

# How Do We Hear?

## Ears are made up of three sections:

### 1. THE OUTER EAR

which is made up of the skin and cartilage on the outside, and the ear canal that leads into your head.

### 2. THE MIDDLE EAR

which begins at the ear drum about 2.5 centimetres inside your head and includes the little bones that carry the sound vibrations to the area where hearing really begins.

### 3. THE INNER EAR

where those vibrations are changed into the signal that is carried to your brain, which you experience as sound. This part of your ear also controls your balance.

## How do your ears work?

Sound (as waves) enters your ear canal and hits your ear drum. This makes it vibrate. Three tiny bones in your middle ear link the vibrating ear drum with the inner part of your ear.

The last of these bones is connected to a tiny bone structure that looks a bit like a snail shell, but is about the size of a pea. It is called the cochlea (pronounced cock-lee-ah). The cochlea is filled with a liquid that carries the vibrations to thousands of tiny hair cells. Each cell is tuned to a particular sound (or frequency).

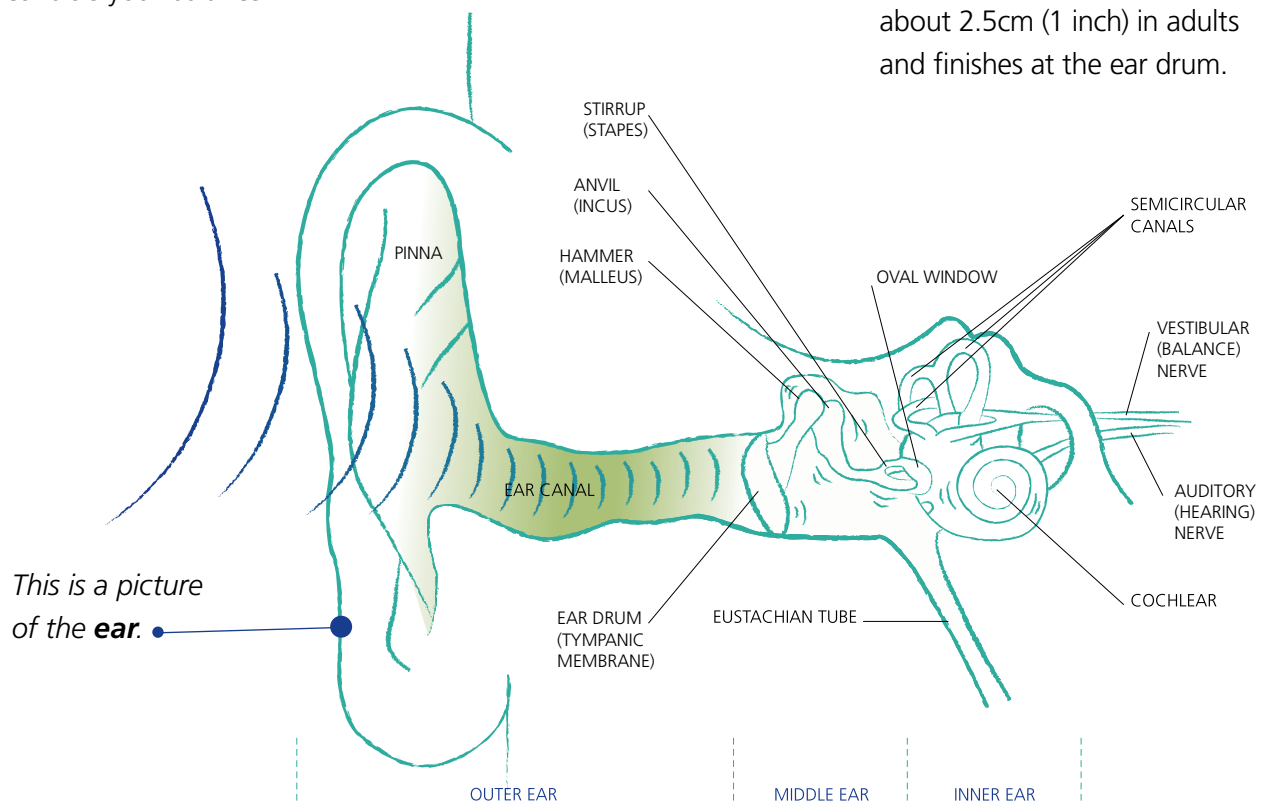
As these little hair cells move in the fluid, they carry a message to the nerve which is connected to your brain, which turns this signal into what you hear. All this happens in a fraction of a second.

## The Outer Ear

consists of the pinna and the ear canal.

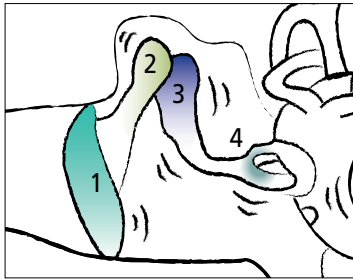
The **pinna** is the external flap of skin that we can all see. It is not very important for good hearing but it does serve to collect or 'funnel' sounds into the ear canal and help us know the direction of sound.

The **ear canal** varies in size and shape from person to person. It runs nearly horizontally toward the centre of the head for about 2.5cm (1 inch) in adults and finishes at the ear drum.



The skin along the outer part of the canal has stiff hairs and produces wax (called cerumen). This **ear wax** has an important function. It discourages foreign objects from entering the ear, and keeps the skin of the canal from drying out.

## The Middle Ear



consists of the **ear drum membrane(1)**, the air filled cavity behind it and its contents, including three tiny bones (ossicles) – the **hammer (malleus-2)**, **anvil (incus-3)** and **stirrup (stapes-4)**.

The **ear drum** is cone shaped, like the cone of a loud speaker. It is stretched across the ear canal and is quite stiff, but flexible.

Behind the ear drum are the three middle ear bones or **ossicular chain**. These three tiny bones are connected, and this is why they are called a 'chain'. The hammer is connected to the ear drum membrane on one end and the stirrup at the other.

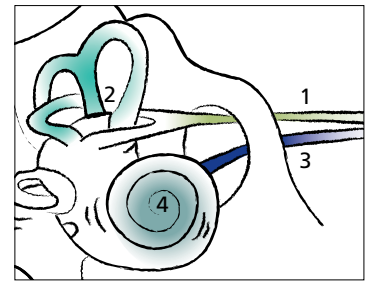
The stirrup is the last of these three bones and is the smallest bone in the body, smaller than a grain of rice. It rests against a membrane that leads into the inner ear, and this membrane is called the **oval window**.

The three bones vibrate together as the drum moves in response to sound, and the stirrup moves in and out of the oval window like a piston.

Located just below the oval window is the **round window**. When the stirrup moves in and out it pushes the fluid in the cochlea. The round window is flexible and allows the fluid to be displaced.

The middle ear cavity is filled with air and is connected to the back of the nose and throat by the **eustachian tube**. The purpose of this tube is to adjust the air pressure in the middle ear space to match the air pressure on the outside of the ear drum. It is normally closed but opens when we swallow or yawn, or when we blow our nose. This is why it helps to yawn or swallow when you are going up or coming down in a plane.

## The Inner Ear



consists of a complicated series of channels and chambers.

The three loops at the top form the **organ of balance**; the **semicircular canals(2)**. The snail shaped part is the **organ of hearing**; the **cochlea(4)**.

The cochlea contains fluid and up to 20,000 tiny hair cells that move when the fluid moves with a sound. Each hair cell connects to the **hearing (auditory) nerve(3)**. When the hair cells move in response to a sound, they send messages along a complex pathway of nerves to the brain. The brain is very good at interpreting what these sounds mean – a dog barking, the phone ringing, a voice, etc.

Damage to any of these three parts of your ear from injury, sickness or other causes could make it hard for you to hear well. Illness, drugs, hereditary factors, injury and loud noise can all damage the sensitive parts of our ears, causing a loss of hearing.

For more information, see the Australian Hearing fact sheet titled 'Causes of Hearing Loss' or visit our website – [www.hearing.com.au](http://www.hearing.com.au).

