level of internal transmitter (Simon and Lamb). Thermal isomerizations would seem to require a higher  $Q_{10}$  than is observed. In turtle rods what appears as a similar fluctuation in membrane potential in the dark can be fractionated into two components on the basis of differences in power spectra; one component of noise is decreased by light, the other is decreased by hyperpolarization produced by intracellular injection of current (Schwartz). Viewed from this vantage point, the function of electrotonic coupling of receptors-a coupling that is surprising for cones, at least, because it would appear to degrade spatial acuity by increasing the size of the receptive field-may be to decrease receptor noise by averaging membrane responses over a population of cells.

Several authors have tried to estimate the amount by which the membrane potential of the receptor cell changes at threshold (Owen and Copenhagen, Fain, Schwartz), and the values range from less than 5 to about 30 microvolts. All of these estimates are several times smaller than the dark noise of the receptors, leaving open the question of how such small signals are reliably transmitted at the receptor-bipolar synapse. Part of the answer may lie in the low frequency response of the synapse (Baylor and Fettiplace), but one comes away from the book with the feeling that our current understanding of the relations between presynaptic voltage, Ca<sup>2+</sup> entry, and transmitter release will prove inadequate for describing the behavior of the synapses between vertebrate photoreceptors and the retinal bipolar cells.

This description fails to convey the full extent of the book's coverage, for there are several additional chapters on the synaptic organization of the retina (Lasansky, Werblin, Toyoda et al., Trifinov and Byzov). Other contributions include studies of the photo-induced conductance changes of outer-segment membranes (Fatt and Falk), an analysis of the retinal photocurrents (Arden), calculations of free energy changes in the bleaching of rhodopsin (Kropf), studies of membrane structure by x-ray and neutron diffraction (Blaurock), and a concluding chapter by Rushton entitled "How does your research explain our inability to see?" For readers interested in the early stages of vertebrate vision, this volume provides a number of views through the eyes of some of the most active of today's investigators.

TIMOTHY H. GOLDSMITH Department of Biology, Yale University, New Haven, Connecticut 06520

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