

# INTRODUCTION TO AUDIOLOGY

## Hearing – Balance – Tinnitus - Treatment



# What is Audiology?

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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?

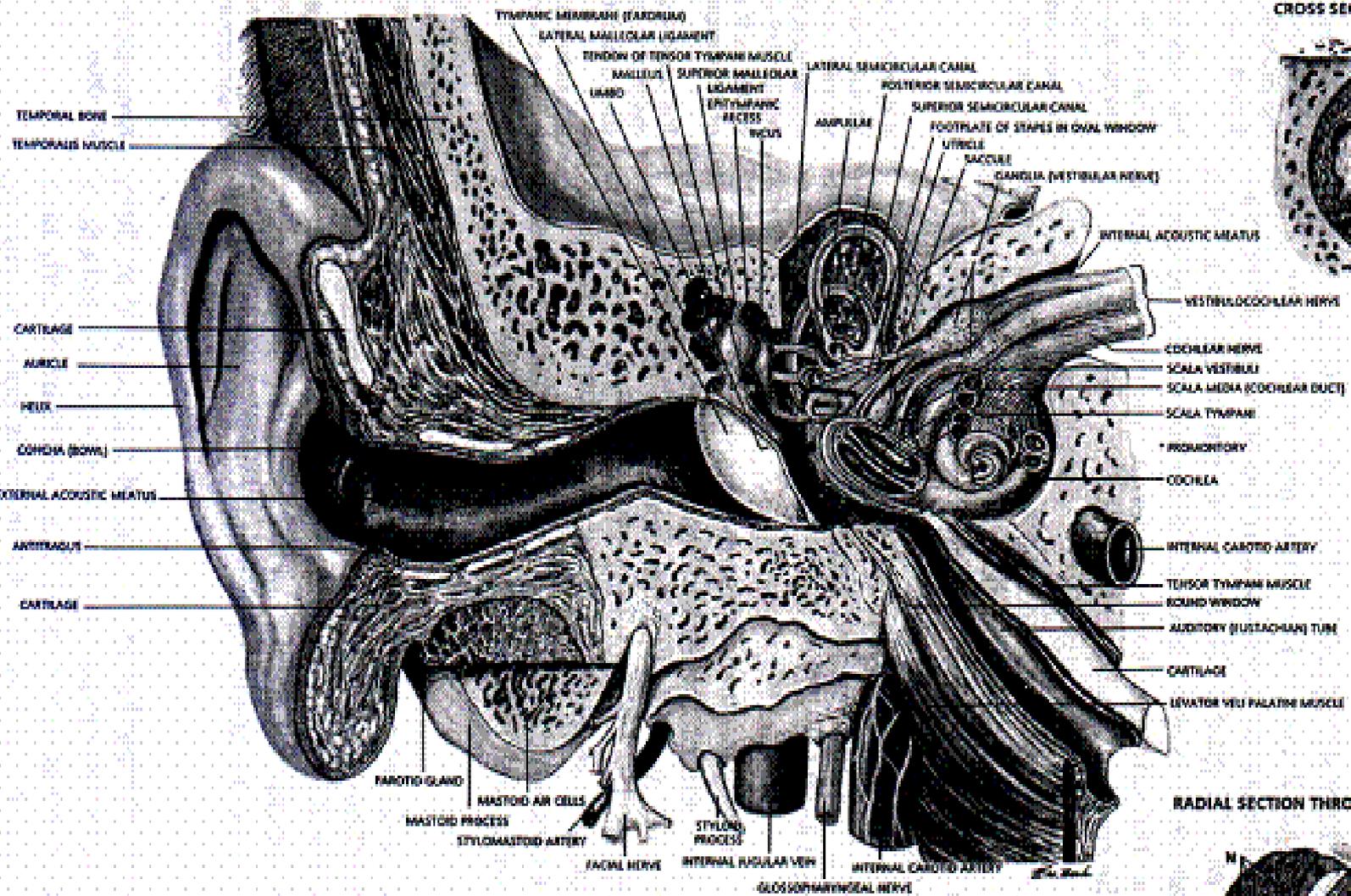
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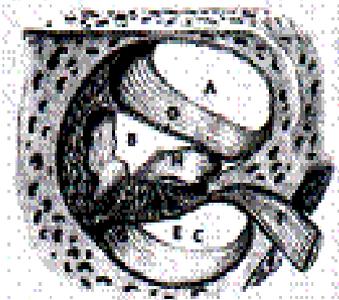
An Audiologist is a health care professional who provides comprehensive diagnostic and rehabilitation services for all areas of auditory, vestibular, and related disorders.



# ANATOMY OF THE HUMAN EAR



CROSS SECTION OF THE COCHLEA



- A - SCALA VESTIBULI
- B - COCHLEAR DUCT
- C - SCALA TYMPANI
- D - STRIA VASCULARIS
- E - BASILAR MEMBRANE
- F - COCHLEAR NERVE
- G - ORGAN OF CORTI (DETAILS BELOW)
- H - TECTORIAL MEMBRANE
- I - SPIRAL LIGAMENT
- J - CELLS OF SOSTERICH
- K - ARCULATE ZONE
- L - PECTINATE ZONE
- M - CELLS OF DEITERS
- N - CELLS OF HENNE
- O - BOSSWORTH'S MEMBRANE
- P - BASILAR MEMBRANE
- Q - OUTER HAIR CELLS
- R - INNER HAIR CELL
- S - RETICULAR LAMINA

RADIAL SECTION THROUGH ORGAN OF CORTI

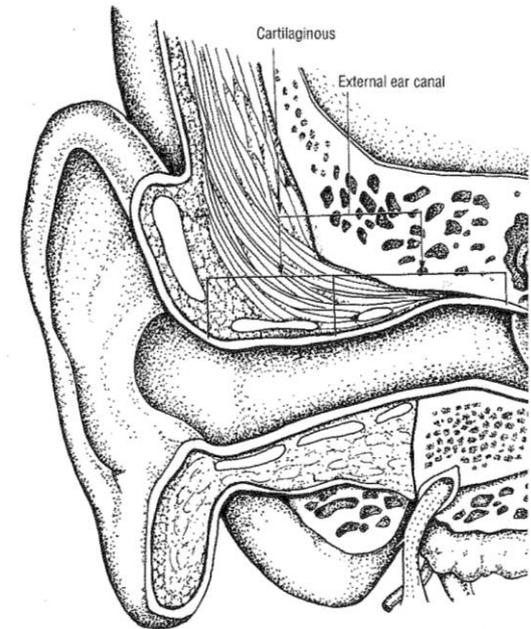


Artwork by STEWART W. BRUCE

# The Auditory System



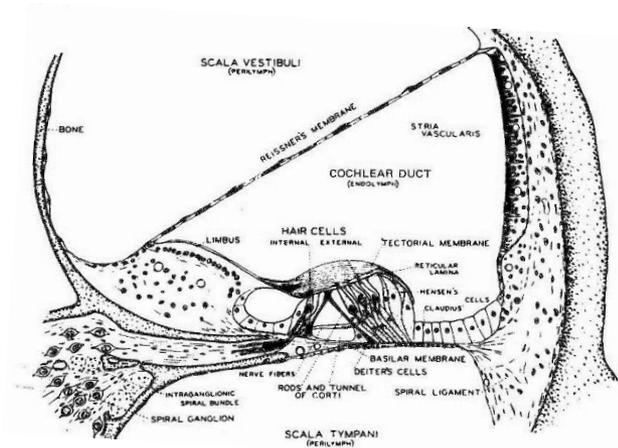
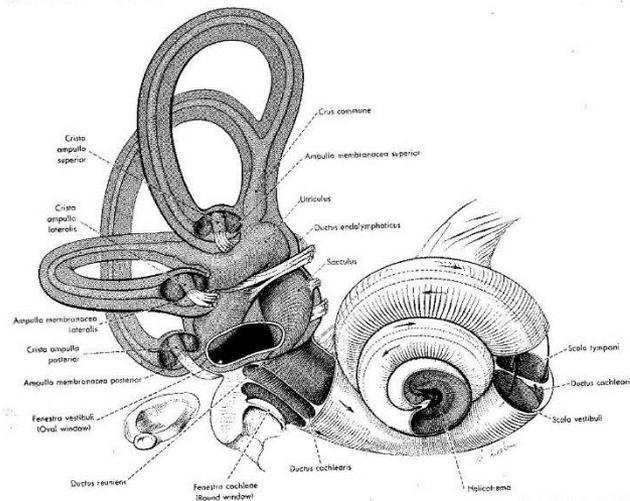
- Hearing has both protective and communication functions
- High sensitivity to loudness and pitch
- Range of human hearing is from 20-20,000 Hz
- Range of human speech is from 125-8,000 Hz
- **Outer ear – Pinna, Ear Canal**
- **Middle ear – Tympanic Membrane, Ossicles, Eustachian tube**



# 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



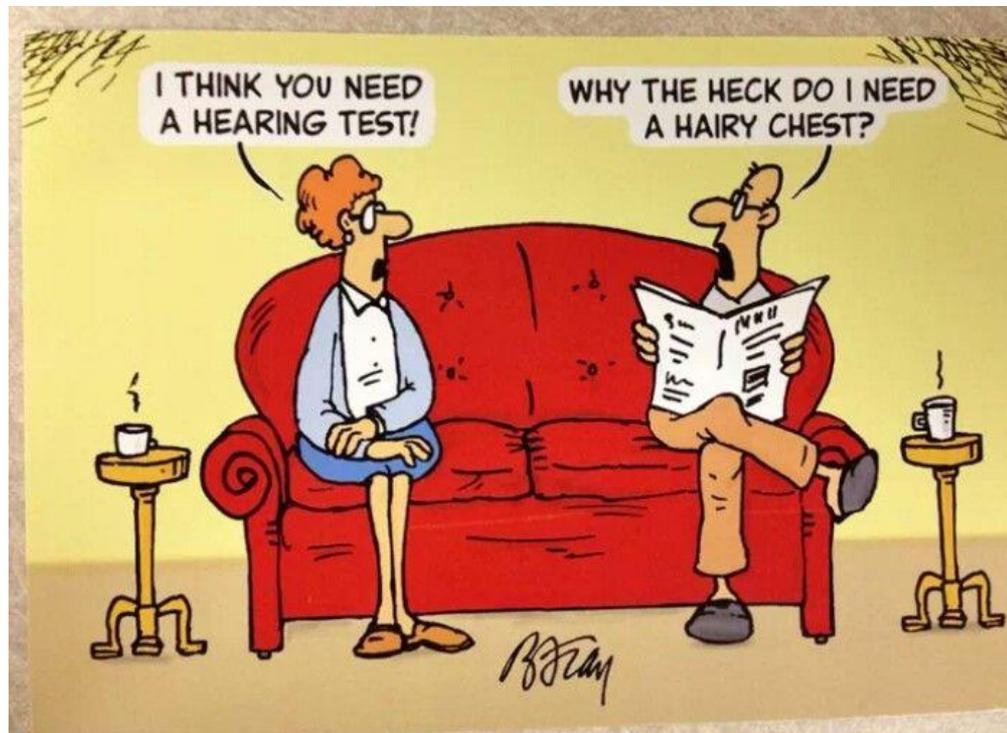
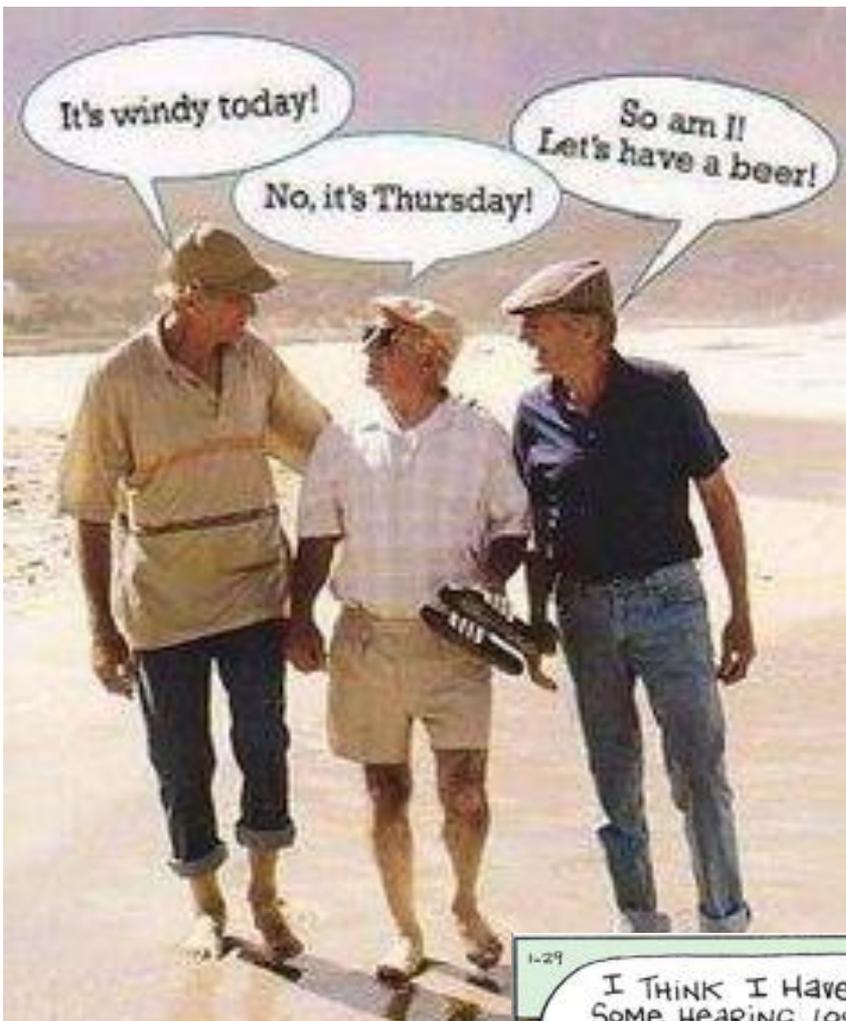
# Do you know?



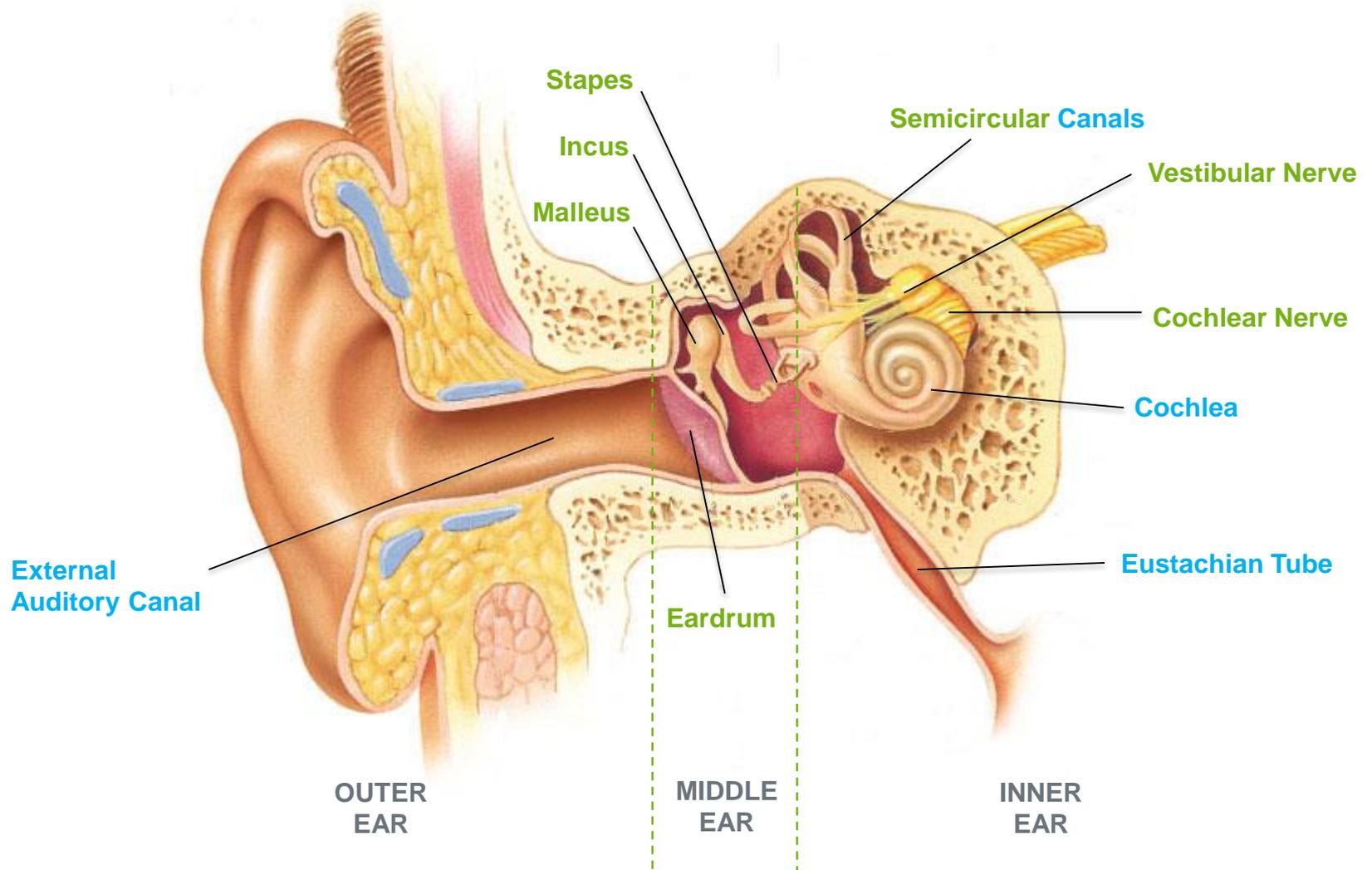
There are more than **48 million people in the US** with some form of hearing loss – that's one in five of us.

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

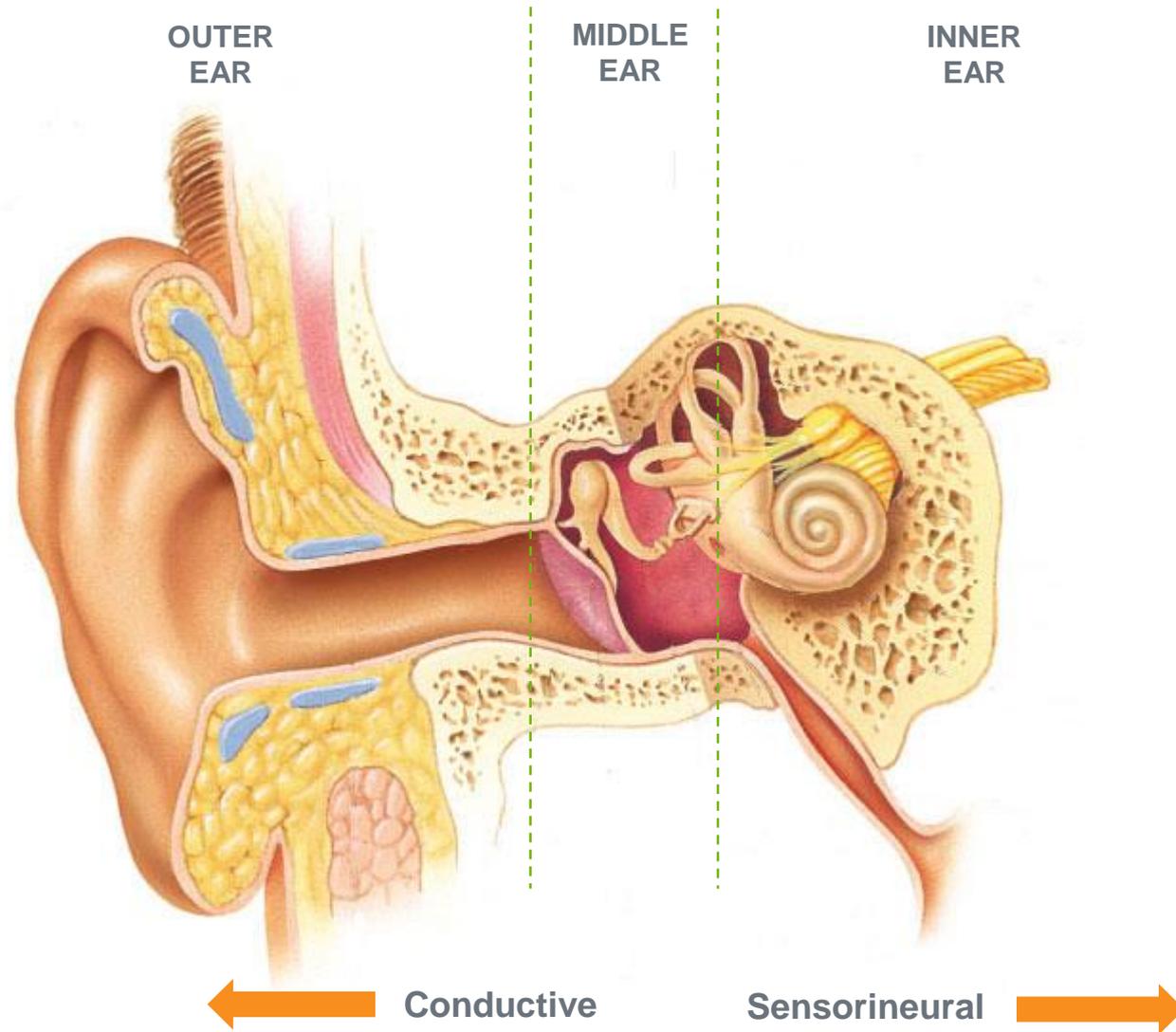
New hearing aid technology **can provide unique solutions** to meet each individual's lifestyle needs.



# How our ears work



# Types of hearing loss



# Common causes of hearing loss

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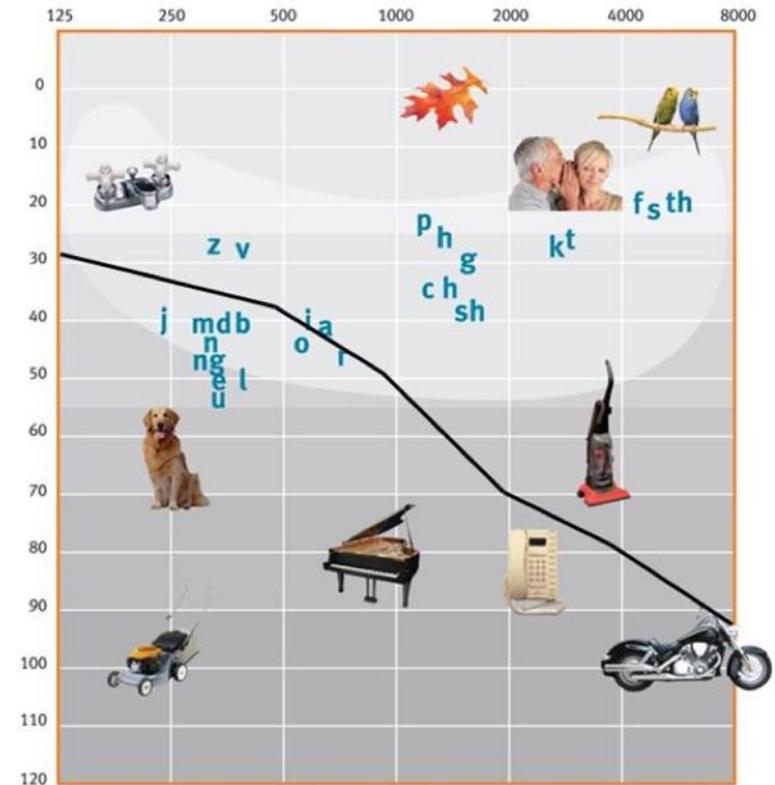


Medically Treatable (Conductive)	Non-Medically Treatable (Sensorineural)
Earwax build-up	Excessive noise exposure
Ear infection	Genetics
Ruptured eardrum	Medicines and illness

# Audiogram explanation



Degree of Hearing Loss	Hearing Loss Range
Normal Range	-10 dB to 15 dB
Slight Loss	16 dB to 25 dB
Mild Loss	26 dB to 40 dB
Moderate Loss	41 dB to 55 dB
Moderate – Severe Loss	56 dB to 70 dB
Severe Loss	71 dB to 90 dB
Profound Loss	91 dB or more



# Hearing loss and dementia

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- 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

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## Tinnitus (definition):

- Perception of sound in the absence of an external source
  - **Most commonly:** Ringing, buzzing, chirping, hissing, music etc.
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- Affects **1 in 5** people
- Mainly those aged **over 40**

# Causes, triggers and treatments

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## 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 hearing aids have tinnitus maskers built into the software that be turned on and off.

# Do I need a hearing test?

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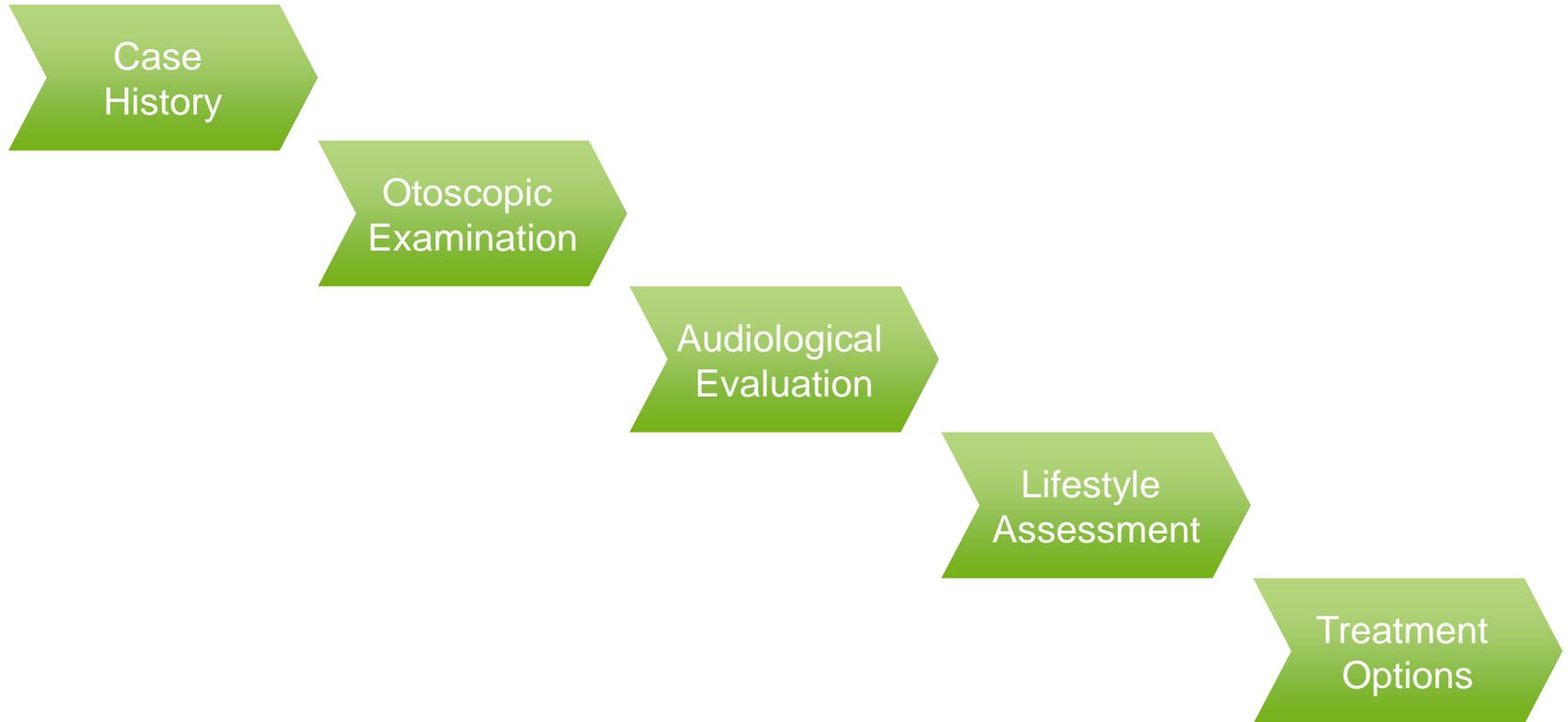


1. Have you noticed that you **don't hear as well** as you used to?
2. Does your family tell you that you **turn up the volume** of the **television or radio** very loudly?
3. When you're talking to someone, do you have to ask the person to **repeat what they're saying** various times?
4. Can you hear 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

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# Hear Tomorrow

Protecting and Conserving Your Hearing

# Noise Exposure

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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

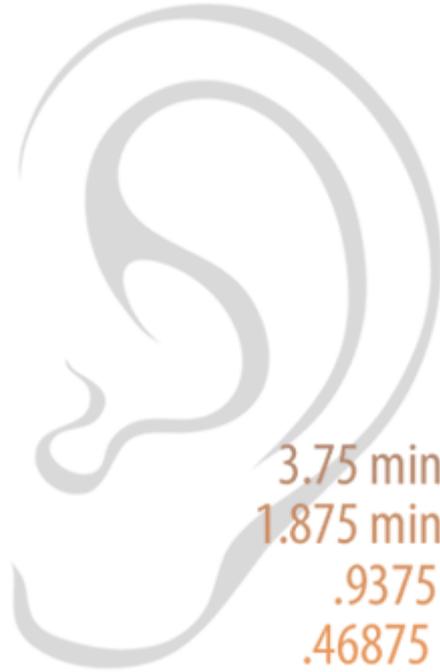
It is difficult for the listener to understand someone who is an arm's length away

Listeners develop pain or a ringing sensation in their ear(s)

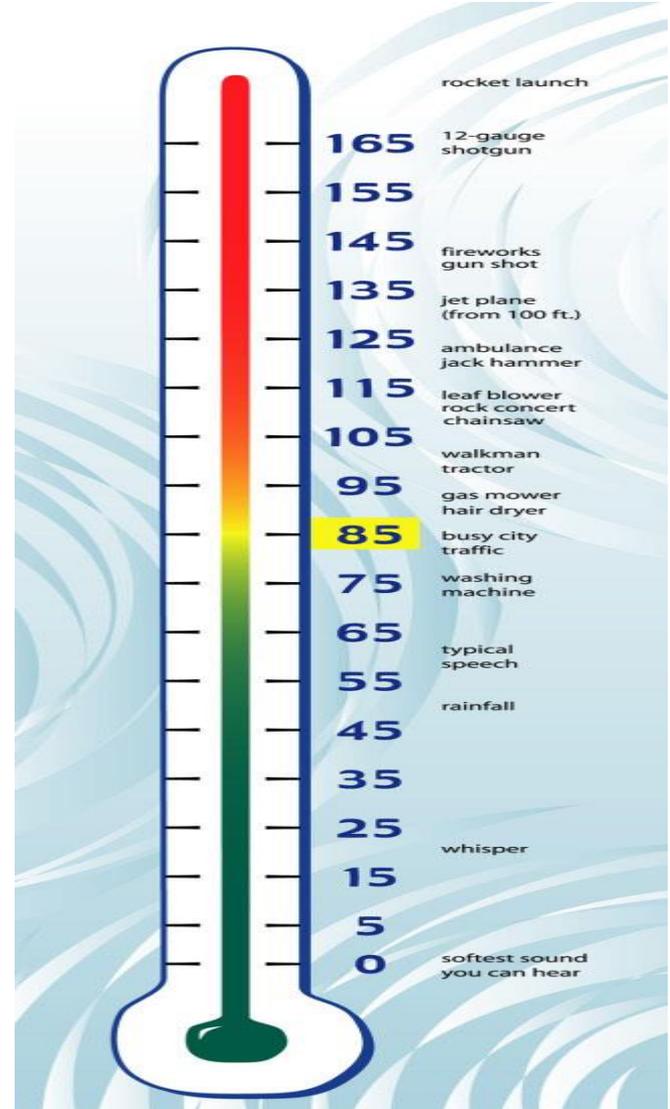
**Continuous dB**

- 85 dB
- 88 dB
- 91 dB
- 94 dB
- 97 dB
- 100 dB
- 103 dB
- 106 dB
- 109 dB
- 112 dB
- 115 dB

**Permissible Exposure Time**



- 8 Hours
- 4 hours
- 2 hours
- 1 hour
- 30 minutes
- 15 minutes
- 7.5 minutes
- 3.75 minutes (< 4 min)
- 1.875 minutes (< 2 min)
- .9375 min (~ 1 min)
- .46875 min (~ 30 sec)



# Earbuds / Headphones



*Make Listening Safe*

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

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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.



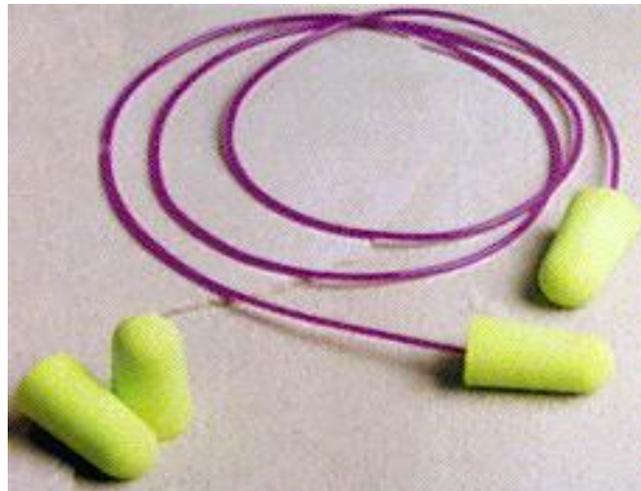
## Foam Earplugs

### 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





## 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





## Ear Muffs

### Advantages:

- Durable, long lasting and reusable
- Correct insertion is more easily accomplished
- Most comfortable for long-term use
- Can be used under earmuffs
- Convenient for use in confined work areas

### Disadvantages:

- Higher cost
- Eyeglasses can interfere with ear muff seal
- Can be uncomfortable in hot environments



# Hearing Aids



# How do hearing aids work?



## Styles of hearing aids



# More about hearing aids

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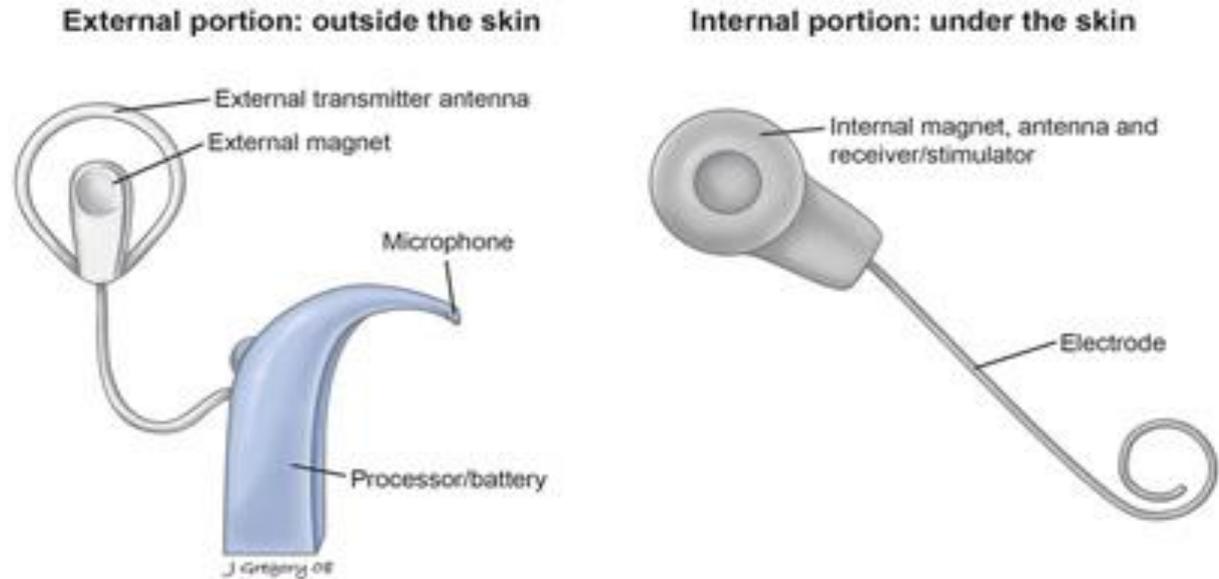


- Many manufacturers
- One hearing aid or Two?
- Unilateral hearing loss
  - Cros/Bi-Cros
  - BAHA
- Analog vs. Digital
- Directional microphones
- Automatic
  
- **Accessories:** Cell phones, television, music, remote microphone, remote control, induction loop, infrared

# Cochlear Implants



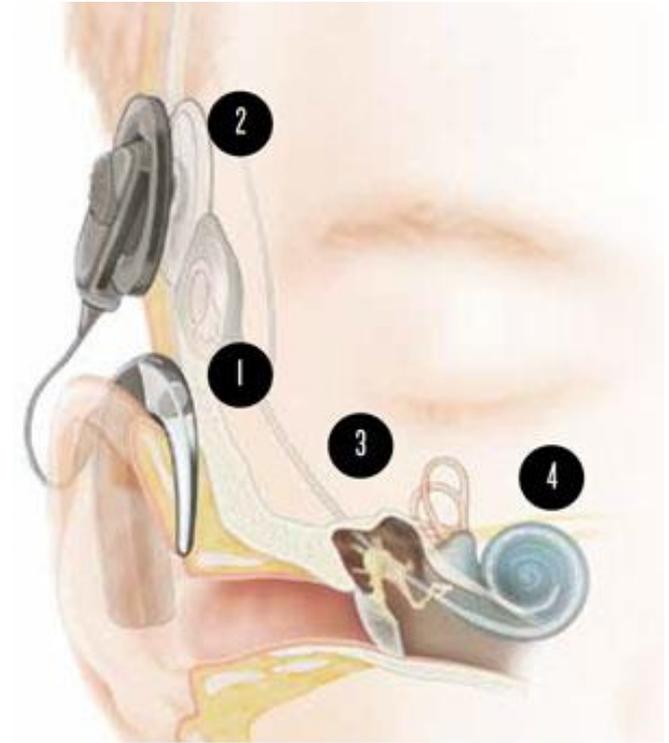
- External Parts
  - Microphone
  - Speech Processor
  - Transmitter
- Internal Parts
  - Receiver
  - Electrode Array
- 3 Manufacturers
  - Cochlear
  - Advanced Bionics
  - Med-El



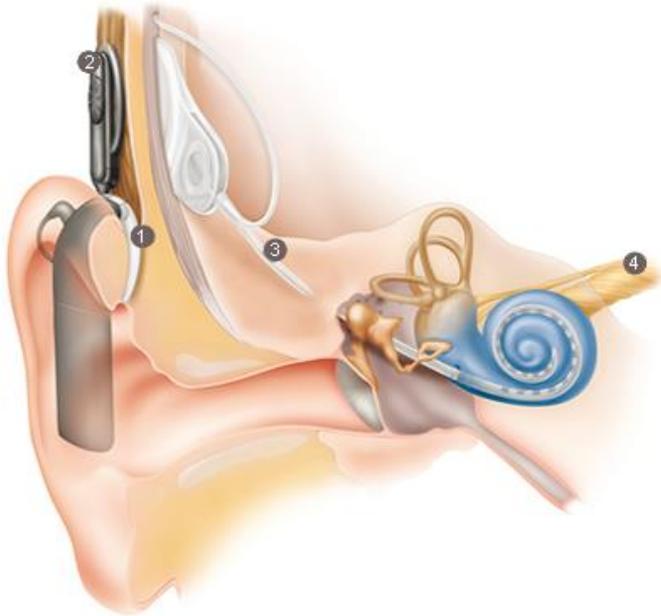
# More about hearing aids



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



- <http://www.cochlear.com/wps/wcm/connect/intl/home/understand/hearing-and-hl/hl-treatments/cochlear-implant>
- <https://www.youtube.com/watch?v=pYQIzjrRjml>
- <https://www.youtube.com/watch?v=z8jJt2GOqHE>

# Any Questions?

Thank you

