



In alkaline solution, where reaction 5 is believed to be faster than reaction 4,^{22,23} the observed quantum yield is twice the yield of primary photoinduced electron transfer (reaction 3). Although the absolute yields of electron transfer are low, it is clear that they are a sensitive function of solution medium. Where complexation is important in the photosensitized system, one would also expect the yield of radicals to be a function of solution medium. Indeed, we have found that to be the case in the $\text{Ru}(\text{bpy})_3^{2+}/\text{MV}^{2+}/\text{EDTA}$ system at high ionic concentrations.²⁴ We have also found that photoactive charge-transfer complexes are formed between MV^{2+} and cysteine, mercaptoethanol, and carboxylic acids.

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(24) Mandal, K.; Hoffman, M. Z., manuscript in preparation.

Book Reviews*

Advances in Chemical Physics. Volume XLIV. Edited by I. Prigogine (University of Brussels and University of Texas, Austin) and S. A. Rice (University of Chicago). John Wiley and Sons, New York. 1980. 671 pp. \$65.00.

It is simply a matter of routine to review an established series such as this. There are five chapters in this review volume.

The text begins with a chapter by L. Englebrecht and J. Hinze, titled Molecular Properties Observed and Computed. The article details formulas derived through ab initio methods for the computation of various molecular properties analogous to different spectroscopic constants leading to quantitative studies of coupling effects which are useful in the interpretation of spectroscopic results. Rightly, little emphasis is placed on spectroscopic quantities that are readily accessible from experiment.

The second chapter is on Generalized Langevin Equation and Many-Body Problems in Chemical Dynamics by S. A. Adelman. New theoretical methods largely developed by the author and addressed to problems pertaining to many-body dynamics applicable to the liquid-state and solid-state chemical phenomena are reviewed. The methods are developed within the regime of continuum mechanics and formulated along linear response theory with a harmonic perturbing force utilizing, as usual, correlation functions. Despite the continuum approach, the method is capable of generating results related to chemical dynamics on molecular time scales. The simplicity of the new approach is contrasted with the complex conventional classical trajectory approaches of Liouvillean mechanics in appendices. The article provides an impressive review which will prove useful to beginners in the field of non-equilibrium statistical mechanics. The heavy reliance on established mathematical techniques (e.g., Fourier and Laplace transforms) and the generous inclusion of intermediate results give increased clarity. There are, of course, parts where the urge to maintain uniformity has been realized at some expense. For example in Section C, the relations (II.43 and II.44) between the Einstein frequency ω_e (the short-time approximation), the adiabatic frequency Ω (the long-time approximation), and the Debye frequency ω_D can readily be generated by the simple equation:

$$\omega^n = \frac{\int_0^{\omega_D} \omega^n \rho(\omega) d\omega}{\int_0^{\omega_D} \rho(\omega) d\omega}$$

$$\omega = \omega_e, n = 2; \omega = \Omega, n = -2$$

where the spectral density $\rho(\omega) \propto \omega^2$ without the need to use correlation functions. However, the latter approach would appear indispensable for the solution of the intermediate case. Fairly complex applications of the theory are discussed.

An article titled Experimental and Theoretical Studies of Roto-translational Correlation Functions by M. Evans, G. Evans, and R. Davies occupies the third chapter. This review provides another treatment of non-equilibrium statistical mechanics of condensed phases, but this time specializing on molecular dynamics associated with mesophases such as plastic and liquid crystals. The approach is essentially conven-

tional via Liouville and Fokker-Planck equations. The strength of the models developed is demonstrated by the remarkable agreement between results from theory and experiment pertaining to far infrared absorption spectroscopy.

The fourth chapter, On a Theoretical Description of Solvated Electrons, by A. M. Brodsky and A. V. Tsarevsky discusses the theoretical treatment of thermalized excess electrons in disordered condensed phases which do not exhibit intrinsic electron conductivity.

The final chapter, by A. E. Hansen and T. D. Bouman, is titled Natural Chiroptical Spectroscopy: Theory and Computations. The theoretical approach in this review, which is essentially spectroscopic (predominantly electronic), covers only ordinary absorption and circular dichroism (CD) and the relation of these quantities to the structure of organic and biological chiral molecules.

In conclusion, all the articles contributed have maintained the high standard expected of these series and the reviews strongly reflect the influence of contributions by their authors in the field.

Chodźwaziwa C. Mjojo, Chancellor College, University of Malawi

Topics in Current Chemistry. Volume 102. Inorganic Ring Systems. Edited by F. L. Boschke et al. Springer-Verlag, Berlin, Heidelberg, and New York. 1982. 237 pp. \$41.00.

This book contains six major review articles on various aspects of the chemistry of non-metal inorganic ring systems. Each contribution is based on a plenary lecture of the third Inorganic Ring Systems (IRIS) meeting held in Graz, Austria, in August of 1981. The contents include: Up-to-date Improvements in Inorganic Ring Systems as Anticancer Agents, by J.-F. Labarre (87 pages, 83 references); Phosphorus(III)-Nitrogen Ring Compounds, by R. Keat (27 pages, 121 references); Sulfur-Nitrogen Anions and Related Compound, by T. Chivers and R. T. Oakley (30 pages, 114 references); Homocyclic Sulfur Molecules, by R. Stuedel (27 pages, 96 references); Cyclic Selenium Sulfides, by R. Stendel and R. Laitinen (20 pages, 80 references); and Polyhedral Oligosilsesquioxanes and Their Homo Derivatives, by M. G. Voronkov and V. I. Lavrent'yev (37 pages, 98 references). An author index for Volumes 101 and 102 is also included.

Each of the articles is written by a recognized authority in the area. Consequently, the content accurately reflects the nature and direction of the research in the subjects under consideration. However, as one might expect, the emphasis is often on work from the authors' own laboratories. The review of sulfur-nitrogen anions is a particularly welcome addition. In recent years, there has been a rapid growth in information on sulfur-nitrogen rings which has been, in part, stimulated by interest in polysulfur nitride. This review contains a concise summary of information on reactions of sulfur-nitrides and of molecular orbital models which allow for the introduction of a certain amount of logical organization into the bewildering array of observations in this area. The chemistry of phosphorus(III)-nitrogen rings with particular emphasis on the complex conformational possibilities inherent in these systems is well presented. A summary of information and approaches to the development of inorganic rings as anticancer agents is concerned primarily with the aziridino phosphosphazenes and phosphathiazenes. Subjects range from synthetic,

*Unsigned book reviews are by the Book Review Editor.

structural and theoretical studies, to biological activity. The ever increasing number of homocyclic sulfur species are reviewed in terms of both preparative and characterizational studies. A companion paper on mixed sulfur selenium rings is also available. Inorganic cage compounds are represented in the article on oligosilsequioxanes derived from trifunctional silanes. Synthetic methods and mechanistic considerations are covered in detail. Structural and physical property investigations are also discussed.

The nature of this collection of reviews is such that it gives representative, in depth views of selected areas of on going interest rather than a comprehensive treatment or broad overview of the subject. Consequently, it may be recommended to those with interests or potential interests in one or more of the topics reviewed.

Christopher W. Allen, *University of Vermont*

Coal Structure. Edited by R. A. Meyers (TRW Inc.). Academic Press, New York. 1982. xiii + 340 pp. \$49.50.

The emergence of "coal science", which embraces not only the chemical and physical aspects of coal but also its mineralogy, its origin, and its utilization as a source of chemicals, as a fuel, or as a source of gaseous or liquid fuels, has given rise to many books during the past 10 years. A large fraction of them have been proceedings of conferences, and some have been broad treatises on coal science, but none so far has dealt exclusively with the structure of coal. As little as 10 years ago, it would have been difficult to write a useful book on just this. However, enough has been learned in recent years to make the time right for such a book, even though there is still much more that is unknown than known (one chapter begins: "Current technologies for processing coal might be described as subjecting a poorly characterized, heterogeneous material to a series of mysterious transformations to produce only slightly more recognizable products").

A succinct introductory chapter orients the reader to the general nature of coal and explains some of the commonly used terms. The remaining six chapters tell us about macerals (the minute fossil plant structures); porosity (closely related to the cellular material of the originating vegetation); aromaticity (the evidence for and the consequences of the largely aromatic carbon skeletons of coal components); functional groups and heteroatoms (overwhelmingly O, N, S); the macromolecular structure; and the inorganic mineral components. The chapters are the work of 12 contributors, drawn from universities, government laboratories, and three petroleum companies. The absence of contributors from traditional coal companies does not seem to have detracted from the authoritativeness of the work, and may only be a reflection of where the most active research is being done.

The chapters are interpretive and, for the most part, critical presentations of their subjects, and are easy to read; they should be helpful to the newcomer to the field as well as to the experienced coal scientist who wants to be brought up to date. The bibliographies are selective rather than comprehensive, and refer the reader both to books and journal articles. Unfortunately, the references are not presented uniformly; in some chapters, they are cited by name and year, and are arranged alphabetically, whereas in others, they are cited by number and arranged in order of citation. Some minor subjects are passed over (arsenic in coal, for example), but this fact is justifiable in a work that is not intended to be encyclopedic.

The illustrations are numerous and good, and include some fascinating electron micrographs. There is a helpful and substantial subject index, although there are some peculiarities in it, such as the fact that "carbonates in coal" is alphabetized under "Carbonates", but "quartz in coal" is alphabetized under "Coal".

This is a most welcome book, and is both educational and useful; anyone doing or thinking of doing coal research should have it.

Studies in Surface Science and Catalysis. Volume 7. New Horizons in Catalysis. Parts A and B. Edited by T. Seiyama and K. Tanabe. Elsevier Scientific Publishing Co., Amsterdam and New York. 1981. 1586 pp. \$170.75.

The renewed interest in heterogeneous catalysis, arising from trends to improve the use of limited natural resources, to conserve energy and to avoid pollution by increased selectivity of industrial processes, is well documented in this two-volume report. Covering many aspects stretching from the scientific investigation of molecules adsorbed on surfaces through development of novel catalysts to application in technical scale, it contains five plenary lectures, 107 contributed papers, and 63 communications.

The following topics are reviewed in more detail to illustrate to the nonspecialist why it could be worthwhile to read at least some of the surveys which, in addition, due to their numerous literature quotations, provide access to further reading, e.g., for teaching at the graduate level.

"Molecular Shape Selective Catalysis" (P. B. Weisz) started in the

1950's from the discovery that catalyst design could be based on transport phenomena depending on the molecular size of reactants. Scaling down the Si:Al ratio in zeolites synthesized by incorporating large organic cations which are later on removed in the calcination process, novel materials like the prototype ZSM 5 have been developed which allow, e.g., the dehydration of methanol to hydrocarbons, the isomerization of *o*- to *p*-xylene, or the increase in gasoline octane number by branching linear alkanes. Starting from the principles of selective diffusion inhibition and selective steric inhibition, the effects of transition-metal-doped zeolites are discussed.

"Surface Science and Catalysis" (G. Ertl) is an area of world-wide actively pursued research. The elementary steps in heterogeneous catalysis—adsorption (accompanied usually by structural changes of the adsorbed species), surface migration, interaction between surface species and desorption—on which kinetic measurement only yield indirect information, are investigated nowadays by an arsenal of physical measurement methods such as X- and UV-PS, Auger spectroscopy, LEED, SIMS, or TDS. Application to the ammonia synthesis, for instance, demonstrates the importance of potassium on the iron (oxide) surface for the low energy dissociation of N₂ into chemisorbed N atoms and proves the NH species to be one of the essential intermediates.

"Coordination Chemistry of Metal Surfaces and Metal Complexes" (E. L. Muetterties): Comparison between coordination phenomena in metal complexes of known structure, on metal crystal surfaces and on "real", i.e., structurally less well defined catalyst surfaces, can provide some rationale for the heterogeneously catalyzed reaction pathway on the latter, as is illustrated for the methyl isonitrile to acetonitrile isomerization. Altogether, many models for surface adsorbed species and their reactivity as derived by chemical analogy are given throughout the books.

"Recent Progress in Elucidating the Mechanism of Heterogeneous Catalysis" (K. Tamaru) is devoted to investigating the heterogeneous catalyst under "working conditions", i.e., by comparing rates of adsorption and of reactions of individual surface species with the overall reaction rate, all of which are determined in a "steady state" mode. Methods employed stretch from volumetric measurements via isotope labeling to spectrophotometric techniques, and are illustrated by the ¹³C + D₂ Fischer-Tropsch synthesis of hydrocarbons.

"Anchored Complexes in Fundamental Catalytic Research" (Yu. I. Yermakov): Another approach to bridge the gap between studies of regular surfaces and "real" catalysts is to anchor metal complexes or clusters of known structure on a non-active support. The preparation, composition and catalytic activity as well as its increase by subsequent redox reactions or added promoters are reviewed.

Although this work is basically aimed at the catalysis specialist, it contains a wealth of information, readily accessible by author and especially subject indexes, also for metal-organic chemists, method-oriented physicists, or for graduate teaching. The two volumes should be available in libraries to interested readers.

Hans Bock, *University of Frankfurt*

Studies in Surface Science and Catalysis. Volume 8. Catalysis by Supported Complexes. By Yu. I. Yermakov, B. N. Kuznetsov, and V. A. Zakharov. Elsevier Scientific Publishing Co., Amsterdam and New York. 1981. 522 pp. \$89.25.

This review of heterogeneous catalysis by metal clusters and metal complexes anchored to non-active supports has been compiled by scientists of the Institute of Catalysis, Academy of Sciences of the USSR, Siberian Branch, located at Novosibirsk. It contains a wealth of information on both the preparation and properties of novel catalysts, including numerous results, which are either scattered in journals not easily accessible to western readers or hitherto unpublished. Altogether 773 (!) literature quotations accompany the 10 chapters, which cover as topics: 1, classification of catalysts immobilized on organic and inorganic supports; 2, transition metal complexes on oxide supports; 3-5, olefin polymerization by supported organometallic catalysis; 6, olefin metathesis on anchored metal complexes; 7, hydrogenation reactions by surface transition metal complexes; 8, oxidation reactions on V, Mo, and W complexes on oxide supports; 9, preparation of supported monometallic catalysts by decomposition of surface complexes and their catalytic activity; 10, preparation and properties of supported bimetallic catalysts.

The contents of the 10 individual chapters may be summarized under the following more general aspects: supports used comprise mainly silica as well as other inorganic oxides with -OH anchors, which can be converted into other functional groups like -Cl, -PR₂, -AlX₂, or -MCl. Complexes immobilized on these surfaces contain a variety of transition metals such as Ti, Zr, V, Nb, Cr, Mo, W, Ni, Pd, or Pt bonded to ligands such as -halogen, =O, -OR, -PR₃, -CO or organic π systems such as allyl, cyclopentadienyl, or benzene and derivatives thereof. Besides monometallic complexes, also those containing two metal centers or which are clusters have been prepared. The synthesis of these supported cata-

lysts, sometimes followed by additional redox reactions or by thermal decomposition, is covered in quite some detail. For their characterization, a variety of methods has been used including IR, XPS, Mössbauer spectroscopy, RED, electron microscopy, and especially kinetic measurements. The catalytic activity has been determined for many different types of reactions, above all olefin polymerization (130 pages), olefin metathesis (30 pages), hydrogenation (8 pages), or oxidation (17 pages).

Two appendices are added, one of which covers the most recent literature up to 1980. The other one, providing an annual (?) account of publications in the area, should have been replaced either by one in alphabetical order or by an author index. Also the 8-page subject index should have been improved, e.g., by quoting page numbers instead of giving references to chapters.

With respect to the most actively pursued world-wide research in organometallic chemistry, the 522 pages on how to anchor metal complexes and clusters on non-active supports such as silica and on how to determine their prospective catalytic activity might be of stimulating interest to chemists who so far have neglected this aspect of their work.

Hans Bock, *University of Frankfurt*

Diradicals. Edited by W. T. Borden (University of Washington). John Wiley & Sons, Inc., New York. 1982. xi + 343 pp. \$44.95.

This survey of species with two electrons occupying two degenerate or nearly degenerate molecular orbitals attempts to present a balance of reviews of experimental work and of various types of calculations and their meaning. Overall, the book succeeds, even though some individual sections may be somewhat unbalanced. Six chapters cover most of the active areas of interest; some 1981 references are included.

Effects of Electron Repulsion in Diradicals (W. T. Borden) deals with electronic states, two-centered diradicals, non-Kekulé hydrocarbons, antiaromatic annulenes, and perturbed diradicals. Singlet-Triplet Energy Separation in Carbenes and Related Diradicals (E. R. Davidson) deals with calculational procedures for determining singlet-triplet separations, with specific examples for methylenes and unsaturated carbenes and their analogues. Nonconjugated Diradicals as Reactive Intermediates (P. B. Dervan and D. A. Dougherty) deals with the observed behavior of 1,4- and 1,3-diradicals and of dehydrobenzenes; included are effects of generation method, temperature, substitution, and spin states with a good statement of the many important unanswered questions. Capturable Diradicals of the Trimethylenemethane Series (J. A. Berson) presents a good blend of experimental results and their theoretical significance, as related to fundamental problems of structure and bonding and to the yet largely untapped potential for useful syntheses. Quinonodimethanes and Related Diradicals (M. S. Platz) deals with problems of characterization through theory, chemistry, and spectroscopy, without attempting a full review of the literature on these species. Intersystem Crossing in Diradicals and Radical Pairs (N. J. Turro and B. Kreauler) deals with photochemical and thermal decompositions as they relate to ISC via spin-orbit coupling and hyperfine interaction; chemiluminescence, quantum yields, magnetic isotope and field effects, viscosity effects, etc. are discussed in terms of mechanistic interpretations.

The quality of the writing is generally good. This book appears well suited for workers in this field and for those serious about entering it. It is not suitable as a general introduction and it does not appear to have been written with that intent.

Andreas A. Zavitsas, *Long Island University*

Technique of Electro-organic Synthesis Scale-up and Engineering Aspects. In *Techniques of Chemistry*. Volume V. Part III. Edited by N. L. Weinberg and B. V. Tilak. Wiley-Interscience, New York. 1982. 536 pp.

Ten contributed chapters cover important elements of engineering fundamentals, scale-up principles and case studies, electrode materials, process evaluation, and economic considerations. The book contains over 1000 references, and is meticulously indexed. The volume is without question the single most useful collection available to the engineering community, and has value for general electrochemical process applications beyond the specific electroorganic syntheses which are of central interest.

The chapter on electrochemical engineering principles as related to electro-organic processes, by Chin and Cheng, provides an excellent general introduction to electrochemical reactor design principles, as well as to fundamental considerations involved in selecting reactors for electro-organic applications.

Feess and Wendt provide a thorough treatment of electrolysis of sparingly soluble compounds which form two-phase mixtures at practical operating conditions. Discussion and copious literature citations cover fundamental principles, techniques for scientific study, and engineering examples of processes.

The chapter by Carlsson, Holmberg, Johansson, and Millson describes

engineering development of a commercially available pilot cell, and discusses operating experience.

A chapter on electrode materials by Tilak, Sarangapani, and Weinberg provides an extremely useful and thorough discussion of the effect of electrode material on the selectivity of electro-organic reactions. Scientific principles for selecting the electrode material are discussed, and examples for the most common industrial reactions are described including hydrogen, oxygen, and halide reactions.

The next four chapters highlight engineering experience gained from some of the most prominently active industrial laboratories. Degner summarizes extensive scale-up experience and evaluation of electrochemical synthesis routes in comparison with conventional chemical routes. These discussions contain a wealth of practical aspects associated with early evaluation of candidate processes. Danly and Campbell provide the most extensive fundamental discussion of the Monsanto adiponitrile process available, including not only specific examples but also general principles of design strategy. Childs describes the electrochemical fluorination of organic substrates and summarizes scientific and engineering aspects associated with over a half-dozen applications. H. V. K. Udupa and K. S. Udupa describe extensive experience in both reductions and indirect oxidations.

Beck, Alkire, Weinberg, Ruggeri, and Stadtherr report procedures for analyzing potential process flowsheets, and provide specific data on a variety of high-tonnage organic compounds. This study provides important general engineering strategies for assessing new process candidates and for identifying limitations on performance throughout the process flowsheet.

In the final chapter, Keating and Sutlic provide invaluable economic data for estimating investment and operating costs of electrochemical cells that have both planar and porous electrode configurations.

In summary, the volume is unique in the electro-organic literature, and provides a major benchmark for summarizing evolution of rational engineering procedures for scale-up and implementation of electro-organic chemical technology. The industrial chemist and chemical engineer who needs a firm foundation in practical aspects of electro-organic synthesis will find this volume to be the single most valuable book in the library.

Richard C. Alkire, *University of Illinois*

Annual Reports in Medicinal Chemistry. Volume 17. Editor-in-Chief Hans-Jürgen Hess (Pfizer Inc.). Academic Press, New York. 1982. xiii + 383 pp. \$32.00.

Volume 17 of these Reports, sponsored by the American Chemical Society, consists of six sections which are subdivided into 33 chapters, organized similarly to its predecessor. This volume covers a wide range of subjects relevant to areas of potential new drugs or of general interest, and the traditional updates in current areas of active drug research as well. Models for serotonin receptors, anti-ischemic and hemorheologic agents, leukocyte motility, cellular mediation immunity, protein growth factor, recombinant DNA research, platelet activating factor, polyamine metabolism, substance P and neurotensin, strategies for the discovery of drugs from natural sources, herbicide and insect control agents, and nonnutritive sweeteners are the new topics presented in this volume. The book chapters include reviews discussing in detail the development of new drugs for the treatment of rheumatoid arthritis and their mechanistic aspects, biological action and the chemistry of arachidonic acid-derived lipoxygenase products, neuropeptides, artificial sweeteners, herbicides, insect control, and a basic elements of recombinant DNA research. The book reflects the excellent management and planning to bring together such a large number of wide-ranging, high-quality review articles. Furthermore, the book includes a list of contributors, compound name and code number index, cumulative chapter title keyword index, and cumulative chapter titles index. The subject matter covered in this volume is very useful to medicinal chemists and those having interests related to this field.

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Organophosphorus Chemistry. Volume 13. A Specialist Periodical Report. Senior Reporters: D. W. Hutchinson and J. A. Miller. The Royal Society of Chemistry, London. 1981. xiv + 296 pp. \$115.

The new volume of "PSPR" reviews the literature published between July 1980 and June 1981. This Series is worth its weight in gold, which is what it takes to buy its volumes. Indeed, the only criticism that can be leveled against the indispensable PSPR is that the publishers may be pricing themselves out of most libraries, not to mention private hands. This is a pity, because most phosphorus chemists of the last decade have developed the reflex action of going first to these Reviews to check on the state of the art in any of the fields which touch on this element, from neutron diffraction to nucleic acids. Since reprints of separate chapters cannot be bought, and in principle "no part of this book may be reproduced...", there is no way the librarian can keep these volumes out of the

hands of graduate students (or faculty) with amnesia.

The exceptionally high standards of critical coverage set by the founder of PSPR, Professor Stuart Trippett, are being fully maintained by the present Senior Reporters, who took over with Volume 12. The format of the Series is, fortunately, similar to that of previous years, except for the introduction of "a series of occasional reviews written by specialists in particular areas of Organophosphorus Chemistry". Having made explicit my admiration for this Series, all that remains is to reproduce the chapter headings, just in case the reader is unable to find this gem in his library: Chapter 1, Phosphines and Phosphonium Salts by D. W. Allen; Chapter 2, Quinquevalent Phosphorus Compounds by C. D. Hall; Chapter 3, Halogenophosphines and Related Compounds by J. A. Miller; Chapter 4, Phosphine Oxides and Related Compounds by J. A. Miller; Chapter 5, Tervalent Phosphorus Acids by B. J. Walker; Chapter 6, Quinquevalent Phosphorus Acids by R. S. Edmundson; Chapter 7, Phosphates and Phosphonates of Biochemical Interest by D. W. Hutchinson; Chapter 8, Cyclophosphamide and its Congeners (Occasional Review) by W. J. Stec; Chapter 9, Nucleotides and Nucleic Acids by J. B. Hobbs; Chapter 10, Ylides and Related Compounds by B. J. Walker; and Chapter 11, Physical Methods by J. C. Tebby.

Fausto Ramirez, State University of New York at Stony Brook

Densitometry in Thin Layer Chromatography. Edited by J. C. Touchstone and J. Sherma. John Wiley & Sons, Inc., New York. 1979. xv + 747 pp. \$29.95.

This book is organized into two major sections: the practice and the application of densitometry in thin layer chromatography (TLC). The editors stated aim was to minimize theory and stress applications. This was apparently successful, since over 80% of this book is devoted to quantitative TLC applications in which densitometry was used.

The first section discusses the history, theory, methodology and instrumentation of TLC densitometry. A reasonably clear, concise description of the theoretical basis of transmittance, reflectance, and fluorescence measurements as they apply to TLC is presented. The description of flying spot scanners seems out of place in the theory section and perhaps would be more appropriate in the chapter devoted to instrumentation. The instrumentation section describes the various optical layouts employed by commercial instruments, but fails to address the mechanical and electronic aspects of these devices. In addition, a critical examination of the various components of a densitometer would have been valuable.

The value of this volume must be considered with respect to the applications sections, which is the major portion. This section is divided into 28 chapters, each written by a different set of authors. The organization of this section, by compound classes, allows for convenient use. Within each chapter, the authors review the TLC methodology for their particular topic. Most chapters include a republication of a specific procedure developed by the authors. The overall value of this type of compilation of applications must be judged by the individual user, but most of the literature cited is somewhat dated.

The chapter on bioautography, while very interesting, is out of place in this volume. The editors justify its inclusion "...because the detection procedure is considered too important to ignore completely". It is doubtful that inclusion in the applications section of a book on densitometry will increase its visibility.

Overall, this book contains a large body of analytically useful information organized in a single volume. For the novice or potential user of quantitative TLC, this book provides a good starting place. It provides sufficient background on theory and instrumentation. The applications section indicates the scope of compound classes which can be determined by densitometry. Its modest price should not deter personal acquisition. The more experienced user of TLC will find this book less useful. While both the practice and applications sections contain numerous references, few are more recent than 1975.

Terrence P. Tougas, University of Lowell

Free Radicals and Cancer. By Robert A. Floyd (Oklahoma Medical Research Foundation). Marcel Dekker, Inc., New York. 1982. 552 pp. \$69.75.

When T. F. Slater wrote his book "Free Radical Mechanisms in Tissue Injury" in 1972, very few books were available on free radical biology. What a change! In the last 12 months alone, numerous excellent books have appeared. Some of these volumes discuss the evidence that radicals are involved in chemical carcinogenesis, in co-carcinogenesis, and in promotion. It is clear that this field has the potential for making an important contribution to our understanding of the role of environmental pollution in causing cancer, but it also is clear that the field is new and many of the basic concepts have not yet been clearly identified and elucidated. You have to be brave to tackle editing a book in a field that is still in flux like this one is, and Bob Floyd must be congratulated for

the task he took on. He has done a good job; this book brings together enough information so that a person interested in these topics can begin a literature search. It is unfortunate, however, that this book appears to have taken several years to produce, with the most recent references having 1980 dates. The evidence for radical involvement in promotion in particular has advanced dramatically in the last 2 years.

The chapters in this book are as varied as are the approaches to study free radical reactions *in vivo*. Chapter 1 is a review of the work of C. Nagata, M. Kodama, Y. Ioki, and T. Kimura. This group has contributed extremely interesting studies of *in vitro* models and *in vivo* work, and this is an excellent introduction of their work. These workers conclude that: "...almost all classes of chemical carcinogens are able to generate free radicals by enzymatic reactions. On the other hand, non-carcinogenic compounds are rather stable and difficult to convert to free radicals under the same conditions". This hypothesis is reminiscent of the postulate made by R. P. Mason that enzymes exist for the metabolism of compounds natural to the biosphere by even electron processes, but xenobiotics are generally metabolized by one-electron processes, since evolution has not designed enzymes to handle their metabolism.

Chapter 2, by A. Stier, R. Claus, B. Bosterling, and I. Reitz, reviews the use of spin labels and aromatic nitroxides. Chapter 3, by H. M. Swartz, brings up to date his insightful, critical, and extremely telling analysis of the use of ESR to detect cancer at early stages. He concludes that, except in special cases, changes in the concentration of free radicals cannot be used to distinguish tumors from regular tissue. Swartz also treats the differences in autoxidizability of normal and cancerous tissue, particularly with regard to ESR studies, and reviews the data showing the interesting fact that tumors often have high levels of defense against autoxidation.

Chapter 4, by E. Cavaliere, E. Rogan, and R. Roth, reviews mechanisms by which PAH become activated to ultimate carcinogens. This group has contributed intriguing evidence that radical reactions can be involved in these processes. Chapter 5, by A. M. Bobst, reviews the use of spin probes to assay nucleic acids. Chapter 6, by J. Cadet and R. Teoule, reviews the binding of radio-sensitizing drugs to DNA. Chapter 7, by F. R. DeRubertis and P. A. Craven, discusses the activation of guanylate cyclase by a free radical mechanism. The role of radicals in the activities of both cGMP and cAMP, and *visa versa*, is the subject of intensive current research. Since these cyclic mononucleotides control a number of cellular processes, the possibility that radicals mediate the levels of these messenger molecules is clearly very important.

Chapter 8, by N. M. Emanuel, provides a valuable guide to a very considerable Russian literature on the concentration of radicals in cancerous versus normal tissue, and the use of ESR to detect and distinguish tumors at early stages. Chapter 9, by R. Sridhar, discusses radiation sensitizers. This is a very important area, with a great deal of current research both at the molecular level and in clinical practice. Chapter 10, by R. A. Floyd, discusses the class of arylamine carcinogens, an area that Floyd has contributed to extensively. Chapter 11, by E. G. Janzen and E. R. Davis, presents simulations of spin adducts as a guide to identifying them; it would have been helpful if Janzen, a leader in this field, had also warned his readers against the many pitfalls to be found in applying spin-trap chemistry to cancer research. Chapter 12, by J. A. Hinson, L. S. Andrews, and J. R. Gillette, reviews the chemistry of *N*-hydroxy-2-acetylaminofluorene. The last chapter, by J. E. Biaglow, M. E. Varnes, C. J. Koch, and R. Sridhar, reviews the activation of nitro compounds; this group has been one of the leading contributors in this area.

This is a handsome book with a lengthy and very useful index. It would have been helpful had chapters been included on promotion and cocarcinogenesis, a very active field for research at present in which radicals appear to be involved, and on structure-activity relationships among carcinogens and for anti-tumor drugs, some of which suggest the involvement of one-electron processes. All in all, however, this book brings a new reader into a number of fields of active research in this area, and also serves to introduce experienced workers to the current views of some of the leading workers in their field.

William A. Pryor, Louisiana State University

A BASIC Programmer's Guide to Pascal. By Mark J. Borgerson. John Wiley and Sons, New York. 1982. 118 pp. \$9.95 (paperback).

Chemists are more and more coming into contact with computers, and having to figure out how to make these complex new tools perform useful tasks without becoming experts on computers. One of the great advances in allowing this to happen has been the development of better languages in which to program the machines. One recent (and widely accepted) language is Pascal, which can be found on most microprocessor systems and many mini-computers and mainframe computers. This book deals with the UCSD dialect of Pascal, and is directed toward a user with a working knowledge of BASIC (probably the easiest language to learn but hard to do anything complicated in). It primarily takes its examples from

the business rather than the scientific world, but the principles remain the same.

The first several chapters deal with names and with the multitude of ways of storing and indexing data in Pascal (i.e., scalars, sets, subranges, arrays, records, etc.). This is followed by the use of disk files, and basic input and output (this is one of the weakest features of Pascal, and is one of the main reasons for using FORTRAN if nicely formatted output is needed). The final chapters treat the structure and control of programs, including a bit on how to decide how a program should be implemented ("top-down" programming), and end with the UCSD Pascal supporting environment (editing, etc.). One appendix gives a number of very useful examples of I/O routines, which help to make up for the deficiency in the language itself, and a second appendix gives a short cross-reference between BASIC and Pascal functions.

The general level of the book is fairly simple and tutorial, but if you are already "computer-literate" it seems a bit informal. If the Apple in your lab or office is your first computer and you have started to outgrow BASIC, this is not a bad way to start to expand your horizons, but if you are already fluent in FORTRAN or C, you probably will be happier with a higher-level treatment.

Kurt W. Hillig, II, *University of Michigan*

Formulas, Facts and Constants. By H. J. Fischbeck and K. H. Fischbeck. Springer-Verlag, Berlin. 1982. 251 pp. \$14.00 (paperback).

This compilation was assembled by a physicist and a physical chemist who apparently found the CRC Handbook a bit cumbersome to carry. It is divided into five chapters, covering basic mathematical information, conversion factors and constants, atomic spectroscopy and structure, basic wave mechanics, and "...data useful in the laboratory". For data which may be of great importance to a researcher (e.g., the speed of light or isotopic masses) references are given. No obvious errors were found in a random sample of 40 pages.

The first chapter includes tables of basic constants, logs, error and hyperbolic functions, derivatives, and integrals, as well as geometric formulae, vector calculus, and common differential equations. The second covers the definitions of the SI units and conversions between these and other units (including board-feet, scruples, shakes, and townships), as well as an extensive list of fundamental and derived physical constants.

The atomic spectra and structures include the hydrogen atom in great detail, along with tables of Clebsch-Gordan coefficients, selection rules, and prominent X-ray and UV-visible-IR lines. Basic atomic and isotopic data include ionization potentials, atomic radii, ground state term symbols, and nuclear spin, parity, and half-life.

Ten pages on wave mechanics show solutions to the 1-D box and harmonic oscillators, then treat the hydrogen atom in some detail, including the calculation of transition dipoles.

The final chapter starts with vacuum system design, then moves to electronics where common symbols are defined, followed by resistors (and the resistivity of common metals) and RC circuits. This leads to a section on logic circuitry, binary arithmetic, and Boolean algebra which is not often found in handbooks. Next come the properties of electrons and electron beams and a section on nuclear radiation, with the end reserved for some basic properties of common materials, including thermal expansion coefficients and dielectric constants, the composition of alloys, thermocouples, and finally the Earth itself.

For those without the muscle to carry large volumes (and whose interest lies in atoms rather than molecules) this is a useful and accurate compendium.

Kurt W. Hillig, II, *University of Michigan*

Nuclear Magnetic Resonance. Volume 11. Specialist Periodical Reports. Edited by G. A. Webb (University of Surrey). The Royal Society of Chemistry, London. 1982. iv + 370 pp. £61.00 (\$121.00); £36.00 RSC members.

This volume follows the by now well-established format of annual (June 80-May 81) and biennial (June 79-May 81) surveys of the NMR literature. This volume opens with a list of six books and 536 review articles. The review articles are listed by the journal or conference volume in which they appeared, in general, with review articles in languages other than English organized by language. The 12 areas surveyed are the following: Theoretical and Physical Aspects of Nuclear Shielding (Cynthia J. Jameson); Applications of Nuclear Shielding (G. E. Hawkes); Theoretical Aspects of Spin-Spin Couplings (J. Kowalewski); Applications of Spin-Spin Couplings (D. F. Ewing); Nuclear Spin Relaxation in Fluids (A. Kratochwill); Solid State NMR (G. R. Hays); Multiple Resonance (W. McFarlane and D. S. Rycroft); Natural Macromolecules (D. B. Davies); Synthetic Macromolecules (J. R. Ebdon); Conformational Analysis (F. G. Riddell); Oriented Molecules (C. L. Khetrapal and A. C. Kunwar); and Heterogeneous Systems (W. Derbyshire).

The surveys average 12.5 ± 6 references per page with some reporters providing more complete background information, a more narrative guide to the literature, and a lower density of references than others. In some cases, the very large number of references (1347 in Heterogeneous Systems) virtually forces the adoption of a tabular approach for some of the material covered.

While there are some attempts to be evaluative, by and large these are not, nor were they intended to be, critical reviews of the areas covered. This volume and its predecessors are useful because references to papers on similar techniques or on similar systems are organized in a logical format. The interested reader can easily find references to papers of immediate interest as well as to papers on related topics. The editor and his reporters are to be commended for the manner in which they have organized their material and the 5000 references.

This series cannot replace a computer search of the literature, however, in part because such searches usually find articles in journals not yet delivered to libraries, whereas these volumes typically appear in libraries a year and a half after the date of the latest references (May 1981 in this volume). The primary utility of this series therefore is in enabling one to quickly locate papers in new areas of research or in areas related to the one in which one is working where one is unlikely to conduct routine computer searches of the literature. The period of time between the appearance of the latest cited paper and the appearance of this volume in libraries is regrettably long, however, due primarily to the publication and distribution processes (the editor and reporters completed their reports by October 1981). The volume as a whole could be more current if the policy were adopted of annual surveys of each area covered and the biennial schedule for some surveys were dropped. In the long run, it would be desirable and practical to utilize modern computer technology to reduce the production time of these (and similar) volumes, thereby further enhancing their value.

Gerald Ray Miller, *University of Maryland*

Topics in Enzyme and Fermentation Biotechnology. Volume 7. Edited by Alan Wiseman (University of Surrey, Guildford). John Wiley & Sons, New York. 1983. 314 pp. \$79.95.

The emphasis in this collection of review articles is on the use of whole cells as biocatalysts. Until recently the techniques available were not mild enough for immobilizing plant and animal cells. However, research in the last few years now makes it possible to exploit the biosynthetic capacity of eukaryotic cells. The chemical activities of methane-utilizing organisms are discussed extensively. The next chapter is devoted to the pre-treatment of materials prior to enzyme attack. Other topics covered are the following: microbial enzymes involved in the biodegradation of sulfated surfactants, thermophilic, anaerobic, and cellulolytic bacteria, immobilized enzymes in water and air purification, and fermentation processes for utilization of food wastes. The detailed chapter on monoclonal antibodies is an excellent introduction to the subject. An index and references are included. This book will be of interest to biochemists, biotechnologists, microbiologists, chemists, biochemical engineers, and workers in the food, brewing, textile, and pharmaceutical industries.

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

Annual Reports of Fermentation Processes. Volume 5. Edited by George T. Tsao (Purdue University, West Lafayette, IN). Academic Press, New York. 1982. ix + 323 pp. \$28.50.

This collection of papers will be of interest to biochemical engineers, biotechnologists, and microbiologists. The chapter on aeration and mixing in fermentation is a good introduction to the theories of aeration and the various kinds of aeration systems. Included in the discussion of cellulases is a description of a small scale technology for producing ethanol from agricultural residues. Other topics included in this volume are the following: amino acids and nucleic acid related compounds, recombinant DNA systems for application to antibiotic fermentation in *Streptomyces*, methods for the measurement of oxygen transfer in microbial systems, growth of *Saccharomyces cerevisiae*, thermophilic saccharide fermentations, and computer applications for analysis and control of fermentation. Extensive references and an index are included.

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

DNA Repair: A Laboratory Manual of Research Procedures. Volume 1. Parts A and B. Edited by E. C. Friedberg and P. C. Hanawalt. Marcel Dekker, Inc., New York. 1981. XVII + 273 pp (Part A) and XIX + 361 pp (Part B). \$29.75 (Part A) and \$39.75 (Part B).

The editors prepared this manual with the goal of compiling detailed technical descriptions of the methods commonly used to study DNA damage and repair. The text is organized into 44 sections, which were contributed by 38 "investigators with acknowledged expertise in each of the respective techniques presented". Interestingly, one-fourth of the contributors also acknowledge a current Stanford affiliation.

The sections are divided into nine groups according to subject matter. For example, six contributions present different assays for pyrimidine dimers and seven contributions describe assays for DNA strand breaks. Additional topics include the isolation of repair enzymes (five contributions), enzymatic detection of DNA damage (three contributions), and assays for chemical damage (six contributions) and for the measurement of repair synthesis (five contributions). Despite the number of contributions, the manual is far from complete and omits many interesting developments. For instance, the Ames test is not described, whereas six contributions are devoted to the use of eukaryotic cell culture as a model system for mutagenesis. There is no hint of the progress in identifying DNA damage at the level of the base sequence. The ingenious ideas that have gone into developing genetic assays with prokaryotic systems such as M13 are omitted. The editors acknowledge such omissions with the statement that "Notable current omissions, together with new developments in this rapidly changing field, will provide ample material for the projected additional volumes on DNA repair". Let the buyer beware that Volume 1 may be the first installment on a work of encyclopedic proportions.

The editors requested that the contributors provide "cookbook detail". The contributors satisfied this charge with precise descriptions of even the minute details of their favorite crafts. (My favorite recipe is a 30-component cell culture medium which includes 12364.0 mg/L of NaCl, 1.6051 mg/L of Folic acid, and so forth.) The manual is a success in the sense that it provides exact easy to follow recipes. However, there are two serious faults in the manual. Firstly, most (but thankfully not all) of the contributors are uncritical advocates of their particular techniques, and consequently little attention is given to the very important reasons for selecting between alternative approaches. This tremendous oversight could have been easily corrected by a short unifying preface to each section, giving an overview of the relative merits and applications of each of the different methods. Instead of a well-edited cookbook, this manual is a collection of favorite recipes. The second serious fault is that this manual is probably unedited.

For example, at least five contributions introduce the concept of a Poisson distribution to assay strand breakage. Would it not be more useful to describe this concept once with care? Each contributor could reference that central description and then describe whatever variations are appropriate to his section. Description of other very routine techniques and ideas such as bacterial and cell culture and media, phage growth and isolation, phenol extractions of DNA, isolation of closed circular DNAs, and definitions and uses of molecular weight averages are repeated by the various contributors. Again there is no critical comparison between the contributors' variations in routine methods, so it does not serve a useful purpose to repeat descriptions of what are often the same method. The editors should provide their contributors with a few master sauces to work into their entrees.

I do not recommend this as a useful laboratory guide.

Carl W. Schmid, *University of California, Davis*

Fundamentals of Enzymology. By Nicholas C. Price and Lewis Stevens (University of Stirling). Oxford University Press, New York and Oxford. 1982. xvi + 454 pp. \$49.00.

The aim of this book is to give a broad account of enzymology from isolated enzymes to the properties of enzymes within the cell. The book is written for the advanced undergraduate who has had an introductory course in biochemistry. In the first six chapters, approximately 60% of the book, the authors present the characterization of isolated enzymes including purification, structure, kinetic properties, mechanisms, and control of enzyme activity. This material is covered at about the same level as in a comprehensive introductory biochemistry textbook and is somewhat redundant for the book's intended audience.

In Chapters 7, 8, and 9, the authors discuss various aspects of organized enzyme systems. These chapters comprise the most interesting section of the book. Chapter 7 gives an excellent presentation of current knowledge on a number of multienzyme complexes including the pyruvate dehydrogenase complex, the carbamoyl phosphate synthetase, and fatty acid synthetase systems, as well as the associated enzymes of the aromatic amino acid biosynthetic pathway. The topic of Chapter 8 is the nature of enzymes in their native environment, within cells, and should be read by all investigators working with isolated enzymes. This chapter describes intra-cellular location on organization of different enzymes, enzyme systems associated with membranes, and in vivo concentrations of substrates and enzymes (in many cases, enzymes at higher concentrations than substrates). Enzyme turnover is presented in Chapter 9. The discussion of enzyme degradation is particularly informative. The final two chapters, 10 and 11, briefly describe clinical aspects of enzymology and enzyme technology, respectively.

In general, this book is well written and informative with many interesting examples provided from the literature. Its main strengths are

in Chapters 7 through 9 which describe enzymic properties in the in vivo setting.

James E. Erman, *Northern Illinois University*

Molecular Theory of Capillarity. By J. S. Rowlinson (Oxford University) and B. Widom (Cornell University). Oxford University Press, New York, NY. 1982. xii + 327 pp. \$59.00.

"This subject," the authors say in their Preface, "has a long history, an active present, and, we believe, an exciting future as it moves ever further into areas of great theoretical and practical interest such as the physics of membranes and colloids." Everything in this statement is amplified in the text, except for the practical connections to the physics of membranes and colloids, of which we hear nothing further. The subject is treated, if not historically, at least in historical order. Even as far back as the 18th century, it was recognized that the surface of a liquid is the field of play of intermolecular forces. The promise of obtaining insight into the units of discrete matter attracted the interest of many great physicists from Newton to Kelvin, including Young, Laplace, Gauss, Maxwell, Gibbs, and van der Waals. Einstein and Bohr also cut their intellectual teeth on this subject. The book has a superb first chapter, extensively referenced, on the pre-thermodynamic theories of capillarity, although it does not contain a detailed discussion of classical capillarity.

An account of Gibbs' thermodynamics of surfaces is followed by that of the contributions of van der Waals and his successors to the development of local or quasi-thermodynamics, and the closely related mean-field theory of the inhomogeneous interface. The advent of the statistical mechanics of non-uniform systems re-established the direct link between intermolecular forces and the macroscopic properties of liquid surfaces. This part of the subject is treated at length in the book, which includes a new general proof of the identity of the surface tension calculated from the virial of the pair potential and that from the direct correlation function. Next, results obtained from statistical mechanics are applied to some model systems by computer simulation and by approximating the exact equations. The book concludes with reviews of three-phase equilibria and of interfaces near critical points.

Both authors have made significant contributions to the subjects included in the book, but areas in which they have not been active, such as the use of contact angles to determine the surface energy of an interface at which one of the phases is solid, are left out. The book, therefore, has a decidedly theoretical tone; experimental results are seldom referred to and experimental techniques not at all.

The style of the writing is clear and terse (although the authors throughout use "which" in places where "that" would be both more correct and less inelegant) and displays mastery of the material. Evidently great care has been taken in the proof reading, for the equations and the references are exceptionally free from errors.

Sydney Ross, *Rensselaer Polytechnic Institute*

Organic Syntheses. Volume 61. Edited by R. V. Stevens. John Wiley and Sons, New York. 1983. xvi + 165 + 12 pp. \$24.50.

The arrival of a new volume of "Organic Syntheses" is always a treat. Over its long and distinguished history, the series has evolved from a simple collection of useful preparative procedures for specific substances to something much more valuable. Reactions that are more general are illustrated by representative examples, with indications of their scope. Recently reported reactions of probable synthetic potential are described with full experimental directions not given in the original publications. Sources of materials, cautions about hazards, alternative procedural details, and detailed directions for purification are included. A new volume of "Organic Syntheses" can play a significant role in increasing one's current awareness. In addition to the thirty checked preparations, a group of procedures not yet checked is listed at the end in equation form, to whet the appetite for the next volume (or, if one is impatient, unedited copies of these procedures may be ordered in advance).

An appreciation of the late Carl R. Noller graces the forepages.

Comparative Crystal Chemistry. By R. M. Hazen and L. W. Finger (Carnegie Institution of Washington). John Wiley and Sons, New York. 1982. xv + 231 pp. \$43.95.

This monograph deals with the X-ray crystallographic analysis of crystals under high temperature and pressure conditions. The book is divided into two parts. The first covers experimental procedures while the second is a summary of results. It will be of interest mainly to chemists involved in crystallography, solid-state, and material science.

The experimental section is excellent. A brief history of the development of heaters and high-pressure cells is presented followed by a nicely detailed description of contemporary devices. Problems associated with high-temperature and -pressure studies are presented along with state-of-the-art solutions. The second section provides a convenient

summary of structural variations with temperature and pressure for the specific systems that have been reported in the literature through June 1981. Complete references are provided as well as a useful list of suppliers and two computer programs for calculating strain tensors and polyhedral volumes and distortion parameters.

This book should be invaluable to anyone considering a high-temperature and/or -pressure structural study or anyone interested in structural variations with temperature and pressure. There is a definite need for monographs of this caliber in X-ray crystallography.

Lewis J. Radonovich, *University of North Dakota*

Inorganic Syntheses. Volume XXI. Edited by J. P. Fackler, Jr. John Wiley and Sons, New York. 1982. xvii + 215 pp. \$37.50.

This volume of the series exhibits the high standards of its predecessors. The editor, checkers, and authors have inserted many safety comments which will be of great assistance to workers using the procedures.

Chapter One describes the synthesis of metal chalcogenide compounds, including the synthesis of precursors such as CSe_2 and $(NH_4)_2S_5$. Chapter Two includes preparations for dinuclear and polynuclear compounds of several metals, including palladium, molybdenum, tungsten, ruthenium, and iron. The section on organometallic compounds includes thallium-, ruthenium-, titanium(III)-, vanadium(III)-, platinum-, and iron-containing substances. Chapter Four describes coordination compounds of carbon dioxide, nitric oxide, alkylated polyamines, and tetrahydrofuran, as well as stable copper(I) carbonyl complexes. The importance of solid-state substances leads to Chapter Five, which describes the synthesis of one-dimensional chain tetracyanoplatinate complexes. Chapter Six contains synthetic procedures for the preparation of stoichiometrically uncomplicated compounds, including tetraammonium diphosphate, uranium(V) fluorides and alkoxides, and *cyclo*-octasulfur monoxide. The last chapter provides syntheses of materials which are often used as ligands and reagents: substituted triaryl phosphines, vanadium dichloride, and uranium(IV) chloride. A synthesis of mercury(II)-free $[Pt(H_2O)_4]^{2+}$ stock solution is also included.

Arnulf P. Hagen, *The University of Oklahoma*

International Table of Selected Constants. 19. Water Vapor Line Parameters from Microwave to Infrared. By J.-M. Fland, C. Camy-Peyret, and R. A. Toth. Pergamon Press, Oxford and New York. 1981. 259 pp. \$75.00.

This book is essentially an atlas, and it consists of tables of the positions and intensities of the rotation and vibration-rotation lines of $H_2^{16}O$, $H_2^{17}O$, and $H_2^{18}O$ from 0 to 4350 cm^{-1} . Its appeal will obviously be great among atmospheric chemists. The first 22 pages contain textual material in English and French on energy levels and their calculation. Thereafter come tables, most of which are computer print-outs. The forepages contain a tribute, with a remarkable beginning, to the late William S. Benedict, to whom the volume is dedicated.

Progress in Solid State Chemistry. Volume 13. Edited by G. M. Rosenblatt and W. L. Worrell. Pergamon Press, Oxford and New York. 1982. v + 386 pp. \$112.00.

The contents of this volume were previously published in the serial of the same title (1981, No. 1 to 4). The six reviews are now bound in boards and are supplemented by a subject index and a list of the contents of previous volumes.

Analytical Methods for Pesticides and Plant Growth Regulators. Volume X. New and Updated Methods. Edited by G. Zweig and J. Sherma. Academic Press, New York. 1978. xviii + 587 pp. \$29.25.

This volume consists of 46 contributed chapters, each on a specific commercial chemical, containing brief summaries of synthesis, properties, reactions, and toxicity, followed by detailed directions for determination in formulations and residues.

McGraw-Hill Encyclopedia of Chemistry. Edited by S. P. Parker. McGraw-Hill Book Co., New York. 1983. 1195 pp. \$49.50.

This volume consists entirely of material previously published in "Encyclopedia of Science and Technology", from which 790 complete entries relating to chemistry have been selected and recombined in alphabetical order. Although it is more efficient for most needs of chemists to have this material collected in one volume, the same gaps remain; some important subjects, such as ylides and phase-transfer catalysis, do not appear, for example.

The individual entries vary from one paragraph to several pages, and generally contain a great deal of succinct information. However, some entries are somewhat vague where precision would have been shorter and more useful; for example, under Formic Acid, it is stated to be "stronger than acetic acid", but the value of K_a is not given. The flaws in the larger parent work, noted in a previous review, are repeated. Benzene rings are

represented in a distractingly large variety of ways, which can only cause confusion for the chemically unsophisticated reader. Nomenclature is a weak point, a particularly unfortunate fact for a work that will be consulted most often by neophytes who will regard it as authoritative. What is the reader to understand by the name "diethylene glycol terephthalate"? It turns out that the compound that the contributor meant is not an ester of diethylene glycol at all, but is bis(2-hydroxyethyl) terephthalate. In another place " ϵ -aminocapro lactam" is stated to be the complete name for ϵ -caprolactam, whereas the former name corresponds to a completely different substance, having two nitrogen atoms (the IUPAC rules are quite explicit on this point). In still other places, sloppy orthography, such as "paraxylene", can be found.

Although this is undoubtedly a useful book, and is reasonably priced, it suffers from inattentive editorial control.

Advances in Heterocyclic Chemistry. Volume 32. Edited by A. R. Katritzky. Academic Press, New York. 1983. ix + 404 pp. \$74.50.

This volume consists of four chapters on subjects new to the series, and one that brings a previously treated subject up to date. Adrien Albert writes about methods of constructing a pyrimidine ring fused to an existing ring, a subject of much interest in medicinal chemistry. John Barker reviews *gem*-dithienylalkanes, compounds that have assumed importance as synthetic intermediates because the sulfur atoms can ultimately be removed so as to produce non-heterocyclic structures. Leroy Klemm continues the treatment of thiophenes by reviewing tetracyclic and pentacyclic condensed thiophene systems. There is a surprising amount of information on the no less than 99 parent ring systems involved, largely because of their relation to dyes, fossil fuel components, and carcinogenicity.

The isomers of the familiar pyrrole system, the *2H*- and *3H*-pyrroles, also known as isopyrroles and pyrrolenines, are reviewed by M. P. Sammes and A. R. Katritzky. The *2H*-pyrroles, which are believed to be involved in some biosynthetic processes, have a long history, but the first *3H*-pyrrole was reported only in 1967. In the last chapter, Frederick Kurzer brings the subject of 1,2,4-thiadiazoles up to date from his review of 15 years ago.

As is usual in this series, the quality of style, presentation, and typography is high. Only the lack of a subject index is felt (there is a cumulative index of titles for the series, however).

The Quality of Foods and Beverages. Volume 2. Edited by George Charalambous (Agricultural and Food Chemistry Division of the American Chemical Society) and George Inglett (U.S. Department of Agriculture). Academic Press, Inc., New York, NY. 1981. xvii + 390 pp. \$26.50.

This is the second volume of Proceedings of a Symposium of the Second International Flavor Conference, held July 1981 in Athens, Greece. It includes 27 papers by noted scientists over a wide range of subjects. About half of these cover recent developments in flavor research. Several papers illustrate the developing roles of computers in flavor analysis and one describes the use of sophisticated analytical instruments to control processing operations on line. Among reports of the food related flavors are the following: enhancing of fruit flavors; role of enzymes in flavors of dairy products; chemical nature of liquid smoke; organoleptic changes of spices in food during storage; and methods of incorporating meat flavors in textured vegetable protein. A paper I found particularly interesting was Development of a Flavor at IFF, Planning, Creation and Commercialization. Manfred Vock describes the necessity of intricate cooperation of the many facets of an R&D team in creating a flavor, from establishing an objective or target product to the final profit evaluation. He illustrates this process with IFF's attempt to enhance cocoa flavor.

Papers on legumes include the following: studies of plant protein additives as functional ingredients in foods; reports on advances in processing treatments for separation of high protein fractions from milled bean flour; and recent developments in Shoyu (soy sauce) research including manufacture, flavor, and safety aspects.

Two papers deal with microbiology: one describes a mechanical device for making viable counts, and the other relates to the ability of certain components in foods to affect water uptake and consequently microbial growth.

Several articles describe foods of certain countries: Views on New Food Developments in Sweden, Novel Food Proteins: View in Italy, and Certain Elements in Greek Wines. Among the other papers is an interesting report on the possible role of carotenoids in stimulating immune reactions and on rejecting viral tumors and another on the method for determining adulteration of cocoa butter with vegetable fats by means of GLC measurements of triterpene alcohol acetates. Additional papers cover areas from California wines to Macademia nuts.

This book should be of interest to most professional food scientists and

scholars interested in quality of foods.

Richard Bassette, Kansas State University

Chemistry of Foods and Beverages: Recent Developments. Edited by George Charalambous (Agricultural and Food Chemistry Division of the American Chemical Society) and George Inglett (U.S. Department of Agriculture). Academic Press, Inc., New York, NY. 1982. x + 348 pp. \$29.50.

This book is a compilation of selected papers from two conferences: the Second International Flavor Conference held in Athens, Greece in July 1981, and the conference on Formulated Foods and Their Ingredients: Recent Progress in Chemistry, Nutrition and Technology, held in Anaheim, California in November 1981. The 17 papers presented represent a very broad range of topics. Eight of these deal with either chemical or sensory analysis of flavors and would be valuable to persons specifically interested in methodology in these areas. Among the papers emphasizing chemical methods are such subjects as changes in aroma components in processing and storage of hops; concentration of flavor volatiles on Tenax in evaluating quality of fruits; head space analysis of flavors with capillary columns and multidetector systems; use of fused silica capillary columns for flavor analysis; combining preparative TC in series with a computer-assisted highly efficient capillary GC system to evaluate carrot volatiles. Several papers on sensory aspects of foods include the following: a description of micro-olfactometer used to evaluate highly purified enantiomers of a series of stereoisomers; relationship of production process to taste (flavor) of soy protein hydrolysate; and the fundamental role and usage of flavor nucleotides in foods.

It is difficult to group the rest of the papers because the range of topics is so broad. Two of these involve corn-derived sweeteners; one describes manufacture, use, and nutritional aspects of high-fructose corn sweeteners, the other covers applications and functional properties of corn sweeteners. Two papers deal with polydextrose; one with the preparation, properties, and safety of this new food ingredient; the other with its functional properties. Two other somewhat related topics are as follows: a report on the use of soy protein isolates in the fabrication of low moisture extruded high protein foods; and a paper describing the wide variety of fabricated foods with currently available extrusion cookers. Among the other papers are such diverse subjects as the use of dairy base ingredients in formulated foods and developments and applications of xanthan gums.

There are a few problems with the book. Aside from the diversity of subject matter, papers were reproduced by offset printing apparently pretty much as they were submitted. Printing and style were different from one chapter to the next. Construction of tables and figures was quite casual in some papers and in a few, headings were poorly defined. Some figures have printing that is hard to read. There was not a consistent format for literature citations and there were quite a few typographical or spelling errors that were obviously on the original manuscript.

The title of this book may be somewhat misleading. If one considers the subject matter recorded in my review, it is apparent that it covers a relatively narrow segment of recent developments in the chemistry of foods and beverages.

In spite of these deficiencies I found the book worthwhile. The contributors have a great deal of expertise in the topics covered.

Richard Bassette, Kansas State University

History of Polymer Science and Technology. Edited by Raymond B. Seymour (University of Mississippi). Marcel Dekker, Inc., New York. 1982. viii + 410 pp. \$65.00

The history of *natural* polymers can be traced as far back as civilization itself through such evidence as 200 000-year-old Neanderthal scraping tools to prepare skins for clothing, patterns of weaves on 35 000-year-old clay vessels from the Old Stone Age, 17 000-year-old Altamira cave paintings by Cro-Magnon man, and more recent flax weavings by Swiss Lake Dwellers 10 000 years ago. However, *synthetic* polymers were not prepared until the late 1800's, and an understanding of their macromolecular structure was not realized until Hermann Staudinger's brilliant and relentless work in the mid-1920's. Before that time, chemists were reluctant to admit the existence of giant organic molecules. As one skeptical chemist remarked at the Düsseldorf meeting of the Gesellschaft Deutscher Naturforscher and Ärzte in 1926, which was arranged in order to confront Staudinger, "We are shocked as zoologists would be if they were told that somewhere in Africa an elephant were found which was 1500 feet long and 300 feet high!"

In the book, Hermann Mark recalls similar incidents from the 1936 Faraday Society Meeting in Cambridge where Wallace Carothers presented his original classification of addition and condensation polymers, and the first IUPAC Polymer Conference in Liege in 1947, at which polymer chemistry was finally accepted as an established chemical dis-

cipline. Equally delightful are Raymond Boyer's personal reminiscences of people-related and chance-dependent events during 40 years of development of styrene and polystyrene at the Dow Chemical Company, and Waldo Semon's personal recollections of the early years of development of vinyl chloride polymers at the B. F. Goodrich Company.

The book results from a symposium sponsored jointly by the History, Organic Coatings and Plastics, Polymer, and Rubber Divisions of the American Chemical Society at its 179th National Meeting in Houston in 1980, and includes a total of 20 papers by pioneers in the field covering the history of biopolymers, polymeric foams, natural and synthetic fibers, coatings, adhesives, thermosetting polymers, organometallic polymers, engineering thermoplastics, crystalline polymers, polymer education, vinyl chloride polymers, natural and synthetic rubber, reinforced plastics, polyolefins, polystyrene, heat resistant polymers, and irradiation cross linking.

Overall, the text provides a fascinating insight into the elaboration of many areas of polymer science and technology, particularly during the 30-year period of spectacular development from the 1920's to the 1950's which resulted in our present understanding of polymer structure, synthesis, and design. It is a worthwhile addition to the libraries of polymer scientists, engineers, and educators.

Frank J. Bockhoff, Cleveland State University

Small Ring Heterocycles. Part 1. Aziridines, Azirines, Thiiranes, Thiirenes. Edited by A. Hassner. John Wiley and Sons, New York. 1983. vii + 696 pp. \$175.00.

This book is intended to bring up to date the reviews of the subject written 20 years ago. The productivity of chemists active in the subject has been so great that, although the reviews build on the earlier ones rather than repeat them, the aziridine chapter alone has 966 references. The present reviews appear to have been written in 1980, for whereas references to 1979 are abundant, hardly any are cited after that, except in terminal paragraphs, headed Recent references, covering 1980 and 1981.

The chemistry of aziridines, reviewed by James Deyrup, has a long history, but great progress has been made on all fronts in the last 2 decades in synthesis, understanding of structure, and reactions. The unsaturated analogues, the azirines, have stolen the show, however, for in 1964, only 3 pages were required to review them, but the present chapter by Vasu Nair is no less than 118 pages long. Nearly all of the work concerns the 1-azirines, for the isomers with the double bond between the two carbons are evidently too unstable to allow isolation. The final chapter, by Uri Zoller, is devoted to all three-membered rings containing sulfur, whether saturated or unsaturated, oxygenated at sulfur or not, or containing nitrogen or oxygen in the ring as well. These three chapters could each stand individually as books in their own right.

As usual in this series, there are extensive indexes of authors and subjects, augmented by unusually detailed tables of contents at the beginning of each chapter. The latter feature makes the book easy to use. The abundance of clearly drawn structures and equations also facilitates browsing.

Annual Reports on the Progress of Chemistry. Volume 78. 1981. Section B: Organic Chemistry. Edited by A. G. Davies and P. J. Garratt. The Royal Society of Chemistry, London. 1982. xvi + 415 pp. \$114.00.

The 14 contributed chapters in this volume of reviews of the chemistry of 1981 include the customary major chapters on broad topics, such as Alicyclic Chemistry, Heterocyclic Compounds (why not "Chemistry"?), Biological Chemistry, etc. In addition, there are special parts on High-pressure Chemistry and on Prostaglandins. The contributions are heavily documented, as is customary, and yet are not too difficult to read. These reports are a handy way to keep from becoming too parochial in one's professional reading, as well as being a useful means for achieving recent awareness. Loads of clear structures and equations make skimming easy. The table of contents is apparently intended to double as a subject index, but although it is 8 pages long, it does not quite do the job. The section on High-pressure Chemistry, for example, is not subdivided at all, but on the other hand, the section on synthesis of prostaglandins is conveniently broken down into 17 sub-entries in the Table of Contents. Treating other sections in the same way would aid the reader substantially.

Annual Reports on the Progress of Chemistry. Volume 78. 1981. Section C: Physical Chemistry. Edited by M. C. R. Symons. The Royal Society of Chemistry, London. 1982. xvii + 467 pp. £44.00; \$95.00.

The ten chapters in this volume are an assortment of broad reviews and narrowly focussed ones. A chapter on gas-phase molecular spectroscopy of over 150 pages, devoted to results, is the second part of the subject, the first part of which, on methods, was reviewed in 1979. The other nine, much shorter chapters include Laser Chemistry, Phase Transitions in Ionic and Molecular Solids, Mössbauer Spectroscopy,

Carbon Acid Reactivity, Electron-Spin Resonance, Spectroscopic Investigations of Metalloproteins, and Modified Electrodes. Many of these subjects are obviously of much interest to other than physical chemists.

The chapters feature the usual comprehensive documentation, and the table of contents is quite detailed in order to substitute for a subject index. There is, however, an author index. The value of the books in this series as a means of keeping abreast of the literature flood is maintained.

Amphoteric Surfactants. Volume 12. Surfactant Science Series. Edited by B. R. Bluestein and Clifford L. Hilton (Witco Chemical Corporation). Marcel Dekker, Inc., New York, NY. 1982. v + 343 pp. \$55.00.

This volume examines amphoteric, a class of surfactants that has gained increasing importance in the marketplace because of its beneficial impact on consumer products, such as shampoos. The following topics are covered: Imidazoline Derivatives (A. Christiansen), Betaines (R. Ernst and E. Miller, Jr.), Lecithin and Related Phosphatides (R. Cowell, D. Sullivan, and B. Szuhaj), Macromolecules as Amphoteric Surfactants (R. Cowell and B. Bluestein), Miscellaneous Polar Surfactants (B. Bluestein and R. Goldsmith), and Analysis and Testing of Amphoteric Surfactants (C. Hilton and B. Kapur).

A comprehensive discussion of the synthesis, physical properties, and applications of amphoteric surfactants is included in each of these chapters. The authors depict an extensive amount of experimental information in tables to provide the reader with a direct opportunity to analyze the unique attributes of these species. Each topic is supplemented with a substantial listing of references.

I recommend this book as a valuable reference tool for chemists in both the industrial and academic domains.

Neil Canter, *Stepan Chemical Company*

Fundamental Principles of Polymeric Materials. By S. L. Rosen (University of Toledo). John Wiley & Sons, New York. 1982. xvi + 346 pp. \$32.50.

The title misrepresents this book. Good descriptions of polymer behavior are given, but the *fundamental* underlying theory and associated equations are frequently absent. Example: theta solvents are mentioned, but excluded volume which creates the need for them is not. The basis for separation by GPC is never stated explicitly, but is only hinted at in a parenthetical aside. The confused discussion of the glass transition seems to stem from the author's reluctance to acknowledge the conventionally measured T_g as a thermodynamically nonequilibrium quantity. In contrast to his comment, one practical consequence of this phenomenon is the observed embrittlement with aging of some polymers.

The text was developed from material in a course given by the author to chemical engineers, and it is to that audience that it is largely directed. Example: the chapters on viscous flow give numerous examples using a "power law fluid". The latter is a useful approximation for engineering calculations over a limited range of shear rates but reveals nothing concerning the molecular basis for non-Newtonian flow. Graessley's theory, which does provide such a basis, is not mentioned.

The author frequently adopts a conversational style. While this can be a useful pedagogical device in the classroom, it is redundant and distracting in print. In a similar vein the use of cute phrases—small polymer molecules "sneak through" the membrane—might better be left to a junior high text.

On the positive side are the large number of excellent problems with worked-out answers providing practical applications of the material. (However, the solution to the problem on page 46 is erroneous.) The discussion of applications is interesting and current.

This book is recommended to those seeking a qualitative introduction to polymer science. The serious scientist or engineer seeking "fundamental principles" must look elsewhere.

Robert A. Stratton, *The Institute of Paper Chemistry*

Developments in Block Copolymers. Volume 1. Edited by I. Goodman (University of Bradford, UK). Applied Science Publishers, Ltd., Barking, Essex, England. 1982. (Distributor in US and Canada: Elsevier Scientific Publishing Co., New York, NY.) X + 358 pp. \$82.50.

This excellent book contains eight chapters. The first four deal with general principles; they are followed by a chapter describing techniques for preparing block copolymers and three chapters dealing with polyurethanes. J. M. G. Cowie deals with the domain formation in block copolymers such as poly(styrene-*b*-isoprene), and particularly with the influence of the solvent from which the block copolymer is cast, on the properties of the material. The chapter contains a surprising error in suggesting that Stockmayer's treatment of the interaction parameter and light scattering behavior pertained to solutions of block copolymers rather than random copolymers. C. Price deals with the association of block copolymers in dilute solution to micelle-like aggregates. The chapter cites

evidence that the aggregates have a narrower weight distribution than the constituent chain molecules; this concept contradicts an observation made by Doty many years ago that for polymers with a constant density of interacting groups, the average numbers of chains forming an aggregate increases with the chain length. A. E. Skoulios, one of the early pioneers of the study of the mesomorphic properties of block copolymers, contributes a brief account of the study of the geometry of phase separation by X-ray diffraction and electron microscopy. E. Helfand and Z. R. Wasserman give an account of their statistical thermodynamic theory of phase-separated structures, including the important treatment of the diffuse phase boundaries characteristic of such systems. A long, beautiful chapter by I. Goodman on the synthesis and properties of block copolymers prepared by the coupling of various "prepolymers" is in itself a sufficient reason to acquire this volume. It contains some interesting historical comments, e.g., the role played by the finding that the silk fibroin chain contains sections of crystalline and sections of amorphous polypeptides in stimulating the synthesis of a polyester built up on the same principle. Chapters by P. E. Gibson, M. A. Vallance, and S. L. Cooper and by R. W. M. van Berkel, S. A. G. de Graaf, F. J. Huntjens, and C. M. F. Vrouenraets give an excellent account of the properties of segmented copolymers containing "soft" and "hard" segments. The final chapter, by D. C. Allport, C. Barker, and J. F. Chapman, deals with the important new fabricating technique of reaction injection molding.

In spite of the high price of this volume, its purchase should be well worth while for anyone interested in this area of polymer science.

Herbert Morawetz, *Polytechnic Institute of New York*

Advances in Organometallic Chemistry. Volume 21. Edited by F. G. A. Stone (University of Bristol) and R. West (University of Wisconsin, Madison). Academic Press, New York. 1982. vii + 304 pp. \$52.00.

The first chapter (55 pages, 112 references) is on Functionally Substituted Cyclopentadienyl Metal Compounds and is by D. W. Macomber, W. P. Hart, and M. D. Rausch. It is a comprehensive survey of synthetic routes to this class of compounds. The only important substituents excluded are the hydrocarbyl and silyl groups. The review focuses exclusively on synthetic procedures, with little discussion on the properties of such compounds. However, I do not believe that this will detract from the usefulness of this review to synthetic organometallic chemists.

Metalloboranes: Their Relationships to Metal-Hydrocarbon Complexes and Clusters is discussed by C. E. Housecroft and T. P. Fehlner in the second chapter (56 pages, 251 references). It is an excellent review which encompasses both a structural comparison between metalloboranes and conventional transition metal cluster compounds, as well as a comparison based mainly on theoretical grounds between boranes and unsaturated hydrocarbons as ligands for transition metals. The arguments are thought-provoking and should stimulate new interest in this area of chemistry. The review also incorporates brief sections on synthesis of metalloboranes and their solution characterization by ^{11}B NMR techniques.

The chapter on Mechanistic Pathways for Ligand Substitution Processes in Metal Carbonyls by D. J. Darensbourg (38 pages, 170 references) is a review of "the basic mechanistic chemistry of ligand substitution reactions of octahedral metal carbonyl complexes", the discussion being confined to mononuclear compounds. Although not comprehensive, it is an excellent summary of our current knowledge on this class of reactions by an expert in the field. This review should be a good starting point for someone venturing to undertake similar studies on multinuclear carbonyl clusters.

The last two chapters are somewhat more specialized in nature. 1,4-Diazo-1,3-butadiene (α -Diimine) Ligands: Their Coordination Modes and the Reactivity of Their Metal Complexes are discussed by G. van Koten and K. Vrieze (89 pages, 189 references). It is a comprehensive review which encompasses the synthesis, structure, and reactivity of this class of ligands and their metal compounds, and every aspect of the chemistry has been thoroughly discussed.

The last chapter (47 pages, 114 references) is devoted to Multiply Bonded Germanium Species and is by J. Satgé. It is a thorough and systematic discussion of the synthesis and chemistry of molecules containing Ge=X bonds (X = Ge, C, N, P, Bi, O, S, and Mn) by an expert in the field. Results of theoretical and spectroscopic studies on these molecules have also been described. This review should stimulate further interest in this remarkable class of compounds.

This volume, like the preceding volumes in this series, is a valuable addition to the literature on organometallic chemistry and should find its place in research libraries. However, due to its relatively high price, it is unlikely to grace the shelves of many private collections.

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