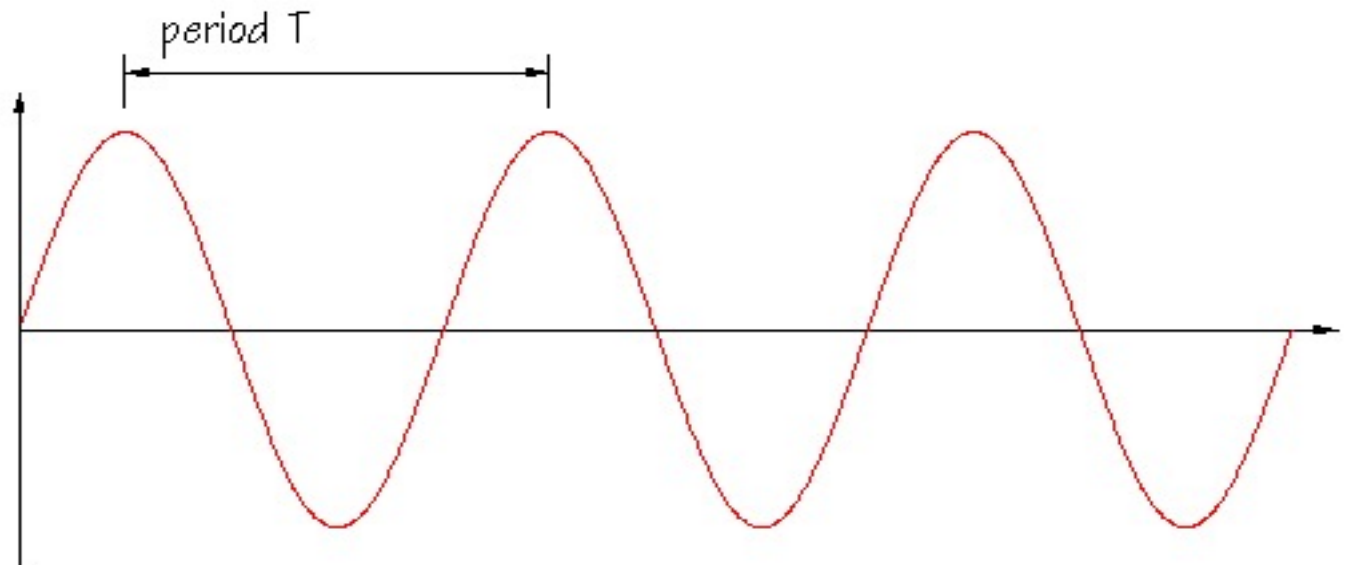


The Sound Wave (hit gong)

- Elasticity
- Compression
- Rarefaction



Frequency and Pitch

- CPS (Cycles per Second)
- Hertz (Hz)
- 20 to 20,000 Hz – 20 to 20 kHz (Hearing)
- Frequency = Pitch
- Octave (20/40 Hz, 40/80 Hz, etc.)
- 10 Octaves (Hearing)

Frequencies

- 300 Hz to 3 kHz (most energy) Speech
- 20 to 80 Hz Low Bass
- 80 to 320 Hz Upper Bass
- 320 to 2,560 Hz Midrange
- 2,560 to 5,120 Hz Upper Midrange
- 2.5k to 5k Hz is 8th Octave and Presence Range
- Emphasis 8th Octave to improve speech or lyrics intelligibility

Amplitude and Loudness

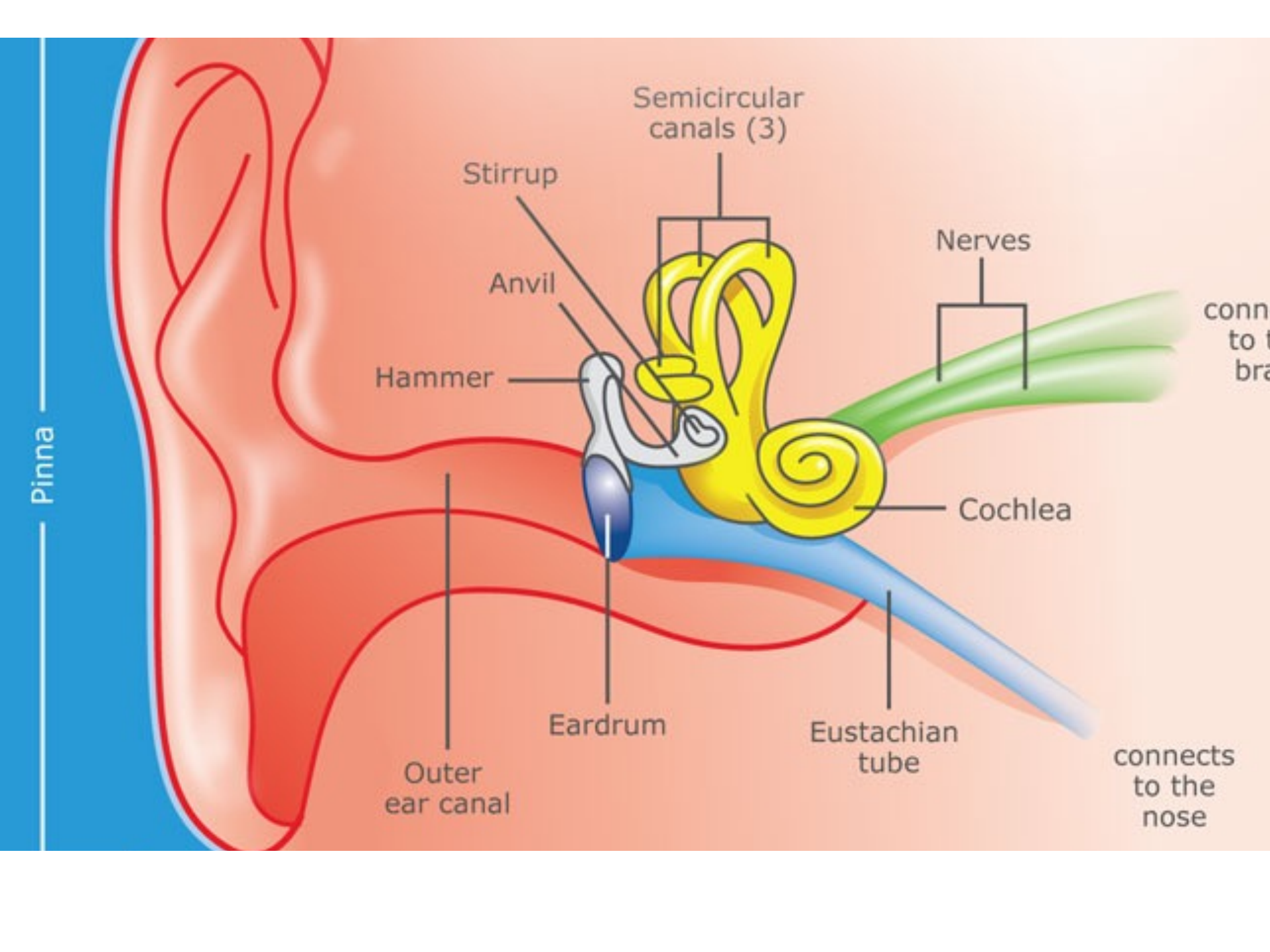
- Decibel dB = a 10th of Bell
- Dynamic Range = Softest to Loudest sound
- dB – SPL (Sound Pressure Level)
- 0 dB = Threshold of hearing
- 30 dB = Quite office
- 60 dB = Average conversation
- 120 dB = Tickle in the ear
- 140 dB = Threshold of pain

Perceived Doubling of Sound

- 3 to 10 dB

The Healthy Ear

- Outer ear
- Middle ear
- Inner ear



Outer Ear

- Pinna
- External Ear Canal
- Capture the Sound

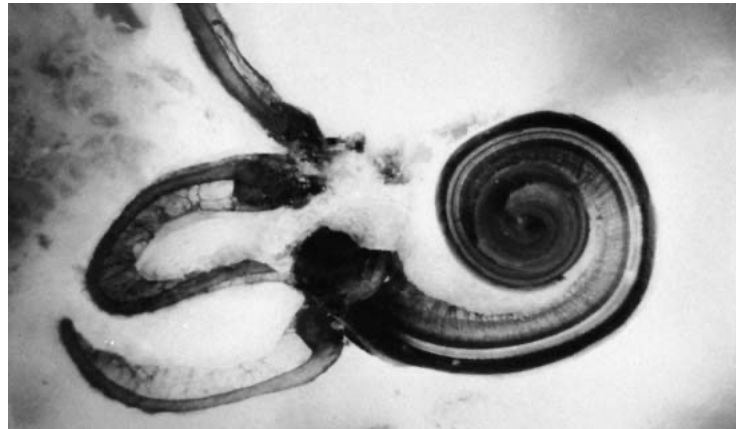
Middle Ear

- Tympanum (ear drum)
- Malleus (hammer)
- Incus (anvil)
- Stapes (stirrup)
- Transducer and amplifier

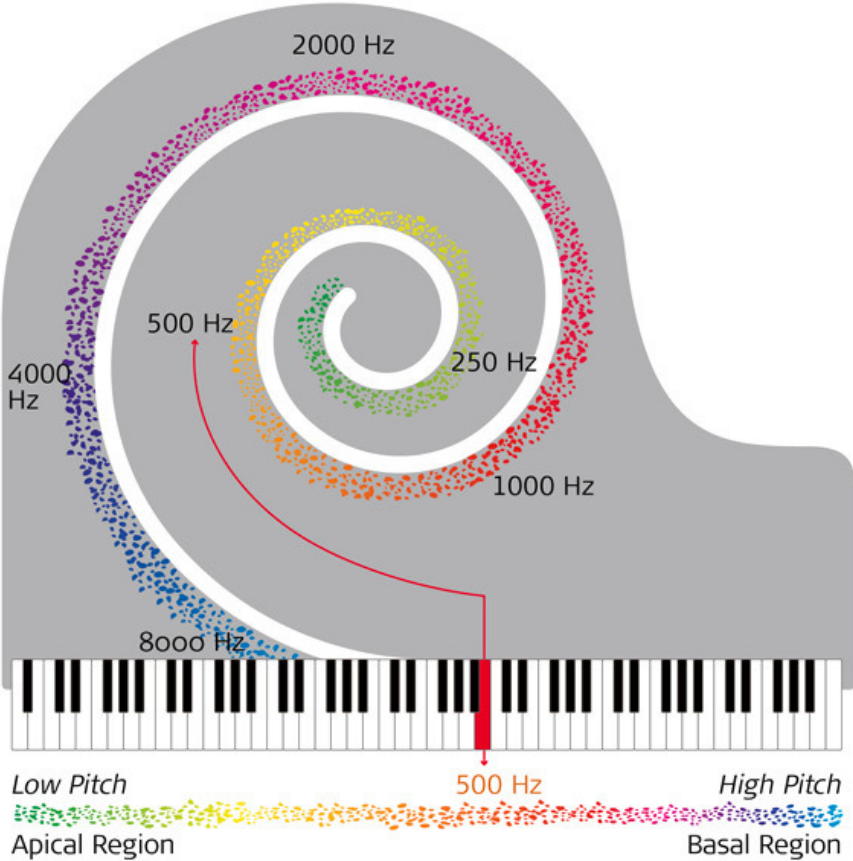
Inner Ear

- Cochlea
- Fluid
- Hairs attached to nerve cells
- Transducer

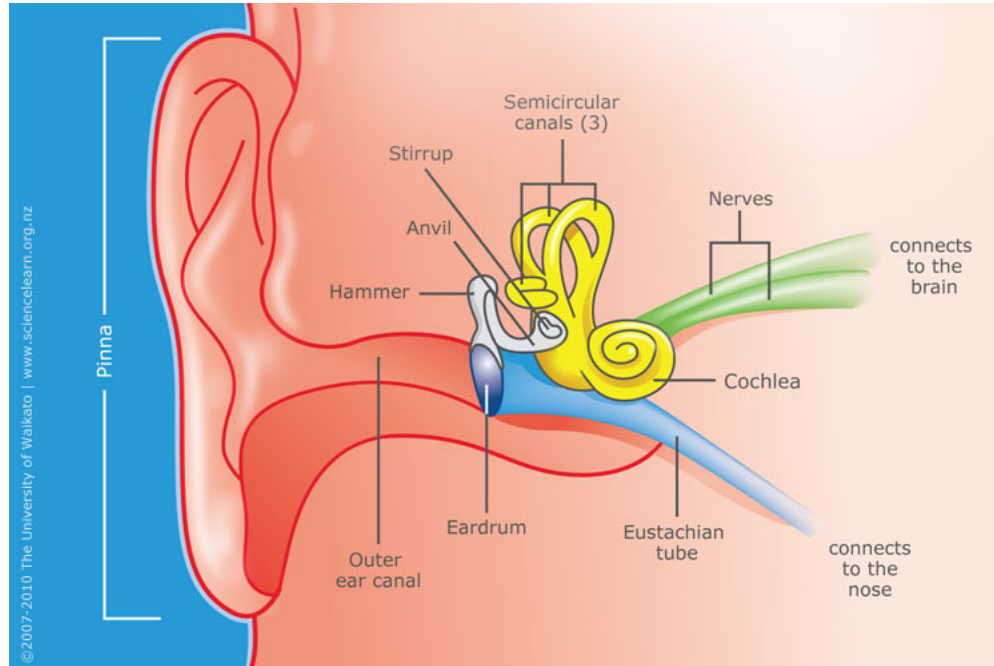
Cochlea



Cochlea



Human Ear



Hearing Loss

- TTS
- Temporary Threshold Shift
- Auditory Fatigue
- Ears stuffed with cotton

- Tinnitus / can foreshadow permanent TTS

Hearing Loss

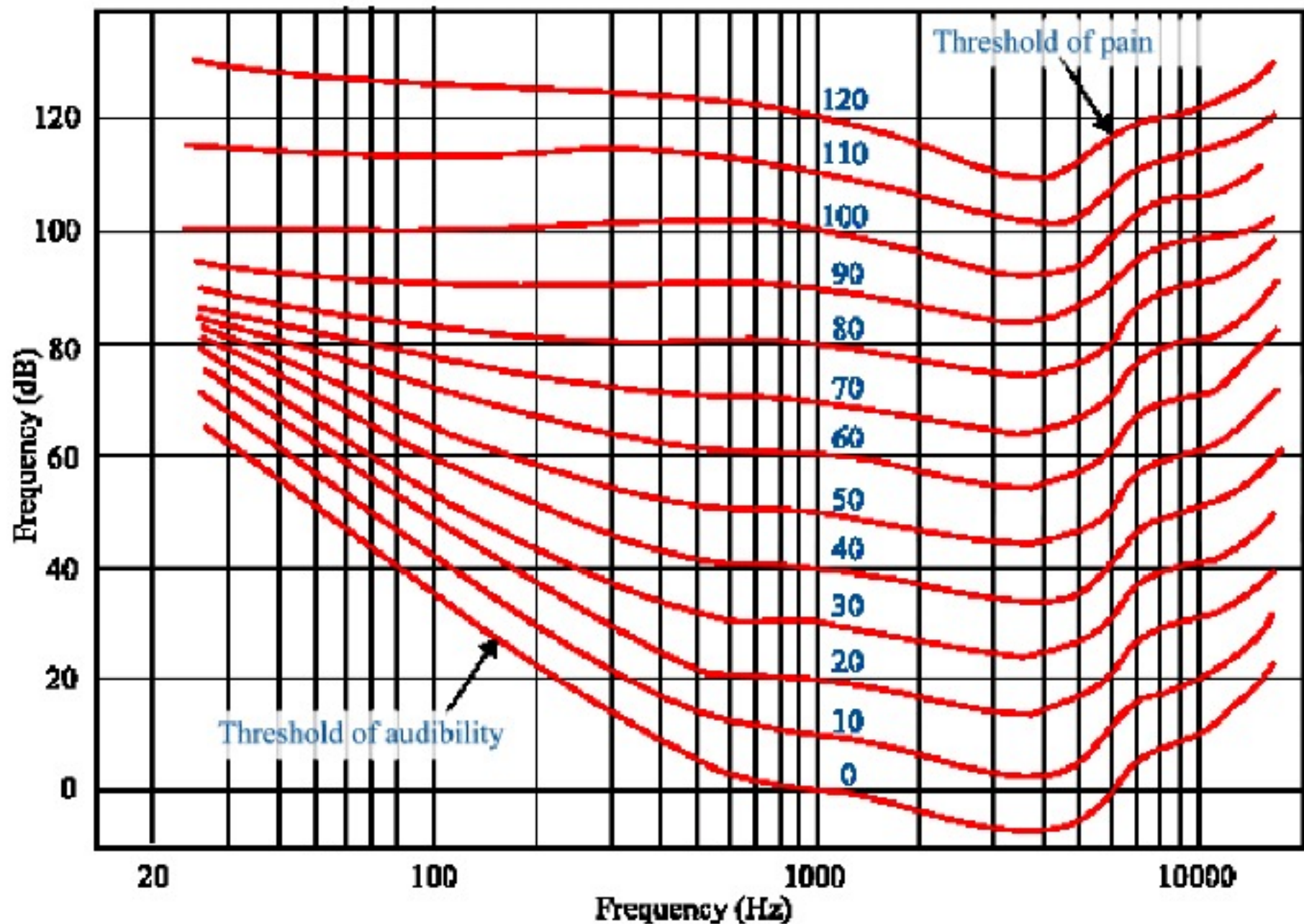
- 2,400 to 4,400 Hz most vulnerable range
- Foam plug
- Musician's plug (Alpine, LiveMusic, Fender, etc.)
- Cotton balls

Etymotic Research Plugs



Frequency and Loudness

- Equal Loudness Principle
- Equal Loudness Effect
- Fletcher-Munson Curve
- Fletcher-Munson Effect
- The softer the sound, the less linear we hear it.
- At low amplitude we hear less bass and treble than we do at higher amplitude.



Impedance

- Ohms
- Ω
- 500 and less = low
- Above 500 = high

Masking

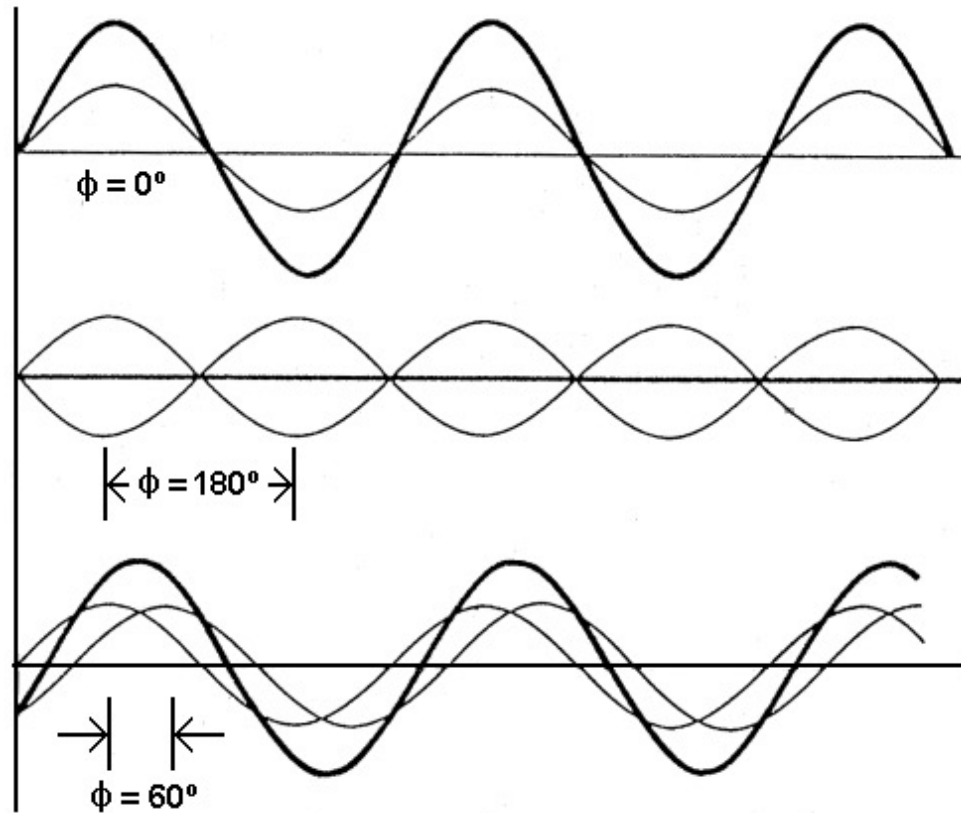
- Amplitude
- Frequency
- Attentive

Velocity

- Sound travels through the air @ 1,130 feet per second @ sea level @ 70 degrees Fahrenheit
- Water = 4,800 feet per second
- Wood = 11,700 feet per second
- Steel = 18,000 feet per second

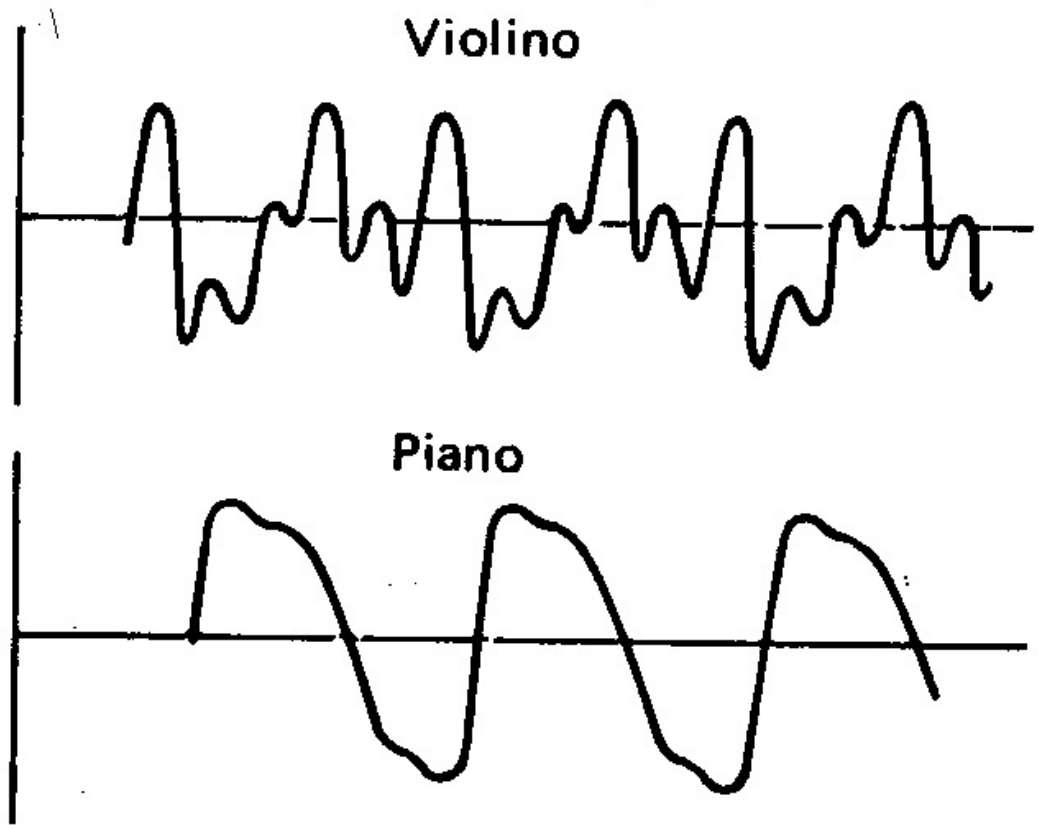
Phase

- Electrical
- Acoustical



Timbre

- Tam burr
- Tone quality



Sound Envelope

- Four Stages (hit gong)
- Attack
- Initial Decay
- Sustain
- Release

