The Nova Phenomenon

Classical Novae. M. F. BODE and A. EVANS, Eds. Wiley, New York, 1989. xvi, 341 pp., illus. $163.

It has been only in the last 30 years that we have come to understand the fundamentals of the nova phenomenon, starting with the pioneering studies of Walker and Kraft, which revealed that novae are close binary systems containing white dwarfs. In the ensuing three decades, novae have proved to be among the more fascinating objects in galaxies. Their outbursts involve surface nuclear reactions in degenerate matter. They are surrounded by accretion disks that themselves are disrupted by 10^7 gauss magnetic fields. Some fraction of nova systems become supernovae through accretion-induced gravitational collapse of the white dwarf to a neutron star. The ejecta contain unusual enhancements of certain elements that enrich the interstellar medium. Dust grains form in the inhospitable environment of the ejecta only months after the outburst, in some instances from within highly ionized, hot gas. The fact that these phenomena occur over a time-scale of months rather than millions of years means that one can follow their evolution in real time, which is unusual in astronomy. For these characteristics novae have attracted considerable attention in recent years.

For some time the standard monograph on novae has been Payne-Gaposchkin's *The Galactic Novae*, published in the 1950s and now very outdated. Bode and Evans attempt to provide a new general reference for the field, which has enjoyed such vitality recently that its many aspects cannot be adequately covered in a journal review article. Although *Classical Novae* is a compendium of 13 chapters by different authors, the editors have done a creditable job of maintaining continuity and balance among the subjects. The selection of topics is appropriate, although I believe the book would have benefited from the inclusion of a chapter on the dynamical evolution of nova systems.

The book contains chapters on the theoretical aspects of the outburst, including mass transfer and thermonuclear reactions, as well as separate chapters on the observations of novae in the x-ray, ultraviolet, optical, and radio regions. Additional chapters discuss the general properties of novae, and a very useful bibliography lists all known research papers on each classical nova studied to date. Such a bibliography was one of the most important aspects of Payne-Gaposchkin's classic monograph.

The book does not try to break new ground but is primarily an overview of work already reported. Most of the authors have published extensively on the topics on which they write, so there are few surprises. The closest to being an exception is Peter Martin's interesting analysis of the spectral evolution of Nova DQ Herculis.

Both because of the depth and breadth of its treatment and as a source of references the book is very useful and should serve active researchers in astrophysics well.

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Hearing

The Comparative Psychology of Audition. Perceiving Complex Sounds. ROBERT J. DOOLING and STEWART H. HULSE, Eds. Erlbaum, Hillsdale, NJ, 1989. xii, 482 pp., illus. $74.95; paper, $29.95.

The title and subtitle of this book confidently suggest that the current methodologies of psychology can reveal something substantive about how complex sounds are perceived by vertebrate animals (including humans). In general, the book convinces us that there are a variety of behavioral paradigms useful in probing the perceptual functions of the brains of animals (primarily birds, primates, and frogs) in relation to sounds more complex than single tones or noise. That is, the promises of behavior analysis technology to allow a "look" into the rather private domain of another species's experience are kept. This is important for both neuroscience and cognitive psychology. Those investigating the neurophysiological bases of sound perception using animal preparations need not be constrained to use data on human perception to generate questions and evaluate neural models. Those studying human awareness potentially have a general biological context against which uniquely human traits might be identified.

Several themes ("bottom-up" versus "top-down" processing, species-specific versus general processing mechanisms, and nonhuman versus human perception) recur in the book. The promise of a bottom-up orientation is that through following the serial transformations of the stimulus from the receptor to the brain sound perception might be understood, at least in part, in terms of peripheral biomechanical and neurophysiological processes (Ehret; Saunders and Henry; Gerhardt; Dooling). Ear structures and the hearing functions determined by them clearly vary across species (the mouse, anuran amphibians, and some birds are the examples discussed here) in ways that constrain perceptual abilities. But Espinoza-Varas and Watson point out in their review of pattern perception by humans that important differences between humans and other animals are more likely to be found in tasks that demand attention, memory, and other general cognitive skills (that is, top-down processing). Hulse, in a crisp chapter on perception of pitch pattern in songbirds, reports having made some of these demands and easily rejects the hypothesis that birds and people perceive pitch relations similarly—birds rely more on absolute frequency (as do monkeys detecting patterns of frequency modulation, studied by Moody and Stebbins).

In a review of speech perception by animals and human infants, Kuhl discusses the questions of species-specific ("special") versus general mechanisms of perception and concludes that for many aspects of speech perception there is little reason to hypothesize unique speech "modules" for humans, particularly since chinchillas, nonhuman primates, and some birds show categorical perception for some aspects of human speech. In general, some attempts to demonstrate species-specific vocalization perception fail (for example, those reported by Beecher *et al.*), whereas others are at least suggestive (Marler and Peters; Sinnott). It also remains unclear what, if anything, is unique about human perception.

I recommend this book, and especially the informative chapters on complex sound, music, and speech perception in humans, to comparative psychologists. Anyone who may believe comparative psychology to be moribund in this time of anthropocentric cognitive psychology and reductionistic neuroscience will find it encouraging.

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Books Received

Absolute or Relative Motion? Vol. 1, The Discovery of Dynamics. Julian B. Barbour. Cambridge University Press, New York, 1989. xvi, 746 pp., illus. $95.

Algorithms for Chemists. Jure Zupan. Wiley, New York, 1989. xvi, 290 pp., illus. $87.95.

Animal Consciousness. Daisie Radner and Michael Radner. Prometheus, Buffalo, NY, 1989. 253 pp. $39.95. Frontiers of Philosophy.

Animal Research and Ethical Conflict. An Analysis of the Scientific Literature, 1966–1986. Mary T. Phillips and Jeri A. Sechzer. Springer-Verlag, New York, 1989. xii,251 pp. $69.

Arachidonic Acid Metabolism in the Nervous System. Physiological and Pathological Significance. Amiram I. Barkai and Nicolas G. Bazan, Eds. New York Academy of Sciences, New York, 1989. xii, 504 pp., illus. $126. Annals of the New York Academy of Sciences, vol. 559. From a conference, Bethesda, MD, April 1988.

Archimedes' Revenge. The Joys and Perils of Mathematics. Paul Hoffman. Fawcett Crest (Ballantine), New York, 1989. x, 274 pp., illus. Paper, $4.95. Reprint, 1988 ed.