Book Reviews

Effects of Weak Interactions

Beta Decay and Muon Capture. MASATO MORITA. Benjamin/Addison-Wesley, Reading, Mass., 1973. xii, 362 pp., illus. $19.50.

The study of beta decay has been pursued for nearly 80 years. However, until the late 1950's most properties of the weak interaction—one of the four fundamental interactions (strong, electromagnetic, weak, gravitational) and the one responsible for beta decay—were essentially unknown. The discovery of parity nonconservation stimulated considerable experimental and theoretical work, which led to the present description of the weak force in terms of a local product of currents.

Beta Decay and Muon Capture touches on all aspects of weak decays, a subject on which Morita has been doing research for nearly two decades. The author's audience is restricted to those who have a basic knowledge of quantum mechanics—presumably first-year graduate students and beyond. Much of the material is self-contained, and the work is based on material he has presented in various graduate courses. However, although the book is quite suitable for use in a nuclear physics course, I am inclined to view it not as a text but rather as a lengthy review article. As such it makes first-rate reading. The discussion is usually clear. The references are extensive. Occasionally, as in the case of hyperon beta decays, Morita offers only a tantalizing glimpse of a subject. But in general, the discussion is more complete and more satisfying. Morita has included lengthy chapters on Fermi theory, parity nonconservation, and the $V - A$ interaction, in which the theoretical basis of our current picture of the decay process is carefully outlined. Numerous experimental consequences are explored. The range of possible experiments on a simple decay process is extensive, but the spectra become even more rich when the daughter nucleus produced in the decay is itself unstable and breaks up, emitting a photon (gamma ray) or alpha particle in the process. Studies of such beta-gamma and beta-alpha transitions permit isolation of small effects such as weak magnetism, which usually are obscured by much larger terms. In a subsequent section, the electron-capture and neutrino-scattering processes, which are related via crossing symmetry to the basic beta decay interaction, and, in addition, double beta decay, muon decay, and nonleptonic decays, which result from logical extensions of the semileptonic Hamiltonian, are described, but in considerably less detail.

The subject even has its "practical application," since the use of beta decay as a probe of nuclear structure is, of course, quite feasible provided the basic interaction is known, and in an interesting chapter the study of pairing correlations, Coulomb mixing, and other aspects of nuclear structure through measurement of weak matrix elements is illustrated. However, lest the reader believe that all is well understood, beginning in the late 1960's questions have again arisen as to the completeness of our knowledge of weak interactions. Recent experiments appear to have revealed charge-symmetry violation in mirror beta decays and larger circular polarizations in gamma decays than the naive Cabibbo Hamiltonian seems to permit. A concluding chapter mentions these problems, which are still under active experimental and theoretical investigation.

In the central portion of the text, Morita examines forbidden transitions and the remaining aspect of his subject—muon capture. The discussion seems to bog down here. I would prefer to have seen fewer equations—especially for forbidden transitions—and considerable amplification of the discussion of the mu capture process, including for example, relativistic corrections to Primakoff's equations, problems in explaining the neutron spectrum from capture to an excited nuclear state lying above the particle-emission threshold, and the interesting subject of radiative capture. Also, throughout the book the discussion is based on single-body currents—that is, the impulse approximation. It would have been useful to separate those aspects of the physics which are independent of any nuclear model from the explicitly model-dependent ones, with perhaps a section on mesonic exchange effects.

It is, however, much easier to find minor flaws in a book such as this than it is to write one. Morita has done a careful job in assembling the varied threads of this vast subject and has woven them into a very interesting and readable account.

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Organic Chemistry

Mechanisms of Elimination Reactions. WILLIAM H. SAUNDERS, JR., and ANTHONY F. COCKERILL. Wiley-Interscience, New York, 1973. xii, 640 pp., illus. $19.95.

Twelve years have elapsed since the appearance of Banthorpe's monograph on mechanistic aspects of elimination reactions, and although the many developments in this field have been regularly covered by review articles, there has been a need for a comprehensive book on the subject. This volume fills that need and is recommended with the same degree of enthusiasm which the authors display in writing it.

The first five chapters deal with the questions of rates, mechanisms, transition state character, stereochemistry, and orientation in heterolytic olefin-forming elimination. The coverage is complete and up to date. A particularly fine discussion of the *syn-anti* dichotomy extends the scope of the posthumous review of the subject by Sicher. Sections on the application of mechanistic tools such as isotope effects, linear free energy relationships, and acidity functions are prefaced by brief theoretical introductions that will assist the relatively uninitiated reader. The reviewer is a little disappointed that more use has not been made of More O'Ferrall's potential energy surface for E1, E2, and E1cB reactions in the discussion of transition state character. The so-called E2C mechanism is given little prominence, but while controversy surrounds this matter the fact remains that eliminations induced by weak bases are useful additions to the range of conventional synthetic methods, and a deeper treatment could perhaps have provided more pointers for synthetic chemists.

The remaining chapters deal with a

more diverse range of topics, and the treatment is necessarily more fragmented. The authors have successfully attempted to maintain perspective and to interrelate sections where possible. Topics covered include alcohol dehydration (homogeneous and heterogeneous conditions), deamination, dehalogenation, pyrolytic eliminations of halides, esters, xanthates, and the like, alkyne-forming eliminations, α- and γ-eliminations, fragmentation, and photochemical eliminations. The coverage is still comprehensive and authoritative.

Except for the subject index the pages have been directly reproduced from a typescript, which has avoided some of the publication delays that one has unfortunately become accustomed to. References are given at the ends of the chapters. No author index is provided.

University libraries require this book, and it should appear on the shelves of all researchers and teachers concerned with heterolytic reaction mechanisms. It is too specialized to serve as a text for advanced courses in organic mechanisms, but relevant chapters can be assigned as ancillary reading. The synthetic chemist who wants to find the best reagent and conditions for introducing unsaturation into a given molecule will have to look elsewhere, as the book has not been aimed in that direction. He or she would be wise, however, to obtain more than just a passing acquaintance with the contents. Mechanistic studies of olefin-forming β-eliminations in particular have in many cases provided extremely useful synthetic guidelines, and problems associated with orientation and stereochemistry cannot be appreciated without a firm mechanistic background.

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Sedimentation

Depositional Sedimentary Environments. With Reference to Terrigenous Clastics. H.-E. Reineck and I. B. Singh. Springer-Verlag, New York, 1973. xvi, 440 pp., illus. $41.60.

This volume is the first major attempt since 1932 to summarize in English work on modern sedimentary environments. This itself is surprising: the concept of sedimentary environments is of crucial importance for geologists because the properties of environments control most aspects ("facies") of the sedimentary rocks that originate in them. Sedimentologists, stratigraphers, and petroleum geologists who try to reconstruct geological history from sedimentary rocks recognize that sedimentary environments, and therefore sedimentary facies, are not infinite in number or random in pattern and that the surest way to recognize and interpret past facies patterns is by using "facies models" based upon the study of modern environments.

The Senckenberg Institute at Wilhelmshaven, where for over 20 years Hans-Erich Reineck and his colleagues have been studying the nearshore and intertidal environments of the North Sea, was founded in 1929 by the paleontologist Rudolf Richter. A long series of papers, almost all published in German, have established the high reputation of the institute, but the language barrier has made the work itself inaccessible to all but a handful of American workers. The present volume will therefore be welcomed on two counts: it provides a long-needed summary in English of German studies on sedimentary environments, and it is a contribution to the elaboration of a comprehensive, synthetic system of modern models for the interpretation of ancient sedimentary facies.

Regrettably, the book can be welcomed only with strong reservations. The authors limit their discussion to physical and biological aspects of sedimentary environments, neglecting chemical aspects. More than 100 pages are devoted to a review of sedimentary structures and textures, topics already adequately discussed in several other books. There remain some 250 pages devoted to a series of systematic reviews of sedimentation in modern glacial, desert, lake, fluvial, deltaic, coastal, and marine environments. The reviews are valuable summaries of a large literature and are amply illustrated and documented, but they could have been improved by careful editing. One can only be grateful that the book is written in English, but its quality is erratic, to say the least. The illustrations are abundant, well chosen, and of excellent quality, but many of them are insufficiently discussed in the text and contain symbols that are not explained in the legends.

Each section of the book ends with a single paragraph listing examples of sedimentary formations deposited in the corresponding environment in the geological past; none of these examples is discussed at length. Relatively little effort has been made to generalize the mass of observations into simplified models suitable for use by geologists who work mainly with ancient sedimentary rocks. The book can hardly be recommended for students, but professional stratigraphers and petroleum geologists will still find it a worthwhile investment of their time and money.

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Books Received

America in the '60s. Cultural Authorities in Transition. Ronald Lora, Ed. Wiley, New York, 1974. xii, 448 pp. $9.95.

Analytical Profiles of Drug Substances. Vol. 3. Klaus Florey, Ed. Academic Press, New York, 1974. x, 582 pp., illus. $19.50.

Anticonvulsant Drugs. Vol. 2. J. Mercier, Ed. Pergamon, New York, 1974. xii + pp. 371–648, illus. $18. International Encyclopedia of Pharmacology and Therapeutics, section 19.

Applications of the Newer Techniques of Analysis. Papers from a symposium, Atlantic City, N.J., Nov. 1972. Ivor L. Simmons and Galen W. Ewing, Eds. Plenum, New York, 1973. viii, 384 pp., illus. $22.50. Progress in Analytical Chemistry, vol. 6.

Ark II. Social Response to Environmental Imperatives. Dennis C. Pirages and Paul R. Ehrlich. Freeman, San Francisco, 1974. xiv, 344 pp. Paper, $3.95.

As They Were. The Aborigines of South-Eastern Australia. Aldo Massola. Heinemann, Melbourne, Australia, 1974 (U.S. distributor, Scribner, New York). x, 166 pp., illus. $12.50.

Assay of Vitamins in Pharmaceutical Preparations. Manzur-Ul-Haque Hashmi. Wiley-Interscience, New York, 1973. xxvi, 512 pp., illus. $32.

Computer Simulation in Human Population Studies. Proceedings of a conference, University Park, Pa., June 1972. Bennett Dyke and Jean Walters MacCluer, Eds. Academic Press, New York, 1974. xxii, 518 pp., illus. $16. Studies in Anthropology.

Concerning Chemistry. Gene D. Schaumberg. Wiley, New York, 1974. x, 358 pp., illus. Paper, $7.95.

Confessions of a Bird Watcher. Roger Barton. McGraw-Hill, New York, 1974. xii, 236 pp. $7.95.

A Configuration Model of Matter. G. V. Samsonov, I. F. Pryadko, and L. F. Pryadko. Translated from the Russian edition (Kiev, 1971) by Albin Tybulewicz. Consultants Bureau (Plenum), New York, 1973. xii, 290 pp., illus. $29.50. Studies in Soviet Science.

Constructive Linear Algebra. Allan Gerwirtz, Harry Sitomer, and Albert W. Tucker. Prentice-Hall, Englewood Cliffs, N.J., 1974. xiv, 494 pp., illus. $13.95.