

## Class 10 Audition

### Stimulus: air

-sounds: From simple(tone) to complicated (voice)

Sound-air pressure waves: 700 miles/hr

Quantifying sound:

Rarefied (neg. pressure) → to the eardrum

### Quantifying sound

Infra (whale)-----sonic (human)-----ultra sonic (bird)

### Sensing the ear

For just audible sounds tympanic membrane traveling distance is comparable to the diameter of a hydrogen atom.

Auditory nerve is attached the the cochlea

### The Cochlea: sound transduction

- Organ of “Corti”
  - Tectorial membrane
  - Outer hair cells
  - Dieter cells
  - Basilar membrane

### The Cochlea in action

Air---mechanical---fluid

High frequency sound waves bend close to window of cochlea

Low frequency sound waves end close to tip of cochlea

The ear: anatomy

(Pressure waves) sound→ middle ear→ inner ear: oval/round→action potential

Organ of Corti: Basal membrane, hair cells, tectorial membrane, cilia, tip links, ion channels

The hair cells are transducers

Mechanical→ electrical (receptor potentials)→ action potential

Tip links physically open a single ion channel (very precise)

1) insertional plaque

2) Cilium

3) Tip link

High firing rate→stretch

Low firing rate→ relaxed

All happens on auditory nerve

Stretch tip links opening of ion channels: loudness

Position of hair cells along basilar membrane: frequency

High near window, low near apex

Cochlear nerve contains axons from inner cells (95%) outer cells (5%)

Tinnitus (disorder with ringing or buzzing)

### Auditory pathway

Auditory nerve→ superior olivary complex cochlear nucleus→ inferior colliculus→ Medial Geniculate nucleus→ auditory cortex

### Auditory perceiving

Tonotopic organization (map of frequencies)

High frequencies: place code (high- windows; low- apex)

Cochlear implants (brain machine interface: stimulates right part of brain with right frequency) use the place code to restore auditory perception

### Auditory cortex:

Anterior-what-complex sound analyzing

Posterior-where-sound localization

### Vestibulo-Ocular Reflex

Warm/cold water→ fluid movement in canals→ eye movement- check if brainstem is okay

Eye movements are used to test the integrity of the brain stem: (normal: both eyes move together)

Vestibular pathway

Vestibular information reaches the vestibular nerve through the thalamus