Figure 2.4
A side view of the visual system, showing the three major sites along the primary visual pathway where processing takes place: the retina, the lateral geniculate nucleus, and the visual receiving area of the cortex.
Figure 2.8
A drawing of the rod and cone receptors made in 1872 by Max Schultze. The rod- and cone-shaped parts of the receptors are the outer segments.

Figure 2.9
Scanning electron micrograph showing the rod and cone outer segments. The rod outer segment on the left is so large that it extends out of the picture, but the cylindrical shape of the rods and the tapered shape of the cones can be clearly seen in this picture (Lewis, Zeevi, & Werblin, 1969).
Figure 2.32
Mosaics of retinal neurons in the periphery of the rabbit retina. Each dot in the top panel represents three receptors, and each dot in the bottom panel represents one ganglion cell. The large difference between the number of receptors and the number of ganglion cells means that signals from many receptors converge onto each ganglion cell. (From Masland, 1988.)
Figure 2.13
Close-up of the retina showing how the receptors face away from the light so the light must pass through the other retinal neurons before reaching the receptors. Since these neurons are transparent, they do not prevent the light from reaching the receptors.
Figure 2.38
The wiring of the rods (left) and the cones (right). The dot and arrow above each receptor represents a “spot” of light that stimulates the receptor. The numbers represent the number of response units generated by the rods and the cones in response to a spot intensity of 2.0. At this intensity the rod ganglion cell receives 10 units of excitation and fires, but each cone ganglion cell receives only 2 units and therefore does not fire. Thus, the rods’ greater spatial summation enables them to cause ganglion cell firing at lower stimulus intensities than the cones’.
Figure 2.29
A linear circuit (left) and the responses of neuron B generated as we increase the number of receptors stimulated (right). Stimulating receptor 4 causes neuron B to fire, but stimulating the other neurons has no effect since they are not connected with neuron B.
Spatial Summation

Figure 2.30
When we add convergence to the circuit, so that B receives inputs from all of the receptors, increasing the size of the stimulus increases the size of neuron B's response.

Figure 2.31
When we add inhibition to the circuit, so that stimulation of receptors 1, 2, 6, and 7 now inhibits B, neuron B responds best to stimulation of receptors 3–5.
Figure 2.3
Cross section of the primate retina showing the five major cell types and their interconnections. Notice that the receptors are divided into inner segments and outer segments. The outer segments contain light-sensitive chemicals that trigger a signal in response to light. (Adapted from Dowling & Boycott, 1966.)
Figure 2.37
A neural circuit that would result in a center-surround receptive field. Signals from the surround receptors reach the cell from which we are recording via inhibitory synapses, while signals from the center receptors reach the cell via an excitatory synapse. Thus, stimulation of the center receptors increases the firing rate recorded by our electrode, and stimulation of the surround receptors decreases the firing rate. In the retina these inhibitory signals are carried by horizontal and amacrine cells.
Figure 2.33
Recording electrical signals from the visual cortex of an anesthetized cat. The bar-shaped stimulus on the screen causes nerve cells in the cortex to fire, and a recording electrode picks up the signals generated by these nerve cells. In an actual experiment, the cat is anesthetized and its head is held in place for accurate positioning.
Figure 2.34
For every point on the screen on which we present the stimuli, there is a corresponding point on the retina.
Figure 2.35
Response of a ganglion cell in the cat's retina to stimulation (a) outside the cell's receptive field (area A on the screen to the right); (b) inside the excitatory area of the cell's receptive field (area B); and (c) inside the inhibitory area of the cell's receptive field (area C). The excitatory-center-inhibitory-surrond receptive field is shown on the far right without the screen.
Figure 2.36
Response of an excitatory-center–inhibitory-surround receptive field. The area stimulated with light is indicated by the shading, and the response to the stimulus is indicated by the records below each receptive field. As the stimulus size increases inside the excitatory region of the receptive field in (a) and (b), the response increases. As the stimulus increases further, so that it covers the inhibitory region of the receptive field in (c) and (d), the response decreases. This cell responds best to stimulation that is the size of the receptive field center. (Adapted from Hubel & Wiesel, 1961.)
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