**Time Lags and V–V′ Steady States in the Infrared Laser Induced Decomposition of $CHClF_2$ and $CDClF_2$ under Collisional Conditions** [*J. Am. Chem. Soc.* **1982**, *104*, 3014]. ERNEST GRUNWALD,* SHU-HUEI LIU, and CHARLES M. LONZETTA.

Page 3016, Table I: The headings of columns 2 and 3 and of columns 5 and 6 should be transposed.

**β-Alkyl Transfer in the Lanthanide Model for Chain Termination** [*J. Am. Chem. Soc.* **1982**, *104*, 6471–6473]. P. L. WATSON* and D. C. ROE.

Page 6473, left column, last two lines: Values for the equilibrium constants appear reversed. The sentence should read as follows: The equilibrium constant for eq 1 is thus $\approx 10^{-5}$ and for eq 2 is $\approx 10^{-3}$.

**Ketonization of Enols. Enol Content and Acid Dissociation Constants of Simple Carbonyl Compounds** [*J. Am. Chem. Soc.* **1982**, *104*, 6122–6123]. Y. CHIANG, A. J. KRESGE,* and P. A. WALSH.

Page 6123, seventh line after eq 4 should read as follows: ... $K_a = 2.4 \times 10^{-12}$ M, $pK_a = 11.63 \pm 0.03$ ...

# *Book Reviews*

**Advances in Chemical Engineering. Volume 11.** Edited by Thomas B. Drew (Massachusetts Institute of Technology), Giles R. Cokelet (University of Rochester), John W. Hoopes, Jr. (ICI Americas, Inc.), and Theodore Vermeulen (University of California). Academic Press, New York. 1981. xiv + 452 pp. $58.00.

This volume is the latest in a series devoted to a comprehensive review of important topics of current interest in chemical engineering. The book is divided into four parts, which are written by different authors.

The first part is by Jean-Claude Charpentier and deals with Mass Transfer Rates in Gas-Liquid Absorbers and Reactors. It is exceptionally well-written and updates (unfortunately only through 1975) the Astarita and Danckwerts books on absorption with chemical reaction. The treatment is more like a textbook than a review and might well be used in that fashion. The review of the theory of combined diffusion and chemical reaction of the form

$$A + zB \xrightarrow{k_2} \text{products}$$

is directed toward an understanding of the important variables for size scale-up of laboratory reactors and of the simulation of absorbers with laboratory scale reactors. The latter includes prediction of performance of a given absorption system without the need for physical property and kinetic data. Also reviewed are correlations and/or experimental methods for obtaining solubility, diffusivity, and interfacial area data as well as gas- and liquid-side mass-transfer coefficients. Seven types of absorbers are treated. Coverage is limited to the isothermal operation.

The second part, by Dee H. Barker and C. R. Mitra, discusses The Indian Chemical Industry--Its Development and Needs. The historical development of the chemical industry in India is reviewed together with the present structure of the industry. Since independence was achieved in 1947, industrial development has accelerated so that a comprehensive, integrated chemical industry now exists in that country. However, the industry has serious needs, including more appropriately trained engineers, more industrial research, manufacturing facilities better suited for local conditions, and less dependence on imported petroleum and imported raw materials. Most research is conducted by government research laboratories and universities and fails to meet industrial requirements. College and university students receive little exposure to industrial practice. Because of an inadequate transportation system and power supply, the industry would benefit from a more highly dispersed structure of smaller plants. Indigenous coal should be substituted for imported petroleum.

The third part concerning The Analysis of Interphase Reactions and Mass Transfer in Liquid-Liquid Dispersions, by L. L. Tavlarides and M. Stamatoudis, covers a broad area including modeling and physical behavior of liquid–liquid dispersions. It discusses a variety of modeling approaches and their potentials and deficiencies, a behaviorial description, and the need for additional data. Information on droplet size, surface area, coalescence, and breakage provides a basis for using the overall models. Both turbulent and laminar/transitional flow regimes are covered.

The fourth part dealing with Transport Phenomena and Reaction in Fluidized Catalyst Beds, by Terukatsu Miyauchi, Shintaro Furusaki, Shigehatu Morooka, and Yoneicki Ikeda, considers the flow properties of fluidized catalyst beds, the factors affecting the flow properties, the mixing properties, heat and mass transfer, and chemical reactor models for these beds. The theory of recirculation in a gas–liquid bubble column is applied to analysis of turbulent-flow phenomena in fluidized catalyst beds. This application seems justified since the fluidity of the emulsion phase in these beds is nearly equivalent to that of water. Several industrial applications of fluidized catalyst beds are mentioned and a brief discussion of technical design problems is presented.

**Charles Glatz and Thomas D. Wheelock,** *Iowa State University*

**Catalytic Aspects of Metal Phosphine Complexes. ACS Symposium Series. No. 196.** Edited by E. C. Alyea (University of Guelph) and D. W. Meek (Ohio State). American Chemical Society, Washington, DC. 1982. 421 pp. $69.95.

This volume is based on the 1980 Biennial Inorganic Chemistry Symposium held in Guelph, Canada, June 5–7, 1980. The symposium program included 30 talks and 23 poster presentations. This volume contains 24 of the oral papers and a listing of the poster presentations in the Appendix. The title is somewhat misleading, since very few of the presentations center on catalysis. The following subtopics were addressed: $^{31}P$ NMR and the nature of the metal–phosphorus bond, the chemistry of bulky phosphine ligands, polydentate phosphines, the reactivity of transition-metal phosphorus compounds, and asymmetric synthesis. Specific catalytic studies include: Palladium–Triarylphosphine Catalysis of Vinylic Halide Reactions (Heck); Rhodium–Polyphosphine Olefin Hydrogenation Catalysts (Meek); Catalytic Oxidation Using Rhodium and Rhenium Clusters (Roundhill); Asymmetric Catalysts (Knowles); Asymmetric Hydrogenation (Bosnich); Asymmetric Hydrocarbonylation (Pino).

This volume appears to continue the high standards set by this series through the years.

**P. E. Garrou,** *Dow Chemical—New England Laboratory*

**Biochemical Education.** Edited by C. F. A. Bryce (Dundee College of Technology). Croom Helm Ltd., London. 1981. 219 pp. $32.50.

Perhaps someday a book will be written to provide chemists an overview of advances in science education with applications to the teaching of chemistry. "Biochemical Education" is not such a book. It includes nine diverse chapters of mixed quality. These relate to a range of educational issues and are connected only by the diffuse theme of teaching biochemistry.

The first chapter, which presents a "systems approach" in teaching biochemistry, is not substantially different from a generic "systems" approach well described elsewhere. The chapter on medical biochemistry curricula offers little new. The chapter on "case oriented" approaches suggests alternatives to chemical academicians who believe that lecturing is the only suitable technique for teaching hard sciences, a notion amplified in subsequent chapters on "innovations," "gaming," and "small groups." The chapter on "assessment" is not useful, either for novice readers or experts. An unusual chapter on "use of print" seems entirely too specialized for inclusion among this mix of other biochemically slanted topics. The chapter on "computer-based learning" contains little of use to novices and little of substance to experienced educators.

This reviewer feels that an investment in two annual subscriptions to any of several broad-based science education journals would provide a substantially higher return on investment than would this single hardbound edition.

**David W. Brooks,** *University of Nebraska-Lincoln*

**Biological Performance of Materials (Fundamentals of Biocompatibility).** By Jonathan Black (University of Pennsylvania). Marcel Dekker, Inc., New York and Basel. 1981. v + 256 pp. $37.75.

This is the 8th volume in the "Biomedical Engineering and Instrumentation" series edited by R. Plonsey and J. L. Katz. This volume, written as an introductory textbook for the junior–senior level undergraduate, probes into an intriguing area where materials and life sciences interface. The broad range of adverse effects that result from co-habitation of materials (of synthetic or biological origin) and living entities at the in vitro and in vivo forms is increasingly a subject of concern to the medical field. The attempts to mitigate and neutralize the destructive effects that result from incompatibility between materials and the biological systems yielded an interdisciplinary yet empirical science designated as Biocompatibility. The vast amount of information that has been accumulated hitherto, as a result of accelerated research during the past two decades, has been sorted and summarized in this book, designed especially for the students and scientists who need a fundamental introduction to the problem.

The bulk of the book is divided into two sections. The first contains relevant elements of material and engineering science in addition to materials responses—chemical, physical, and mechanical—to habitation with or without a living entity (as for implants). The second section addresses the host response to implants and describes systematically the major aspects of the related inflammatory allergic and toxic syndromes that may result in the biological system interfacing and absorbing leachables and degradation products of implants.

The two sections provide a welcomed opportunity for engineers and material and biological scientists to review some of the fundamentals concerning the hybrid science of Biocompatibility. The author included an important chapter that deals with in vivo, in vitro testing as well as qualification, regulation, and standardization of implants. This section introduces the reader to the ASTM standards and to the FDA regulation–spirit, elements which should not be ignored and which have to be preconsidered sometimes before scientific trials can be conducted.

Although the coverage of some topics in this book is rather sketchy (e.g., Fick's Laws, p 18), specific references and a helpful general bibliography accompany each chapter. Jonathan Black is a gifted writer whose book can easily be read by individuals who have basic scientific background and want to obtain some first-hand knowledge of a very complicated subject.

I may add that this book, unfortunately, possesses a most confusing title. The author takes issue with what he perceives as inappropriate and defective terminology in the field and states (page 4), "We shall adopt the term *biological performance* as a descriptor of materials in order to replace the present idea of biocompatibility". The author then defines *biological performance* as a combination of *host response* and *material response*. While terminologies coined in an evolving interdisciplinary science have often been a source for fruitful semantic debates, in this instance, a well-written and a quite important book may be overlooked because of an inappropriate title.

**Israel Cabasso**, *State University of New York, Syracuse, New York*

**Gas Kinetics and Energy Transfer. Volume 4.** Senior Reporters: P. G. Ashmore (University of Manchester) and R. J. Donovan (University of Edinburgh). The Royal Society of Chemistry, London. 1981. 234 pp. $113.00.

This is the fourth volume of the approximately biennial series of "Specialist Periodical Reports" on reaction kinetics. Following the pattern of the previous editions, the book consists of reviews in selected areas of kinetics by leading experts in the field. The six reviews fall into the three categories of reaction and collision dynamics, multiphoton excitation, and gas-phase kinetics.

The molecular beam review, by R. Grice, concentrates on the period 1977–1979, summarizing recent experimental techniques and reviewing the laboratory studies in the categories of metal, atomic hydrogen, halogen, and atomic oxygen reactions. These reviews are followed by a description of the theoretical models currently used to interpret the data. A Report by A. J. McCaffery deals with the rather esoteric subject of elastic and inelastic atom–diatomic collisions which lead to change in the magnetic quantum number, $m$. Both molecular beam and optical experiments are described, and scattering theory is reviewed as it pertains to these experiments. Two articles on multiphoton excitation, by M. N. R. Ashfold and G. Hancock and by J. Donovan, provide a comprehensive review of these interesting new techniques and point out the utility of both methods as sources of atoms and free radicals for kinetics studies. The final pair of Reports are also well-matched in that a review of hydroxyl reactions by D. L. Baulch and I. M. Campbell provides a natural introduction to the chapter on tropospheric chemistry by R. A. Cox and R. G. Derwent. Baulch and Campbell have properly, if mercilessly, converted all reported rate parameters and other quantities to the somewhat unfamiliar SI units. The Cox and Derwent article is useful as a general survey of the troposphere and deals not only with chemistry but also with physical properties such as transport. Their Report points up the great practical importance of tropospheric chemistry in connection with such processes as scavenging of stratospheric pollutants, urban air pollution, and $SO_2$ chemistry (acid rain).

While it is not quite true as yet that answers to some of the puzzling questions about kinetics raised in the last half of the book can be found by techniques described in the front, such is perhaps not too far in the offing.

**William B. DeMore**, *California Institute of Technology, Jet Propulsion Laboratory*

**An Introduction to Chemical Analysis.** By Walter E. Harris and Byron Kratochvil (University of Alberta). Saunders College Publishing, Philadelphia, Pa. 1981. xii + 611 pp. $26.95.

This text is "designed for students who have a background in general chemistry and have sufficient need for high-quality experimental work to benefit from an intensive course in chemical measurements". One of the authors' major goals is to balance theory with practical application, and they achieve this goal. For example, working emphasis is placed on formal potentials, conditional equilibrium constants, and distribution ratios after the theoretical introduction of standard potentials, thermodynamic equilibrium constants, and distribution constants. Real titration data are superimposed upon calculated titration curves. Skewed chromatographic peaks are shown. The short chapters on Automation in Chemical Analysis (primarily continuous flow and centrifugal analyzers) and Sampling (including sampling of particles) give the reader additional insight into practical aspects of analytical chemistry. The organization of the book (e.g., chapter two introduces basic laboratory operations) lends itself well to the teaching of a laboratory-oriented course.

**Stanley N. Deming**, *University of Houston*

**Chemistry and Biochemistry of Amino Acids, Peptides, and Proteins. Volume 6.** Edited by B. Weinstein (University of Washington, Seattle). Marcel Dekker, New York. 1982. xi + 327 pp. $49.50.

This volume of six review articles continues a series noted for its eclectic and international flavor. Walter Hill (Montana) surveys the biosynthesis, structure, and topology of ribosomal proteins (181 references). Charles Stammer (Georgia) returns with an overview of unsaturated amino acids and peptides (150 references). Loren Pickhart (Seattle) outlines the role of peptide and protein complexes of transition metals as modulators of cell growth (89 references). Ettore Benedetti (Naples) provides a very useful summary of the structure and conformation of peptides as determined by X-ray crystallography (269 references). Scott Chilton (Seattle) describes the host of unusual amino acids elaborated by mushrooms (223 references). Ivar Ugi, Dieter Marquarding, and Reinhard Urban (Munich) review the synthesis of peptides by Ugi's method of four-component condensation (124 references). These useful contributions are well-written summaries of recent developments in their respective areas. This volume will be useful to biochemists, peptide chemists, cell biologists, crystallographers, and mycologists.

**Bruce W. Erickson**, *The Rockefeller University*

**Annual Reports on the Progress of Chemistry. Section C. Physical Chemistry. Volume 77. 1980.** Edited by M. C. R. Symans. Royal Society of Chemistry, London. 1981. 216 pp. £36.50.

This book contains six chapters devoted to some important selected areas in physical chemistry.

The first chapter is a thorough discussion of the progress in the determination of the electronic structure of molecules. After a discussion of the different models available (molecular orbitals, valence bond, estimation of the correlation energy), the basis-set is discussed as well as the difficulties arising from the use of an inadequate choice of basis-set. Some examples illustrate the above points.

The second chapter describes the advances in solid-state chemistry. In particular, novel inorganic and organic systems are described.

Nuclear magnetic resonance spectroscopy, radiation chemistry, and finally laser-induced chemistry and gas-phase kinetics are the topics discussed in the following chapters.

As usual in this series, major areas are discussed, each problem being covered with considerable depth.

**O. Eisenstein**, *University of Michigan*

**Macromolecular Reviews. Volume 16.** Edited by A. Peterlin. John Wiley & Sons, New York. 1981. 538 pp. $55.00.

This volume contains some comprehensive reviews of narrow topics (Fluoroaldehyde Polymers, Initiation in Carbocationic Polymerization) and some reviews of much narrower scope than their titles suggest (NMR of Solid Polymers, Structure and Properties of Ionomers, Interchange Reactions Involving Condensation Polymers). The time between the most recent references in each review and the publication date varies from 1.5 to 3.5 years.

Fluoroaldehyde Polymers (40 pages, references to 1977) by K. Neeld and O. Vogl is a compilation of fluoroaldehyde, fluorothioaldehyde, and fluoroketone monomers and their polymers.

The Structure and Properties of Ionomers (82 pages, references to early 1979) by W. J. MacKnight and T. R. Earnest, Jr., emphasizes the dynamic mechanical and melt rheological properties of dry polymers. Ionomers are defined as copolymers containing <10% of ionic repeat units. There is little mention of water contents under normal atmospheric conditions or of ionomer properties in hydrated form.

Chemistry of Initiation in Carbocationic Polymerization (76 pages, references to early 1980) by J. P. Kennedy and E. Marêchal is comprehensive. Parts of its are in a book, "Carbocationic Polymerization", by the same authors. Because the initiation and chain-transfer processes in cationic polymerization are so closely related, most readers should go to the book for a more complete picture of the polymerization processes.

Glow Discharge Polymerization (95 pages, references to 1978) by H. Yasuda emphasizes the techniques of plasma polymerization. It is intended to be critical rather than comprehensive.

Recent Advances in the NMR of Solid Polymers (72 pages, references to 1978) by V. J. McBrierty and D. C. Douglass emphasizes $^1$H NMR $T_1$, $T_2$, and $T_{1\rho}$ measurements of heterogeneous samples over wide ranges of temperature. The brief sections on solid-state high-resolution NMR and biopolymers are inadequate.

Interchange Reactions Involving Condensation Polymers (29 pages, references to early 1980) by A. M. Kotliar is limited to polyamides and polyesters.

Formation, Characterization, and Catalytic Activities of Polymer–Metal Complexes (126 pages, references to early 1979) by M. Kaneko and E. Tsuchida attempts to cover everything from metalloenzymes to organic semiconductors. Its best section is on polymeric catalysts for the oxidative coupling of 2,6-dimethylphenol. The range of subjects made it impossible to be comprehensive or critical.

**Warren T. Ford,** *Oklahoma State University*

**Kinetics and Mechanism. Third Edition.** By J. W. Moore (Eastern Michigan University) and R. G. Pearson (University of California, Santa Barbara). John Wiley & Sons, Inc., New York. 1981. xi + 455 pp. $32.00.

For those, like this reviewer, who have always liked the type of treatment of kinetics and its applications to the study of reaction mechanisms provided by earlier editions (1952, 1961) of "Kinetics and Mechanism" and wished in recent years that an updated version were available, this new edition is most welcome indeed. While retaining all the necessary basic material on kinetics of its predecessors, the book has been extensively rewritten and expanded to include information on the many important new developments in kinetics that have taken place since 1961. Examples include: molecular beam experiments and state-to-state chemistry (Chapter 4); trajectories over potential-energy surfaces and RRKM theory (Chapter 5); more extensive treatment of relaxation methods, such as *T*-jump experiments (Chapter 8); chemical oscillators (Chapter 8); computerized analysis of experimental data (Chapters 2 and 3) and computer simulation of complex mechanisms (Chapter 8); diffusion-controlled proton transfers in acid–base catalysis (Chapter 9); more extensive treatment of branching chain reactions (Chapter 10); and kinetics in photochemistry (Chapter 10). There is also a section in Chapter 5 on orbital symmetry, this being written, however, primarily with the interests of other than physical–organic chemists in mind. Some of the discussions of these topics are in considerable depth while others are fairly brief and strictly introductory in nature. However, in every case there are adequate references to the original literature so that those wishing to pursue a topic in greater depth can do so. The number of practice problems at the end of each chapter has been significantly increased. Previous editions included a final chapter in which the mechanisms of a selected group of reactions were discussed in detail with emphasis on how kinetics and other experimental approaches had been used to deduce those mechanisms. This chapter has been omitted in the current edition, but in partial compensation there is increased presentation of specific examples of the use of various kinetic tools in elucidation of mechanism at appropriate points throughout the text.

Earlier editions of this book, or "Frost and Pearson", as it was often called, have been widely used as a text for introductory graduate-level courses in kinetics and by organic and inorganic chemists as their principal reference on chemical kinetics. Now "Moore and Pearson" should doubtless find equally wide acceptance for these same purposes.

**John L. Kice,** *Texas Tech University*

**Understanding Enzymes.** By Trevor Palmer (Trent Polytechnic, Nottingham, England). Halsted Press, Division of John Wiley and Sons, New York. 1981. 405 pp. $80.95.

The aim of this book is, in the author's own words, "to help the student understand the concepts involved in enzymology (hence the title!); it is not a reference book for practising enzymologists". As such, its reasonable breadth of coverage is not matched by its depth of treatment of most topics. After a brief introduction which contains a worthwhile discussion of the naming and classification of enzymes, Part I of the book relates their structure and function. Part II focuses on kinetic and chemical mechanisms of enzyme-catalyzed reactions, with a dominant emphasis on kinetics. Three chapters alone are devoted to cooperativity of binding of ligands to proteins and their sigmoidal kinetic behavior. Disappointingly, in the entire text only four figures representing three-dimensional structures of enzymes based on X-ray diffraction studies are presented, and these are all based on work reported prior to 1968. Also, in Chapter 11, the now largely discredited "charge relay system" is invoked to explain in part how chymotrypsin catalyzes the hydrolysis of ester and amide linkages. Part III is devoted to the application of enzymology, including details of assay procedures, extraction and purification of enzymes, enzymes as analytical reagents, instrumental techniques available for use in enzymatic analyses in medicine and industry, and biotechnological use of both normal and immobilized enzymes.

**George L. Kenyon,** *University of California*

**Standards in Fluorescence Spectrometry.** By the UV Spectrometry Group, edited by J. N. Miller (Loughborough Institute of Technology). Chapman and Hall, London. 1981, viii + 115 pages. $19.95.

This small volume attempts to address problems of accuracy, sensitivity, and calibration in analytical fluorescence spectroscopy. There are discussions of wavelength calibration, stray light problems, alternative definitions of instrument sensitivity, inner filter effects, temperature and photodecomposition effects, correction of spectra, and measurement of quantum yields.

In each case the discussions are clear, practical, and concise. Recommended procedures or definitions are given as part of the discussion of each topic. These recommendations are generally quite sound and quite cautious. However, the information contained here can also be found in the standard introductions to fluorescence spectroscopy. These volumes usually provide much more experimental detail, as well as analytical procedures and theoretical background. For that reason, I cannot recommend the purchase of this book.

**Michael D. Morris,** *University of Michigan*

**Structure and Bonding. Volume 46. Inorganic Chemistry.** Edited by M. J. Clarke, J. B. Goodenough, P. Hemmerich, J. A. Ibers, C. K. Jørgensen, J. B. Neilands, D. Reinen, R. Weiss, and R. J. P. Williams. Springer-Verlag, New York. 1981. 176 pp. $41.90.

There are three articles in this volume. The first, The Context and Application of Ligand Field Theory, is by M. Gerloch, J. H. Harding, and G. Wooley. (46 pages and 60 references). The authors review the relation between ligand field theory and its underlying principles with the intent of defining more clearly the basic assumptions involved and indentifying the quantum-mechanical heritage of the parameters it employs. The authors promote the use of the angular overlap model (AOM) to permit a more detailed analysis of bonding in transition-metal complexes and demonstrate that the AOM can be developed naturally from quantum mechanics. The AOM is presented as a model that overcomes limitations inherent in other models that are based on high symmetries and global rather than local parameters.

The second article, Structure and Bonding of Transition Metal-Sulfur Dioxide Complexes, is by R. R. Ryan, G. J. Kubas, D. C. Moody, and P. G. Eller (54 pages and 210 references). This article begins with a neatly condensed development of the types of bonding modes observed for $SO_2$ and their associated energy levels and the energy and symmetry properties of frontier orbitals of selected transition-metal-complex fragments. These two concepts are successfully used to account for the structure and bonding of transition metal–$SO_2$ complexes as found in the $d^n$ ($n = 6, 8, 10$) metals. The authors also take up ligand-bound $SO_2$ and polynuclear $SO_2$-bridged species and reactions of $SO_2$ with metal–carbon bonded species and show correlations between the physiochemical properties of $SO_2$ complexes and their known, or probable, structures. There is an ample and appropriate use made of structural diagrams to illustrate the major types of complexes presented. The appendix lists over 100 $SO_2$-containing complexes and their S–O IR frequencies which, as of their writing, have not been structurally characterized.

The final article, Non-Commensurate (Misfit) Layer Structures, is by E. Makovicky and B. G. Hyde (70 pages and 119 references). The title structures are stated to be those "...which have two more or less independent, though modulated, sub-lattices derived from misfitting layers of two types, alternating regularly in the layer-stacking direction". The related terms incommensurate (I), semi-commensurate (S), and commensurate (C) are defined and then used as a basis of classification for examining individual and combined modes of misfit layer structures. The work is replete with excellent illustrations that provide the necessary visual component to compliment the text.

**Stephen F. Pavkovic,** *Loyola University of Chicago*

**NMR in Molecular Biology.** By O. Jardetzky and G. C. K. Roberts. Academic Press, New York. 1981. xii + 681 pp. $59.00.

The major emphasis of this book is on the interpretation of NMR spectra of selected biological systems to illustrate the wealth of information available to provide a better understanding of molecular events. The apparent stimulus for writing a book of this nature is the observation that a large fraction of recent NMR papers on biological systems addresses the questions of molecular structure and conformation. The authors have therefore chosen to review only the basic concepts of NMR in Chapters II–IV and refer to other sources for detailed descriptions of the experimental methods and rigorous mathematical derivations. Some of the topics reviewed in these chapters are the following: the chemical shift; spin–spin coupling; Fourier transform NMR; paramagnetic perturbations; and the problem of averaging in the description of time-dependent phenomena. The remaining chapters (V–XIV) are devoted to specific biological systems to illustrate main areas of interest in molecular biology. The major areas include the following: structure and conformational transitions; ligand association with proteins; ligand and protein association with DNA; internal dynamics of proteins and DNA; and the structural dynamics of membranes. The general approach for each system is a presentation of sufficient background to familiarize the reader with the system and then to present the NMR spectra which illustrate the NMR application being emphasized. The reader should find these chapters quite informative.

The book is not, however, without shortcomings. The reader is cautioned to pay close attention to the equations for errors. For example, on page 468 the spectral density function $J(\omega)$ is said to be defined by eq II-46 and II-3. The respective equations are $1/T_{1,2}\ \alpha\ \langle H_i^2\rangle J(\omega)$ ($J(\omega)$ is the value of the spectral density function at the Larmor frequency in this expression) and $T = \mu \times H$ ($T$ is the torque, $\mu$ is the magnetic moment, and $H$ is the magnetic field). The spectral density function is (almost) correctly defined by eq II-45, $J(\omega) = \int_{-\infty}^{\infty} \overline{F(t)F(t+\tau)}\ \exp(-i\omega t)\ d\tau$ ($\exp(-i\omega t)$ should be $\exp(-i\omega\tau)$) and by eq XII-1 (the integral sign is missing), where $\overline{F(t)F(t+\tau)}$ is the autocorrelation function for local field fluctuations. The reader is also cautioned in reference to the glossary of terms at the end of the text. For example, $\tau_c$ is defined on page 59 and in the glossary as the correlation time for local field fluctuations whereas it is referred to as the overall tumbling motion of page 473 ($\tau_R$ is defined as the rotational relaxation time in the glossary). While errors of this nature are annoying they are not unsurmountable and do not detract from the main objective of the book.

**Kenneth S. Schmitz,** *University of Missouri—Kansas City*

**Microbial Growth on $C_1$ Compounds.** Edited by Howard Dalton (Warwick University, UK). Heyden and Son Ltd., London. 1981. xiii + 377 pp. $48.00.

The papers included in this book were presented at the Third International Symposium held in Sheffield, UK, in 1980. They will be of interest to microbiologists, biotechnologists, biochemical engineers, and chemists who have a particular interest in microbial products. In session I, which was devoted to metabolic and molecular aspects of methylotrophs, the topics discussed were methane monooxygenases, hydrocarbon oxidation by *Methylosinus*, methanol dehydrogenases, methylotrophic pathways, and growth on methylated amines. In session II, metabolism and growth physiology of autotrophs, papers were presented on molecular regulation of carbon dioxide assimilation, carbon dioxide fixation, chemolithotrophic bacteria, growth on carbon monoxide, and phototrophic bacteria. Metabolism and growth physiology of methanogens was the subject of session III. Some of the topics in this session were methanogenesis, biosynthesis, growth, novel coenzymes, energy coupling, and evolution. The next session included the interrelationship of autotrophy and methylotrophy, energy transduction and carbon assimilation in methylotrophic yeasts, methane-oxidizing yeasts, and the second part of the icl$^-$ serine pathway. The subject of session V was energetics of methylotrophy and included cell-free ATP synthesis and electron transport and energy transduction as well as energy utilization and formate dehydrogenase from *E. coli.* The two final sessions were devoted to taxonomy and genetics and applied aspects of methylotrophy. Three papers discussed single cell protein production. References and an index are included.

**M. C. W. Smith**

**Photochemical Conversion and Storage of Solar Energy.** Edited by John S. Connolly (Solar Energy Research Institute, Golden, Colorado). Academic Press, New York. 1981. xi + 444 pp. $34.50.

This book contains the proceedings of a conference held in Boulder Colorado in 1980. Among the topics covered are simulating photosynthetic quantum conversion, biomimetic systems, quantum harvesting and energy transfer, photochemical electron transfer, photoinduced water splitting, photogalvanic and photovoltaic cells, photoelectrosynthesis at semiconductor electrodes, and photochemical energy storage. The discussions that followed the papers as well as an index are included. In general, the subjects are treated in a technical fashion and will be of interest to physical chemists and engineers.

**M. C. W. Smith**

**Denitrification, Nitrification and Atmospheric Nitrous Oxide.** Edited by C. C. Delwiche (University of California, Davis). John Wiley and Sons, New York. 1981. ix + 286 pages. $40.

The natural fixation of nitrogen from the atmosphere occurs at a rate such that the entire atmospheric burden would be completely removed in about 20 million years if not constantly replenished by other chemical processes. The chief source of the $N_2$ needed for a steady state is broadly biological denitrification, a term that masks a myriad of complex pathways within the natural nitrogen cycle. Molecular $N_2$ is not the only nitrogenous product from denitrification, and the overall role of nitrous oxide, $N_2O$, is the primary focus of this book put together by one of the leading experts in the study of the nitrogen cycle in the soil. Some practical agricultural problems (eutrophication of lakes by run-off waters rich in nitrates from fertilizers; loss of fixed nitrogen by bacterial conversion before incorporation into plants) have stimulated research into the understanding and possible control of the release of $N_2$ and $N_2O$ from soil. In the last decade atmospheric scientists have joined in the study of $N_2O$ because of its role in the formation of NO and $NO_2$ in the stratosphere and thereby in the control of ozone concentrations in the natural atmosphere. The book contains an introductory chapter by Delwiche and nine other chapters covering different aspects of the $N_2O$ story. The breadth of chemistry involved is enormous, with something new for everyone.

The two longest chapters are on Atmospheric Chemical Processes... (28 pages) by Paul J. Crutzen and Nitrous Oxide in the Oceans (50 pages) by Jürgen Hahn, both from the Max Planck Institute in Mainz. Crutzen completed his chapter in 1979 and recognized that the interpretations of $NO_x$ chemistry in the stratosphere were, and are, subject to substantial alteration with increasing knowledge. In 1982, stratospheric models are again predicting substantial depletion of ozone by the $NO_x$ emissions from large fleets of supersonic transports (i.e. roughly 100 times more than are now flying), and the effects of increases of atmospheric $N_2O$ concentrations may not be as unimportant toward the ozone concentrations as indicated here. On the other hand, Weiss and colleagues have shown that the rate of increase of $N_2O$ in the atmosphere has been about 0.2% per year since 1964, corresponding to a doubling time of about 500 years unless nonlinear processes become involved. Hahn's chapter is a very complete description of the oceanic investigations of $N_2O$, also of 1979 vintage. The remaining seven chapters cover in about 20 pages each Microbiology and Genetics of Denitrifiers, Physiology and Biochemistry of Denitrification, ...Nitric Oxide and Nitrous Oxide as Intermediates in Denitrification, Denitrification in Wastewater Management, Nitrous Oxide and Nitrogen Gas Production in Fertilizer Loss, Terrestrial Nitrification as a Source of Atmospheric Nitrous Oxide, and Dissimilatory Nitrate Reduction to Ammonia.

**F. S. Rowland,** *University of California*