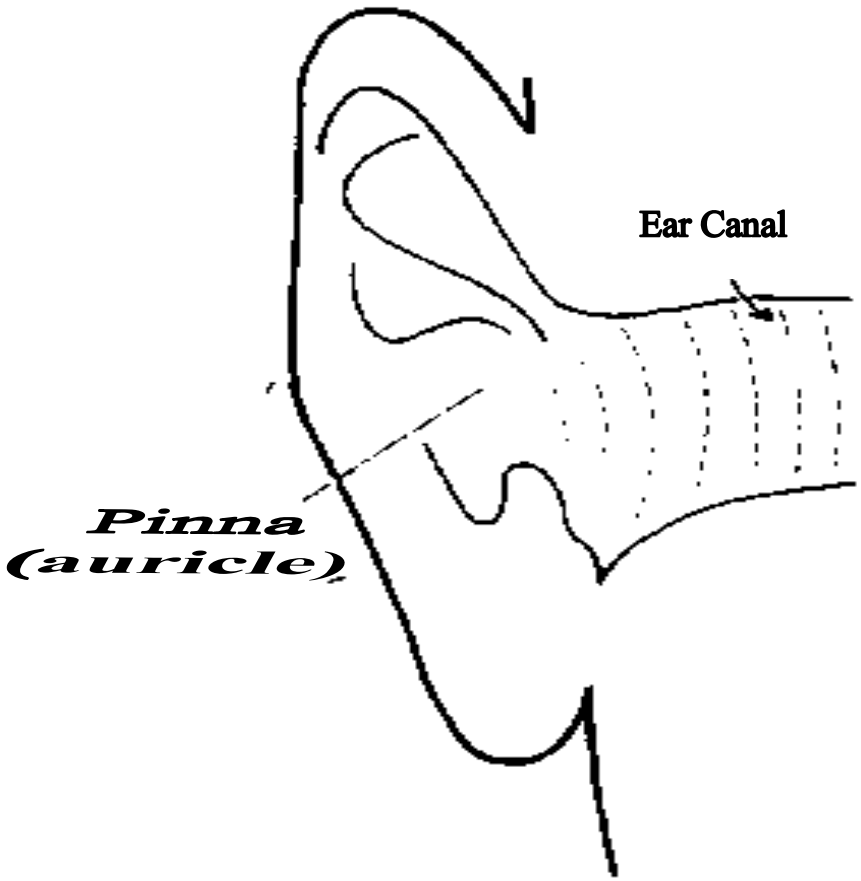
Hearing Conservation

FERMILAB

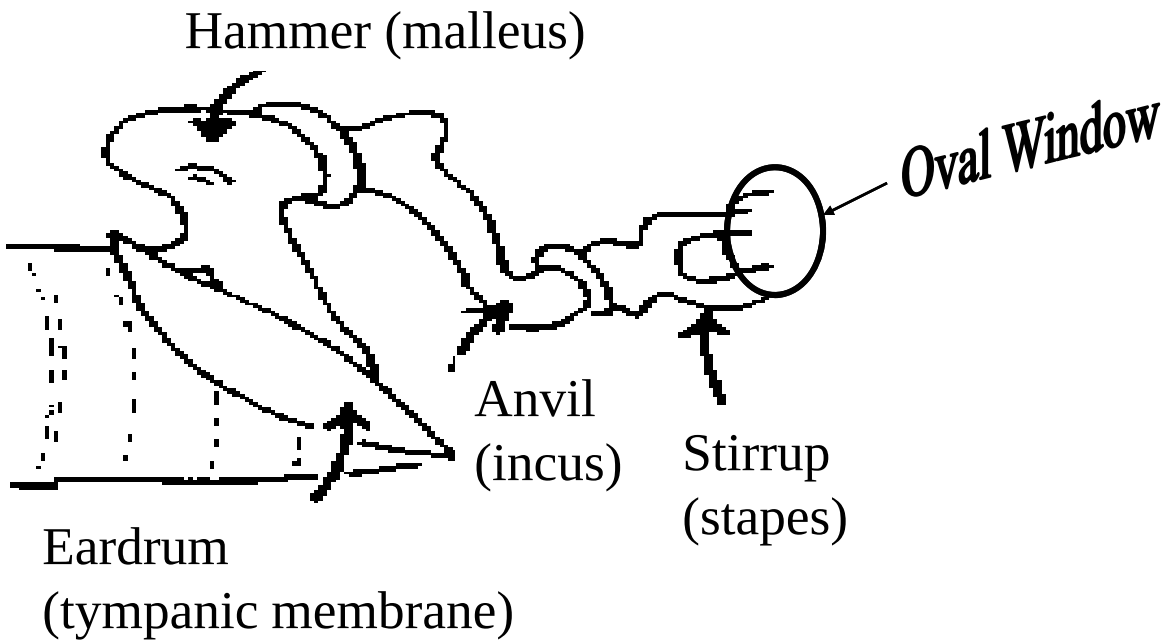
Objectives

- Anatomy and Physiology of the Human Ear
- What is considered hazardous noise
- Sound level measurement
- How noise effects the ability to hear
- The Elements of Fermilab's Hearing Conservation Program
- Ways to protect your hearing
- Q & A

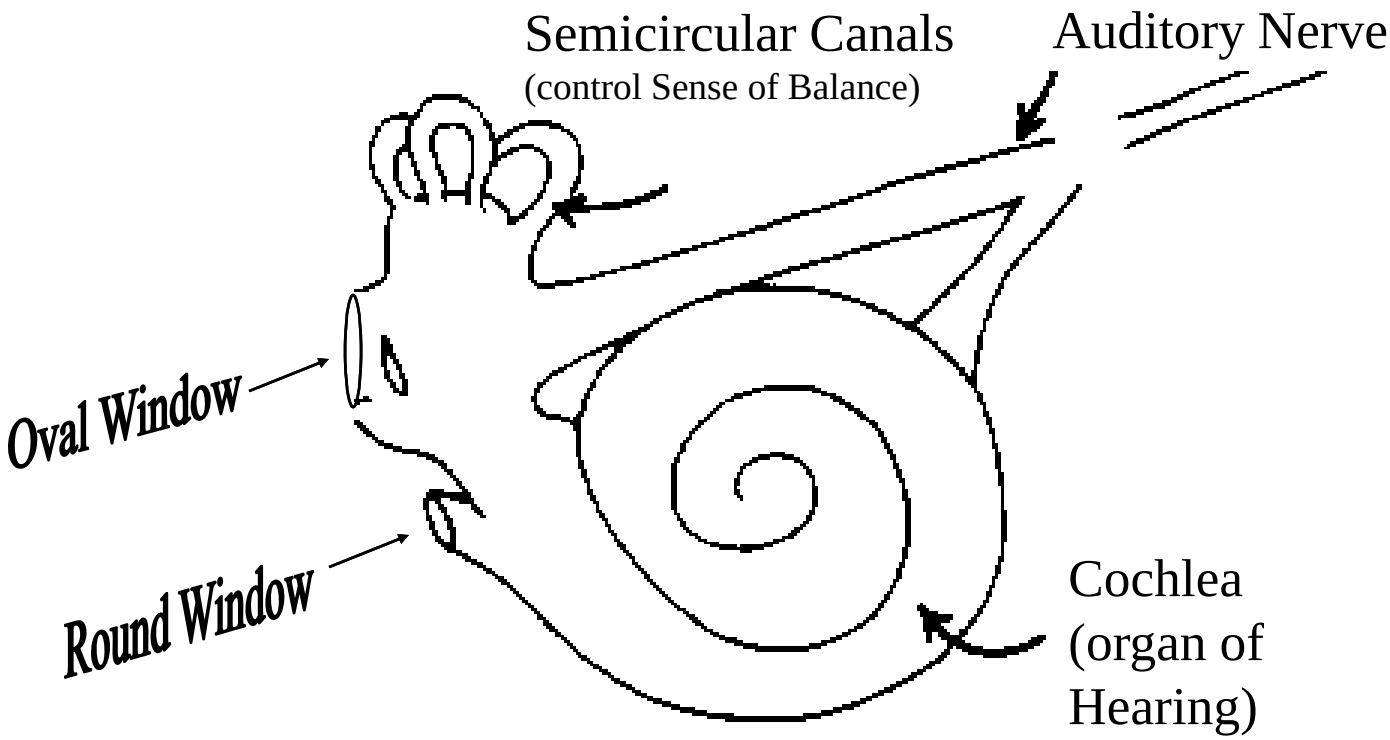
Outer Ear



Middle Ear


Hammer (malleus)
Oval Window
Anvil
(incus)
Stirrup
(stapes)
Eardrum
(tympanic membrane)

Inner Ear


Semicircular Canals
(control Sense of Balance)
Auditory Nerve
Oval Window
Round Window
Cochlea
(organ of
Hearing)

Nerve Cells

Normal

Damaged

Threshold Limit Values for "Continuous" Noise

T, Duration per Day (hours)	SPL Sound Pressure Level (dBA)
24	80
16	82
8	85
4	88
2	91
1	94
½	97
¼	110

Sound level measurement

- Sound level meter (SLM)
- Noise Dosimetry

Typical A Weighted Sound Levels

- 80 Vacuum Cleaner
- 70
- 60 Conversation at 1 m
- 50 Urban Residence
- 40
- 30 Soft Whisper at 2 m / Rice Krispies
- 20 North Rim of Grand Canyon
- 10
- 0 Threshold of Hearing (1000Hz)

Typical A Weighted Sound Levels

- **140** **Threshold of Pain**
- **130**
- **120** **Jet Takeoff at 100 m**
- **110** **Rock Concert**
- **100** **Jackhammer at 15 m**
- **90** **Drilling Concrete**
- **85** **Heavy Truck at 15 m**

Typical A-Weighted Sound Levels

80 TORO Ground Master 72 Riding Mower (87 dBA)

70 Personnel Dosimetry Results {near compressors and performing some grinding operations (73dBA-77 dBA)

IB-1 Shop Area (68dBA-70dBA) During Drilling Operations

60

50

40

30 Lab Audiometric Testing Booth (< 25 dBA)

20

10

Typical A-Weighted Sound Levels

140	Threshold of Pain	
130		
120		
110	Testing of Fire Alarm System in FCC	
100	MRRF - F0 Compressor Room	
	CHL Nitrogen Plant	
90	TORO Grounds Master 322-D Riding Mower	
	TORO TV5004 Master Push Mower	
	CUB	Lab D Compressor Room
	CDF A/C units	CHL Chiller Room

Time Weighted Average Exposure (dBA)	Employee Population Experiencing Hearing Loss (%)
< 80	0
80	5
85	10
90	20
100	~100
>100	100

Effects of Hearing Loss

- Everybody Mumbling
- Communication with people
- Tinnitus

The 4 P's of Hearing Loss

- **Progressive**
- **Painless**
- **Permanent**
- **Preventable**

Fermilab Hearing Conservation

- Annual Training
- Annual Audiometric Testing
  - Baseline Hearing Test
  - Annual Hearing Test
  - Medical Department
- Accessibility to Hearing Protection
- Sound Level Measurements/Audiodosimetry

Hearing Protection Devices (HPD)

- Ear Muffs
- Ear Plugs
  - Pinna Pull
  - Roll and Fit
- Occlusion Effect
- Hear better in louder environments

Q & A

- **How can I tell when a noise may be harmful to my ears?**
- **I don’t need hearing protection, I am used to the noise!**
- **Do earmuffs block out noise better than earplugs?**

Q & A

- **I've already lost some or most of my hearing: why should I have to wear hearing protection?**
- **What is the Noise Reduction Rating and what does it mean?**

Summary

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