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# Hearing Conservation



**FERMILAB**

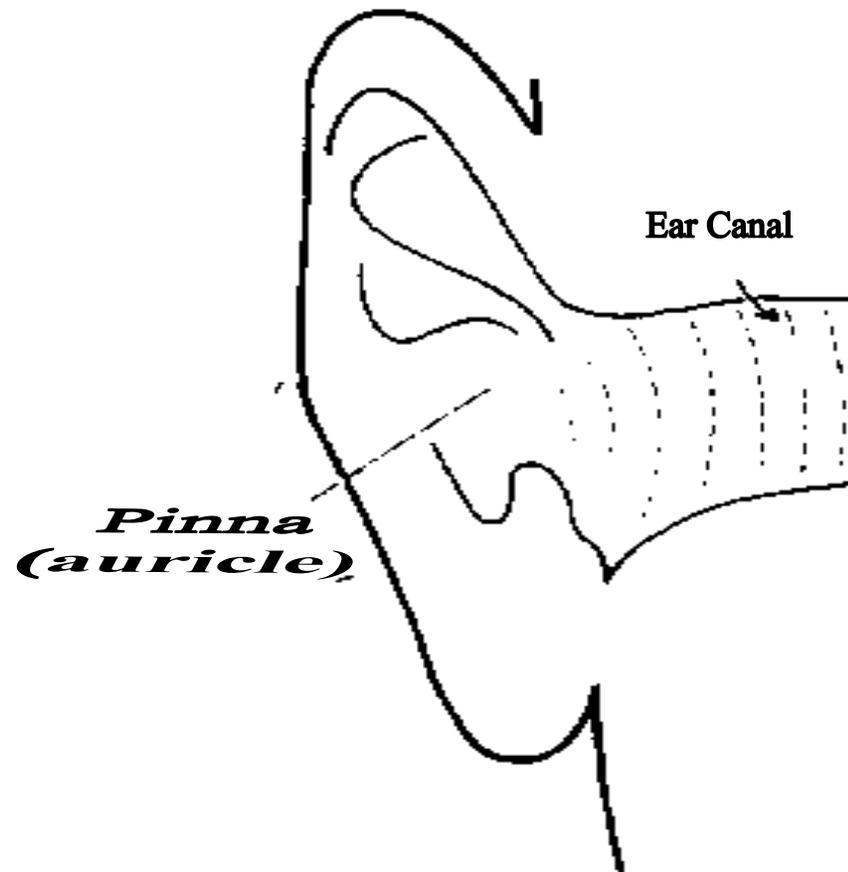
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# Objectives

- 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

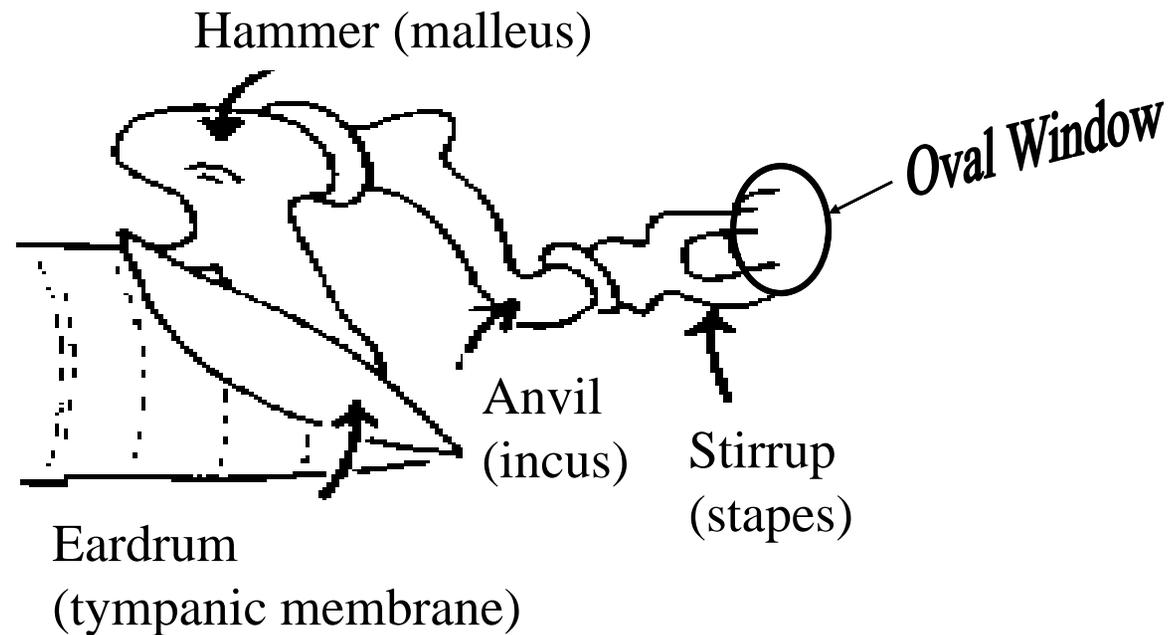
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# Outer Ear



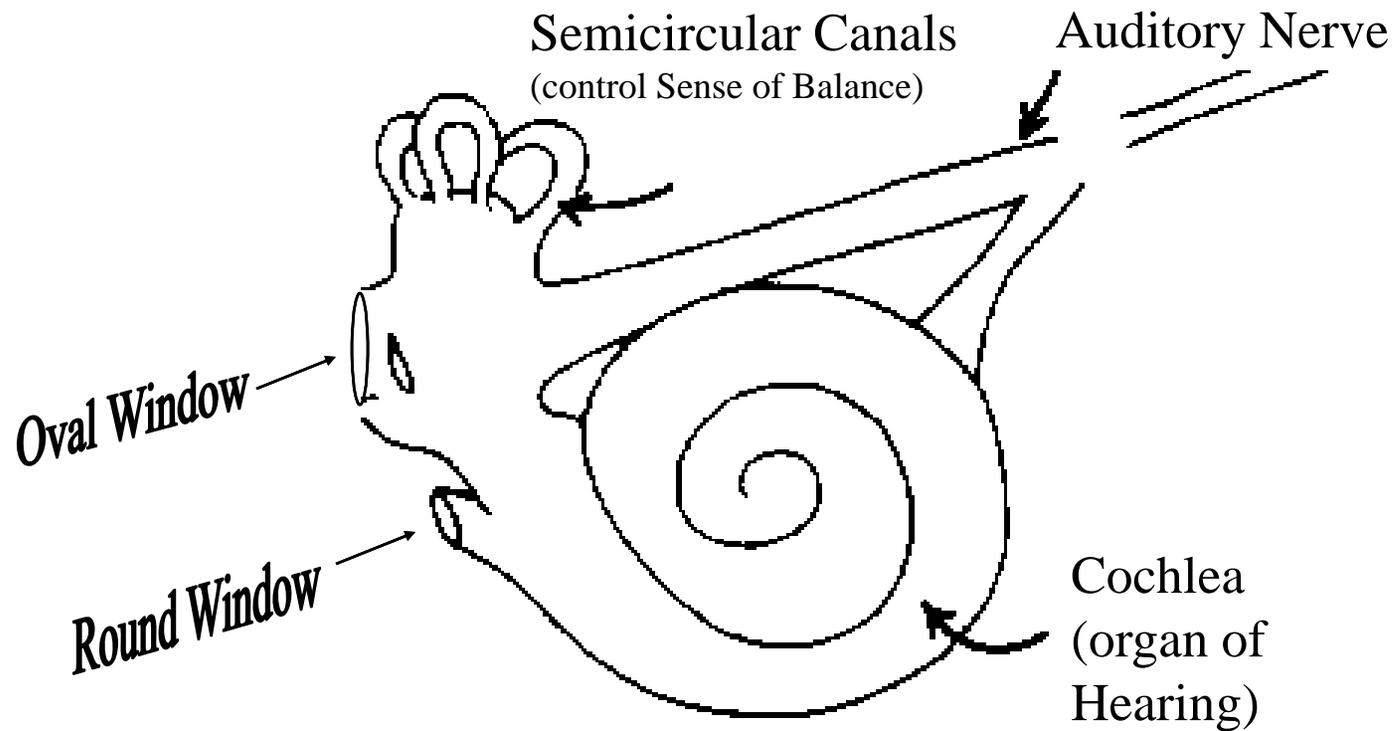
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# Middle Ear



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# Inner Ear



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# 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
1/2	97
1/4	100

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# Sound level measurement

- Sound level meter (SLM)
- Noise Dosimetry

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# 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)**

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# 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**

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# 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	

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# 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

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**Time Weighted  
Average  
Exposure (dBA)**

**Employee Population  
Experiencing  
Hearing Loss (%)**

<b>&lt; 80</b>	<b>0</b>
<b>80</b>	<b>5</b>
<b>85</b>	<b>10</b>
<b>90</b>	<b>20</b>
<b>100</b>	<b>~100</b>
<b>&gt;100</b>	<b>100</b>

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# Effects of Hearing Loss

- Everybody Mumbling
- Communication with people
- Tinnitus

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# The 4 P's of Hearing Loss

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

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# Fermilab Hearing Conservation

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

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# Hearing Protection Devices (HPD)

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

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# 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?**

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# 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?**

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