Book Reviews

Quantum Science, Methods and Structure. Edited by J. L. CALAIS, O. GOSCINSKI (University of Uppsala), J. LINDERBERG (University of Aarhus), and Y. OHRN (University of Florida). Plenum Press, New York, N.Y. 1976. vii + 595 pp. $49.50.

This volume is dedicated to Per-Olov Löwdin and contains the work of many researchers associated in one way or another with Löwdin over the years. There are several distinct sections to the volume. In the first part a few workers offer personal recollections of Löwdin as a researcher, teacher, and friend. A bibliography of Löwdin's work is given. There are 39 chapters presenting a variety of research topics that have interested Löwdin over the years. Of course, a number of contributions deal with the non-orthogonality or overlap problem. There are several papers concerning methods of numerical calculation, including a 34-page chapter by J. C. Slater on power series methods for cellular calculations in the $X\alpha$ method. Another area of special interest is the problem of bounds in different types of calculations. E. Brandas presents a review of the Löwdin bracketing function. Four chapters are devoted to perturbation theory. The correlation problem also receives a good bit of attention. The volume concludes with a number of chapters presenting results of calculations on problems of applied chemistry. A discussion of proton tunneling and mutagenisis by Abdulnur and one on hydrogen bonding by Ratner and Sabin are included.

In many of the articles there is an attempt to make the discussion self-contained by including a review section on the methodology (some of the papers, such as C. E. Reid's on lower energy bounds, are intended to be reviews). Although this aids in making the work more accessible to the general audience of chemists, the text will still be of interest mainly to the specialist (however, this includes a large variety of specialists). The importance and quality of the papers vary, as would be expected. Although some of the papers appear to be routine, others are attempting to set forth matters of fundamental importance. Examples of the latter group would be J. C. Slater's article and D. A. Micha's paper on the many-body theory of molecular collisions (this, as others, has several typographical errors).

In summary, the volume shows the influence, diversity, and enthusiasm of one of the pioneers in the field of quantum chemistry. It is a fitting tribute.

James M. Howell, *Brooklyn College, City University of New York*

Chemical Kinetics: A Modern Survey of Gas Reactions. By JOHN NICHOLAS (University of London King's College). Halsted Press (John Wiley), New York, N.Y. 1976. xii + 241 pp. $19.50.

The subject of this text is homogeneous gas-phase reaction kinetics. The level of presentation is appropriate for a student who has completed introductory, full-year courses in calculus and physical chemistry, with the latter preferably including an introduction to statistical thermodynamics. The coverage begins with a review of basic kinetic principles, proceeds to a well-placed discussion of molecular activation processes, gives a brief description of most classical and modern experimental techniques for monitoring reaction rates, and introduces the commonly used theoretical approaches to describing reaction rates. The latter half of the book concentrates on radical reactions, molecular dynamics, and nonthermal (photochemical, hot atom, ion-molecule) reactions. Examples used range from historical landmark studies to topics of current research interest such as the ion-molecule chemistry of the upper atmosphere.

This book appears to have been composed from lecture notes developed over a period of years. The text is lucid and well organized, and the figures are unusually large and clear. The problem sets following each chapter are relevant, appropriate in level of difficulty, and nonredundant. SI units are used throughout, except that pressures are given in both Nm^{-2} and torr in each instance. Perhaps unavoidably, the author's attempt to describe a wide variety of experimental methods has led to the inclusion of some incorrect statements about techniques with which he is not personally familiar. The description of shock tube techniques contains at least three misstatements, such as the allegation that sampling of hot reacting gas for mass spectrometric analysis is usually accomplished through a "pin-hole". Another limitation is that the referenced papers and suggested "Further Readings" appear to have been chosen on the basis of historical value or familiarity to the author, and are sometimes not the most complete or up to date. Although the text in general is quite free of typographical errors, a quick perusal of the literature references revealed three incorrect citations. The author has also bowed to the all too common habit of failing to include literature references on some tables of data.

The chapter devoted to reaction rate theories seems the least extensively developed. There is a good historical development of unimolecular reaction rate theories, but recent important contributions to RRKM theory, such as by Forst, are not included. Also not discussed are the contributions, particularly by Benson, in the area of kinetic predictions from thermodynamic considerations. Throughout the text, the strict adherence to homogeneous kinetics is evident. No mention was found of the important areas of homo- or heteromolecular nucleation, or of reactions with or at surfaces.

Overall this book's strong points outnumber its shortcomings, and it merits serious consideration for adoption as a class text for courses in gas kinetics at the advanced undergraduate or beginning graduate level. It should also be a good choice for chemists in other fields who wish to get an overview of this field on their own. However, it will be of less use to the person beginning research in gas kinetics and seeking direction to the pertinent literature and reviews in his area.

David K. Lewis, *Colgate University*

Advances in Free Radical Chemistry. Volume V. Edited by G. H. WILLIAMS (Bedford College). Academic Press, London. 1975. vi + 394 pp. $34.00.

This volume contains five chapters, each authoritatively written, apparently thorough, and containing references through 1973, with a few later references submitted as addenda requested when a publication delay became clear.

Of the five chapters, two are of fairly general interest: "Chemically Induced Dynamic Nuclear Polarization. Theory and Applications to Mechanistic Chemistry", by Kaptein, and "Configurations and Conformations of Transient Alkyl Radicals in Solution by Electron Spin Resonance Spectroscopy", by Kochi. These two chapters are also the most appropriate for a book entitled "Advances in etc.", for the references are mostly very recent because the work is recent. The other three chapters are "Homolytic Substitution Reactions of Polyfluoroaromatic Compounds", by Bolton and Williams, "Diels-Alder and 1,4-Diradical Intermediates in the Spontaneous Polymerization of Vinyl Monomers", by Pryor and Lansdell, and "Formation and Reactions of Free Radicals from Pyrolysis of Nitro Compounds", by Fields and Meyerson. These three chapters are vey highly specialized, and they cover less recent work, since more than half of the references are to work published more than ten years before the publication date; this is quite reasonable since the subjects have not been recently reviewed.

Libraries associated with laboratories with active free-radical research will want this volume. This reviewer feels, however, that potential readers, science in general, the authors, libraries, and possibly even the editors and publishers would be better served by avoiding the publication and purchase of such collections of highly diverse, highly specialized reviews. The more widely circulated and read standard review journals offer faster publication as well as lower cost per review.

Edward S. Lewis, *Rice University*

Charged Gels and Membranes. Part I: Edited by E. SÉLÉGNY, H. BOYD, and H. P. GREGOR. **Part II:** Edited by E. SÉLÉGNY (Volumes 3 and 4 of the series: Charged and Reactive Polymers). D. Reidel Publishing Co., Boston, Mass. 1977. Part I: xxiii + 305 pp. $39.00. Part II: xi + 244 pp. $26.00.

These two volumes are the proceedings of the "Advanced Study Institut" meeting in Forge les Eaux (France) in September 1973. Most

of the published articles are, however, updated to 1974. They are far from being a homogeneous lot since they deal with very different aspects of membrane research.

Part I, dedicated to the 70th anniversary of Karl Solner and Torsten Teorell, starts with the written version of their opening lectures, presenting the history and the development of membrane research. Solner's paper gives a delightful presentation of the views and the approaches of the old masters of physical and colloid chemistry like T. Graham, W. Ortwald, M. Traube, W. Nernst, F. G. Donnan, J. Bernstein, F. Haber, L. Michaeli, H. Freundlich, J. Loeb, A. Bethe, etc., which is both historically interesting and pedagogically instructive.

The heterogeneity of the topics discussed in these two volumes made it difficult but therefore very essential to arrange the sequence of the articles in a didactically consistent form. The technical papers start with two papers on equilibria in polyelectrolyte gels by Boyd and Rinaud. Then there comes a series of six papers on application of irreversible thermodynamics which for some unknown reason includes a paper by Brun, Interaction with Ion Exchanges, which should be in the section on Equilibria. The other five papers in this section consist of three of a theoretical nature: Uses of Membrane Transport Coefficients by Meares; Interpretation of Membrane Phenomena using Irreversible Thermodynamics by Paterson, et al.; and Transconformation Surface Reaction and Hydrodynamic Stability by the Sanfeld couple. The other two papers by Sélégny and Bourdillon are experimental. They deal with the use of phenomenological coefficients for correlation and interpretation of results of Measurement of Fluxes and Forces at the Surface of Cation Exchange Membranes.

Part I of Charged Gels and Membranes ends with a section on Ultra- and Hyper-Filtration Membranes which contains papers on the following topics: Fixed Charge Ultrafiltration Membranes by Gregor; Osmosis and Ion Transport in Charged Porous Membranes by Sonin; Membrane Potentials of Asymmetric Cellulose Acetate Membranes by Pusch; and Polarization at Membrane-Solution Interfaces in Hyperfiltration by Minning and Spiegler.

It would be appropriate if this section would be lumped together with sections 3 and 4 of Part II which are on Charged Mosaic and Arrays and on Carriers and Charges. They contain the papers by Caplan on Charged Membrane Arrays, by Krasne and Eisenman on the Ion Selectivity of Carrier Molecules, by Kedem et al. on Valinomycin-Induced Ion Specificity, and by Varoqui and Pfeferkorn on Ion Exchange and Structural Properties of Macromolecular Carrier in Liquid Membranes. The three sections have in common the interrelation between the structure and composition of the membranes and their transport properties. The three sections should be preceded by the section dealing with spectroscopic investigation of Interaction and of Conformation in membranes which contains two papers: Electronic Spectroscopy of Complex Species in Polyelectrolyte Gels by Heitner-Wirguin and The Influence of Cations on the Conformation of Biological Membranes and Macromolecules by Zundel. They should be then followed by the section on Nonisothermal Transport and concluded by the section on Fluctuation, Oscillation Excitation. These two last sections comprise the following articles: Non-Isothermal Transport Phenomena in Charged Gels and Membranes by Lorimer; the Effect of Temperature on Ouabain on Membranes of Valonia Cell by Thorhaug, Field Fluctuation in Ionic Solutions and Membranes by Oosawa; Non-Linear Transport and Oscillation in Fixed Charge Membranes by Teorell; and Physico-chemical Properties of the Nerve Membrane by Tasaki. The very fundamental article on Oxidation-Reduction Polymers by G. Manecke, to whose 60th (and Körösy's 70th) anniversary Part II has been dedicated, stands by itself with remote relation to the other subjects discussed in these two volumes. It has, however, a bearing on the oxi-reduction and electron transport processes in many vital biological membranes.

On the whole, the general standard of the articles presented in these two volumes is very good and they may be of great use to people interested both in synthetic and in biological membranes.

Israel R. Miller, *The Weizmann Institute of Science*

Surface and Defect Properties of Solids (A Specialist Periodical Report. Volume 5). Senior Reporters: M. W. ROBERTS (University of Bradford) and J. M. THOMAS (University College of Wales). The Chemical Society, London. 1976. ix + 233 pp. £16.00.

This volume presents a review of recent literature published up to mid-1975, providing excellent critical reports in a series of highly specialized research areas. The eight chapters deal with a wide range of topics, several of which should prove valuable to researchers in the field.

The first chapter successfully ties together certain aspects of topics included in the remainder of the book. The subject of disclination structures in carbonaceous mesophase and graphite is presented in the second chapter, while the effects of surface defects on the vaporization of arsenic and antimony are treated in the third chapter. These and other chapters discuss the application of old and new instrumental techniques as applied to specific topics. Chapter 4 deals with the problems encountered in studying defects in organic crystals when using an electron microscope.

Chapter 5 is devoted to metal-catalyzed dehydrogenation of hydroaromatic compounds. In this chapter, using a model related to that developed by Balandin, Tetenyi relates the activity of the various metals to their respective interatomic distances. The effects of different adsorbates on the ultraviolet photoemission spectra of surfaces are treated in Chapter 7, while Chapter 8 illustrates the application of secondary ion mass spectrometry as a technique for studying surface reactivities. The final chapter discusses a combination of Chemical Physics and Organometallic Chemistry of transition metal surfaces. The extremely valuable conclusions following each chapter briefly review the article and predict future developments.

Each author should be commended for his efforts since each chapter represents much careful work. The book is a useful aid to those scientists who desire to keep abreast of their respective specialties.

Laurence D. Neff, *East Texas State University*

Foreign Compound Metabolism in Mammals. Volume 4. Senior Reporter: D. E. HATHWAY (Central Toxicology Laboratory I.C.I. Ltd). The Chemical Society, London. 1977. xii + 411 pp. $55.00.

The book contains four chapters that review the literature published during 1974–1975 in the field of drug kinetics, biotransformations, mechanisms of biotransformation, species, strain, and sex differences in metabolism.

P. G. Welling reviews drug kinetics in Chapter 1. He discusses the processes of drug absorption, distribution, metabolism, and excretion and the rates at which these events occur for a wide spectrum of drugs. The theoretical and practical approaches to the kinetics associated with drug interactions are described. Chapter 2 by D. E. Hathway discusses the metabolism and the structure of metabolites for several new and improved drugs, food additives and contaminants, carcinogens, and toxins. The third chapter by D. H. Hutson presents the mechanisms of metabolism with special regard to recent findings in the field of hepatic enzymes. Chapter 4 by J. D. Baty discusses factors such as species, strain, and sex differences on the course of metabolism.

In general the book is an excellent review. It has an adequate subject and author index; each chapter is well referenced, giving the reader easy access to sufficient up-to-date literature, making it extremely useful for researchers in the field. The only drawback to the book is its high cost.

Mohamed E. Nasr, *College of Pharmacy, University of Michigan*

Synergetics—An Introduction. By H. HAKEN (Universität Stuttgart). Springer-Verlag, Berlin—Heidelberg. 1977. xii + 325 pp. $31.70.
Self-Organization in Nonequilibrium Systems. By G. NICOLIS and I. PRIGOGINE (Université Libre de Bruxelles). John Wiley & Sons, New York, N.Y. 1977. xiv + 491 pp. $27.50.

In his preface, Professor Haken says, "In recent years it has become more and more evident that there exist numerous examples in physical and chemical systems where well-organized spatial, temporal, or spatio-temporal structures arise out of chaotic states. . . . It came as a surprise to many scientists that numerous such systems show striking similarities in their behavior when passing from the disordered to the ordered state. . . . In our book we wish to explain such basic principles and underlying conceptions and to present the mathematical tools to cope with them." Both of these books concern themselves with those remarkable systems far from equilibrium that spontaneously develop ordered behavior. Despite appearances to the contrary, such ordering is entirely consistent with the laws of thermodynamics.

The book by Hermann Haken has seven background chapters with subtitles: Goal (Why You Might Read this Book), Probability (What We can Learn from Gambling), Information (How to Be Unbiased), Chance (How Far a Drunken Man Can Walk), Necessity (Old

Structures Give Way to New Structures), Chance and Necessity (Reality Needs Both), Self-Organization (Long-Living Systems Slave Short-Living Systems). The remaining chapters deal with applications in physical systems (lasers and instabilities in fluid dynamics), chemical and biochemical systems (unstable steady states with and without coupled diffusion), biological systems (population dynamics, evolution, and morphogenesis), and sociology (formulation of public opinion). The book is intended as a text to provide the mathematical background for persons with no more than an undergraduate course in calculus, and several exercises are suggested for practice. It attempts to show that similar mathematics can handle many superficially different systems.

The book by Gregoire Nicolis and Ilya Prigogine (1977 Nobel Laureate in Chemistry) is divided into five major sections: Thermodynamic Background, Deterministic Mathematical Methods, Stochastic Methods, Control Mechanisms in Chemical and Biological Systems, and Evolution and Population Dynamics. The applications are mostly chemical and biological (progressing from subcellular regulation to cellular differentiation), but the discussion moves beyond to whole organisms and even suggests a mathematical model for the evolving social structure in a termite colony.

Anybody who expects final answers from either book will be disappointed. Mathematicians have no general techniques for handling these nonlinear equations, and it is not at all clear we even know the forms of many equations that will be needed to model real systems. Haken emphasizes mathematical and physical problems and is superficial in treating chemical kinetics and biology. Nicolis and Prigogine explain the experimental systems well but sometimes devote excessive space to detailed numerical solution of models of doubtful applicability. These books introduce readers to the fascinating possibilities of behavior in systems far from equilibrium and reveal how superficial our present understanding really is. Let no young scientist think the interesting and important problems have all been solved!

Richard M. Noyes, *University of Oregon*

Kinins. Pharmacodynamics and Biological Roles. By F. SICUTERI (University of Florence), N. BACK (SUNY at Buffalo), and G. L. HABERLAND (Bayer A.G.). Plenum Press, New York, N.Y. 1976. xi + 398 pp. $37.50.

The above text comprises Volume 70 of "Advances in Experimental Medicine and Biology." This comprehensive volume contains the edited proceedings of the International Symposium on Vasopeptides, held in Fiesole-Villa Medici, Florence, Italy, July 15–17, 1975.

The text is highly specific and is written with the researcher in mind. Indeed the book is a must for those actively engaged in vasopeptide research. Most of the 42 articles describe ongoing research in the kallikrein–kinin (vasopeptide) system with very little introductory material. For this reason outsiders may find the volume less useful than a regular text book. Much of the book concerns Bradykinin, a nonapeptide hormone of composition, Arg-Pro-Pro-Gly-Phe-Ser-Pro-Phe-Arg. The importance of understanding the functional conformations of the peptide is stressed.

A valuable feature of the book is the inclusion of those papers that are devoted specifically to methodology. Twelve of the 42 articles contain new and highly useful "Materials and Methods". This feature alone is worth the price.

The articles in general are brief and to the point and of good quality. A few articles merit specific mention. These include a paper by Kato et al. on the isolation and characterization of peptides produced by plasma and tissue kallikreins; by Lemon et al. on the isolation of the enzyme kallikrein from the submaxillary gland of the pig; and by Vargaftig and Giroux on the mechanism of clostripain (short for clostridiopeptidase, a thiol proteinase from *Clostridium histolyticum*)--induced kinin release from various plasmas. Ryan (U.S. and J. W. Ryan) et al. present two papers on kininase II, the angiotensin-converting enzyme, which give the reader some idea of the current scope of vasopeptide research. By preparing antibodies to kininase II from pig lung, the Ryans and their co-workers have localized the cellular and subcellular sites of the enzymes in intact lungs and in pulmonary endothelial cells in culture. Unifying schemes of the type presented by Webster et al. (Figure 4, p 294) on the proposed activation of Hageman factor are strongly recommended for future volumes.

One final point seems pertinent. If "Kinins" loses something from its lack of introductory material, it gains much more from its unheralded emphasis on *ongoing research*. Since symposia seem to be a major source of new information in vasopeptide research, it therefore appears that the present text is successful.

Gerard A. O'Donovan, *Texas A&M University*

Electroanalytical Chemistry: A Series of Advances. Volume 10. Edited by ALLEN J. BARD. Marcel Dekker, Inc., New York, N.Y. 1977. 320 pp. SFrs. 98.

Volume 10 of "Electroanalytical Chemistry" continues the tradition of this series of Advances. Each of the two reviews contains an adequate coverage of theoretical principles and experimental techniques. The practicing analytical chemist gains therefrom an understanding and an appreciation of the current state of the science.

The first review on "Techniques of Electrogenerated Chemiluminescence" is a contribution from the Editor and one of his former students. These active workers in the field of electrogenerated chemiluminescence (ECL) present a good balance among theoretical considerations, experimental techniques, and data analysis in this chapter. However, the experimental approach to luminescence resulting from electron transfer in simple redox systems (involving metal complexes as well as aromatic and heterocyclic ions) is emphasized. Furthermore, quantitative experimentation of the present and certainly of the future overshadows the qualitative efforts of the past.

In considering reactions in electrochemical cells, transient techniques involving single pulse measurements and multicycle methods are well described. Excellent directions are included for the preparation of the suitable electrodes and solvent systems which are requisite for good analytical work. Steady-state methods utilizing the rotating ring–disk electrode for the measurement of emission efficiencies and for the simultaneous measurement of radiant intensity and electrical current as a function of applied potential are also described. Discussions of magnetic field effects upon chemiluminescence and interception techniques which are useful in elucidating luminescent reactions are included. There are 172 references.

The second review on "Electron Spin Resonance and Electrochemistry" begins with a simplified introduction to ESR and to ESR spectrometers. This is followed by a section dealing with interpretation of ESR spectra: hyperfine splitting, g values, and line widths. The line-width coverage includes discussions of exchange, chemical kinetics, alternating line widths, and modulation of line widths by incomplete averaging of g tensor and hyperfine tensor anisotropies. The last major section deals with the generation of free radicals by electrochemical methods. This includes a list of methods of free radical generation, reaction media, various types of electrochemical cells for generating in situ free radicals, practical advice on experimental methods, signal averaging, and spin-trapping. An appendix treats some elementary ideas on spin densities and Hückel methods (HMO) of calculation. The review contains a great deal of qualitative, phenomenological information which would certainly be useful to an electrochemist inexperienced in ESR. The illustrations of cells for electrochemical generation of free radicals are very good, as are the examples of spin systems which exhibit dynamical line-shape effects. The general level of theoretical treatment, however, is naive, and quantitative line-shape methods (such as programs available from the QCPE) are virtually ignored. There are 437 references.

Ronald T. Pflaum, Robert E. Coffman, *University of Iowa*

Organophosphorus Chemistry. Volume 7 (A Specialist Periodical Report). By S. TRIPPETT, Senior Reporter, and R. S. DAVIDSON, R. S. EDMUNDSON, J. B. HOBBS, D. W. HUTCHINSON, R. KEAT, J. A. MILLER, D. J. H. SMITH, J. C. TEBBY, and B. J. WALKER. The Chemical Society, London. 1976. xi + 285 pp. £20.

This volume summarizes the literature of organophosphorus chemistry from July 1974 to June 1975, following the same outline which has become characteristic of this valuable publication series [see, e.g., *J. Am. Chem. Soc.*, **94**, 7940 (1972), for a review of Volume 3]. A new and timely chapter on Nucleotides and Nucleic Acids has also been included.

In 1974 the Senior Reporter wrote: "There are many unanswered questions in a field in which little is known with certainty and almost all is conjecture" [S. Trippett, *Pure Appl. Chem.*, **40**, 595 (1974)]. At about the same time, however, R. Singleton reached the following conclusion: "In summary, the chemistry of phosphorus and especially phosphate is relatively well understood. Basic principles have been established describing the mechanistic behavior of phosphate in

chemical systems . . ." [R. Singleton, *J. Chem. Educ.*, **50**, 538 (1973)]. The juxtaposition of these two quotations (which I owe to Seymour Meyerson of the Standard Oil Company of Indiana) brings out nicely the important role played by these volumes. The phosphorus literature is scattered and is written from many points of view, obviously because the chemistry of this element is relevant to so many fields of science. Dr. Trippett and his reporters provide a sense of unity and of continuity to this fast-developing story, and they maintain the highly selective and critical standards which they initiated in Volume 1.

There remain, of course, "many unanswered questions" in the field of phosphorus chemistry. As the bonding capabilities of this element are being experimentally developed and confirmed, it becomes apparent that the roles played by phosphate and pyrophosphate esters in biochemistry, in particular in conjunction with metal ions, are poorly understood. It is quite possible that some of the phenomena associated with photosynthetic phosphorylation, mitochondrial oxidative phosphorylation, the structure and function of biological membranes, and the workings of the enzyme in phosphoryl transfers, could depend on properties of the phosphorus atom which are barely implicit in, or even totally absent from, this volume. There is a fair degree of probability that the synthesis of information which is included in this slim volume will provide strong stimuli toward the eventual solution of such problems.

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

Physical Chemistry. By V. FRIED, H. F. HAMEKA, and U. BLUKIS. Macmillan Publishing Co., New York, N.Y. 1977. xix + 983 pp. $16.95.

This physical chemistry text has several outstanding features which make it a refreshing addition to a course area which has often been characterized by significant dissatisfaction with existing textbooks. The material is presented in the order: states of matter, classical thermodynamics, quantum mechanics, statistical mechanics, chemical kinetics, and electrochemistry. The eight chapters on quantum mechanics are reprinted from Hameka's book: "Quantum Theory of the Chemical Bond" (1975). The material within each topic is presented using a mixture of textual material and worked example problems. Where appropriate, extensive use of real experimental examples (often with literature references) is made both in the text portion and in problems at the end of each chapter (of which there are about 450 total). Answers to 80% of the problems are provided, and also included are several Appendices explaining mathematical principles, the systems of units used (mostly SI), tables of fundamental constants, and unit conversions. Much of the material presented is well documented, with lists of references and recommended reading given at the end of each chapter.

An outstanding feature of this book is the well-organized, well-written treatment of the "fundamental" topics: gases, thermodynamics, quantum mechanics, statistical mechanics, and (to a lesser extent) kinetics. I find the book much more readable than Moore for gases and thermodynamics, and much more thorough than Castellan for quantum mechanics, statistical mechanics, and kinetics. Also several confusing points which are poorly treated in many physical chemistry texts are clearly treated here. For example, the standard state chemical potentials for solvent and solute reference are consistently denoted by different symbols (μ_i° versus $\mu_i^{\bullet}$ rather than a single (common) symbol).

Throughout the book, however, there is a tendency to use equations to replace words in the textual material, which results in a rather high number of equations per page. This will be an advantage for mathematically adept students, as it enables a level of rigor in the development which is matched by few of the competing textbooks. The less mathematically versed students will, however, probably find the general level of treatment of fundamentals quite advanced, thereby causing confusion (even frustration) in understanding physical concepts.

The book also contains a detailed treatment of several "special topics", especially within the fields of kinetics and electrochemistry. This serves the important role of bridging the gap between "textbook" physical chemistry and modern research in physical chemistry and is an important feature of the book. An entire chapter (Chapter 22) is devoted to the resolution of reactant and product states in chemical kinetics including molecular beam scattering, infrared chemiluminescence, and intermolecular energy transfer. Often, however, the level of treatment of such topics is too advanced for all but the most advanced students in a typical physical chemistry course. For example, magnetic resonance is treated in some detail (an entire chapter discusses basic principles of NMR and ESR, and two sections in a kinetics chapter concern measurements of relaxation times and CIDNP). Much of the discussion of the theory of chemical shifts, spin–spin coupling and the Bloch equations is only slightly simpler than the treatment of Carrington and McLachlan, which is supposedly a graduate level text on magnetic resonance.

As might be expected for a first edition text, there are a few awkward points in its organization. For example, occasionally specialized material and more fundamental material are mixed together indiscriminately in a single chapter, thus leaving to the student the task of sorting out (or being confused by) what is essential versus what is not. This especially occurs in Chapter 20 (Rates and Mechanisms of Reactions) where (as just one example), in a section on heterogeneous reactions, during a subsection on surface structure and composition, a minisection (of several pages) on the general theory of crystal structures is introduced just to aid in explaining how LEED experiments give surface structural information. Another organizational problem involves Chapter 4 (Miscellaneous Topics) which really should be part of Chapter 2 (on kinetic theory of gases). Also, the title of Chapter 21 (Statistical Theories of Kinetics) is somewhat misleading since some of the theories discussed therein are not statistical (in the usual sense used in chemical dynamics). It is also to be noted that extensive use is made of script symbols, a practice which is unlikely to be popular with students.

Overall, the clarity and thoroughness of presentation in this book make it potentially superior to competing textbooks in physical chemistry, but the advanced level of treatment of several topics could make it very difficult for many students especially those with weak math backgrounds.

George C. Schatz, *Northwestern University*

Vibrational Spectra and Structure. Volume 6. Edited by JAMES R. DURIG (University of South Carolina). Elsevier Scientific Publishing Co., Amsterdam–Oxford–New York. 1977. xiv + 397 pp. $59.60.

This latest issue in the volumes edited by Professor Durig continues this series of significant contributions to spectroscopy.

Chapter I by James K. G. Watson is entitled "Aspects of Quartic and Sextic Centrifugal Effects on Rotational Energy Levels". In the 90 pages devoted to this topic, the basic theory associated with centrifugal distortion effects in rotational spectra is reviewed and relationships are derived by appropriate perturbation theory for quartic and sextic terms.

Chapter II by H. F. Shurvell and J. T. Bulmer encompasses 81 pages and is entitled "The Applications of Factor Analysis and Band Contour Resolution to Infrared and Raman Studies of Equilibria in Solution". This chapter should be of considerable interest to practicing chemists in addition to spectroscopists. The methods of factor analysis are discussed, and it is shown how a considerable amount of useful chemical information can be derived from complex infrared or Raman bands. However, the technique appears to be one which might profitably be applied in other situations in which the data are complex because of overlapping effects. In the latter part of the chapter, the methods are applied to several experimental problems including the self-association of acetic acid, trichloroacetic acid, and phenol and other similar examples. The chapter concludes with several pages of Fortran programs for carrying out this type of analysis on spectral data.

Chapter III on "Coherent Anti-Stokes Raman Spectroscopy" is a joint effort by J. W. Nibler, W. M. Shaub, J. R. McDonald, and A. D. Harvey. The CARS technique has been of considerable interest ever since its introduction and is now reaching the stage of useful application to specific problems. In this chapter, the authors describe experimental aspects, review selection rules, and polarization behavior briefly and then proceed to a survey of articles in the literature which have employed CARS. The chapter concludes with a short summary of the technique's advantages.

Chapter IV, by D. C. Moule, devotes 45 pages to "Vibrational Structure in Electronic Spectra: the Polydimensional Franck-Condon Method". The author considers the problem of vibrational intensities accompanying electronic transitions for the case of polyatomic molecules. Formaldehyde is used as a specific example of the methods employed and other examples are also discussed.

The final chapter in this volume, by James E. Griffiths, is 103 pages long and entitled "Molecular Reorientation of Symmetric Top Mol-

ecules in the Liquid State". This represents another area which has seen a considerable increase of interest in the last few years. After a review of correlation functions, the author describes experimental techniques employed for various types of spectroscopy, and discusses the benefits to be obtained by the use of combined experimental techniques. The chapter concludes with a review of several specific systems.

Robert C. Taylor, *The University of Michigan*

Liquid Crystals. By S. CHANDRASEKHAR (Raman Research Institute). Cambridge University Press, New York and London. 1977. x + 342 pp. $38.50.

The modern era of liquid crystal research may be regarded as being ushered in by the review article of Brown and Shaw[1] and the book of Gray.[2] Since the appearance of these two works, numerous reviews, monographs, conference proceedings, and collections have been published. The monograph by Chandrasekhar, a volume in the Cambridge series of monographs on physics, is the most recent. It is essentially an expansion and update of Chandrasekhar's 1976 review article.[3] The book preserves the five-section format of the review: an introduction followed by chapters dealing with statistical theories of nematic order, the continuum theory of the nematic state, cholesteric liquid crystals, and smectic liquid crystals. There are 176 figures and over 400 references (some dating from 1975 and a few from 1976) in the book (compared to 53 figures and approximately 300 references in the 1976 review article).

As the author himself states, discussion of some topics had to be curtailed for lack of space. Subjects omitted, or touched on only briefly, include lyotropic systems, applications of magnetic resonance techniques, and recent neutron scattering results. Two earlier publications (both entitled Physics of Liquid Crystals) by deGennes[4] and Stephen and Straley[5] do treat some topics not discussed by Chandrasekhar (e.g., magnetic resonance) or give greater emphasis to other areas. However, Chandrasekhar devotes considerable space to both the Pople-Karasz theory of melting and the McMillan model of smectic A; neither of these subjects is discussed by deGennes, while the McMillan model is touched on only briefly by Stephen and Straley. Surprisingly Chandrasekhar does not choose to extend his discussion to include the recent McMillan-Meyer theories of the smectic C, B, H, E, and VI phases.[6] He devotes only a few sentences to the planar nematic phase exemplified by mesomorphic pitches which only recently have begun to receive increased attention from liquid crystal scientists.[7]

Although the scope of the book has had to be limited, it accomplishes quite well its primary purpose—"to provide an insight into the variety of new phenomena" exhibited by liquid crystals. The scientist interested in the physics of these mesomorphic phases now has at his disposal a valuable new resource.

(1) G. H. Brown and W. G. Shaw, *Chem Rev.*, **57**, 1049–1157 (1957).
(2) G. W. Gray, "Molecular Structure and the Properties of Liquid Crystals", Academic Press, New York, N.Y., 1962 (314 pp).
(3) S. Chandrasekhar, *Rep. Prog. Phys.* **39**, 613–692 (1976).
(4) P. G. deGennes, "The Physics of Liquid Crystals", Clarendon Press, Oxford, 1974 (333 pp).
(5) M. J. Stephen and J. P. Straley, *Rev. Mod. Phys.* **46**, 617–704 (1974).
(6) Some of these models have been reviewed by G. W. Smith, *Adv. Liq. Cryst.*, **1**, 189–266 (1975), who also has discussed other theories of liquid crystalline and plastic crystalline phases.
(7) See, for example, J. D. Brooks and G. H. Taylor, *Carbon*, **3**, 185 (1965), and R. Alben, *Liq. Cryst. Ordered Fluids*, **2**, 81 (1974).

George W. Smith, *General Motors Research Laboratories*

Modern Practice of Gas Chromatography. Edited by R. L. GROB (Villanova University). John Wiley & Sons, Inc., New York, N.Y. 1977. xvi + 654 pp. $22.50.

This book, emerging from the Gas Chromatography Course presented annually by the Chromatography Forum of Delaware Valley, fulfills admirably the need for a text aimed at covering the basic theory, analytical techniques, current instrumentation, and applications of modern gas chromatography.

Part One of the book is concerned with theoretical and basic concepts in chromatography with the first two chapters, by R. L. Grob, defining the terms common to chromatography and outlining the laws governing phase equilibria, adsorption, and diffusion in separation phenomena to illustrate the fundamental concepts of gas-liquid and gas-solid chromatography. The third chapter, by W. R. Supina, develops the theory into practical terms by discussing factors affecting column efficiency, solid supports, stationary phases including Rohrschneider/McReynolds' system of retention indices "McReynolds constants", together with the general mechanics of preparing and optimizing the efficiency of packed and open tubular columns. Chapter Four begins with a discussion by M. A. Kaiser on the identification of components by comparative retention data, corresponding Kovat's retention indices, peak functional group tests, and molecular weight chromatography. The quantitative aspects that follow described by F. J. Debbrecht include graphical, mechanical, and electronic methods for peak area assessment, the standardization by internal and external procedures of gaseous and liquid samples, and a discussion on the general errors inherent in gas chromatographic quantitative analysis.

The second part of the text, concerned with instrumentation and technique, is introduced by J. J. Sullivan and M. J. O'Brien in Chapter Five with an in-depth account of the design, function, utility, selectivity, and operation of the thermal conductivity, flame ionization, electron capture, flame photometric, and alkali flame ionization detectors. Several less common detectors are described concisely including the piezoelectric sorption detector which potentially ranks as a rival to the more ubiquitous types. The next chapter by R. Schill furthers the presentation of instrumentation by describing the other basic components of a gas chromatographic unit such as carrier gas systems, sample inlet systems, column ovens, recorders, and data handling systems. The procedural techniques and guidelines for trace analysis are presented in Chapter Seven by G. R. Umbreit and the intrinsic dangers of looking for a "needle in a haystack" are adequately elaborated. Data handling hardware, ranging from simple integrators to midicomputer systems, are evaluated by H. L. Pierson and D. J. Steible in Chapter Eight which includes advice on the selection and acquisition of data systems to meet required needs.

The third section of the book illustrates the diverse applications available to gas chromatography. Chapter Nine, by H. L. Rothbart, outlines succinctly the utility of gas chromatography to the structural elucidation and characterization of lipid, protein, and carbohydrate components of food. The determination of steroids, catecholamines, aromatic acids, and amphetamines in urine and the determination of alcohols, anesthetics, and amino acids in blood are described in detail by J. C. Touchstone and M. F. Dobbins in Chapter Ten to illustrate successfully the clinical applications of gas chromatography. The study of thermodynamics, chemical kinetics, transport properties, and virial coefficients employing gas-liquid and gas-solid chromatography are presented by M. A. Kaiser in Chapter Eleven, including derivations of the mathematical expressions used for the physicochemical parameters measured. The final chapter of the book by E. J. McGonigle illustrates effectively the use of gas chromatography for drug analysis by including techniques for sample preparation, selection of standards, derivatization and determination of analgesic, antipyretic, nitrogenous base, barbiturate, hormonal, antibiotic, and vitamin components of drugs.

Each chapter, which is well indexed, includes a comprehensive selection of key references. The editor has compiled the subject matter wisely to afford an eminently readable book which is highly recommended as an excellent introduction to gas chromatography and essential as a basic text to laboratories engaged in gas chromatographic practices.

John N. C. Whyte, *Fisheries and Environment Canada*

Biochemical Insect Control. By M. SAYEED QURAISHI. Wiley/Interscience, John Wiley & Sons, New York, N.Y. 1977. viii + 280 pp. $19.95.

While not wishing to engage in the polemics of precisely defining the subject indicated by the title of the book it is difficult for this reviewer to agree with the author that "only a few books on biochemical insect control are available in English". Indeed, during the last few years we have been literally bombarded with a plethora of volumes (books, monographs, symposia proceedings, committee reports, etc.) covering at some level of specialization almost every conceivable aspect of the insecticide field. Many of these are comprehensive, detailed, and of excellent quality and professional value. Unfortunately, "Biochemical Insect Control", one of the latest additions to this formidable literary explosion, cannot be included in this group.

The stated aim of the book is "to provide the student of insect toxicology with a balanced account of insecticides and insect control agents and to provide readers in several disciplines with a broad picture of insecticides in relation to insects, man and other living organisms". The area which the book attempts to cover is, of course, enormous in both breadth and diversity, a conglomerate of highly specialized disciplines each with a voluminous and rapidly expanding literature. "Biochemical Insect Control" emphasizes the fact that the field has probably already passed the point at which it can be covered adequately by a single author in a general text. The book does indeed provide readers with a "broad picture of insecticides", but any advantages to be gained from this are more than offset by the fact that large portions of the picture are at best superficial and others outdated, unclear, misleading, and sometimes erroneous.

The book contains a total of 24 chapters, 22 of which are divided between two major sections on "Chemicals for Insect Control" and the "Dynamics of Insect Toxicology". Two additional sections each consisting of a single chapter are concerned with "Insecticides, Fungicides and the World Economy" and "Integrated Control and Pest Management". Much of the first section of the book is simply a rehash of material which has appeared in earlier texts. It consists mainly of general discussions of the various groups of commercially important insecticides and other control agents (e.g., chemosterilants, attractants, pheromones, hormones, and microbial agents) with brief accounts of their properties, structural characteristics, modes of action, and metabolic pathways. There is little here that is not available in previous texts and in most chapters, references past 1970 are at a premium. Some of the discussions (e.g., on organophosphorus and carbamate mode of action) are extremely confusing and contain statements which are misleading and in some cases wrong. Many of the chapters are short and their titles misleading. Thus Chapter 8 entitled "Pharmacodynamics of Chlorinated Hydrocarbons and Their Present Status" devotes 18 lines to pharmacodynamics and the next $2\frac{1}{2}$ pages to a discussion of the history of the demise of DDT.

The section on the "Dynamics of Insect Toxicology" consists of eight chapters constituting a sort of potpourri of subjects ranging from insecticide penetration, through mixed-function oxidases, synergism, and insect resistance to carcinogenicity and mutagenicity. Throughout this section the coverage is again extremely shallow, outdated (e.g., most of the references in the chapter on resistance mechanisms are 10–15 years old), and often in error. There are numerous cases of serious overlap and repetition with material in earlier chapters of the book.

In brief summary there is little that this reviewer can find to recommend in "Biochemical Insect Control". Although it is likely to prove of little value as a reference or teaching text, it may be of some use in providing nonprofessionals with a broad overview of the field.

C. F. Wilkinson, *Cornell University*

Oxides and Oxide Films. Volume 4 (Anodic Behavior of Metals and Semiconductors Series). Edited by JOHN W. DIGGLE and ASHOK K. VIJH. Marcel Dekker, Inc., New York, N.Y. 1976. 277 pp. $33.00.

This volume (277 pages) contains three contributions which include (a) Diffusion and Defects in Oxide, (b) Radiation Effects in MOS Devices, and (c) The Aluminum-Water System. The first contribution, "Diffusion and Defects in Oxides" by M. S. Seltzer, Materials Science Section, Batelle's Columbus Labs., Columbus, Ohio, is 95 pages long with 117 references. This chapter gives an excellent discussion of the diffusion mechanisms in oxides with discussion of the properties of a number of binary and ternary oxides. The author emphasizes the effect of atomic disorder and defect complexes on diffusion in oxides. The second chapter, "Radiation Effects in MOS Devices" by C. W. Gwyn, Radiation Effects Division, Sandia Labs., Albuquerque, New Mexico, is 63 pages in length with 142 references. The author discusses radiation effects in MOS devices (predominantly SiO_2) which are acceptable for use in radiation environments. The effect of selective impurity doping, in the oxide, to increase the radiation tolerance of MOS devices is discussed. This chapter is essentially descriptive and the lack of a "physical viewpoint" on the role of processing methods and impurity effects is pointed out. The third chapter entitled "The Aluminum-Water System" by Robert S. Alwitt, R&D Labs., Sprague Electric Co., North Adams, Mass., is 77 pages long with 142 references. In this chapter the $Al-H_2O$ reaction to form Al_2O_3 film is studied with respect to structure and growth kinetics. This chapter is also essentially descriptive in which the author shows the complexity of this "seemingly simple system" and presents a summary of the research which has been reported.

Murray Robbins, *Bell Laboratories*

The Structure of Biopolymers. By OSWALD L. HÖRER (Institute of Virology, Bucharest, Rumania). Abacus Press, Tunbridge Wells, Kent, England (U.S. Distributor ISBS, Inc., Forest Grove, Oregon). 1973. 294 pp. $17.50.

This relatively short book undertakes the ambitious task of presenting a complete picture of the structure of biopolymers. It deals with biopolymers in a general way, drawing upon specific discussions of hydrocarbon, polysaccharide, polynucleotide, and polypeptide biopolymers only as examples to illustrate underlying principles and phenomena. The two major chapters deal with primary structure and with "association" structure. The latter includes discussions of secondary, tertiary, and quaternary structures, although the distinctions among these levels of organization are not always clearly drawn. In the chapter on primary structure, the author deals exhaustively with determinations of simple chemical composition, with molecular weight analyses, and with residue sequence characterization. The author appears to assume no previous knowledge of polymer or macromolecular science and attempts to present a text that would serve at the same time as a textbook on fundamental polymer science and on biopolymers. A minor chapter deals with the relationships between structure and biological activity of biopolymers. It seems unfortunate that only 12 pages are devoted to this important topic. Indeed it would have been preferable to deal more exhaustively and in greater depth with this topic at the expense of some of the introductory material on polymer science.

The translation from the original Rumanian leaves a great deal to be desired. Recognizing the inherent difficulties in this task, one must nevertheless point out that the resultant phraseology and sentence structure are frequently difficult and at times impossible to understand. Since the subject matter itself is quite complex, it is certain that the typical student would be better served by other available texts in this field.

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