

Anatomy and Physiology of the Human Ear

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Purpose

To explain in simple terms the major parts of the ear and their function

Chapter Topics

- Anatomy of the Ear
- The Outer Ear
- The Middle Ear
- The Inner Ear

To better appreciate our role in hearing conservation, we need to understand how we hear. Hearing is a remarkably intricate process that is often taken for granted. Our sense of hearing relies on extremely complex and sensitive organs that operate with great efficiency over a wide range of volume and tones. The young, healthy human ear can hear frequencies from 20 to 20,000 **cycles per second** (cps), or **Hertz** (Hz). It can transform vibrations in the environment into meaningful signals that inform and protect us, allow development of spoken language, bring us the sounds of nature and music and allow us to share the lives of our family members and friends. In short, the ear is remarkable; preserving its function is priceless.

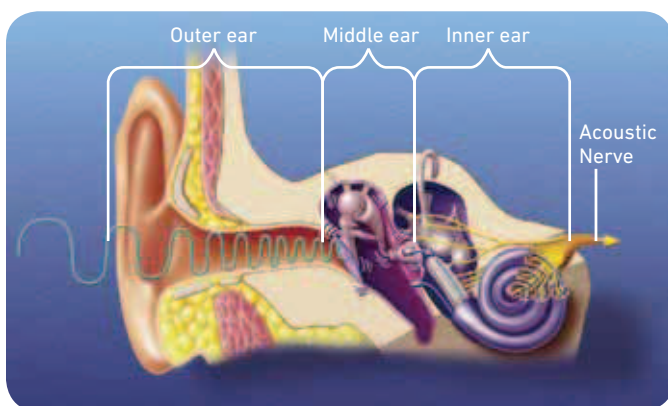


Figure 4-1. Major components of the peripheral hearing mechanism. Note the relative size of the outer ear compared with that of other structures. Courtesy of BSIP/Science Source

All sounds begin as air vibrations that activate a series of reactions in the auditory system. These vibratory pressures are collected and directed by the **outer ear** into the **external audi-**

tory canal. The external auditory canal then channels the vibration toward the eardrum, or **tympanic membrane** (TM). This in turn causes the eardrum to vibrate, which sets into motion the mechanical structures of the **middle ear.** The middle ear is an air-filled space that contains the **ossicles**, or middle ear bones. These 3 tiny bones are attached to the TM and move as it moves. They transmit the sound waves further along the auditory chain to the **inner ear.** This motion is processed in the **inner ear** via mobilization of sensory membranes and their associated sensory **hair cells.** The hair cells of the inner ear convert the mechanical movement into a representative nerve impulse. Finally, the nerves associated with hearing transmit this stimulation to the brain for interpretation (**Figure 4-1**). Although this description sounds fairly straightforward, the anatomy and complexity of the transformation of a simple vibration to interpretation of a sound signal is not simple at all.

Anatomy of the Ear

If you want to understand how the auditory system works, you must know the anatomy of the ear. There are three parts to the ear: the outer ear, middle ear and inner ear.

The Outer Ear

The **pinna**, also called the **auricle**, is part of the outer ear and the most visible portion (**Figure 4-2**). Its major function is to capture and direct sound waves into the **ear canal.** It also helps localize the direction of sounds. The most prominent landmark of the auricle is the bowl-shaped portion called the **concha.** The pinna directs the sound waves toward the ear canal (external auditory canal). The external auditory canal is known as the **external auditory meatus.**

The external auditory canal is about 1 to 2.5 cm (0.5 to 1 inch) long. Although most people imagine the ear canal as a straight cylinder, it is shaped like an "S." Furthermore, people have different-sized right and left ear canals, which is an important consideration when fitting earplugs. The outer third of the ear canal is surrounded by cartilage, and the internal two-thirds are surrounded by the **temporal bone** of the skull. This bony segment is often sensitive to touch because there is little cushion between the skin and bone.