

Sight Encyclopedia Article

Sight

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Sight

Sight—one of a human being's five senses—begins when rays of light hit an object and reflect back into the eye through the cornea--the clear membrane covering the eyeball, through the pupil--the opening in the center of the eye, and through the lens situated behind the pupil. The lens focuses the rays onto the retina at the back of the eye where the light first penetrates a layer of ganglion cells and a layer of bipolar cells (the long axons of which form the optic nerve to the brain), before stimulating rods and cones. These electromagnetic receptors contain photoreceptor molecules which, when stimulated, produce action potentials which synapse to the bipolar cells which synapse to the ganglion cells. The signal travels along the optic nerve to the lateral geniculate nucleus and on to the primary visual cortex at the back of the brain. Some signals are carried to a "higher" cortex where shape, color, or motion are decoded.

Light—electromagnetic radiation—consists of differing wavelengths, or frequencies, measured in nanometers (nm). Humans detect light between 300-700 nm. Rods, pigmented with "visual purple" and stimulated by very low-level frequencies, do not function in bright light, nor do they differentiate color. They do, however, allow us to see by moonlight, but only in shades of grey. Rods are heavily concentrated around the outer edge of the retina, decreasing toward the center--the fovea--where they are nonexistent. Therefore, to see a dim star, we must look slightly away from it. Cones--outnumbered by rods twenty to one--do not respond to low frequency wavelengths, are concentrated toward the center of the retina, and densely packed in the fovea. Cones allow us to perceive color and see with high acuity. Three types of cones contain a different pigment, each of which only absorbs light waves of specific frequencies. Some absorb wavelengths between 445-450 nm (decoded as blue light); others wavelengths between 535-540 nm (green light); and others only long wavelengths (red light). Wavelengths of approximately 565 nm (yellow light) are perceived by both green and red cones, therefore yellow appears as a very bright color. Shades and hues are determined by the aggregate stimulation of these color receptors. Because pigment is destroyed as it processes light energy to chemical energy, it must regenerate. Vitamin A is essential to this regeneration process.