oxidation at $E_{1/2}$ = +0.46 V, and a quasi-reversible reduction at $E_{1/2}$ = −0.65 V vs Ag/AgCl. This redox behavior suggests that the parent Rh(II) complex easily converts to stable Rh(I) and Rh(III) species and with minimal structural change or decomposition. We are investigating appropriate chemical routes in an effort to isolate these products.

The present study illustrates the ability of an alkoxide-substituted triphenylphosphine ligand to stabilize a rarely encountered oxidation state for mononuclear rhodium. The methoxy groups are capable of coordinating to the metal center through weak interactions, which helps to lightly stabilize low coordination numbers but does not render the molecule inert as is often the case with very bulky ligands and with cyclometalated groups possessing strong M–C bonds. Furthermore, the phosphine has a very flexible coordination mode in that it may behave as a mono-, bi-, or tridentate ligand depending on the electronic and geometric preferences of the metal center. Further work is underway to elucidate the coordination geometry of TMPP with metals possessing d^n electronic configurations of n = 2–10.

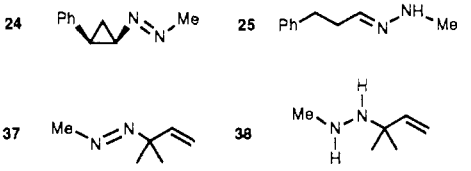
Acknowledgment. We thank Judith Eglin for help with the SQUID measurements and Chris Bender for his assistance in obtaining EPR data. We are grateful to the donors of the Petroleum Research Fund, administered by the American Chemical Society, and to Michigan State University for an All-University Research Initiation Grant. X-ray equipment was supported by a grant from the National Science Foundation (CHE-8403823).

Supplementary Material Available: Tables of crystallographic parameters and equivalent isotropic displacement parameters, bond distances and angles, and anisotropic thermal parameters (9 pages); table of observed and calculated structure factors (24 pages). Ordering information is given on any current masthead page.

Additions and Corrections

Reduction of Azoalkanes by Benzhydryl Radicals [*J. Am. Chem. Soc.* **1989**, *111*, 1830]. PAUL S. ENGEL* and WEN-XUE WU

Page 1831: In Table I, the structure (designated #It) accompanying product 25 is missing. It is located incorrectly immediately below the structure for the azoalkane **37**. The correct sequence for the azoalkane/product combinations **24**/**25** and **37**/**38** follows.



Book Reviews

Vitamins. By Wilhelm Friedrich (Institut für Physiologische Chemie). Walter de Gruyter: Berlin and New York. 1988. 1060 pp. DM380. ISBN 3-11-010244-7.

Professor Wilhelm Friedrich was one of the pioneering and successful researchers with Professor K. Bernhauer in Stockstadt/Main/Germany on vitamin B_{12} and particularly on the corrinoids. The expertise of Professor Friedrich on vitamin B_{12} is also exemplified by his co-editorship with B. Zagalak on *Vitamin* B_{12}, 1979, which is the Proceedings of the Third European Symposium on Vitamin B_{12}, and the *Intrinsic Factor* in Zurich, March 1979.

His *Vitamins* of 1988 is encyclopedic although in one volume, and it is a monumental and extraordinarily useful book. This remarkable book includes the important historical aspects but emphasizes the basic information on vitamins. The book is divided into special chapters for the 13 vitamins: vitamin A and its provitamins; vitamin D; vitamin E; vitamin K; thiamin, vitamin B_1, aneurin; vitamin B_2: riboflavin and its bioactive variants; niacin: nicotinic acid, nicotinamide, NAD (P); vitamin B_6, folic acid and unconjugated pteridines; biotin; pantothenic acid; vitamin B_{12}; and vitamin C.

This book has an appendix that provides the more important publications, particularly those that are relevant to medicine, that appeared after the chapters had been written. This appendix extends to May 1986.

The scope of information in this book is truly extensive and embraces history, discovery, organic chemistry, physical characteristics, biochemistry, biological activities such as antitumor effects, distribution in tissues, absorption, transport, enzymes, proteins, deficiencies, and many other relevant aspects.

This comprehensive book should be in the personal library of all scientists, whether academic or otherwise, and all investigators and all physicians who have a responsibility depending upon knowledge of the vitamins.

Not many scientists have the painstaking and persevering skill and knowledge to create such a book. For his stupendous accomplishment, Professor Friedrich deserves congratulations by all concerned with vitamins.

The chapters are very extensive. For example, the chapter on vitamin D consists of 76 pages with 73 sections and 8 pages of references. The chapter on vitamin B_6 consists of 75 pages with 70 sections and 8 pages of references. The chapter on vitamin B_{12} consists of 89 pages with 97 sections and 14 pages of references.

It is understandable that Professor Friedrich selected only the very well established vitamins for inclusion. Certain other nutritional entities were largely omitted on the basis of their "questionable vitamin character" but are cited in Table 1–34, which requires only half a page. Included in this table are lipoic acid, myo-inositol, and particularly ubiquinone or coenzyme Q. If Professor Friedrich publishes a future new edition of this book, surely he will include a chapter on coenzyme Q comparable in coverage to that for the majority of the 13 vitamins that are included.

Coenzyme Q is known to be essential for human life to exist, its mitochondrial biochemistry is extensively elucidated, and its lifesaving and life-extending activity for patients with cardiomyopathy is already well-documented. Those who defined the word vitamin, about 77 years ago, could not have foreseen the discoveries in this field up to the late 1980's. The expression "coenzyme Q", endorsed by David Green and Karl Folkers in 1957, was and is appropriate for academic biochemists but inappropriate for the physicians and the countless patients of today who respond to treatment with coenzyme Q_{10}. For these physicians and patients, the expression "vitamin Q_{10}" would have been communicative while the expression "coenzyme Q_{10}" is not communicative and the frequent omission of co- from coenzyme Q_{10} is erroneous since the quinone is not an enzyme. Nomenclature of nutritional entities should be flexible and particularly communicative to all disciplines upon which the entity has an impact. For example, niacin is included in *Vitamins* by Professor Friedrich as Chapter 8 and as one of the thirteen vitamins, although dietary tryptophan (8.7.1.1 on p 490) is reviewed as an established niacin precursor on the basis that dietary tryptophan is enzymatically converted to NAD(P) in the animal body. It is known that tyrosine is converted to coenzyme Q_{10} in the animal body, and the biochemical conversion is that of nutritional science. Such background on niacin and coenzyme Q_{10} is a basis for the communicative expression "vitamin Q_{10}". Therefore, the inclusion on p 55 of coenzyme Q as of "questionable vitamin character" is one of a 77-year old definition rather than recognition today of the essentiality of coenzyme Q_{10} to human life and its established use in medicine to save the lives of patients having cardiac disease.

An aspect of importance for this book is the excellent documentation with references in contrast to a book that can be largely "conversational" without citations to original literature.

Karl Folkers, *University of Texas at Austin*

Correlation Analysis of Chemical Data. By Otto Exner (Czechoslovak Academy of Sciences). Edited by John Shorter (University of Hull). Plenum: New York and London. 1988. 275 pp. $55.00. ISBN 0-306-14559-3.

This book is the work of one of the best-known practioners of correlation analysis. It consists of eight chapters describing the purpose of correlation analysis, the Hammett equation as a typical correlation equation, theoretical properties and extensions of Hammett-type equations, the evaluation of inductive, mesomeric, and steric effects; multiparametric and special correlation equations; statistical problems; and basic concepts of multivariate analysis. The last two topics are particularly well done. Thanks in part at least to the efforts of the editor, it is clear and readable. Though the book includes 39 problems with answers, it is not really a textbook but rather a position paper; it presents Prof. Exner's views regarding the present state of the field. These views in some cases at least are not held by the majority of the workers in correlation analysis. For example, the generally held position concerning the mode of transmission of the localized (field and/or inductive) electrical effect is that it is through space (field) rather than through bonds (inductive) as Prof. Exner believes. My own view is that it is probably through space whenever it must pass through more than one bond. Again, in Prof. Exner's opinion those groups which generally behave as strong electron acceptors (NO_2, COX, SO_2X, ...) have little or no delocalized (resonance) electrical effect. This is certainly contrary to the commonly held view.

Although these differences in interpretation might be thought to exclude the choice of the book as a text, this is not the case. Any problem is easily overcome by appropriate supplementation on the part of the instructor. What is most important is that this book is an invaluable presentation of the ideas, results, and opinions of one of the major figures in this area of research. In view of the widespread use of correlation analysis in physical organic, biorganic, inorganic, medicinal, biological, and environmental chemistry, it should be of interest to a very wide range of chemists. I recommend its purchase to every library, personal or professional, which serves those interested in modelling the effect of structure on chemical properties and reactivities. The book is quite free of typographical errors. There is one which should be noted, however: p 82, section 2.6, line 2, known rho's should read known sigmas.

Marvin Charton, *Pratt Institute*

Handbook of Polycyclic Hydrocarbons. Part B: Polycyclic Isomers and Heteroatom Analogs of Benzenoid Hydrocarbons. By J. R. Dias (University of Missouri–Kansas City). Elsevier: Amsterdam and New York. 1988. xiv + 404 pp. $155.25. ISBN 0-444-43007-5.

This volume is a sequel to Part A, which was titled *Benzenoid Hydrocarbons* and published in 1987. The term "handbook" is something of a misnomer. This monograph is basically a treatise on graph theory to which have been appended three sets of tables containing very little data of any practical value. The first 100 pages comprise four chapters, which are devoted to the following: nomenclature (6 pages), chemical graph theory (34 pages), isomer enumeration (20 pages), and spectroscopy (40 pages). In the nomenclature section, four sentences give the "nomenclature rules for heterocyclic analogs of benzenoid hydrocrbons". The "spectroscopy" chapter is devoted mostly (34 pages) to the "facile computation of eigenvalues". The purpose of this four-chapter preamble is to organize the title classes of compounds according to their molecular graphs. "The essential and unique feature of this organizational approach is that it will allow easy intercomparison of molecules that are topologically and graph-theoretically related." The book does accomplish this objective. For example, we learn that "there are 1320 triazadiphospha benzenoid analog isomers of triphenylene where three CH groups have been replaced by N and two CH groups by P" or that "there are 1980 $C_{13}H_7X_3Y_2$ benzenoid isomers of naphthacene."

Chapter 5 (101 pages) is a compilation of polycyclic conjugated hydrocarbons and their chemical properties and chapter 6 (163 pages) is a compilation of aza and related heteroatom analogs of benzenoid hydrocarbons. These chapters deal only with even-carbon molecular species, so that molecules such as indole are not considered. The compilation chapters catalog two compounds per page and deal primarily (although not exclusively) with known compounds. Listed vertically are the following features of each system: formula, name, mp, bp, solubility, π-energy, structure count (K), HOMO, synthesis, UV, NMR, PI (ionization energies), toxicity, uses, and references. For most compounds, the molecular formula, name, mp, and a reference are given, although the references only list a single author's name et al. For the most part, the other data are simply lacking. Syntheses, where given, are one-line descriptions. In some instances the omission extends to the compounds themselves, so that one finds only a blank half page with a listing of potential properties.

The book ends with a 39-page supplement titled "Additions and Corrections to the Part A Volume" One cannot help but wonder how long would be a corresponding supplement for this Part B Volume.

Randolph P. Thummel, *University of Houston*

Surfactant Science and Technology. By Drew Myers. VCH: New York and Weinheim. 1988. xiv + 351 pp. $45.00. ISBN 0895-73339-0.

This book makes an admirable attempt to condense the basics of surfactants. The author correctly states that there is a difference in the research approaches taken by academia and industry to understand the effects of surfactants. Most fundamental research focuses on studying the properties of surfactants in their purest state. In sharp contrast, industry works with surfactants characterized by blends and impurities. The latter can play a major role in affecting surfactant performance. This book intends to present a rudimentary view of surfactant science which will be meaningful to the chemical professional caught in the middle.

Topics covered in this book include the organic and physical chemistry of surfactants. The introductory chapter provides a brief review that enables an unfamiliar reader to get a feel for the basic structure and function of surfactants. Inclusion of historical background and economic considerations such as applications and consumption manifests the significant impact of surfactants. The placement of a glossary to define key terms at the end of the chapter leaves the reader with an excellent lead into the book.

Description of the four main surfactant classes (anionic, nonionic, cationic, and amphoteric) is covered in the organic chemistry chapter. The author mentions key chemical structures, characteristics, and applications for prominent members of each class. A section that covers the main starting raw materials is particularly effective in informing the reader of the myriad of possible raw materials used to manufacture surfactants.

The remainder of the book delves into the role surfactants play and how this basic function translates into a large number of applications. Emphasis is placed on the mechanism of surfactant activity at liquid/vapor, liquid/liquid, and solid/liquid interfaces. The author describes such general topics as micellar theory, surface tension, and emulsions (micro and macro). Application of these topics in discussion of the foam, wetting, and detergency phenomena is conducted with excellent lucidity by the author. The industrial chemist is provided with an excellent overview of these three major applications. A discussion that correlates chemical structure with surfactant performance and indicates the limitations of the major surfactant class is included.

Extensive references for each chapter are listed for the reader's benefit. A bibliography section is provided which enables the reader to quickly find references that focus on specific topics discussed in the text. The only shortcoming to the book is the author's inclination to derive a number of mathematical equations that describe physical phenomena. This type of work is best left to books that provide a more rigorous treatment of specific subjects. In spite of this drawback, this book should

be a valuable reference for those chemists who need to work with surfactants but lack the needed background.

Neil M. Canter, *Mayco Oil & Chemical Company*

Active Carbon. By R. C. Bansal (Panjab University), J.-B. Donnet (Centre National de la Recherche Scientifique), and F. Stoeckli (University of Neuchâtel). Marcel Dekker: New York and Basel. 1988. xiv + 482 pp. $125.00. ISBN 0-8247-7842-1.

Activated carbon has been used as an adsorbent and purifying agent for millennia. Today, hundreds of thousands of tons per year are used for a host of important applications. Currently, activated carbon is an area of vigorous research both in the quest for new and improved applications and in the pursuit of fundamental knowledge on the nature of its efficacy. This book is an in-depth study of a highly useful and interesting subject. The authors are world-renowned experts whose previous books on carbon are classics.

The book is in six chapters. Chapter One covers the manufacture of activated carbons from all important carbon sources. The carbonization and activation processes are described and the mechanism of activation is discussed briefly. Chapter Two details the functional groups on the carbon surface and their chemical reactivity. Infrared spectroscopy including Fourier transform methods is given extensive coverage along with X-ray photoelectron spectroscopy (ESCA). Chapter Three looks at the pore structure of activated carbons and its relationship to adsorption capacities.

Chapter Four considers the characterization of the surface of activated carbons. Parameters evaluated arise from immersion calorimetry and from adsorption studies under different conditions. The nature of active sites in the carbon is considered.

Chapter Five discusses modification of the surface of activated carbons. Methods of surface modification include oxidation, surface impregnation by a wide variety of atoms, ions, and molecules, and reactions of the carbon surface with halogens, sulfur, and ammonia. The profound changes in the adsorption and catalytic properties of the carbon are outlined.

The many and varied applications of activated carbons are detailed in the final chapter. This includes discussion of the mechanisms involved. The sections on adsorption of gold by active carbons and removal of organics from drinking water get particularly complete coverage. Catalysis on activated carbon surfaces is covered here for a number of oxidations, decompositions of peroxides, and other reactions.

The usefulness of the book is increased by extensive tables and graphs and exhaustive lists of references for each chapter. I consider this to be a book of exceptional value and indispensable for a wide variety of scientists and engineers. It will be highly useful for anyone working in a related field and I am sure that it will stimulate new research in this important area.

Herbert Beall, *Worcester Polytechnic Institute*

Advanced Inorganic Chemistry, 5th edition. By F. Albert Cotton (Texas A&M University) and Geoffrey Wilkinson (University of London). John Wiley and Sons: New York. 1988. xx + 1455 pp. $44.95.

It is gratifying that research chemists as active as Cotton and Wilkinson still find time to periodically update their voluminous compendium of inorganic chemistry.

Although this fifth edition is only about 4% longer than the fourth edition of 1980, many significant changes have been made. Recognizing that many of the theories and principles of inorganic chemistry are now discussed in other textbooks, the authors have eliminated much material of that sort. Thus the initial section on introductory topics and discussions of ligand field theory and the spectra and magnetism of transition-metal complexes have been completely reorganized and abbreviated.

Thousands of references to the 1980–1987 literature are cited in support of the new data in the book. Older literature citations have unfortunately been deleted; thus earlier editions of the book are useful if the earlier citations are sought.

The over-all flavor of the book has not changed. There is an emphasis on the synthesis and structures of compounds that are of particular interest to Cotton and Wilkinson, namely transition-metal coordination compounds. The kinetics and mechanisms of reactions of non-metal compounds receive little attention. Few thermodynamic data are presented or used to interpret phenomena. The solid state is not covered as thoroughly as recent developments warrant. And historical backgrounds, industrial processes, and commercial applications are seldom discussed. Some of these slighted topics are covered better in Greenwood and Earnshaw's recent compendium, *Chemistry of the Elements*, which volume therefore probably competes seriously in the market with Cotton and Wilkinson. Nevertheless, in spite of its deficiencies, Cotton and Wilkinson is still to be recommended as the first place to go when seeking general information about the chemistry of a particular element, especially when up-to-date, authoritative information is desired.

William L. Jolly, *University of California*

Solid/Liquid Dispersions. Edited by Th. F. Tadros (ICI). Academic: Orlando. 1987. xii + 331 pp. $49.00. ISBN 0-12-682178-X.

This multiauthor volume arose from a 1986 residential course at Bristol University. While most of the chapters are from workers in the UK, the book contains a number of contributions from the University of Melbourne, and from the laboratory of Physical and Colloid Chemistry in Wageningen (The Netherlands). The purpose of this edited volume is to teach the fundamental principles of colloid and surface phenomena underlying the preparation and utilization of solid/liquid dispersions, and also to provide practical information on this subject. The topics covered are the following: Preparation of dispersions (D. J. Walbridge); Structure of the interface and the electrical double layer (J. Lyklema); Stability of dispersions (B. H. Bijsterbosch); Adsorption of surfactants (R. Aveyard); Adsorption of polymers (T. Cosgrove); Stability of dispersions in the presence of polymers (B. Vincent); Flocculation by polymers and polyelectrolytes (J. Gregory); Concentrated dispersions (R. H. Ottweill); Rheology of dispersions (J. W. Goodwin); Settling of suspensions and sediment prevention (Th. F. Tadros); Measurements of interfacial electrostatic potentials (T. W. Healy); and Properties of suspensions (Th. F. Tadros).

The technical quality of the individual contributions in this 11-author volume is in general very high. The authors are productive and, for the most part, well-known experts in their fields. The general level of readability and informativeness is very good. Particularly notable examples of clarity are the chapters by Lyklema, Bijsterbosch, Cosgrove, and Vincent. The degree of self-citation in each chapter tends to be extensive, but the other side of this coin may be that contributions whose titles might suggest overlap (e.g. effects of polymers) so strongly reflect the authors' research that they turn out to involve very different approaches. The presentations are up to date, with many references to papers published after 1984.

The assemblage of a work of this sort presents several challenges. The treatments range from fundamental to highly descriptive. The themes of necessity entail some overlap, and the topics are inherently not amenable to any unique logical sequence. On the whole, these difficulties have been dealt with satisfactorily. A high degree of uniformity in style and level of presentation has been achieved by the authors, and this is complemented by the consistency in format and physical appearance of the chapters. The detailed introductory overview by the editor clarifies the interrelationships among the various topics and so improves cohesiveness. Some weaknesses persist, however. The electrical double layer is discussed in several chapters, as is polymer adsorption; while the treatments are not exactly redundant, there is little cross-referencing. Also, with regard to balance, the citations could be more cosmopolitan; for example, one would like to see more reference to the very good work on silica flocculation done in Paris and Strasbourg.

Solid/Liquid Dispersions is a valuable introduction for the novice and a substantial resource for the skilled practitioner working with such systems. In addition, several individual contributions make this a worthwhile reference source for scientists interested in e.g. the electostatic behavior of charged colloids and the adsorption of polymers to surfaces. This book represents a fine addition to the collections of such researchers.

Paul Dubin, *Indiana-Purdue University at Indianapolis*