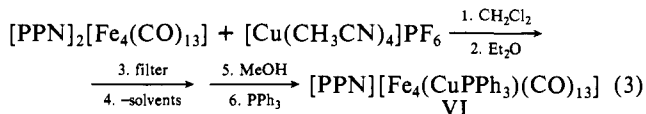


Figure 2. ORTEP diagram of $[\text{Fe}_4(\text{CuPPH}_3)(\text{CO})_{13}]^-$ anion thermal ellipsoids at the 50% probability level. Selected bond distances (\AA): Fe-Fe distances range 2.576 (6)–2.644 (5), Cu1-Fe2 = 2.561 (5), Cu1-Fe3 = 2.525 (6), Cu1-Fe4 = 2.580 (6), C33-Fe3 = 2.09 (2), C33-Fe4 = 1.88 (3), C33-Fe1 = 2.44 (2).

$^\circ\text{C}$, suggesting only one isomer in solution.¹⁷

The R_3PAu^+ cation is often used as a proton mimic in cluster chemistry,²⁰ and the isolobal LCu^+ cation has received some use.²¹ We therefore prepared the complex $[\text{PPN}][\text{Fe}_4(\text{CuPPH}_3)(\text{CO})_{13}]$ (VI) according to eq 3. The solution IR spectra of this complex



(20) Hall, K. P.; Mingos, D. M. P. *Prog. Inorg. Chem.* **1984**, *32*, 237 and references therein.

(21) (a) Freeman, M. J.; Green, M.; Orpen, A. G.; Salter, I. D.; Stone, F. G. A. *J. Chem. Soc., Chem. Commun.* **1983**, 1332. (b) Bradley, J. S.; Pruet, R. L.; Hill, E.; Ansell, G. B.; Leonowicz, M. E.; Modrick, M. S. *Organometallics* **1982**, *1*, 748. (c) Albano, V. G.; Brago, D.; Martinengo, S.; Chini, P.; Sansoni, M.; Strumolo, D. *J. Chem. Soc., Dalton Trans.* **1980**, 52. (d) Carriedo, G. A.; Howard, J. A. K.; Stone, F. G. A. *Ibid.* **1984**, 1555.

and III are nearly identical, with VI having an additional weak absorption at 1723 cm^{-1} .²² The spectrum of VI in the solid state does not have an absorption in the II-CO region ($1420\text{--}1380 \text{ cm}^{-1}$) but rather is similar to that in solution. The $-80 \text{ }^\circ\text{C}$ ^{13}C NMR spectrum of the solid dissolved at $-78 \text{ }^\circ\text{C}$ displays only a single resonance at δ 220.4. Warming this solution to room temperature and then recooling to $-80 \text{ }^\circ\text{C}$ generates a ^{13}C NMR spectrum with a weak downfield resonance at 286.7 ppm, four new resonances in the terminal CO region, and the main resonance at 220.4 ppm.²³ From these data, it appears that the solid-state structure possesses a tetrahedral core of iron atoms which in solution opens into a butterfly with a II-CO as a second, minor isomer. As shown in Figure 2 the solid-state structure of complex VI does have a tetrahedral iron core.²⁴ From this result, we conclude that for both $[\text{HFe}_4(\text{CO})_{13}]^-$ and $[\text{Fe}_4(\text{AuPET}_3)(\text{CO})_{13}]^-$ the resonances in the ^{13}C NMR spectrum at δ 216.7 and 222.4, respectively, arise from similar face-capped tetrahedra. The crystallization of two forms of analogous molecules, III and VI, and NMR spectra on solutions demonstrate that the energy difference between the butterfly and tetrahedral isomers is small, just as it is in $[\text{H-Fe}_4(\text{CO})_{13}]^-$.¹⁴ Our results, along with theoretical calculations which reveal basicity centered at the Fe-Fe hinge bond of similar butterfly molecules²⁵ indicate that other simple acceptors should induce the tetrahedron to butterfly transformation.

Acknowledgment. This research was funded by NSF Grant CHE-8204401. C.P.H. was the recipient of an E. I. du Pont de Nemours and Co. fellowship.

Supplementary Material Available: Complete listings of positional parameters, bond angles and distances, anisotropic thermal parameters, and observed and calculated structure factors for $\text{Fe}_4(\text{AuPET}_3)(\text{CO})_{12}(\text{COCH}_3)$ and $[\text{PPN}][\text{Fe}_4(\text{CuPPH}_3)(\text{CO})_{13}]$ (128 pages). Ordering information is given on any current masthead page.

(22) IR (CH_2Cl_2) 2040 (m), 2000 (m, sh), 1974 (vs), 1912 (m, sh), 1723 (vw) cm^{-1} . ^{31}P NMR (36.19 MHz, CD_2Cl_2) Ph_3P , δ 3.03; $[(\text{Ph}_3\text{P})_2\text{N}]^+$, δ 21.9. Anal. Calcd (Found) for $\text{C}_{67}\text{H}_{45}\text{O}_{13}\text{P}_3\text{NFe}_4\text{Cu}$: Fe, 15.40 (11.33); Cu, 4.38 (4.12).

(23) ^{13}C NMR (22.49 MHz, CD_2Cl_2) δ 286.7, 221.5, 220.4, 217.4, 212.9, 209.7 (after warming to room temperature and recooling).

(24) Crystal data for $[\text{PPN}][\text{Fe}_4(\text{CuPPH}_3)(\text{CO})_{13}]$: $a = 16.352$ (5) \AA , $b = 15.169$ (6) \AA , $c = 13.811$ (4) \AA , $\alpha = 99.06$ (2) $^\circ$, $\beta = 78.17$ (2) $^\circ$, $\gamma = 76.88$ (3) $^\circ$, $Z = 2$, $d_{\text{calcd}} = 1.511 \text{ g cm}^{-3}$, space group PI , $R_w = 0.078$.

(25) (a) Harris, S.; Bradley, J. S. *Organometallics* **1984**, *3*, 1086. (b) Wijeyesekera, S. D.; Hoffman, R.; Wilker, C. N. *Ibid.* **1984**, *3*, 962. (c) Fehlner, T. P.; Housecroft, C. E. *Ibid.* **1983**, *3*, 764.

Book Reviews*

Annual Reports of the Progress of Chemistry. Volume 79. 1982. Section C. Physical Chemistry. Senior Reporter: M. C. R. Symons (University of Leicester). The Royal Society of Chemistry: London. 1983. xiv + 297 pp. \$95.00.

This volume provides review chapters on seven areas. Of these, four are follow-on reviews by the same authors of chapters that appeared in Volume 76 of the same series. These include the sections on Thermochemistry by M. N. Jones and H. A. Skinner, a compilation of data with some interpretation, such as questioning the suitability of using benzoic acid sublimation as a standard when the product may not be solely the monomer; Macromolecular Chemistry by E. A. Boucher, a brief survey of polymer chemistry supplementing Volume 2 of the Specialist Periodical Reports of the same name; Catalysis by D. A. Dowden, who, after indicating that "there has been no major advance despite the outpouring of published material" since his last review, produces an extensive review, though with lower coverage of the surface science currently in vogue

among chemical physicists in this country; and Spectroscopic Studies of Liquids and Solutions at High Pressures by D. J. Gardiner, a short chapter focusing on Raman, IR, UV-vis, and NMR spectroscopic applications. The other three chapters in Volume 79 consist of a chapter entitled Kinetics of Reactions in Solution. Part II. Fast Reactions, covering proton transfer, electron transfer, radical, metal-complex formation, association, and micellar reactions, by J. E. Crooks, which is the complement to a previous chapter from Volume 76, and two new topics termed "middle of the road reviews" by the Senior Reporter.

The first of these new topics is Spectroscopic Studies of Intermolecular Forces in Dense Phases by J. Yarwood which focuses on optical spectra through shifts, broadening, and line widths of IR and Raman spectra. The ability to separate relaxation processes into homogeneous and inhomogeneous components is examined, as is the relation between macroscopic and microscopic correlation times, which includes discussions of recent theoretical developments and of the errors induced because collision-induced intensities have been incorporated. Yarwood discusses attempts to correlate experimental work with intermolecular forces by using interaction induced spectra and includes a section on studies of

*Unsigned book reviews are by the Book Review Editor.

intermolecular interactions in systems containing molecular complexes. The review does not include discussion of correlation time characterizations based on magnetic resonance methods.

The other new chapter is Elementary Reactions of Atoms and Small Radicals of Interest in Pyrolysis and Combustion by J. E. Baggott and M. J. Pilling. This chapter includes brief discussions of recent developments in experimental techniques including laser-induced fluorescence, laser magnetic resonance, infrared spectroscopy (both laser and FTIR), optogalvanic spectroscopy, multiphoton ionization, optoacoustic spectroscopy, mass spectrometry, and laser photolysis and includes extensive sections on reactions between atoms and radicals, high-temperature kinetics, flame kinetics, and numerical methods of data analysis. This latter section could be of special interest to experimentalists as it includes a discussion of methods of numerical integration and sensitivity analysis. Even editorialization about funding and the importance of reproducibility in error analysis is inserted. This is the most self-contained chapter in this volume, and an extensive presentation of results for studies of elementary reactions and unimolecular reactions is incorporated.

The reviews generally maintain a refreshing balance between touching base with the recent literature while providing both interpretive and correlative analysis of those studies perceived to be most significant. Advances in technique, summaries of recent findings, and new interpretations are all components of the reviews. Though not likely to be useful as a first exposure of the reader to each of these subjects, these reviews should prove valuable to specialists and workers in related areas who value the consolidation and interpretation provided.

Richard D. Bates, Jr., *Georgetown University*

Chemistry and Biochemistry of Amino Acids, Peptides, and Proteins. Volume 7. Edited by Boris Weinstein (University of Washington). Marcel Dekker Inc.: New York. 1983. x + 395 pp. \$69.50.

Volume 7 of this eclectic series focuses heavily on peptides and peptide analogues of unconventional constitution, with one chapter on *N*-(carboxyalkyl)amino acids. In Chapter 1, R. K. Olsen presents a balanced review on the quinoxaline depsipeptide antibiotics. These are the cyclized form of a dimerized tetramer containing an *N*-methylamino acid esterified to the hydroxy group of a seryl residue bearing a quinoxaline-2-carbonyl substituent on its amino function. In addition, the side-chains of two other residues are linked by a sulfur-containing bridge. Included is discussion on structure determination, conformation, biosynthesis, chemical synthesis, mode of binding to nucleic acids, and biological activity.

Chapter 2, by R. Rocchi and V. Giormani, deals with the nature of the linkage between carbohydrate and protein moieties in glycoproteins. There are short sections on the constitution of the saccharide units and amino acid residues and combinations thereof which are implicated, and on the distribution in nature and function of glycoproteins. Most of the chapter is devoted to describing the strategies, protecting groups, and bond-forming reactions which have been used to attach the anomeric carbon atom of a monosaccharide to the side-chain hydroxy group of an amino acid or the carboxamido group of asparagine. This account is a useful repository of the data on the subject.

Chapter 3, by J. Tempé, is a comprehensive survey of the open-chain imino acids HO₂C-CHR-NH-CHR'-CO₂H found in marine animals and crown gall tumors (plant overgrowths). Included is their isolation, structure determination, chemical synthesis, biosynthesis and degradation, and biological function. Unfortunately, it is a very difficult read for two reasons. The nomenclature, both trivial and systematic, is horribly confusing, and the author has failed to guide the reader through this terminological and stereochemical maze. What can the reader do but throw his hands up in despair when confronted with a compound called D-octopine, more precisely described as *N*²-(1-D-carboxyethyl)-L-arginine, which has an enantiomer called *L*-allo-octopine, and which, on conversion of its guanidino group to an amino group, becomes octopinic acid? There is a definite need for some authoritative person or committee to come to grips with this aspect of the subject to make it more intelligible to outsiders.

In Chapter 4, R. W. Roeske and S. J. Kennedy discuss the structure and physical properties of the ion-transporting antibiotics and their analogues which are useful models for studying the mechanism of ion-permeability through membranes. These well-studied molecules are the cyclodepsipeptide ion-carriers valinomycin and the enniatins, characterized by alternating amide or methylamide and ester bonds, and the linear peptide channel-formers gramicidin and alamethicin, with alternating L- and D-residues and a high α -methylalanine content, respectively. The emphasis is on ordered structure-function relationships. Also included are some uncharacterized protein channel-formers.

The last chapter, by A. F. Spatola, is a remarkably lucid compilation of all the types of modifications which have been effected at the main-chain level of synthetic peptides, with an analysis of the conformational

and hydrogen-bonding implications thereof. Particularly appealing and helpful is the simple structure designation system used throughout, exemplified by -Val ψ [CO₂]Ala- where ψ [] indicates replacement of the CONH atoms linking valine and alanine by the atoms inserted in the brackets. This chapter with its cautionary remarks on the interpretation of results should be required reading for anyone attempting to deduce, from studies with analogues, the structural requirements for biological activity in a molecule.

The bibliographies cover references up to mid-1981 or the end of 1981. There are, understandably, a few more editorial lapses than usual, but they are inconsequential. This volume is a useful addition to the series and a fitting tribute to a well-known editor who died before its publication.

N. Leo Benoiton, *University of Ottawa*

Energy Resources through Photochemistry and Catalysis. Edited by Michael Gratzel. Academic Press: New York. 1983. xiv + 573 pp. \$59.50.

This book reviews the advances made over the past decade toward the development of catalytic systems for solar energy conversion and storage. Three areas of photocatalysis are examined: hydrogen and oxygen production from water photolysis; photochemical fixation of carbon dioxide; and catalytic nitrogen fixation. The fundamental aspects of these phenomena are covered by discussions of light-induced redox reactions, reaction dynamics in organized assemblies, colloidal and solid metal or semiconductor catalytic systems, and strategies for molecular engineering of artificial photosynthetic devices.

One important emphasis is on the use of colloidal metals or semiconductors as catalysts for water photolysis. Seven chapters deal specifically with the photocatalytic properties of TiO₂ colloids and the improvements in these systems when doped with specific hydrogen- and oxygen-evolving catalysts like Pt and RuO₂. Of the remaining nine chapters, three deal with other semiconductor materials and methodologies for electrode modification; among topics discussed are Pt-group metal photocathode, metal chalcogenides in polysulfide electrolytes, and the use of electrically conducting polymers on semiconductor electrodes. Two chapters discuss the use of chlorophyll and similar porphyrin systems as sensitizers in visible light induced water photolysis. The remaining chapters deal with charge separation and vectorial electron transfer in organized assemblies (micelles, microemulsions, vesicles), photochemical CO₂ fixation, N₂ fixation by transition-metal compounds, as well as the theory of light-induced electron-transfer reaction.

The descriptions of colloidal metal and semiconductor catalysts are definitive treatments of the considerable progress made in the field over recent years. By contrast, the reviews of work on porphyrin-chlorophyll systems and vectorial electron-transfer mechanisms are slightly less satisfactory, being somewhat incomplete in detail, or fragmentary in scope. Overall, the volume provides an interesting account of the diversity and enormous breadth of an emerging research undergoing varying degrees of refocusing its many promising orientations. The present reviewers were struck, on reading this book, by an intriguing possibility: through proper digestion of the many facts and findings presented here one might come upon a photocatalytic apparatus, perhaps through judicious use of chlorophyll and inorganic catalyst in a configuration optimized for vectorial electron transfer, capable of efficient conversion of visible light into stored energy in a biomimetic approach to in vitro photosynthesis.

As a reference book, this work contains much useful information on the development and characterization of catalytic systems for solar energy conversion and storage. Each chapter contains an adequate, if not comprehensive, reference list which should prove useful to novices interested in the general area of photocatalysis. The material presented has appeared in many different publications. In this respect this work provides in one single, convenient collection a timely and welcome summary of the progress made in energy research.

Francis K. Fong and Michael S. Showell, *Purdue University*

Handbook of Solubility Parameters and Other Cohesion Parameters. By Allan F. M. Barton (Murdoch University). CRC Press, Inc., Boca Raton: FL. 1983. ix + 594 pp. \$99.50.

This "handbook" is written in the style and format of a chemical review. It includes a concise summary of the theory of solubility as developed by J. H. Hildebrand and his school and tabulates the required data, especially the solubility parameters and subsidiary cohesion parameters from dispersion, polar, and hydrogen-bonding interactions. About half of the book is devoted to tables and graphs of data. Much of the remainder is devoted to applications of these data to the prediction of solubilities and thermodynamic activities of liquids, solids, gases, and polymers, to the treatment of heterogeneous equilibria, and to semi-empirical schemes for predicting solubility parameters as additive-con-

stitutive functions of molecular structure. Treatment of polymer solubility is particularly extensive.

The author's outstanding contribution is that he has consolidated information about solubility parameters from all areas of chemical science and presented it in a consistent manner, with a consistent notation. He cites more than 1700 references from journals of basic chemistry, pharmacology, polymer science, paint technology, chemical engineering, colloid and interface science, and biotechnology. As far as I know, nothing so comprehensive has been published before. The Index and Table of Contents are excellent, and I like the fact that the references include full titles of the cited articles.

For scientists wishing to use solubility parameters, this book provides easy access to required data and to key references. Since the author does not evaluate the accuracy of the various methods of prediction, non-experts will have to read some of the references.

In conclusion, I enjoyed reviewing this book and expect to use it in my own work.

Ernest Grunwald, *Brandeis University*

Topics in Applied Physics. Volume 54. Light Scattering in Solids. Volume IV. Electronic Scattering, Spin Effects, SERS and Morphic Effects. Edited by M. Cardona and G. Guntherodt. Springer-Verlag: New York. 1984. xiv + 542 pp. \$45.00.

This volume is a continuation of a series on light-scattering effects in solids. It includes a variety of phenomena such as scattering of light by electronic excitation, surface-enhanced Raman scattering (SERS), spin-dependent Raman scattering, and pressure-Raman effects with emphasis on semiconductors. Perhaps the two chapters on SERS will be the most interesting to a broader chemist audience, as SERS bears on the microscopic understanding of chemisorption.

Miklos Kertesz, *Georgetown University*

Terpenoids and Steroids. Volume 12. Edited by J. R. Hanson (University of Sussex). Royal Society of Chemistry: London. 1983. xii + 354 pp. £56.00.

This final volume of the current series covers the terpenoid and steroid literature for the period from September 1980 to August 1981. Subsequently, these reports and others have been combined into the new "Natural Products Reports". One can only hope that the latter Reports will maintain the excellent quality and comprehensiveness of the series it replaces!

The organization of this volume is as follows. Part I Terpenoids: Chapter 1, Monoterpenes (not reviewed since Volume 9, by D. V. Banthorpe and S. A. Branch); Chapter 2, Sesquiterpenoids (by J. S. Roberts); Chapter 3, Diterpenoids (by J. R. Hanson); Chapter 4, Triterpenoids (by R. B. Boar); and Chapter 5, Carotenoids and Polyterpenoids (by G. Britton). Part II Steroids: Chapter 1, Physical Methods (by D. N. Kirk); and Chapter 2, Steroid Reactions and Partial Syntheses (by B. A. Marples). The crisp and illuminating writing style of all the reviewers is coupled with a wealth of descriptive reaction schemes, structural formulae, including compilations of newly isolated compounds, and accurate literature references. All synthetic chemists can profit from even casual perusal of these pages, while those involved more directly in any phase of isoprenoid chemistry cannot afford to be without access to this volume, along with its predecessors.

Peter T. Lansbury, *State University of New York at Buffalo*

Advances in Magnetic Resonance. Volume 10. Edited by J. S. Waugh (Massachusetts Institute of Technology). Academic Press, Inc.: London and New York. 1982. vi + 223 pp. \$35.00.

This volume continues the tradition of excellence in providing comprehensive and well-written reviews and articles dealing with specific areas of magnetic resonance of theoretical and experimental importance.

The first article (50 pp, 12 references), written by J. Jeener, deals with the application of superoperators to some traditional NMR problems. When a density operator is used to describe the state, kets and bras are usually no longer needed for the formal discussion of quantum mechanical problems. Thus a set of eigenkets $|a\rangle$ of some observable can be replaced by the corresponding set of eigenprojectors $|a\rangle\langle a|$. At the same time there arises a concept of linear transformation of one operator into another, such as the transformation leading from density operator at some initial time t_0 to any time t . Such transformations are called superoperators and assume the original role of the operators, while the operators assume the original role of the kets and bras. Although the superoperator version of quantum mechanics has been in use for a long time due to its compactness and its suitability for describing relaxation processes and effects of irreversibility, it is felt by Jeener that it is often badly understood or even ignored in magnetic resonance. The present article has for its main objective to improve this situation by stressing the analogy of the superoperator formalism with that of conventional quan-

tum mechanics and to point a way for its adaption to the discussion of spin dynamics in multiple-pulse NMR experiments. Jeener admirably meets this objective by compactly presenting the necessary mathematical formalism and illustrating it with the simple example of a single spin $1/2$.

The stated purpose of the second article, by S. D. Devine and W. H. Robinson, is to show how the technique of ultrasonically modulated electron paramagnetic resonance (UMER), or strain modulated electron spin resonance (SMESR), can be used to measure the effect of strain on a magnetic center in a solid. After a brief introduction, the authors proceed to describe the various ultrasonic techniques employed to produce strain modulation. Next follows an outline of the principles of modulation spectroscopy with a discussion of the experimental layout for the particular case of ultrasonically modulated EPR. A comprehensive section on theory includes the use of tensors describing the strain modes and considers the appropriate spin Hamiltonian. The theoretical treatment also includes the relationship between the strain parameters and the spin-lattice relaxation parameters, as well as the discussion of the methods of fitting the parameters to the experimental findings. After that there is a comprehensive review of actual experiments and measurements performed on various systems, including those in which the strain effect is observed through the crystal field interaction, the g tensor, exchange-coupled pairs, and magnetostriction. This is followed by the application of UMER to thin samples, to the simplification of complex spectra and extension to NMR. The article is clear, informative, and well written. There are 75 references.

Finally, the stated objective of a review article written by Nar S. Dalal is to illustrate the utility of electron paramagnetic resonance (EPR) and electron-nuclear double-resonance (ENDOR) techniques for studying low-frequency (10^6 – 10^{11} Hz) modes of atomic fluctuations and their significance for understanding the mechanism of structural phase transitions in solids. Spectroscopic investigation of such low-frequency modes has been prompted by the discovery of Riste et al. (*Solid State Commun.* 9, 1455 (1971)) of the so-called "central peak" (CP) phenomenon, which points to the existence of lattice modes in the sample which are several orders of magnitude smaller than the normal lattice vibrations. The CP phenomenon has become especially significant because it manifests itself most strongly in the immediate vicinity of a variety of phase transitions. A better understanding of the origin of this peak may provide important clues on the nature of lattice excitations leading to phase transitions and other cooperative phenomena. Although the CP mode can be studied by neutron and light scattering techniques, the time scale of this phenomenon falls in the domain which is ideally suited to magnetic resonance techniques. Apart from a few digressions on a number of subsidiary questions, the primary purpose of this article, as stated by the author, has been to provide a concise exposition of the CP phenomenon and its relationship to changes in the line shapes of magnetic resonance near ferroelectric, antiferroelectric, incipient ferroelectric, and purely structural phase transition. Since the review was written mainly from an experimentalist's point of view, only enough theoretical background was included and references to theoretical papers are selective rather than exhaustive. There is a total of 163 references in this review article and 9 additional references in the Addendum, which deals with the local pseudo-freeze-out model and EPR studies of cationic probes. It is an excellent review and should be of great interest to scientists involved in solid-state research.

George B. Savitsky, *Clemson University*

Azepines. Parts 1 and 2. Edited by A. Rosowsky. John Wiley and Sons: New York. 1984. Part 1: xvi + 822 pp. Part 2: xix + 889 pp. \$225.00.

Seven-membered rings containing one or more nitrogen atoms were once oddities, but so much has been discovered about them in the last 25 years that these two fat volumes are sufficient to cover only a part of the subject. In fact, simple monocyclic azepines are not dealt with here; the content consists of chapters on only bicyclic and tricyclic systems.

The great interest in the subject is recent years derives in part from theoretical considerations to do with aromaticity and partly from the pharmaceutical importance of some azepines and diazepines as anxiolytic and antidepressant drugs. Both of these aspects are represented in this work.

Part 1 consists of only two chapters. The first one, by B. Renfroe and C. Harrington, could be a book by itself; it is about Dibenzazepines and Other Tricyclic Azepines. The title subsumes other heterocyclic rings that may be fused to an azepine ring, such as cyclopentatetraazoloazepine, etc. The second chapter, by G. R. Procter, is about Azepine Ring Systems Containing Two Rings. It starts with cyclopropazepines and proceeds to cycloheptazepines, but the benzazepines require the most space. The chapter concludes with an extensive treatment of bridged systems, such as azabicyclononane. The nomenclature shows a curious vacillation between systems; the 3,7-ring systems are named as azabicyclooctanes instead of cyclopropazepines, the 4,7-ring systems are treated analo-

gously, but the 5,7-systems are named as cyclopentazepines rather than azabicyclodecanes. For a subject like this, the replacement names seem less appropriate than the fusion names, for the former effectively disguise the essential presence of the azepine skeleton.

Part 2 also consists of but two chapters, each of which is divided into subchapters. J. W. H. Watthey and J. Stanton tackle the enormous subject of Dibenzodiazepines and Other Tricyclic Diazepine Systems. The pharmaceutical interest in them has greatly enlarged the content of this subject. The second chapter, by N. P. Peet, deals with Monocyclic and Condensed Triazepines and Tetrazepines. This less-developed subject requires only 205 literature references, compared to 1010 of the first chapter.

Each part is individually indexed and can be bought separately. Each is faithful to the guiding principles of the series "The Chemistry of Heterocyclic Compounds", of which it is one volume, under the editorship of A. Weissberger and E. C. Taylor, and presents a richly detailed array of factual material set out in equations with clearly drawn structural formulas, in numerous tables, and in written text. There are both author and subject indexes. Presumably, further parts are planned to complete the subject of azepine chemistry.

Atlas of Steroid Structure. Volume 2. Edited by J. F. Griffin, W. L. Duax, and C. M. Weeks. IFI/Plenum Publishing Corp.: New York. 1984. v + 754 pp. \$140.00.

This large volume is a supplement to the initial volume. It consists of a 22-page introduction that contains much useful general data, reference thereto, sections showing schematic drawings and least-squares plane projections, and indexes of authors and structures. There are 42 estrane, 61 androsane, and 81 pregnane structures included. Each is allotted three pages, on which are to be found both graphic and numerical descriptions of crystal data, including conformation, distances, angles, packing patterns, close intermolecular contacts, etc. No statement appears about the extent of the literature search, but there are many references dated 1982, and apparently none of later date.

Ambident Anions. By O. A. Reutov, I. P. Beletskaya, and A. L. Kurts. Translated from the Russian by J. P. Michael. Consultants Bureau, Plenum Publishing Corp.: New York. 1983. xiii + 338 pp. \$59.50.

The special reactivity of ambident anions, such as enolates, nitrite, cyanide, etc., which react with electrophiles at either of two sites, has a history dating from the nineteenth century but does not appear to have been reviewed before in the comprehensive manner of this book. The authors, who have been active in this research area for many years, first introduce the subject by discussing classification, factors controlling reactivity, and reaction mechanisms. In the remaining six chapters, they take up the several types of ambident anions and present the subject critically and interpretatively in a systematically organized form. These chapters are devoted to enolates (including phenolates), nitrite ion, anions of nitroalkanes, cyanide, cyanate, and thiocyanate anions, ambident anions of heterocyclic compounds, oxime anions, diazoate anions, and sulfinate and sulfonate anions. Ambident anions of phosphorus have been deliberately omitted. A substantial amount of data is tabulated.

The references cited run from the 1870s to 1977; if there are any more recent than that, they are very unobtrusive. This fact dates the work, but such a time lag is characteristic of translated works. The book is reproduced directly from typescript, and typographical errors are thus more abundant than usual. The subject index is satisfyingly thorough.

This is a book that should be important to both physical-organic chemists and chemists concerned with selectivity in synthesis; it is an excellent introduction to an important subject and a key to the literature.

Advances in Heterocyclic Chemistry. Volume 34. Edited by A. R. Katritzky. Academic Press: New York and London. 1983. ix + 450 pp. \$89.00.

Although the field of heterocyclic chemistry is growing at a dazzling rate, the indefatigable Alan Katritzky and his contributors maintain a determined effort to keep up with it. In this volume, he collaborates with Michael Sammes in two chapters, the 3*H*-Pyrazoles and the 4*H*-Pyrazoles, the non-aromatic tautomers of the commoner 1*H*-Pyrazoles. These two chapters complement those in Volume 33 on the related 2*H*- and 3*H*-pyrroles.

The chemistry of triazolopyridines was last reviewed over 20 years ago. Gurnos Jones and Robert Sliskovic have now brought the subject up to date. I. Kuthan has taken on the formidable task of reviewing pyrans and their sulfur and selenium analogues comprehensively and has contributed the longest chapter in the volume. The remaining chapter is not about a specific heterocyclic system, but it deals with nucleophilic substitution; B. Illuminati and F. Stegel discuss structures, rates, and equilibria involving Meisenheimer complexes, a field in which they have been quite active.

The editor states in the preface that the literature has been covered "up to and beyond 1981". The entire volume maintains the high standards of its predecessors. There is a cumulative index of titles of chapters, but there is no subject index.

Organic Reaction Mechanisms—1982. Edited by A. C. Knipe and W. E. Watts. John Wiley and Sons: New York. 1984. ix + 560 pp. \$175.00.

The 18th volume in this useful series has four new members on the contributing team: A. Alberti, D. Billington, J. Brennan, and C. Chatgililoglu. The literature dated December 1981 to November 1982 comprises the subject matter, which is reviewed in succinct detail in 15 chapters, ranging from Reaction of Aldehydes and Ketones to Molecular Rearrangements. The present volume is large and expensive, but that is, of course, largely a reflection of the great activity in the field of mechanisms. Even so, the size has been limited by careful avoidance of overlap with other review series.

The style of writing is necessarily quite terse, and there is not room for critical discussion. This series serves primarily as a means of "recent awareness"; the arguments, numerical data, and other specific data must be sought in the references given. The division into chapters by type of reaction or type of reactive intermediate helps the reader to focus on the area of interest, and author and subject indexes allow greater resolution of retrieval. Many chemists will find it profitable to read entire chapters; it is surprising how much one misses in casual reading of journals.

Analytical Profiles of Drug Substances. Volume 121. Edited by K. Florey. Academic Press: New York and London. 1983. ix + 735 pp. \$47.00.

The policy of this series is to cover all drug substances of medical value, giving in each volume review of selected examples. These reviews are substantial and include much more background information on properties, reactions, and synthesis, as well as a generally non-critical presentation of methods of detection and determination. Experimental details are often given. The table of contents, which lists the 17 drugs treated in this volume, serves as an index, but there is also a cumulative index to drugs treated in previous volumes.

Theilheimer's Synthetic Methods of Organic Chemistry. Volume 38. Edited by A. F. Finch. S. Karger, A. G.: Basel, 1984. xxiv + 620 pp. SF 578.00 (ca. \$346.00).

It is hard to imagine a chemist active in organic synthesis who is not aware of this key to awareness of recent developments; most will have made frequent use of it and will be impatient for the appearance of the next volume. The importance of comprehensive and highly organized reviews such as this series increases every year, as the volume of new literature becomes ever more difficult for an individual to keep up with.

This volume covers material published in 1982 and the first half of 1983 (although a few more recent references, including one dated 1984, can be found). The usual systematic arrangement by reaction type is followed, using a symbolic formalism of the type of transformation for classification purposes. However, an extraordinarily thorough index allows retrieval by almost any approach. Many chemists will simply enjoy browsing; the many structural equations make visual recognition quick and easy. A 5-p review, Trends in Synthetic Organic Chemistry, gives a quick orientation to the more prominent developments.

Although the price may seem high, it appears much more reasonable when one normalizes it in relation to the amount of information provided and the researcher man-hours it can save. Chemical librarians simply must have it if they are to serve organic chemists.

1,3-Dipolar Cycloaddition Chemistry. Volumes 1 and 2. Edited by Albert Padwa. John Wiley and Sons: New York. 1983. Volume 1: xii + 817 pp. Volume 2: xii + 704 pp. \$300.00.

This is a monograph in a new series, "General Heterocyclic Chemistry", intended to complement the series "The Chemistry of Heterocyclic Compounds", which deals with individual heterocyclic systems. It is devoted to the process for preparing five-membered heterocyclic rings elaborated and generalized by Huisgen over the past score of years. Appropriately, it begins with a comprehensive chapter by Huisgen: Introduction, Survey, Mechanism. The other 14 chapters, contributed by an international group of chemists, including the editor and some of Huisgen's former students, are largely devoted to specific types of 1,3-dipolar systems, such as diazoalkanes, ozone, etc., but the last three are titled Theory of 1,3-Dipolar Cycloadditions, 1,3-Dipolar Cycloreversions, and Higher-order Dipolar Cycloadditions, respectively.

The two volumes are offered as "as collection of essays" including "most of the important areas of current research interest". The presentation is critical and not merely a setting out of facts. Even so, the bibliographies are lengthy, tables of data are numerous, and equations

abound. This work is thus well suited to be a reference, and its utility is enhanced by thorough author and subject indexes. Unfortunately, there is no statement as to the termination data for the literature coverage, but some of the chapters have addenda that include 1983 references. In other chapters, coverage seems to have ceased at the end of 1981 or early 1982. In any event, this is bound to be a widely consulted book.

Electrochemistry. Volume 9. A Specialist Periodical Report. Senior Reporter D. Pletcher. The Royal Society of Chemistry, Burlington House: London W1V 6BN. 290 pp. £63.00.

This year's volume in the series of Specialist Periodical Reports on Electrochemistry contains six chapters. Two of the chapters, Organic Electrochemistry and The Electrochemistry of Transition Metal Complexes, are updates on topics which are covered in previous volumes. The remaining four chapters are more specialized and include the following topics: The Electrochemistry of Porous Electrodes, Semiconductor Electrochemistry, Spectroelectrochemistry, and State Gas Sensors and Monitors. An effort was made throughout the volume to cover the literature up to 1982.

This volume can be used both as a comprehensive reference for those who work in the particular fields that are being covered and particularly the more specialized topics can be used on the introductory level, by nonspecialists who want to expose themselves to some of the new directions to which electrochemistry has evolved during the last few years.

The choice of topics is commendable, and they cover new and old applications of electrochemical systems and nonconventional spectroscopic techniques for study of electrochemical system. I was particularly impressed by the chapter by Hampson and McNeil on porous electrodes. They have included a section on the Soviet efforts on this subject which will be of great help to those of us who do not cover the Soviet literature on a regular basis. In addition, they have succeeded in bringing some modern flavor to an old topic which is still in the center of most applied electrochemical systems.

Micha Tomkiewicz, *Brooklyn College of CUNY*

Spin Polarization and Magnetic Effects in Radical Reactions. By Yu. N. Molin (Institute of Chemical Kinetics and Combustion, USSR Academy of Sciences, Siberian Branch). Elsevier Science Publishers: Amsterdam and New York. 1983. 416 pp. \$95.75.

This text presents a well rounded introduction and review to a range of spin polarization and magnetic effects in organic reactions. For a multiauthored translation, the text reads well and is nearly free of confusing errors. The Introductory Chapter reviews the mechanism of the origin of most spin-polarization and magnetic effects on reactions in solution, namely, the physical principles of the radical pair theory developed by Closs and by Oosterhoff and Kaptein. This theory, which assumes that nuclear-electronic hyperfine coupling (as the key to singlet-triplet intersystem crossing in radical pairs), involves the principles of magnetic resonance, molecular dynamics of diffusion, and chemical dynamics of radicals and radical pairs. The dominant manifestations of spin polarization and magnetic effects are nicely generalized and systematized in this chapter. In the following chapters which constitute most of the first half of the text, detailed discussions are given of the theory of radical recombination, including the molecular dynamics and spin motion of radical pairs, the theory of external field and isotope magnetic effect in radical reactions, and the theory of chemically induced dynamic nuclear and electron spin polarization. The remainder of the text is devoted to experimental examples of magnetic effects in radical reactions, the magnetic isotope effect, chemically induced dynamic polarization, and chemically induced dynamic electron polarization.

This text performs an excellent service in showing how the very weak (compared to thermal energy) magnetic interactions in free radicals can nonetheless control, under certain conditions, the chemical kinetics of radicals. The author does an excellent job of showing the underlying unity of the phenomena covered in the text. As a result, the book is both easy and stimulating to read. In addition, the comprehensive coverage of materials makes it an excellent reference for the period covered (most of the references are to literature of 1979 or earlier).

Nicholas J. Turro, *Columbia University*

Carbohydrate Chemistry. Volume 15. Part I. A Specialist Periodical Report. Senior Reporter N. R. Williams (Birbeck College, University of London). Reporters B. E. Davison, R. J. Ferrier, and R. H. Furneaux. The Royal Society of Chemistry: London. 1983. IX + 277 pp. £30.00.

The 15th volume of this series is the first one in which Parts I and II have been issued under separate cover. This review covers only Part I. The 23 chapters cover mono-, di-, and trisaccharides and their derivatives. Separate chapters are for free sugars, glycosides, ethers and anhydro-sugars, acetals, esters, halogeno-sugars, amino-sugars, miscellaneous ni-

trogen derivatives, thio- and seleno-sugars, unsaturated derivatives, branched-chain sugars, aldoses along with dialdoses and diluloses, sugar acids and lactones, inorganic derivatives, alditols and cyclitols, antibiotics, nucleosides, NMR spectroscopy and conformational features, other physical methods, separatory and analytical methods, and synthesis of enantiomerically pure non-carbohydrates. The presence of almost 1400 references to the original literature makes this Part I valuable to anyone working in carbohydrate chemistry. The literature cited covers the year 1981. The listing of references to *Chemical Abstracts* for those articles published in the less available journals has been continued, making the book valuable to those who do not have immediate access to an extensive library. The practice of listing some review articles at the beginning of each chapter is also helpful.

While the text does discuss isolation and proof of structure of naturally occurring carbohydrates and derivatives, its major emphasis is on the synthetic organic chemistry of carbohydrates.

The chapters on antibiotics and nucleosides, particularly C-nucleosides, should be valuable to those not originally trained in carbohydrate chemistry but rather drawn into it because of its biological and medical applications. The same thing is true for those interested in the use of carbohydrates as "chiral pools" in the synthesis of enantiomerically pure non-carbohydrate compounds.

The section on mass spectrometry under Other Physical Methods is brief, but it does provide references to some good reviews.

The Senior Reporters seemed to feel that it was necessary to explain the use of a camera-ready format and hand-drawn formulae in this volume in order to lower the publication costs and speed the production. No explanation was really necessary; the hand-drawn formulae are quite professional and the savings in cost more than compensate for any differences in the print. This is a thoroughly professional, useful publication.

C. Edwin Weill, *Rutgers, The State University of New Jersey*

Natural Products Synthesis Through Pericyclic Reactions. (ACS Monograph 180). By Giovani Desimoni and Gianfranco Tacconi (University of Pavia) and Achille Barco and Gian Piero Pollini (University of Ferrara). American Chemical Society: Washington D.C. 1983. xi + 443 pp. \$89.95.

This book is written primarily for the practicing synthetic organic chemist and comprises an excellent survey of selected natural products syntheses that utilize a pericyclic reaction in a key construction. Each of the chapters which include chelotropic reactions, [2 + 2], [3 + 2], [4 + 2], cycloadditions, [m + n], polar and [2 + 2 + 2] cycloadditions, sigmatropic rearrangements, ene reactions and electrocyclic reactions, provides a brief but very palatable introduction to the current molecular orbital theory for each reaction class. This is then followed by a variety of specific examples of natural products syntheses where the key pericyclic construction that was utilized is highlighted and discussed. In numerous examples, reference is continually made throughout the discussion to the introductory MO theory where regio- and/or stereochemical observations help to solidify in the readers mind the theoretical principles which govern the reaction. From the organic chemists' point of view, this is valuable since a reasonably clear picture of the scope, limitations, the predictive potential for each reaction class is left in the readers mind.

The graphics are fairly well rendered and include the pertinent synthetic schemes, correlation diagrams, and FMO interactions to illustrate key regio- and stereochemical preferences. The largest chapter (135 pp) deals with [4 + 2] cycloadditions reflecting the popularity and utility of the inter- and intramolecular Diels-Alder and hetero-diels-Alder reactions in synthesis.

The book has a reasonably good index plus a very useful appendix listing in alphabetical order the >550 natural products discussed in the book with a cross-reference to the formula number, chapter, literature citation (1059 references total), and compound class (i.e., alkaloid, terpene, etc.).

This excellent book should be of interest to any synthetic organic chemist and should prove particularly useful for teaching graduate students both the art and theory of pericyclic reactions as applied to synthesis.

Robert M. Williams, *Colorado State University*

Biochemistry. Second Edition. By Frank B. Armstrong (North Carolina State University). Oxford University Press: New York. 1983. xxv + 653 pp. \$27.95.

The 2nd edition of Armstrong's textbook, like the first, is designed for introductory level courses to accommodate students from varied curricula. Its coverage, therefore, is broad, but of necessity not very deep, as it considers only essential points of each topic. The author assumes that the student has been exposed to general and organic chemistry, although two of the introductory chapters provide a good review of the solvent

properties of water, acid-base theory, the general properties and bonding of carbon compounds, and types of molecular interactions. Introductory chapters also cover historical review, global cycles, and biological organization at the cellular level. The text then proceeds to chapters dealing with the structure and properties of proteins, carbohydrates, lipids and membranes, and nucleic acids (in that order), followed by five chapters on energy metabolism, one each on lipid biosynthesis and nitrogen metabolism, three on molecular genetics, and chapters on hormones and human nutrition. A concluding chapter on recombinant DNA research has been added to the second edition.

Each chapter concludes with a summary, a series of review questions and problems, and a bibliography. Answers to the questions are provided at the end of the book. For the most part, the questions and their answers are straightforward and clear and have been well-proofed to avoid any confusing errors; in fact, the entire book is quite error free. The bibliographies would be difficult for many students at this level to use on their own; many of the books and monographs cited would be heavy reading for such students. On the other hand, articles cited (listed separately) are primarily from *Scientific American*, *TIBS*, and *Annual Reviews* and seem more appropriate for the level of the textbook.

As an introductory text, the book is quite well done, although some subject areas are treated rather lightly. For example, the section on biosynthesis of amino acids includes only the nutritionally non-essential amino acids, a reflection of the general orientation of the book toward human biochemistry. Overall, however, anyone preparing to teach an introductory level biochemistry course, not orientated toward students in chemistry or biochemistry curricula, would do well to consider using this textbook.

Harry C. Winter, *The University of Michigan*

Polymer Chemistry: The Basic Concepts. By P. C. Hiemenz (California State Polytechnic University, Pomona). Marcel Dekker, Inc.: New York. 1984. xi + 738 pp. \$34.50.

As Prof. Hiemenz notes in the preface, "the approach of this book is physical chemical". In this context, the book is a great success. The book is divided into an introductory chapter which touches on the scope of things to come plus the three other major sections. These are the following: bulk polymers and their mechanical properties; classes of polymers and polymerization; and solution properties and characterization of polymers. Each chapter is preceded by an amusing lyric, from a variety of sources, which reminds the reader of the ubiquitous nature of polymers. The book is written at a level suitable for advanced undergraduate or beginning graduate level courses in polymer chemistry.

There is no doubt that the text has a definite slant toward physical chemistry, and with this in mind, it is successful for many reasons. The theoretical treatments are developed in enough detail that the readers cannot only use the final equations to solve problems but also understand the concepts upon which they are based. There are a large number of well-written problems, many of which are solved, to help reinforce the written material. For the type of material covered in the text, meaningful problems are a must if the text is to be used for a course. Other polymer texts should follow this example. Most of the problems are literature based, which helps convince the student of their relevance, or at least exposes them to the polymer literature (even if only to get the answer). The book also includes some of the newer concepts in polymer physics (e.g., reptation) which do not seem to have made it into other polymer chemistry texts.

The first section, bulk polymers and their properties, is quite extensive and includes chapters on the viscous state, elasticity and viscoelasticity, and glasses and crystals. Thorough treatments dealing with bulk polymer systems are not often found in chemistry texts, especially with respect to viscoelasticity. The polymerization section includes chapters on condensation polymerization, addition polymerization, and polymer microstructure. The latter includes copolymerization and stereoregular polymers. In the polymerization section the physical chemical topics such as molecular weight distributions, kinetics, and microstructure determination are well done, but the discussion of the polymerization reactions is insufficient. More examples of the synthesis of important commercial polymers are also needed. The last section, solution properties, includes chapters on thermodynamics, frictional properties, and light scattering of polymer solutions. In addition to the theoretical treatment of these properties, their applications in the determination of molecular weight, coil size, and phase equilibria are covered.

The book does have a few weak points, but these seem to be "sins of omission, rather than commission". There is only limited discussion of the synthetic aspects of polymerization and even less of other classes of polymers such as inorganic or biological polymers. The reader is often referred to the literature, but the bibliographies are not supplemented with pertinent review articles. Also missing is any serious discussion of polymer reactions, degradation, radiation effects, additives, or applica-

tions. Considering the stated orientation of the text, most of these sins can be forgiven. The text would also benefit from an appendix containing polymer names (common and chemical), structures, and perhaps selected properties. For these reasons, there are several other polymer textbooks which would make better general reference books. If used for a polymer course that is more than one term, the organic chemistry should be supplemented with another text. However, as an introduction to polymers which is oriented toward polymer physical chemistry it is a fine textbook and a good reference.

Frank D. Blum, *Drexel University*

Solvation, Ionic and Complex Formation Reactions in Non-aqueous Solvents. By Kálmán Burger (L. Eötvös University, Budapest). Elsevier Scientific Publishing Co., Inc.: New York. 1983. 268 pp. \$61.75.

Although this book is from a series on "studies in Analytical Chemistry", it is no more analytical than any other kind of chemistry. The title well reflects the focus of the book. It is an excellent survey of the literature into 1983 dealing with ion-ion and, in particular, ion-solvent effects in nonaqueous solutions. It surveys theoretical as well as experimental approaches to the problems of nonaqueous chemistry and, in spite of the fact that there is rather sketchy coverage of many topics—a necessity in such a comprehensive survey—the pertinent references are given.

I would consider the two strongest chapters to be those concerned with (a) Donor-acceptor Interactions and (b) Experimental Methods. In the reviewer's mind, there is, perhaps, too much space given to Mössbauer spectroscopy, but inasmuch as this is an area where the author has made significant contributions, it is easy to be understanding. Additionally, there are chapters on kinetics, metal complexes, and mixed solvent systems, as well as more general survey chapters.

Near the end of the book there is a chapter that deals with the problems of purification and the use of various techniques to test the purity of a variety of common solvents. This chapter is out of character with the rest of the book but, for some, it may prove to be the most useful.

This book should not be considered as a text. But for those working in the field of nonaqueous solutions, it will be an invaluable reference source.

M. C. Day, *Louisiana State University*

Receptor-Mediated Endocytosis, Receptors and Recognition. Series B. Volume 15. Edited by P. Cuatrecasas (Wellcome Research Laboratories) and T. F. Roth (University of Maryland). Chapman and Hall: London; Methuen: New York. 1983. x + 304 pp. \$77.00.

The field of receptor-mediated endocytosis has evolved from a highly acclaimed infancy to an adolescence with all of the controversy attendant to that period of development. The general features of the process of cellular recognition are now documented, but function-dependent details differ. The uptake of a spectrum of proteins has been demonstrated to bind to receptors that are internalized via regions on the plasma membrane referred to as clathrin-coated pits. What remains controversial is the fate of the protein ligands and their receptors, i.e., the internal trafficking of these two entities via specialized organelles such as receptorosomes (endosomes). The answer to such questions will depend on whether the protein is a hormone, growth factor, or enveloped virus. Thus, one of the messages of this timely and generally well-written monograph is that one cannot assume the applicability of adequately characterized processes to other systems without documentation. Since many chapters contain incisive reviews with highlights of discrepancies, one can obtain a clear understanding of the status of our knowledge for each protein.

Despite the cross-section of protein uptake mechanisms covered, it is regrettable that some of the best characterized systems, the low density lipoprotein (LDL) and insulin uptake processes, were not included. The Editors explain in the preface that the omission of LDL was due to the surfeit of reviews of this subject in the contemporary literature and note that LDL is referred to in several chapters by way of comparison. However, references to LDL are brief and do not provide a satisfactory overview.

The volume contains several chapters of a more general nature that precede more specific subjects. The first chapter by Willingham and Pastan treats their elegant morphological approach to the elucidation of the internalization of α -macroglobulin into fibroblasts. The second by Linden and Roth is a superbly written description of the structure and methods of purification of coated vesicles. Although the third chapter by King and Cuatrecasas focuses on epidermal growth factor it contains an excellent exposition of the differences between down-regulation, desensitization, and their relationship to function. On a temporal scale, receptor-mediated internalization of this growth factor does not correlate with all of its mitogenic effects. Furthermore, there are a sufficient number of receptors remaining on the cell surface after down-regulation

to mediate the mitogenic response. This is reminiscent of the spare receptor concept postulated for neuronal tissue. It also emphasizes the importance of distinguishing the relevance of protein internalization to function. The fourth chapter on nerve growth factor (NGF) by Shooter and co-workers attempts to correlate the multiplicity of its receptors with down-regulation. Whether multiple binding sites are pertinent or not, this chapter contains an excellent review of the kinetic analyses of NGF binding and its interpretation.

Subsequent chapters examine more specific topics with theoretical and/or descriptive treatments. These include entry of enveloped viruses by Lenard and Miller, lysosomal enzymes by Stahl, asialoglycoproteins by Stockert, toxic proteins by Olsnes and Sandvig, maternal-fetal proteins by Woods and Roth, and formyl peptides by Niedel. As noted by some authors, the term receptor is used loosely at times to include binding sites. In certain chapters, often only scant details of the endocytotic mechanisms are available. The questions of receptor recycling, ligand sorting, and even the involvement of coated pits remain to be elucidated. Nevertheless, in this manner the monograph effectively introduces the reader to the potential universality of this mechanism. In summary, this book is a valuable treatise on endocytosis that will be of use to all scientists interested in this field.

Carmine J. Coscia, *Saint Louis University School of Medicine*

Humus Chemistry: Genesis, Composition, Reactions. By F. J. Stevenson (University of Illinois). John Wiley and Sons: New York. 1982. xiii + 443 pp. \$42.86.

The term *humus*, as used by Stevenson in this book, refers to the "Total of the organic compounds in soil, exclusive of undecayed plant and animal tissues, their 'partial decomposition' products and the soil biomass" (Table 2.3). It is thus being used synonymously with the term *soil organic matter*. As such, humus includes a wide range of natural products in an essentially endless variety of mixtures, in addition to the myriad of degradation and resynthesis products resulting from the chemical reactions of these substances. It also includes that enigmatic class of materials, which due to our inability to describe otherwise, is denoted by the rather vague label *humic substances*. A discourse on the chemistry of humus must then include discussions of the reactions of many classes of discrete organic compounds as well as the reactions of humic substances per se. Stevenson accomplishes this task admirably.

In Chapter 1 the reader is introduced to the nature and functions of soil organic matter and the transformations it undergoes. This is followed by a chapter on the extraction, fractionation, and "purification" of soil organic matter components. The next four chapters discuss the chemistry of specific classes of compounds and the transformations they undergo in the soil environment. Included in this section are discussions of nitrogen, phosphorus, and sulfur compounds, as well as carbohydrates and lipids. The remaining eleven chapters are largely devoted to humic substances, and provide a thorough overview of many diverse aspects of this subject. Chapter 8 reviews various theories for the formation of humic substances in soil. The chemical nature of soil humic substances is discussed in Chapters 9 and 10, and the application of spectroscopic methods to this field is discussed in Chapter 11. Many of the properties of humic substances are governed by their colloidal nature, charge characteristics, and ion-exchange activity; these topics are reviewed in Chapters 12 and 13.

Much of the interest in humic substances stems from their interactions with other materials including metal ions, clays, oxides, and pesticides, and these aspects are dealt with in Chapters 14 through 17. The interaction of other soil organic matter components is treated in those chapters also. The book concludes with a chapter on the geochemical and pedogenic processes involving the mediation of soil organic matter, such as weathering of rocks and minerals, and soil horizon development.

Stevenson's book is unique among books on this subject in terms of the chemical detail presented. The book is written critically and is well documented with references to the original literature. Many of the experimental methods are discussed in detail and their limitations pointed out. Where a consensus does not exist, diverse viewpoints are presented, or at least mentioned. The book is devoted to *soil* humus and does not deal to any appreciable extent with humic substances in other environments. This text is particularly suitable for a graduate or advanced undergraduate course in soil science, environmental science, or geochemistry. This reviewer considers it to be the most suitable text presently available in the subject area. In addition, it will serve as a useful reference book for researchers, and it points out areas where further research is warranted. "Humus Chemistry" is written in an easy-to-read style and contains some, though not an inordinate number of, typographical and grammatical errors. The book is up to date; perhaps its greatest shortcoming is the brevity of discussion of NMR data.

Patrick MacCarthy, *Colorado School of Mines*