Book Reviews

Developments in Polymer Characterisation. 1. Edited by J. V. DAWKINS (Loughborough University of Technology, U.K.). Applied Science Publishers Ltd., London. 1978. x + 283 pp. $30.00.

The purpose of this book is to introduce the reader to the most recent techniques gaining prominence in the field of polymer characterization, and to the results gathered from them. The book is divided into eight chapters, each dealing with a different technique. Each chapter is prefaced with a brief summary, very helpful to the casual reader. The chapters are extremely well written (and edited) and are accompanied by substantial number of references of recent vintage.

Chapter 1 (by A. V. Cunliffe) deals with the application of ^{13}C NMR spectroscopy in polymer characterization, especially through high resolution and dynamic studies. New information obtained by mass spectroscopy is presented in Chapter 2 (by R. D. Sedgwick). The characteristics of column packing material in GPC instruments, and their effects on resolution, are discussed in Chapter 3 (by J. V. Dawkins and G. Yeadon). In Chapter 4 (by A. J. Hyde), three areas of light scattering are presented: Brillouin scattering, Rayleigh line broadening, and critical opalescence.

Chapters 5 (by R. W. Richards) and 6 (by D. S. Brown and R. E. Wetton) deal with recent observations by means of small-angle neutron scattering and small-angle X-ray scattering, respectively, on the dimensions and segmental distribution of macromolecules essentially in the bulk. The presentation of theory, experimental results, and their evaluation is excellent (especially in Chapter 5). Chapter 7 (by M. J. Richardson) concentrates on quantitative differential scanning calorimetry in general, and on fusion and crystallization in particular. Chapter 8 (by D. Hemsley) describes several recent techniques used in the microscopic studies of polymeric surfaces.

The only reservation this reviewer has is the omission of rigid-rod polymers from consideration. Recent data on polyaromatic amides obtained by means of GPC, light scattering, and microscopy could have broadened the scope of the book.

Several techniques, such as EXAFSS, Raman spectroscopy, and ESCA, were not mentioned. It is our hope that subsequent volumes of this (apparent) series will cover this omission. The editor and authors should be complimented on producing this excellent volume that will be very useful to workers in the general field of polymer characterization.

Shaul M. Aharoni, *Allied Chemical Corporation*

Thermodynamic Network Analysis of Biological Systems. By J. SCHNAKENBERG (Rheinisch-Westfälische Technische Hochschule). Springer-Verlag, Berlin-Heidelberg-New York. 1977. viii + 143 pp. $16.80.

The potential importance of the interdisciplinary area between chemistry-physics-mathematics on the one hand and biology on the other has been known for some time. In recent years this area has become of interest to an increasing number of scientists and been the subject of a number of books. However, if this area is explored in any depth, one quickly comes to the conclusion that the "gap" between these disciplines is enormous. The notion that one person or one approach can "bridge the gap" between them may be inappropriate. Perhaps a better analogy to represent the meaningful flow of information that will be required for full development of this interdisciplinary area would be that of a "bucket brigade".

According to this analogy Schnakenberg's book occupies a position on the physics end of the brigade and provides a very readable introduction for physicists interested in moving toward biology. It also provides a superb introduction to the thermodynamic perspective for those theoretically oriented but slightly closer to the biologist in the interdisciplinary spectrum.

As with the treatment of most interdisciplinary subjects, this book begins with an explicit statement of basic principles and assumptions. This is done from the perspective of a physicist in four chapters that deal with the relation of physics to biology, a sample of physical models already used in biology, a brief treatment of irreversible thermodynamics, and the elements of network analysis. The remaining three chapters are devoted to an examination of a variety of models formulated in the language of thermodynamic network analysis and to general techniques for stability analysis. There are problems at the end of each chapter that contribute to the attractiveness of this book as a supplemental text for a course on biological systems analysis.

M. A. Savageau, *University of Michigan*

Microbiology—1978. Edited by DAVID SCHLESSINGER. American Society for Microbiology, Washington, D.C. 1978. x + 449 pp. $22.00.

With the exception of the chapter on nitrification and reduction of nitrogen oxides, which will be of interest to soil scientists and environmental biologists, this collection of papers will find an audience almost exclusively among microbiologists and biochemists involved in cellular and molecular biology. A major part of this volume is directed toward extrachromosomal elements. Two other sections are devoted to cellular and molecular biology of mycoplasma and bacterial L-forms, and human papovaviruses.

M. C. W. Smith, *University of Michigan*

Aquatic Microbial Communities. Edited by JOHN CAIRNS, JR. (Virginia Polytechnic Institute and State University). Garland Publishing, Inc. New York and London. 1977. x + 695 pp. $50.00.

This collection of papers is a welcome addition to the growing field of microbial ecology and will be useful not only to biologists but also to civil and environmental engineers. Among the subjects covered are adaptations for photoregenerative cycling, experimental laboratory ecosystems and models, interrelationships between a variety of organisms, oxygen uptake, carbon flow, extracellular release, fresh water to air transfer of microorganisms and organic matter, and seasonal distribution of B vitamins in rainwater.

M. C. W. Smith, *University of Michigan*

Progress in Water Technology. Edited by S. H. JENKINS (Tame Division, Severn-Trent Water Authority, Birmingham, U.K.). Pergamon Press, Elmsford, N.Y., and Oxford, U.K. Vol. 8, No. 4/5: 1977. 765 pp. $77.00. Vol. 8, No. 6: 1977. 553 pp. $55.00. Vol. 9, No. 5/6: 1978. 646 pp. $50.00.

Engineers and workers in environmental health will find these journals a valuable source of information on all aspects of water technology.

M. C. W. Smith, *University of Michigan*

Photochemistry of Small Molecules. By HIDEO OKABE (National Bureau of Standards). John Wiley & Sons, New York. 1978. xiv + 431 pp. $34.50.

Hideo Okabe has produced a very thorough review of the photochemistry of atoms and small molecules. In three chapters he covers in clearly expressed detail the essential spectroscopy, photochemical processes, and experimental techniques. The remainder moves from single atoms through five-atom molecules, to end in a short chapter of related topics. This last chapter is necessarily "once over lightly" and does not add a great deal to an otherwise excellent work.

Careful attention to detail is evidenced by over 1000 references, some as recent as 1977. It is this completeness which assures that Okabe's book will not date rapidly, and will be a useful reference to the decade of literature produced since Calvert and Pitts "Photochemistry". In my experience several questioning graduate students have been answered simply by showing them sections of this book, which are usually illustrated by relevant spectra. The practicing photochemist involved with small molecules in any way will need this book on (and frequently off) his shelf.

D. H. Stedman, *University of Michigan*

The Chemical Physics of Surfaces. By S. ROY MORRISON (Stanford Research Institute). Plenum Press, New York. 1977. xvii + 415 pp. $39.50.

This book is best viewed as an attempt to introduce chemists to the ideas and nomenclature of surface and solid-state physics that are relevant to current theoretical descriptions of electronic surface states and of the techniques that go under the general name of surface spectroscopy. This goal is achieved using a minimum of mathematics and a maximum of verbal description, which is a good way to give an introduction to the field but which is not always adequate to allow one to actually use the concepts discussed. However, references to the literature are very extensive and the serious reader should have no trouble in locating detailed treatments. On the negative side is the fact that Morrison's coverage of the literature tends to be comprehensive rather than critical; furthermore, the number and variety of topics discussed is so large that it is impossible to avoid the criticism of superficiality in some of the descriptions given. The book covers the solid-state physicist's approach to surface states and surface sites, including surfaces of semiconductor materials; over 20 different experimental techniques are briefly described, as well as a selection of the results that have been obtained using these techniques on both clean and adsorbate-covered surfaces. Gas-solid physisorption, chemisorption and catalysis, and solid-liquid interfaces and photoeffects at semiconductor surfaces are also discussed. Indeed, almost any surface scientist should be able to find something of interest in the book. However, it would be of most use to someone wishing to be introduced to the state of the art. Since the state of this particular art is still changing quite rapidly, the book will be out-dated relatively soon and, at a price of nearly $40, cannot be highly recommended for personal libraries.

William Steele, *The Pennsylvania State University*

Cryobiochemistry: An Introduction. By PIERRE DOUZOU (Institute de Biologie Physico-Chimique, Paris). Academic Press, London and New York. 1977. x + 286 pp. £12 60/$24.65.

As interpreted by Pierre Douzou, "cryobiochemistry" does not refer to the biochemistry of subzero life per se. The book is relevant to cryobiology, to be sure, but only in an indirect manner. In his introduction, the author makes this clear when, on p 3, he writes "another potential application of cryobiochemistry could be cryobiology . . .". Two pages of Chapter 1 (Introduction) are given over to life at low temperatures and cold resistance in nature. Thereafter, the author's purposes become clear: the use of subzero temperatures as an aid to the study of biochemical process, and use of mixed-solvent systems as a means for facilitation of such studies. The author thus presents an investigative technology as it has evolved in his laboratory. As a "first", one might have hoped for a more extensive review of the fields which provide the foundations for cryobiochemistry as here delimited. Nevertheless, the documentation is adequate, especially for a highly personalized treatise.

The 79 pages of Chapter 2 are addressed to the behavior of mixed solvents as related to temperature. The discussion begins with the structure of water and nonaqueous solvents, proceeds to a general consideration of density and viscosity, and then continues with a fairly detailed treatment of dielectric constant well supported by tabular and graphical data. There follow some 30 pages devoted to acid-base equilibria and buffers, again well illuminated with graphs and tables. A good discussion of the adaptation of the glass electrode for subzero procedures is presented, including a critical dicussion of the use of H-ion activity (pa_H or pH*) instead of concentration (pH) as a parameter in "hydro-organic" solvents. The chapter ends with an extremely interesting, well-organized discussion of solubility in mixed systems.

A sound base in the physical chemistry of subzero solvent systems having been established, the next foundation stone (Chapter 3) is concerned with temperature-dependent effects of solvents on enzyme activity. Here there is a piece-by-piece reexamination of the main elements of Chapter 2 as they now relate to enzyme reactions: electrostatic effects and dielectric constant, intrinsic solvent effects, uncontrolled changes in pH*, pH-activity curves in mixed solvents, and weak electrolyte behavior. The author then proceeds to examine the enzyme as a macromolecule, discussing the conformational changes related to activity. A more or less conventional review of Michaelis-Menton kinetics follows, including derivation of the Lineweaver-Burke equation and an exposition of its applications to the analysis of inhibition. This presentation is intended to prepare the reader to use the Lineweaver-Burke method for analysis of solvent effects in enzymic reactions.

A brief consideration of the Arrhenius equation follows. Most significant is the demonstration that the Arrhenius relation is profoundly nonlinear at subzero temperatures, allowing reactions too fast to be recorded at room temperatures to be brought into measurement range. The chapter then closes with a discussion of quaternary structure vs. temperature, including cold inactivation, cryoprotection, and cryo-dissociation.

The treatment of methodology for subzero experimentation (Chapter 4) is concise and concerns two points: preparation of cooled biopolymer solutions in aqueous-organic solvents and fast kinetics techniques for subzero temperatures. A brief discussion of problems in both areas is accompanied by schematics for apparatus and component specifications for each.

The foregoing 185 pages prepare the reader for Chapter 5, which is concerned with applications. These are: first, to enzyme-substrate intermediates; second, kinetics of elementary steps; third, subzero protein and enzyme-substrate crystallography; and fourth, membrane-bound multienzyme systems. To the extent that the experimental procedures and results given are based on the literature, this chapter is a useful review. Those experiments and results originating in the author's laboratory and based on the techniques developed there may be subject to refinement but nevertheless appear to be sound in execution and interpretation.

This volume is not intended for the casual reader. It is very much a "how-to-do-it book" and is recommended to those who are actually interested in low-temperature chemistry.

S. M. Siegel, *University of Hawaii*

Excited States, Volume 3. Edited by E. C. LIM (Wayne State University). Academic Press, New York. 1977. ix + 351 pp. $32.00.

This is the third volume (in four years) of this fine series. It contains articles on (1) two-photon spectroscopy (by McClain and Harris); (2) the time evolution of excited states (by Mukamel and Jortner); (3) energy distributions in the products of the dissociation of polyatomic molecules (by Freed and Band); (4) optical nuclear polarization in molecular crystals (by Stehlik); and (5) vibronic interactions and luminescence in aromatic molecules containing nonbonding electrons (by Lim).

The most common problem of series of this type is that, by publication time, the articles are out of date. Happily, this is not the case for this volume (and for this series, in general). The reasons are simple: All the articles mentioned above contain new and important results in the study of large molecule spectroscopy and they are well written and authoritative.

The article by McClain and Harris contains an elegant and complete guide to polarization studies in the two photon spectroscopy of a molecule of any symmetry. In my opinion, it is likely to become the handbook for future studies. The article by Mukamel and Jortner is a theoretical treatment of time and energy resolved photon scattering from an arbitrarily complex molecular electronic structure. This is an awesome task, but the authors have given us an unusually clear presentation. Freed and Band give a theoretical description of photodissociation which focuses on the two processes involved: transition from the metastable to the repulsive potential surface and the motion of the receding fragments. There is an extensive comparison to earlier theoretical descriptions. The article by Stehlik begins with an excellent theoretical and experimental discussion of nuclear polarization, and then discusses, in detail, the experiments on phenazine and fluorene. Finally, the article by Lim is an up-to-date and complete discussion of the effects of nonbonding electrons on radiationless transitions and fluorescence.

This is an excellent volume in a fine series. The authors and editor are to be congratulated.

Robert Silbey, *Massachusetts Institute of Technology*

Physical Biochemistry, Applications to Biochemistry and Molecular Biology. By DAVID FREIFELDER (Brandeis University). W. H. Freeman and Co., San Francisco, Calif. 1976. x + 570 pp. $16.95 (hardcover); $10.95 (softcover).

The objective of the book is to provide sufficient understanding of the physical methods of biochemistry for advanced-level undergraduates or first-year graduate students to read, understand, and evaluate current scientific literature. The material is developed without mathematical derivations; however, assumptions that have been made in the derivation of equations are identified along with conditions that must be satisfied before the equation can be utilized. The first chapter is a review of the polymeric materials of biochemistry. The remainder

of the book is organized in six general areas. In Part I, Direct Observation, individual chapters describe light microscopy and electron microscopy. Part II, General Laboratory Methods, contains chapters on measurement of pH, radioactive labeling and counting, autoradiography, membrane filtration, and dialysis. In Part III, Separation and Identification of Materials, chromatography, electrophoresis and immunological methods are described. In Part IV, Hydrodynamic Methods, sedimentation, partial specific volume and the diffusion coefficient, and viscosity are discussed. Part V, Spectroscopic Methods, contains individual chapters on absorption spectroscopy, fluorescence spectroscopy, optical rotatory dispersion and circular dichroism, and nuclear magnetic resonance. The final section is Part VI, Miscellaneous Methods. There is a glossary. Each chapter contains selected references to comprehensive textbooks, appropriate review articles, and selected papers. With the exception of Chapter 4, Measurement of pH, all chapters have problem sets, for which answers and extensive discussions of the answers are provided. The book contains 304 illustrations and 28 tables. Both the experimental data and schematic illustrations of instrument design are utilized to communicate effectively the underlying principles. Utilization of italics to indicate key words in the text enhances the readability of the book. The book is quite readable and can be used effectively in self-study programs and as a textbook for an advanced level undergraduate course, particularly with students without a strong mathematical background.

L. C. Smith, *Baylor College of Medicine and The Methodist Hospital, Houston, Texas*

Advances in Electrochemistry and Electrochemical Engineering, Volume 10. Edited by HEINZ GERISCHER (Fritz-Haber Institute) and CHARLES W. TOBIAS (University of California, Berkeley). John Wiley & Sons, New York. 1977. xi + 491 pp. $29.95.

The reappearance of a volume in this distinguished and widely used series after a lapse of four years is most welcome. This volume is comprised of five unrelated chapters. H. Dietz, W. Haecker, and H. Jahnke discuss electrochemical sensors for analysis of gases and give a clear and complete description of the basic principles and application of these devices. W. Jaenicke describes electrochemical aspects of photographic processes. The models and concepts given in this chapter will be particularly useful to scientists interested in semiconductor electrodes and dye photosensitization of these materials. S. Trassatti deals with the still controversial area of the work function in electrochemistry. The literature and past work is reviewed nicely, but the basic idea of the author, i.e., that "the behavior of metals is expected to be largely dependent on the values of their work functions", remains debatable. The last two chapters will be of particular interest to those interested in batteries. R. A. Huggins discusses ionically conducting solid-state membranes, with a particularly good account of the β-aluminas, and R. P. Tischer and F. A. Ludwig give a critical and comprehensive discussion and review past work on the sulfur electrode in nonaqueous media with particular emphasis on fused salt melts.

Although H. Gerischer has replaced P. Delahay as the editor responsible for electrochemical science, the stated goals and the high standards of previous volumes in this series have been maintained. The change in format to camera-ready typewritten copy produces a less attractive volume, however, with about one-third less textual material per printed page.

Allen J. Bard, *University of Texas, Austin, Texas*

Cooperative Equilibria in Physical Biochemistry. By D. POLAND (Johns Hopkins University). Oxford University Press, Oxford, England. 1978. x + 344 pp. $34.95.

It is approximately 20 years since the first statistical mechanical treatments of cooperative conformation changes in biological macromolecules appeared in the scientific literature. In the intervening period many important cooperative phenomena have been discovered in biological systems, and these in turn have often been analyzed in terms of formalisms which draw more or less heavily on various techniques of statistical mechanics. The research worker most often confronted by the experimental manifestations of cooperative binding and/or conformation change in biochemistry or molecular biology is frequently one whose formal training in physical chemistry did not include more than the most elementary introduction to statistical mechanics. Professor Poland has undertaken in his book to bridge the gap between the powerful statistical mechanical methods mandatory for facile treatment of the complex multiple equilibria ubiquitous in modern biology and the notions of chemical equilibrium and elementary classical thermodynamics with which these workers are comfortably familiar. He has succeeded admirably in this task, and in the process he has catalogued insights and generalizations which may have eluded many workers already somewhat conversant with the statistical mechanical methods in question.

The first chapter provides a thorough treatment of simple multiple equilibria. Classical and statistical thermodynamic methods are developed in tandem, and the partition function is introduced. Chapter 2 is a condensed, but effective, general discussion of the relationship between classical and statistical thermodynamics plus an examination of the inter- and intramolecular forces operative in biological systems. This material can be omitted without disrupting the continuity of the other chapters, but it does provide the reader with the basis for making a connection between the highly parameterized statistical thermodynamic treatments of cooperative biological systems and the topics to be found in elementary statistical mechanics textbooks. Chapter 3 deals with association of biopolymers using as examples the dimerization of oligonucleotides, inter- and intrastrand association of poly(A-T), and termolecular association in collagen and its synthetic analogues. Formal methods for evaluation and differentiation of linear chain partition functions are developed in Chapter 4, where matrix and generating function methods are emphasized. Cooperative binding of small molecules to macromolecules is dealt with in Chapter 5, while Chapter 6 brings the reader to the frontiers of the subject in a discussion of cooperative equilibria in specific sequence macromolecules.

This highly didactic book should be most valuable to all workers interested in analyzing and interpreting cooperative phenomena in biological systems.

David A. Brant, *University of California*

Techniques of Chemistry, Volume XII, Separation and Purification, Third Edition. Edited by EDMOND S. PERRY and ARNOLD WEISSBERGER (Eastman Kodak Co.). Wiley-Interscience, New York. 1978. xi + 438 pp. $30.00.

Of the seven chapters in this volume of the well-known Weissberger "Techniques" series, three are revised from the previous edition and four are new. Those that appeared previously cover separation by liquid–liquid extraction, centrifuging, and filtration. The new chapters deal with criteria and tests for purity, solvent selection for separation processes, ion-exchange chromatography (including high-pressure liquid chromatography), and affinity chromatography. Each chapter provides a broad survey of its topic with guidelines and references for practical applications as well as an exposition of basic theory and principles.

From the standpoint of the research chemist, as opposed to the production chemist, much of the material in this volume is less useful than that of the previous edition, which it therefore does not entirely supplant. This deficiency is especially noticeable in the chapters on filtration and liquid–liquid extraction. In addition, techniques of crystallization and recrystallization and solvent removal, evaporation, and drying must now be consulted in separate volumes.

The book is well printed and appears to be relatively free of errors. In Table 1.1, however, the percentage range of 0.01–1 is incorrectly given as 100–1000 ppm, instead of 100–10,000 ppm.

Albert W. Burgstahler, *The University of Kansas*

Environmental Fluoride, 1977. By DYSON ROSE and JOHN R. MARIER. Associate Committee on Scientific Criteria for Environmental Quality, National Research Council of Canada, Ottawa, Ontario, Canada K1A OR6 (NRCC No. 16081). 1977 (released July 1978). 152 pp. $2.00.

Since 1971 the Canadian National Research Council has been issuing an impressive series of valuable reports on environmental topics ranging from contamination by chemicals to pollution by heat, noise, and radioactivity. In the present report, Rose and Marier critically examine the major sources and effects of industrial and commercial fluorides that are being dispersed into our air, water, soil, and vegetation. With thorough documentation including 25 tables and ca. 480 references, they offer a careful assessment of the cumulative impacts of these fluoride intrusions on livestock, crops, forests, wildlife, aquatic species, and, most of all, human populations.

The report goes far beyond the known but still not widely recognized air-pollution aspects of the subject and touches on many neglected areas. For example, it cites evidence that water hardness and other

factors can significantly moderate human fluoride toxicity. Increased fluoride intake enhances the body's requirements for calcium, magnesium, vitamin C, and manganese. "There is no doubt that inadequate nutrition [which is certainly not uncommon] increases the severity of fluoride toxicosis."

Owing in large measure to the widespread use of fluoridated water for food processing as well as for beverages and drinking, fluoride intake in Canada and the United States has increased markedly. Another important source is mechanically deboned meat, which contains about ten times more fluoride (from bone particles) than hand-deboned meat. As a result, the average adult's total intake of fluoride from food, beverages, and fluoridated water is now between 3.5 and 5.5 mg/day—about double previous estimates. Not included in this amount are the many additional sources from air, cigarettes, dentifrices, mouth washes, pharmaceuticals, and fluorinated anesthetics.

The report also cites evidence that prolonged ingestion of even comparatively small amounts of extra fluoride can cause adverse changes in the blood, kidneys, liver, spleen, brain, nerves, and other organs of the body, besides bones and teeth. Recent studies indicate that when plasma concentrations of ionic fluoride exceed 2–3 μM (normal 0.5–1.0 μM), particularly in the elderly, bone fragility and spontaneous fractures occur more frequently. Since nephrogenic diabetes appears to be exacerbated by fluoride, the authors recommend careful monitoring of blood plasma fluoride among persons at risk to detect latent or potential injury. This procedure is especially important for individuals with impaired kidney function, suboptimal nutrition, exposure to fluoride-polluting industries, or excessive intake of fluoride from food and/or water.

Unlike the fluoride chapter of the U.S. National Research Council's recent report "Drinking Water and Health" (1977), which largely omits or discounts evidence for toxic effects to man from fluoride exposures commonly encountered in today's environment, the present document not only identifies areas where more research is needed but also frankly acknowledges the existence of already serious fluoride hazards to many different groups of people.

Unfortunately, because of the favorable but often greatly exaggerated image of fluoride as a deterrent to tooth decay, too many scientists do not yet recognize the magnitude and seriousness of fluoride as an environmental pollutant. For this reason the importance of this report cannot be overestimated.

Albert W. Burgstahler, *The University of Kansas*

Chemical Analysis by Emission Spectroscopy. By SAM EPSTEIN (formerly American Smelting and Refining Co.). Franklin Publishing Co., Inc., Palisade, N.J. 1977. 160 pp. $12.00.

This book covers spectroscopes and spectrographs, but not optical emission spectrometers as tools in an industrial laboratory. The book is intended to introduce people to spectroscopy and to discuss a variety of practical aspects of analysis. For hobbyists it includes a 19-page section on how to build a spectrograph with additional material on constructing simple power sources.

The author is careful to discuss spectroscopy so that almost anyone can understand it. For the serious student or spectrochemist, the book lacks the depth and detail of other books, and could give a wrong perspective of spectroscopy.

D. C. Spindler, *Ferro Corporation*

The Electronic Structure of Rare-Earth Metals and Alloys: The Magnetic Heavy Rare-Earths. By B. COQBLIN (Université Paris-Sud, Orsay, France). Academic Press, London and New York. 1977. xvi + 656 pp. £29.50/$57.75.

Six of the 15 lanthanide metals—gadolinium, terbium, dysprosium, holmium, erbium, and thulium—are grouped together in this book as the "magnetic heavy rare earths", none of which deviates from trivalency in the metallic state even at extremes of temperature and pressure. Since the early 1960s, the properties of these metals have been carefully and extensively studied, and theoretical considerations have kept pace with the experimental work. Coqblin's objective is to provide a reference volume which brings the reader up to the current state of thought and research in this area.

Following an introductory section dealing with properties of all the rare earth metals, the author turns to magnetic ordering in the heavy rare earth metals and alloys, dealing first with the experimental situation and then with the molecular field and spin wave theories. The use of measurements of magnetization, specific heat, electrical resistivity, inelastic scattering of neutrons, and magnetic resonance to obtain spin wave spectra is discussed. Among additional topics covered are variation of magnetic periodicity, superzones, magnetoelastic effects, magnetic order transitions, band structure, and transport properties.

Although the line dividing solid-state chemistry from solid-state physics is diffuse, the material in this book is well over on the physics side. Accordingly, it will probably be of greater interest and utility to physicists and modern metallurgists than to chemists. However, this is a very fine, scholarly achievement with a great deal of information and 684 references, and the individual should make a personal decision regarding whether a copy belongs in his library.

Lawrence Suchow, *New Jersey Institute of Technology*

Gmelin Handbuch der Anorganischen Chemie. Ergänzungswerk zur achten Auflage. Band 26. Zinn-Organische Verbindungen. Teil 1. Zinntetraorganyle SnR_4. Prepared by the Gmelin Institute for Inorganic Chemistry. Springer-Verlag, Berlin-Heidelberg-New York. 1975. x, iv + 182 pp. $132.50.

The stated purpose of the New Supplement Series is "to facilitate the rapid reporting of new developments in inorganic chemistry", laying the emphasis on related "chemical classifications and structural features". Gmelin's application of this policy to the burgeoning literature of organometallic chemistry seems particularly apt. While possessing possibly an embarassing number of annual, or topical reviews, organometallic chemistry has nothing like the compilation of data and coverage of literature offered by Gmelin. Being inorganic chemistry's equivalent to the monumental Beilstein's "Handbuch der Organischen Chemie", Gmelin seeks to offer for each known organometallic compound a summary of all available data, information, and literature citations (excepting those sources or patent details not given in *Chemical Abstracts*).

The present volume, the first of three dealing with tetraorgano derivatives of tin (i.e., tin bonded to four other carbon centers), is devoted to the known symmetrically substituted derivatives, R_4Sn. Written in German with English marginal subtitles, the volume begins with a thorough (30-page) bibliography of background monographs and reviews in all languages. In its great thoroughness, this section strikes this reviewer as prototypical of what is to follow. For the first compound treated, tetramethyltin, the information is organized sequentially under the headings: formation and preparation; molecular spectral properties; physical properties; chemical behavior; solution properties; physiological effects; and applications. The relevant literature citations are given after each of these headings. Further coverage proceeds homologously through the tetraalkylstannanes, with a subsequent coverage of tetracycloalkyl, substituted tetraalkyl, tetraalkenyl, tetraalkynyl, tetraaryl, and tetraheterocyclic derivatives. As aids in locating compound entries, there are a detailed table of contents, a formula index, and the logical organization of the material itself.

Though the conception of such Handbücher by Beilstein and by Gmelin itself deserves praise, surely the execution of such a project must be recognized as Herculean, and its continuation, Sisyphean. In organotin chemistry alone, the number of published papers is estimated to be about 10,000 and is growing at about 1000 annually. The present volume claims to have sifted all pertinent publications from 1849 through 1973. The result for tetramethyltin itself is 27 pages of densely packed data and citations, an awesome accomplishment for the editors, Herbert and Ingeborg Schumann, and the diligent Gmelin staff.

In general, the summaries of data and observation are factual and nonjudgmental. But the thoroughness of literature coverages leads to the juxtaposition of disconsonant observations (for example, that two different research groups report different results with the same reagents), and this is valuable to the attentive reader. Furthermore, although many preparative procedures are usually summarized, no attempt is made to offer all detail necessary to reproduce the results. All available thermodynamic, kinetic, and spectral data are apparently included, as well as structural and spectral interpretations; but equations are not.

Based upon his first-hand knowledge of certain narrow aspects of these compounds, the reviewer judges the literature coverage to be authoritative and thorough. He would certainly counsel any scientist interested in a specific organotin compound first to consult its Gmelin entry before proceeding to the primary literature. Unfortunately, such

a consultation will most likely occur in a library, for the price generally precludes personal ownership.

John J. Eisch, *The State University of New York at Binghamton*

Gmelin Handbuch der Anorganischen Chemie, Ergänzungswerk zur achten Auflage, Band 29, Zinn-Organische Verbindungen, Teil 2, Zinntetraorganyle R_3SnR', 1975. xii, iii + 480 pp. $346.80. **Band 30, Zinn-Organische Verbindungen, Teil 3, Zinntetraorganyl $R_2SnR'_2$, $R_2SnR'R''$, $RR'SnR''R'''$, Heterocyclen und Spirane**, 1976. xv + 164 pp. $143.90. Springer-Verlag, Berlin-Heidelberg-New York.

Both these volumes cover the unsymmetrical tetraorgano derivatives of tin (i.e., tin bonded to two or more different carbon centers). Volume 29 deals with those compounds of the type R_3SnR'; Volume 30 surveys all other types of unsymmetrical tetraorganotins. The literature cutoff date is the end of 1973. The organization of the compound entries consists in beginning with $(CH_3)_3SnR'$ or $(CH_3)_2SnR'_2$, for the respective volumes, and treating sequentially their derivatives where R equals (1) a substituted methyl group whose substituent is not connected by another carbon center; (2) a substituted methyl group whose substituent is connected by another carbon center; (3) higher homologues of unsubstituted and substituted alkyl groups; (4) cycloalkyl; (5) alkenyl; (6) cycloalkenyl; (7) alkynyl; (8) aryl and derivative aryl; and (9) heterocyclic groups. Thereafter, the R in R_3SnR' is varied in a similar sequence to form the further subheadings. In both these volumes, additional general literature citations concerning the preparation, reactions, physical properties, analysis, and uses of unsymmetrical organotin derivatives are compiled in the Introduction. Many preparative methods and reactions are compiled in the 71 tables, and an indispensable 40-page formula index is appended. The logic of organization and depth of coverage are a tribute to the editors, Herbert and Ingeborg Schumann, and their co-workers.

For the preparation of a given organotin derivative, all of the yields and physical constants reported by different research groups are cited: under triphenylallyltin, for example, we find six different yields and six different melting points individually listed. Surely this is carrying completeness to a trivial extreme; ranges of values would have been more concise. On the other hand, for all the chemical reactions, no yields or ratios of products are given. Here such data would have conveyed the ease and relative importance of competing processes.

Since unsymmetrical tetraorganostannanes are assuming a greater importance in organic and inorganic synthesis, one would expect such recognized applications to be noted. This is not always the case. Although the reader is informed, for example, that $(C_4H_9)_3SnCH_2COCH_3$ is a valuable reagent for introducing the CH_2COCH_3 group into other molecules, nothing is stated about the great value of the reaction of $(C_6H_5)_3Sn(CH_2)_nCH{=}CH_2$ with C_6H_5Li for making salt- and donor solvent-free vinyl- and allyllithium reagents. Summarizing the relevance of a given tin compound, not only to commerce but also to other fields of chemistry, would have been a worthy improvement for the Verwendung (Uses) section.

John J. Eisch, *The State University of New York at Binghamton*

Gmelin Handbuch der Anorganischen Chemie, Ergänzungswerk zur achten Auflage, Band 35, Zinn-Organische Verbindungen, Teil 4, Organozinnhydride, Springer-Verlag, Berlin-Heidelberg-New York. 1976. xiv, v + 134 pp. $136.90.

This volume, under the same editorship as Teile 1-3, covers the literature of mononuclear organotin hydrides, R_nSnH_{4-n}, through 1974. Commencing with a four-page general bibliography, the treatment considers the homologous series of trialkyltin hydrides first and then takes up cycloalkyl, aryl, and other types. Successively, R_2SnH_2 (including stannocyclic types) and $RSnH_3$ types are reviewed. Noteworthy among the known hydrides is almost the complete lack of unsaturated hydrides, such as alkenyl and alkynyl hydrides (excepting the known, but very unstable $CH_2{=}CHSnH_3$). The reason, of course, is the same one that makes these reagents so valuable in synthesis: the ease of hydrostannating unsaturated functional groups. Not only their hydrostannating properties but also their applications as selective reducing agents toward organic halides receive extensive attention in this monograph. The chemistry of the most frequently used tin hydride, $(n\text{-}C_4H_9)_3SnH$, is reviewed in a 20-page section containing 9 pages of tabular entries. As noted with regret in the foregoing review, here again yields for these reactions are generally not given. But the wide variety of organic substrates exemplified does make this survey valuable for the preparative chemist seeking to appreciate the value of these tin reagents.

John J. Eisch, *The State University of New York at Binghamton*

Some Modern Methods of Organic Synthesis, 2nd Edition. By W. CARRUTHERS. Cambridge University Press, New York. 1978. xii + 532 pp. $59.50 hardbound; $15.95 paperback.

This, the second edition of this text, is appearing eight years after the first one came out. The material is covered in seven chapters: formation of carbon-carbon single bonds, formation of carbon-carbon double bonds, the Diels-Alder reaction, reactions at unactivated C-H bonds, synthetic applications of organoboranes and organosilanes, oxidations, and finally reductions.

Generally, the scope and limitation of each method is given: stereochemical aspects of the described reactions are not neglected. Also an effort is made to provide a mechanism for the presented methods. In the chapter of C-C single bond formation the increasingly useful "Umpolung" (dipole inversion) is dealt with in more detail than has been done for "older" ones of the modern methods presented. The same cannot be said about methods effecting a directed aldol condensation. The pioneering work of G. Wittig unfortunately is not mentioned. In this method, the aldehyde carbonyl group is transformed into an azomethine function. The protected aldehyde can now be metalated and undergo a directed aldol condensation with a ketone, e.g., acetophenone [G. Wittig and H. Reiff, *Angew. Chem., Int. Ed. Engl.*, 7, 7 (1968)]. In the chapter on the formation of C-C double bonds the method of "Wittig and related reactions" is discussed on 22 pages. The stereochemistry of the Wittig reaction, however, is presented as if the final word on it has been spoken. Thus, the reviewer cautions the reader and suggests the inspection of recent publications on stereochemical aspects of this reaction, especially those by Bestmann and Schlosser. The "very useful alternative method for the preparation of resonance-stabilized phosphoranes for use in the Wittig reaction proceeds from phosphonate esters . . ." is now commonly referred to as the Horner-Emmons reactions. The by-product of this reaction is not a water-soluble phosphate ester but rather the water-soluble anion of a diester of orthophosphoric acid (p 110).

A good aspect of the book is the emphasis on the increasing use of organosulfur, organoselenium, and organosilicon compounds in organic synthesis. In Chapter 5 (synthetic applications of organoboranes and organosilanes), 20 pages are devoted to such a use of organosilicon compounds. Among the methods discussed are the protection of functional groups by the trimethylsilyl moiety, reactions involving trimethylsilyl cyanide, and elimination reactions involving the β position.

There are more than 800 references which enhance the usefulness of this book considerably. If sometime in the future a third edition of this book is contemplated, the reviewer suggests the referencing of the text in the conventional way by use of numbers rather than giving the author's name(s) and listing all cited authors alphabetically at the end of the book. Also, the term "carbonium ion" should not be used; carbocation or carbenium ion are the correct and accepted names for R_3C^+ species.

In summary, then, the author has presented "Some Modern Methods of Organic Synthesis" in a useful and very readable manner. It can be recommended as a text for a one-semester course in organic synthesis for advanced undergraduates or beginning graduate students. It also will prove of value to the practicing organic chemist in keeping him (her) up-to-date on developments in the field of synthesis. The value of the book is enhanced by the reasonable price of its paperback edition.

Hans Zimmer, *University of Cincinnati*