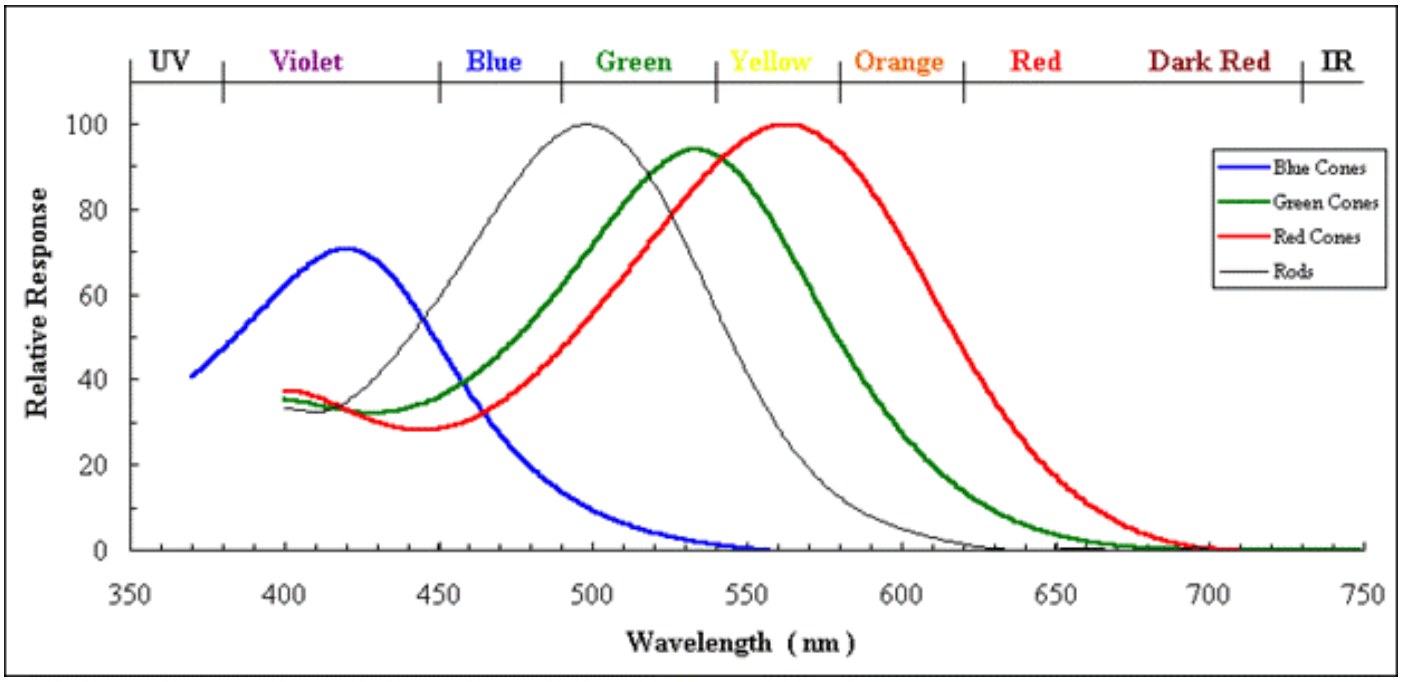
Primates use a three-cone (**trichromatic)** system that allows us to see in many hundreds or thousands of colors. However, some animals have even more cones (or cones with different **absorption spectra**) than this. For example, some insects and sea creatures, such as the mantis shrimp, have cones that allow them to see ultraviolet and infrared wavelengths that humans cannot see.

FIGURE 40



Cone absorption spectra.[44]

Phototransduction

In most sensory systems, when a receptor is activated by its preferred stimulus, the receptor cell is depolarized, leading to an action potential and/or transmitter release. The photoreceptors in the retina work in the opposite way, in that light hitting the opsin causes a conformational change that results in hyperpolarization, making the sending of a signal *less* likely! In the absence of light, the receptor is in a depolarized state and is constantly releasing neurotransmitter. Thus, rods and cones are triggered to send a chemical signal by darkness, not by light, which then halts that process. While this arrangement may seem odd, the only true requirement for visual processing is that a change in luminance results in a change in the signal output of the photoreceptors—it doesn't matter which state is "on" and which is "off."

Light being absorbed by the opsin causes a conformational change in the molecule found inside, altering the molecule's shape, which activates the opsin. When the opsin encounters a G protein, it activates it according to the previously discussed mechanism, which then activates the enzyme phosphodiesterase. This enzyme breaks down cyclic guanosine monophosphate (cyclic GMP), which is the molecule that keeps special ion channels open. When cGMP is broken down, there is not enough of it to bind to the ion channels, so they must close and stop the influx of sodium and calcium that depolarizes the cell to release neurotransmitter. So, to recap, when opsins absorb light, *less* transmitter is released because the ion channels are closed by the indirect action of the opsin pigment.