itself. While such flights into abstraction are satisfying to many, others are baffled trying to determine which theoretical work merits their attention and empirical efforts. The putative roles of structured demes and trait groups in promoting group selection would certainly be a risky gamble.

ERIC R. PIANKA
Department of Zoology, University of Texas, Austin 78712

Visual Development

Developmental Neurobiology of Vision. Papers from a NATO Advanced Study Institute, Rethymnon, Crete, Greece, Sept. 1978. RALPH D. FREEMAN, Ed. Plenum, New York, 1979. xiv, 446 pp., illus. $39.50. NATO Advanced Study Institutes Series A, vol. 27.

Developmental Neurobiology of Vision explores the role of neuronal activity and experience in shaping the response properties of single visual neurons. It also attempts to cover molecular and cellular events in visual neurogenesis. This is an ambitious project and one that is not entirely successful. Developmental studies of the thalamic and cortical visual projections of mammals are strongly emphasized, and the treatment of this subject is generally good. More biochemical or cellular aspects of visual development are either covered haphazardly or neglected completely.

The book is a compilation of short review and research papers by participants in an advanced study institute. The institute was organized by Ralph D. Freeman and Wolf Singer, and the volume reflects their interests. More than half of the 38 papers are devoted to the development or function of the visual projection from the retina to the primary visual cortex of the cat. Several more deal with similar phenomena in other mammals including humans. The theme of genetic wiring with superimposed modulation or verification through visual experience is common to all the developmental papers, and a substantial section of the book covers studies of vision in the mature cat, thereby providing a context in which to evaluate the ontogenetic work.

The papers in the volume are specialized and jargon-packed. The uninitiated will need to refer to the basic research reports frequently in order to fully comprehend the experimental paradigms and results. However, most of the major issues concerning the role played by visual experience in shaping the response properties of neurons in the primary visual cortex and dorsal lateral geniculate nucleus are apparent because they are addressed repeatedly by different authors. Papers by Bonds, Imbert, Fregnac, and Cynader, for example, explore various aspects of orientation selectivity (the ability of a visual neuron to respond to specifically oriented line stimuli). It becomes obvious that dualistic notions postulating preprogrammed "genetic" specifications of the inputs to some neurons and environmental tuning of the inputs to others must be employed to explain the available data.

Probably the most useful attribute of *Developmental Neurobiology of Vision* is its coverage of the idea that monocular afferents within the cortex must compete with each other during the formation of binocular cortical neurons. A number of papers explore the role played by activity in this process, and several utilize early monocular or binocular occlusion to study the critical period for obtaining physiological changes in an eye's ability to drive cortical cells (ocular dominance). In addition, Sherman has provided an excellent review of the differential effect of eye occlusion on two of the major classes of neurons in the dorsal lateral geniculate, the X (linear spatial summation) and Y (nonlinear spatial summation) cells. The studies Sherman discusses demonstrate that the effects of visual deprivation per se can, in some instances, be quite convincingly separated from the results of binocular competition. Rauschecker expands on the subject of competition with evidence that changes in ocular dominance are also dependent upon the stimulus response properties of the cortical neurons themselves. Finally, there is an intriguing report of predominantly electrophysiological work by Singer suggesting that a nondeprived eye can only exert its competitive advantage when it is oriented normally in the socket; rotated eyes fail to become physiologically dominant over occluded eyes. Several neuroanatomical studies have now indicated an increase in the size of a nondeprived eye's ocular dominance columns in cortical layer IV. It would be extremely interesting if this morphological correlate of binocular competition could also be prevented by eye rotation.

The book is not without its disappointments. The title will generate widespread interest, since research on the visual system has been instrumental in producing many of the currently accepted principles in neural development. The contributions of visual work derive, however, from neuroanatomical, physiological, and biochemical studies on retina and on brainstem visual projections in a variety of species as well as from work on the visual cortex. In this book the space devoted to the former approaches is disproportionately small. Only 14 papers deal with subjects that bear no close relation to the visual cortex. These range from a paper on enzyme development in cultured chick retina to one on the rat trigeminal (somatosensory) system. Each author deals with a relatively specific set of experiments, and there is no way to evaluate particular conclusions or interpretations. For example, Finlay summarizes a series of her studies on retinotectal map formation in hamsters after various neonate lesions of the superior colliculus. She suggests that superior temporal regions of the retina have the highest adhesivity to all parts of the tectal lobe and that this retinal-to-tectal interaction may be crucial to the stereotyped alignment of the visual field projection. The same section contains a paper by Fraser on spreading of only temporal inferior retina over an entire denervated tectum in *Xenopus* and a paper by Bunt, Horder, and Martin purporting to support fiber-fiber interactions in the formation of ordered goldfish retinotectal maps. Common issues of graded retinal-to-tectal cell affinities, sorting, and competition among afferents run throughout these three papers, yet there is no effort to articulate the commonality. The incorporation of some of the discussions that presumably went on among the authors might have been helpful in distinguishing the real differences and similarities in the biological material from the more apparent differences in technique, interpretation, and semantics.

The book is a fairly accurate reflection of the questions, the debates, and the points of agreement that have evolved from studies of the projection from the retina to the lateral geniculate to the visual cortex. There is little editorial attempt to make the book cohesive. Nevertheless, the pronounced concentration on the geniculo-cortical system should make the collection a valuable reference for any who are seriously interested in the role played by experience in the functional development of the brain. The value of its treatment of other aspects of visual development will be strictly dependent on the background of the reader and the skills and inclinations of the individual authors.

MARTHA CONSTANTINE-PATON
Department of Biology,
Princeton University,
Princeton, New Jersey 08544