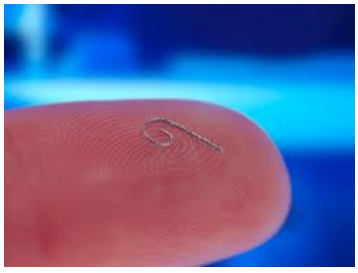
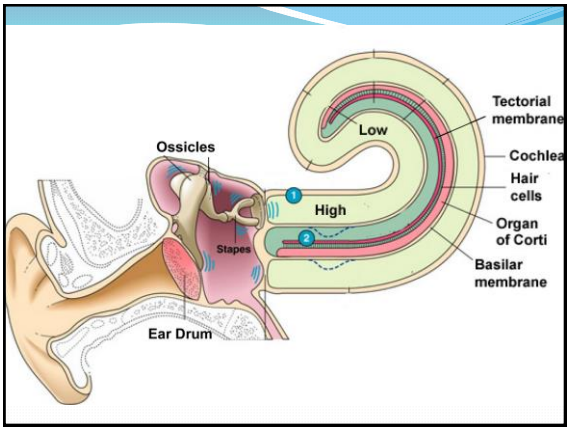
Musicians & Hearing

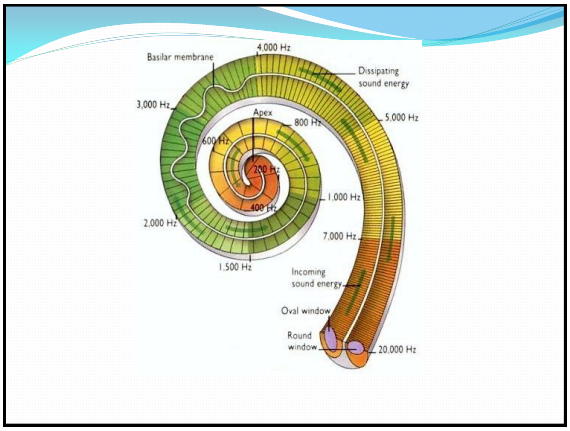
- The hearing mechanism
- Understanding hearing loss
- Noise and hearing loss
- Music and musicians

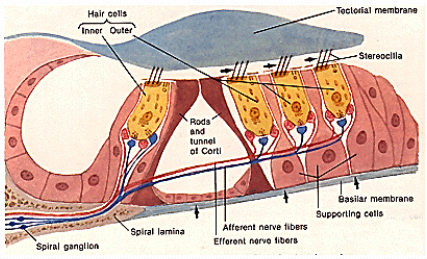
The Hearing Mechanism



- We hear a range of frequencies from 20-20,000 Hz
- And intensities with a range (from softest sound to feeling of pain) of $1\text{-}\ 10^{14}$ or about 140 decibels





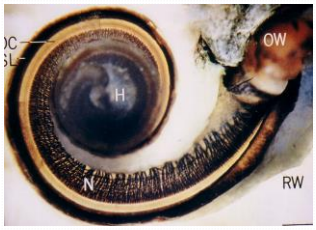


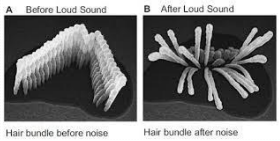
Auditory Transduction

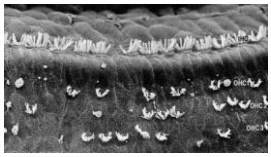
- https://www.youtube.com/watch?v=46aNGGNPm7s

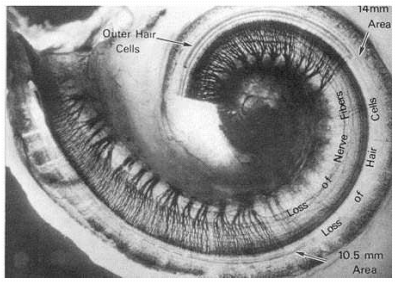
Understanding Hearing Loss

Sound is Pressure

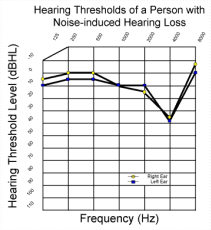








Human Hair Cells Cannot Regenerate



Noise & Hearing Loss

Noise-Induced Hearing Loss

- Occurs slowly over time
- Three stages
  - Damage to outer hair cells
  - Damage to high frequencies first
  - Damage to outer and inner hair cells, affecting speech understanding, beginning with high frequencies and then moving to mid- and lower-frequency sounds

Warning Signs

- Muffling of sound
- Tinnitus

Hearing Loss in Young Adults

- National Health & Nutrition Examination Survey of US adolescents 12-19 years

Survey Results

1988-1994	2005-2006
• 3211 participants	• 2288 participants
• 12.5% had evidence of noise-induced loss	• 16.4% had evidence of noise-induced hearing loss
	• 31% increase!
	• 1 in 5 teens demonstrated a hearing loss!

- Noise-induced hearing loss is PREVENTABLE!

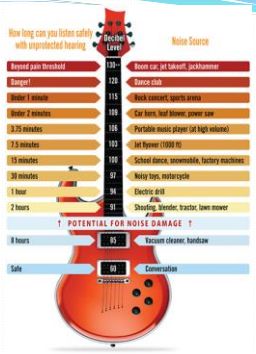
Noise-Induced Hearing Loss

Volume or Intensity

Exposure time

Earphone type

- PMPs
  - Volume levels average 75-105 dBA
  - Levels may exceed 130 dBSPL
- Concerts
  - Levels range from 120-140 dBSPL



Exposure Time

- Time/Intensity tradeoff
- Listening to music at 105 dBSPL for 5 minutes = exposure to industrial noise at 85 dBSPL for 8-hours

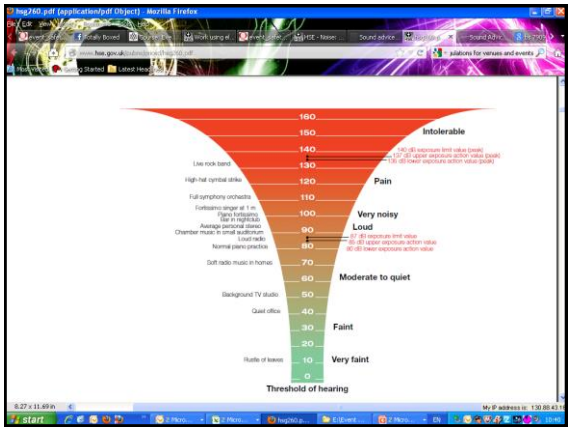
Recommendations for PMPs

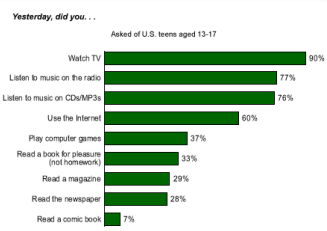
- The 60/60 rule:

Listen at 60% volume for no longer than 60 minutes at a time

- Insert earphones vs. earbuds vs. supra-aural earphones

Music & Musicians





- Music majors more aware of effects of noise on hearing health than non-musicians
- BUT . . . in a recent survey
- Only 22% wore hearing protection when exposed to what they considered to be harmful noise
- 79% never wore hearing protection
- 90% did not wear hearing protection during performances

Why?

- Hearing protection

  - Reduced sound quality
  - Lessened ability to control sound
  - Hindered ability to stay in tune with other performers in an ensemble
  - Produced occlusion effect that made it difficult to listen to sound around them
  - Could not communicate
  - Uncomfortable

Risk of noise-induced hearing loss

- Bassoon, horn, trumpet, trombone, clarinet, and flute players at great risk

- Noise range from 79-99 dBSPL

What's a Musician to do??

- Get a baseline audiogram
  - Pure Tone Audiometry

Otoacoustic Emissions

Hearing Protection

Etymotic transparent hearing protection