middle-class fascination with them, a suggestion about which Clarke reveals some sensitivity, his review does demonstrate that investigations of these mollusks have made a significant contribution to the subject. His paper also confirms the point made less explicitly in many others in this collection; a reasonably deep understanding of the ecology of populations is necessary for a direct demonstration of the action of selection on them.

As a testimony to the ecumenical nature of contemporary population biology, two papers are devoted to plants. M. T. Clegg, A. L. Kahler, and R. W. Allard review some recent work on the genetic demography of plants and summarize some of the evidence for both fertility and viability components to fitness and for selection for different genotypes during different stages of the life cycle. D. A. Levin considers the effects of the diverse mechanisms of reproduction and spatially fixed modes of existence on the effective sizes and genetic structure of and the operation of selection in plant populations. These two papers clearly indicate that the models of freely recombining, single-aged populations existing in dimensionless habitats upon which much of the mathematical theory of ecological genetics is based are even less appropriate as analogs of plant populations than they are of animal populations.

The final section of this collection, the "coda," is a paper by R. R. Sokal examining some of the evidence in support of the fundamental hypothesis (sometimes mistakenly considered to be an axiom) that the processes of evolution as they are studied and understood at the population level, microevolution, are sufficient to account for evolution at higher systematic levels, macroevolution. Although the evidence presented on patterns of variation within populations and among geographically distinct populations is considered to be consistent with this hypothesis, Sokal expresses his conviction that other "genomic rearrangements" are necessary for the manifested diversity to be realized. This possibility that other mechanisms are involved in evolution at higher systematic levels was once the subject of considerable controversy, which has also recently reemerged from comparisons of data on morphological and molecular evolutionary rates. It seems clear that the elucidation of these possible other mechanisms will require an odyssey beyond the p's, q's, and N's of the integrated population biology and into as yet uncharted areas of molecular and developmental biology.

In summary, this is a good collection of papers in contemporary population biology. I see little utility for the volume as a textbook for any but the most advanced "topics" courses. However, people working in evolutionary and population biology should be aware of its existence and I expect may want to photocopy at least a few papers from it (for their own personal use, of course).

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Metal Chelate Compounds

Metal β-Diketonates and Allied Derivatives. R. C. MEHROTRA, R. BOHRA, and D. P. GAUR. Academic Press, New York, 1978. viii, 382 pp., illus. $42.40.

Probably no other class of metal complexes has been as extensively studied as the metal β-diketonates. This is not particularly surprising in the light of their interesting and useful properties. The work done before 1900 by Combes, Claisen, and Urbain paved the way for advances. Since the turn of the century and the pioneering work of Werner, and later of Morgan and others, β-diketonate complexes of nearly all of the elements have been synthesized and studied. Since 1960 novel volatile and soluble complexes have been synthesized and studied for their application in gas chromatographic trace analysis, in nuclear magnetic resonance (NMR) spectroscopy as shift reagents, in laser technology, in isotope separations, and as catalysts and fuel additives. Underlying all of the progress has been a continuing improvement in the understanding of the basic chemical principles that give rise to the interesting characteristics of these compounds. Mehrotra, Bohra, and Gaur have undertaken the monumental task of summarizing their chemical and physical properties as well as some of their uses. They have done a commendable job of assembling and summarizing nearly 2000 references, and the book will be valuable to coordination chemists as well as to researchers in analytical, organic, and physical chemistry and in allied sciences. Although there are occasional lapses, on balance the volume is a worthwhile guide to the original literature.

The book discusses many aspects of metal chelate compounds. After a brief introduction to metal-β-diketonate complexes, which covers their general chemistry and historical background and classifies the different types of complexes, there is a chapter on the oxygen-bonded β-diketone complexes. Carbon-bonded β-diketone complexes are discussed next; thio-β-diketones and their metal derivatives are discussed in two chapters. The book closes with a short chapter on applications of these compounds.

Chapter 2, on oxygen-bonded β-diketone complexes, is understandably the longest in the book. Brief sections on the synthesis and the chemical properties of these complexes are followed by a long section on their physical properties. The section on synthesis is concise and readable, giving a quick yet reasonably thorough overview of the various methods of synthesizing β-diketonate complexes. The section on chemical properties contains a discussion of electrophilic substitution reactions that take place at the carbon atom between the carbonyl groups. The brief coverage of the formation of adducts by expansion of the coordination number of the metal is basically a list of references to all the reported examples of the process. The section gives a good summary of ligand replacement and exchange reactions that result in a variety of mixed ligand metal complexes. One topic noticeably missing from the section is the Schiffs base condensation of primary amines with β-diketones to form β-ketoimines. The section on physical properties includes coverage of volatility, thermal stability, and vapor pressure, stability constants and polarographic studies, nuclear magnetic resonance studies, infrared spectra, electronic spectra, mass spectra, Mössbauer spectra, x-ray crystal and molecular structure, and magnetic properties. Conclusions about which factors cause increased volatility and thermal stability, and why they cause improvements, are presented clearly.

The chapters on carbon-bonded β-diketones and thio-β-diketones are well done. Synthesis procedures for preparing both classes of compounds are described in detail.

The chapter on applications considers the use of metal β-diketonates in NMR spectroscopy as shift reagents, as laser chelates in vapor-phase chromatography, and in solvent extraction techniques. Coverage of these applications is by no means complete, tending to just touch on major accomplishments, with most of the papers on the subject given in a large list of references.

There is some unevenness in the way

the chapters are organized; for example, in chapter 2 the authors discuss the synthesis of complexes according to the class of starting materials, whereas in chapter 3 the information is organized according to the metal ion.

In other parts of the book material is basically presented as lists of examples, each in a separate paragraph. Some of these parts suffer from a lack of continuity, and conclusions are not drawn and presented as one unit. Such sections do, however, serve as an excellent source of references for very specific areas of research.

The references are the most comprehensive ever published on the chemistry of metal β-diketonates, and the book is well indexed.

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Planetary Explorations

The Saturn System. Papers from a workshop, Reston, Va., Feb. 1978. DONALD M. HUNTEN and DAVID MORRISON, Eds. National Aeronautics and Space Administration, Washington, D.C., 1978 (available from National Technical Information Service, Springfield, Va.). vi, 420 pp., illus. Paper, $13.25. NASA Conference Publication 2068.

NASA's program for the exploration of the outer solar system is in full swing, with the Voyager 1 encounter with Jupiter and the Pioneer 11 encounter with Saturn recently completed and encounters with Jupiter, Saturn, and Uranus programmed to occur in the next few years.

In *The Saturn System* we get a glimpse of the next "logical" step in the program: the planned SOP^2 mission that will orbit Saturn and probe the atmospheres of both Saturn and Titan (Titan is Saturn's largest satellite and is the only satellite in the solar system known to possess a substantial atmosphere).

Planning for complex deep space missions such as this one requires an enormous lead time; for example, Project Galileo (formerly JOP, Jupiter orbiter probe) was at a similar stage in 1975, its preliminary design stage has only just been completed, and the spacecraft will not be launched until 1982 and will not begin its 20-month scientific mission until it arrives at Jupiter in 1985. Thus, though the present volume contains neither a detailed nor a complete discussion of the accomplishments that will eventually be expected of SOP^2, we get a very human glimpse of the interaction that goes on between selected members of the space science community and NASA planning staff in setting out the scientific basis for a mission.

The book consists of papers and discussions thereof that are based on presentations given at a 1978 workshop. It is described by the editors as a compendium of knowledge of Saturn, its satellites, its rings, and its (possible) magnetosphere.

As an expression of the state of scientific research on Saturn, the book is, in this reviewer's opinion, without equal. It provides an excellent guide to the technical literature, and, in the papers that specifically address research topics, it conveys the spirit of the research that is going on. For example, the book contains three papers on the vertical structure of Titan's atmosphere, each promoting a quite different view. What is being presented in the papers is three different sides of a research debate that is irresolvable, given the precision of remotely sensed ground-based data. The papers give a clear sense of the competitive nature of space science and also of the inherent weaknesses, often poorly recognized, in remote sensing from the ground.

Other papers discuss the technical problems that face SOP^2 and the relationship of the mission to results that might be obtained from the Pioneer 11 and Voyager 1 and 2 Saturn flyby encounters. With two exceptions these papers will probably not add much to the book from a general reader's point of view. The exceptions are the paper by R. P. Rudd describing a possible SOP^2 baseline mission (this includes the important ion drive propulsion system, which is expected to be in NASA's 1981 budget for a new start) and the paper by J. Blamont of the Service d'Aeronomie of the French CNRS on a possible way to explore Titan's atmosphere with a self-buoyant, "solar Montgolfière" balloon.

The latter proposal shows all of the technical ingenuity and verve that have become the hallmark of French space scientists, and it is an idea that this reviewer believes should be taken far more seriously than it is in the chapter that reports the conclusions and recommendations of the workshop. As Blamont points out, with the descent of a single probe through an atmosphere one may learn very little (or possibly get a highly distorted view) of the dynamical and physical state (for example, cloud structure) of the atmosphere, although one would get definitive results concerning other aspects of the atmosphere, such as its elemental and isotopic composition. With its long lifetime, large payload capacity, and multiple traversals of the atmosphere, the French hot air balloon, versions of which have been tested in the earth's atmosphere and a version of which is scheduled for launch to Venus in 1983 in a joint Russian-French mission, solves this problem and presents an exciting prospect for atmospheric research on Titan.

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Books Received

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Agricultural Terracing in the Aboriginal New World. R. A. Donkin. Published for the Wenner-Gren Foundation for Anthropological Research by University of Arizona Press, Tucson, 1979. xii, 196 pp., illus. Paper, $8.50. Viking Fund Publications in Anthropology, No. 56.

The Art of Software Testing. Glenford J. Myers. Wiley-Interscience, New York, 1979. xiv, 178 pp., illus. $17.95. Business Data Processing.

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