ANATOMY OF 8TH CRANIAL NERVES

VESTIBULOCOCHLEAR PATHWAYS

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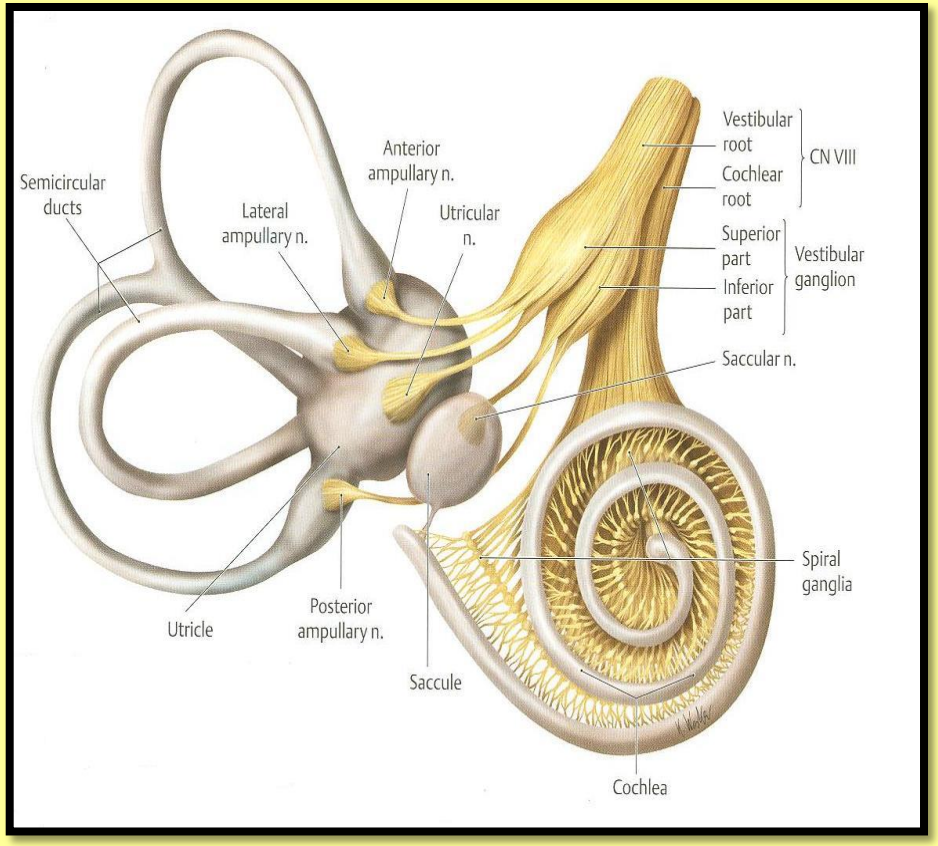
OBJECTIVES

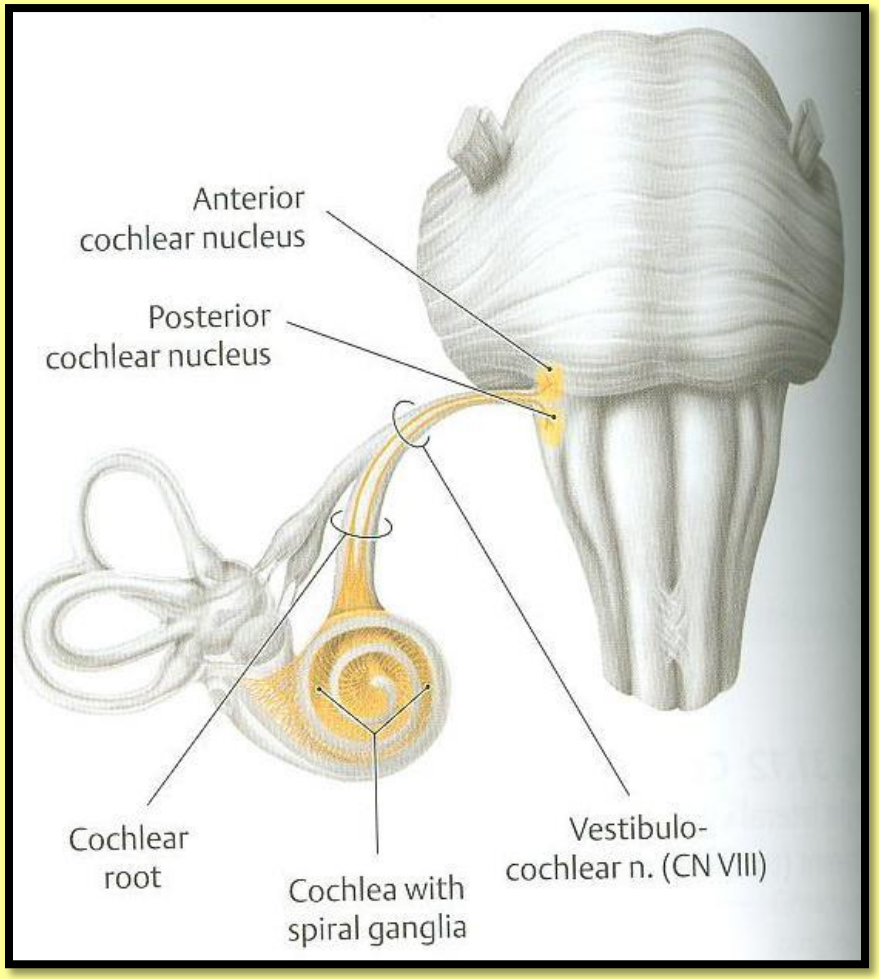
At the end of the lecture, the students should be able to:

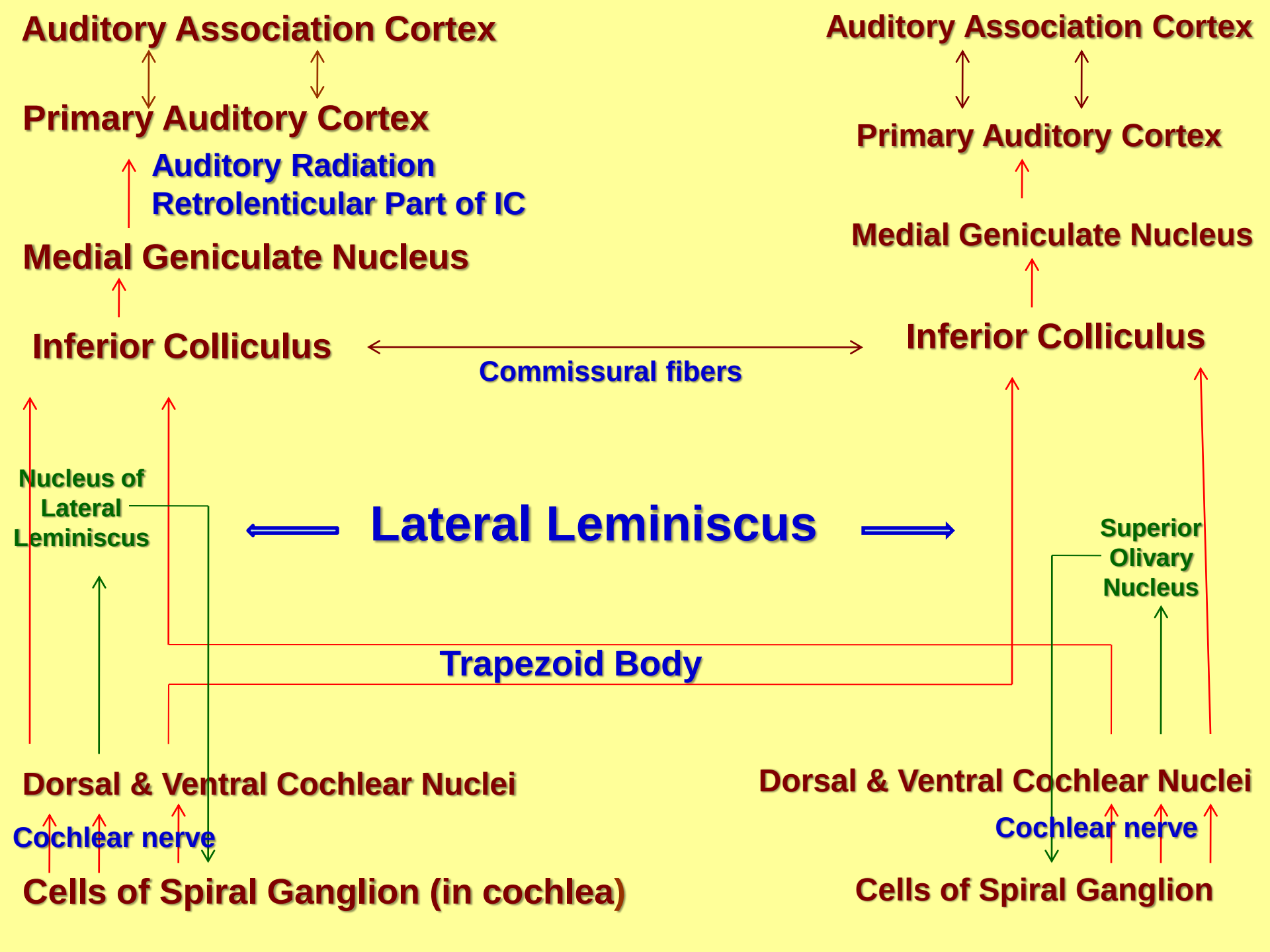
- **List the nuclei related to vestibular and cochlear nerves in the brain stem.**
- **Describe the type and site of each nucleus.**
- **Describe the vestibular pathways and its main connections.**
- **Describe the auditory pathway.**

AUDITORY PATHWAY

AUDITORY PATHWAY






Auditory Association Cortex
Primary Auditory Cortex
Auditory Radiation
Retrolenticular Part of IC
Medial Geniculate Nucleus
Inferior Colliculus
Commissural fibers
Auditory Association Cortex
Primary Auditory Cortex
Medial Geniculate Nucleus
Inferior Colliculus
Nucleus of Lateral Leminiscus
Lateral Leminiscus
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

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 leminiscus.***
- **Some fibers end in *Superior Olivary Nucleus & Nucleus of Lateral Leminiscus*.**

AUDITORY PATHWAY

- ***Superior Olivary Nucleus & Nucleus of Lateral Leminiscus:*** **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 neurones supplying tensor tympani & stapedius muscles.**

AUDITORY PATHWAY

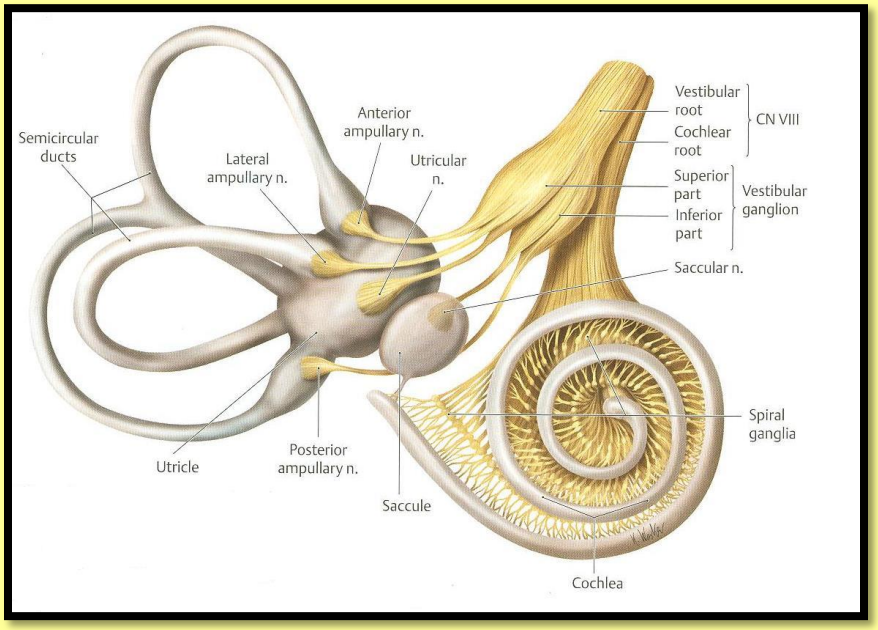
- **THIRD ORDER NEURONES:** ***Cells of inferior colliculus (midbrain).*** **Both colliculi are interconnected by commissural fibers.**
- **FOURTH ORDER NEURONES:** ***Cells of medial geniculate nucleus (thalamus).***
- **Axons form *auditory radiation* that pass through retrolenticular part of internal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

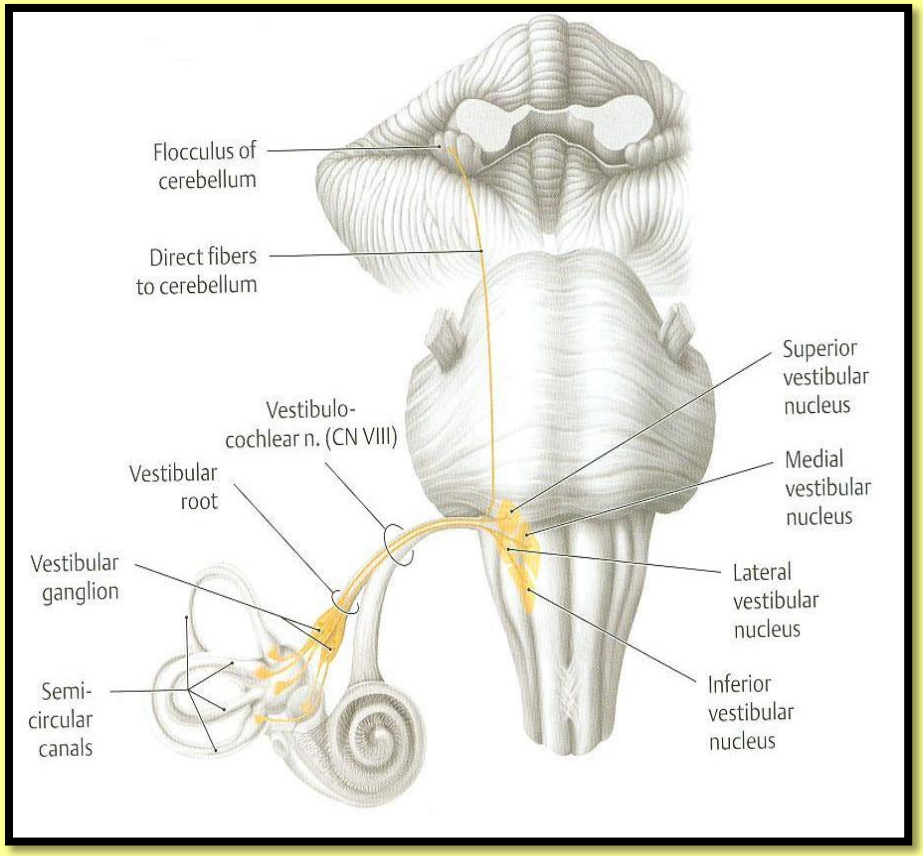
AUDITORY PATHWAY

- 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.**

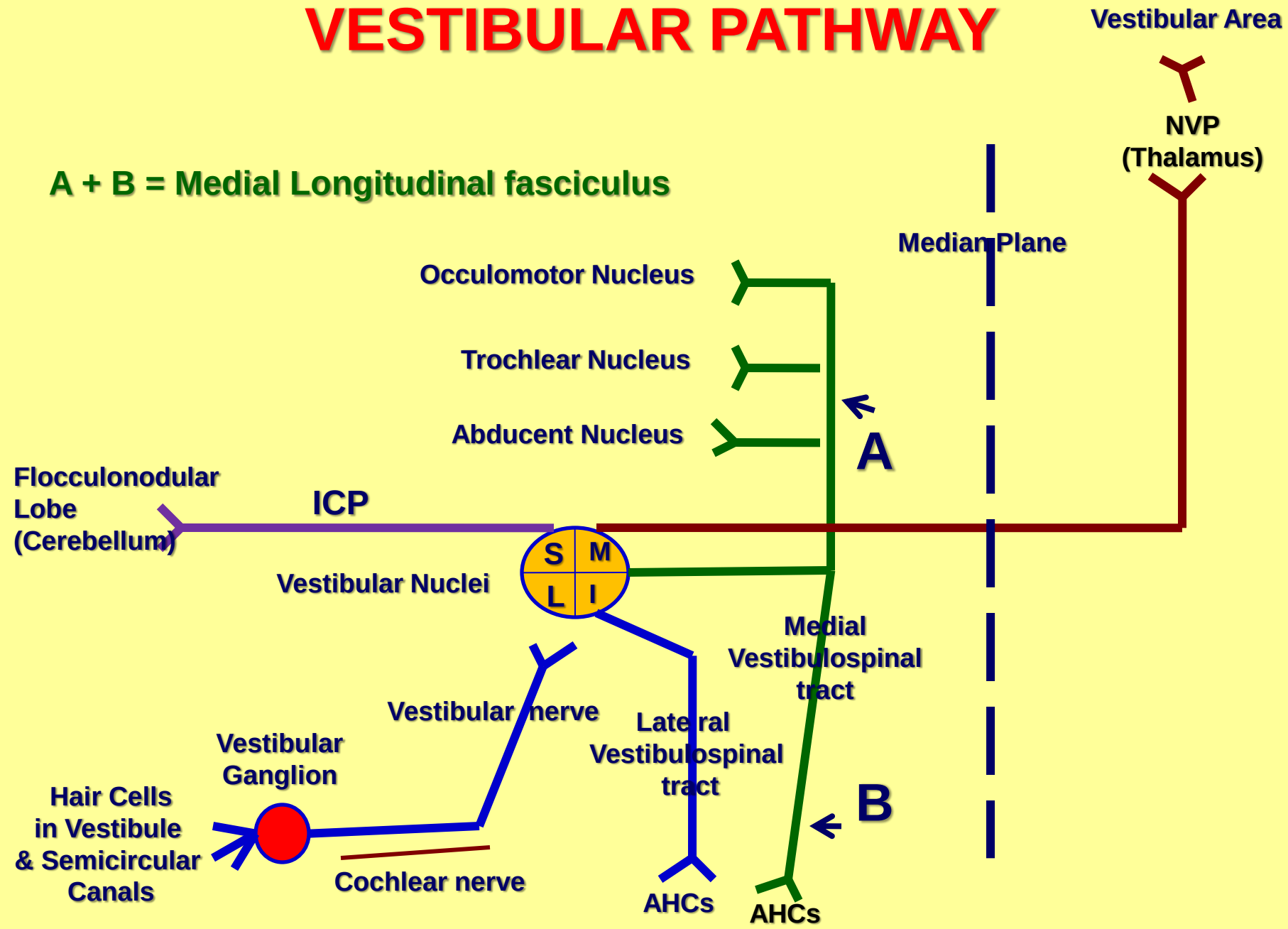
VESTIBULAR PATHWAY

VESTIBULAR PATHWAY





VESTIBULAR PATHWAY



VESTIBULAR 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 Occulomotor, Trochlear & Abducent Nuclei (Motor Nuclei for extraoccular 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 occulomotor nuclei** through:

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


THANK YOU