

Book Reviews*

Flame Retardancy of Polymeric Materials. Volume 4. Edited by W. C. KURYLA and A. J. PAPA. Marcel Dekker Inc., New York, 1978. ix + 183 pp. \$25.00.

Two chapters make up the content of this book: "The Importance of Intumescence and Char in Polymer Fire Retardance", by Hindersinn and Witschard, and "Mechanisms of Fire Retardance in Polymers", by Chamberlain. Each is a critical essay on applied physical organic chemistry—the mechanism of burning and flaming. The chapters have a relevance considerably beyond polymeric materials, and can be recommended to anyone in need of fundamental introductory information.

Fire retardants may act in at least two ways: interruption of free-radical chain reactions and generation of protective coatings of char. Halogen, phosphorus, and antimony compounds have been widely used to attain these ends, but understanding of the mechanisms through which they act is still incomplete. Catalysis of recombination of hydrogen atoms to H₂ and of oxygen atoms to O₂ appears to be important, but the evidence is still inconclusive. Greatly increased public concern resulting from recent spectacularly tragic building fires is intensifying the study of this field, which has received relatively little attention outside of industry and government regulating agencies.

Phase Transfer Catalysis. By CHARLES M. STARKS (Continental Oil Co.) and CHARLES LIOTTA (Georgia Institute of Technology). Academic Press, New York, 1978. ix + 365 pp. \$38.00.

The authors treat the subject somewhat in the manner of "Organic Reactions", in that there is a brief historical introduction, followed by a chapter on mechanism, and concluded by a detailed presentation of scope, with long tables of examples and extensive bibliographies. Representative specific experimental directions are described, and general procedures and critical comparisons of experimental methods are given.

Phase-transfer catalysis is a technique of the 1970s that is an alternative way to handle the problem of achieving reaction between mutually insoluble reagents, such as an alkyl halide and an inorganic salt. Instead of the classical procedure of using a mutual solvent, the salt is converted to a kinetically significant extent into one having a lipophilic counterion, commonly a large quaternary ammonium ion, or a metal ion complexed with a crown ether. The earliest report of the phenomenon appears to be by Jarrouse in 1951, who observed an accelerating effect when benzyltriethylammonium chloride was added to an experimental preparation of benzyl cyclohexyl ether from benzyl chloride, cyclohexanol, and alkali.

This book should be a most useful aid to nearly all organic chemists concerned with synthesis.

Biochemistry: Mechanisms of Metabolism. By E. B. CUNNINGHAM (Medical University of South Carolina). McGraw-Hill Book Co., New York, 1978. x + 767 pp. \$26.00.

This book is presumably intended for use as a textbook for an introductory course in biochemistry, although the preface does not clearly identify its intended use. It treats the subject from the standpoint of reaction mechanisms and kinetic mechanisms, and with unusual physical-organic rigor, such that an organic chemist is likely to feel a more comfortable relationship with this book than with most biochemical texts.

The first third of the book is composed of a group of chapters on the fundamental chemistry of carbohydrates, lipids, amino acids and proteins, and purines, and, most gratifyingly, on optical activity, which is presented with clarity and rigor. These subjects are presented seriously and efficiently, without pedagogical padding, and are evidently aimed at students with a mature outlook. The remaining portion of the book progresses from chapters on thermodynamics and kinetics in biochemical systems to chapters on metabolic pathways for the major classes of biochemical compounds, and on electron transport and energy production.

There are almost no references or bibliographies, an unfortunate fact, for with them the book could serve as a more useful reference work. Furthermore, there are no problems or exercises. If one wants a straightforward, unadorned, and chemically rigorous exposition of biochemistry, however, this is an appealing book. It does not shrink away from mathematics where it is called for, and does not waste space on pretty pictures where they are not essential. There is an adequate subject index.

Topics in Current Chemistry. Volume 75: Organic Chemistry and Theory. Edited by F. L. BOSCHKE. Springer-Verlag, New York, 1978. 187 pp. \$36.00.

This "series" is an enigma for a reviewer, for it seems to fall between two stools, being not quite a coherent series of books and not quite a journal. It began as a journal, *Fortschritte der chemischen Forschung*, and was so published for many years, until publication was briefly interrupted. It then began appearing as bound volumes, which later acquired individual subtitles. Publication has been at irregular intervals, and subscription at a fixed price per year or volume is not offered. The price per page is uncommonly high.

The content consists of critical reviews, generally well done by experts in the field. However, the several reviews in a given volume often have little relation to each other as indicated by the peculiar subtitle of this volume. Because of such disparateness, it will be a rare chemist who will be sufficiently motivated to buy a copy personally. The reviews in this volume cover electron transfer in transition metal complexes, photochemistry of *N*-acyl imidic esters (strangely called "keto imino ethers"), computation of correlation energy, and measurement of chirality and its application to synthesis. Eighteen authors produced these four reviews.

Lange's Handbook of Chemistry. Twelfth Edition. Edited by J. A. DEAN (University of Tennessee). McGraw-Hill Book Co., New York, 1979. 1470 pp. \$28.50.

This usefully compact reference volume has grown considerably since the first edition in 1934. The content is well selected so as to embody most of the average chemist's first-order needs for numerical data, with a minimum encumbrance with extraneous matter. New material is to be found in this edition: structure-correlation tables for nuclear magnetic resonance and infrared spectroscopy, ionization potentials for molecules and radicals, and reference-electrode potentials for aqueous-organic solvent mixtures. Many other areas have been expanded or revised, including the table of Hammett and Taft substituent constants, physical properties of solvents, solubilities and vapor pressures, bond energies, and much more. The table of conversion factors now includes SI units, although "hertz" and "becquerel" are still missing.

In spite of these many good points, the publisher's news release, claiming the book to be "completely up-to-date and comprehensive . . ." is an unbelievable travesty of the truth, for some sections have obviously not been touched for 40 years. The section on organic rings, for example, is an antique period piece, and shows diazomethane as a ring compound, and prints most rings in totally obsolete forms that are so incorrect and confusing that a student using them on an examination would lose all credit (cyclobutane is illustrated by a square surrounded by four CH₂ groups, and more closely resembles 1,2,3,4-tetramethylenecyclobutane; pyridine is shown as cyclohexylnitrene). The reference given to "help" the reader is to the 1940 (sic!) edition of the "Ring Index", and the discussion of general nomenclature of organic compounds refers the reader to Beilstein and to Austin Patterson's 1933-6 reports (IUPAC recommendations are not mentioned at all). The compilers have their own difficulties with nomenclature, which is wildly inconsistent from one place to the next. As just one example, the same compound that in the table on vapor pressures is listed as "cyclohexylamine" must be recognized as "cyclohexanamine" in the table of properties of solvents, and as "aminohexahydrobenzene" in the general table of properties of organic compounds.

* Unsigned book reviews are by the Book Review Editor.

Apart from the foregoing horrors, this is, nevertheless, a valuable compendium of information for the forewarned, and is excellent value for the price.

Biochemical and Clinical Aspects of Hemoglobin Abnormalities. Edited by W. S. CAUGHEY. Academic Press, New York. 1978. xvii + 725 pp. \$33.50.

This book contains the proceedings of an international conference held in Colorado in 1977. It presents the texts of 56 papers, including figures, tables, and references. They all appear to be reports of original research; the oral discussions that followed each paper accompany them. The papers are not arranged according to subject categories, unfortunately, but there is a substantial subject index.

Handbook of Derivatives for Chromatography. Edited by K. BLAU and G. KING. Heyden & Son, Inc., Philadelphia, Pa. 1977. xvi + 576 pp. \$48.00.

As the title implies, this book concerns chromatography broadly; liquid/solid and gas/liquid, column and layer, and ion-pair partitioning. Derivatives are made for various purposes: to increase volatility, to facilitate detection or to improve separations. This book deals with these matters essentially from an empirical standpoint in fourteen contributed chapters, three of which include the editors as authors. It is thus a coherent treatment of a practical subject, designed to aid the chemist who must deal with chromatographic separation or analysis.

The content is organized by functional group, beginning with synthetic tables, from which one can quickly determine the derivative-forming reactions, the type of derivatives produced, and the appropriate chapter to consult for further information. In addition to the separate chapters devoted to classes of derivatives, there is an Introduction with much practical information, and chapters on micro-reactions, fluorescent derivatives, derivatives of inorganic anions for gas chromatography, GLC of metal ions, and chromatographic resolution of chiral compounds. The chapters include introductory comments and discussions of mechanism, but are largely composed of directions for preparing derivatives or the reagents required for them. These directions may not always be sufficiently detailed for use by those not already familiar with the procedures, but the text is for the most part well supplied with references.

The discussion parts are not always well integrated with the practical procedures, and discussion often avoids critical comparisons in favor of simple description. The preparation of a reagent, "diazobenzene", for making phenyl esters is described, but the preparation of such esters seems to have been overlooked, and phenyl esters are not cited in the index. Simple equations for reactions are sometimes offered as "mechanisms". Nevertheless, the structures and text are commendably free of errors, and the abundant references allow one to augment what may be described too briefly in the book. It is certainly a useful work, and its usefulness is enhanced by a substantial subject index.

Residue Reviews. Volume 69. Edited by F. A. GUNTHER and J. D. GUNTHER. Springer-Verlag, New York. 1978. viii + 146 pp. \$19.80.

This volume contains three contributed chapters: Soil-Parathion Surface Interactions (by B. Yaron and S. Saltzman); Polycyclic Aromatic Hydrocarbons in Foods (by M.-T. Lo and E. Sandi), and Toxaphene (by G. A. Pollock and W. W. Kilgore). They reflect the general concern of this series with the chemistry, biological effects, and related matters arising from use of pesticides in agriculture. The complexity of the field is indicated by the fact that toxaphene, an insecticide in use since the 1940's, has been found to contain at least 177 components, chlorinated camphene derivatives.

Handbuch der Photometrischen Analyse Organischer Verbindungen. First Supplement. By B. KAKAČ and Z. J. VEJDELEK. Verlag Chemie, New York and Weinheim. 1977. 464 pp. \$61.40.

Photometric analysis of organic compounds has advanced substantially since the original work appeared in 1973. This supplement covers new material published in 1970-1975. It is divided into eighteen chapters, according to class of compound, and includes reagent, author, and subject indexes. New reactions are included, as well as advances in old ones, particularly with respect to understanding of mechanisms. The color-forming test reactions that are described may in general be used as qualitative tests, or adapted for quantitative

determination. Each reaction is systematically presented with respect to principle, specificity, interferences, and concise experimental procedures.

BOOKS RECEIVED

Coal Ash Utilization. Fly Ash, Bottom Ash and Slag. Edited by S. TORREY. Noyes Data Corp., Mill Rd. at Grand Ave., Park Ridge, N.J. 07656. 1978. xiv + 370 pp. \$39.00.

A collection of review papers arising from the Proceedings of symposia on the title subject or from government reports.

Cancer: Science and Society. By JOHN CAIRNS. W. H. Freeman and Co., San Francisco, Calif. 1978. xi + 199 pp. \$10.00.

A nontechnical account written for the general public and for students with biological orientation; includes a chapter on chemical carcinogens and radiation.

An Economic Model-New Oil and Gas Supplies in the Lower 48 States. By YOUNG Y. KIM and RUSSELL G. THOMPSON. Gulf Publishing Co., P.O. Box 2608, Houston, Texas 77001. 1978. ix + 110 pp. \$14.95.

Fiberglass-Reinforced Plastics Deskbook. By NICHOLAS R. CHEREMISINOFF and PAUL N. CHEREMISINOFF. Ann Arbor Science Publishers, Ann Arbor, Mich. 1978. viii + 327 pp. \$27.50.

Annual Review of Biophysics and Bioengineering. Volume 7. Edited by L. J. MULLINS. Associate Editors: WILLIAM A. HAGINS, CAROL NEWTON, and GREGORIO WEBER. Annual Reviews, Inc., Palo Alto, Calif. 1978. viii + 601 pp. Price. ?

Professional Engineer's License Guide: What You Need to Know and Do to Obtain PE (and EIT) Registration. Third Edition. By JOSEPH D. ECKARD, JR. Herman Publishing, Inc., 45 Newbury St., Boston, Mass. 02116. 1978. xix + 108 pp. \$11.95.

Developments of Lithium-Metal Sulfide Batteries. Prepared by Atomics International, Canoga Park, Calif. Research Reports Center, P.O. Box 10090, Palo Alto, Calif. 94303. 1978. xiv + 159 pp. \$6.75.

A report on the work done at Rockwell International in 1976-1977 for the development of high-temperature lithium-silicon-iron sulfide batteries.

Some Safety Considerations for Conceptual Tokamak Fusion Power Reactors. Prepared by University of California, Los Angeles. Research Reports Center, Palo Alto, Calif. 1978. xxiii + 336 pp. \$11.50.

Some Safety Considerations in Laser-Controlled Thermonuclear Reactors. Prepared by University of California, Los Angeles. Research Reports Center, Palo Alto, Calif. 1978. xv + 78 pp. \$4.00.

Longitudinal Unbalanced Loads on Transmission Line Structures. Prepared by GAI Consultants, Inc., Monroeville, Pa. Research Reports Center, Palo Alto, Calif. 1978. xiii + 347 pp. \$11.50.

Three-Phase UHV AC Transmission Research. Prepared by General Electric Co., Pittsfield, Mass. Research Reports Center, Palo Alto, Calif. 1978. xxxi + 304 pp. \$11.00.

The Nonclassical Ion Problem. By HERBERT C. BROWN (Purdue University) with comments by PAUL VON R. SCHLEYER (University of Erlangen-Nürnberg). Plenum Press, New York. 1977. xxii + 301 pp. \$24.95.

This book, in one provocative, entertaining, informative, and manageable volume, presents the experiments, reasoning, and conclusions, mostly already published, regarded as most significant to an understanding of the nonclassical ion problem by a man who has spent nearly twenty years intensely pursuing the "hobby" of asking difficult questions of the proponents of bridged ion intermediates. Each chapter is followed by brief comments by a man long respected for his objectivity and keen insight into subtle physical organic questions. The whole is spiced with H. C. Brown's very personal perspective on the history of the controversy and salted lightly with exchanges between two men unafraid to reveal their humanity. The combination should provide a valuable reading experience both for those who have followed the nonclassical ion controversy and those who have not, but wish they

had. The book could also be used as a well-referenced text for a special topics course using the controversy as a vehicle to explore the application of physical organic techniques and principles to the analysis of a very subtle structural-mechanistic problem.

After a brief, carefully selected, reasonably accurate description of the history of the problem, with the author in the self-styled role of the innocent child crying, "But the emperor is naked!" (an amusing and forgivable self-indulgence), and a rather cynical indictment of the scientific establishment (less amusing, but understandable), the author identifies some of the difficulties he sees with the "soft" non-classical ion theory, and presents his intent to select two key systems, the cyclopropylcarbinyl and norbornyl cations, and subject them to "intensive reexamination". In a significant juxtaposition, the very next comment by Schleyer, "general principles are more important than individual examples," sets the stage for the ensuing dialogue in which Brown repeatedly asks for inescapable evidence that the specific ions he has chosen are σ -bridged, while Schleyer repeatedly presents σ -bridging as an established phenomenon in chemistry which *can* account for the facts in some of Brown's specific cases. In following the exchange, I was led to appreciate once again the humility with which we must interpret the facts we are able to wrest from nature's hands.

In subsequent chapters, a "serious attempt . . . to arrive at a generally acceptable definition of the term 'nonclassical ion'" is made (for the first time by any workers in the field, if one is to believe the author!). The result has the virtue of mutual acceptance by the participants, although I find the later description of the norbornyl problem as the distinction between a double or single minimum potential surface a more useful perspective. The cyclopropylcarbinyl cation is discussed rather briefly, leaving me with the impression that, although the opponents agree on the structure of the cation (i.e., its geometry and general electron distribution), they can't agree to call it either "classical" or "nonclassical". So much for mutual acceptance of definitions! Chapters 6 through 12 deal with a variety of norbornyl cations, and it is here that the author really shines as he uses selected significant facts, Goering-Schewene diagrams, and clearly stated reasoning to undermine all of the "classical" criteria for the presence of σ -bridging as a *necessary* factor in the solvolysis of these systems. Exo/endo rate and product ratios, racemization, and rate acceleration are systematically shown to be explicable in terms of steric effects or inadequate models in case after case. Schleyer's comments avoid disputation over wide-ranging details and, rather, focus attention on two important ideas: (1) the theory of steric effects is also a "soft" theory, and (2) it is treacherous to extrapolate from tertiary ions to the secondary norbornyl cation. In this way the reader is not overwhelmed by numbers and other facts whose pertinence to the central question is soon lost. Chapters 13 and 14, dealing with stable ions and new systems, are perhaps the weakest in that they are the most superficial and selective. The author is still asking difficult questions, but with less precision and with more obscure alternative answers. Schleyer's comments provide a good balance here and ask some difficult questions of Brown. The Coates' cation provides a timely example of a cation whose structure is accepted as σ -bridged by both participants in the dialogue, as well as evidence that Brown *can* be convinced that a specific ion is σ -bridged. It is thought-provoking that the very Joseph Priestley whom Brown quotes—"a philosopher who has been long attached to a favorite hypothesis. . . . will not sometimes be convinced of its falsity by the plainest evidence of fact"—was a staunch defender of the phlogiston theory to his death, though he, himself, discovered the facts that ultimately led to its rejection. Recognition of the human failings of others does not assure that we will be free from them ourselves.

One can imagine many possible criticisms of the book: e.g., "the information is too selected and one-sided", "the comments are not critical enough in scope and detail", "this or that work has been ignored, slighted, or dismissed perfunctorily", "not enough distinction is made between σ -bridging in stable cations and σ -bridging in solvolysis transition states", "the style is too inflammatory", "the work has all been published before", "the norbornyl cation controversy is stale", etc. It will undoubtedly arouse much of the very emotion the author laments in his preface. Nonetheless (or perhaps therefore), the book will surely be read greedily by anyone who wants to be informed about σ -bridged ions. After all, how can one ignore the work of a giant of a man who insists on asking questions and demanding answers with such infuriating persistence?

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Atmospheric Pollution 1978. Studies in Environmental Science 1. Edited by MICHELM M. BENARIE (Institut National de Recherche Chimique Appliquee). Elsevier Scientific Publishing Co., Amsterdam. 1978. xii + 292 pp. \$47.75.

This volume contains a selection of 53 papers presented at the 13th International Colloquium on Atmospheric Pollution held in Paris, France, in April 1978. Included papers represent a wide range of interests in the air pollution field. The papers were deliberately selected by the editors from the 80 papers presented to represent a broad cross section and emphasize practical or engineering aspects of air pollution, rather than the theoretical. This document thus serves to give an overview of the tone of the conference and would be of most interest to the experienced air pollution disciplinarian. Because of the emphasis on practical application rather than theoretical or basic research, the papers are in general brief and results-oriented. As such they do not give enough information on the techniques and analytical methods utilized to be of use to novice investigator or student. The subject matter contained ranges from survey methods and analytical techniques to the health effects of the various air pollutants. Of special interest to some investigators is the fact that the papers represented in this document are almost exclusively a result of investigations conducted within the European scientific community and represent a convenient up-to-date overview of the various air pollution investigations occurring within this community. When the broad range of subject matter and brevity of the individual papers is considered, this document would be recommended only for the experienced investigator and/or student of air pollution control who has the prerequisite background and basics of the subject in question, be it measurement, analytical methods, or modelling techniques. This is not recommended as a textbook or general source of information for the unexperienced individual. Because of the applications and practical orientation and the breadth of subject matter, this document would be of modest interest to the readers of the *Journal of the American Chemical Society*, unless already serious students of air pollution control.

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Gmelin Handbuch der Anorganischen Chemie. Ergänzungswerk zur achten Auflage. Band 36. Eisen-Organische Verbindungen, Teil B; Einkernige Verbindungen, Teil 1. Prepared by the Gmelin Institute for Inorganic Chemistry. Springer-Verlag, Berlin-Heidelberg-New York. 1976. viii, viii + 209 pp. \$215.50.

This volume commences the review of all reported organoiron compounds, whether their existence has been completely substantiated or not. Literature coverage is claimed through the end of 1975, with some consideration of reports that appeared up to the middle of 1976. Teil B confines its discussion to nonferrocene derivatives; Teil A, in which series Volumes 14, 41, 49, and 50 have already appeared, treats various ferrocene derivatives. Curiously, two-thirds of the present volume is written in English; those sections dealing with alkyl, aryl, acetylenic, and porphyrin derivatives are in German. The sequence of topics is a review of C-Fe σ -bonded derivatives (alkyl, aryl, and 1-alkynyl), then a treatment of carborate derivatives, and finally a survey of carbonyl compounds. The last topic is covered up through tricarbonyliron derivatives bearing metal or nonmetal ligands, but those derivatives bearing olefinic or diolefinic ligands are reserved for a subsequent volume. Iron compounds having cyano, cyanato, or thiocyanato groups are explicitly omitted. The information is complemented by 36 tables, 18 figures, and many structural representations of configurations, unusual ligands, and complicated porphyrin-like derivatives.

Although the number of general references listed at the beginning of the volume is small (ca. 1.5 pp), sizable groups of references are included at the start of, or in the body of, individual sections. Thus, the introduction to carbonyl derivatives offers 26 general references and the section on the important $(CO)_3FeL_2$ system offers 156 citations.

As with the organometallic derivatives of titanium, the successful preparation of alkyl or aryl derivatives of iron has been achieved only in recent years after almost a century of failure. Learning from Wanklyn's unsuccessful attempt to alkylate $FeCl_2$ with $(CH_3CH_2)_2Zn$ (1861), chemists in the 1960's finally realized that special donor ligands (e.g., bipyridyl) or stabilizing alkyl or aryl groups (e.g., C_6Cl_5) had to be employed for the feasible isolation of R_2Fe types. Indeed, the general lability of all such C-Fe σ bonds should make one very skeptical of many of the published claims that are impartially summarized in this volume. The lack of proper analytical

or spectral data will alert the reader to the presumptions of the author. Often the structure of a proposed intermediate, such as $\text{Li}[\text{Fe}(\text{CH}_3)_3]$, rests on the shaky foundation of stoichiometry: that a precipitate was observed when CH_3Li and FeI_2 were admixed in a 3:1 ratio.

Two topics of broad interest are discussed under the format of a systematic treatment of organoiron compounds. The first is a 45-page review of iron porphyrin complexes and their analogous model systems, which is considered under the rubric of monocarbonyliron complexes. This section would be worthwhile for biochemists seeking a solid review of the inorganic chemical aspects of heme and related model complexes. The second topic is that of the coordination chemistry of trigonal-bipyramidal and octahedral complexes of transition metals. The carbonyl derivatives of iron are amenable to investigation by a variety of spectral measurements and hence are frequent objects of study in coordination chemistry. The discussions offered here are instructive in showing how data are marshaled in making specific configurational assignments.

In general, the authors have done good work in integrating the unusual breadth of topics presented, which range from essentially bioinorganic (porphyrins) to inorganic (metal carbonyls) to classical organometallic (C-Fe σ bonds). They have presented both credible data and dubious information, but they often do add a cautionary note about the latter. The reader would do well to consult the original publications before deciding on the merits of certain structural claims.

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Gmelin Handbuch der Anorganischen Chemie. Ergänzungswerk zur achten Auflage. Band 40. Titan-Organische Verbindungen, Teil 1; Einkernige Verbindungen, Teil 1. Prepared by the Gmelin-Institute for Inorganic Chemistry. Springer-Verlag, Berlin-Heidelberg-New York. 1977. vii, vi + 212 pp. \$240.50.

The present volume launches a review, published in German, of the preparation and properties of organotitanium compounds, as reported in the scientific and patent literature through the end of 1975. The editor, Ulf Thewalt, treats in Teil 1 those mononuclear compounds containing at least one C-Ti σ bond, $\text{R}_n\text{TiZ}_{4-n}$ ($n = 1-4$), as well as those bearing di-, tri-, tetra-, and pentahapto carbon ligands. In the last case, this volume covers only those bearing one pentahapto ligand: types such as $(\eta^5\text{-C}_5\text{H}_5)\text{TiX}_2$ are included but systems like $(\eta^5\text{-C}_5\text{H}_5)_n\text{TiZ}_{4-n}$ ($n = 2-4$) are not. Moreover, the coverage offered here differs markedly from the purely objective and factual account offered in such Gmelin volumes as those dealing with organotin compounds (Bände 26, 29, 30, 35). The existence of many of the organotitanium compounds discussed here has not been proved: they represent hypothetical intermediates proposed by various authors for the nonce, in order to rationalize decomposition, polymerization, or other reactions; or they represent poorly characterized, amorphous solids, such as CH_3TiCl_2 , that are thought to be formed by treating titanium salts with organometallic reagents. Many of these chimerical structures stem from the patent literature. However, only those compounds mentioned in the patent examples are actually included. Transitory organotitanium compounds though to exist on surfaces are explicitly excluded from consideration.

This intermingling of substantiated data and speculative views seems to be in keeping with Gmelin's policy of attaining a complete, and hence nonjudgmental, coverage (for a selective coverage would mean that some literature reports would have to be considered unworthy of inclusion). The reader must weigh the available information (or its paucity) supporting the formation of a given compound and decide whether its existence is credible.

The volume commences with a general bibliography of 2.5 pages and a review of unsuccessful methods of preparing organotitanium compounds. From the first abortive attempt of Cahours to the first successful preparation of an organotitanium compound by Herman and Nelson in 1952, almost 90 years of frustration intervened. This history attests to the lability of many C-Ti σ bonds and makes understandable why a complete structure proof of organotitanium intermediates is often so difficult.

Some 30 tables are used to portray the essential variables for the preparation of, and the key properties for the characterization of, organotitanium compounds. A liberal use of structures accompanies succinct discussions of hypothetical intermediates formed in transalkylation, Ziegler-Natta olefin polymerization, titanium-catalyzed magnesium hydride transfer, and X-ray crystallographic data. In a

compendium of this type it would be unfair to expect an authoritative treatment of such intricate and poorly understood subjects as Ziegler-Natta polymerization, so its sketchy, scattered treatment in this volume is not a serious failing. What would have been invaluable and in keeping with Gmelin's aims would have been a comprehensive bibliography, *in one place*, of the pertinent Ziegler-Natta literature. Perhaps a further volume in the series could fill this need.

No formula index is included; apparently such an index will be issued after two further volumes, devoted to other mononuclear and to bi- and polynuclear compounds, respectively, have been published. A useful feature in this volume is the indication at the bottom of many pages of where the next list of relevant literature citations is to be found.

The editor and his staff are to be congratulated for a most satisfactory completion of an unusually difficult task: summarizing and tabulating the fact and fiction of organotitanium chemistry.

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Gmelin Handbuch der Anorganischen Chemie. Ergänzungswerk zur achten Auflage. Band 41. Eisen-Organische Verbindungen, Teil A; Ferrocene, Teil 6 (Zweikernige und mehrkernige Ferrocene). Prepared by the Gmelin-Institute for Inorganic Chemistry. Springer-Verlag, Berlin-Heidelberg-New York. 1977. viii, viii + 316 pp. \$321.00.

This volume continues, in German, Teil A, the survey of ferrocene derivatives, of which Bände 14, 49, and 50 are predecessors. Encompassed here are those ferrocenes having two or more iron nuclei (actually, up to hexanuclear systems); so-called ferrocene polymers are excluded by design. The organization of material consists in an initial treatment of binuclear ferrocenes with successively longer carbon, and then heteroatom, bridges between the ferrocenyl moieties. Thereafter, trinuclear derivatives are discussed under sections devoted to chain-linked derivatives (ferrocene units united through C_5 units) and to pendant derivatives (three ferrocenyl units attached to one or more atoms in a chain), respectively. The number of well-characterized tetranuclear and higher compounds is small; 12 pages suffice to recount their properties. The coverage is made concise by resorting to 41 tables and the discussion clarified by 24 figures and numerous illustrations of reaction schemes and stereochemistry. The formula index is most useful in finding specific compounds among this rather complicated collection of derivatives. The literature consulted is, in all cases, that which appeared by the end of 1975; in some instances, citations up to mid-1976 have been included.

For extensively studied systems, such as biferrocenes or biferrocenylenes, the sequence of treatment is to consider, in turn, formation and preparation, physical properties, structure, chemical properties, and literature citations. One aspect almost wholly lacking in this volume is the discussion of any use, to which such ferrocene derivatives could be put. From the literature one can discern some potential applications for these systems, such as components in polymers and in photo- or thermo-conductive materials. It appears, however, that many of the studies summarized here were motivated by pure curiosity: since ferrocene is an "aromatic" system like benzene, what would be the properties of ferrocene analogues of biphenyl (biferrocene), terphenyl (terferrocene), etc.? The number of compounds listed here shows that such curiosity must now be largely satisfied. In the great majority of cases, such information will probably rest in the literature, undisturbed by posterity.

In one area that transcends ferrocene chemistry, however, there has been moderately active research: namely, the field of electrical conductivity. The ready redox reaction possible between a ferrocene and its ferricenium ion has stirred an interest in oligonuclear ferrocenes in which the iron centers might be induced by photo- or thermo-excitation to undergo an internuclear electron transfer. The monocations of biferrocenes and biferrocenylenes (mixed-valence compounds) are of great interest in this regard. Such compounds are being considered not only as potential semi- and superconductors, but also as models for biochemical redox processes.

In general, the editors have succeeded in imposing organization on these diverse compounds, only loosely related in having two or more ferrocene units in their composition. This branch of ferrocene chemistry is highly specialized, so it is unlikely to be consulted very often by inorganic or organometallic chemists. Electrochemists and solid-state physicists, on the other hand, may find it as a valuable reference in their research.

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Computer Modeling of Matter. ACS Symposium Series No. 86. Edited by PETER G. LYKOS (Illinois Institute of Technology). American Chemical Society, Washington, D.C. 1978. 271 pp. \$24.00.

This monograph is a collection of papers presented at a symposium sponsored by the ACS Division of Computers in Chemistry during the 175th National Meeting of the ACS, in Anaheim, CA, March 1978.

The collection consists of 18 contributions, about one-third of which deal with Monte Carlo (MC) and one-third with molecular dynamics (MD) simulations. The applications of these techniques cover diverse topics: liquids with ionic interactions; ST-2 water and Xe-Xe interactions therein; an LJ model of the liquid-vapor interface; the hydrated Li cation; methane and the liquid-vapor surface of N₂ and Cl₂; high-field electrical conductivity; simulation of $S(Q, \omega)$ for various solids; a multichain polymer system; MCY-CI water and dilute aqueous ionic systems.

Roughly, another third of the monograph/symposium deals with certain newer methodologies that differ from the classical MD and MC techniques: multidimensional Newton-Raphson energy and minimization methods applied to defects in polymer crystals; the use and greater cost effectiveness of Array Processors for MC simulations; coupling of multiple time step with singularity free algorithms using quaternions; optimization techniques for MC sampling; LJ pair and Axilrod-Teller triplet potentials used with the multiple time step scheme; fermion and Green's function MC algorithms for quantum liquids and crystals; motivation for a hierarchy of simulations ranging from microscopic molecular dynamics to macroscopic nonequilibrium events.

One cannot help but be impressed by the rapid publication of this volume. The finished book was in hand for review ten months after the symposium—many chapters were received by Lykos, the symposium organizer and editor, only four months before the appearance of this book! Such, of course, has been the goal of the ACS Symposium Series.

The contributors to this volume are, in a sense, members of the third generation of computer modelers; their work, theoretically and computationally, has paralleled the development of computer architecture. Lykos has performed a valuable service in calling together representative work of this now identifiable body of computational scientists.

Russell D. Larsen, *The University of Michigan*

Quantitative Drug Design: A Critical Introduction (Medicinal Research: A Series of Monographs, Volume 8). By YVONNE CONNOLLY MARTIN (Abbott Laboratories). Marcel Dekker, New York. 1978. x + 425 pp. \$38.50.

The assistance of computers in analyzing the link between structure and biological activity has now become an established approach in drug design. There are many reviews of the mathematical models currently in use but very few introductory monographs. In attempting to provide a self-study guide for workers who are unfamiliar with quantitative methods, Dr. Martin has produced a valuable and readable volume.

Chapters 1-3 summarize the extrathermodynamic and de novo methods and describe the types of noncovalent interactions correlated with measurable physical properties. Chapter 4 deals very adequately with the measurement and calculation of the physical properties of prime interest and comments briefly on the use of dummy variables. The derivation and choice of relative biological potencies (Chapter 5) is somewhat uncritical and sparsely referenced, although a useful comparison between enzymes and receptors is given. A discussion of empirical and model based equations (Chapter 6) is followed by an introduction to the statistics of multiple linear regression and the steps in the analysis of a real data set (Chapters 7 and 8). In Chapter 9 the detailed calculations which led to regression equations for certain erythromycin esters are described as a prelude to the more detailed presentation of several case studies in Chapter 12. A brief review of other statistical methods apart from regression is given in Chapter 10 and a brief but adequate summary of noncomputer methods is outlined in Chapter 11. The data on the erythromycin esters are used again in Chapter 13 to exemplify the application of the Free-Wilson method. This section (Chapters 9-13) should prove the most useful. The final chapter on enzyme inhibitors and conformational methods, although interesting, seems inappropriate. This reviewer would have preferred a more detailed discussion and comparison of the various chemical starting points for drug design, with emphasis on optimizing

the selectivity of action with the aid of quantitative methods. Conformation could have been included in an earlier chapter along with other molecular properties such as pK_a and tautomerism.

In summary this book, which is generally well referenced with a good index, should prove invaluable both as an introductory text and as an aid to the more experienced drug researcher.

John C. Emmett

The Research Institute, Smith Kline & French Laboratories Ltd.

Ein Gelehrtenleben: Ernst und Satire. By ERICH HÜCKEL. Verlag Chemie, GMBH, Weinheim. 1975. 181 pp. \$19.50.

Professor Hückel has written a thoroughly enjoyable autobiography. His book is a full 181 pages long, but seems much shorter. This, I think, is because it is written in anecdotal form, with perhaps 100 one-half to two-page sketches. The book is easily read in bits and pieces and is an excellent work to carry around and read while waiting in shopping lines and dentists' offices.

Professor Hückel covers a lot of ground, starting with notes on his grandparents and running through his childhood, school years, marriage, and career as a researcher and professor. Along the way he gives us glimpses of his grandparents, parents, brothers, friends, teachers, and colleagues. Because he describes his life in a series of brief anecdotes, however, Hückel never dwells long on any one subject. There are no tirades or long philosophical discussions; there are no involved stories covering his first romance or his many years at the university.

The book is subtitled "Ernst und Satire", and is indeed divided about equally between the serious and the amusing. Among the serious notes are passages on war, fascism, teaching methods, and the death of his mother. The "satire" includes light little anecdotes on his nightly going-to-bed ritual as a child, his stint as a sailor in Kiel, and "a ride with Debye in his Studebaker".

In an appendix, Professor Hückel has also provided some examples of his publications and brief comments on his theory on solutions of strong electrolytes and his theories on benzene and resonance.

In all, the book is well written, easy, and interesting to read. I only wish there were an edition in English so that more people could read and enjoy this book.

Timothy R. Erdman, *Chevron Chemical Company*

Chemical Transmission in the Mammalian Central Nervous System. Edited by CH. H. HOCKMAN and D. BIEGER (University of Illinois). University Park Press, Baltimore, Md. 1976. x + 442 pp. \$34.50.

This book represents a well-organized and clearly written review on transmitters in the central nervous system. The contributions by nine authors focus particularly on functional concepts, systematically reviewing the evidence for the synaptic role of individual neurotransmitters. Less emphasis is placed on molecular mechanisms of the phenomena under consideration, e.g., drug-receptor interactions.

The first chapter (H. McLennan) is devoted to an overview of synapse function, focusing on events related to transmitter release and uptake. The following chapters deal with the inhibitory transmitters γ -aminobutyric acid and glycine (G. A. R. Johnson); excitatory amino acids, primarily glutamate and aspartate (P. N. R. Usherwood); acetylcholine (J. W. Phillis); dopamine (D. Bieger and Ch. H. Hockman); norepinephrine (B. J. Hoffer and H. F. Bloom); and serotonin (T. J. Marczyński).

The book was published in 1976, and research in the field has been reviewed up to 1974. Accordingly, the book does not contain information on endogenous opioid peptides, i.e., endorphins and enkephalins, compounds with a wide range of effects in the central nervous system. Their possible biological functions include analgesia, neuroendocrine regulation, and interaction with other neurotransmitter systems (GABA, acetylcholine, dopamine) in the brain. Information, presently appearing at an overwhelming rate, in this exciting area of research allows the postulation of a neurotransmitter or modulator role for the endorphins and/or enkephalins.

In summary, this monograph represents a review of established knowledge on chemical transmission. The book, because of its date of appearance, does not include some recent important developments in neurotransmitter research. Despite the latter drawback, the book should, owing to the clearly presented systematic approach, become a valuable reference particularly for the researcher not working in the field.

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