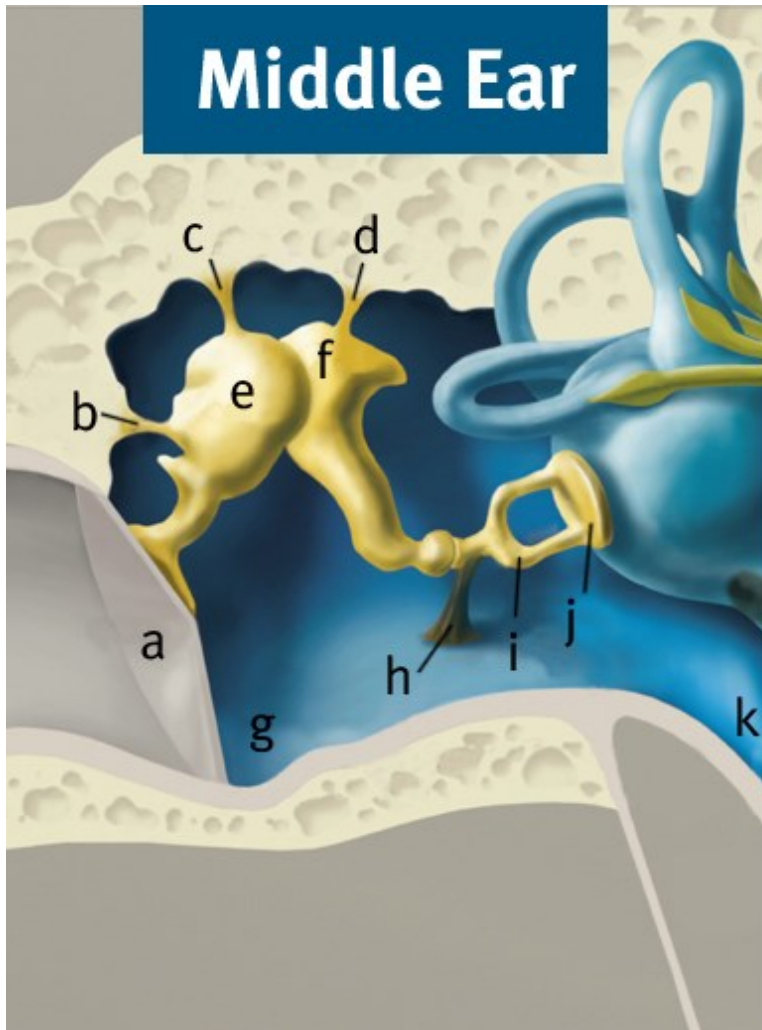


The middle ear is channeled in the temporal bone and is comprised of ligaments, muscles, and three bones which are the smallest in the human body. Only about the size of a garden pea, this section of the hearing system acts as a **transducer** as it converts the acoustic energy from the outer ear into a mechanical energy and also a **transformer** as it increases the sound pressure by a 22:1 ratio. This system is sealed and filled with air.

In this lesson you will learn the basics of how the middle ear anatomy works and how it transfers the acoustic energy from the outer ear into a mechanical energy.



- a) Eardrum
- b) Lateral malleolar ligament
- c) Upper malleolar ligament
- d) Incudal ligament
- e) Malleus
- f) Incus
- g) Middle ear
- h) Stapedius muscle
- i) Stapes
- j) Stapes footplate and oval window
- k) Eustachian tube

As the acoustic sound vibrates the eardrum, the ossicles begin a lever action that moves along with the vibration. Attached to the eardrum is the **malleus**, then the **incus**, then the **stapes**. The stapes is attached to the **oval window** with the **annular ligament** and is the separation between the middle and inner ear. There are two main muscles that hold the ossicles in place, the **tensor tympani** attaches to the handle of the malleus and the **stapedius** attaches to the stapes. These muscles help keep the bones in place and can also constrict so loud sounds do not damage the inner ear. This action is called **acoustic reflex**.

The **Eustachian tube** runs from the lower part of the middle ear cavity, to the upper part of the throat. Horizontal to the tube is the **nasopharynx** behind the nose that provides a connection for outside air to enter the middle ear through the Eustachian tube. This is also the way fluid and bacteria can enter the middle ear and cause a conductive loss. If the Eustachian tube is not functioning properly a mass of negative air can draw the fluid into the middle ear.

Adults have a **patent** horizontal eustachian tube which means it opens when sneezing, coughing or swallowing. This can allow air in and out of the middle ear to equalize pressure as needed. Conversely, in children it is horizontal and not patent, which allows germs to readily pass through the tube and cause more ear infections and issues.

In summary, sound hits the ear drum and works its way through the system in this order: **Outer ear> Eardrum> Malleus> Incus> Stapes> Oval Window> Inner ear**. This transfer of energy is from acoustic to mechanical energy as the bones physically move. The attic of the middle ear is called the **epitympanic cavity** and is sometimes used synonymously as a term for the middle ear in general.