

# Anatomy and Physiology

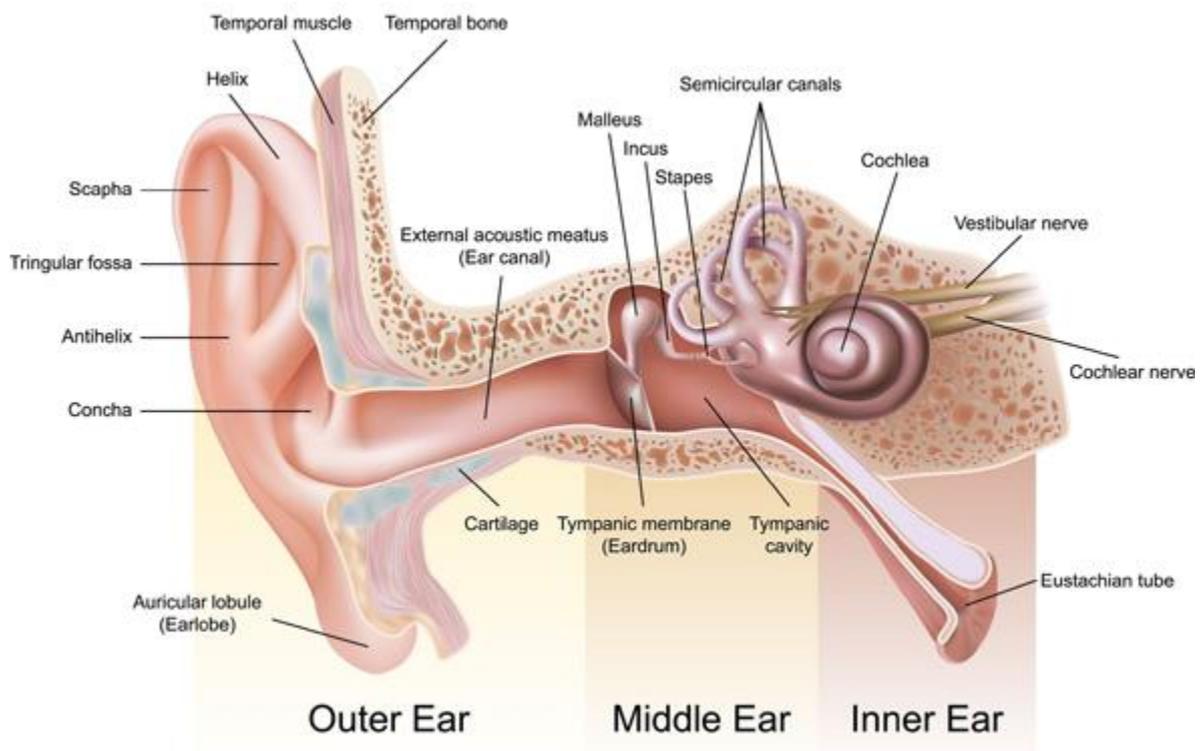
## Laboratory 3 - Audiometric hearing examination – pure tone audiometry

### 1. Introduction

Hearing is a sense allowing to receive acoustic signals, namely sound waves. The organ responsible for hearing in vertebrates is the ear. Hearing is used for communication and recognition among others.

From the mechanical point of view, the ear is a transducer of sound (air vibrations) into mechanical waves, then neural signals (electric). The ear is composed of the outer ear, middle ear and inner ear.

When a sound wave reaches the auricle, it is amplified and directed to the tympanic membrane through the external acoustic meatus (ear canal). On the internal side of the membrane starts the middle ear. It is a small cavity in the skull filled with air. When the sound comes, the tympanic membrane vibrates, stimulated by the wave. The vibrations are conducted mechanically to the ossicles. Again amplified by the ossicles, the signal is directed to the inner ear. The last of the ossicles, the stapes, is adjacent to the oval window, a structure covered by a membrane. In such way the sound is converted and conducted to the fluids of the inner ear, located in the cochlea. Inside cochlea, the vibrations are transduced into electrical signals (neural signals). Impulses from ears are transported to the brain through the cochlear nerve. The inner ear is also responsible for balance.



The ear By *Anatomy\_of\_the\_Human\_Ear.svg*: Chittka L, Brockmann derivative work: M. Komorniczak -talk- -*Anatomy\_of\_the\_Human\_Ear.svg*, CC BY 2.5, <https://commons.wikimedia.org/w/index.php?curid=7825581>

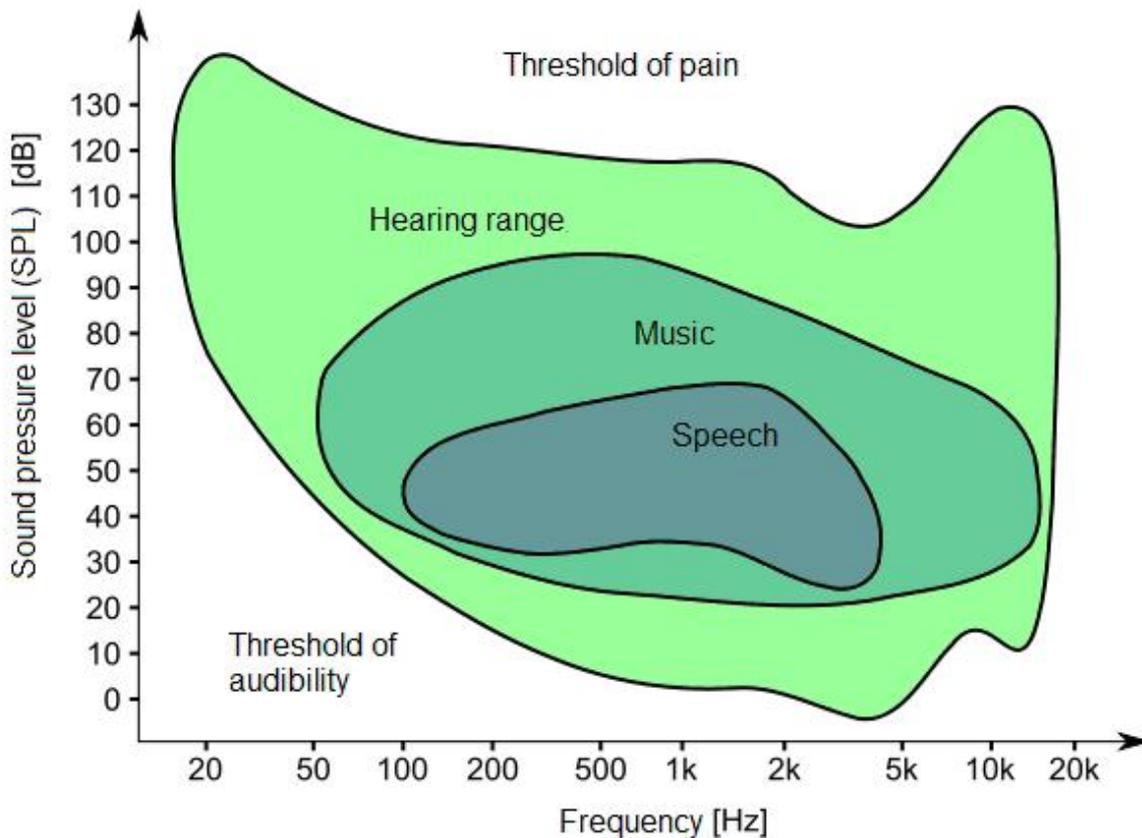
Hearing test is based on the assessment of the patient (organism) reaction to the acoustic stimulus.

The tests are divided into objective and subjective. The subjective tests require patient feedback, in contrast to objective tests.

The most common subjective hearing test and a standard one is pure tone audiometry (PTA). The aim is to find the auditory threshold of pure tones in the frequency range from 125 Hz to 10 kHz.

The examination procedure is as follows. The subject is placed in a sound-proof booth. The sound is delivered to the examined patient's headphones (bone conduction or air conduction). The device for the procedure is called an audiometer. The sound are played in a range of loudness levels and frequencies.

When a tone is hearable, the patient should react, e.g. by pressing a button. PTA allows to estimate the auditory threshold and thus assess the kind and degree of hearing impairment.



#### Hearing Borders

[https://pl.wikipedia.org/wiki/Granice\\_slyszalno'sci#/media/File:Powierzchnia\\_slyszalnosci.svg](https://pl.wikipedia.org/wiki/Granice_slyszalno%27sci#/media/File:Powierzchnia_slyszalnosci.svg) - a modification

## 2. Laboratory tasks

1. Visit webpage to test your hearing and generate the audiograms:  
<https://hearingtest.online/>
2. Follow the instructions to perform the hearing test for all members of your group.
3. Perform test for left, right and for both ears. If your results are good, move to "alt low" and then to "alt high" tests.
4. Copy the obtained audiogram and paste it to the report. Add information about the audiogram as showed in the example below.



Example audiogram. Green – both ears, blue – left ear, red – right ear.

5. Visit another webpage to test your hearing ability for speech in noise:  
<https://www.hear-it.org/Online-Hearing-Test>
6. Perform the test and put the percentage results for all group members in Table 1.

Table 1

Name	Hearing test result [%]

### 3. Final questions

1. How do the left- and right-ear audiograms differ from each other? Why?

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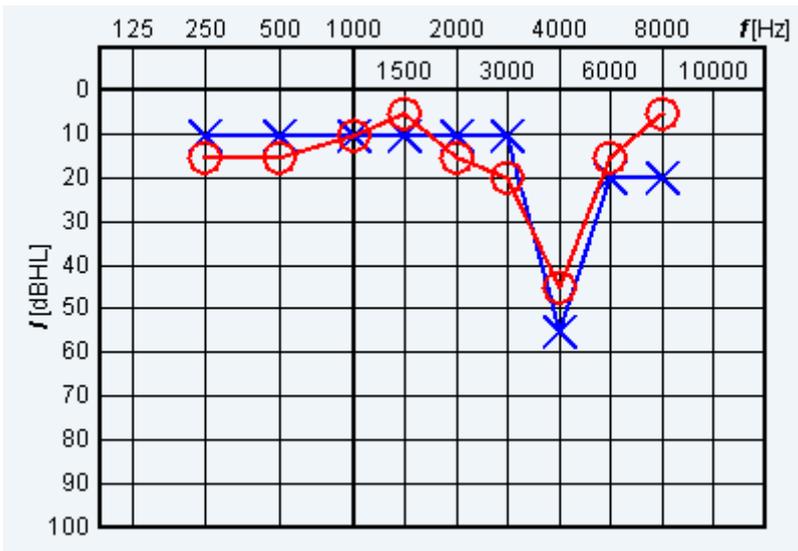
2. Is there a difference between the audiograms for different group members?

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3. Hearing loss is caused by pathological conduction or reception of sounds. What are the types/causes of hearing loss?

1. ....
2. ....
3. ....
4. ....
5. ....
6. ....

4. Try to guess what type of hearing loss is presented in the below audiograms (what can be the cause of this type of hearing loss). Possible options: genetically impaired hearing loss, aging of the hearing organ, a cochlear tumour on the right side, Menier's disease, acoustic trauma



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