



Gaza Ophthalmic Centre

21.2.1 The Pons Part 1 Neurosciences I

Maged A AbuRamadan
MD, FRCSEd, FICO, PPOS

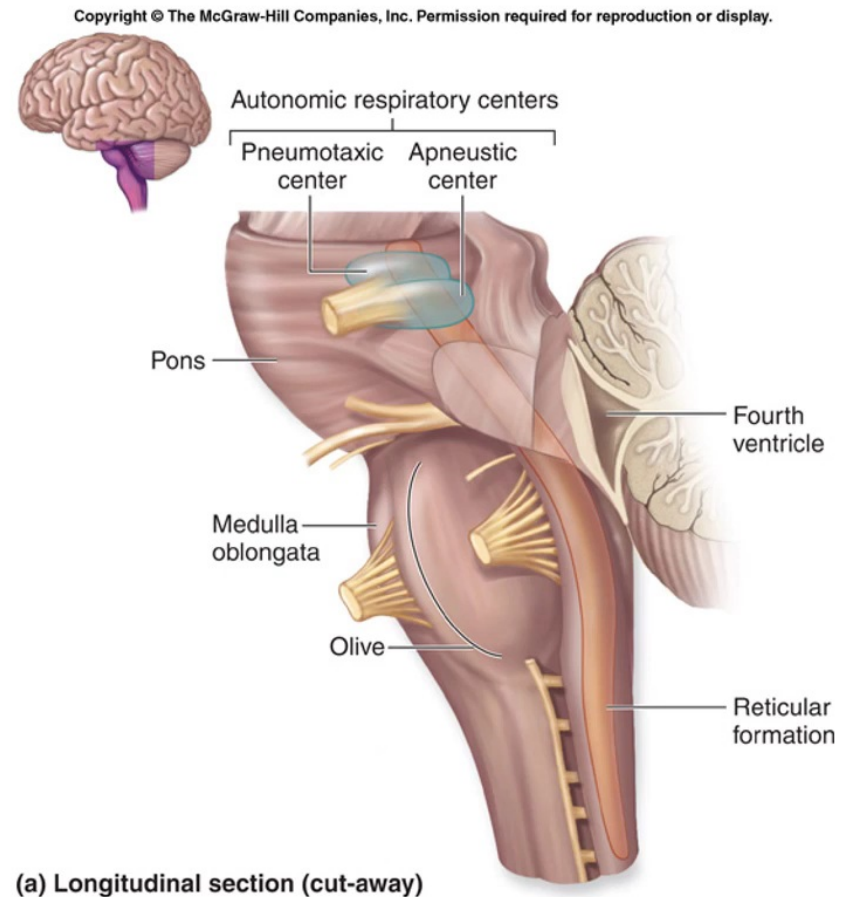
Gaza Ophthalmic Centre

Dr. Maged Awni Abu-Ramadan, MD, FRCSEd



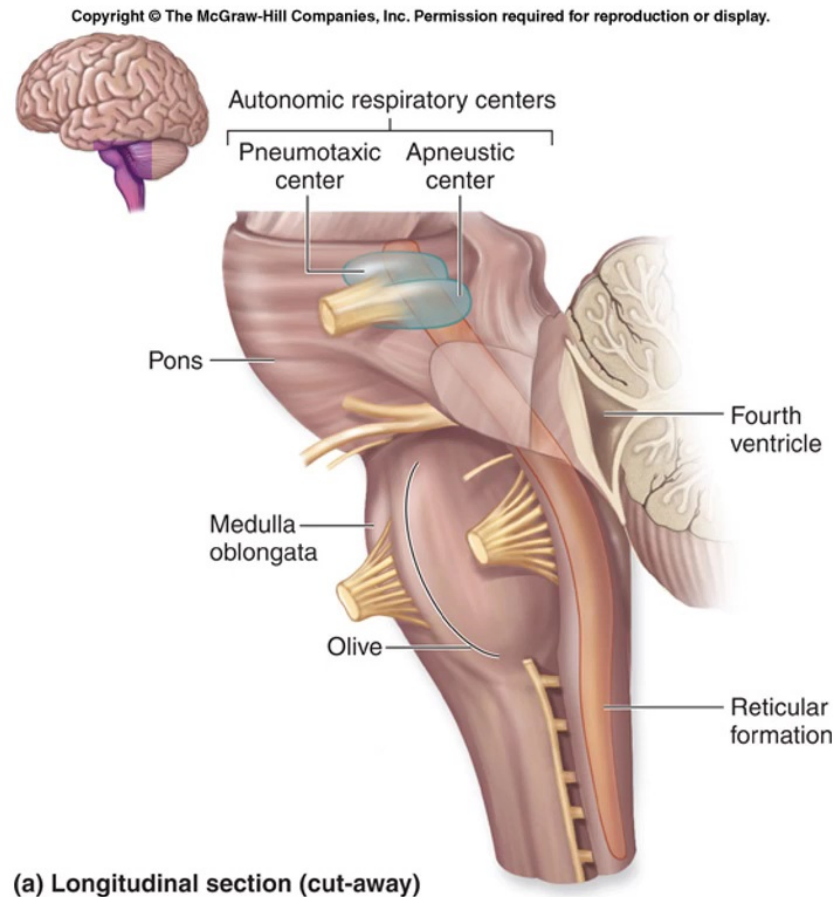
The Pons

- Convex structure
 - From above downward
 - From side to side
- 2 Middle Cerebellar Peduncles → cerebellum
- 2 cerebral peduncles of midbrain pass from above
- 2 pyramids emerge from below
- Contains the nuclei of cranial nerves V, VI, VII & VIII
- Two general groups of cranial nerve nuclei
 - Motor nuclei
 - Sensory nuclei



The Pons

- **Located**
 - Between the midbrain and medulla oblongata
 - In front of the cerebellum
- **2 borders**
 - **Superior**
 - Level of Basilar A division → 2 PCA
 - Receives 2 Crura Cerebri of Mid Brain
 - Pos boundary of the Interpeduncular fossa
 - **Inferior**
 - 2 Vertebral Aa unite → Basilar a
 - Abducent nerve exit
 - VII & VIII escape at CPA

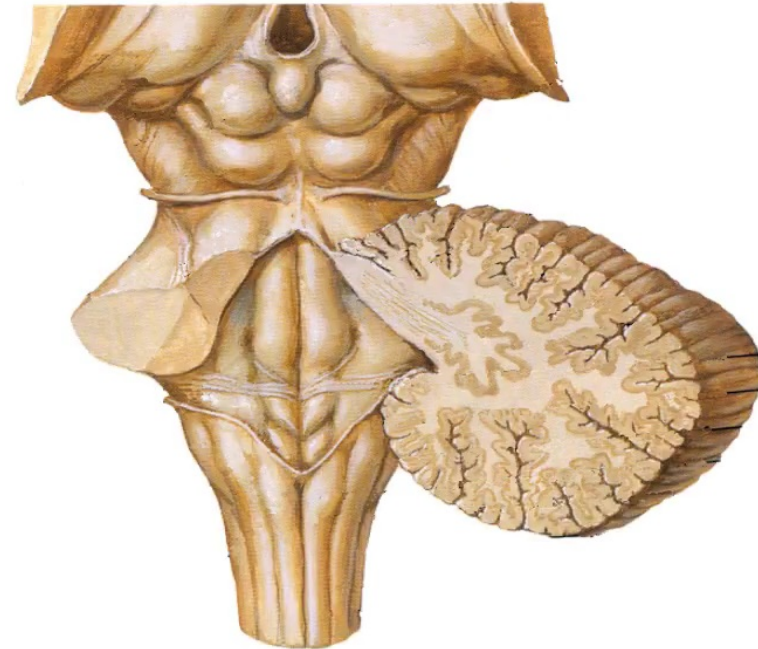
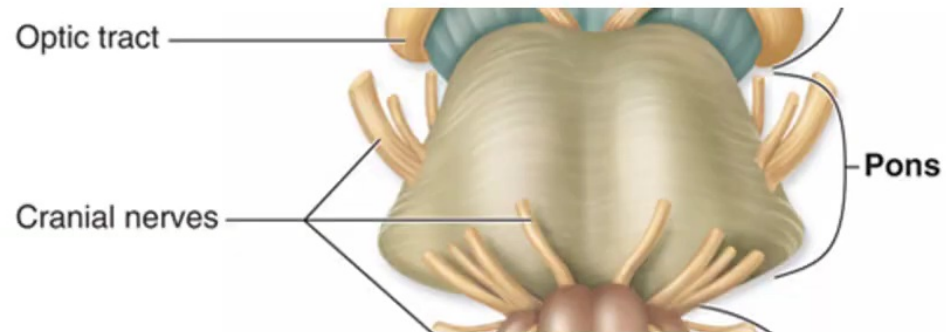


The Pons

- 2 Surfaces

1. Ventral

2. Dorsal



The Pons

- **Ventral**

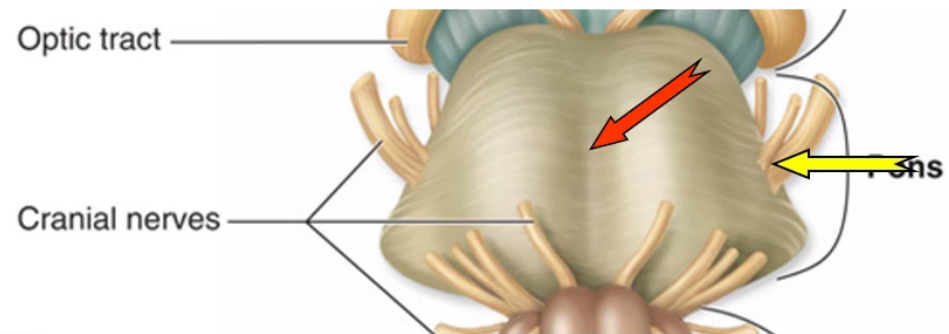
- **Pons Proper**

- Median sulcus for basilar a

- **Trigeminal nerve exit**

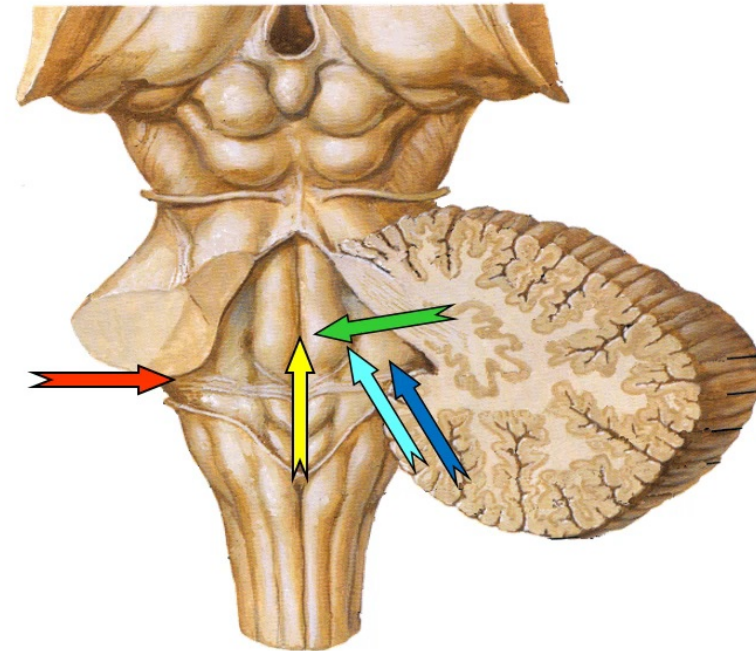
- **Middle cerebellar peduncles**

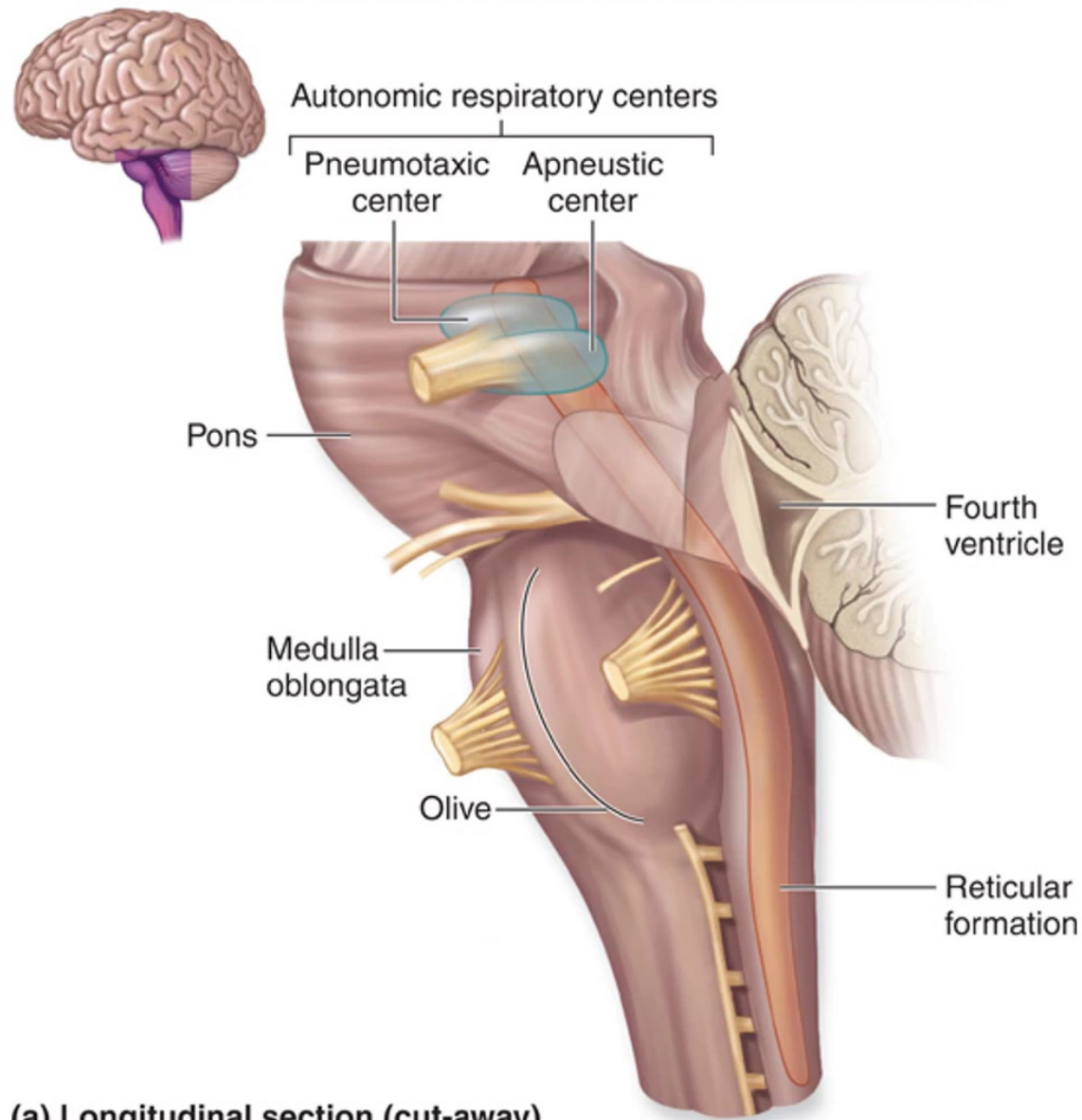
- Ponto cerebellar f

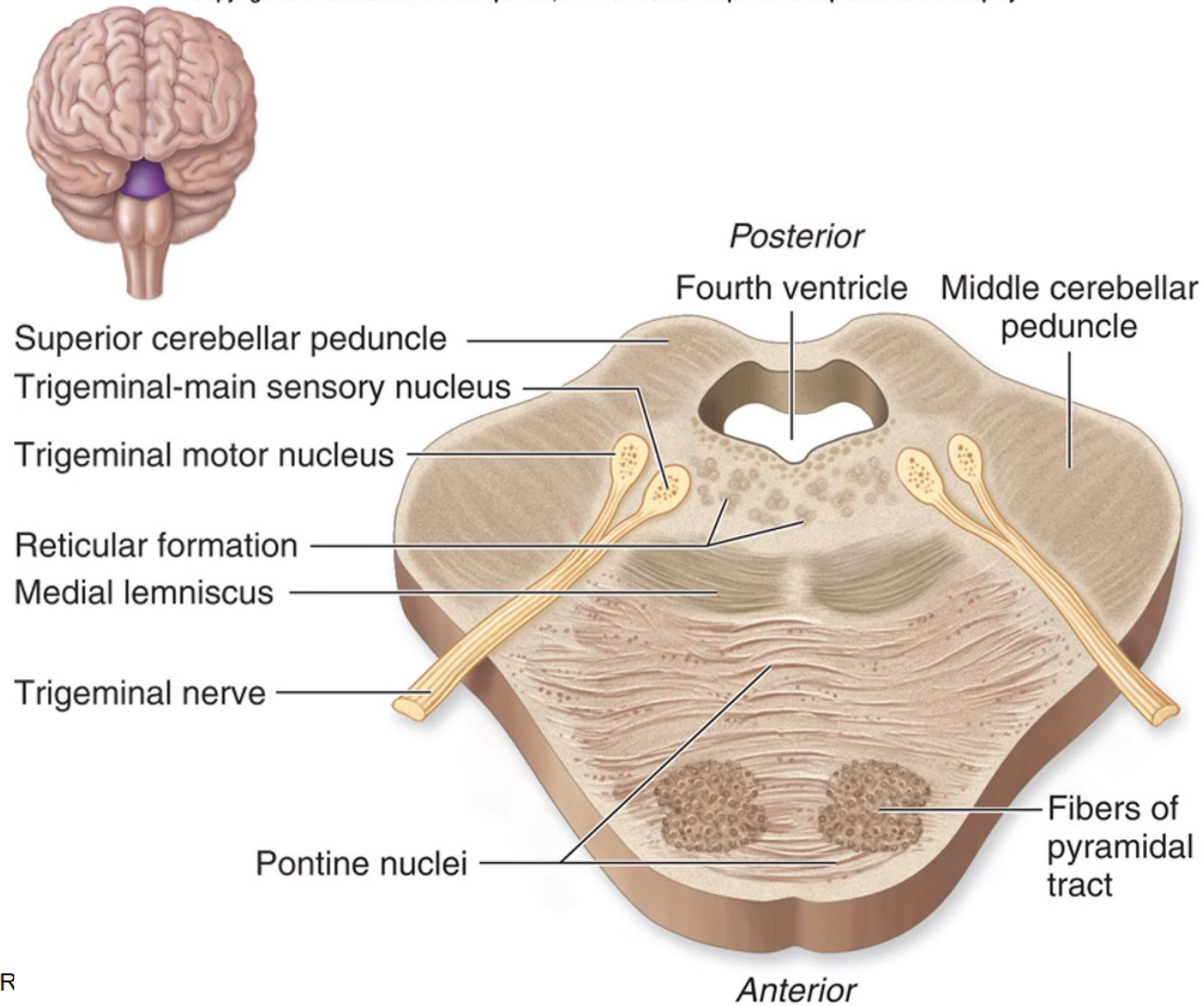


The Pons

- Dorsal
 - Upper part of the floor of V4
 - Lower limit → medullary striae
 - Vertical median sulcus
 - Medial Eminence
 - Longitudinal ridge
 - Lower part → Facial Colliculus
 - Sulcus Limitans
 - Lateral to ME
 - Lower part → Superior Fovea
 - Vestibular Area
 - Lateral to Sup Fovea



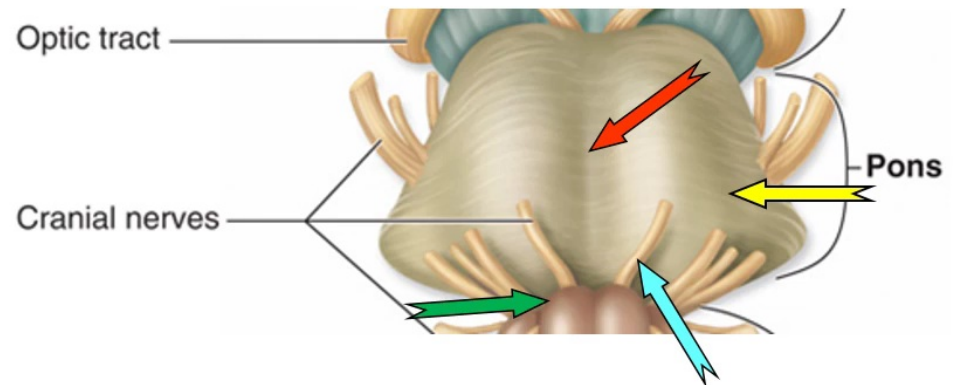




Pons: External Features

The Anterior surface

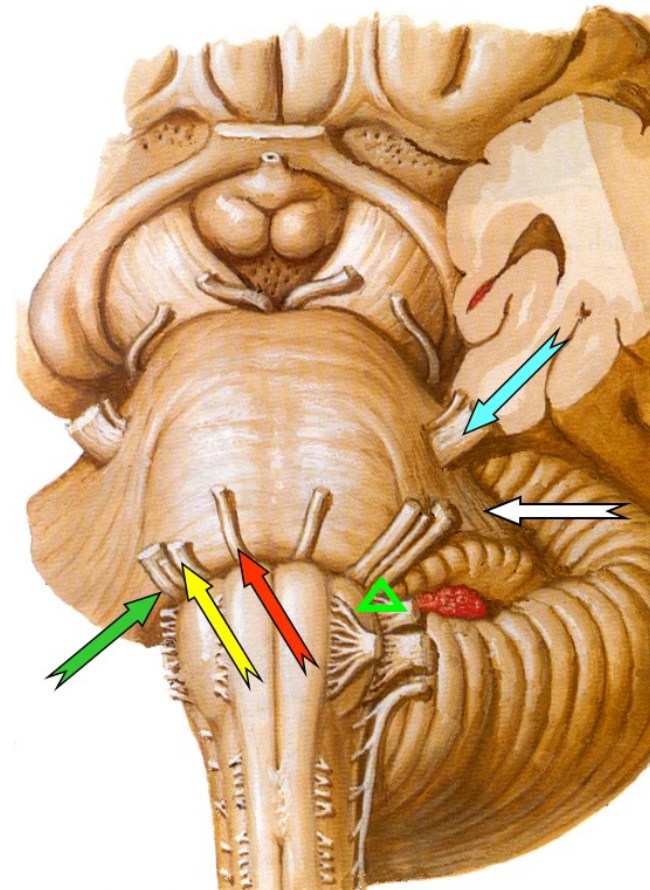
- Shallow median groove
 - Midline
 - Basilar a
- Transverse ridges
 - Many thick ridges
 - Transverse pontine fibres
- Sulcus separates pons from medulla
 - Abducent nerve emerge near midline



Pons: External Features

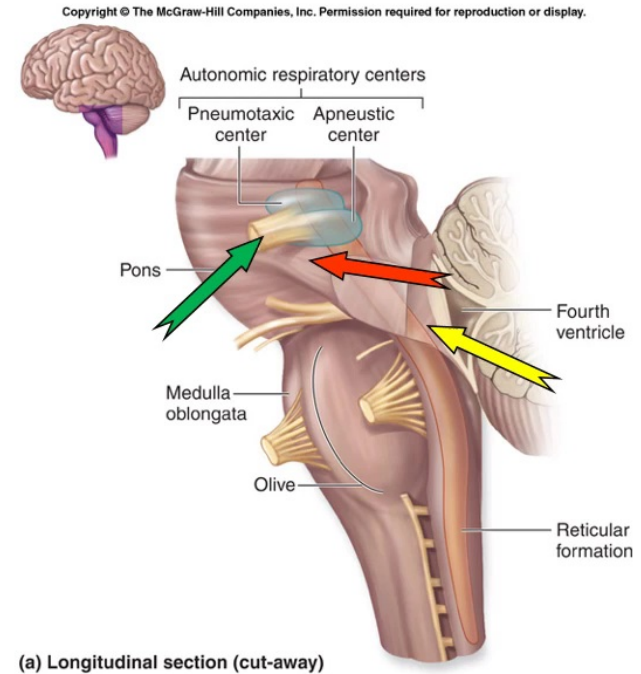
Ventral surface

- **Bulbopontine sulcus**
 - from medial to lateral,
 1. **Abducent,**
 2. **Facial and**
 3. **Vestibulocochlear nerves**
- **Middle cerebellar peduncle**
- **Trigeminal nerve**
- **Pontocerebellar trigone**
 - the junction of medulla, pons and cerebellum



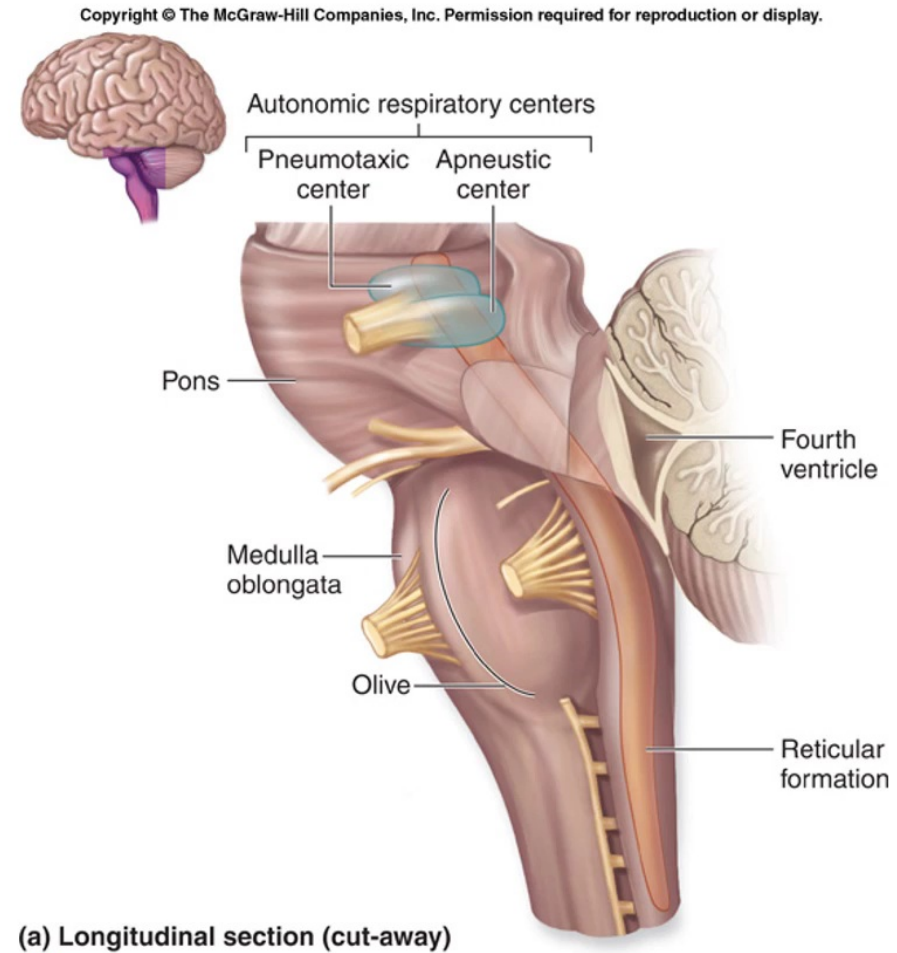
Pons: External Features

- The Lateral surface
 - Middle cerebellar peduncle
 - Brachium pontis
 - Transvers pontine fibres collecting → compact thick bundle
 - Sinks into the corresponding cerebellar hemisphere
- Trigeminal nerve
 - The largest cranial nerve
 - Leaves the lateral part of the middle of the pons



Pons: External Features

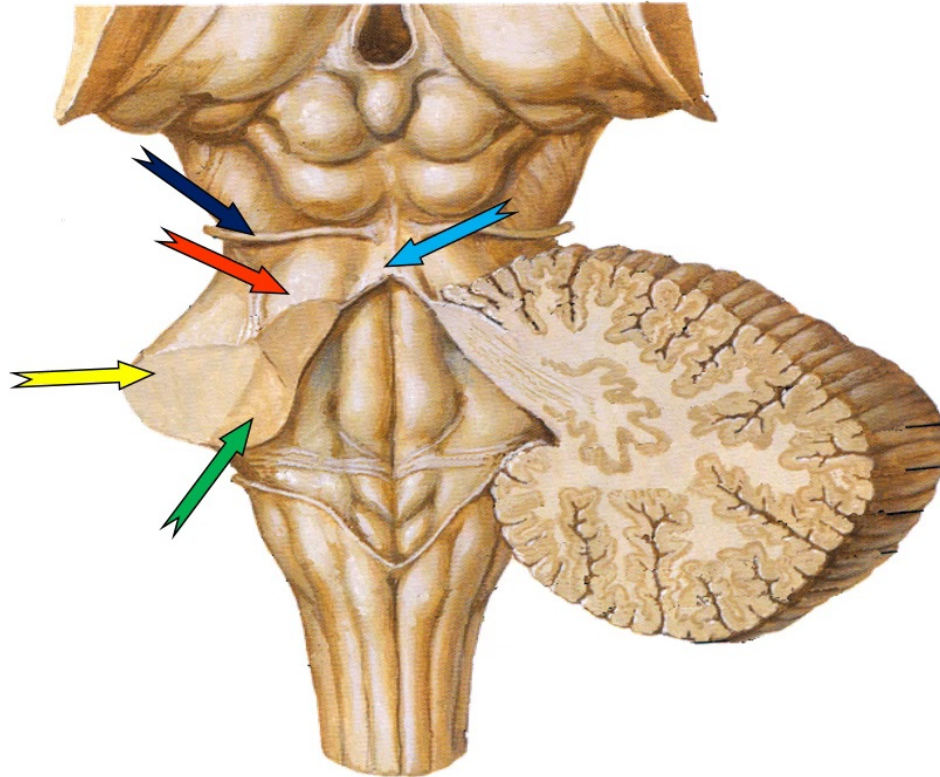
- The Lateral surface
 - The Pontocerebellar angle
 - Triangular space
 1. Lower border of MCP
 2. Cerebellum
 3. Upper medulla
 - Facial nerve
 - Attached at CPA
 - Auditory nerve
 - Attached at CPA



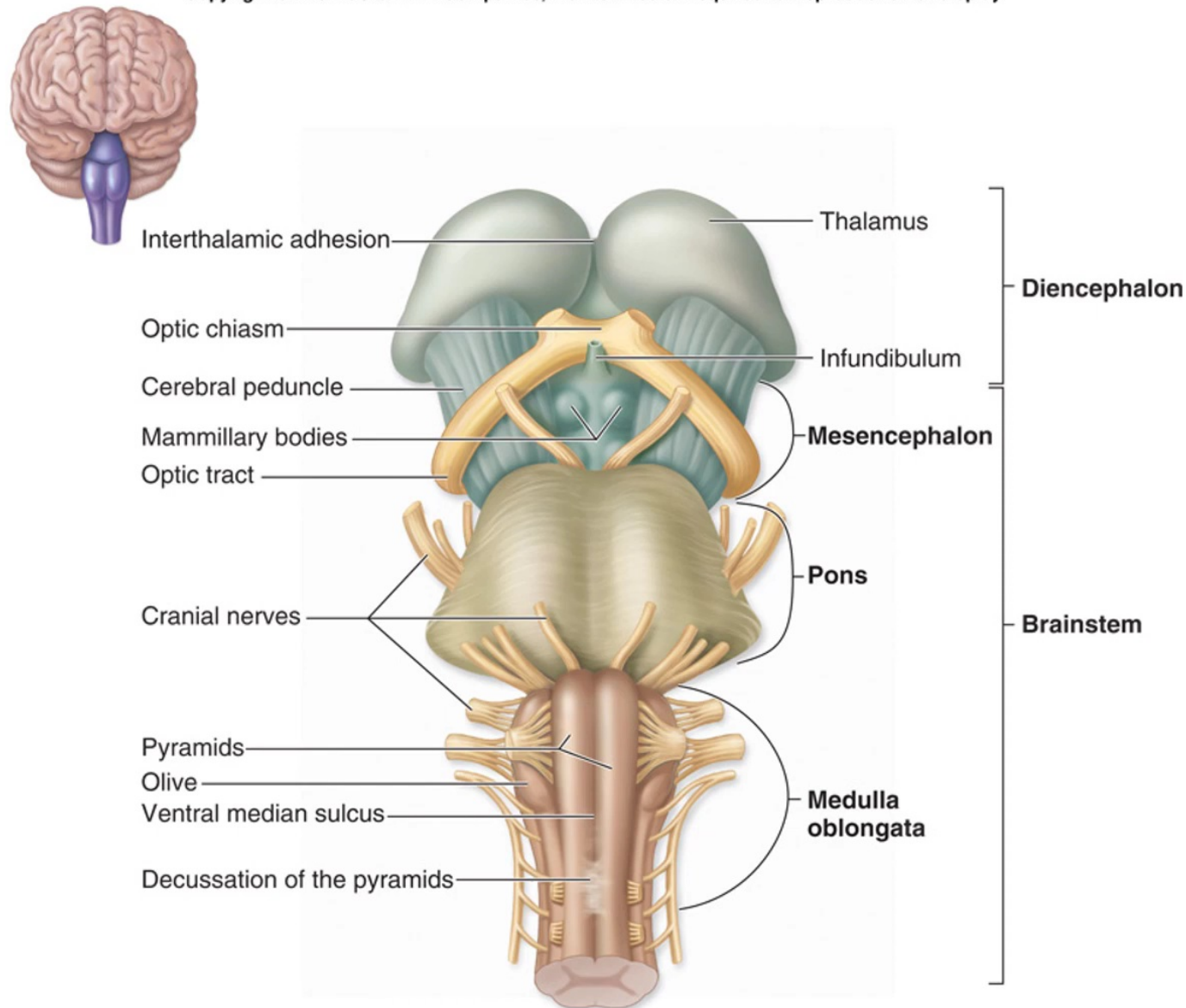
Pons: External Features

Dorsal surface

- Superior cerebellar peduncle
- Middle cerebellar peduncle
- Inferior cerebellar peduncle
- Superior medullary velum
- Trochlear nerve

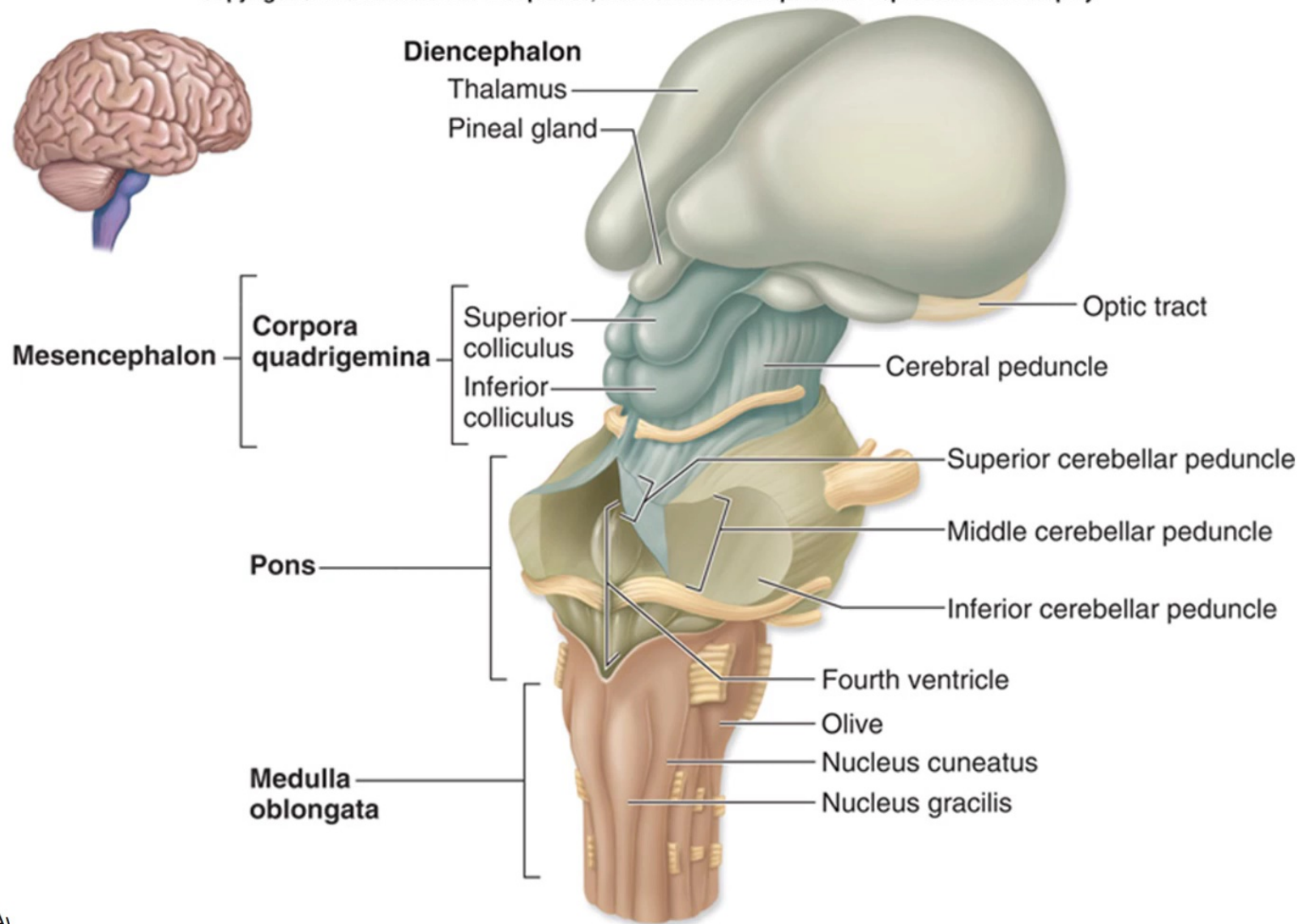






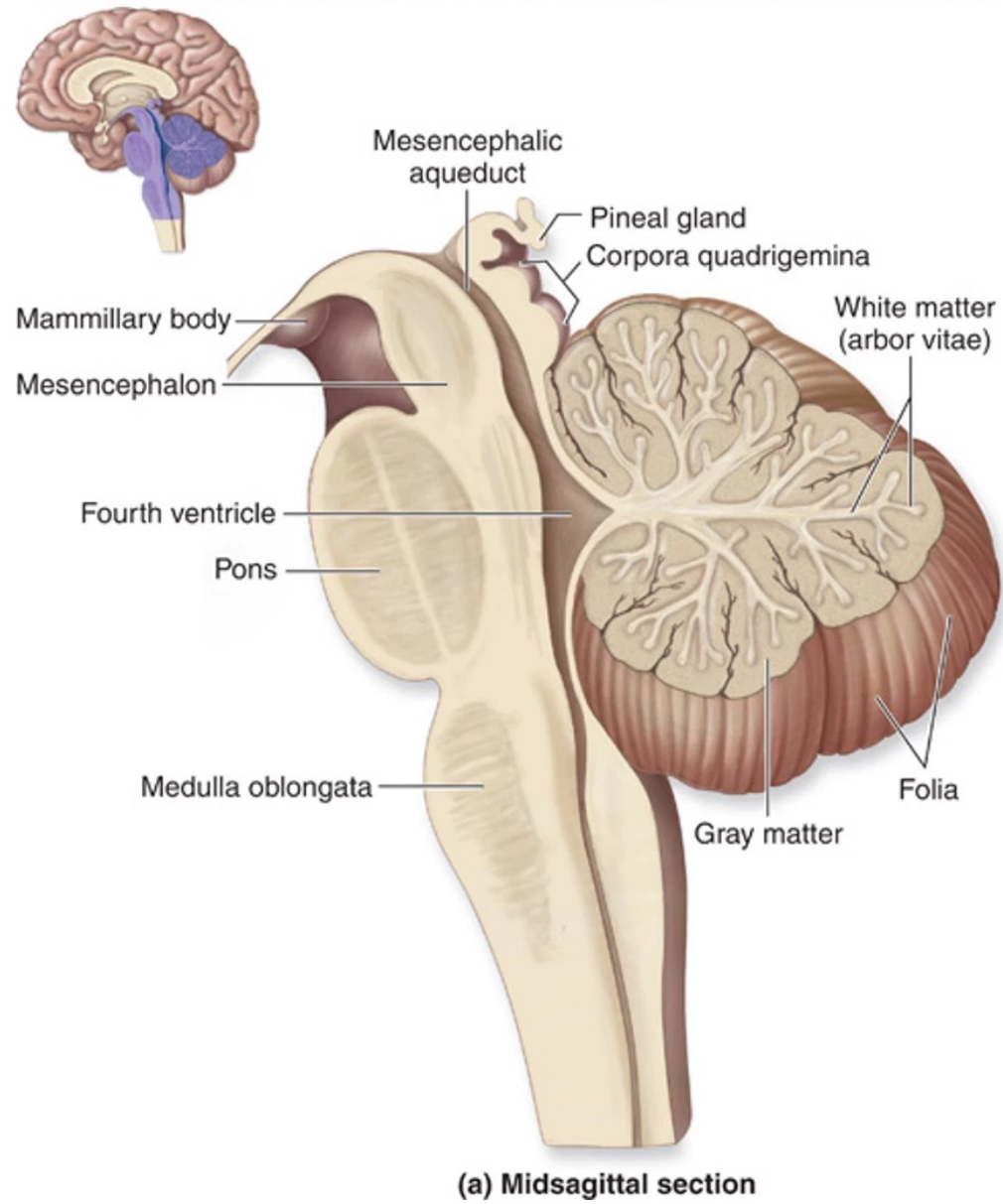
(a) Anterior view





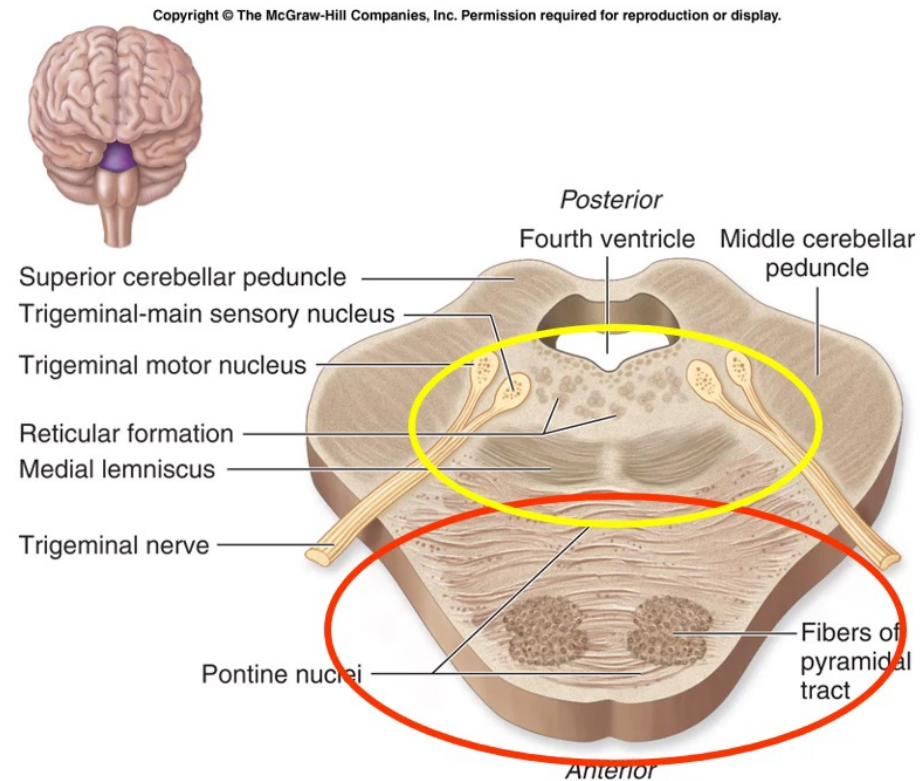
(b) Posterolateral view





Pons: Internal Structure

- Ventral part:
 - Basis Pontis
- Dorsal part:
 - Pontine Tegmentum



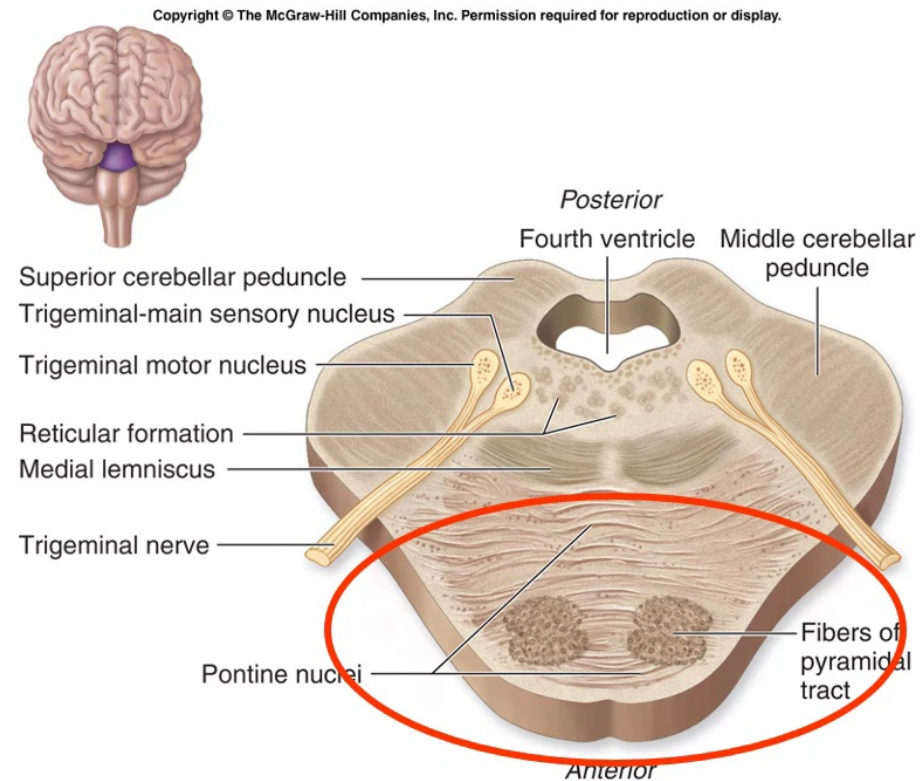
(b) Pons cross section



Pons: Internal Structure

- Ventral part:
Basis Pontis

1. Cortico Spinal F (disbursed Bundles)
2. Cortico Nuclear F
3. Cortico Pontine F
4. Ponto Cerebellar F
 - Axons of Pontine Nc
 - Run Transversely
 - Cross midline
 - → MCP → Neocerebellum



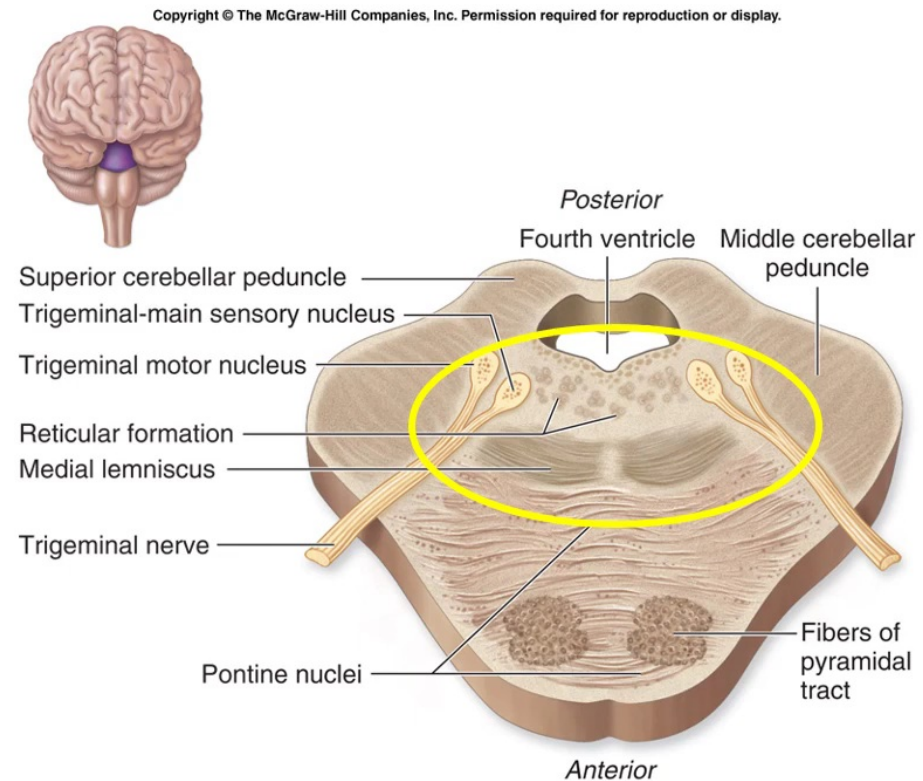
(b) Pons cross section



Pons: Internal Structure

- Dorsal part:
Pontine Tegmentum

1. Superior Olivary Complex
2. Central Nc of middle 4 CrNn
3. Ascending & descending Tracts
4. Lemnisci

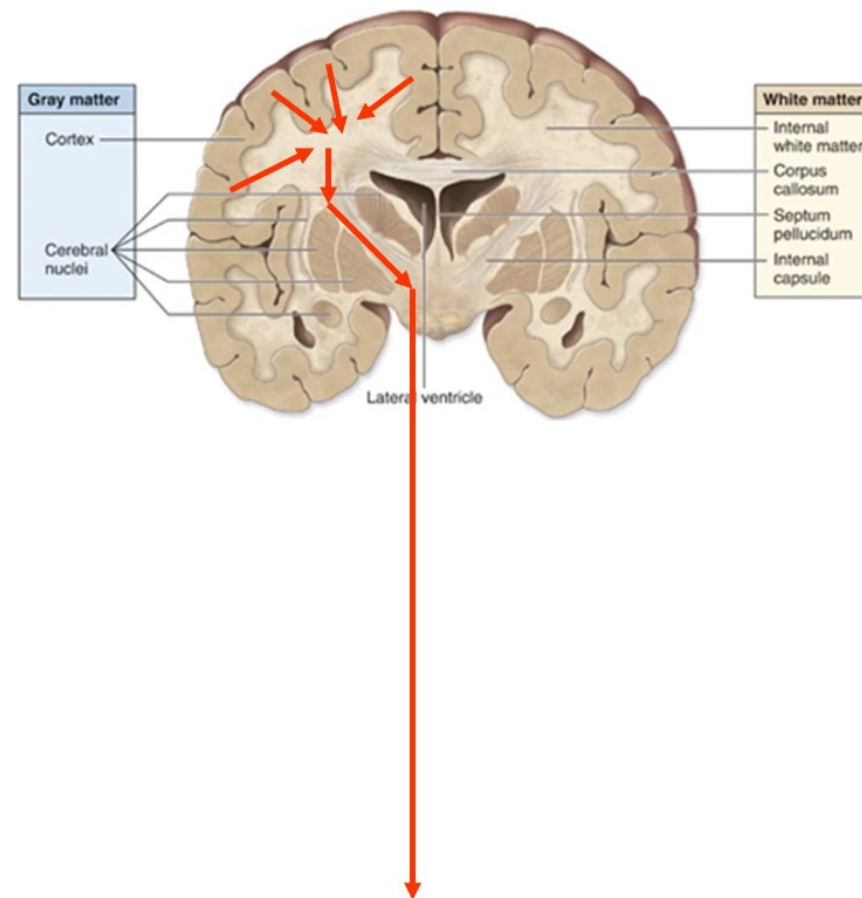


(b) Pons cross section



Pons: Cortico Nuclear Pathway

- **Origin**
 - Lower part of Precentral Gyrus
- **Course**
 - Genu of Internal Capsule
 - Medial side of Crus Cerebri in Midbrain
 - Basis Pontis



Pons: Cortico Nuclear Pathway

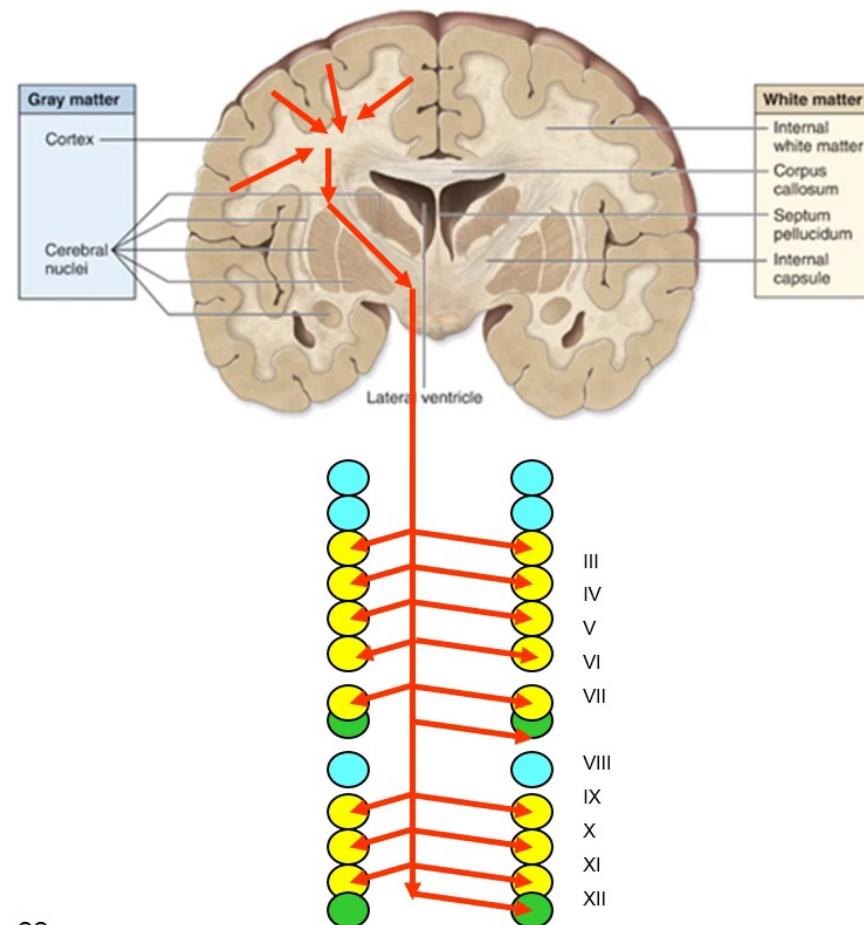
- Termination

- Nc of General Somatic Efferent Column

- III
- IV
- VI
- XII

- Nc of Special Visceral Efferent Column

- Motor Nc of V
- Motor Nc of VII
- Nc Ambiguous → IX X XI



Pons: Cortico Nuclear Pathway

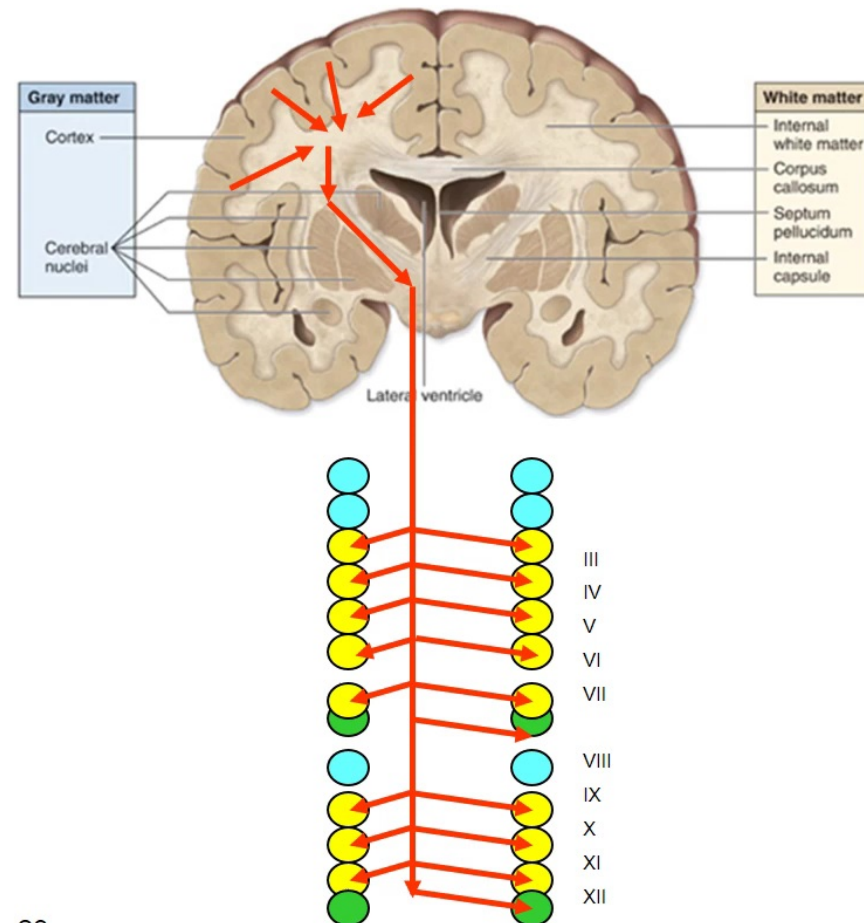
- NB

- All Nc receive bilateral
- Cortico Spinal F
- Except

1. Lower part of VII (CL)
2. Part of XII innervating Genioglossus (CL)

- Function

1. CNF → UMN of Cranial Nerves
2. Cr N Nc → LMN

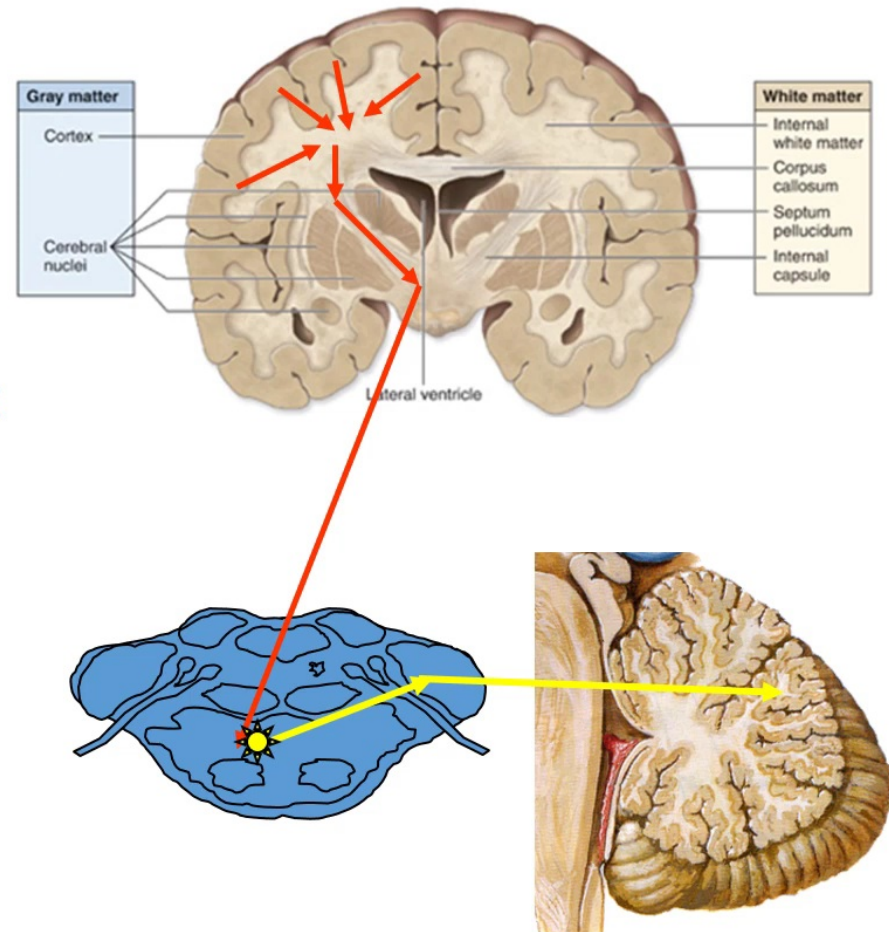


Pons: Cortico Ponto Cerebellar Pathway

- Pathway connects
 - Different lobes of cerebral cortex
 - To CL hemi cerebellum

2 order Neuron

- Neuron I
 - Neurons in different lobes of cerebral cortex
 - Axons → Cortico Pontine F
 - → IC → Crus Cerebri → Pons
- Neuron II
 - Neurons of pontine Nuclei
 - Axons → ponto Cerebellar F
 - Cross midline
 - → MCP
 - → CL Hemicerebellum



Pons: Cortico Ponto Cerebellar Pathway

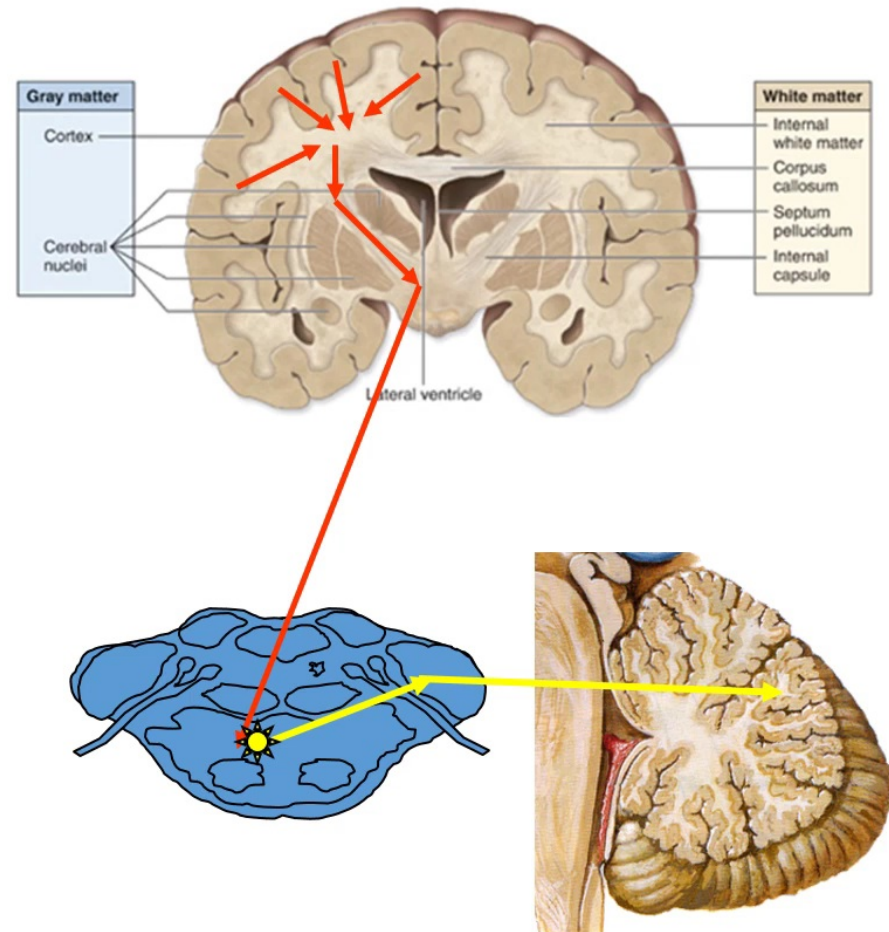
- Function

- Cerebral Cortex informs CL Neocerebellum

- Plan & sequence
 - Of Intended movement
 - Before its Beginning
 - Throughout its Performance

- MCP

- Bundle of nerve fibres
 - Ponto cerebellar fibres (Pons)
 - Tecto ponto cerebellar fibres (MB)

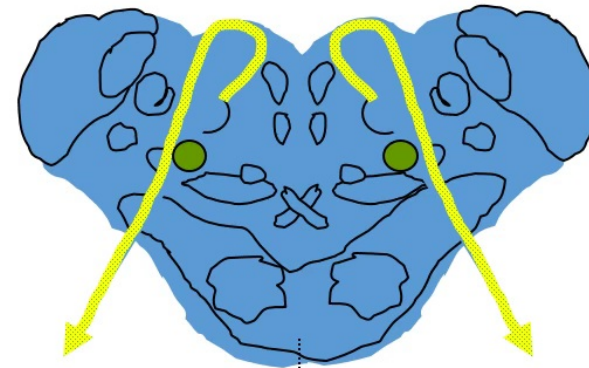


Pons: The Superior Olivary Complex

- Group of Nuclei
 - Dispersed among fibres of
 - Auditory pathway
 - In Lower Pons

Involved in

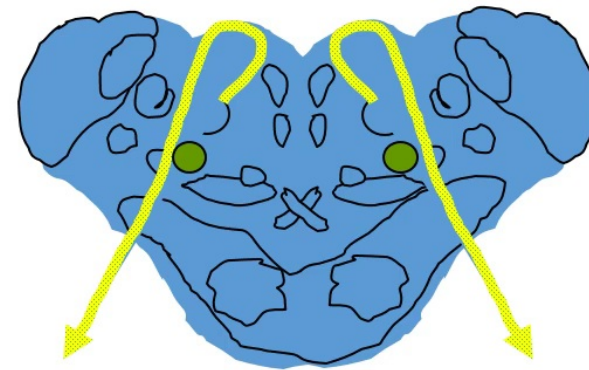
- Spatial Localization of
 - Sound Source
-
- Nuclei
 1. Medial Superior Olivary nc
 2. Lateral Superior Olivary nc
 3. Retro Olivary Nc



Pons: The Superior Olivary Complex

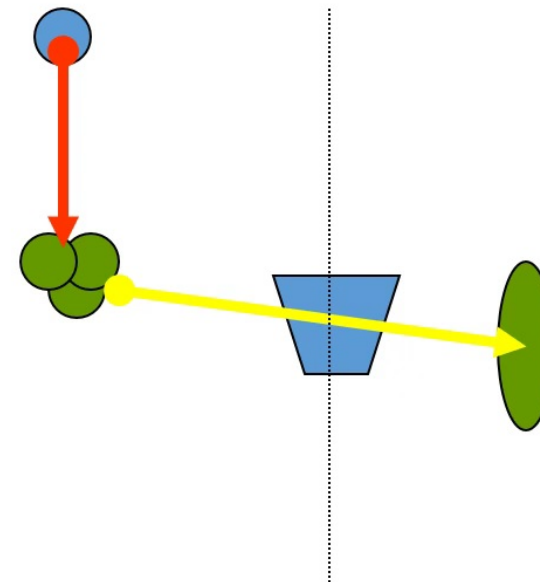
- Input

- Excitatory
- From IL
- Ventral Cochlear Nc



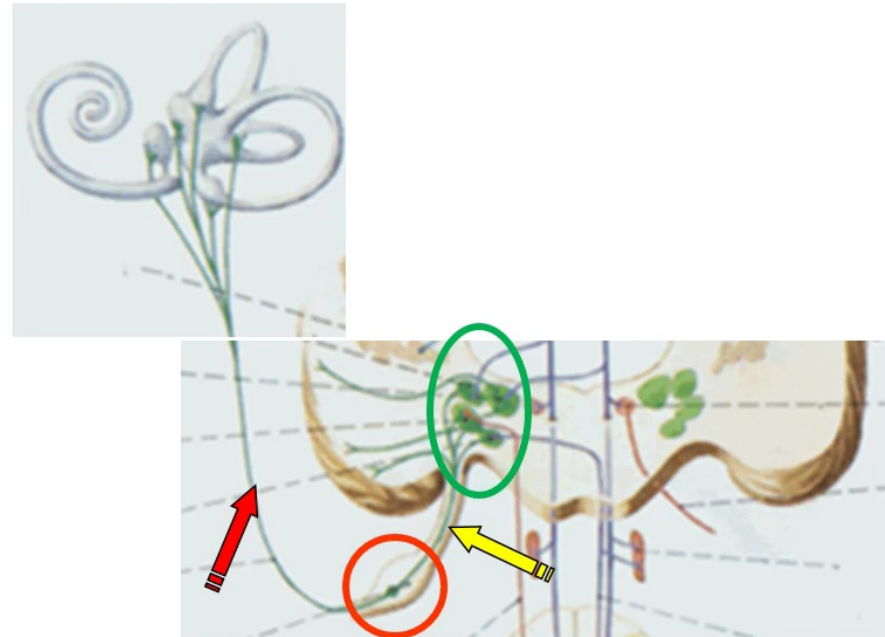
- Output

- Inhibitory F
- Crossed
- Via Nc of Trapezoid Body
- → CL Superior Olivary Nc



Pons: the Vestibular Nerve

- Central axons of the
 - Bipolar neurons of the
 - Vestibular Ganglion
- Vestibular Ganglion
 - On the trunk of the Vestibular N
 - In the depth of the Internal Acoustic Meatus
- Bipolar Neurons
 - Peripheral Process
 - → Vestibular system of Inner Ear
 - Central Process
 - Most f → Vestibular Nc
 - At Ponto Medullary junction
 - Some f → ICP → Cerebellum directly



Pons: the Vestibular Nerve

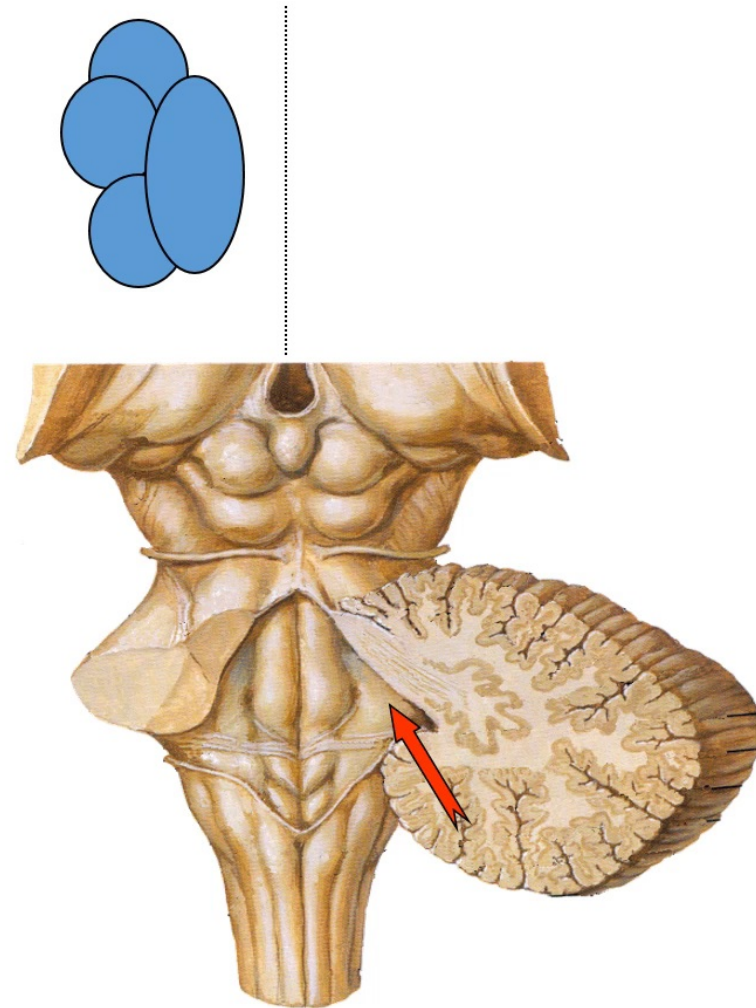
- Vestibular Nuclei

- 4 Nuclei

- Sup
- Inf
- Lat
- Med

- Vestibular area

- Floor of V4
- Lower Pons & Upper Medulla



Pons: the Vestibular Nerve

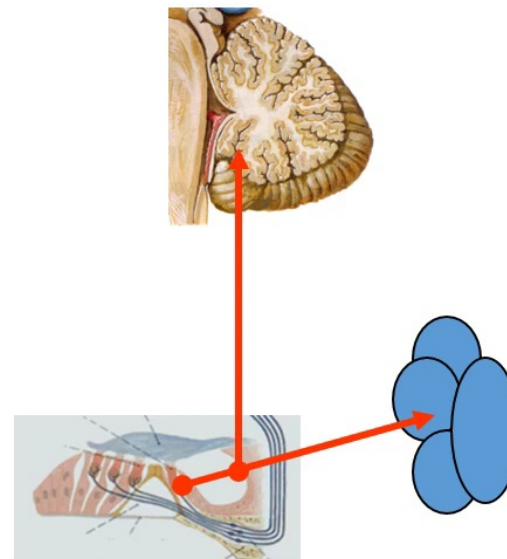
- **Afferents to Vestibular Nc**

- 1) **Vestibular Nerve**

- Central processes of
- Bipolar cells

- 2) **Cerebello Vestibular F from**

- Flocculonodular Lobe



Pons: the Vestibular Nerve

- Efferents from Vestibular Nuclei

- 1) Vestibulo Spinal Tract

- Lateral tract from Lat V Nc
- Medial tract from Med V Nc

- 2) Vestibulo Cerebellar F

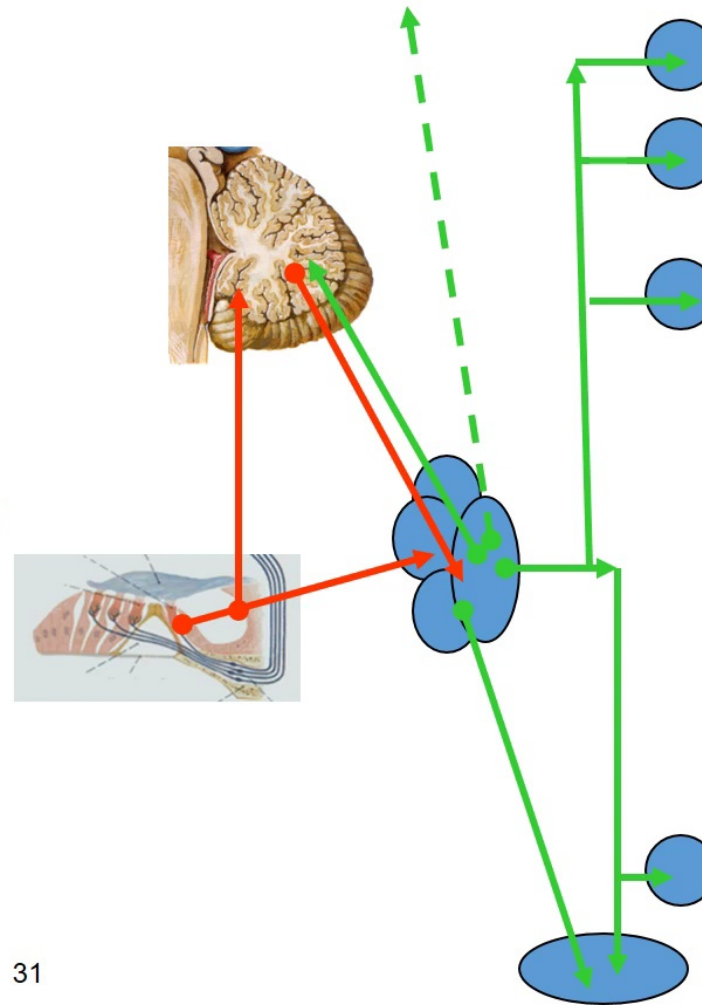
- → ICP → Flocculo Nodular Lobe

- 3) Vestibulo Ocular F

- → MLB → Gaze Centres of Brainstem

- 4) Vestibulo Cortical F

- Ascend to Thalamus
- → Cortical Vestibular area
 - Lower postcentral gyrus
 - Superior temporal gyrus



Pons: the Vestibular Nerve

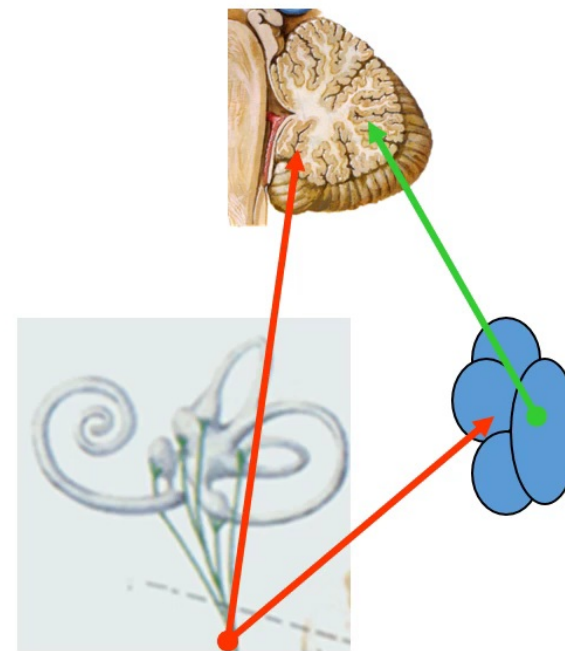
- **Function**

- **Maintenance of**

1. Posture
2. Equilibrium

- **In relation to head**

1. Position
2. Movement



Pons: the Vestibular Nerve

Cerebellum receives

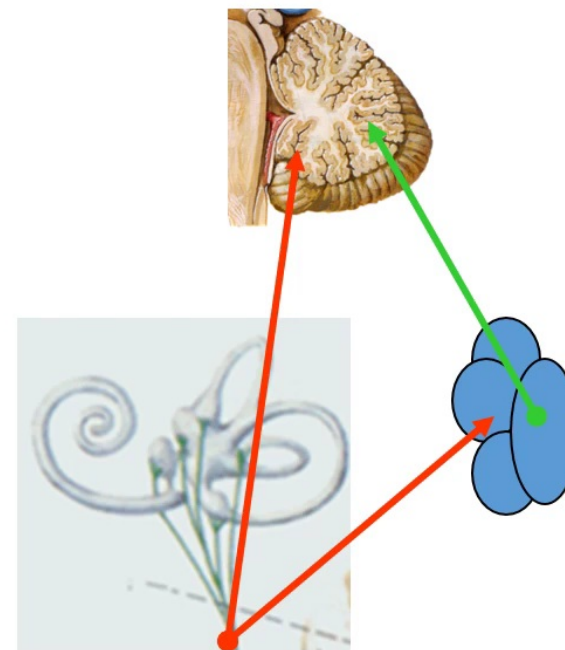
- 2 types of vestibular f

1ry Vestibular F

- Direct from
- Vestibular Ganglion

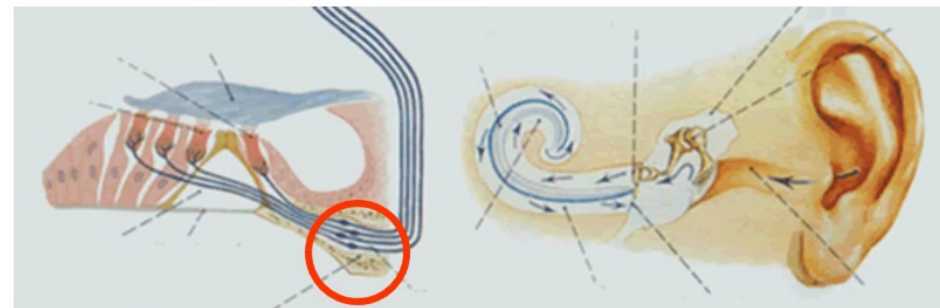
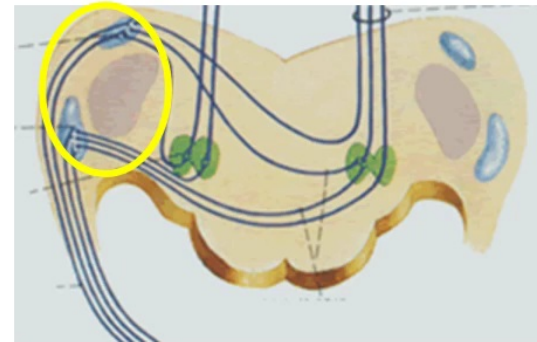
2ry vestibular F

- Indirect from
- Vestibular Nc



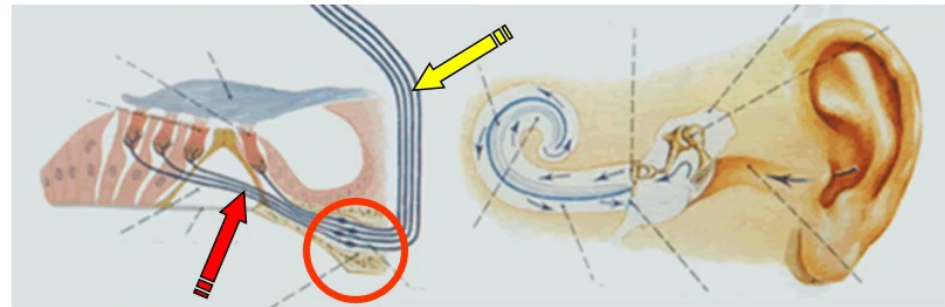
Pons: Cochlear Nerve & Auditory pathway

- **Spiral Ganglion**
 - In the spiral Canal of
 - The Cochlea
- **Cochlear Nuclei**
 - Lower Pons



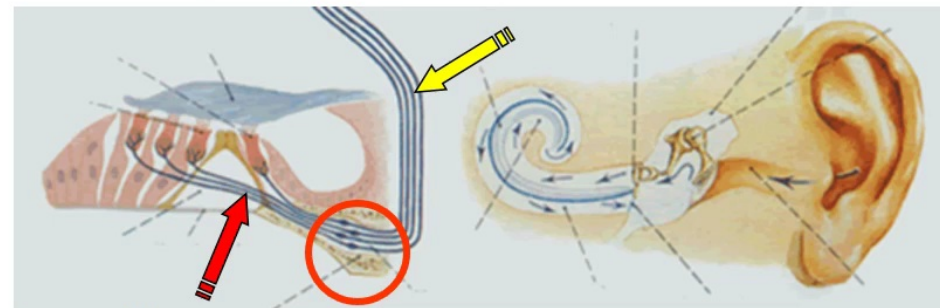
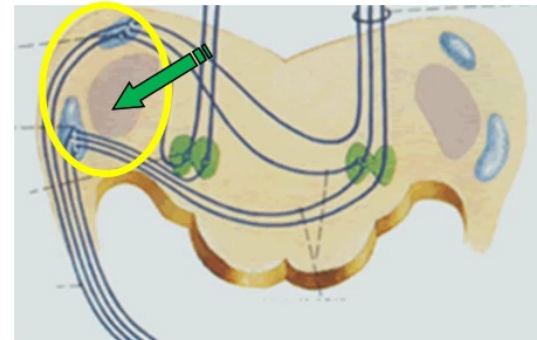
Pons: Cochlear Nerve & Auditory pathway

- **Spiral Ganglion**
 - In the spiral Canal of
 - The Cochlea
- **Bipolar Neurons**
 - **Peripheral Processes**
 - → Hair Cells of Organ of Corti
 - **Central Processes**
 - → Pierce the Internal Acoustic Meatus
 - → Cerebello Pontine Angle
 - → Lower Pons



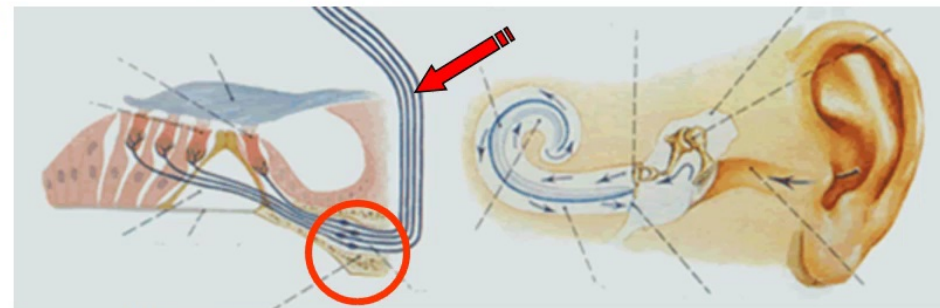
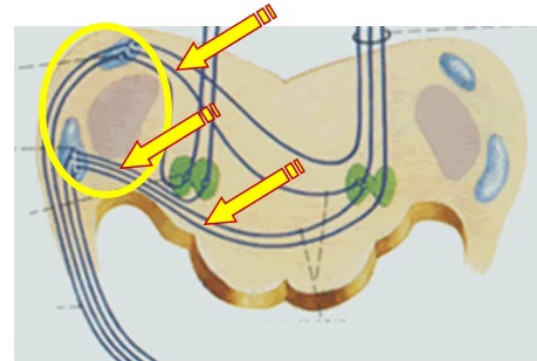
Pons: Cochlear Nerve & Auditory pathway

- Cochlear Nuclei
 - Ventral & Dorsal Nc
 - Lower Pons
 - Ventral & Dorsal to ICP



Pons: Cochlear Nerve & Auditory pathway

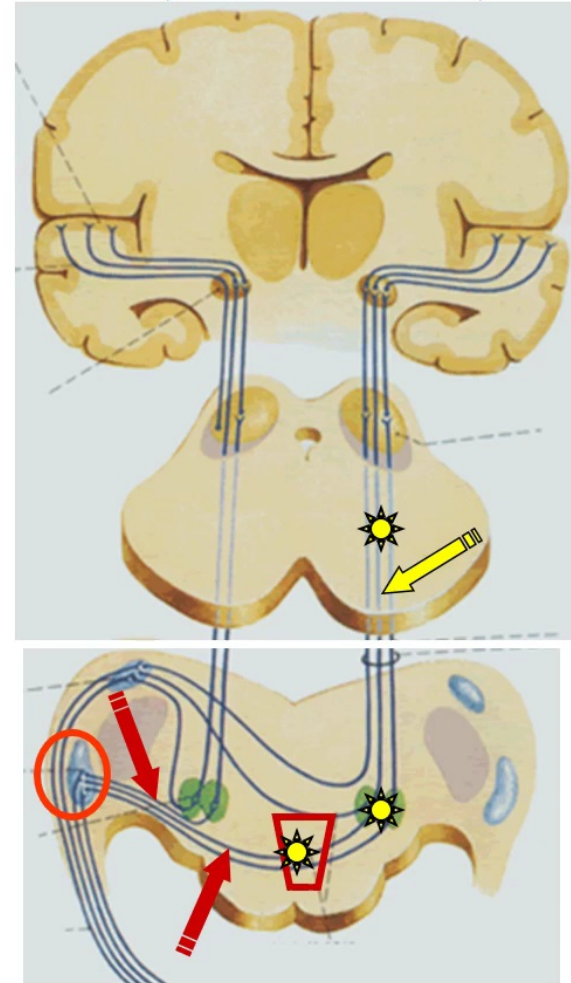
- Auditory Pathway
- Neuron I
 - Bipolar Neurons of Spiral Ganglion
 - Central processes → Cochlear Nerve
- Neuron II
 - Neurons of Ventral & Dorsal Cochlear nuclei
 - Axons → 3 pathways called Acoustic Striae



Pons: Cochlear Nerve & Auditory pathway

• Neuron II (Cont.)

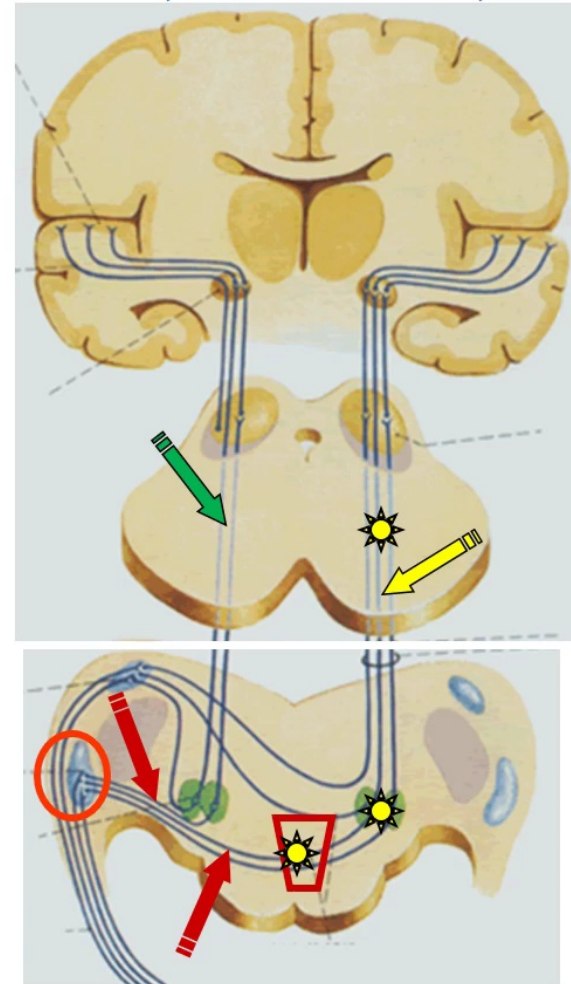
- 1) Ventral Acoustic Stria
 - Axons of Ventral Nc
 - Cross to CL side
 - Ascend in Lateral Lemniscus
 - Decussating fibres → Trapezoid Body
 - Relay in 3 intermediary Nc (IL + CL)
 1. Superior Olivary Nc
 2. Nc of Trapezoid Body
 3. Nc of Lateral Lemniscus



Pons: Cochlear Nerve & Auditory pathway

• Neuron II (Cont.)

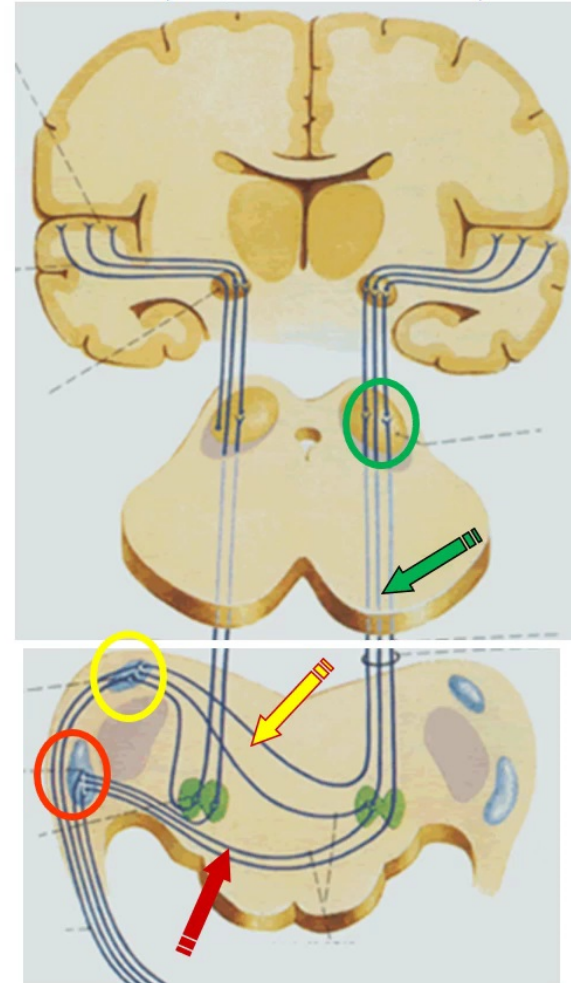
- Few f do not cross
 - Ascend in the
 - IL Lateral Lemniscus
- Each Lat Lemniscus
- carry fibres from
- Both Ears



Pons: Cochlear Nerve & Auditory pathway

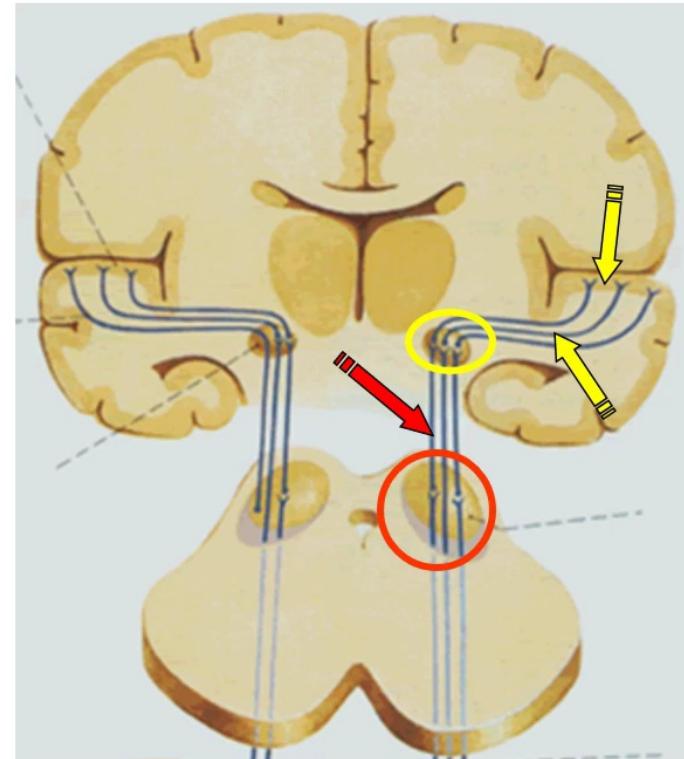
- Neuron II (Cont.)

- 2) Intermediate Acoustic Stria
 - Axons of Ventral Nc
 - Cross
 - Joins the CL Lateral Lemniscus
- 3) Dorsal Acoustic Stria
 - Axons of Dorsal Nc
 - Cross
 - Join CL Lateral Lemniscus
- Lateral Lemniscus Terminates in the Inferior Colliculus of MB



Pons: Cochlear Nerve & Auditory pathway

- Neuron III
 - Neurons of the Inferior Colliculus
 - Projects to the MGB of Thalamus
- Neuron IV
 - Neurons of Medial Geniculate Body
 - Axons → Auditory Radiation
 - → via Sublentiform part of Internal Capsule
 - → Auditory Cortical Area



Pons: Cochlear Nerve & Auditory pathway

- Auditory Cortical Areas

- 1ry Auditory Area A1
 - Gyrus of Heschl
 - Anterior transverse temporal gyrus
 - Floor of the Posterior Ramus of the Lateral Sulcus
 - + adjacent Superior Temporal gyrus
- 2ry Auditory Area A2
 - Superior temporal Gyrus

