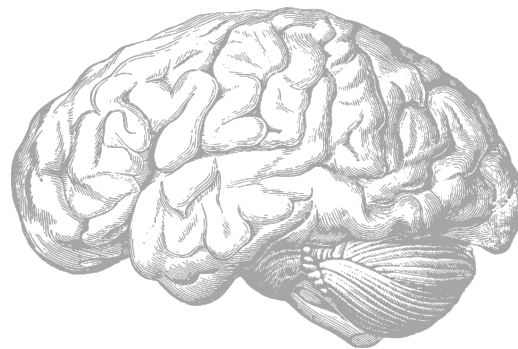




Cranial Nerve VIII

CNS Block








Color Index

- ◆ Main Text
- ◆ Female Slides
- ◆ Male Slides
- ◆ Drs' Notes
- ◆ Important
- ◆ Extra info

[The Editing File](#)



Objectives

-  List the nuclei related to vestibular and cochlear nerves in the brain stem.
-  Describe the type and site of each nucleus.
-  Describe the vestibular pathway and its main connections.
-  Describe the auditory pathway and **its main connections**.
-  Know the Clinical Anatomy concerned to the 8th cranial nerve.



You can find helpful video by [Clicking HERE!](#)

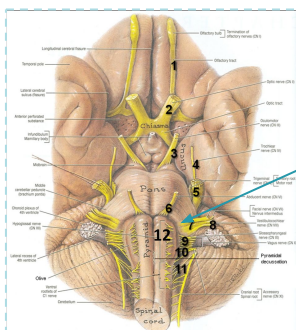


You can find Atlas by [Clicking HERE!](#)

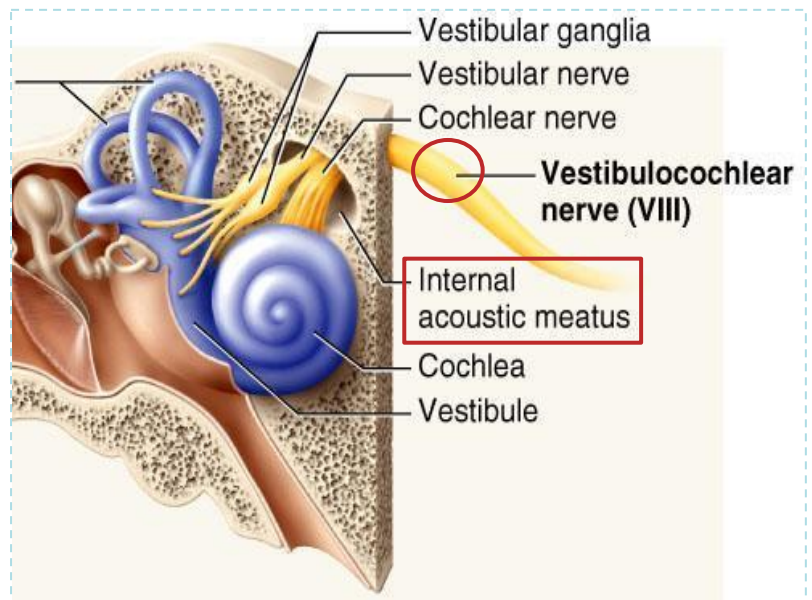
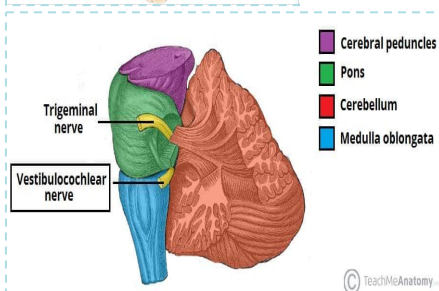
8th CN: Vestibulocochlear

Introduction

Type	Special Sensory Afferent (SSA) conveys impulses from inner ear to nervous system .
Origin	Vestibular & cochlear parts leave the ventral surface of brain stem through the pontomedullary sulcus at cerebellopontine (=pontocerebellar) angle (lateral to facial nerve).
Course	Run laterally in posterior cranial fossa and enter the internal acoustic meatus along with 7 th nerve facial.



Ponto-medullary Sulcus (cerebello-pontine angle)



Components

Vestibular Part

Conveys impulses associated with **body posture, balance and coordination of head & eye movements.**

Cochlear Part

Conveys impulses associated with **hearing.**

Vestibular Nerve

Vestibular nuclei belong to **Special Somatic Afferent** column in Brainstem.

1. First Order Neurons

The cell bodies are located in the **vestibular ganglion** within the internal auditory meatus.

The Peripheral processes' afferent fibers/axons (vestibular nerve fibers) make dendritic contact with hair cells in vestibule & semicircular canals/membranous labyrinth (inner ear).

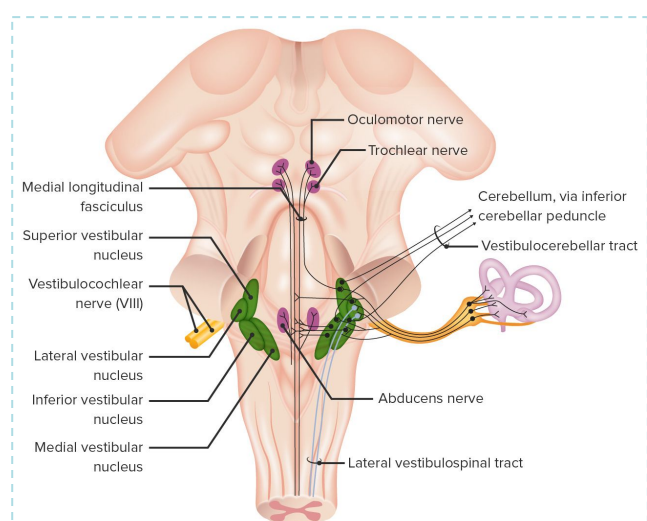
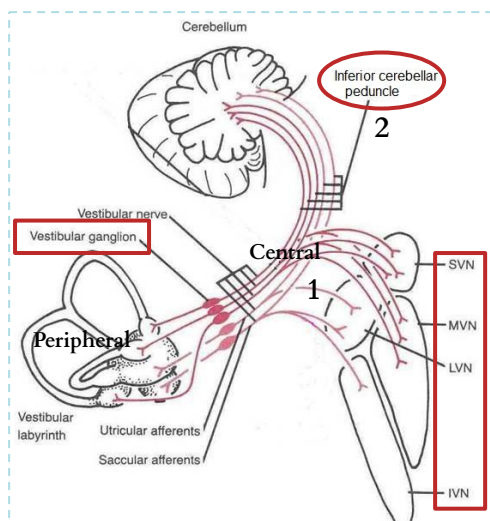
Both cochlear & vestibular nerves meet & emerge through internal auditory (acoustic) meatus to cranial cavity.

Vestibular & cochlear parts enter brainstem through pontocerebellar (Cerebellopontine) angle (lateral to facial nerve).

2. Second Order Neurons

The central processes (form the vestibular nerve) which are efferent fibers, mostly end up in the lateral, medial, inferior and superior vestibular nuclei of the rostral medulla and pons (located beneath the lateral part of the floor of 4th ventricle).

Some fibers go to the cerebellum through the inferior cerebellar peduncle.



Vestibular Pathway

Axons (Efferents) from the vestibular nuclei project to number of other regions:

To **ipsilateral** Flocculonodular lobe of cerebellum (vestibulo-cerebellar tract)

through inferior cerebellar peduncle. for maintenance of Balance.

Bilaterally (cross midline and ascend) to Ventral posterior nucleus of thalamus

which in turn project to the vestibular area in cerebral cortex. for Conscious awareness.

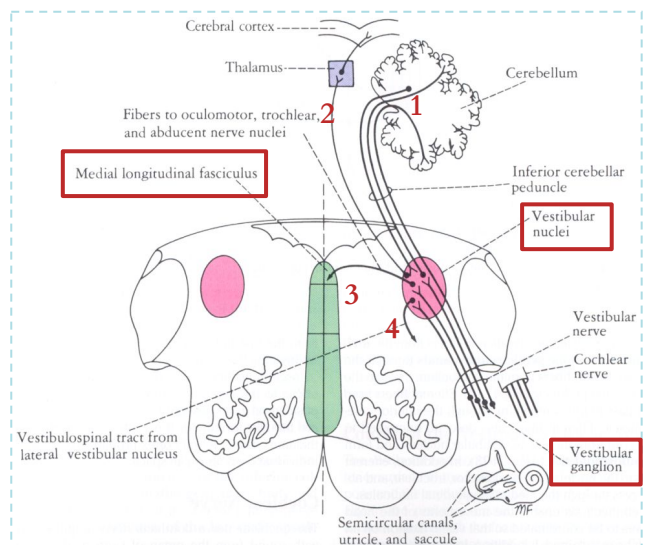
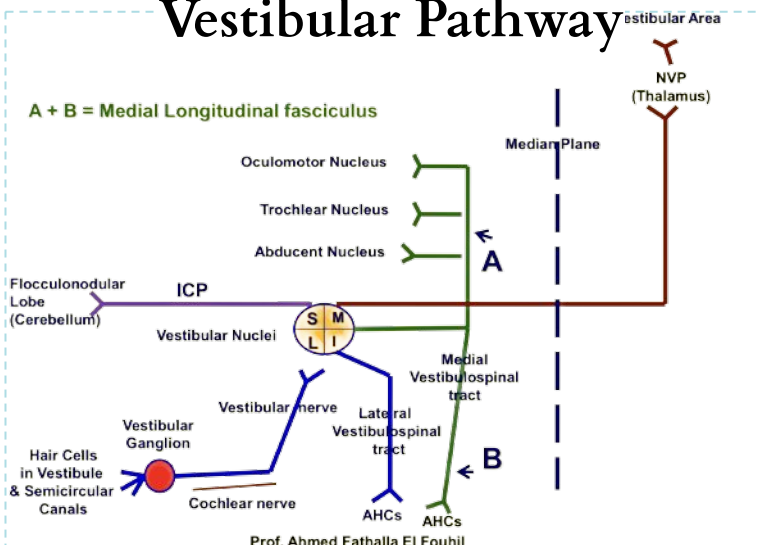
Bilaterally to motor nuclei of cranial nerves (vestibulo ocular tract)

through **Medial longitudinal fasciculus**. for Coordination of head & eye movements.

To **Motor neurons** (anterior horn cells) of the spinal cord:

A. Directly as lateral (ipsilateral) vestibulospinal
B. Join MLF (medial longitudinal fasciculus) and descend as medial vestibulospinal (bilateral) tracts. for Control of body posture.

Vestibular Pathway



Vestibular Pathway Cont.

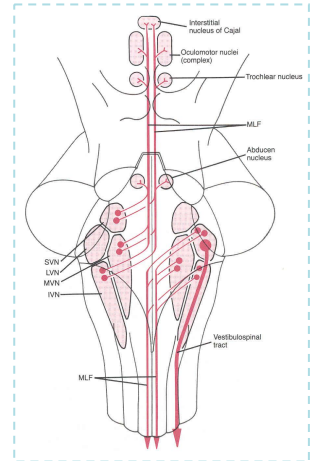
Medial Longitudinal Fasciculus (bundle)

Extension

Extends through out the **brainstem** and formed of both ascending & descending fibers.

Projection

Projects **bilaterally**



The Ascending Component (Vestibulo-ocular)

Establishes connections with the **nuclei (in brain stem)** of the Oculomotor III, Trochlear IV & Abducent VI nerves (motor nuclei for extraocular muscles).

for coordination of head & eye movements

The Descending Component (Vestibulo-spinal)

Extends into **anterior horn cells of the cervical segment of spinal cord** as the **medial vestibulospinal tract**.

for control of the body posture

Vestibulospinal Tracts

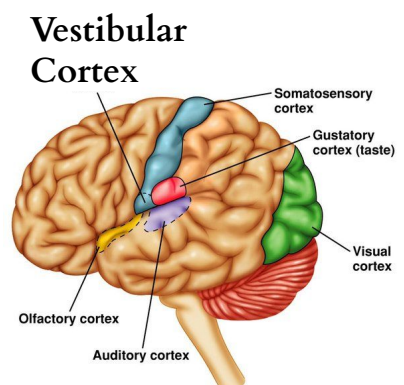
Vestibulospinal fibers influence the activity of spinal motor neurons concerned with the control of **body posture and balance**.
Has 2 tracts:

- ❖ **Lateral** arises from lateral vestibular (Deiter's) nucleus, descends **ipsilaterally**.
- ❖ **Medial** is the descending part of the medial longitudinal fasciculus, projects **bilaterally**.

Female Slides

Vestibular Cortex/Area

- ❖ Located in the **lower part of postcentral gyrus** (head area).
- ❖ Responsible for **conscious awareness** of vestibular sensation.



Auditory Pathway

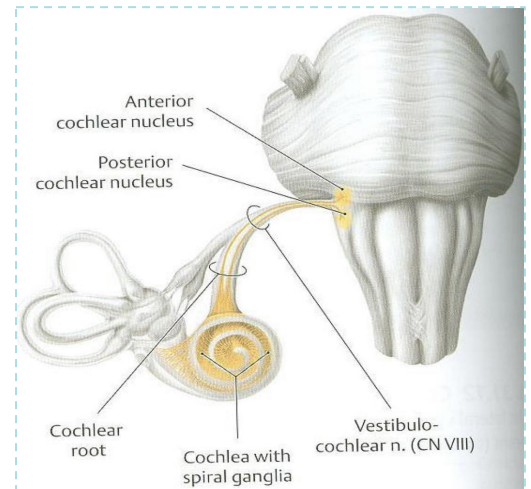
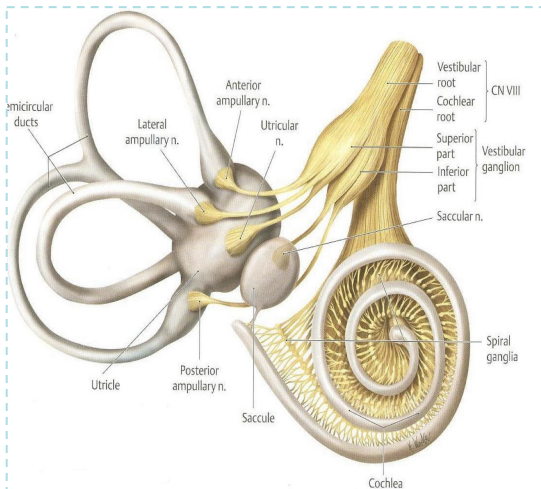
Female Slides

Introduction

It is **multisynaptic** pathway. **Complicated more than the vestibular.**

There are **several locations** between medulla and the thalamus where axons **may synaps** and **not all the fibers behave in same manner.**

Representation of cochlea is bilateral at all levels **above cochlear nuclei**, so **Hearing is bilaterally** represented.



Auditory Association Cortex

Primary Auditory Cortex

Auditory Radiation
Retro-lemniscular Part of IC

Medial Geniculate Nucleus

Inferior Colliculus

Commissural fibers

Auditory Association Cortex

Primary Auditory Cortex

Medial Geniculate Nucleus

Inferior Colliculus

Nucleus of Lateral Lemniscus

Lateral Lemniscus

Superior Olivary Nucleus

Trapezoid Body

Dorsal & Ventral Cochlear Nuclei

Cochlear nerve

Cells of Spiral Ganglion (in cochlea)

Dorsal & Ventral Cochlear Nuclei

Cochlear nerve

Cells of Spiral Ganglion



Cochlear (Auditory Nerve)

Cochlear nuclei belong to **Special Somatic Afferent (SSA) column** in Brainstem.

First order neurons

Location of cell bodies:

In The **spiral ganglion** within the cochlea (organ of Corti in inner ear), axons form cochlear nerve.

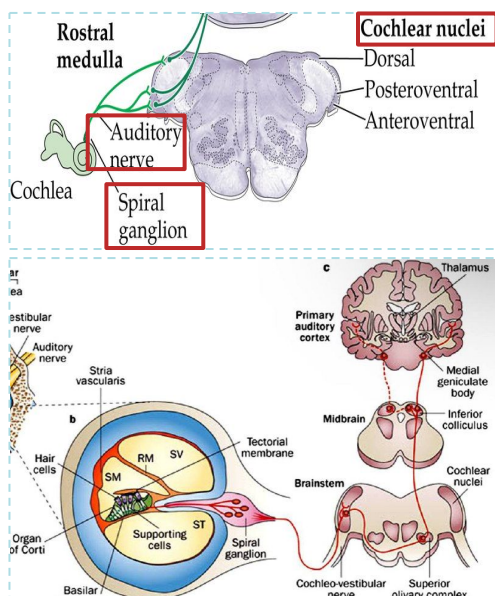
Spiral ganglion has two processes:

1. **The Peripheral Processes/ Cochlear Nerve:**

Make dendritic contact with hair cells of the **organ of Corti** within the cochlear duct of **inner ear**.

- ❖ Both cochlear & vestibular nerves meet & emerge through internal auditory (acoustic) meatus to cranial cavity.
- ❖ Vestibular & cochlear parts enter pons through pontocerebellar (Cerebellopontine) angle (lateral to facial nerve).

2. Central processes → in 2nd order neuron



Second order neurons

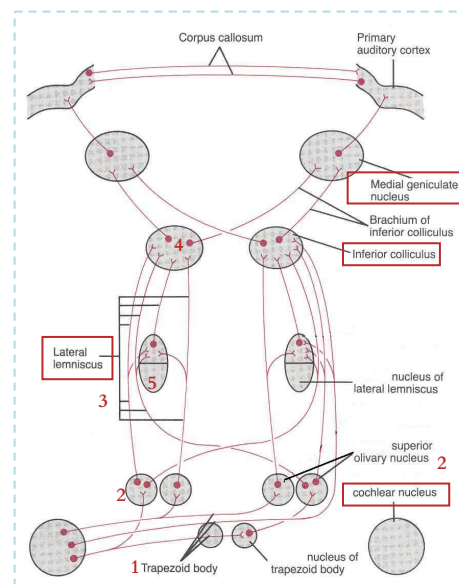
2. The Central Processes

(cochlear nerve fibers) terminate in: cells of **dorsal and ventral cochlear nuclei** in pons & medulla, which lie close to the inferior cerebellar peduncle (ICP) in **open rostral medulla**.

Fibres **ascend** into the pons, where:

1. **Most fibers/axons decussate** in nucleus of **trapezoid body** OR in the **contralateral superior olivary gland**, & form **lateral lemniscus**,
2. Some fibers run **ipsilaterally** and **terminate** in the **superior olivary nucleus**.
3. Some fibers **end** in the superior olivary nucleus, nuclei of trapezoid body & nucleus of lateral lemniscus.

From superior olivary nuclei, ascending fibers comprise the **lateral lemniscus** containing both crossed (**mainly**) and direct (few) cochlear fibres, which runs through tegmentum of pons.



It sounds complicated but actually it's not don't worry.

زي ما قلنا في السلايد اللي فات ان الفايرز لها سينابسر كثير بين الـ medulla والـ thalamus.

And check the video linked above for better view.

Cochlear (Auditory Nerve)

Third order neurons

- ❖ cells of the **inferior colliculus** of the midbrain.
- ❖ Both colliculi are interconnected by commissural* fibers.

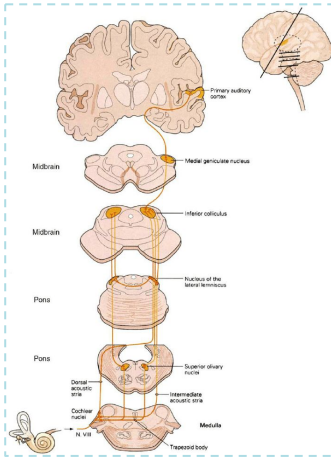
EXTRA:

There are 3 types of brain fibers:

1- **Association fibers:** The tracts that connect cortical areas within the same hemisphere.

2- **Commissural fibers*:** The tracts that connect corresponding cortical areas in the two hemispheres.

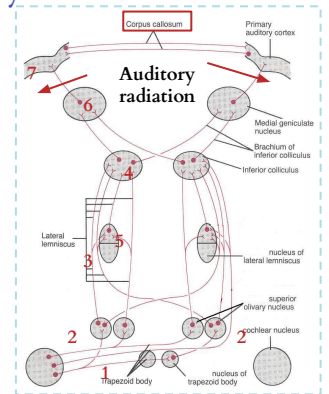
3- **Projection fibers:** The tracts that cerebral cortex with the corpus striatum, diencephalon, brainstem and the spinal cord. The corticospinal tract for example.



Fourth order neurons

Some axons of lateral lemniscus terminate in nucleus of the lateral lemniscus.

- ❖ The inferior colliculi project to cells of **medial geniculate nuclei** of thalamus.
- ❖ The axons originating from the medial geniculate nucleus form **auditory radiation** that pass through sublenticular/retrolenticular part of the internal capsule,
- ❖ Auditory radiation ends in the primary auditory cortex (Brodmann's areas 41, 42) (it is the area that allows hearing) located in the dorsal surface of the superior temporal gyrus (Heschl's gyrus) which is connected to auditory association cortex.



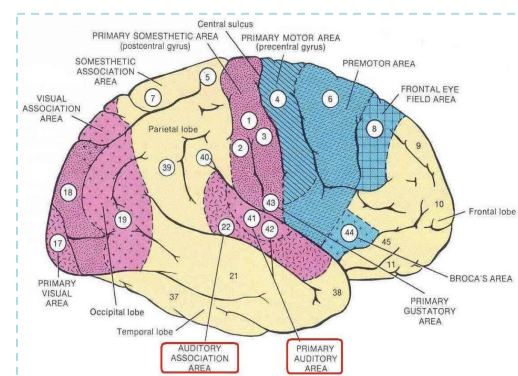
Auditory Cortex

The region surrounding the **primary auditory cortex** (Brodmann's areas 41 & 42)

Is known as The auditory association cortex or **Wernicke's area** (Brodmann's areas 22)

Wernicke's area is related to **recognition and processing** of language by the brain.

Female Slides



Other Functions of Some Nuclei

Male
Slides

Superior Olivary Nucleus, Nuclei of Trapezoid Body & Nucleus of Lateral Lemniscus:

Modulate transmission of auditory information to cochlear nerve by:

1. **Sending inhibitory fibers** through vestibulocochlear nerve ending in Organ of Corti.
2. **Establishing connection** with motor neurons supplying **tensor tympani & stapedius muscles**

Female
Slides

Superior olivary nucleus in Pons:

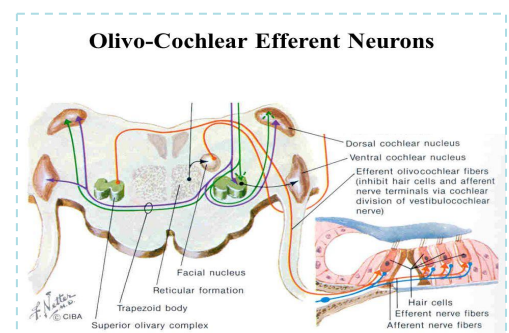
Sends olivocochlear fibers in M.O to end in organ of Corti through the vestibulocochlear nerve. **These fibers are inhibitory in function and serve to modulate transmission of sound to the cochlear nerve.**

Superior Olivary Nucleus & Nucleus of the Lateral Lemniscus:

Establish reflex connections with motor neurons of trigeminal and facial motor nuclei mediating contraction of tensor tympani and stapedius muscles as they reduce the amount of sound that gets into the inner ear in response to loud noise.

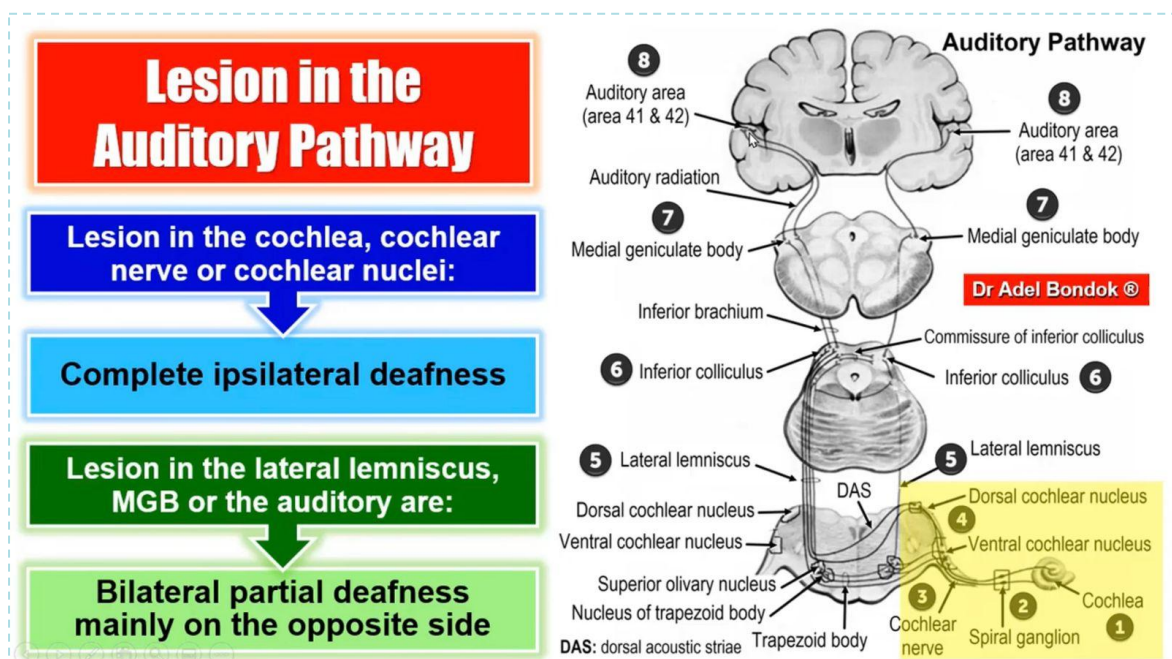
Inferior Colliculi:

Establish reflex connections with motor neurons in the cervical spinal segments (via tectospinal tract) for the **movement of head and neck in response to hearing.**



Clinical Notes

Lesion of Vestibulocochlear Nerve	Acoustic Neuroma	Rostral to the Cochlear Nuclei
<p>Produces deafness = Disturbance of cochlear nerve functions</p> <p>Disturbance of vestibular nerve functions: tinnitus, vertigo, dizziness, nausea, nystagmus, loss of balance and ataxia.</p>	<p>A benign tumour of 8th nerve (or other near nerve tumor) leads to compression of the nerve leading to attacks of dizziness, and profound complete deafness and ataxia.</p>	<p>The representation of cochlea is essentially bilateral at all levels above cochlear nuclei.</p> <p>So, Lesions anywhere along this pathway /above the level of cochlear nuclei, usually have no obvious effect on hearing, producing weakness of hearing/hearing affected in both ears but mostly in the opposite ear.</p> <p>But Complete Deafness of the affected ear is essentially only caused by damage to the cochlea (inner ear), or auditory nerve itself.</p> <p>Cochlear nerve/nuclei lesions: Ipsilateral hearing loss.</p>



Summary



Ganglia related to vestibulocochlear nerve are located in the inner ear.



Vestibular & cochlear nerves pass through internal auditory meatus to cranial cavity, then enter pons at pontocerebellar angle, lateral to facial nerve.



Cochlear & vestibular nuclei are of the special somatic afferent type (receiving special afferent sensation, hearing & equilibrium from inner ear), and are located in pons & medulla.



Inferior colliculi, medial geniculate nucleus and finally auditory cortex are stations in cochlear pathway.



Hearing is bilaterally represented above the level of the cochlear nuclei.



Vestibular nuclei are connected to: spinal cord 3rd, 4th & 6th nuclei in brainstem (directly or through medial longitudinal fasciculus), to flocculonodular lobe of cerebellum and to vestibular area of cerebral cortex.

MCQs

Q1. The second order neuron in the auditory pathway is:

A. Inferior colliculus

B. Cochlear nucleus

C. Medial geniculate nucleus

D. Vestibular nucleus

Q2. Which one of the following has auditory fibers'?

A. Lateral lemniscus

B. Medial lemniscus

C. Spinothalamic

D. Corticospinal

Q3. What kind of nuclei is found in the auditory pathway?

A. General visceral afferent

B. General visceral efferent

C. Special Somatic afferent

D. Parasympathetic

Q4. Which ONE of the following fibers is concerned with coordination of head and eye movement'?

A. Rubrospinal tract

B. Medial Longitudinal bundle

C. Spinal lemniscus

D. Trapezoid body

Q5. What is the location of vestibular cortex'?

A. Precentral gyms

B. Postcentral gyms

C. Superior temporal gyms

D. Superior frontal gyrus

Q6. Which of the following cranial nerves emerges from cerebellopontine angle?

A. Oculomotor

B. Abducent

C. Vestibulocochlear

D. Trigeminal

A1. B A2. A A3. C A4. B A5. B A6. C

FOR ANKI FLASHCARDS





[OR CLICK HERE](#)



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◆ **Special Thanks to Aleen Alkulyah for the Wonderful Design!**



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