



كلية المستقبل الجامعة  
قسم الفيزياء الطبية  
المرحلة الرابعة

# Medical Physics

# Neurophysics

## Lecture 8

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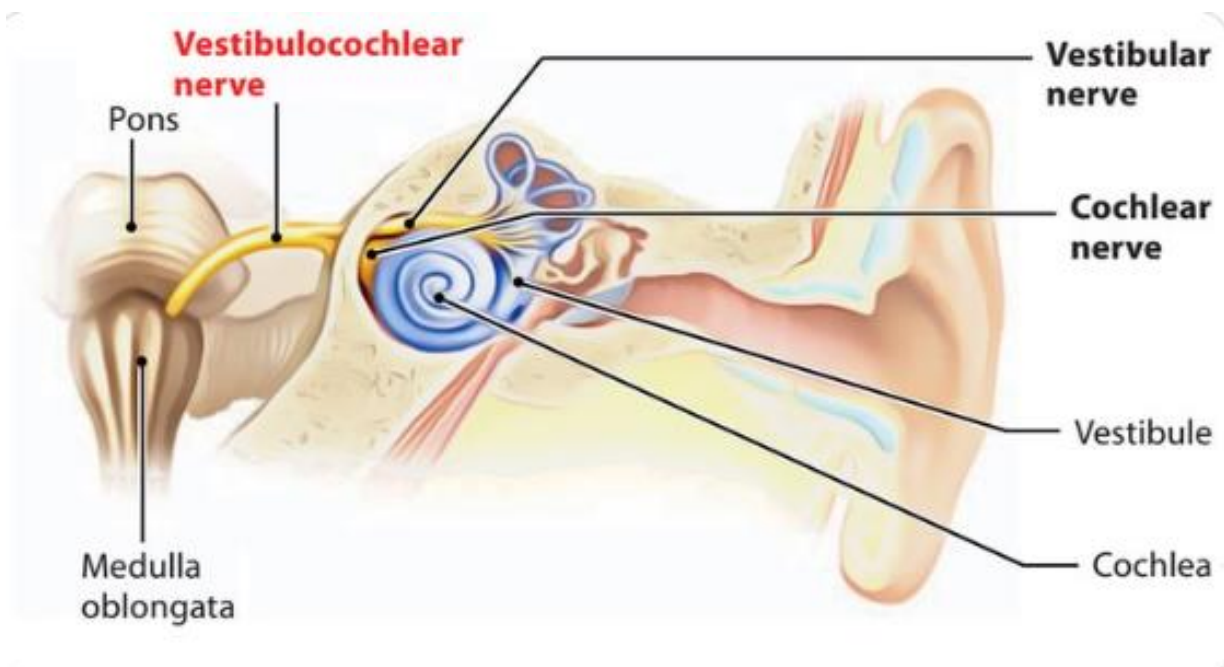
## **Auditory Impulse Transmission :**

### **Vestibulocochlear Nerve :**

Nerve in the human ear, serving the organs of equilibrium and of hearing.

It consists of two anatomically and functionally distinct parts:

- 1- The cochlear nerve, distributed to the hearing organ .
- 2- The vestibular nerve, distributed to the organ of equilibrium .



The vestibular portion of the vestibulocochlear nerve originates in a group of nerve cells called the vestibular ganglion, in the internal acoustic, a channel in the temporal bone through which the facial and auditory nerves and some blood vessels run.

The sensory endings of this portion of the nerve are in the semicircular canal and in the utricle and saccule, the structures of the inner ear responsible for the sensation of equilibrium .

## Vestibular System :

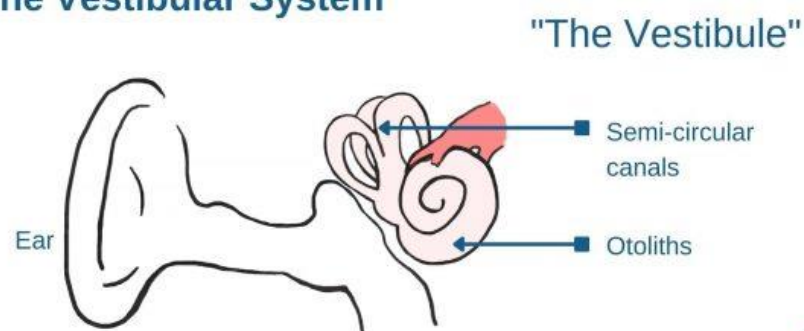
The vestibular system, in vertebrates, is a sensory system that provides the leading contribution to the sense of balance and spatial orientation for the purpose of coordinating movement with balance. Together with the cochlea, a part of the auditory system, it constitutes the labyrinth of the inner ear .

Vestibular system, apparatus of the inner ear involved in balance. The vestibular system consists of two structures of the bony labyrinth of the inner ear :

- 1- Vestibule (the otoliths) , which indicate linear accelerations .
- 2- Semicircular canals , and the structures of the membranous labyrinth contained within them .



### The Vestibular System

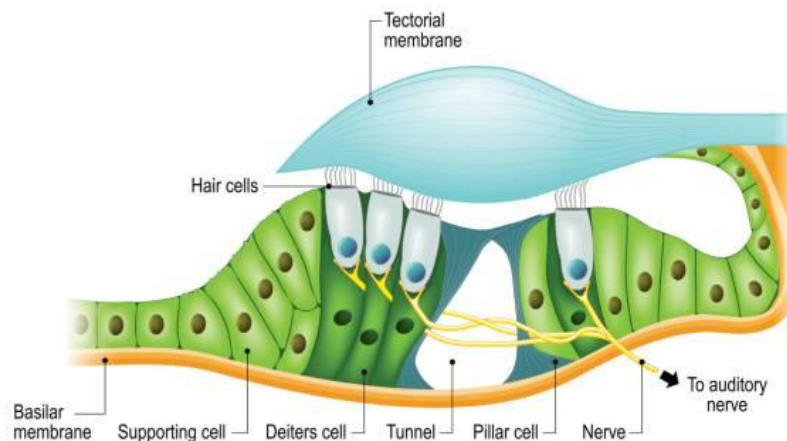


## Organ of Corti :

The organ of Corti contains sensory cells with hairlike projections, called hair cells, that are deformed by the progress of the wave. The hair cells trigger nerve impulses that travel along the cochlear nerve, a branch of the auditory nerve, to the brain, where they are interpreted as sound.

This highly varied strip of epithelial cells allows for transduction of auditory signals into nerve impulses' action potential. Transduction occurs through vibrations of structures in the inner ear causing displacement of cochlear fluid and movement of hair cells at the organ of Corti to produce electrochemical signals .

## ORGAN OF CORTI



## Function :

The function of the organ of Corti is to convert (transduce) sounds into electrical signals that can be transmitted to the brainstem through the auditory nerve.

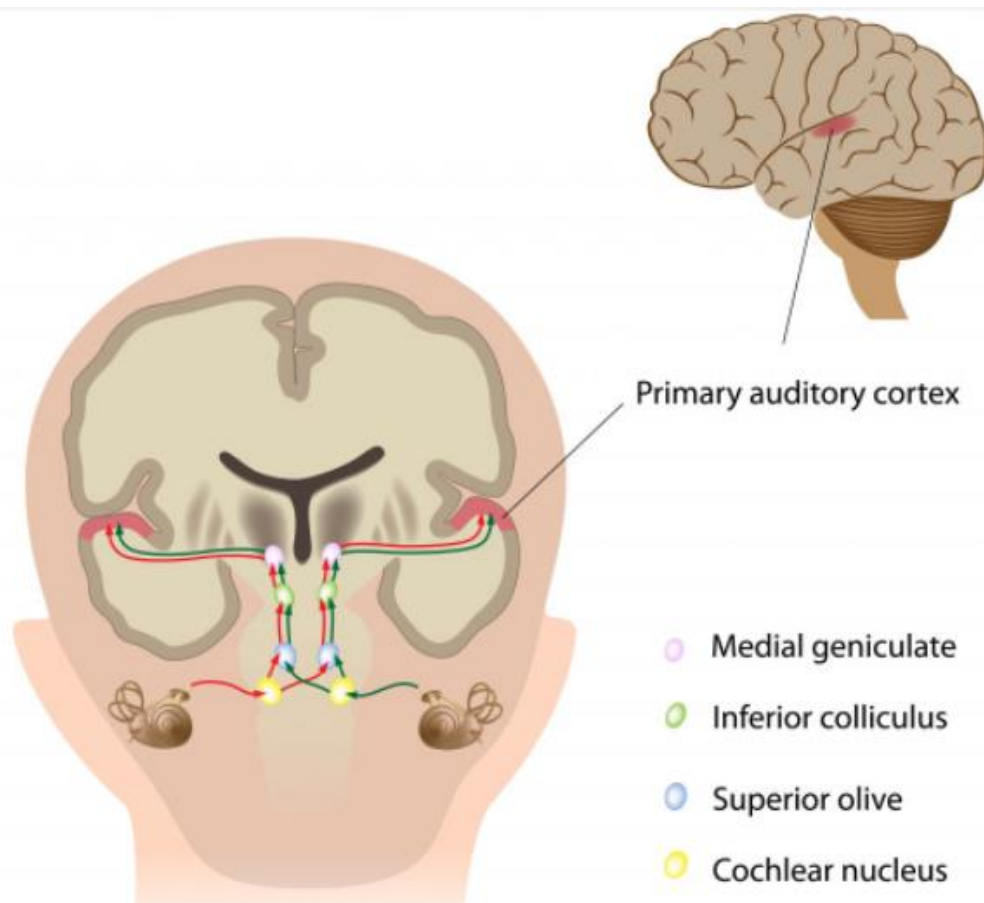
It is the auricle and middle ear that act as mechanical transformers and amplifiers so that the sound waves end up with amplitudes 22 times greater than when they entered the ear .

## **Auditory Pathway :**

The auditory pathway conveys the special sense of hearing .

Information travels from the receptors in the organ of Corti of the inner ear (cochlear hair cells) to the central nervous system, carried by the vestibulocochlear nerve (CN VIII) .

This pathway ultimately reaches the primary auditory cortex for conscious perception. In addition, unconscious processing of auditory information occurs in parallel .



## **Medial Geniculate Nucleus ( MGN ) :**

It is part of the auditory thalamus , represents influences the direction and maintenance of attention .

**Inferior Colliculus :** The inferior colliculus is a part of the midbrain that serves as a main auditory (sound) center for the body. It acts as the channel for almost all auditory signals in the human body. Its primary roles are signal integration, frequency recognition, and pitch discrimination. It also processes sensory signals .

**Superior Olive :** is a collection of brainstem nuclei that functions in multiple aspects of hearing and is an important component of the ascending and descending auditory pathways of the auditory system .

**Cochlear nucleus :** is the first integrative, or processing, stage in the auditory system. Information is brought to the nuclei via the cochlear nerve.

## **Components of The Auditory Pathway :**

The auditory pathway is complex in that divergence and convergence of information happens at different stages .

There are two main components of the auditory pathway :

### **1- Primary (lemniscal) pathway :**

This is the main pathway through which auditory information reaches the primary auditory cortex (A1) .

### **2- Non-lemniscal pathway :**

Mediating unconscious perception such as attention, emotional response, and auditory reflexes .