

and has grown so quickly that there are, in fact, very few well-established hypotheses. As an example, the reader might well come away with the impression that most researchers agree that release of volatiles from the Martian interior was triggered by a period of early heavy impact bombardment of the Martian surface. It is not clear by any means that a period of heavy bombardment would deposit enough energy to initiate such a triggering. Second, the book suffers somewhat from a lack of discussion of the physical and chemical connections between the evolution of planetary interiors and surfaces. For instance, lunar mascons (mare volcanic fill), the lithospheric loading that they induce, and their probable relationship to the formation of graben and mare ridges are only briefly mentioned. A more extensive geophysical discussion of the Tharsis plateau on Mars, which dominates the low-order terms of the global gravity field, might also have been appropriate.

Despite these problems, the book provides the best introductory discussion to date of comparative planetology. I believe it will serve as the standard introductory textbook for some time to come. I plan to adopt the book for use in my introductory course on the solar system, and I am encouraging my colleagues to purchase copies for their personal libraries.

RAYMOND E. ARVIDSON
*McDonnell Center for the Space Sciences, Department of Earth and Planetary Sciences,
Washington University,
St. Louis, Missouri 63130*

Auditory Mechanisms

Comparative Studies of Hearing in Vertebrates. Papers from a workshop, Honolulu, Nov. 1978. ARTHUR N. POPPER and RICHARD R. FAY, Eds. Springer-Verlag, New York, 1980. xiv, 458 pp., illus. \$39.80. *Proceedings in Life Sciences.*

This volume consists of 16 chapters whose subjects range from underwater sound localization to mammalian auditory cortices. The book is divided into sections dealing respectively with fishes, amphibians, reptiles, birds, and mammals. Throughout, major attention is directed toward the auditory periphery, but there are also two chapters dealing exclusively with the central auditory system. In the insightful final chapter T. H. Bullock discusses the important questions that still need to be examined.

The basic structure and physiology of the auditory system are well reviewed for all the groups but mammals, but there is so much material on the mammalian auditory periphery that a review would require a full volume in itself. Sound localization and psychoacoustics are beautifully discussed for all the groups but amphibians and reptiles, as befits the state of our knowledge on these topics. Most of the chapters not only discuss their authors' contributions but include excellent reviews of other pertinent literature as well. For both authors and readers, one of the joys of such a book is the opportunity, not available in refereed journals, for speculation. Eight of this book's chapters contain what I would call responsible speculation, clearly labeled as such, consistent with factual data, and often suggesting new research approaches to unanswered problems.

Some chapters contain particularly interesting points of view and have the data to back them up. Stebbins (chapter 15) discusses the evolution of mammalian hearing using a wide spectrum of data from paleontology, comparative anatomy, ecology, and psychoacoustics. His inclusion of behavioral data in a nonteleological manner is provocative and refreshing.

Lombard (chapter 4), using a synergistic blend of comparative anatomy, paleontology, and embryology, presents a cogent argument for the evolutionary independence of the amphibian auditory system. He finds that only the middle ear cavity and Eustachian tube have a similar ancestry in present-day amphibians and other vertebrates. In the following chapter, Capranica and Moffat convincingly ascribe functional nonlinearities in the ears of toads to the hair-cell-tectorial-membrane relationship; both the nonlinearities and their structural bases are remarkably similar to those of mammals.

One of the high points of the volume is Knudsen's (chapter 10) description of auditory localization in birds—particularly owls. The logic, ingenuity, and ability to ask the right questions exhibited in this series of experiments by a handful of researchers provides a standard toward which most of us only strive.

The most obviously neglected topic is echolocation; it could be argued, however, that reviews on this topic are already plentiful. The index is disappointing and typographical errors are more numerous than one would hope, but I found few factual errors.

This book is of obvious value to all who are interested in the evolutionary aspects of vertebrate audition. I believe

it should be of special importance to those who know only the "standard" auditory research animals—cats, guinea pigs, monkeys, and humans—for it demonstrates the awesome diversity that has evolved in auditory structure, physiology, and behavior.

DOUGLAS B. WEBSTER
Departments of Otorhinolaryngology and Anatomy, Kresge Hearing Research Laboratory of the South, Louisiana State University Medical Center, New Orleans 70119

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