INTRODUCTION TO AUDIOLOGY

Hearing – Balance – Tinnitus - Treatment
Audiology refers to the
“SCIENCE OF HEARING AND THE STUDY OF
THE AUDITORY PROCESS” (Katz, 1986)

Audiology is a health-care profession
devoted to the study of hearing and
hearing related disorders
What is an Audiologist?

An Audiologist is a health care professional who provides comprehensive diagnostic and rehabilitation services for all areas of auditory, vestibular, and related disorders.
The Auditory System

- Hearing has both protective and communication functions
- High sensitivity to loudness and pitch
- Range of human hearing is from 20-20,000 Hz
- Range of human speech is from 125-8,000 Hz

- **Outer ear** – Pinna, Ear Canal
- **Middle ear** – Tympanic Membrane, Ossicles, Eustachian tube
The Auditory System continued

- Inner Ear – cochlea, hair cells, vestibular system
- Central Auditory pathway – cranial nerve VIII, up to the temporal lobe

http://www.youtube.com/watch?v=dyenMluFaUw
http://www.youtube.com/watch?v=Xo9bwQuYrRo&feature=related
http://www.youtube.com/watch?v=stiPMLtjYAw
Hearing and Hearing Loss
Do you know?

There are more than **48 million people in the US** with some form of hearing loss – that’s one in five of us.

That number **rises to one in three** past the age of 65.

New hearing aid technology **can provide unique solutions** to meet each individual’s lifestyle needs.

*Source: Hearing Loss Association of America* - [http://www.hearingloss.org/content/basic-facts-about-hearing-loss](http://www.hearingloss.org/content/basic-facts-about-hearing-loss)
It's windy today!

No, it's Thursday!

So am I!

Let's have a beer!
How our ears work

- External Auditory Canal
- Malleus
- Incus
- Stapes
- Eardrum
- Semicircular Canals
- Vestibular Nerve
- Cochlear Nerve
- Cochlea
- Eustachian Tube

Outer Ear
Middle Ear
Inner Ear
Types of hearing loss

- **Conductive**
- **Sensorineural**
Common causes of hearing loss

<table>
<thead>
<tr>
<th>Medically Treatable (Conductive)</th>
<th>Non-Medically Treatable (Sensorineural)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earwax build-up</td>
<td>Excessive noise exposure</td>
</tr>
<tr>
<td>Ear infection</td>
<td>Genetics</td>
</tr>
<tr>
<td>Ruptured eardrum</td>
<td>Medicines and illness</td>
</tr>
<tr>
<td>Degree of Hearing Loss</td>
<td>Hearing Loss Range</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Normal Range</td>
<td>-10 dB to 15 dB</td>
</tr>
<tr>
<td>Slight Loss</td>
<td>16 dB to 25 dB</td>
</tr>
<tr>
<td>Mild Loss</td>
<td>26 dB to 40 dB</td>
</tr>
<tr>
<td>Moderate Loss</td>
<td>41 dB to 55 dB</td>
</tr>
<tr>
<td>Moderate – Severe Loss</td>
<td>56 dB to 70 dB</td>
</tr>
<tr>
<td>Severe Loss</td>
<td>71 dB to 90 dB</td>
</tr>
<tr>
<td>Profound Loss</td>
<td>91 dB or more</td>
</tr>
</tbody>
</table>
Hearing loss and dementia

• Hearing loss can lead to depression, isolation, withdrawal, loneliness, anxiety and other social and emotional problems.

• Johns Hopkins study – indicated a link between untreated hearing loss and cognitive problems including dementia.

• The study found that when compared with normal hearing:

  – Those with mild loss were 3 times as likely to develop dementia
  
  – Those with a severe loss were 5 times as likely to develop the condition
  
  – And, for every 10 decibels of hearing loss, the risk of developing dementia grew by 20%
Tinnitus (definition):

- Perception of sound in the absence of an external source
- Most commonly: Ringing, buzzing, chirping, hissing, music etc.

- Affects 1 in 5 people
- Mainly those aged over 40
Causes, triggers and treatments

Causes:
• Hearing loss (most common)
• Exposure to loud noise
• Injury to the ear
• Earwax
• Circulatory changes
• Etc., etc., etc...

Triggers:
• Caffeine
• Tobacco
• Salt
• Medication
• Alcohol
• Stress
• Fatigue

Treatment Options
• No cure
• Management is possible:
  • Habituation Techniques
  • Sound Therapy (hearing aids)
  • New hearings aids have tinnitus maskers built into the software that be turned on and off.
Do I need a hearing test?

1. Have you noticed that you **don’t hear as well** as you used to?

2. Does your family tell you that you **turn up the volume** of the **television or radio** very loudly?

3. When you’re talking to someone, do you have to ask the person to **repeat what they’re saying** various times?

4. Can you hear when someone is speaking to you in a **noisy setting such as a pub or restaurant**?

5. Can you hold a **conversation in a group setting** when several people are speaking at the same time?

6. Are you **over 60** and have **never had a hearing test**?

If you answered **YES** to most of these questions then you could benefit from getting your hearing checked.
What to expect from a hearing test

- Case History
- Otoscopic Examination
- Audiological Evaluation
- Lifestyle Assessment
- Treatment Options
Hear Tomorrow

Protecting and Conserving Your Hearing
Noise Exposure

Safe listening levels depend on the intensity (loudness), duration (length of time) and frequency (how often) of the exposure.

The daily recommended safe volume level is below 85 dB for duration of a maximum of eight hours.

Sounds may be too loud if:

People must raise their voice to make themselves understood to a listener

It is difficult for the listener to understand someone who is an arm’s length away

Listeners develop pain or a ringing sensation in their ear(s)
### Continuous dB vs. Permissible Exposure Time

<table>
<thead>
<tr>
<th>Continuous dB</th>
<th>Permissible Exposure Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>85 dB</td>
<td>8 Hours</td>
</tr>
<tr>
<td>88 dB</td>
<td>4 hours</td>
</tr>
<tr>
<td>91 dB</td>
<td>2 hours</td>
</tr>
<tr>
<td>94 dB</td>
<td>1 hour</td>
</tr>
<tr>
<td>97 dB</td>
<td>30 minutes</td>
</tr>
<tr>
<td>100 dB</td>
<td>15 minutes</td>
</tr>
<tr>
<td>103 dB</td>
<td>7.5 minutes</td>
</tr>
<tr>
<td>106 dB</td>
<td>3.75 minutes (&lt; 4 min)</td>
</tr>
<tr>
<td>109 dB</td>
<td>1.875 minutes (&lt; 2 min)</td>
</tr>
<tr>
<td>112 dB</td>
<td>.9375 min (~ 1 min)</td>
</tr>
<tr>
<td>115 dB</td>
<td>.46875 min (~ 30 sec)</td>
</tr>
</tbody>
</table>

**Sound Levels:**
- Softest sound you can hear: 0 dB
- Rocket launch: 165 dB
- 12-gauge shotgun: 155 dB
- Fireworks gun shot: 145 dB
- Jet plane (from 100 ft.): 135 dB
- Ambulance jack hammer: 125 dB
- Leaf blower, rock concert, chainsaw: 115 dB
- Walkman, tractor: 105 dB
- Gas mower, hair dryer: 95 dB
- Busy city traffic, washing machine: 75 dB
- Typical speech: 65 dB
- Rainfall: 55 dB
- Whisper: 45 dB
Earbuds / Headphones

Some mobile phones / personal audio devices are capable of producing volume up to 120 dB

Use the 60:60 rule
Listen to your music at 60% of the maximum volume for no more than 60 minutes a day

Choose noise-cancelling headphones
These block out background noise and allow you to have the volume lower

Key Facts
1.1 Billion young people worldwide are at risk of hearing loss due to unsafe listening practices
Among people 12-35 years in middle to high income countries 50% listen to unsafe levels of sound through personal audio devices
Noise-induced hearing loss is the most common permanent and preventable occupational injury in the world.

*World Health Organization*
Noise Induced Hearing Loss

1. Causes no pain
2. Causes no visible trauma
3. Leaves no visible scars
4. Is unnoticeable in its earliest stages
5. Accumulates with each overexposure
6. Takes years to notice a change

Is Permanent and 100% Preventable.
Hearing Protection

Foam Earplugs

**Advantages:**
- Inexpensive; disposable
- Small and easily carried
- Can be used under earmuffs
- Convenient for use in confined work areas

**Disadvantages:**
- Can be difficult to place or remove
- Improper insertion is common and lowers noise reduction effectiveness
Hearing Protection

Custom Earplugs

**Advantages:**
- Custom fit for each individual
- Correct insertion is more easily accomplished
- Small and easily carried
- Most comfortable for long-term use
- Can be used under earmuffs
- Convenient for use in confined work areas

**Disadvantages:**
- Higher short term cost as compared to foam earplugs
### Hearing Protection

#### Ear Muffs

<table>
<thead>
<tr>
<th>Advantages:</th>
<th>Disadvantages:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Durable, long lasting and reusable</td>
<td>• Higher cost</td>
</tr>
<tr>
<td>• Correct insertion is more easily accomplished</td>
<td>• Eyeglasses can interfere with ear muff seal</td>
</tr>
<tr>
<td>• Most comfortable for long-term use</td>
<td>• Can be uncomfortable in hot environments</td>
</tr>
<tr>
<td>• Can be used under earmuffs</td>
<td></td>
</tr>
<tr>
<td>• Convenient for use in confined work areas</td>
<td></td>
</tr>
</tbody>
</table>
How do hearing aids work?

The Microphones

The Battery

The Speaker

The Microchip & Amplifier (inside)

Manual Program Change

Styles of hearing aids

IIC (invisible-in-the-canal)
CIC (completely-in-the-canal)
ITC (in-the-canal)
ITE (in-the-ear)
RIC (receiver-in-the-canal)
BTE (behind-the-ear)
Super Power
More about hearing aids

• Many manufacturers
• One hearing aid or Two?
• Unilateral hearing loss
  • Cros/Bi-Cros
  • BAHA
• Analog vs. Digital
• Directional microphones
• Automatic

• **Accessories**: Cell phones, television, music, remote microphone, remote control, induction loop, infrared
Cochlear Implants

- **External Parts**
  - Microphone
  - Speech Processor
  - Transmitter

- **Internal Parts**
  - Receiver
  - Electrode Array

- **3 Manufacturers**
  - Cochlear
  - Advanced Bionics
  - Med-El
1. Microphones on the sound processor pick up sounds and the processor converts them into digital information.

2. This information is transferred through the coil to the implant just under the skin.

3. The implant sends electrical signals down the electrode into the cochlea.

4. The hearing nerve fibers in the cochlea pick up the signals and send them to the brain, giving the sensation of sound.
More about hearing aids


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

- https://www.youtube.com/watch?v=z8jJt2GOqHE
Any Questions?
Thank you