use of X-ray diffraction methods in materials science is also reported.

This volume is very impressive in providing a solid introduction to the principles of X-ray fluorescence analysis as well as surveying the frontiers of the art. As X-ray analysis instruments become easier to obtain and operate and their applications more diverse, it is inevitable that new users are not always trained analysts or even scientists. It is therefore increasingly important to stress the fundamentals at the same time that the advantages of the method are broadcast. This has been done by many of the nearly 50 sets of authors who contributed papers to this book. The relationship between sophisticated applications and underlying physical principles is clearly and concisely presented in almost every paper. The reader has ample opportunity to contrast the variety of available X-ray sources and detectors and to learn the optimization of excitation energy, the use of Compton-scattering peaks to normalize emission intensity with energy-dispersive detectors, and the enhancement of resolution by computerized deconvolution.

The planners of the conference, the authors, and the editors of this volume have been unusually successful at capturing the flavor of a diverse and interesting field. A complete program of the conference and a thorough subject index further enhance this book.

Peter P. Gaspar, *Washington University*