

$\Delta = (2J)^{-1}$: (b) for a CH_2 "doublet", the carbon spins precess at rates $\pm J$ and 0, yielding on proton decoupling a zero signal at $\Delta = 0$, $(2J)^{-1}$, and $1/J$ and phase-alternated maxima at $(4J)^{-1}$ and $3(4J)^{-1}$; and (c) for a CH_3 quartet, the spins precess at rates $3J/2$, $J/2$, $-J/2$, and $-3J/2$, yielding a complex signal intensity dependence on Δ but a zero signal at $(2J)^{-1}$ and signals with the same relative phase at $(4J)^{-1}$ and $3(4J)^{-1}$. The approximate constancy of J combined with the above differences in signal maxima/minima, depending on carbon type, provide a powerful assignment aid and a new method of spectral simplification.

These effects are dramatically illustrated in ^{13}C spectra² of cholesterol (Figure 2A–D). Spectrum A is the normal FT spectrum. Spectrum B is a polarization transfer spectrum^{3,4} determined with $\tau = \Delta = 1.9 \text{ ms} \approx (4J)^{-1}$. Note that non-protonated carbons do not appear. Spectrum C is a PT spectrum

(2) Spectra were determined on a Bruker HX-90 NMR spectrometer fitted with an Aspect 2000 24K computer, and a CXP-type receiver, the pulse programmer and modulator allowing complete computer control over rf phase and timing. Phase alternation of the final ^1H $\pi/2$ pulse was employed.¹ Broad-band decoupling was used during data acquisition. ^{13}C and ^1H pulse widths were $t_c = 12.5 \mu\text{s}$, $t_{\pi/2}^{\text{H}} = 60 \mu\text{s}$. All spectra are the result of 200 pulses averaged with a recycle time of 2 s; a spectral width of 2000 Hz is shown. Spectra were determined with the carrier frequency set upfield of the CH_3 resonances; spectra, therefore, run downfield left to right. This was used to suppress the olefinic carbon resonances. The sample was approximately 1.5 M in CDCl_3 .

(3) Notes of caution: The delay Δ introduces a large linear-phase (LP) variation across the spectrum given by $\text{LP} \approx 180^\circ(\Delta/\text{DW})$ where DW = dwell time. As the utility of PT spectra for assignment purposes depends on phase comparisons, the correct linear-phase correction must be used. For example, for spectrum D, $\text{LP} \approx 4500^\circ$. Because an incomplete Fourier transformation is now employed (time-delayed spectra), a slightly distorted peak is recorded. It must be appreciated that for molecular fragments (such as fluoroalkanes, alkynes, etc.) for which J_{CH} varies significantly from $145 \pm 15 \text{ Hz}$ (the value found in most bonding situations) the spectra resulting from missetting the values of τ and Δ will produce peaks with different phase characteristics than those recorded here: (see: D. T. Pegg, D. T. Thomas, M. R. Bendall, and D. M. Doddrell, *J. Magn. Reson.*, in press.

with $\tau = 1.9 \text{ ms}$ and $\Delta = 3.8 \text{ ms} \approx (2J)^{-1}$. Only CH carbons give intense resonances; seven such carbon nuclei resonate in the spectral region shown; only seven intense peaks are observed. Spectrum D is a PT spectrum with $\tau = 1.9 \text{ ms}$ and $\Delta = 5.7 \text{ ms} \approx 3(4J)^{-1}$. CH_3 and CH resonances appear in-phase; by comparison, CH_2 resonances appear 180° out-of-phase. Note the cancellation of the overlapping CH_2 and CH resonances (marked with a P). Spectra A–D allow a complete and simple breakdown of the resonances into carbon type. The off-resonance spectrum, E, although of some use, is severely broadened and has many overlapping lines. Note as well the greatly increased information content of the PT spectra; the time required to record spectra B–D was less than a quarter of that required to obtain the off-resonance spectrum E.

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(4) A referee has raised the question of the homogeneity of the rf pulses used. The spectra were recorded with the normal cross-coil high-resolution probe system; such a system produces extremely inhomogeneous ^1H rf pulses. It is possible to show (unpublished) that the only effect of such an inhomogeneity is a loss of signal-to-noise ratio but no phase information. Our PT spectra are boosted by about a factor of 2.5 compared to the theoretical value of ~ 4.0 ($\gamma_{\text{H}}/\gamma_{\text{C}}$). It should be possible to introduce PT spectroscopy on most NMR spectrometers; all that is required is pulse programmer control over the ^1H rf channel. Phase alternation of the ^1H channel is not a necessary requirement.

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Book Reviews*

The Proteins. Volume IV. Edited by H. Neurath (University of Washington) and R. Hill (Duke University Medical Center). Academic Press, New York. 1979. xiv + 679 pp. \$49.50.

"The Proteins" is a treatise reviewing protein structure, preparative and analytical techniques, and the molecular basis of protein function. This volume considers protein evolution and three specific protein groups: the chromosomal proteins, the contractile proteins of muscle, and collagen.

In the chapter on Protein Evolution, R. F. Doolittle discusses the mechanisms by which both "neutral" and advantageous changes to proteins can occur, and how these changes become characteristic of the organism. Arguments are presented which favor the concept that amino acid replacements can become fixed in a population despite conferring no apparent reproductive advantage. In the case of proteins with new functions, the author supports the view that they have arisen primarily from related, pre-existing proteins through gene duplication. To illustrate or argue for these theoretical considerations, the author employs often fascinating examples to great advantage. This helps to make the article appropriate for interested readers of all backgrounds.

The chapter entitled Chromosomal Proteins by R. J. DeLange and E. L. Smith focuses on the histones and protamines, the most characterized and understood of the proteins associating with the DNA of all but the most primitive organisms. The stress is on the elucidation of the primary structure of these proteins, the authors' area of expertise, and on the extensive post-translational modifications to which these proteins are subjected. These modifications may prove to be a sophisticated mechanism by which nuclear function is modulated. As noted by the authors, this article was prepared many years ago, and therefore a detailed description of the recent dramatic progress in the definition of the role of

the histones in the primary organization of the DNA is not provided.

In the chapter on Contractile Proteins of Muscle by W. F. Harrington, the importance of structure to function is stressed. First, each component of the contractile apparatus is examined in terms of its structure, function, and regulation. Then, in the clearly and concisely presented models for the conversion of chemical energy to mechanical force, the relationship between structure and function is made apparent. Considering the specialized function of the contractile proteins described in this chapter, it is intriguing that they may function in almost every eukaryotic cell. An evaluation of this in the chapter might have been worthwhile in providing a better understanding of these proteins.

Collagen, comprising roughly one-third of the protein content of most vertebrates, functions to maintain shape and resist deformation in a variety of tissues and organs. In the final chapter, the chemistry and biology of this protein are discussed by P. Bornstein and W. Traub. The synthesis of this protein as procollagen, its secretion, and the extensive extracellular modifications which it undergoes are defined. The authors have made this chapter of interest to readers of many backgrounds, especially by including discussions of its involvement in disease and aging.

In the preface to this book, the editors express a desire that "The Proteins" present unifying concepts in protein chemistry. In this volume, they have achieved this to a certain extent. Each of the chapters on the specific protein groups points out the importance of structure and organization to the functions performed by these proteins, and the thorough examination of these proteins provides further insight into the problem of protein evolution.

Bjorn K. Lydersen, *University of Colorado Health Sciences Center*

Gas Phase Ion Chemistry. Volume I. Edited by M. T. Bowers (University of California, Santa Barbara). Academic Press, New York. 1979. xiii + 435 pp. \$39.50.

"Gas Phase Ion Chemistry" consists of two volumes. The dominant theme of the treatise is the chemical physics of gas-phase ion chemistry.

*Unsigned book reviews are by the Book Review Editor.

Volume 1 presents eight excellent reviews written by leading experts in their respective areas. These works represent the most extensive review in this field since the two-volume work, "Ion-molecule Reactions", edited by J. L. Franklin in 1972.

Chapter 1 (D. Smith and N. G. Adams) gives a detailed account on recent developments in flow-tube studies of ion/molecule reactions along with a concise discussion of the merits and problems of various versions of flow-tube apparatus. Chapter 2 (E. E. Ferguson, F. C. Fehsenfeld, and D. L. Albritton) reviews the ion chemistry of major constituents of the E and F regions of the ionosphere and the more complex lower altitude D region, the stratosphere and the troposphere. Chapter 3 (T. Su and M. T. Bowers) concentrates on classical ion/molecule collision theory. It begins with the Langevin ion-induced dipole theory which is followed by various ion-dipole theories. The effect of the ion-quadrupole potential, the induced dipole-induced dipole potential, and the anisotropy of the polarizability of molecules on ion/molecule collisions are also discussed. Chapter 4 (W. J. Chenavich and M. T. Bowers) summarizes much of the recent progress in statistical methods. The presentation is divided into three main parts covering (1) statistical theory, (2) the orbiting transition state, and (3) the application of statistical theory to chemical systems. Chapter 5 (T. Baer) describes experimental considerations and applications of the photoion-photoelectron coincidence in studies of unimolecular reactions. Chapter 6 (M. Meot-Ner (Mautner)) concerns the effects of temperature and pressure on rate constants and on the thermal pyrolysis of gaseous ions. Chapter 7 (J. L. Franklin) concentrates upon the problems of energy distribution in the unimolecular decomposition of ions. Chapter 8 (V. L. Talrose, P. S. Vinogradov, and I. K. Larin) is devoted to a discussion of three problems related to the basic kinetic aspects of ion/molecule reactions, namely, the fast rates of ion/molecule reactions, the "solvated" shell effect on these rates, and the effects of vibrational-translation relaxation.

Each of these chapters is well written and often contains tables which summarize the results of the most recent works in its area. This volume will serve as a useful reference for students and researchers in the field of gas-phase ion chemistry. Chemists interested in chemical kinetics should also find this volume useful.

Cheuk-yiu Ng, Ames Laboratory, Iowa State University

Solubilities of Inorganic and Organic Compounds. Volume 3 (in three parts). Edited by H. L. Silcock. Pergamon Press, Oxford-New York. 1979. 3,321 pp. \$595.00.

This volume covers "Ternary and Multicomponent Systems of Inorganic Substances". The period covered is only up to mid-1965, but this may not be as serious as it may seem, since solubility data change little, and most of the important values were determined long ago. The primary information given is the composition of saturated solutions, augmented by data on solid phase, and in some instances, specific gravity and pH of solutions. The work is a translation, if that is the appropriate word for a text composed mostly of numbers, from a Russian original.

This work is a collection of tables, largely presented in the form used by the authors who originally reported the data. The original references are collected at the end of Part 3 (there are 2,782 citations). Part 3 also contains an index, which for a work such as this is absolutely essential for finding desired information. It is organized in a hierarchical way according to key elements. The complexities in defining the components of multicomponent systems of ionic compounds are substantial (e.g., $\text{NaCl} + \text{KBr} + \text{H}_2\text{O}$ could also be $\text{KCl} + \text{NaBr} + \text{H}_2\text{O}$), and to resolve this, the compilers have retained the definitions of the original investigators. The book is thus not completely self-consistent, nor ideally simple to use, but it seems as good as one could reasonably ask for.

The appearance of this set completes the English version of the compilation commissioned by the Academy of Sciences of the USSR. Volume 1, which lists solubilities of binary systems, such as a single solute in water or other solvent, obviously sees the greatest use. The less demanded information in Volumes 2 and 3 is, nevertheless, a most important reference resource, and there is no other equivalent compilation. The weakest point of the work is one beyond the control of the compilers: the gaps and inconsistencies in the results of primary investigators.

The complete set (all volumes) is available for \$990.00.

Kirk-Othmer Encyclopedia of Chemical Technology. Third Edition. Volume 8. Executive Editor: M. Grayson. John Wiley & Sons, New York. 1979. xxvi + 930 pp. \$120.00.

Twenty-eight entries, from Diuretics to Emulsions, make up this volume. The largest number of them deal with dyes or with electrochemical phenomena, such as Electromigration. The entries are substantial and show evidence of having been carefully revised or rewritten for this edition. The contributors are, appropriately, largely from the chemical industry, mostly in the United States.

It is always a pleasure to see in this series that the chemical structures

and names are given correctly, according to current convention, unlike so many works on chemical technology. The entries, as is characteristic of the series, are a usefully balanced mix of fundamental chemistry and its applications, and one does not have to be a technologist to benefit from reading them.

Symmetry and Spectroscopy: An Introduction to Vibrational and Electronic Spectroscopy. By D. C. Harris and M. D. Bertolucci. Oxford University Press, New York. xii + 550 pp. \$16.00.

A textbook intended for students at the senior or first-year graduate level introducing chemical group theory and the principles of IR, visible, and UV spectroscopy. The overall emphasis is on practical aspects of spectral interpretation. Chapters on elementary quantum mechanics and molecular orbital theory are included. The book is written in a breezy style, making relatively modest demands on the reader's background. Some 200 problems with worked-out solutions are included. An appendix contains one of the most extensive compilation of character tables one is likely to find anywhere, including groups not yet represented among known molecules—containing up to tenfold axes. In all, the book accomplishes its purpose and can be recommended as a textbook for courses or independent study.

Assessing Toxic Effects of Environmental Pollutants. Edited by S. D. Lee and T. B. Mudd. Ann Arbor Science Publishers, Inc., Ann Arbor, Mich. 1979. x + 306 pp. \$30.00.

Techniques for assessing the toxicity of environmental pollutants are becoming increasingly important in today's regulatory climate. This book provides much needed insight into the methods used for assessing toxic effects, and goes beyond merely determining the lethal dose to discuss the underlying mechanisms of toxicity.

The first four chapters of the book discuss general features of the toxicity of environmental pollutants with specific reference to human toxicity. These chapters are: From Animals to Man, The Grand Extrapolation of Environmental Toxicology, by D. B. Menzel; The Role of Nonhuman Primates in Environmental Pollution Research, by W. Castleman, J. Gillespie, P. Kosch, L. Schwartz, and W. Tyler; Health Effects of Air Pollution: Controlled Studies in Humans, by J. D. Hackney, W. S. Linn, K. A. Bell, and R. D. Buckley; and Relationships of Long-Term Animal Studies to Human Disease, by J. F. Stara and D. Kello.

The remaining chapters deal with effects on the pulmonary system by a wide range of environmental pollutants, ranging from cigarette smoke to ozone. The topics covered are: Pulmonary Alveolar Macrophage Function: Some Effects of Cigarette Smoke, by J. B. L. Gee, B. R. Boynton, A. S. Khandivala, and G. J. W. Smith; Alteration in Host-Bacteria Interaction by Environmental Chemicals, by D. E. Gardner; Biological Effects of Environmental Pollutants; Methods for Assessing Biochemical Changes, by M. G. Mustafa and S. D. Lee; Applications of Lung Organ Culture in Environmental Investigations, by R. S. Bhatnagar, M. Z. Hussain, and J. C. Belton; Reaction of Ozone with Human Erythrocytes, by B. A. Freeman, B. E. Miller, and J. B. Mudd; Pulmonary Responses to Sulfuric Acid Aerosols, by L. W. Schwartz, Y. C. Zee, B. K. Tarkington, P. F. Moore, and J. W. Osebold; Effects of Chronic Exposure of Rats to Automobile Exhaust, H_2SO_4 , SO_2 , $\text{Al}_2(\text{SO}_4)_3$, and CO, by J. P. Lewkowsky, M. Malanchuk, L. Hastings, A. Vinagar, and G. P. Copper; Mutagenic Activity of Airborne Particulate Organic Pollutants, by J. N. Pitts, Jr., D. Grosjean, T. M. Mischke, V. F. Simon, and D. Poole; Biophysical Studies of the Effects of Environmental Agents on the Plasma Membrane of Intact Cells, by J. R. Rowlands, C. Allen-Rowlands, A. Noyola, and J. Padilla; Biomathematical Modeling Applications in the Evaluation of Ozone Toxicity, by F. J. Miller; and Influence of Atmospheric Particulates on Pulmonary Absorption Phenomenon, by J. M. Charles and D. M. Menzel.

This volume should be of interest to anyone working in the field of environmental toxicology and in particular to those studying the toxic effects of air-borne pollutants.

Deborah D. Ross, Procter & Gamble Company

Analytical Profiles of Drug Substances. Volume 8. Edited by Klaus Florey. Academic Press, Inc., New York. 1979. x + 558 pp. \$28.00.

Even the title of the book does not fully convey the completeness of the information on the drugs described. Each section is devoted to a single drug and contains virtually all the important physical and chemical information available, including biological degradation and metabolism. In this volume 17 drugs are listed in alphabetic order of the principal portion of the name, e.g., calcium leucovorin is listed as L. The drugs covered range from the most common aspirin and antibiotics to some no less important but less frequently used drugs such as an anti-epileptic drug.

This book should be very valuable to those who study drugs or to physicians who are interested in knowing something about the properties

of the drugs they prescribe. Since it is hoped that this type of information will be made available for all new drugs which attain compendial status, it is obvious that the most valuable procedure would be to make the information available as soon as possible. Such an arrangement precludes any attempt to arrange the drugs in some orderly fashion such as function, e.g., antibiotics. It would be useful to devise some system whereby the location of the information for a particular drug would be possible without having to peruse the table of contents of each volume.

It is amazing to this critic that the Pharmaceutical Analysis and Control Section, Academy of Pharmaceutical Sciences has been successful in publishing such a useful and scholarly treatment of information on drugs. The editors are to be congratulated.

Taft T. Toribara, *University of Rochester School of Medicine and Dentistry*

Advances in Biochemical Engineering. Volume 10. Immobilized Enzymes I. Edited by T. K. Ghose, A. Fiechter, and N. Blakebrough. Springer-Verlag, Berlin-Heidelberg-New York. 1978. ix + 177 pp. \$34.00.

Five topics are discussed in Volume 10. The first is devoted to design and operation of immobilized enzyme reactors, followed by chapters which discuss biotechnology of immobilized multienzyme systems, carriers for immobilized biologically active systems, industrial applications of immobilized biocatalysts, and starch hydrolysis by immobilized enzymes, industrial applications. Although directed toward engineers, biochemists will also find this book informative. References are included.

M. C. W. Smith, *Ann Arbor, Michigan*

Annual Reports on Fermentation Processes. Volume 3. Edited by D. Perlman. Academic Press, New York. 1979. xiv + 346 pp. \$22.00.

Industrial microbiologists, biochemical engineers, and technologists will appreciate the variety of topics in this third volume of Annual Reports. The following areas are covered: stimulation of innovation in the fermentation industries, genetics of industrial microorganisms, aeration, the use of economic analysis of penicillin G manufacturing costs in establishing priorities for fermentation process improvement, cellulase and biosynthesis regulation, single cell protein from C_1 compounds, β -lactam antibiotics, antitumor antibiotics, nucleosides and nucleotides, microbial transformation of steroids, and mushrooms: single cell protein from cellulose. References are included.

M. C. W. Smith, *Ann Arbor, Michigan*

Chemistry and Agriculture. The Proceedings of a Symposium organized by The Industrial Division of the Chemical Society as part of the Annual Chemical Congress, 1979, Bristol. Special Publication No. 36. The Chemical Society, London. 1979. xiv + 287 pp. £7.00.

As the title indicates, this collection of papers will be of interest to individuals involved in agriculture and the manufacture of products for agriculture. Among the topics covered are pesticides, fertilizers, trace elements, plant growth regulators, protecting plants from fungi, herbicide research, animal health, chemicals in meat production and dairying, chemistry and beverages, nitrogen fixation, and effects of total energy considerations on agriculture by the year 2020.

M. C. W. Smith, *Ann Arbor, Michigan*

Gasohol for Energy Production. Energy Technology Series. By Nicholas P. Cheremisinoff. Ann Arbor Science Publishers, Ann Arbor, Mich. 1979. x + 140 pp. \$14.95.

This book provides an overview of the technology and economics involved in the production and uses of alcohol. First, biomass is discussed; then follow chapters concerned with the chemistry of alcohols, methanol synthesis, automotive uses of methanol, ethanol synthesis, development of a nationwide biomass-based alcohol-gasoline fuel system, and mass production of biomass for synthetic fuels. There is also a chapter devoted to special uses and problems with alcohol fuels which includes fuel uses of propyl and butyl alcohols, alcohols for electric power generation, miscellaneous uses of alcohol fuels, and environmental problems. References are included.

M. C. W. Smith, *Ann Arbor, Michigan*

Microbiology of Foods. By John C. Ayres, J. Orvin Mundt, and William E. Sandine. W. H. Freeman and Co., San Francisco. 1980. xii + 708 pp. \$19.95.

This book was designed as a text for advanced undergraduate and graduate students who are preparing to enter the food industries or related fields. Since the authors state that it is the first comprehensive presentation of food microbiology since the 1930's, it should have a wider audience. Part One discusses classification of microorganisms, prevention of food spoilage, control of moisture, canning, radiation and electromagnetic waves, and chemicals in foods. Part Two is devoted to fermentations and includes those by alcoholic yeasts, other yeasts, lactic acid, acetic acid, and other fermentations. Specific food products, including spices and condiments, cereals, flours and pastas, sugars, starch, sweetening agents, beverages, fruits and vegetables, dairy products, fish and shellfish, poultry, and eggs and egg products, make up Part Three. The final section deals with nonmicrobial and microbial food borne infections and bacterial and fungal foodborne intoxications. This is a very interesting and informative book and should certainly be in the library of anyone who is teaching a general microbiology course. It is well illustrated and includes extensive references.

M. C. W. Smith, *Ann Arbor, Michigan*

Individual Onsite Wastewater Systems. Proceedings of the Fifth National Conference, 1978. Wastewater Treatment Alternatives for Rural and Semirural Areas. Edited by Nina I. McClelland. Ann Arbor Science Publishers, Ann Arbor, Mich. 1979. vii + 303 pp. \$24.50.

Because of its comprehensive treatment of the subject, this book will appeal to civil engineers, environmentalists, and planners, as well as persons responsible for building codes. The acceptance of onsite waste disposal systems will make possible more intensive land use. A number of waste disposal systems are described and evaluated, government policies are discussed, and onsite treatment is compared to centralized treatment plants. References are included.

M. C. W. Smith, *Ann Arbor, Michigan*

Reviews in Biochemical Toxicology. Volume 1. Edited by E. Hodgson, J. R. Bend, and R. M. Philpot. Elsevier/North Holland, New York. 1979. x + 316 pp. \$32.00.

As stated in the preface, this first volume of a series is intended to present succinct and critical reviews of work using newer tools in the field of toxicology. With multiple-authored chapters, there is some overlap of details of liver metabolic functions. In general, the individual reviews of developments in methods and techniques are lucid and thorough. References are used extensively. The chapter on biochemical mechanisms of nephrotoxicity is particularly informative about nonexcretory functions of the kidney. The chapter on oxygen toxicity has a scholarly introduction and excellent presentation but omits reference to the role of vitamin E. In the chapter on hepatocyte cultures one is drawn to the inevitable comparison between function of cells in vitro and in vivo, i.e., in the intact individual. A chapter on the nonrespiratory function of the lung is illuminating.

Titles and authors of the ten chapters are: Multiple Forms of Cytochrome P-450 (E. F. Johnson), Imprinting of Enzyme Systems of Xenobiotic and Steroid Metabolism (P. Skett and J.-Å. Gustafsson), Biochemical Mechanisms of Nephrotoxicity (J. B. Hook, K. M. McCormack, and W. M. Kluwe), Biochemical Toxicology of Chloroform (L. R. Pohl), Superoxide, Superoxide Dimutase and Oxygen Toxicity (J. M. McCord), Lipid Peroxidation and Its Role in Toxicology (J. S. Bus and J. E. Gibson), Free Radical Metabolites of Foreign Compounds and Their Toxicological Significance (R. P. Mason), Use of Primary Hepatocyte Cultures in Biochemical Toxicology (J. R. Fry and J. W. Bridges), The Isolated Perfused Liver: A Model to Define Biochemical Mechanisms of Chemical Toxicity (R. G. Thurman, L. A. Reinke, and F. C. Kauffman), and Use of the Isolated Perfused Lung in Biochemical Toxicology (J. A. Roth). This volume should be instructive and useful to chemists interested in biochemical phenomena. Indexing by subtitles is particularly useful.

Paul E. Norris, *Procter & Gamble*