動物生理学 III　Handout No. 3

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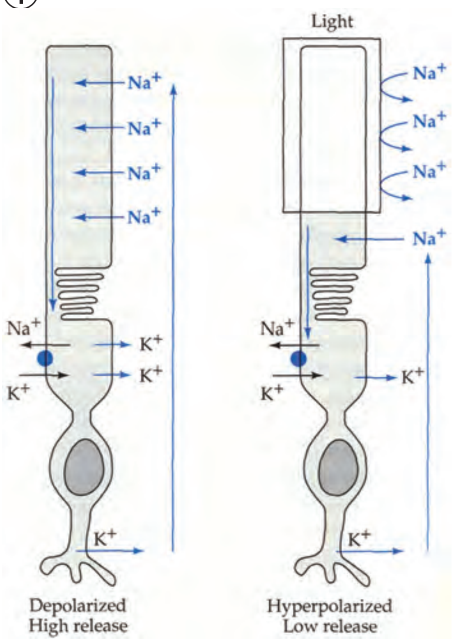

FIGURE 19.10 Dark Current in a Rod. (A) In darkness, sodium ions flow through cation channels of the rod outer segment, causing a depolarization; calcium ions also enter through the cation channels. The current loop is completed through the neck of the rod with the outward movement of potassium through the inner segment membrane. (B) When the outer segment is illuminated, the channels close because of a decrease in intracellular cyclic GMP, and the rod then becomes hyperpolarized. This hyperpolarization reduces transmitter release. Sodium, potassium, and calcium concentrations of the rod are maintained by pumps and exchangers in the inner segment (red circles); calcium exchangers are also present in the outer segment (see Box 19.1). (After Baylor,1987.)

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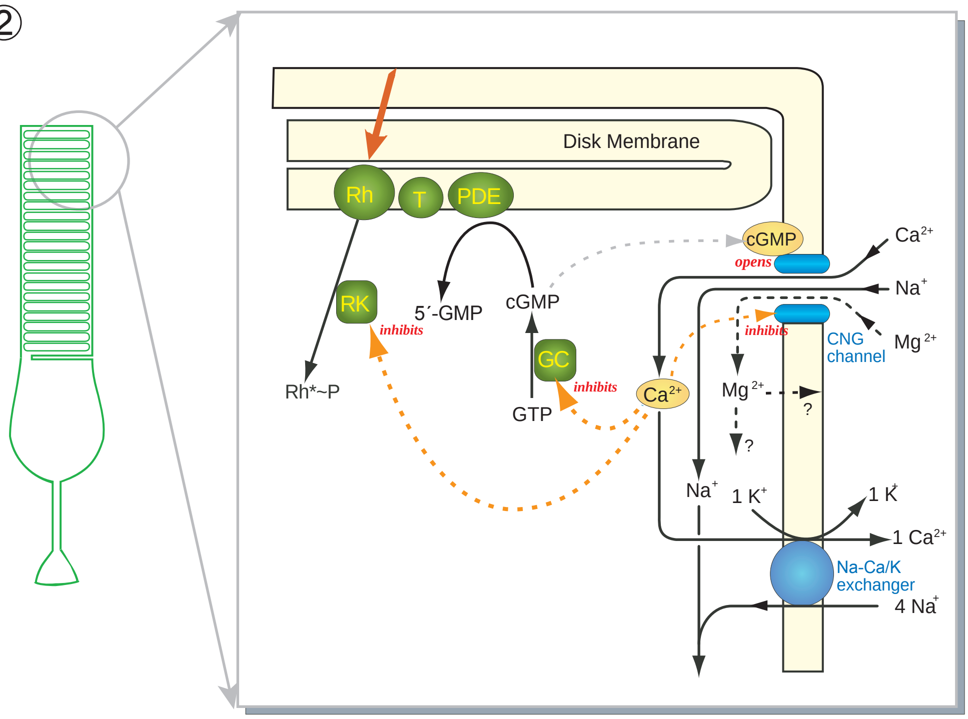

Schematic diagram of phototransduction

GC:	gyanylate cyclase
PDE:	phosphodiesterase
Rh:	rhodopsin
Rh*:	photoisomerized rhodopsin
Rh*~P:	phosphorylated rhodopisn
RK:	rhodopsin kinase
T:	transducin (G protein)

③

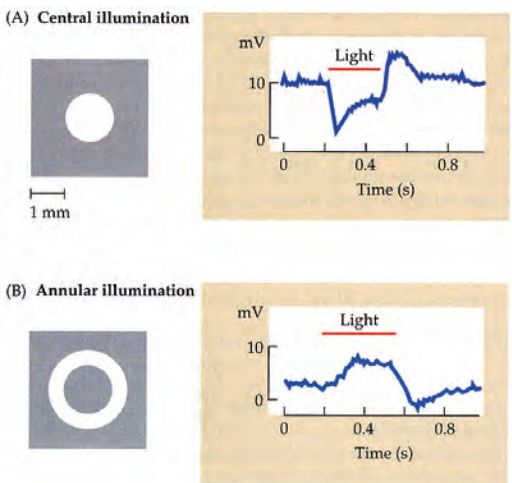

FIGURE 19.18 Receptive Field Organization of a Hyper-polarizing (H) Bipolar Cell. Records made from the bipolar cell in the goldfish retina show a hyperpolarization (A) in response to illumination of the center of the receptive field. Annular illumination causes the cell to respond with a depolarization (B). Diffuse light would have little effect on the cell. For a depolarizing (D) bipolar cell, illumination of the center would produce depolarization, while the annulus would produce hyperpolarization. (After Kaneko, 1970.)

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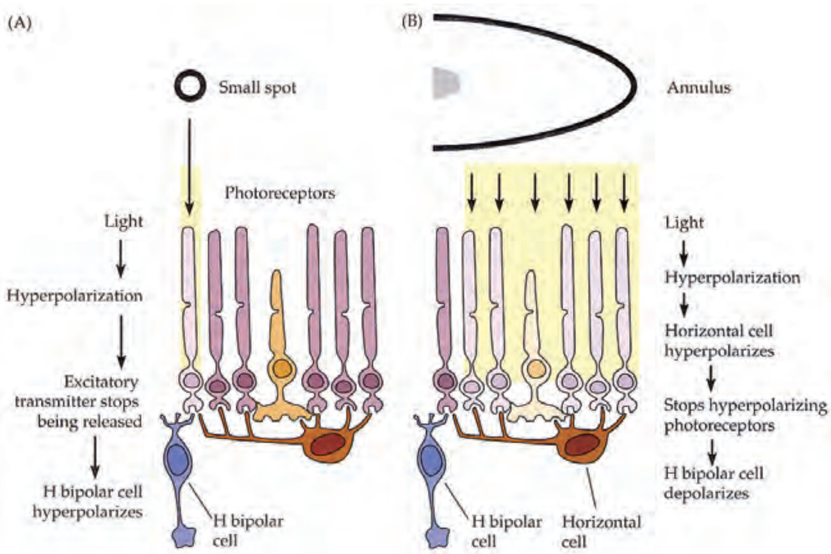

FIGURE19.19 Connections of Photoreceptors, Bipolar Cells, and Horizontal Cells. The figure illustrates connections required to elicit responses in bipolar cells. (A) Light falling on a single photoreceptor causes it to become hyperpolarized. As a result, glutamate stops being released and the H bipolar cell, as in Figure 19.18, becomes hyperpolarized through loss of excitation. (B) Light falling on the surrounding area in the form of an annulus again prevents glutamate from being released by photoreceptors. As a result, the horizontal cell becomes hyperpolarized; this hyperpolarization prevents the horizontal cell from releasing its inhibitory transmitter, GABA, onto the photoreceptor. The photoreceptor that is connected to the H bipolar cell therefore becomes depolarized (through removal of inhibition). It once again releases glutamate and depolarizes the bipolar cell. With diffuse light, the depolarizing and hyperpolarizing effects cancel each other out. Thus, horizontal cells play an essential part in the construction of the receptive field properties of bipolar cells.