found for $Mo_2(OPr\text{-}i)_8$[13] and $Mo_2(OPr\text{-}i)_6(NO)_2$[5] is interesting (see Figure 1). In all three compounds, the molybdenum atoms are in distorted trigonal-bipyramidal environments and the bridging ligands form alternately long (axial) and short (equatorial) bonds.

$Mo(O)_2(OBu\text{-}t)_2$ is a yellow liquid at room temperature, which distills in vacuo at 55 °C (10^{-4} torr) and is monomeric in benzene as determined by a cryoscopic molecular weight determination. The monomeric nature of this compound in benzene is further supported by the natural abundance ^{17}O NMR spectrum which shows a single sharp signal (width at half-height ~90 Hz) at 862 ppm relative to $H_2{}^{17}O$.[14] This value is well within the range observed for terminal oxomolybdenum(VI) groups. Indeed, according to the Miller and Wentworth[15] correlation of ^{17}O chemical shifts with Mo–O bond distances, we calculate Mo–O = 1.71 Å for the oxo ligands in $Mo(O)_2(OBu\text{-}t)_2$.[16]

Supplementary Material Available: Fractional coordinates and isotropic and anisotropic thermal parameters for $[Mo(OBu\text{-}t)_2(NC_7H_8)_2]_2$ (3 pages). Ordering information is given on any current masthead page.

(13) Chisholm, M. H.; Cotton, F. A.; Extine, M. W.; Reichert, W. W. *Inorg. Chem.* **1978**, *17*, 2944.

(14) Klemperer, W. G. *Angew. Chem., Int. Ed. Engl.* **1978**, *17*, 246.

(15) Miller, K. F.; Wentworth, R. A. D. *Inorg. Chem.* **1979**, *18*, 984.

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*Book Reviews**

Medical Botany. Plants Affecting Man's Health. Walter H. Lewis (Missouri Botanical Garden) and Memory P. F. Elvin-Lewis (Department of Dental Microbiology, Washington University, St. Louis, Missouri). John Wiley and Sons, New York, London, Sydney, Toronto. 1977. xv + 515 pp. $29.50.

Biologists, pharmacologists, physicians, and anyone interested in how plants affect the body will find this book fascinating and informative. The first section, titled injurious plants, discusses internal poisons, allergy, and cell modifiers. This is followed by a section which is concerned with medicinal plants and which gives examples of plant remedies for cancer, the nervous system, heart and circulation, metabolism, eye and ear, oral hygiene, gastrointestinal tract, respiratory system, urogenital system, and skin. Antibiotics, antiseptics, pesticides, and universal remedies complete this section. The final section is devoted to stimulants, hallucinogens, and depressants. The survey is extensive and includes the folk lore of plants as well as references to scientific studies and uses by orthodox medicine. Extensive descriptions of disease states as well as the physiological effects of medicinal plants are included. References, a glossary, and an index complete the book.

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

Nutrition and Environmental Health: The Influence of Nutritional Status on Pollutant Toxicity and Carcinogenicity. By Edward James Calabrese (School of Public Health, University of Massachusetts, Amherst, Massachusetts). John Wiley and Sons, New York. 1980. xix + 585 pp. $60.00.

Physicians and investigators in the fields of environmental and occupational health will find this an informative book. The vitamins A, B, C, D, and E are dealt with in relation to a variety of pollutants and toxic agents. It is suggested that an inadequate diet may predispose one to experience the adverse effects of certain toxic materials, while vitamin supplements may provide some protection from these substances. Extensive references and an index are included.

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

Renewable Resources, A Systematic Approach. Edited by Enrique Campos-Lõpez (Centro de Investigacion en Quimica Aplicada, Saltillo, Coahuila, Mexico). Academic Press, New York. 1980. x + 410 pp. $29.50.

The seventeen papers which make up this book were originally presented at the CIQA International Conference in Saltillo, Coahuila, Mexico, in August 1979. The first part is devoted to systems and models and includes such titles as, systems analysis models in forest utilization, socioeconomic models in renewable natural resource utilization, global systematization of resource depletion in terms of nonrenewable factors, and others. The second part is titled scientific and technological trends. Some of the papers in this section are concerned with biomass for energy, trends in microbial technology for developing countries, future prospects for steroid drugs from botanical sources, and conversion of renewable resources into chemical feedstocks. A case study of guayule is also presented. This book will be useful to workers in the area of resource management. References and an index are included.

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

Chemical Bonding. 2nd Edition. By Audrey L. Companion (University of Kentucky). McGraw-Hill, New York. 1979. x + 179 pp. $5.95 (paperback).

This book in its new edition remains an excellent supplement for undergraduates introducing quantum theory and chemical bonding.

Thermochemical Kinetics. 2nd Edition. By S. W. Benson (University of Southern California). John Wiley & Sons, New York. 1976. xi + 320 pp. $22.50.

Methods for empirical estimation of thermodynamic functions and rate parameters for gas-phase systems.

Physics of Quantum Electronics. Volume 7. Free-Electron Generators of Coherent Radiation. Edited by S. F. Jacobs, H. S. Pilloff, M. Sargent III, M. O. Scully, and R. Spitzer. Addison-Wesley, Reading, Massachusetts. 1980. xix + 813 pp. $36.50.

This volume is based on a series of lectures sponsored by the Office of Naval Research in 1979 at Telluride, Colorado, and is primarily of interest to physicists.

Theoretical Chemistry, Advances and Perspectives. Volume 3. Edited by H. Eyring and D. Henderson. Academic Press, New York. 1978. xi + 239 pp. $25.00.

This volume contains five essentially unrelated reviews of topics of current research interest: Theoretical Studies of Negative Molecular Ions (J. Simons); Geometrical Aspects of Equilibrium Thermodynamics (F. Weinhold); A Model of the Liquid State (M. S. John and H. Eyring); Structure of Fluid ^4He (R. D. Murphy); Proton Transfer Reactions and Kinetics in Water (F. H. Stillinger).

Progress in Liquid Physics. Edited by C. A. Croxton (University of Newcastle, New South Wales, Australia). Wiley-Interscience, New York. 1978. vii + 592 pp. $63.00.

A collection of 14 articles by 18 contributors covering recent advances in the statistical-mechanical theory of liquids. Emphasized topics include quantum fluids, critical phenomena, irreversibility, transport processes, phase transitions, polymeric systems, liquid crystals, and triplet correlations.

Perchloric Acid and Perchlorates. By Alfred A. Schilt (Northern Illinois University). G. Frederick Smith Chemical Co., Columbus, Ohio. 1979. ix + 189 pp. $15.00 hardbound, $8.00 paperbound.

This book is a comprehensive review of the chemistry of perchlorates and includes a nearly complete bibliography through 1977 (papers on their use in explosives and propellants are generally omitted, however). There are chapters on preparation, properties, applications, analysis biological effects, and safety and environmental concerns. A substantial appendix tabulates references to equilibrium data for binary, ternary, and

*Unsigned book reviews are by the Book Review Editor.

quaternary systems containing perchlorates. There are some unfortunate typographic errors, such as "metal hydrazines" where presumably "methylhydrazines" is meant, and some information is summarized in such a way that significant facts may be hidden, as in the case of the solubility of lithium perchlorate in acetone; it is stated that it has been measured over a large temperature range, but information on its actual magnitude is not given. Nevertheless, this book is a valuable contribution, and the great effort that must have gone into compiling such a bibliography will surely facilitate the work of other chemists.

The Way of Discovery: An Introduction to the Thought of Michael Polanyi. By Richard Gelwick (Stephens College, Columbia, Missouri). Oxford University Press, London. 1977. xix + 181 pp. $12.95.

An exploration of the religious, ethical, and behavioral theories of the physical chemist-turned-philosopher Michael Polanyi (1891–1976).

Theoretical Chemistry. Volume 3 (Specialist Periodical Reports). Senior Reporters R. N. Dixon and C. Thomson. The Chemical Society, London. 1978. vii + 138 pp. $28.00 (available from Special Issue Sales, ACS).

This volume reviews the recent literature on four topics: Ab Initio Calculations on Molecules Containing Five or Six Atoms; Theories of Organic Reactions; Quantum Mechanical Calculation of Electric and Magnetic Properties; Pseudopotentials in Molecular Calculations.

Handbook of Paper Science. Volume 1. Edited by H. F. Rance. Elsevier Scientific Publishing Co., New York and Amsterdam. 1980. xiii + 298 pp. $78.00.

This is the first of an open-end series of volumes, and it is subtitled "The Raw Materials and Processing of Papermaking". The first of the five chapters, Cellulose-Water Interactions by H. Corte, and to a lesser extent the second, The Fibrous Raw Materials of Paper by H. W. Emerton, contain most of the chemistry, whereas the remainder of the book is more oriented toward engineering, and is devoted to preparation of pulp fibers and forming and consolidation of the web of paper. The exposition is very lucid, and relates the practical aspects of manufacture and requirements for use to the fundamental chemical, physical, and botanical properties of the substances concerned. The sulfite process for paper is not described in this volume, but presumably will appear in a future one.

Annual Review of Biophysics and Bioengineering. Volume 9. Edited by L. J. Mullins and Associates. Annual Reviews, Inc., Palo Alto, Calif. 1980. viii + 643 pp. $17.00 postpaid in USA.

This is a collection of 19 diverse chapters contributed by an international selection of authors. Representative topics include Solution X-ray Scattering, Photoacoustic Spectroscopy, Optical Activity of Nucleic Acids, Radioimmunoassay, Magnetic Circular Dichroism of Biological Molecules, etc. There are author and subject indexes, and cumulative (Volumes 5–9) indexes of contributors and titles. A useful feature is a page listing articles of related interest appearing in other books of the Annual Reviews group. Reprints of individual articles can be ordered for $1.00 each. The essay reviews are not meant to be encyclopedic; they do not generally include information on how recently the literature was surveyed.

Hydroboration. With Supplement: Nobel Lecture, 1979. By Herbert C. Brown (Purdue University). Benjamin/Cummings, Inc., Advanced Book Program, Reading, Mass. 1980. xiv + 321 pp. $19.50 paper.

Originally published in 1961, this book has been out of print for some time. Although in certain respects it is obviously out of date, it maintains great value as a reference because of its comprehensiveness, notwithstanding the appearance of more recent books on more narrowly circumscribed aspects of the subject. This is actually only a second printing of the work, but it has been augmented by Professor Brown's 29-page Nobel Lecture delivered in December, 1979, which serves as a supplement to bring the treatment up to date. The original book was hardbound; the appearance of the present one in paperbound form will make it available to a wider circle for personal purchase.

Purification of Laboratory Chemicals. Second Edition. By D. D. Perrin, W. L. F. Armarego, and D. R. Perrin. Pergamon Press, New York and Oxford. 1980. x + 568 pp. $72.00.

The original edition of this work appeared in 1966 and has been out of print for some time. It was written to provide a central source of information on how to purify a substantial selection of common reagents sufficiently well to meet most ordinary requirements. It consisted of a section on general purification methods, followed by an extensive tabulation of individual compounds. In this new edition, the section on general methods has been rewritten to include major advances and to extend the scope to recognize the more stringent requirements that have developed in recent years. The tabulation of compounds has also been expanded.

The two chapters on physical and chemical methods of purification are brief (73 pp) and are written for the chemist already trained in common laboratory operations. The great bulk of the book is found in the tabulation (475 pp), which includes thousands of compounds, organic and inorganic. This is followed by a useful chapter on general methods for purification of classes of compounds. The entries in the main tabulation are very succinct, giving a melting or boiling point and the barest essentials, such as "*tert*-Butyl ethyl ether, b.p. 71–72°. Dried with $CaSO_4$, passed through an alumina column, and fractionally distd". Only when there is good reason are more elaborate descriptions given and references included (*tert*-butyl hydroperoxide, for example, rates two paragraphs and three references). The book is obviously a very useful compendium to have handy in the laboratory; it is a pity it is so expensive, especially in view of the fact that it is photoreproduced from typescript.

Molybdenum Chemistry of Biological Significance. Edited by William E. Newton (Charles F. Kettering Research Laboratory) and Sei Otsuka (Osaka University). Plenum Press, New York. 1980. x + 425 pp. $39.50.

This volume contains the proceedings of the First International Conference on Molybdenum Chemistry of Biological Significance, held at Lake Biwa, Japan, in April 1979. As such, it consists of 32 relatively short (ranging from 8 to 20 pages each) manuscripts submitted at the meeting. These have been edited, retyped, and reproduced directly from the typed manuscripts, accounting for the rapid appearance of the volume (less than a year after the meeting). The papers have been organized under three headings: Molybdoenzymes (12 papers), Iron–Molybdenum Cofactor and Mo–Fe–S Cubane Clusters (6 papers), and Reactions and Properties of Molybdenum Complexes (14 papers). Overall, almost half the papers deal with aspects of biological nitrogen fixation, ranging from physiology to physical biochemistry of the nitrogenase enzyme to putative synthetic models for the iron–molybdenum cofactor of nitrogenase. The rest deal with studies of and models for other molybdoenzymes, such as xanthine oxidase, and various aspects of molybdenum chemistry of potential biological relevance.

In general, this book gives a good view of the status of the field at the time of the meeting, inasmuch as representatives from virtually all the major research groups in the field were present. The international flavor of the conference is reflected in the proceedings: only half the papers are from United States laboratories, with Japan, Great Britain, Australia, New Zealand, West Germany, and Sweden represented as well. The volume unfortunately does not capture the lively give-and-take of the discussion sessions following each presentation; at least a brief summary of the discussions would have been most informative to the reader. Since the majority of the contributions have since appeared in more complete form in the primary journals, however, it is difficult to justify a personal copy unless one is working directly in the field. The book does furnish a good introduction to and summary of the area, so most libraries will certainly want to acquire a copy.

Bruce A. Averill, *Michigan State University*

Nitrates: An Environmental Assessment. By the Panel on Nitrates of the National Research Council. National Academy of Science. Washington, DC. 1978. XXV and 723 pp. $15.25.

In 1975 the Environmental Protection Agency asked the National Academy of Science to assess the current knowledge on a number of selected environmental contaminants for which regulatory action was being considered; this report is the Academy's effort on nitrate and it contains in 750 pages everything you will want to know about the chemistry and geochemistry of nitrate and its ecological, health, and economic effects. The report is thorough, having found and evaluated even the most obscure papers and unpublished reports, and comprehensive, treating all aspects of the "nitrate problem". However, the most salient feature of the report is not thoroughness but the exceptional multidisciplinary synthesis that is brought to bear on the scientific, technical, and societal issues concerning nitrate. As a scientist concerned with nitrate in basic ecology, I was fascinated by the analyses of costs and benefits of changing our present societal procedures regarding nitrate. For example, the losses from acid rain in forestry and recreational fishing were computed to be considerably less than the cost of eliminating nitrates in emissions from stationary sources such as power plants. Nevertheless, society has chosen to try to solve the acid rain problem rather than accept it as an inevitable consequence of modern culture; this decision emphasizes that narrow economic considerations are not the only factor guiding policy on pollution. In the same context, chemists and other researchers who handle carcinogenic *N*-nitroso compounds or the precursors of these compounds should be fascinated by the discussion on page 584 of how a value is set on the increased risk of death associated

with exposure to such compounds.

It would be a disservice to give the impression that the major contribution of the report is in the area of societal issues; that is not so. The first 500 pages of the report give a very complete and moderately readable account of what we know about nitrate. The chemistry, biochemistry, and geochemistry of the nitrogen cycle are very competently treated in the early chapters and lead into two chapters on the occurrence and analysis of the critical compounds of the nitrogen cycle. The early "basic science" chapters culminate in Chapter 5, which gives excellent and mainly new material on the mass balance of nitrogen. Complementing this chapter there is a 100-page appendix devoted to mass balance analyses of three lakes, two river basins, two states (Wisconsin and Florida), and the entire earth. Since most of the mass balance syntheses were developed de novo for this report they are particularly welcome. In one regard it is unfortunate that this original material is buried in an Academy report; the information would be more easily accessed if it appeared in separate publications that were indexed under subject headings of nitrogen mass balances.

The middle section, Chapters 6 through 10, treats the applied aspects of nitrate. The sources of excess fixed nitrate and other species of fixed nitrogen, the ecological effects and health effects of these excesses, and the techniques and strategies for control of excess nitrate in air, water, soil, and food are presented. Chapters 11 and 12 analyze economic and policy issues related to (1) anthropogenic nitrogen fixation and the depletion of ozone, (2) atmospheric nitrogen oxides and acid rain, and (3) ingested nitrites and cancer. Chapters 9, 11, and 12 and Appendices B and C of the report all treat aspects of the nitrite–cancer question. These sections should be required reading for policymakers and congressional staff, not because any answers are given, but because the complexity of a real health versus economics conflict is well described. Appendix B describes the clear statistical correlation between the consumption of meat containing nitrite and increased cancer mortality, but emphasizes that causality cannot be established by the statistical methodology used to show the correlation. Appendix C is an argument that a quantitative assessment of the risk of increased cancer mortality from nitrite, nitrate, or nitrosoamines cannot be made with the currently inadequate data base. Chapter 11 uses the correlation data from Appendix B to compute that cancer deaths from pork consumption alone are 129 330 per year in the urban U.S. population, imposing a cost of 33 billion dollars. (This rate is 2.7 times the calculated cancer deaths from cigarettes.) But the report says clearly: "Since considerable uncertainty accompanies any assessment of the risk associated with environmental exposure to nitrate and nitrites it is questionable whether these quantitative assessments of damages resulting from nitrite ingestion are meaningful. However, the suggestion from the Kneese–Schulze study that current dietary practices, and possibly in particular nitrite preservatives in pork products, may have an enormous cost indicates a need for intensive research to improve risk assessments" (page 588).

The discussion of economic, health and policy issues concerning nitrite in food demonstrates the dilemma facing society today. Both scientists and policymakers try to avoid facing such messy issues. For example, it seems clear that an uncertain number of stomach cancer deaths could be avoided if nitrite were eliminated from cured meats, but that uncertain benefit would be obtained at a cost of (1) "loss of product quality" (that is, the meat would be gray instead of red) and (2) increased risk of botulism. Death from botulism would be directly traceable to meat without nitrite; it appears that as a society we have chosen to accept increased stomach cancer deaths to avoid botulism deaths and we get attractive "product quality" as a side benefit. Whether we admit it or not such choices are being made right now. Are we making the choice consciously? In this report the National Academy of Science provides the scientific and technical basis for such choices on nitrate, nitrite, and the numerous closely related compounds linked together in the nitrogen cycle. The Academy deserves congratulations for this assessment.

Richard T. Barber, *Duke University*

Flames, Their Structure, Radiation and Temperature. Fourth Edition. By A. G. Gaydon (Imperial College, London) and H. G. Wolfhard (Institute for Defense Analyses). Chapman and Hall, London. 1979. xiii + 449 pp.

As a general introduction to the great variety of flame phenomena and the physical measurement of flame properties, there is no better book. Gaydon has now revised this classic to include recent developments during the decade since the Third Edition was published. New topics such as laser-Doppler anemometry and laser-Raman scattering for measuring vibrational temperature are discussed and compared with more traditional methods. The organization of the book remains the same, with discussion of both premixed and diffusion flames and the methods used to determine temperatures, burning velocities and flammability limits. A variety of unusual phenomena are discussed including cool flames, soot formation, singing and sound-sensitive flames, ionization, flames with exotic fuels and oxidizers, invert flames, and polyhedral flames. There are color pictures and excellent Schlieren photographs showing the internal structure of flames.

This book does not emphasize the chemistry and kinetics of combustion and consequently does not discuss the progress that has been made in computer modelling of flames. There is need for an up-to-date book on combustion chemistry, although there may not be sufficient consensus at this time to write such a book. Also, Gaydon and Wolfhard's book does not deal extensively with the spectroscopy of flames since Gaydon has written a separate volume on this topic.

The last sentence in this book summarizes, "This book has aimed to give those scientists who study applied research an overall understanding, in a phenomenological sense, of the great variety of phenomena that can be observed in flames." It does that very well for all of us.

Kyle D. Bayes, *University of California, Los Angeles*

Transmission Electron Microscopy of Materials. By Gareth Thomas (University of California) and Michael J. Goring (Oxford University). John Wiley & Sons, New York. 1979. xiv + 388 pp. $24.00.

This book represents an attempt by two highly competent authors to present a description of the current methods and theories for studying crystalline materials by transmission electron microscopy. Considering the scope and complexity of the subject their efforts have been remarkably successful. The first three chapters, covering 220 pages, are basically operational in orientation. The first chapter gives a concise, but remarkably detailed, description of the calibration and operation of electron microscopes for such procedures as selected area diffraction, lattice imaging, convergent beam diffraction, and weak beam methods. Chapter two gives a similarly efficient treatment of the theory, methods, and applications of electron diffraction, including the various uses of Kikuchi patterns, while Chapter three contains a description of the methods for obtaining and interpreting images of various lattice defects such as stacking faults, dislocations, antiphase boundaries, precipitates, and voids. Chapters four and five are theoretical in character, with the former developing the image contrast theory from a simple kinematical introduction through a dynamical treatment for many beams including absorption, and the latter demonstrating the applications of these theoretical methods to interpretation of more complex image features. The book is well written and effectively illustrated. It is not particularly an introductory text; however, it would be extremely valuable to persons with some previous experience in electron microscopy and a general familarity with diffraction theory and the mathematics of physical optics.

W. C. Bigelow, *University of Michigan*

Electron Microscopy and X-Ray Applications to Environmental and Occupation Health Analyses. Edited by Philip A. Russel (Denver Research Institute) and Alan Hutchings (Philips Electronics Company). Ann Arbor Science Publishers, Ann Arbor, Mich. 1978. ix + 278 pp. $39.95.

This book contains a collection of papers that were presented at the Second Symposium on Electron Microscopy and X-Ray Applications to Environmental and Occupational Health Analyses. The book is divided into three sections. The first contains seven papers dealing with the application of X-ray fluorescence techniques to such problems as the analysis of urine, filter-collected aerosol particles, atmospheric dust, and lung tissue. The second section contains two rather elementary papers on X-ray-diffraction theory and instrumentation plus three applications papers. The final section contains twelve papers describing a variety of applications of electron diffraction and electron microscopy. Considering the emphasis being placed on environmental problems at the present time, this book will undoubtedly be of interest to a large number of individuals and organizations.

W. C. Bigelow, *University of Michigan*

Atom–Molecule Collision Theory. A Guide for the Experimentalist. Edited by R. B. Bernstein (Columbia University). Plenum Press, New York. 1979. xx + 779 pp. $57.50.

This volume comprises 22 chapters by 19 contributing authors reviewing a wide range of theoretical and computational aspects of atom–molecule collision dynamics. From the editor's introduction: "For a century since Boltzmann, it has been recognized that intermolecular collisions are primarily responsible for most observable rate phenomena, both physical and chemical, in fluid systems. The goal of research in the field of heavy-particle collisions is to gain a detailed, quantitative description of these rate processes starting from first principles." Specific topics emphasized include intermolecular potentials, elastic, inelastic, and reactive scattering cross sections, rotational, vibrational, and electronic energy transfer, and applications of information theory. Recently developed classical and semiclassical techniques are extensively utilized. A quite impressive international roster of contributors has produced a

valuable compendium for researchers in molecular dynamics, both experimental and theoretical.

S. M. Blinder, *University of Michigan*

Advanced Quantum Theory; Its Applications Through Feynman Diagrams. By M. D. Scadron (University of Arizona). Springer-Verlag, New York. 1979. xiv + 386 pp. $39.80.

This is a text designed for use by second-year physics graduate students. The treatment focusses on covariant perturbation techniques, with illustrative applications to atomic, solid-state, nuclear, and particle physics. The author's style is crisp and succinct and, for readers with the requisite preparation, fundamental principles are formulated with clarity and elegance. Two chapters on the formal theory of scattering and simple scattering dynamics are of possible utility to workers in molecular dynamics.

S. M. Blinder, *University of Michigan*

Advances in Quantum Chemistry. Volume 11. 1978. Edited by Per-Olov Löwdin (Uppsala University, Sweden). Academic Press, New York. 1978. xii + 487 pp. $47.50.

This volume of the series contains an especially diverse and excellent collection of contributions to modern theoretical chemistry. The full contents is as follows: Experimental Measurements of Charge and Momentum Densities (Bonham, Lee, Kennerly, St. John); Convergence Limit in the Electronic Spectra of Linear Polyenes (S. Basu); Kossel Isoelectronic Series and Photoelectron Spectra (Jørgensen); Localized Orbitals in Spectroscopy (Caldwell and Eyring); Electronic Molecular Structure (Scrocco and Tomasi); Complex Eigenvalue Problems (Yamabe, Tachibana, Fukui); The Unitary Group and the Many-Body Problem (Matsen); Zero-Range Potential Model (Drukarev); Polarization Propagator Calculations (Oddershede); Relativistic Quantum Chemistry (Pyykkö); and Fundamentals of Equilibrium Thermodynamics and Statistical Mechanics (Sperber).

S. M. Blinder, *University of Michigan*

Intermolecular Interactions: From Diatomics to Biopolymers. Edited by B. Pullman (Paris). Wiley-Interscience, New York. 1978. ix + 447 pp. $48.50.

An earlier volume was devoted to the quantum theory of intramolecular interactions and molecular conformations. The present volume consists of four papers on intermolecular interactions. A. D. Buckingham reviews the basic theory of intermolecular forces with applications to small molecules. P. Claverie's contribution, taking up over half the volume, covers approximate methods for large molecules, with applications in organic chemistry. R. Rein describes biomolecular interactions, with applications to nucleic acid structure and function. The concluding chapter by P. Shuster considers the fine structure of the hydrogen bond.

S. M. Blinder, *University of Michigan*

Reagents for Organic Synthesis. By Mary Fieser. John Wiley & Sons, New York. 1980. 602 pp. $36.00.

The continued appearance of this useful work will gratify organic chemists, not only as a most fitting memorial to Louis Fieser, but as a welcome aid in keeping abreast of the swelling tide of new developments of synthetic interest. Mary Fieser is carrying on with the help of a sizable and happy-looking group, whose picture appears as a frontispiece. Papers appearing in 1977 and the first half of 1978 have been scrutinized for new reagents, or new uses for old ones. The extracts are presented as brief descriptions with properties, equations of representative reactions, literature sources, and references to earlier volumes where pertinent. The entries are, as usual, in alphabetical order of the reagent, but one should not rely completely on this means of access, because a reaction that involes two or more significant reagents will be listed under only one of them. A subject index fills the gap, and is augmented by an Index of Reagents According to Type, and an author index. Apart from this, browsing is also profitable, even when one is seeking no particular piece of information.

Future Sources of Organic Raw Materials. CHEMRAWN I. Edited by L. E. St-Pierre and G. R. Brown (McGill University). Pergamon Press, Oxford, New York. 1980. IV + 651 pp. $45.00.

This book is based on the detailed scientific and technical papers presented at the first CHEMRAWN (Chemical Research Applied to World Needs) World Conference held in Toronto, Canada in July 1978, on the problem of Future Sources of Organic Raw Materials. Fifty-two papers cover such varied subjects as fossil hydrocarbons, biomass, climate, pyrolysis, the ethanol experiment in Brazil, agriculture, homogeneous and heterogeneous catlaysis, peat, natural rubber, tar sands, solar energy, lignin, lipids, and enzymatic production of chemicals. The papers, not arranged in any particular order, are in problem areas in which chemical science and technology can contribute significantly to better solutions and, recognizing the limitations of purely technological solutions, address simultaneously the associated social, economic, and environmental factors.

The articles appear to be freshly written with many authors writing in a second language. Some of the papers were modified to improve clarity, but not rewritten to a standard "North American" English. Sixty-eight authors, with approximately half from non-English-speaking countries, contributed information. The articles are in general well written, informative, and interesting, and integrate information scattered throughout the scientific literature. Approximately one-third of the available space is devoted to graphs, tables, and figures. The references are from 1978 or earlier in the majority of the articles.

This book should be a part of every library which is concerned with the current and future sources of organic raw materials on an international scale from the standpoint of use as chemicals, feedstocks, and sources of energy. Chemists will find many of the articles of particular interest, and the book will be a valuable reference to those entering the energy resource field.

Kenneth E. Daugherty, *North Texas State University*

Recent Developments in Chromatography and Electrophoresis. Volume 10. Edited by A. Frigerio and M. McCamish. Elsevier Scientific Publishing Co., New York and Amsterdam. 1980. x + 340 pp. $68.25.

This volume is part of the Analytical Chemistry Symposia Series, and contains the proceedings of the 10th International Symposium on Chromatography and Electrophoresis, held in Venice in 1979. It consists of 34 papers and an author index. The papers appear to be all reports of original research, and are written as conventional journal papers, with experimental descriptions, figures, tables, and references. They deal mostly with applications to specific problems, such as analysis of diesel exhaust, organic matter in soils, blood components, etc., but a group of five papers presents new instrumental methods or modifications.

Principles and Applications of Electrochemistry. Second Edition. By D. R. Crow (The Polytechnic, Wolverhampton). Chapman and Hall, London. 1979. xi + 229 pp. $14.95 paperback.

Crow's book is a clear, concise, summary account of the main aspects and principles of classical electrochemistry. Most of the content can be described as an elaboration on topics that are often included in basic texts on physical chemistry.

After an introductory chapter, there are three chapters on ionics, beginning with a discussion of ion activities and the Debye–Hückel equation, moving through classical acid–base theory with a very general summary discussion of the pH scale, buffers, etc. This is followed by a long chapter on electrolytic conduction. The various methods of determining transport numbers are especially well presented. Then come two chapters on reversible potentials and their application. Most, if not all, of the classical topics are covered, including criteria of reversibility, concentration cells, and determinations of standard potentials, equilibrium constants, and pH using various electrodes. The next two chapters deal with interfacial phenomena and electrodics including discussions of overvoltage and decomposition potentials. The book concludes with very brief sections on polarography, mixed potentials, corrosion processes, and electrochemical energy cells.

The text appears to be virtually free of errors and there are helpful suggestions for further reading throughout. In keeping with the well-established nature of the subject matter, there is very little recent literature cited, most of the citations being from past decades. This is definitely not a text for those seeking specific enlightenment on electrochemical topics of current research interest such as fuel and solar-energy conversion cells and specific ion or semiconducting electrodes. However, where a review or supplementary text on the main principles of physical electrochemistry is wanted, Crow's book should serve admirably.

Newton C. Fawcett, *University of Southern Mississippi*

Selective Toxicity. The Physico-Chemical Basis of Therapy. By Adrien Albert (State University of New York at Stony Brook). John Wiley and Sons, New York. 1979. xiii + 662 pp.

This book is concerned with selectively toxic agents. These are chemical compounds which affect certain living cells without causing harm or appreciable harm to other cells. Thus, the compounds discussed range from drugs used for treating illness in man and his domesticated or food-suppling animals as well as the range of fungicides, insecticides, and weed killers that are in use today. Professor Albert discusses not only the physical and chemical properties of these compounds but often puts the development of the drug into a historical perspective and gives, usually, a short but clear explanation about their known or probable biochemical mode of action.

Part one of this book, which occupies 273 pages, presents a detailed

introduction to the general subject of selective toxicity and includes chapters on selectivity in the service of man, steps in the correlation of structure with biological action, differences in distribution as related to the absorption, distribution and excretion of drugs, comparative biochemistry, comparative cytology, chemotherapy, and pharmacodynamics. Part two covers an additional 285 pages and reexamines in depth topics from part one. This section begins at a very elementary level by discussing the nature of chemical bonds and adsorption. Chapters that follow deal with metabolites, enzymes and metabolite analogues, ionization and how ionization of chemical species can bring about changes in biological activity, metal binding substances, the covalent bond in selective toxicity, steric factors, the modification of membranes by surface-active agents, and biological behavior unrelated to structure. A final chapter discusses various approaches to improve upon the activity and selectivity of a substance that has been discovered with a rare and required biological property, including multiple regression analysis and the approaches possible from molecular orbital calculations and molecular connectivity. Four appendices follow which show how to do ionization calculations, present tables of partition coefficients, explain the Hammett and Taft σ values, and give a brief introduction to NMR spectroscopy.

This is a large book and I found it to be fascinating. It is easy to read and is packed with references to the original literature; indeed there must be close to 2000 references. An excellent subject index is also provided. This book will be a valuable addition to the library of any chemist or biochemist working with compounds having real or potential biological activity.

Glenn **Dryhurst**, *University of Oklahoma*

Residue Reviews. Volume 73. Residues of Pesticides and Other Contaminants in the Total Environment. Edited by Francis A. Gunther and Jane Davies Gunther (University of California, Riverside). Springer-Verlag, New York. 1980. vii + 130 pp.

This is a collection of articles most of which were presented at the National Meeting of the American Chemical Society held in Miami, Florida, in September of 1978. Seven articles cover such diverse topics as regulatory and research programs at the state level, pesticide residue programs in developing countries, analytical quality control problems, and an introduction to the metabolism of pyrethroids.

The first article, by C. H. Van Middelem, entitled Regulatory and Research Approach to Current Pesticide Residue Problems at the State Level, outlines the program in the state of Florida. The Florida program should provide a useful model for many pesticide regulations and research in states with less developed programs. Pesticide Reisudes and Revelant Directions for Developing Countries, by E. D. Magallona, is an interesting discussion of the problems of pesticide monitoring and control in developing countries such as the Philippines. The article suggests that the tolerance system is simply not practical for such countries; rather, policies based on requirements of good agricultural practice should be substituted. In Quantitative Residue Analytical Reliability: Beatitude Through Application of Latitude, H. Frehse and G. Timme review the concept of latitude as it relates to analytical determination of residues. The concept of latitude is, briefly stated: "the smaller the reported body the greater the probability of complete unreliability." The authors propose a mathematical relationship between relative latitude and correct value as a guide to analysts, legislators, and regulators, suggesting that maximum residue levels be established with these principles in mind. R. Lal and D. M. Saxena in Cytological and Biochemical Effects of Pesticides on Microorganisms present a scholarly review of the subject treating in separate sections herbicides, fungicides, insecticides, and PCB's (165 references). R. A. Conklin reviews the interaction and interdependency of the regulatory and analytical aspects of residue determination in From One to Point Zero One Part per Billion: The First 25 Years. The article is generally nonquantitative and historical. In Contamination of Pollution–The Judgement Aspect of Residues, C. L. Dunn presents perhaps the most clearly written summary of the state of residue science and art. The article is historically written and presents evolution of residue policy as influenced by new analytical chemistry developments. The author seriously questions the use of "conscious exaggeration" to estimated risk, saying it inevitably leads to unrealistic regulations. The author also points out the problems inherent in risk/benefit analysis as a determining step in the regulation of pesticides, pointing out that risk acceptance is a matter that is or should be established by society. The author also speaks strongly in favor of the current scientific peer review system in preference to some type of adversary proceedings in a science court. In summary, the author points out that "final regulatory action requires excellent scientific input to be used in this process but is not in itself a totally scientific exercise". In the final article, An Introduction to The Metabolism of Pyrethroids, John Chambers reviews research in this area for a list of major pyrethroids. In addition the author discusses photochemical degradation pathways which are important in limiting the use of pyrethroids as insecticides.

In summary this volume of "Residue Reviews" should be useful to a broad audience, some of whom will appreciate the depth of scientific content of some of the articles and others who will be more interested in the broad brush approach to matters of equal concern to the scientific and regulatory community.

William H. **Glaze**, *The University of Texas at Dallas*

Drug Level Monitoring. By W. Sadee and G. C. M. Beelen (University of California at San Francisco). John Wiley and Sons, New York. 1980. xii + 490 pp. $35.00.

It has been recognized for many years that the relationship between dose and the concentration of a drug in blood varied significantly from patient to patient. For some drugs this does not present a problem, but for others there is a relatively small range between the concentration needed for therapeutic effect and the concentration which can elicit toxic side effects. Measuring drugs in blood ("therapeutic drug monitoring") can improve therapy for individual patients and study of drug concentration as a function of time (pharmacokinetics) can result in improved drug formulations and dosage forms. This book presents a very cursory introduction to drug metabolism, pharmacokinetics, and analytical techniques commonly used for drug determinations in blood and other biological fluids. While the introductory material is by itself not very complete, the text is well referenced and serves as an excellent introduction to the literature in these areas. The authors have also provided us with several very useful tables summarizing the properties of the most commonly used drugs.

The vast majority of this book deals with capsule reviews of 102 drug substances in common use. For each drug there is a brief review of the therapeutic concentration range, the known metabolism, and the relationship of the compound to analogous compounds. Analytical methods which have been proposed or are in active use for therapeutic drug monitoring for the substance in question are described in more detail. Each capsule provides an excellent introduction to the literature, with references reported as late as November 1979. The reviews of individual analytical methodology benefit from the fact that the authors make value judgements about the relative merits of different procedures. The original literature is fully relied on in making the evaluation. Apparently the authors have not themselves tested most of the methods which are reviewed here. Because this area is moving very rapidly, it is likely that many of these procedures have already been improved upon to some degree. Nevertheless, this is a very useful survey for those wishing to gain an introductory route to the literature of therapeutic drug monitoring techniques. I can recommend it highly as a reference source for clinical chemists involved in this area and also for analytical chemists working to improve drug measurement methodology. The book does not serve well as a teaching source for drug metabolism, pharmacokinetics, or analytical chemistry, but this is not its apparent goal.

Peter T. **Kissinger**, *Purdue University*

Organophosphorus Reagents in Organic Synthesis. Edited by J. I. G. Cadogan. Academic Press, New York. 1979. viii + 608 pp. $89.50.

Synthesis of, and by, organophosphorus compounds is an area of tremendous development in chemistry. The book here reviewed will serve as the best available introductory discourse on the field until more extensive expositions of organophosphorus chemistry begin to appear in standard organic textbooks.

After reading the book's evocative introduction (14 pages, 26 references), we encounter four chapters concerning transformations utilizing phosphorus-stabilized anions: Stereoselective Syntheses of Alkenes *via* the Wittig Reaction (125 pages, 380 references); PO-Activated Olefination (42 pages, 240 references); Reactions with Electrophiles other than Aldehydes and Ketones (14 pages, 15 references); and Heterocyclic Synthesis *via* Alkylidenephosphoranes, Iminophosphoranes, and Vinylphosphonium Salts (42 pages, 107 references). There follow two chapters about deoxygenation using phosphorus(III) reagents: Heterocyclic Synthesis using Aromatic Nitro Compounds (23 pages, 75 references); and General Functional Group Conversions (50 pages, 159 references). We then are treated to chapters on desulfurization *via* phosphorus(III) reagents (31 pages, 146 references), functional group conversions using phosphorus(III) reagents and polyhalogenoalkanes (37 pages, 249 references), functional group conversions using phosphorus(III) reagents with halides and halogens (29 pages, 150 references), pentacoordinate phosphoranes in synthesis (36 pages, 217 references), and organophosphorus reagents in the synthesis of peptides (22 pages, 70 references).

The book has indexes both by author and by subject. In general the literature is thorougly covered through 1977, with 1978 and 1979 refrences present, but in scant numbers only. There is little overlap of subject matter between the chapters, and each author has written in a lively and pleasant manner. Sometimes the chemistry sounds almost too

easy, but the welcome inclusion of some experimental procedures and warnings serves to give proper perspective to the actual laboratory work. Every chemist with synthesis or reaction mechanism on his mind should go to a library and at the very least glance through this book—its price makes it an unlikely candidate for inclusion in personal collections.

Robert M. Kren, *University of Michigan-Flint*

Porous Silica. Volume 16. Journal of Chromatography Library. By K. K. Unger (Department of Chemistry, University of Mainz). Elsevier Scientific Publishing Co., Amsterdam and New York. 1979. ix + 336 pp. $58.50.

Even a modicum of understanding of the chromatographic process presupposes extensive knowledge of the physicochemical properties of stationary and mobile phases and the attendant interactions with solutes which partition between the two. Broadly speaking, only the stationary phase is of interest in gas chromatography since difficulties associated with, e.g., virial effects and mobile-phase solubility in (or on) the solvent have over the years been recognized and clarified. In contrast, solute solution in the stationary phase remains only poorly understood, treatments such as those associated with solubility parameter theory having been shown to be of little or no value in describing infinite-dilution activity coefficients of nonelectrolyte species. The situation is compounded considerably in liquid chromatography, where a solid (generally an adsorbent) phase is brought into contact with a flowing liquid. Thus, solutes are subjected in LC to elution through beds of bulk adsorbent, adsorbent plus surface-adsorbed mobile phase and bulk mobile phase, as well as the respective interfaces. The text reviewed here, one of a continuing series of monographs on topics of interest to those engaged in one or another form of chromatographic separations, seeks in this regard to clarify the role of porous silica adsorbent as well as the question of surface-sorbed mobile phase.

The treatment is divided into nine chapters, the first four of which offer a discussion of the physical and chemical properties of silica, while the latter five review the use of various forms of the adsorbent in LC. Chapter 1 begins the presentation with an overview of the physicochemical properties of, for example, various crystalline silicas (which is particularly relevent in view of the controversey surrounding cristobalite emissions from Mt. St. Helens), types of surface hydroxyl groups, hydroxylation, hydration, infrared spectra of surface species, and dissolution. Chapter 2 defines and explores topics related to the pore structure of silica, which is of importance inter alia in mass-transfer effects in chromatography. The surface chemistry of porous silica is treated in considerable detail in Chapter 3, the topics covered including the reactivity of surface hydroxyl groups, synthesis and properties of chemically modified silica supports, and ion-exchange properties. Chapter 4 presents methods of particle characterization.

Discussion of more practical aspects of the use of silica in LC commences with Chapter 5 which is entitled, Silica Columns–Packing Procedures and Performance Characteristics. Chapters 6–9 then cover liquid–solid, liquid–liquid, ion-exchange, and gel chromatographic techniques. The text concludes with an Appendix of commercially available silica packings, a List of Symbols and Abbreviations, and a Subject Index.

Coverage of the indicated topics throughout the work is extensive, well written, and thoroughly referenced (with the majority of citations dated prior to 1978). It would in fact be difficult to envisage a monograph of greater breadth and depth regarding current understanding of the physicochemical properties of porous silica and its use as a stationary sorbent in LC. The text can therefore be recommended wholeheartedly and without reservation.

R. J. Laub, *The Ohio State University*

Atomic Structure. By E. U. Condon (Deceased, formerly at Joint Institute for Laboratory Astrophysics, University of Colorado) and H. Odabaşi (Boğazici University, Turkey). Cambridge University Press, New York. 1980. xviii + 658 pp.

The authoritative work on atomic theory for many years, E. U. Condon and G. H. Shortley's "Theory of Atomic Spectra", has now been supplanted by an updated and expanded version. The new work by Condon and Odabasi was originally conceived by Condon as a two-volume set. Odabaşi has striven since Condon's death in 1974 to bring the first volume to completion.

Beginning with a superb summary of nineteenth and early twentieth century atomic physics, we are led to the period just prior to the discovery of quantum mechanics and then to the spectacular unfolding of the general theory in the late 1920's. Chapters on the principles of quantum mechanics, angular momentum theory, and the central field approximation follow and are virtually complete works on the subjects. The next three chapters entitled, Racah Methods, Group Theoretical Methods and Applications of Group Theory Methods to Atomic Structure, form the centerpiece of the new work. Powerful and modern, these methods have become a permanent part of the study of atomic theory and as such, the chapters will represent a welcome introduction to these ideas by advanced undergraduate and beginning graduate students in physics and chemistry. Chapters 8 and 9 contain Hartree–Fock SCF theory, the Thomas–Fermi model, and an introduction to configuration interaction, respectively. Although these chapters are not as fully developed as earlier ones, practical computational details are heavily referenced, though somewhat dated. The text, tables, and appendices are uniformly well done.

Hopefully, the promised second volume will contain such modern topics as diagrammatic many-body perturbation theory and Green's function methods in addition to the anticipated sections on electric and magnetic interactions, relativistic effects, configuration mixing, and ligand field theory. If the final volume is as well done as the first, the set will form a new comprehensive treatment of atomic theory rivaling the original "Theory of Atomic Spectra".

Bernard J. Laurenzi, *State University of New York at Albany*

Developments in Chromatography. Volume 2. Edited by C. E. H. Knapman. Applied Science Publishers, London. 1980. ix + 187 pp. $37.50.

This slender book contains five reviews by British authors: Liquid Chromatography Detectors by R. B. Meiris, Preparative Scale Liquid Chromatography by P. A. Haywood and G. Munro, Some Chemical Carcinogens and their Analysis by E. A. Walker, Use of Chromatography in the Brewing Industry by G. K. Buckee and D. E. Long, and Chromatography and Quality Assurance in the Pharmaceutical Industry by D. G. T. Greig. All are up to date—up to and including 1978, that is—with a few 1979 references to be found in their extensive and well-done bibliographies. Mostly these are very good reviews; one can even find a few critical passages here and there.

For its comprehension and judgement, I liked the first review best. Meiris writes a concise and lucid account of LC detectors and ancillary equipment developed in the past few years. The text is supplemented by well-chosen illustrations. However, it not only shows and cites, but it explains, questions, projects, and puts ideas in the reader's head how to solve his own problems.

The second review is also general in nature. Haywood and Munro compile the literature on batch-type (as opposed to continuous) preparative HPLC, and attempt to stress general principles for optimizing throughput. This is by no means an easy task. The preparative version of HPLC follows conceptually from the analytical one and, here as there, opinions vary.

Both LC detectors and preparative HPLC are broad fields, still in their period of vigorous growth in theory and praxis. In comparison, the following three reviews deal with more narrow and applied topics.

Walker draws heavily on his experience with the International Agency for Research on Cancer in discussing chromatographic methodology for four selected carcinogen types: polynuclear aromatics, aflatoxins, nitrosamines, and vinyl chloride. Beyond its well-executed review function, the article conveys some of the sense of mission as well as the difficulties and doubts associated with high-pressure applied research.

The survey that follows is much more relaxed: Buckee and Long discuss the brewing of beer and associated chromatographic methods. Their approach is methodical and portly, providing reams of literature undoubtedly helpful to workers in that field.

Least helpful to me as a chromatographer was the last contribution, a treatise on quality control in the pharmaceutical industry by Greig. Its periphrastic pleonasm and Tixylix linctus aside, this overview turns out to be less chromatographic than philosophical. It is replete with definitions, classifications, and generalizations, but does offer an interesting look behind the scenes of pharmaceutical houses.

Timely reviews can be extremely helpful. Given his serious interest in at least one of the five topics, I can definitely recommend to the reader the purchase of this second volume of "Developments in Chromatography".

Walter A. Aue, *Dalhousie University*

Dynamics, Exposure and Hazard Assessment of Toxic Chemicals. Edited by Rizwanul Haque. Ann Arbor Science Publishiers Inc., Ann Arbor, Michigan 48106. 1980. viii + 496 pp. $34.00.

This book comprises papers given at the symposium "Dynamics, Exposure, and Hazard Assessment of Toxic Chemicals in the Environment" held at Miami Beach, Florida, September 11–13, 1978. The 31 papers are contributed by scientists from government, industry, and academia; they include biologists, mathematicians, and chemists.

The first few papers are of a general nature and could be of interest to anyone wanting to know the background events relating to the Toxic Substances Control Act (TOSCA). Following the introductory papers, there are 2 papers involving the photochemistry of organic compounds

in air and water and 2 papers concerning the volatility and vapor behavior of toxic organic compounds. The bulk of the remaining papers describe the biodegradation, hydrolysis, bioaccumulation, elimination, and partitioning of toxic organic chemicals. Several of the latter papers are in-depth studies of specific chemicals (aromatic and chlorinated hydrocarbons) acting on specific animals (fish, rats, and mice). Three papers are concerned with computer models, predictions of the likely fate of organic chemicals, and physiological modeling. The last few papers in the book cover testing chemicals for hazards and risks to humans.

The quality of the presentations is uneven; some are very detailed and some are very general. Some papers are field studies, some are progress reports, others are simulations. The book is more appropriate to an institutional rather than a private library.

Barbara Booker, *University of Michigan*

Electron Spectroscopy: Theory, Techniques and Applications. Volume 3. Edited by C. R. Bundle (IBM Research Lab., San Jose) and A. D. Baker (Queens College, CUNY). Academic Press, New York. 1979. ix + 361 pp. $44.50.

This is the third volume in this series and the first to deviate in a substantative way from photoelectron spectroscopy. The volume is almost exclusively directed toward chemical physicists with the single exception being a chapter on analytical aspects of XPS. The book is divided into six chapters, each written by an acknowledged expert in their fields.

Chapter 1 (D. S. Urch) deals with X-ray emission spectroscopy. The chapter presents a useful introduction to the technique for those unfamiliar with it and also emphasizes the complimentary nature of X-ray emission spectra to the more popular XPS technique. Experiment is emphasized with interpretations given based on MO theory.

Chapter 2 (R. J. Celotta and R. H. Huebner) deals with low-energy aspects of electron impact spectroscopy. The emphasis is on experimental aspects, especially on atoms and small molecules, but a brief theoretical discussion is included as are a few experimental results on polyatomic systems. The authors give a good survey of work within the scope mentioned and offer a useful section on future aspects.

Chapter 3 (R. A. Bonham) deals with high-energy (1–50 keV) aspects of electron spectroscopy and nicely compliments Chapter 2. Again the emphasis is on experimental aspects of simple systems but a fairly detailed theoretical introduction is provided as well.

Chapter 4 (J. M. Dyke, N. Jonathan and A. Morris) deals with UPS of transient species. This chapter presents a lucid introduction to the technique and briefly discusses methods of calculating orbital energies. A useful review of work done prior to July 1976 completes the chapter.

Chapter 5 (J. H. D. Eland) addresses the topic of ionic fragmentation mechanisms, particularly as they pertain to photoelectron spectroscopy. This extensive chapter gives a good introduction to fragmentation mechanisms and provides sufficient documentation to allow further inquiry. A very useful survey of fragmentation and photoelectron spectra of small molecules completes the chapter.

Chapter 6 (D. Briggs) completes the volume by discussing analytical applications of XPS. The chapter begins with a detailed analysis of the information content in XPS Spectra and concludes with applications to a very wide variety of materials and disciplines (catalysts, polymers, fibers and textiles, alloys, electrochemistry, trace element analysis, biology, pollution studies, and others). While this chapter does not fit the theme of the remainder of the volume, it is well done and useful in its own right.

Michael T. Bowers, *University of California of Santa Barbara*

Alkali Halide Vapors; Structure, Spectra, and Reaction Dynamics. Edited by P. Davidovits and D. L. McFadden. Academic Press, New York. 1979. xi + 542 pp. $55.00.

The alkali halide vapors have been very intensively studied for a number of reasons. Among these have been their ready availability in pure form, sensitive detectibility of the ions, and reasonable volatility at easily accessible temperatures without serious container corrosion. Additional factors have been the well developed theoretical models for ionic compounds and the challenge to characterize the gaseous polymeric species which are significant constituents of the vapor. The alkali halides have played an important role in the development of techniques for study of molecular interactions upon collisions, particularly in molecular beams. The interactions are governed primarily by single electron interactions and are amenable to simple theoretical modeling for interpretation of experiments. The variation of parameters from Li to Cs and from F to I provides a ready test of theoretical models.

This volume is a very well organized summary of the large amount of experimental and theoretical work that has accumulated. More than half of the volume, Chapters 6–14, is devoted to the dynamics of alkali atom–halogen interactions. Chapters 1, 3–5, and 15 cover the structural and spectral properties of the alkali halide molecules while Chapter 2 on Production and Detection of Alkali Halide Vapors describes the techniques for producing alkali halide vapors and alkali and halogen atoms and ions and their experimental characterization. The 16 expert authors have done an excellent job of providing information about experimental and theoretical techniques and a large amount of quantitative data has been tabulated. In addition to the usual subject index, the editors have prepared a very useful table index covering over 90 tables grouped in the categories: Physical and Spectral Properties, Thermodynamic Properties, and Reaction Dynamics and Kinetics plus an additional four miscellaneous tables.

Leo Brewer, *University of California*

Plant Pigments, Flavors and Textures. The Chemistry and Biochemistry of Selected Compounds. By N. A. Michael Eskin (University of Manitoba). Academic Press, New York. 1979. xi + 219 pp. $18.50.

The author states in the preface that this book "focuses on the chemistry and biochemistry of compounds responsible for the pigments, flavors, and textures of some fruits and vegetables. Since much of the information presented is scattered in the scientific literature, an attempt has been made to integrate the material into a concise yet comprehensive text." Although in 183 pages of text it is impossible to more than scratch the title subject areas, several of the specific problems in food processing that are reviewed have general significance. The work will probably be of greatest use to food technologists, and its value will depend mostly on their interest in the particular subtopics considered.

Some 600 references are cited, mostly from the 1960's and early 1970's. The most recent inclusions are from 1977. Historical background material, even ranging into the 19th century, is included where appropriate. The style is concise and reasonably easy to follow. An adequate subject index is included.

Section I, on food pigments, contains chapters on chlorophylls, carotenoids, and anthocyanins, and discusses their degradation, both enzymatic and nonenzymatic, during processing.

Section II, Natural Flavor Compounds of Foods: Their Biogenesis and Effects on Quality, consists of three chapters. The first of these considers the sulfur compounds in the onion (sulfides, disulfides, polysulfides, thiosulfonates) and cabbage (sulfides and isothiocyanates) families and the Shiitake mushroom (polythiepanes). The next chapter is concerned with terpenoids and flavonoids of citrus fruits, with particular emphasis on bitterness. The third chapter discusses aldehydes, alcohols, and esters of tomatoes and bananas.

Section III, on the textural components of foods, considers the following: cellulose and hemicellulose; pectic substances of various fruits, avocados and tomatoes; lignin, particularly in relation to the quality of pears and asparagus; the textural role of the cell wall protein extensin in several vegetables; toughening of several fruits and vegetables caused by the glycoprotein callose.

Keith T. Buck, *Fries & Fries Division, Mallinckrodt, Inc.*

Physical Chemistry and its Biological Applications. By W. S. Brey (University of Florida). Academic Press, New York. 1978. xi + 589 pp. $14.95.

An introductory textbook.