

## **The Eye**

The eye is an optical system that focuses light rays on photoreceptors, which change light energy to nerve impulses. Human eyes are spherical organs located in bony orbits, or eye sockets, cavities formed by the bones of the skull. The eye is embedded in orbital fat for insulation and protection. It is attached to the orbit by six muscles, the extrinsic eye muscles, which control eye movement. Small tendons connect these muscles to the outermost layer of the eye. Structures of the eye include:

1. The sclera is the tough, white outer layer of the eyeball that protects the interior of the eye. At the front of the eye, the sclera forms a domed transparent orb called the cornea. The cornea has a curved surface that focuses light coming into the eye.
2. The uvea is the vascular layer below the sclera. It supplies blood to muscles and nerves within the eye and gives the eye its color. It contains three structures: the choroid, the ciliary body, and the iris.
3. The choroid, a darkly pigmented layer of tissue, houses many tiny blood vessels and acts to absorb light within the eye. This prevents the blurring of visual images. The ciliary body, an extension of the choroid, enables the eye to focus on objects of varying distances. Another extension of the choroid is the iris. Pigmentation of the iris is what determines the eye color. At the center of the iris is an opening called the pupil. The pupil of the eye expands and contracts, regulating the amount of light entering the eye.
4. On the inner surface of the choroid is the retina, light-sensitive receptor cells. The retina contains rods and cones that detect color stimuli (photopigments), which it sends to the brain for interpretation.
5. The optic nerve carries impulses from the retina to areas of the brain that are responsible for processing visual information.
6. Although not involved in vision directly, the eyelids and eyelashes protect the eyeball from physical trauma. A thin membrane known as conjunctiva lines the inside of each eyelid.
7. The lacrimal glands of the eye produce tears, which keep the eye lubricated.

## The Ear

The ear has three distinct and anatomically separate sections: the outer, middle, and inner ears. The middle ear lies within the temporal bones of the skull. It contains three tiny bones, the auditory ossicles. They are named for their shapes. Starting from the outside, they are the malleus (hammer), incus (anvil), and stapes (stirrup). The malleus is connected to the tympanic membrane. The middle ear cavity opens to the pharynx via the Eustachian tube, also called the auditory tube. The Eustachian tube serves as a pressure valve. Yawning and swallowing open the tube to equalize pressure within the middle ear. The inner ear is a mazelike structure that occupies a large cavity in the temporal bone. It consists of bony and membranous structures surrounded by fluid. It contains two sensory organs—the cochlea, a snail shell-shaped bony structure that houses the organs of hearing, and the vestibular apparatus. The cochlea is a hollow, bony spiral containing three fluid-filled canals: the upper vestibular canal, the middle cochlear canal, and the lower tympanic canal.

The organ of Corti contains the receptor cells, tiny hair cells that are stimulated by sound vibrations. The sound vibrations are then converted to nerve impulses that are transmitted to the brain for interpretation. To summarize briefly how we hear, let us create a pathway of sound waves through the ear by structure and function:

1. The outer ear auricle (pinna) funnels sound waves into the external auditory canal, which directs it to the tympanic membrane (eardrum) causing it to vibrate.
  2. The middle ear, which contains the eardrum ossicles, the malleus, incus, and stapes, vibrate when struck by the sound waves and transmit the sound to the cochlea in the inner ear by causing the oval window to vibrate the fluids within the canals.
  3. The cochlea converts the fluid waves to nerve impulses. The semicircular canals, the sacculi and utricle, detect head movement and linear acceleration and are often described as the organ of balance.
  4. The auditory nerve fibers that lie close to the hair cells of the organ of Corti pick up the sound wave impulses and transmit them to the cerebral cortex of the brain, where they are interpreted and we are able to hear.
- Opticians specialize in examining the eye when prescription lens are needed.
  - Ophthalmologists are physicians who specialize in diseases and treatment of the eye.
  - Otolaryngologists are physicians who specialize in the diagnosis and management of diseases of the ears, including hearing loss, balance disorders, and congenital disorders of the inner and outer ear.