

# Biology 30 notes



**ASSIGN  
BUSTER**

The senses transmit sensory information's, in the form of electrochemical impulses, to the brain. Different forms of energy stimulate the sensory receptors — the nerve endings and cells that detect sensory information. The sensory receptors then initiate neural impulses. Sensation occurs when the neural impulses arrive at the cerebral cortex. Neural impulses that begin in the optic nerve are sent to the visual areas of the cerebral cortex, and we see objects. Each person's unique perception results from how the cerebral cortex interprets the meaning of the sensory information. Sensory adaptation: brain filters out redundant, insignificant information. Example: when you no longer the ticking of a clock or the feel of clothes on your skin. The senses detect a significant change in external or internal conditions, and the body readjusts. In order to process sensory information quickly, the brain parallels or splits up this input to various areas of the brain, and forms a neural multi-tasking. Sensory receptors are specialized cells or neuron endings that detect specific stimuli. Human sensory receptors can be classified into four categories: photoreceptors, chemoreceptors, mechanoreceptors, and thermoreceptors. Each receptor is able to transduce or convert one form of energy from a specific stimulus into electrochemical energy, which can be processed by the nervous system. Light energy stimulates photoreceptors. Our eyes contain photoreceptors, called rods and cones that absorb light and allow us to sense different levels of light and shades of color. Certain chemicals stimulate chemoreceptors. The tongue contains taste buds that detect various particles in the food we eat. The nose has olfactory cells that detect odors in the air. Other chemoreceptors detect changes in the internal environment. Mechanoreceptors respond to mechanical forces from some form of pressure. Example: hair cells in the

inner ear are activated when sound waves cause parts of the inner ear to vibrate. Other hair cells in the inner ear are stimulated when they bend, thus providing information about body and head position. Proprioceptors in and near the muscles also provide information about body position, as well as movement. Mechanoreceptors allow you to detect light touch, pressure and pain. Thermoreceptors in the skin detect heat and cold. Damaged to particular sensory receptors such as photoreceptors can result in the loss of the associated sense. \*\*Artificial Eye: includes a digital video camera that is mounted on glasses. The camera captures images and sends them to a small computer on a belt worn by a person who is visually impaired. The images are processed and sent to several electrodes that are implanted in the visual cortex, thus bypassing the damaged light receptors in the eye.

Photoreceptors: vision — rods and cones in the eye — detects visible light

Chemoreceptors: taste — Taste buds on tongue — food particles in saliva

Smell — olfactory receptors in nose — odor molecules Internal Senses:

osmoreceptors in the hypothalamus (low blood volume) receptors in the

carotid artery and aorta (blood pH) Mechanoreceptors: touch pressure pain

— receptors in the skin — mechanical pressure Hearing — hair cells in the

inner ear — sound waves Balance — hair cells in inner ear — fluid movement

Body Position: proprioceptors in the muscles and tendons and at the joints —

muscles contraction, stretching, and movement Thermoreceptors:

temperature — heat and cold receptors in the skin — change in radiant

energy Because the lens is flexible, it can change shape. This allows for finer

focus when viewing objects, whether they are nearby or far away. If an

object is nearby, the ciliary muscles contract and the suspensory ligaments

relax, causing the lens to become more rounded. If an object is far away, the

ciliary muscles relax and the suspensory ligaments become taut, causing the lens to flatten. The ability of the lens to change shape in order to focus images clearly on the retina is a reflex called accommodation. \* Cataracts: an eye's protein structure can start to degenerate, making it opaque and preventing light from passing through. It will cause grey-white spots on the lens. To prevent this, the lens can sometimes be surgically replaced. \* Astigmatism: due to an uneven curvature of part of the cornea. Because the cornea is asymmetrical, it cannot bend light rays so that they meet at the correct focal point, causing blurred vision. \* Myopia (nearsighted): eyeball is elongated, so the focused light falls in front of the retina instead of on the photoreceptors. Nearsighted people can wear concave lenses, which diverge incoming light rays so that the image falls directly on the retina. \* Hyperopia (farsighted): the light rays do not meet before they reach the retina, so the image is focused behind the retina. Convex lenses can correct hyperopia by bending light rays at a sharper angle. Human retina contains about 125 million rods and 6 million cones. Rods are extremely sensitive to light. A rod can be stimulated by a single photon of light. They do not enable us to distinguish colors. Rods also detect motion and are responsible for the peripheral vision. Rods are spread out throughout the retina but are more concentrated in the outside edges. The cones are the color-detecting sensors of the eye. They are packed most densely at the fovea centralis at the back and center of the retina. Cones require relatively intense light to stimulate them, thus the structures of the eye must focus light onto the fovea centralis in order to produce a sharp image. There are three types of cones and each absorbs a different wavelength of light. The combination of cones that can detect red, blue, and green wavelengths of light allows us to see a range of

colors. Color blindness is an inherited condition that occurs more frequently in males than in females. Color blindness is actual color deficiency, because it is caused by a lack or deficiency in particular cones, usually red or green cones. Rods contain a light-absorbing pigment called rhodopsin, which is composed of retinal and the protein opsin. In the dark, the rods release an inhibitory neurotransmitter that inhibits nearby nerve cells. When the rods absorb light, however the rhodopsin splits into retinal and opsin. This triggers a chain reaction that STOPS the release of the inhibitory neurotransmitter, thus allowing transmission of a neural impulse to the optic nerve. Similar process occurs in the cones except the pigment is photopsin, which reacts only to certain wavelengths of light. Where the ganglion cells merge to form the optic nerve is the blind spot. This does not contain photoreceptors and is therefore incapable of detecting light. Before the brain can integrate visual information from both eyes, however, the retina must send information to the optic nerve. From there, the information travels to the thalamus and then to the occipital lobe of the cerebral cortex for interpretation. The image is split in the occipital lobe because the left optic tract carries information about the right portion of the visual field, and the right optic tract carries information about the left visual field. Binocular vision — forward-facing eyes