BOOK REVIEWS

A Bird's-Eye View

Vision, Brain, and Behavior in Birds. H. PHILIP ZEIGLER and HANS-JOACHIM BISCHOF, Eds. MIT Press, Cambridge, MA, 1993. xxiv, 415 pp., illus. $75 or £67.50.

The more than 8500 species of birds on this planet exploit an amazing diversity of habitats and exhibit an incredibly rich repertoire of behavior. Little wonder, then, that visual, neural, and behavioral scientists have selected certain species of birds as a model system with which to gain fundamental insight into the underlying principles of visual organization. Take, for example, the exquisitely precise dive of kingfishers and gannets, or the strike of herons and ospreys: All these species beautifully compensate for refraction of light at the air-water interface and visual distortion caused by ripples to deftly capture their fish prey. Likewise, the visual systems of ground-feeding birds such as the much studied pigeon and domestic chicken allow them to skillfully search for grain and food items and to adjust the gape of their beaks so as to pluck them from the ground, rapidly and accurately.

Many other aspects of birds' behavior are also predicated on an appropriately tuned eye and visual system. These include visuomotor behaviors such as avoiding branches when flying through thickets, landing on branches, striking prey with talons, and flying in formation in flocks. Visual recognition of predators and prey, conspecifics and nonconspecifics, mates and rivals, nest material and nest sites, home territory and neighbors' territories, familiar landmarks for navigation, and sites to hide food (in hoarding species) all require a visual processor with sophisticated perceptual and cognitive functions. It is not surprising, then, that we find many of the classical problems of sensory physiology, neuroanatomy, ethology, and psychology addressed in this book, often with respect to a particular avian species, but also, where appropriate data exist, as a context for comparison between different species. The book consists of five parts, each of which addresses a major topic in avian vision. The parts cover, respectively, the eye and basic visual capacities, the functional anatomy of the visual system, the development of the visual system, visuomotor mechanisms, and perceptual and cognitive processes.

Major differences in lifestyle, such as are found between daytime predators like hawks and falcons and grain-eating birds like pigeons and doves, are associated not only with differences in the structure of the eyes but also with the differential elaboration of specific areas of the visual system (such as the *Wulst*, which is remarkably similar to the visual cortex in mammals), and corresponding differences in perceptual phenomena. In general, this opportunity for comparison is handled well throughout the book, not only between different avian species but also between more phylogenetically remote species. It is especially refreshing to see comparison and contrast of mammalian and avian visual systems in relation to parallel processing of visual information, developmental visual neuroanatomy, head and eye movements, cerebral lateralization, stereopsis, and color vision. All too often those working on the mammalian visual system pass up the opportunity to explore how similar and different solutions to common visual problems have evolved across a broad spectrum of species.

Although the scope of this book is broad, it is not an exhaustive review of the field. Rather, it conveys the current state of knowledge in those areas where there has been sufficient progress over the past decade or two for fruitful model systems to emerge, at the same time reminding us of major questions that remain unanswered. Although much of the book deals with information derived from laboratory studies, considerable effort is made to relate these findings to the natural ecology of the species in question. Students of behavioral ecology, visual and comparative neuroscience, cognitive science, and experimental psychology will find much of interest in this volume. It will be especially welcomed by all those with a serious interest in avian vision and behavior.

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Neural Mechanisms

Synaptic Plasticity. Molecular, Cellular, and Functional Aspects. MICHEL BAUDRY, RICHARD F. THOMPSON, and JOEL L. DAVIS, Eds. MIT Press, Cambridge, MA, 1993. xiv, 263 pp., illus. $50 or £44.95.

Neuroplasticity encompasses a broad set of phenomena that have become central to our view of nervous system function. Synaptic plasticity—that is, alterations in synaptic structure and function—has received special attention as a key to our understanding of complex issues such as information processing, neural correlates of behavior, and nervous system responses to injury and trauma. The 11 contributions to this volume cover a wide range of topics, from extracellular-matrix molecules (Hockfield) to mathematical models of visual cortex function (Intrator *et al.*) to models of degenerative disease (Finch and McNeill), the thread linking them together being, apparently, the personal interests of the editors. The result is an informative but rather idiosyncratic collection.

For the naïve but curious, the book is not easily accessible, in part because it is not always clear how a given chapter relates to the theme of synaptic plasticity. Some of the best contributions fall into this category—for example, Steward's chapter on "molecular sorting," which is lucid and conceptually important with respect to the development of the basic mechanism of cell structure–function relationships. Similarly, the contribution by Berger *et al.* on "modeling the hippocampus" provides an appealing discussion (even if one doesn't have a mathematical background) of how modeling techniques can be used to investigate CNS function but does not make it clear how such a model can be used to illuminate (and predict) the mechanisms and consequences of synaptic plasticity. This is not to say that these chapters are irrelevant to the main subject of the book, but only that further clarification is needed to establish their place in this volume.

For those who have followed the field closely, the contributions on long-term potentiation (Teyler and Grover; Baudry and Lynch) and long-term depression (Ito; Artola and Singer) are both useful and a little disappointing. Although they provide good reviews of recent studies and identify key issues in a very active field, as a group they are poorly integrated, each apparently having been written completely independently of the others, even though the material overlaps considerably. Thus the authors do not deal substantively with controversies in the field: For example, are LTP and LTD generally similar (as suggested by Artola