Book Reviews

Hormone Chemistry. Volume II. Second Edition. Steroid and Miscellaneous Hormones. By W. R. BUTT (The Birmingham and Midland Hospital for Women, England). Halsted Press, New York. 1977. xiv + 257 pp. $37.50.

This is the second volume of a revised edition of "Hormone Chemistry" by Professor Butt, and covers the topics of steroid and thyroid hormones, biogenic amines, and prostaglandins. It is a most useful volume for two reasons: it is concise and well written, and it presents both chemical and biochemical information of great usefulness. For example, in Chapter 1, "Steroid Hormones", the topic of steroid stereochemistry is presented with a terse lucidity, and a comprehensive presentation is made of physical and chemical methods of steroid structure determination. Following this, an overview of steroid metabolism and a good discussion of methods of steroid analysis, including chemical and binding assays, are given. The treatment of steroid hormones occupies most of this volume (176 out of 257 pp), with each class covered separately. This will be useful to those concerned with steroid hormones from several points of view—from chemist to medical student and clinical researcher. The other chapters share the same qualities of presentation as those on steroids: concise presentation of practical significance with critical discussion, but they are less thoroughly developed, especially in contrast to the treatment of steroids. They are, however, quite adequate.

Some minor criticisms of this volume can be made. Thus, it would facilitate initial consideration of steroids to present at the outset structures of the steroid molecules which are the subject of discussion in the text. In other instances, topics chosen for representation in figures seem somewhat arbitrary and not representative of the more important aspects of the hormones under question. Certain insufficiencies exist as well. For example, more discussion of steroid aromatization and catechol estrogen formation seems warranted. On the whole, though, these are relatively minor criticisms of a most estimable volume.

In summary, Professor Butt has produced a work which is succinctly written, yet comprehensive, critical, and enormously useful to a wide audience.

Jeffrey F. McKelvy, *The University of Texas Health Science Center at Dallas*

Treatise on Analytical Chemistry. Part III. Analytical Chemistry in Industry. Volume 3. Edited by I. M. KOLTHOFF, P. J. ELVING, and F. H. STROSS, John Wiley & Sons, Inc., New York. 1976. xxi + 598 pp. $36.95.

Part III of this extensive treatise stresses applied analyses and techniques used in the industrial laboratory. It is not intended to provide exhaustive, detailed procedural details; these are covered adequately in other publications. It does provide background information, often with fundamentals, to acquaint the analytical chemist with organization and needs as well as approaches for specific measurements.

Volume 3 deals with "Standards and Specifications" (Section C), "Physical Testing Methods for the Characterization of Materials" (Section D), and "Thermal and Chemical Testing" (Section D-1). Section C covers well bases for the increasingly critical needs for standard reference materials (SRM's) particularly in trace analyses for specific compounds and elements. Sources of SRM's are noted emphasizing those available at the National Bureau of Standards in 1973 (why not 1976?). Brief descriptions are given of standards organizations in the United States, in other countries, and International standards bodies such as ISO. Mandel of the NBS presents a good discussion of "Statistical Methods in Analytical Chemistry" with an adequate bibliography. An excellent practical presentation of Quality Control is given by R. S. Bingham, who clearly defines its essential role in industrial operations.

As an introduction to Section D, J. B. DeCoste presents useful background information on "Rationale for Methods of Physical Testing". Subsequent chapters describe the general techniques and tools for mechanical testing. Section D-1, dealing with thermal and chemical testing, consists of two chapters: "Chemical Resistance of Nonmetallic Materials" by R. B. Seymour and "Thermal Aging and Oxidation with Emphasis on Polymers" by H. L. Friedman. The former provides background information on mechanisms of chemical attack, resistance to environment, and physical, electrical, and chemical tests. This general presentation includes an extensive bibliography (more than 500 references) for those interested in more details. The final chapter describes techniques for study of thermal aging of polymers, including methods for kinetic decomposition and oxidation measurements. References are well chosen and timely

This volume serves as a valuable reference for both new and experienced industrial analytical chemists. To the latter it is a convenient review source of practices and applications of various techniques. To the former it describes approaches for quality control and analytical backup to industrial technical programs. Academic people can also benefit by learning how analytical chemistry serves industry—including its role in international trade, in environmental quality studies, and in occupational health.

John Mitchell, Jr., *E. I. du Pont de Nemours & Company, Inc.*

Treatise on Analytical Chemistry. Part III. Analytical Chemistry in Industry. Volume 4. Edited by I. M. KOLTHOFF, P. J. ELVING, and F. H. STROSS, John Wiley & Sons, Inc., New York. 1977. xxviii + 686 pp. $39.95.

Volume 4 of the treatise covers "Thermal and Chemical Testing" (a continuation of Section D-1 from Volume 3). Initially the general theme changes to a series of flammability test methods for specific classes of materials, e.g., building materials, plastics, fabrics, paper. To this reviewer, the empirical test details appear to be an illogical part of the series. Most of these are ASTM or Government tests. The succeeding Section D-1 on "Radiation Resistance" is a return to technique-centered presentation with a good bibliography and glossary of terms which better serves the needs of a reference text.

Section D-2 is devoted to "Evaluation of Surface Properties". Following a brief presentation of optical methods (primary reflectance), sections are devoted to "The Examination and Characterization of Phase Interfaces" and "Adhesive Properties". The former is particularly impressive in its clean and concise coverage of an important area, with a good balance of theory and practice.

Section D-3 covers "Evaluation of Particle Properties" in three portions dealing with particle size, surface area, pore size, and volume measurements. All are prepared by Clyde Orr, Georgia Institute of Technology. All are well written and give good concise reviews. Particularly impressive is the one on particle size covering techniques in the range 0.002 to 1000 μm. Reference is made to the interesting new technique of small angle X-ray scattering for surface area measurements but not to its application to particle size measurements up to 0.1 or 1 μm, depending on the type of equipment available.

Section D-4 covers general aspects of "Mechanical and Electrical Testing" starting with a brief review of creep and stress properties and tests including a helpful tabular listing of ASTM standards. Good brief reviews of "Fatigue Testing" follow dealing with the progressive fracture of materials caused by repeating or fluctuating loads, of "Quasistatic Strength" dealing primarily with stress-strain behavior, and of "Mechanical Damping". A brief but excellent review is presented on "Rheological Properties of Fluids" covering theoretical and experimental approaches for studying fluid flow behavior. This section includes an extensive bibliography. The volume concludes with a brief discussion of "Analytical Applications of Electrical Resistivity Measurements on Polymers" with a helpful bibliography.

Cumulative author and subject indexes are included for the four volumes which have issued in Part III. These are of considerable value to the readers, most of whom will find these texts are good reference sources.

John Mitchell, Jr., *E. I. du Pont de Nemours & Company, Inc.*

Proceedings of the Fourth Tihany Symposium on Radiation Chemistry. Edited by PETER HEDVIG and ROBERT SCHILLER (Hungarian Academy of Sciences). Akademiai Kiado, Budapest. 1977. 1085 pp. $65.00.

This volume comprises the text and subsequent discussions of 141 papers presented at the Fourth Tihany Symposium on Radiation Chemistry, June 1-5, 1976.

The papers describe a wide variety of topics ranging from the application of radiation to polymers, the role of radiation generated electrons in the evaluation of the quantum mechanical tunnel effect and radioresistance of bacteria, to such exotic species as positrons and positronium. They provide a good cross section of the modern trends in radiation chemistry. The large representation from Eastern Europe provides the reader with a good survey of the present status of radiation chemistry in these countries.

The editors have organized the papers in three parts, dealing with the radiation effect in organic materials, polymers, aqueous solutions, plus one section of miscellaneous papers. This categorization provides a welcome guideline in view of the large amount of material presented. The contributions are generally well written and the discussion following each paper is of special interest, since questions are raised or problems pointed out which otherwise might not be immediately obvious to the reader.

The short opening address by Gabor Földiak, which is included in this volume, is a timely assessment of the present status of the application of radiation in the various areas of chemistry and industrial chemistry.

In summary, this volume can be considered a comprehensive, well prepared, and well organized report of a successful conference on radiation chemistry. It will be of interest to every chemist concerned with radiation effects and related phenomena.

The only major deficiency of this book is the lack of an alphabetical index of the authors' names (and the page number on which their contributions appear).

Hans J. Ache, *Virginia Polytechnic Institute and State University*

Lipid Biochemistry: An Introduction. By M. I. GURR and A. T. JAMES (Unilever Research Laboratory, Sharnbrook, U.K.). Halsted Press, New York. 1976. viii + 244 pp. $19.50 cloth; $10.00 paper.

While standard biochemistry texts usually devote 40-60 pages to discussion of lipids, "Lipid Biochemistry" treats the subject with an order of magnitude more detail. In addition to an introductory section on nomenclature and analytical techniques, separate chapters cover fatty acids, neutral lipids, phospholipids, glycolipids and sulfolipids, lipids as components of macromolecules, and lipids in foods. The anabolic and catabolic pathways for the various lipid types are stressed throughout.

I suspect that this book is aimed primarily at the British student reading an honours degree in biochemistry or chemistry. Such a student would find both the topical coverage and level of the book ideal to his needs. In the United States the book would be useful to supplement a high-level survey course in biochemistry. Because each chapter contains an extensive list of review articles and other important secondary sources, "Lipid Biochemistry" might also serve as the nucleus of a specialized course on lipids.

Two minor difficulties with the work should be noted. The first is that the literature coverage extends only into 1975, a fact which limits to some extent the utility of the bibliographies. A second problem is that the treatment of membrane structure occupies only eight pages, rather less, relative to the length of the book, than current interest in the topic might dictate.

A final comment concerns the book's unusual and useful set of four indices. In addition to a general index extremely thorough for a book of its size, "Lipid Biochemistry" has supplementary indices of references in the text to lipid-related diseases, to plant and animal species, and to tissues and subcellular particles.

B. George Barisas, *St. Louis University*

Introduction to the Electron Theory of Small Molecules. By A. C. HURLEY (CSIRO Division of Chemical Physics, Australia). Academic Press, New York. 1976. x + 329 pp. $26.25.

As Dr. A. C. Hurley is a distinguished researcher in the area of theoretical chemistry, the publication of this book is particularly welcome and appropriate.

The book consists of seven chapters and two appendices. The major topics include potential energy curves, variational wave functions, symmetry of molecular electronic states, the hydrogen molecule, the determinantal method, and molecular orbitals and the Hartree-Fock (HF) method. Fully a third of the book is devoted to open- and closed-shell HF theory for small molecules in their ground and low-lying excited electronic states. Only ab initio methodology is considered.

The average chemist with, say, credit in a one- or two-semester course in quantum chemistry will find considerable value in Dr. Hurley's lucid discussion, with appropriate examples, of a wide variety of important theoretical concepts. For example, physical interpretations are provided for electron correlation and for localized orbital schemes; the sections dealing with closed- and open-shell HF methods are written in understandable terms; and Mulliken's (1932) correlation diagram for diatomics as well as Walsh's (1953) diagram for the variation of orbital energies with bond angle in HXH molecules are redrawn in light of more recent developments.

For the theoretician, the book provides a rich assortment of jewels scattered among more-or-less better known ideas. Notable sections include a natural orbital analysis, the "symmetry paradox", the use of branching diagrams and spin projection operators, and a discussion of the relative merits of various basis functions.

On the negative side, few of the references were to work published after 1972, and hence very recent calculations are not included in the book. The brief section on symmetry of molecular electronic states is perhaps too complicated for the average nontheoretical chemist. Also, the discussion of hydrogen molecule is marred by undue emphasis on the temporary discrepancy between theory and experimental results for the ground-state energy. None of these flaws should discourage a person from buying the book.

Dr. Hurley has written a fine book which is not muddled by endless arrays of equations and which sheds considerable theoretical and physical insight on the ab initio quantum theory of small molecules. He sets a worthy standard for others in the field to follow.

Stuart M. Rothstein, *Brock University, Canada*

Isotopes in Organic Chemistry. Volume 3. Carbon-13 in Organic Chemistry. Edited by E. BUNCEL (Queens College, Kingston, Ontario) and C. C. LEE (University of Saskatchewan) Elsevier, Amsterdam. 1977. xvi + 288 pp. $60.95.

This volume concerning the application of carbon-13 to organic chemistry contains a lot of valuable and useful material in what has been an active and important field. The chapter on biosynthetic studies using ^{13}C-enriched precursors by G. Kunesch and C. Poupat is a very extensive and well-written review of this area. The methods are described clearly, and a great number of interesting applications are covered. This reviewer was surprised that the authors were able to list 200 references in this field. I found the chapter on application of ^{13}C NMR to problems of stereochemistry by Arthur S. Perlin well written, thorough, and full of interesting information.

The chapter on ^{13}C NMR methodology and mechanistic application by J. Hinton, M. Ika, and A. Fry had an introduction which duplicates material found in several books about ^{13}C spectroscopy However, it goes on to consider a number of interesting reactions which have been studied with the aid of ^{13}C including ones using ^{13}C CIDNP.

The two remaining chapters on ^{13}C kinetic isotope effects in cleavage and formation of bonds to carbon by A. V. Willi are somewhat less successful. This is a much older area of investigation. The most important work discussed by Dunn was published more than 20 years ago. However, a review still might be valuable if it summarized the methods and results very clearly and if it applied critical standards to the conclusions. Unfortunately, the chapter by Dunn, for the most part, simply states the various conclusions drawn by the authors, leaving a number of questions of interpretation uncertain. The chapter by Willi is written more clearly and discusses a more interesting variety of reactions. There is incidentally an overlap with the discussion in Dunn's chapter of isotope effects on decarboxylation.

Martin Saunders, *Yale University*

Physical Chemistry for the Life Sciences. By JAMES R. BARRANTE (Southern Connecticut State College) Prentice-Hall Inc., Englewood Cliffs, N.J. 1977. xiv + 337 pp. $14.95.

The text is intended to serve premedical and biological science students taking a one-semester course in physical chemistry. Because

of the brevity of the course, the subject matter is limited to those areas of physical chemistry which are thought to be particularly important to life science majors. The eleven chapters include seven on classical thermodynamics. The remaining four chapters are devoted to chemical kinetics, electrochemistry, macromolecules, and photochemistry. The choice of subjects is very good given the amount of material which can be realistically included in a one-semester course. Each chapter includes several numerical examples as well as 20 or more problems.

The level at which the thermodynamics is presented is comparable to that of many traditional physical chemistry texts. The author has wisely avoided making unnecessary concessions to the widespread erroneous belief that life science students are weak in mathematics. In fact, the chapters on thermodynamics are a rather standard and undistinguished presentation of the subject. There is no evidence to support the claim that this material is designed for life science majors.

A major shortcoming of the work is that there is little to spark a student's intuition or interest, which will be dulled by the author's formal approach to the topic. Many topics which could have been presented at a descriptive level were neglected. I wish to illustrate these criticisms with a few examples. The equation for the Debye–Hückel limiting law is stated in its final form without giving the student any motivation for distinguishing between electrolytes and nonelectrolytes. The concept of an ion atmosphere is virtually ignored. This concept could provide students with valuable insight into other topics presented later in the text: Donnan Equilibrium, "salting in", and the concentration dependence of molar conductivity. Each of these topics is relevant to a biochemist. In this instance the text fails to provide the necessary insight to connect the physical properties of simple model systems to more complex biochemical systems. There are other examples of similar failures. In the macromolecules chapter, the virial equation for osmotic pressure is stated without mention of its connection to activity coefficients or even of the derivation of osmotic pressure given in an earlier chapter. A half chapter is devoted to conductivity without depicting the relationship between the velocity of an ion and the conductivity of a solution. Furthermore, numerical values are cited for both the conductivity and mobility of ions without even noting the proportionality of these parameters. The electrophoretic mobility of proteins is considered in a later chapter, but again the connection between the properties of biopolymers and small ions is ignored. I doubt that many students will see the relevance of the section on conductivity to their use of electrophoresis, an important biochemical technique.

The integration of life science material with the basic physical chemistry is at best incomplete. This text is not designed for life science students as much as it is designed for a brief physical chemistry course. Except for its brevity, there is little to recommend this book. A more thorough discussion of descriptive material, such as found in many other texts designed for complete courses, would be an even better recommendation for life science students.

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

Fundamentals of General, Organic and Biological Chemistry. By JOHN R. HOLUM (Augsburg College). John Wiley & Sons, New York. 1978. xxxiii + 765 pp.

The authors's stated goal is to provide chemical and biochemical background to college students preparing for careers in the various health sciences such as nursing, dental technology, etc.

The book is organized into three distinct parts approximately equal in length: general chemistry, organic chemistry, and biological chemistry. In the selection of topics, their sequence and the depth in which they are discussed, this book does not differ markedly from many other similar undergraduate texts published in the last few years. It does differ, however, in the manner in which the material is presented. It has an extremely detailed table of contents (22 pages) and an excellent subject index at the back of the book, making the job of locating any particular topic a very easy one. The brief summary presented at the end of each chapter should be a popular feature with students. A large number of applications, in-chapter exercises, and illustrations facilitate learning and teaching. Mathematics is kept to a bare minimum: the unhappy but presumably pragmatic view of the author seems to be that today's college students are capable of little more than addition and subtraction. All in all, this is a carefully written, painstakingly streamlined book.

Chaya Venkat, *University of Michigan*

Aquametry. A Treatise on Methods for the Determination of Water. Part I. Second Edition. By JOHN MITCHELL, JR., and DONALD MILTON SMITH. John Wiley & Sons, New York. 1977. xi + 632 pp. $29.95.

Since its first appearance in 1948, "Aquametry" has occupied a conspicuous place on the bookshelves of many analytical chemists. In the meantime, the determination of water has become increasingly important, and the state of the art has advanced markedly. Accordingly, a second edition has become necessary.

This new edition will be published in parts, of which the present book is the first. This is made necessary by recent advances and by a broadening of the scope to include all methods having application to analysis for moisture, whether in a gas, liquid, or solid matrix.

Part I is devoted to techniques based on chemical, gravimetric, thermal, separations, spectrophotometric, and physical methods. Various modifications of each of these techniques are described in sufficient detail to permit an assessment of their applicability to a given analytical situation. Detailed references the original literature and to ASTM or other standard methods are given when available.

Part II will cover techniques based on electrical measurement while Part III will be devoted to the Karl Fischer reagent.

The treatise is authored by eminent analytical chemists who have made outstanding contributions in this measurement area. Their perceptive treatment of the subject matter makes it especially useful to all who may need to make measurements of moisture or to interpret such data.

John K. Taylor, *National Bureau of Standards*

Advances in Magnetic Resonance. Volume 8. Edited by J. S. WAUGH (Massachusetts Institute of Technology). Academic Press, New York. 1976. xii + 266 pp. $24.50.

This volume is typical of most in this series: detailed review articles by authors who have contributed heavily to the field.

J. H. Freed and J. B. Pedersen present a unified, very sophisticated treatment of the theory of chemically induced dynamic spin polarization in liquids which covers both nuclear and electron polarizations. This treatment is largely theoretical but includes sections on various models and on the theoretical results which may distinguish among the various models.

A companion article by K. H. Hausser and H. C. Wolf surveys optical spin polarizations in solids. Optical nuclear polarization, optical electron polarization, and optically detected magnetic resonance are covered; the development includes both theoretical treatments and experimental techniques.

D. W. Jones and T. F. Child survey the field of NMR in flow systems, beginning with a brief review of theory and then focussing on applications, including industrial processing, biomedical uses, and magnetic field measurements.

The final article is a review of the rapidly expanding field of saturation transfer ESR spectroscopy by L. R. Dalton and co-workers. A useful empirical overview opens that article and a detailed treatment of theory is then given. It concludes with a survey of applications, principally in the use of spin labels.

This volume will be useful to researchers working in or on the periphery of these areas.

Charles G. Wade, *University of Texas—Austin*

Photochemical and Photobiological Reviews. Volumes 1 and 2. Edited by KENDRIC C. SMITH (Stanford University). Plenum, New York. Vol. 1: 1976. xi + 391 pp. $32.50. Vol. 2: 1977. ix + 329 pp. $29.50.

These books, edited by a noted photobiologist, represent the first installments in what is promised to be a continuing series. Photobiology might be defined as the study of photochemical reactions under conditions where certain complications (usually membranes, living cells or even whole organisms) can serve to obscure the photoreaction mechanism. In spite of these "complications", our knowledge of the photochemical bases for the many responses of biological systems to UV and visible light has advanced substantially in the last few years, and there has for some time been a need for a comprehensive collection of reviews covering areas relevant to photochemistry and photobiology. Although both volumes reviewed here are biased toward biology in their contents, chemists who have any interest at all in the effects of light on living matter will find useful information in these books. Volume 1 presents review of topics relating to photosynthesis (C-4 metabolism and phycocyanin structure), limnology (Transmission

of Solar Radiation into Natural Waters, Photobehavior and Photophysiology of Plankton), melanin pigmentation, a therapeutic application of visible light, and responses of *E. coli* to UV irradiation. Volume 2 contains reviews by M. W. Berns (Biological, Photochemical, and Spectroscopic Applications of Lasers) and L. Kittler and G. Löber (Photochemistry of the Nucleic Acids) of immediate interest to photochemists. The other topics covered include effects of UV radiation on the human eye, biological effects of near-UV radiation, and DNA repair enzymes. All of the articles are well written, with adequate historical perspective, descriptions of recent advances, and comprehensive references to the original research. The present volumes are a valuable addition to the literature of photobiology; inclusion of more material on primary photochemical reactions in future editions would enhance the appeal of this series to chemists.

Charles F. Yocum, *University of Michigan*

Turbulence in Internal Flows. Edited by S. N. B. MURTHY (Purdue University). Hemisphere Publishing Corp., Washington, D.C. 1977. xii + 573 pp. $39.00.

The present volume, in copyready form, contains the proceedings of a Project Squid workshop. As is usually the case, the book appeared some one and a half years after the workshop itself. My reservations about this volume are quite general in that I have begun to question the validity of publishing such proceedings of limited conferences. Let me emphasize that these reservations are not associated with conducting such meetings, which I deem extremely valuable, but rather with the publication of their proceedings.

To set the stage, let me provide a few details about this workshop volume. The workshop was divided into three parts more or less associated with turbulence in internal flows. The first part involved eight papers under the general heading of fundamental problems. These ranged from discussions of the newer aspects of coherent structures to problems associated with measurement techniques. The second part was on modeling procedures and involved seven papers, for the most part on predictions of complicated flows. The final part contained six papers on turbomachinery applications.

In recent years there has been a proliferation of conferences and workshops on many subject areas such as the present one. When asked to attend one of these conferences for which a volume is going to be published, one is obligated to contribute. The pressure of a deadline on a *research paper* can only be detrimental, unless one presents old work which would be a questionable contribution. Thus, something is presented and a typed version batted out. Why worry: its an easy publication and will appear in copyready form, usually unreviewed. Don't worry too much about the quality because the effort will be lost since it is not part of the reputable journal literature. We all know the circulation of proceeding type books is limited because of the cost crunch on libraries as a result of inflationary pressures.

Of the seven presentations in the part on fundamental problems, five indicated that the work was preliminary in nature. One was too short to be of much use. The work on structures of the viscous wall layer by Walker and Abbott was of more than passing interest, and the effort on experimental methods by Freymeth was important. Nevertheless, these efforts properly presented should be in the journal literature. If the authors are planning to publish the same material elsewhere, then there is even less justification for this type of volume.

It is clear from a comparison of parts I and II that, at the time of publication, little dialogue had taken place between the experimentalists and modelers. Good modeling work is being done, but it is unfortunate that so much of it is going to be buried. Some comments were very critical, and one wonders why the modeling does so well. The criticisms raised are not incorporated into the works themselves.

Part III on turbomachinery applications is useful since a number of practical and applied problems are discussed thoroughly. Such problems are complex and apply to specific systems, but there should be a form for this type of material (e.g., *Journal of Fluids Engineering*) so that it would not be lost in a volume such as this.

Is there any justification for proceedings of meetings? The answer is yes; but the yes must be qualified. For example, the recent proceedings of the IUTAM meeting held in Washington in 1976 on "Structural Turbulence and Drag Reduction" was published as a part of the *Physics of Fluids* and issued as a separate volume. These proceedings were critically reviewed as in the normal manner. One could also justify a critical review volume for a specific subject area, for example, as a part of *Annual Reviews of Fluid Mechanics*.

What should we do about symposia and workshops that produce volumes such as the present one. First, encourage our younger colleagues not to use this as a mode of quick and easy publication, but rather to complete their work and make sure of its quality. We can impose self-discipline and attend, but refuse to contribute to such efforts. Indeed, I suspect that if we were to ascertain the total cost of the production of the volume (time and effort by contributing authors, editor, publisher, libraries, secretaries, etc.), we could afford to produce an exchange beneficial to research rather than a monument to the supporting agency.

Robert S. Brodkey, *The Ohio State University*

Dynamics of Solids and Liquids by Neutron Scattering (Topics in Current Physics, 3). Edited by S. W. LOVESEY (Institut Laue-Langevin) and T. SPRINGER (Institut für Festkörperforschung, KFA Jülich). Springer-Verlag, Berlin. 1977. xi + 379 pp. $32.35.

The neutron has several remarkable advantages as a probe of condensed matter: its lack of charge makes it penetrating, its massive nature allows it to follow lattice excitations over the entire Brillouin zone, its sensitivity to nuclear structure means that scattering properties can be changed by isotopic variation, and its magnetic moment makes it uniquely valuable as a probe of magnetic structure. The existence in Europe of user-oriented neutron-scattering facilities (of which the Institut Laue-Langevin at Grenoble is the premiere example) has led to a more vigorous exploitation of neutron-scattering techniques and a more rapid diffusion of these techniques among scientists who are not professional neutron scatterers than has been the case in the United States. This situation may change—the National Science Foundation has funded a user-oriented facility for small-angle neutron scattering at Oak Ridge, and outside users will be encouraged to utilize the intense pulsed neutron source currently under development at Argonne. Chemists and materials scientists who want to assess the possible advantages of neutron scattering in their own fields will be interested in this volume.

The book consists of seven chapters on dynamic phenomena which are currently being studied by neutron-scattering techniques. The first chapter, by S. W. Lovesey, is an introduction to the formalism of neutron-scattering theory and establishes the notation used throughout the book. H. G. Smith and N. Wakabayashi contribute a review of current phonon studies, including phonon anomalies in superconductors, excitations in layered compounds, and the effects of pressure on phonon spectra. A very active field, the study of the role of phonons in structural phase transformations, is reviewed by B. Dorner and R. Comes. A comparison of X-ray and neutron-scattering techniques is a valuable feature of this chapter.

A chapter of special interest to chemists is a wide-ranging review by John White of the neutron scattering of molecular crystals, polymers, and adsorbed species. Flashes of wry wit are to be found in this chapter as, for example, when White, a noted experimentalist, refers to "predictions of precious theoretical models . . ." (p 223).

The contributions of neutron scattering to the study of molecular rotations and diffusion in solids are discussed by T. Springer. Studies of hydrogen in metals receive special attention. Springer also discusses high-resolution studies of quantum-mechanical splitting in the energy levels of hindered rotators in the solid state (4-methylpyridine, dimethylacetylene, methane). Such studies have been carried out in the gas phase by microwave spectroscopists since the pioneering work of E. B. Wilson, but it is only recently with the development of ultrahigh-resolution neutron techniques that extension to the solid state has been possible.

Chapters on collective modes in liquids (R. D. Mountain) and magnetic scattering (S. W. Lovesey and J. M. Loveluck) conclude the volume. The reviews offered here are up to date and authoritative. Readers wishing a more gradual introduction to neutron-scattering spectroscopy may wish to consult earlier works such as "Chemical Applications of Thermal Neutron Scattering" (B. T. M. Willis, Ed., Oxford University Press, London, 1973) or "Spectroscopy in Biology and Chemistry" (S.-H. Chen and S. Yip, Ed., Academic Press, New York, 1974).

C. V. Berney, *Massachusetts Institute of Technology*