

ANATOMY OF 8TH CRANIAL NERVES

VESTIBULOCOCHLEAR

PATHWAYS

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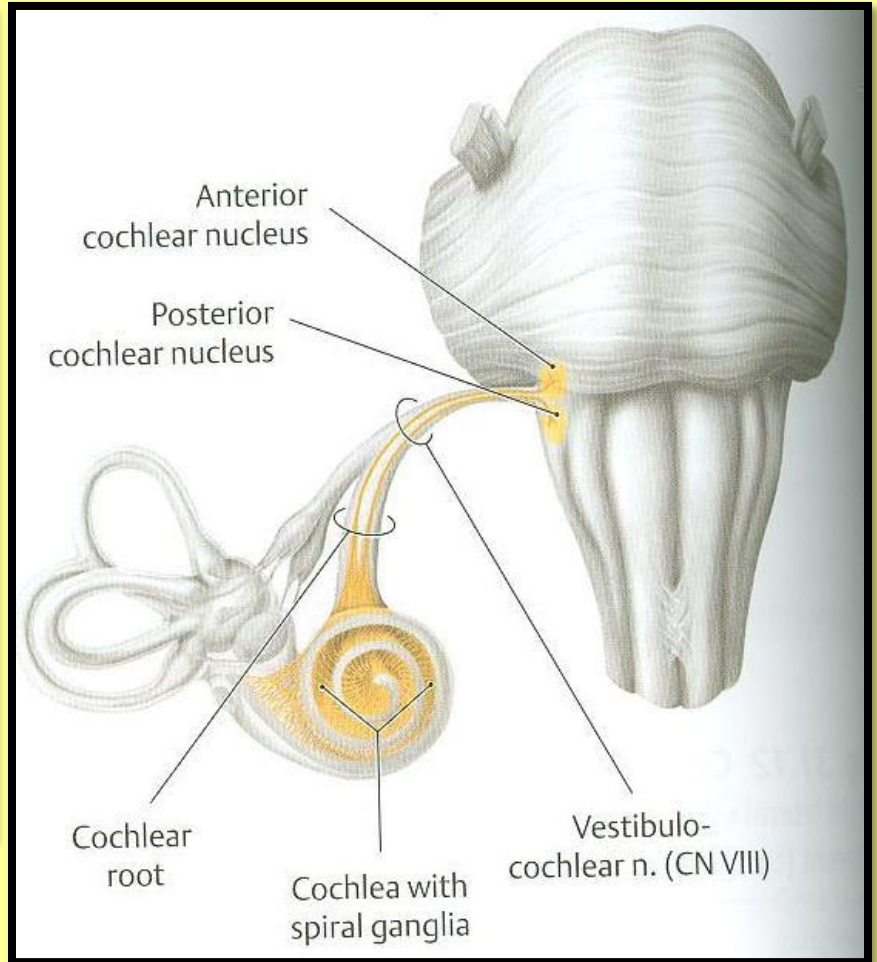
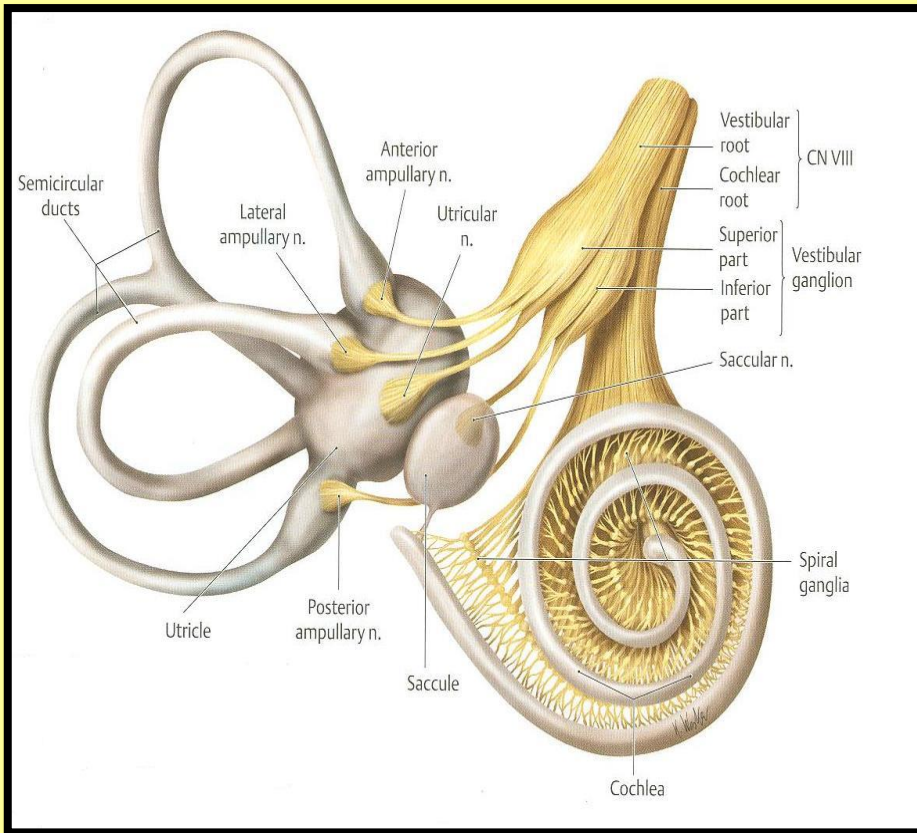
OBJECTIVES

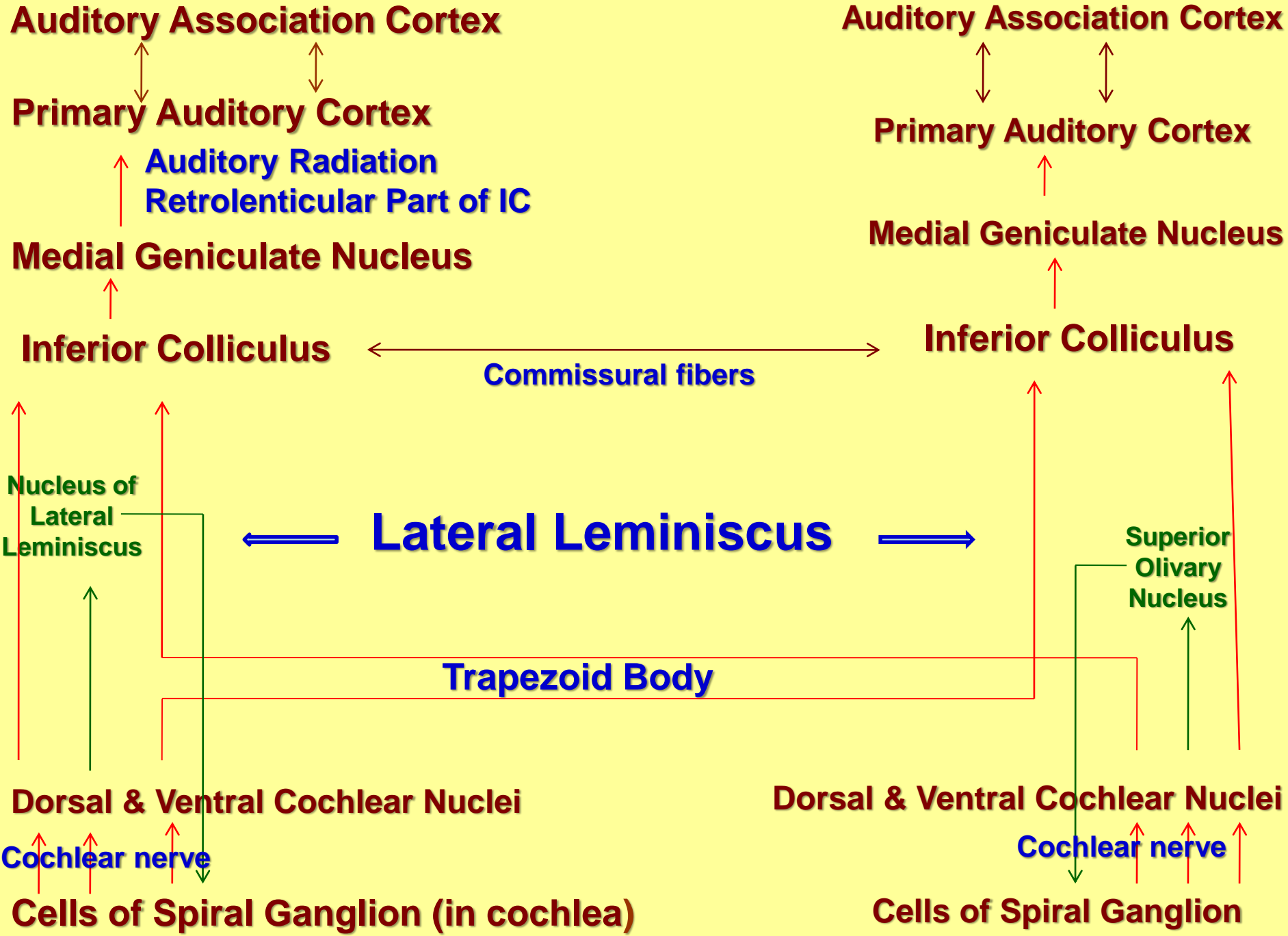
At the end of the lecture, the students should be able to:

- List **the nuclei** related to vestibular and cochlear nerves in the brain stem.
- Describe **the type** and **site** of each nucleus.
- Describe **the vestibular pathways** and **its main connections**.
- Describe **the auditory pathway**.

AUDITORY PATHWAY

AUDITORY PATHWAY





AUDITORY PATHWAY

- **FIRST ORDER NEURONES:** *Cells of spiral ganglion in the cochlea. Axons form cochlear nerve.*
- Cochlear nerve makes dendritic contact with hair cells of *Organ of Corti* (in Cochlear Duct).
- 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)*.

AUDITORY PATHWAY

- **SECOND ORDER NEURONES:** *Cells of dorsal & ventral cochlear nuclei in pons.*
- Cochlear nuclei belong to *special somatic afferent column in brain stem.*
- On ascending, most of axons decussate in the *trapezoid body* & form *lateral lemniscus.*
- Some fibers end in *Superior Olivary Nucleus & Nucleus of Lateral Lemniscus.*

AUDITORY PATHWAY

- ***Superior Olivary Nucleus & 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.**

AUDITORY PATHWAY

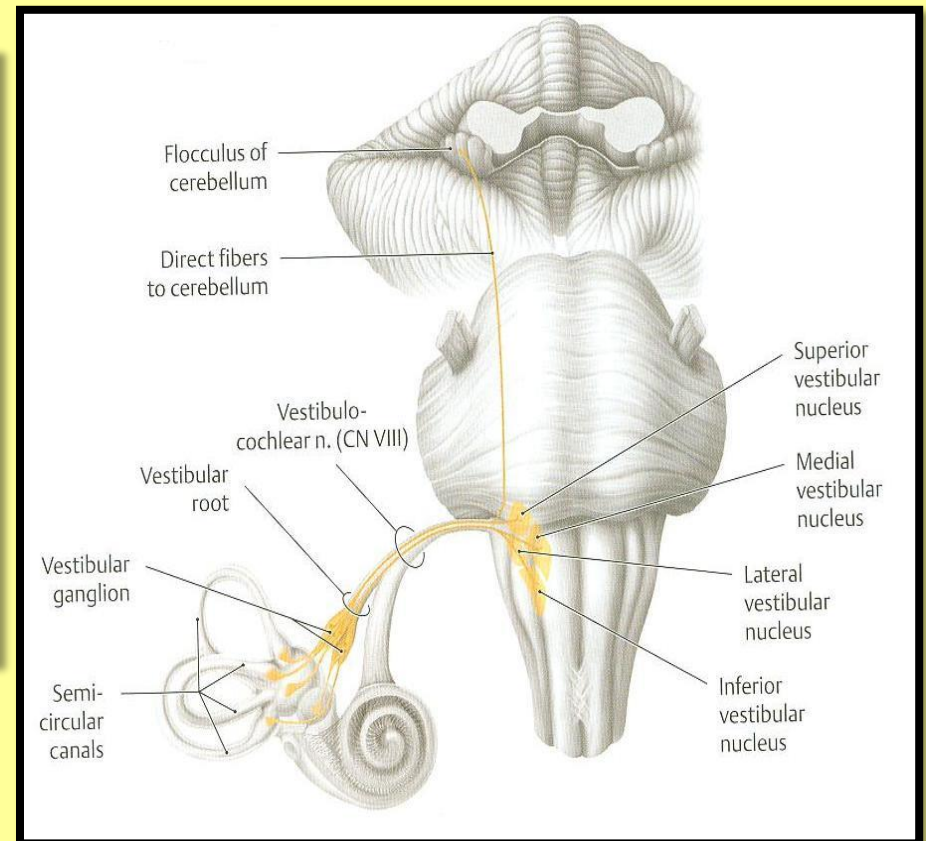
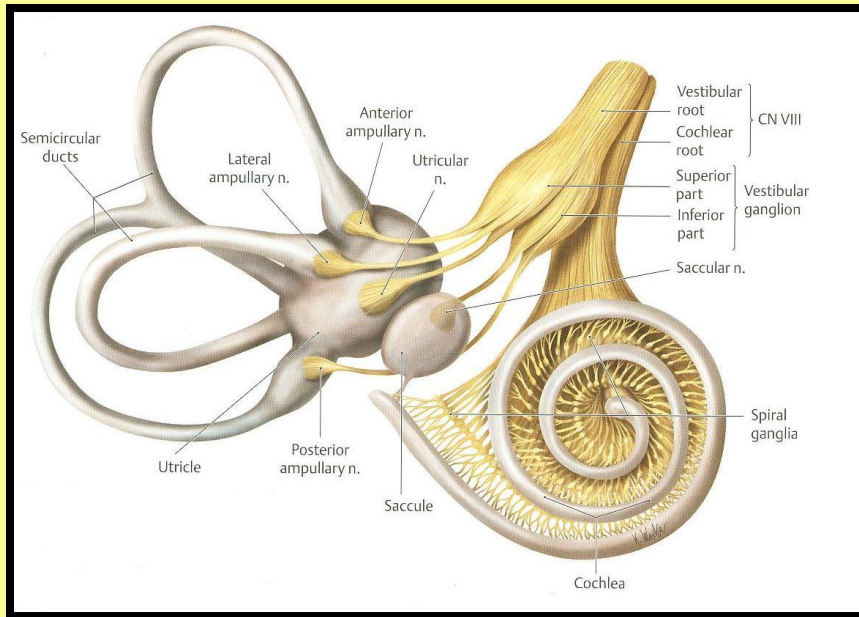
- **THIRD ORDER NEURONES:** *Cells of inferior colliculus (midbrain).* Both colliculi are interconnected by commissural fibers.
- **FOURTH ORDER NEURONES:** *Cells of medial geniculate nucleus (thalamus).*
 - Axons form *auditory radiation* that pass through retrolenticular part of internal capsule.

AUDITORY PATHWAY

- Auditory radiation ends in **primary auditory cortex (superior temporal gyrus)** which is connected to *auditory association cortex*.
- ***N.B.:*** Representation of cochlea is bilateral at all levels above cochlear nuclei.

VESTIBULAR PATHWAY

VESTIBULAR PATHWAY



VESTIBULAR PATHWAY

Vestibular Area

A + B = Medial Longitudinal fasciculus

Median Plane

NVP
(Thalamus)

Oculomotor Nucleus

Trochlear Nucleus

Abducent Nucleus

A

B

Flocculonodular
Lobe
(Cerebellum)

ICP

Vestibular Nuclei



Medial
Vestibulospinal
tract

Vestibular nerve

Lateral
Vestibulospinal
tract

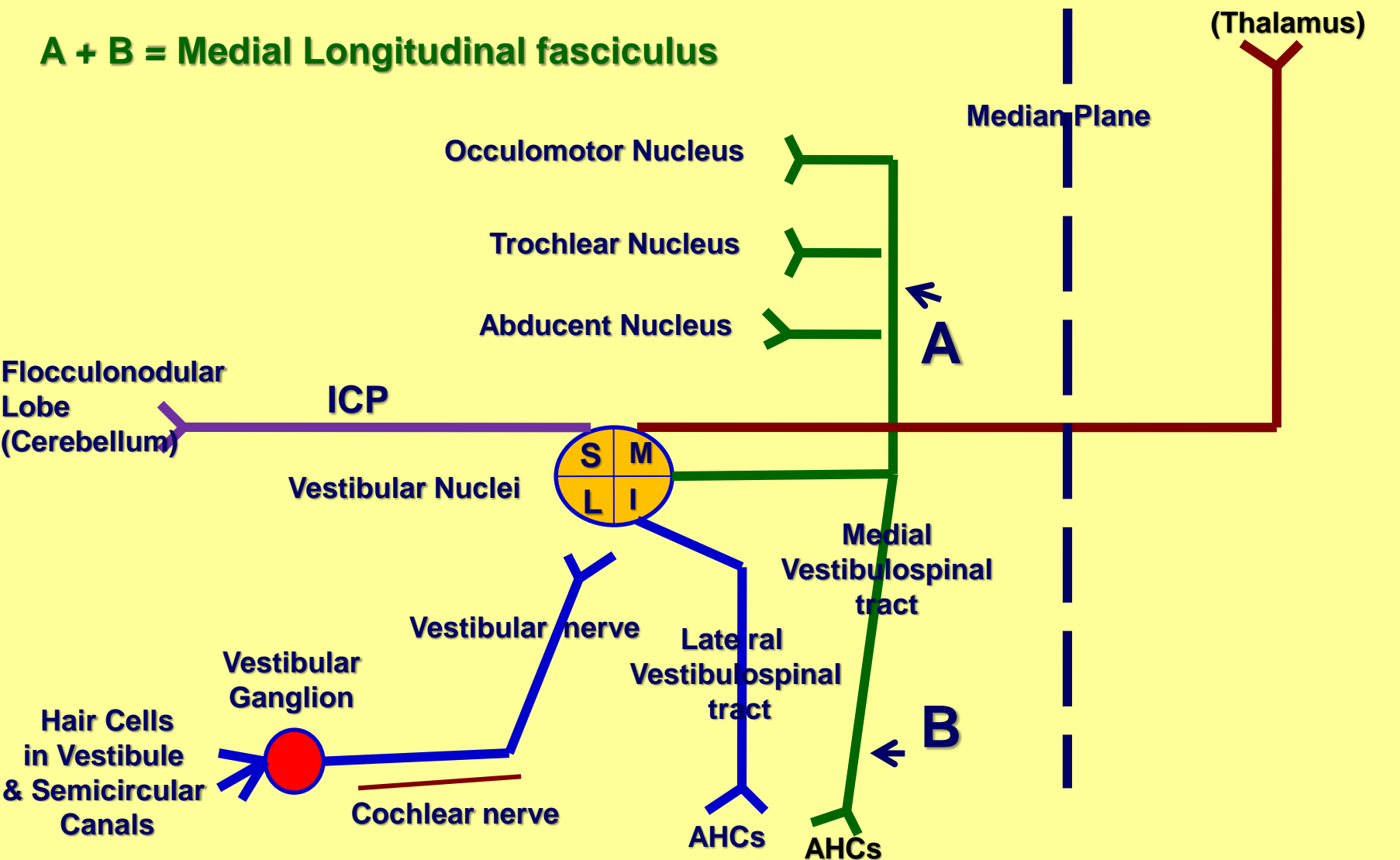
AHCs

AHCs

Vestibular
Ganglion

Cochlear nerve

Hair Cells
in Vestibule
& Semicircular
Canals



VESTIBULAR PATHWAY

- **FIRST ORDER NEURONES:** *Cells of Vestibular ganglion* located in Internal Auditory Meatus.
- Axons make dendritic contacts with hair cells in vestibule & semicircular canals.
- 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)*.

VESTIBULAR PATHWAY

- **SECOND ORDER NEURONES:** *Cells of Superior, Lateral, Medial & Inferior Vestibular Nuclei* in medulla & pons.
- Vestibular nuclei belong to *special somatic afferent column in brain stem.*

CONNECTIONS OF VESTIBULAR PATHWAY

- **Axons of vestibular nuclei may:**
 - 1. Descend as lateral vestibulospinal tract to anterior horn cells of spinal cord.**
 - 2. Join medial longitudinal fasciculus & descend as medial vestibulospinal tract to anterior horn cells of spinal cord.**
 - 3. Pass through inferior cerebellar peduncle to flocculonodular lobe of cerebellum.**
 - 4. Cross midline & ascend to ventral posterior nucleus of thalamus then to vestibular area in cerebral cortex.**

VESTIBULAR PATHWAY

- **Medial Longitudinal fasciculus:** formed of both descending & ascending fibers:
 1. **Descending (medial vestibulospinal tract) to anterior horns cells for control of body posture & balance.**
 2. **Ascending to Oculomotor, Trochlear & Abducent Nuclei (Motor Nuclei for extraocular muscles) for coordination of head & eye movements.**

VESTIBULAR PATHWAY

□ Vestibular area:

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

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, and are located in pons & medulla.**

SUMMARY

- ❑ Inferior colliculi, medial geniculate nucleus and finally auditory cortex are stations in cochlear pathway.**
- ❑ Hearing is bilaterally represented.**
- ❑ Vestibular nuclei are connected to: spinal cord (directly or through medial longitudinal fasciculus, flocculonodular lobe of cerebellum and to vestibular area of cerebral cortex.**


QUESTION 1

The third order neurones of auditory pathway are found in:

1. Mid brain. 
2. Thalamus.
3. Pons.
4. Cerebral cortex.

QUESTION 2

The vestibular nuclei are connected to **the oculomotor nuclei** through:

1. **The lateral lemniscus**
2. **The lateral vestibulospinal tract**
3. **The medial longitudinal fasciculus** 
4. **The vestibular nerve**

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THANK YOU