

# HEARING (Audition) p.133-140

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Humans hear a wide range of sounds but hear best with frequencies in the range of human voices

We are also attuned to variations in sound

## HOW DO WE HEAR?

- Our ears transform vibrating air into nerve impulses which our brain decodes as sound

- The strength (or amplitude) of sound waves determines their loudness

- Sound waves vary in length and frequency

- frequency determines pitch
- ie: long waves = low frequency = low pitch
- short waves = high frequency = high pitch
- <http://www.youtube.com/watch?v=VxcbppCX6Rk> (Can you hear?)

- We measure sound in decibels

- the absolute threshold for hearing is arbitrarily defined as ZERO decibels
- ex: a normal conversation = 60 decibels
  - a whisper = 20 decibels

## How Does the Ear Transform Sound Energy into Neural Communication? (P.135)

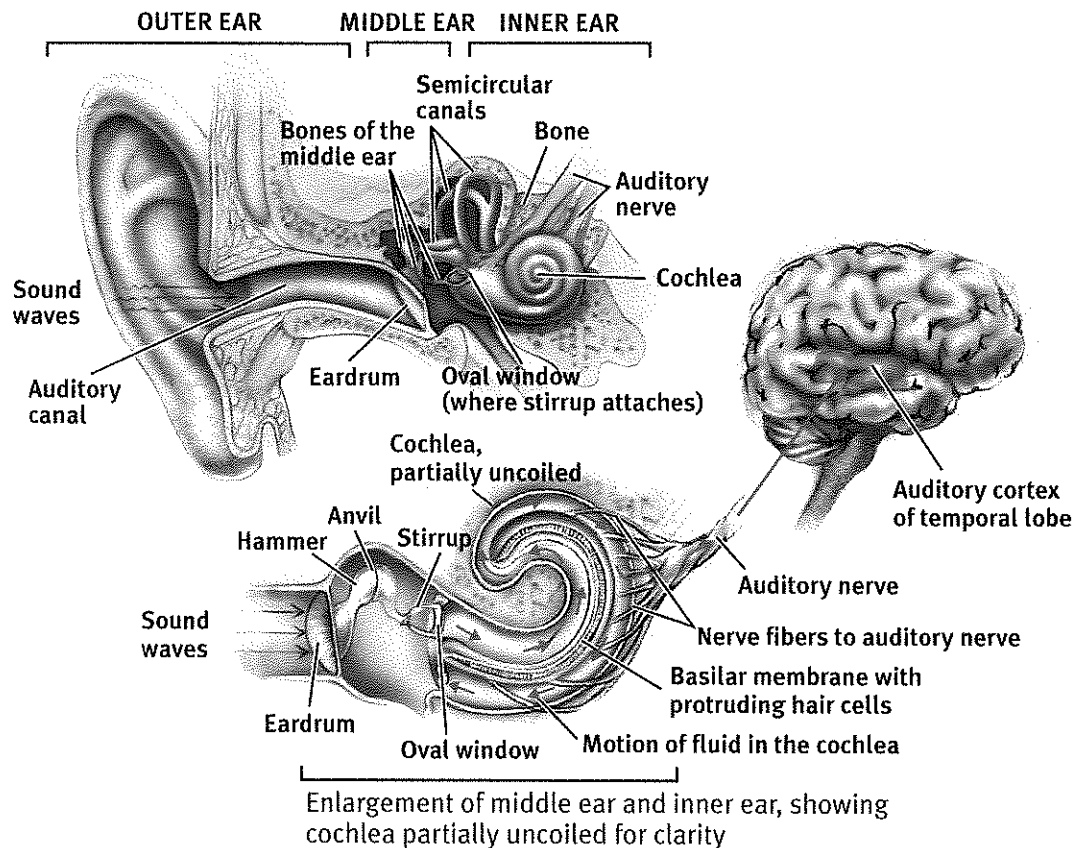
How? By converting sound waves into neural activity through an intricate mechanical chain reaction

1) The visible Outer Ear channels sound waves through the auditory canal to the eardrum (a tight membrane that vibrates with the waves)

2) The Middle Ear then transmits the eardrum's vibrations through a piston made of three tiny bones (the hammer, anvil, and stirrup) to the cochlea

3) The incoming vibrations cause the cochlea's membrane (the oval window) to vibrate jostling the fluid that fills the tube

- this motion causes ripples in the basilar membrane bending the hair cells lining the surface
- this triggers impulses in the adjacent nerve cells whose axons form the auditory nerve which sends neural messages (via the thalamus) to the temporal lobe's auditory cortex
- Voila! We hear! 😊



## PERCEIVING PITCH (p.137)

What theories help us understand pitch perception?

### 1) Place Theory (Hermann von Helmholtz)

- different frequencies of sound waves are said to vibrate different places on the cochlea. These places are wired to different parts of the auditory cortex in the brain so the sound can be processed correctly.

### 2) Frequency Theory

- the entire cochlea is believed to vibrate at a particular frequency, thus sending the signal of the quality of sound to the brain