

# **CENTRAL NERVOUS SYSTEM**

## **The Brainstem External Features & 4<sup>th</sup> Ventricle**

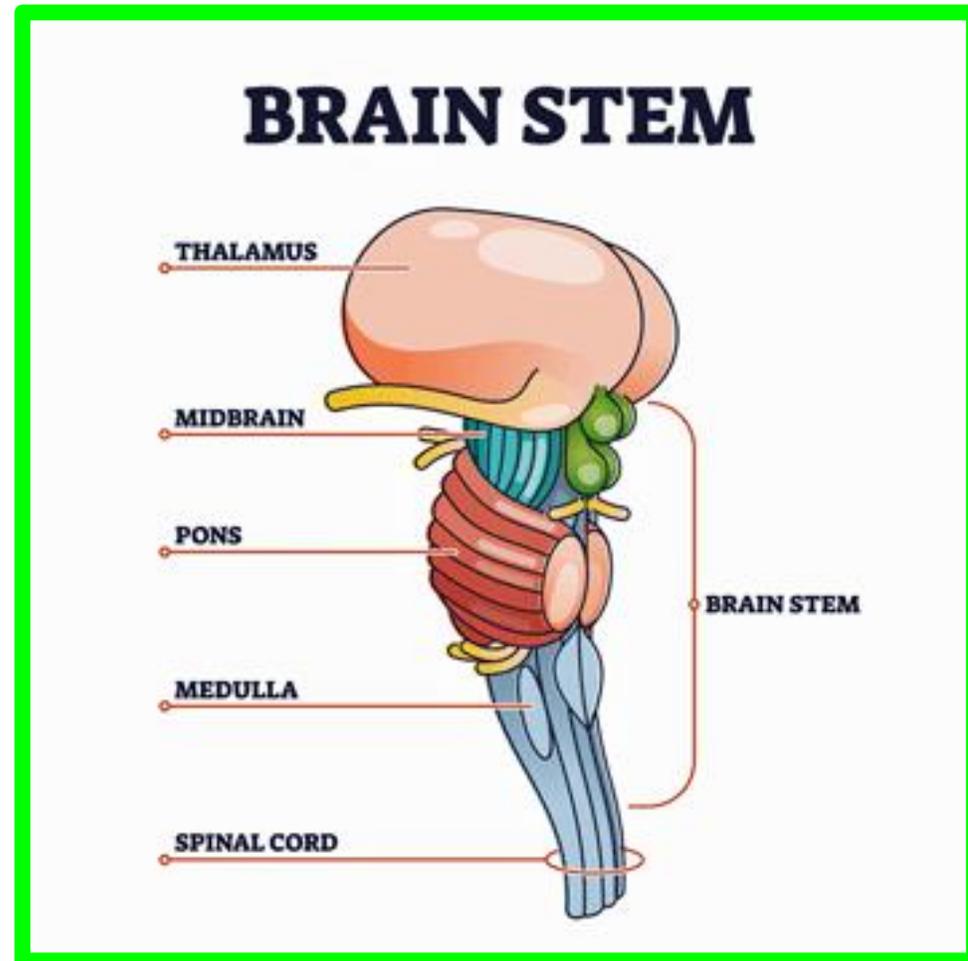
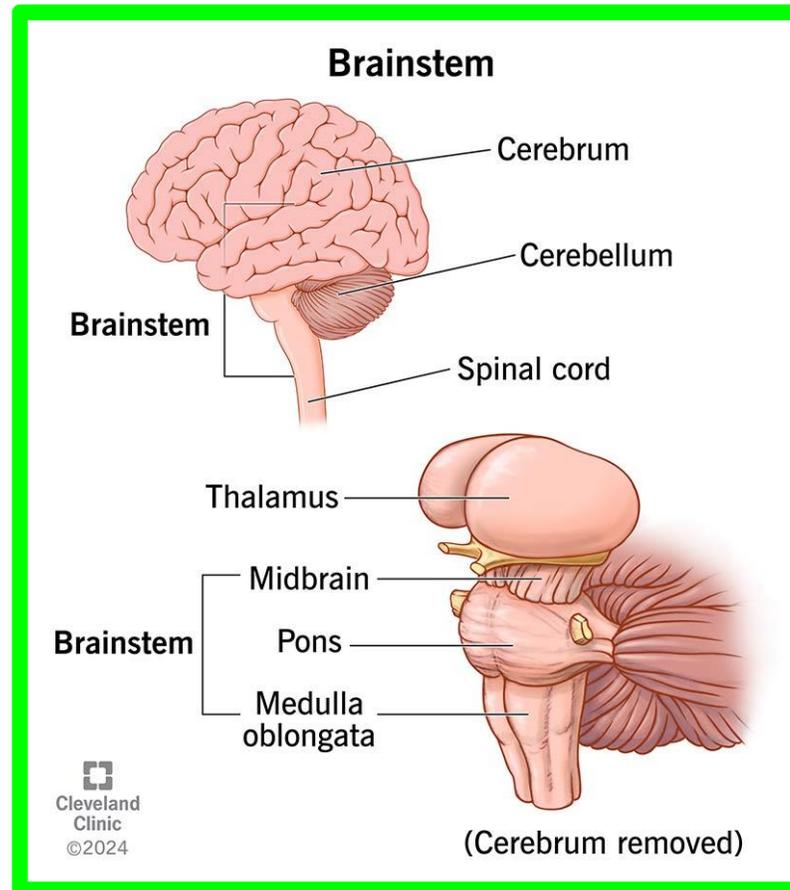
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**College of Medicine / University of Mutah**

**Thursday 11 December 2025**

# Introduction to the Brainstem

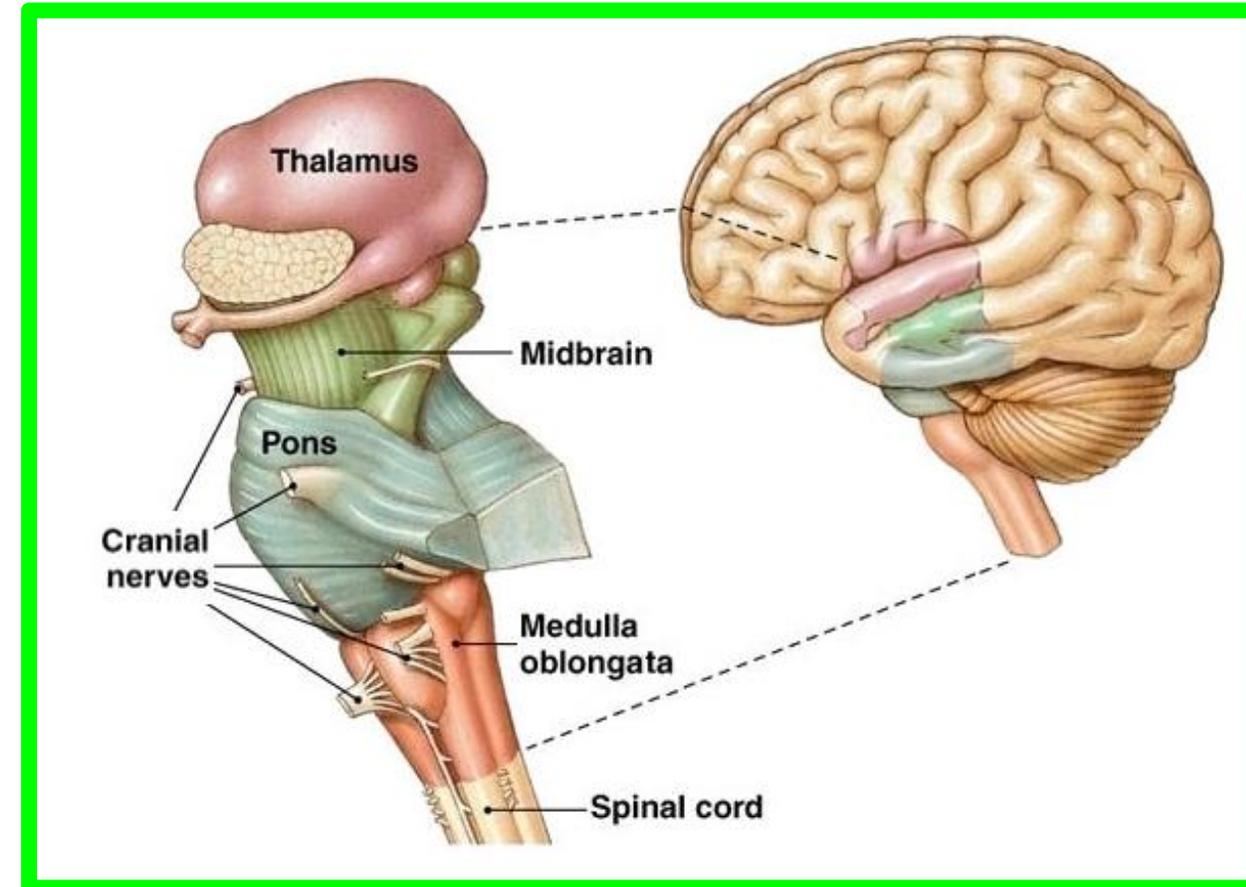
- ✓ The brainstem is made up of **the medulla oblongata, the pons, and the midbrain** and occupies **the posterior cranial fossa of the skull**
- ✓ It is **stalklike in shape** and connects the narrow spinal cord with the expanded forebrain



# Introduction to the Brainstem

❖ The brainstem has three broad functions:

- ✓ (1) it serves as a conduit for the ascending tracts and descending tracts connecting the spinal cord to the different parts of the higher centers in the forebrain;
- ✓ (2) it contains important reflex centers associated with the control of respiration and the cardiovascular system and with the control of consciousness; and
- ✓ (3) it contains the important nuclei of cranial nerves III through XII.



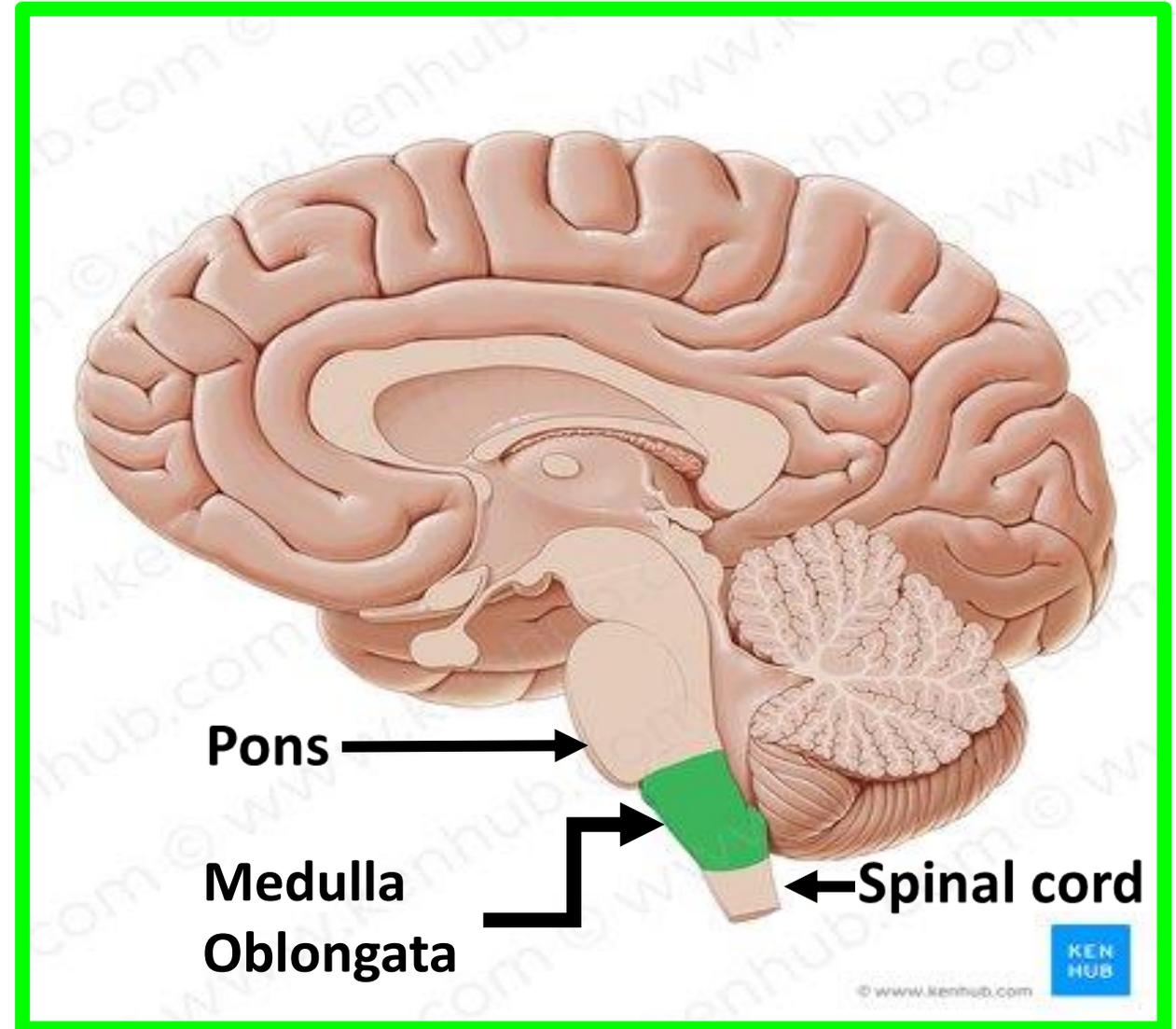
# The Medulla Oblongata

The medulla oblongata is the lower part of the brain stem.

## \*\* Extent:

- ✓ Superiorly, it is continuous with the pons.
- ✓ Inferiorly; the lower part of the medulla passes through the foramen magnum.

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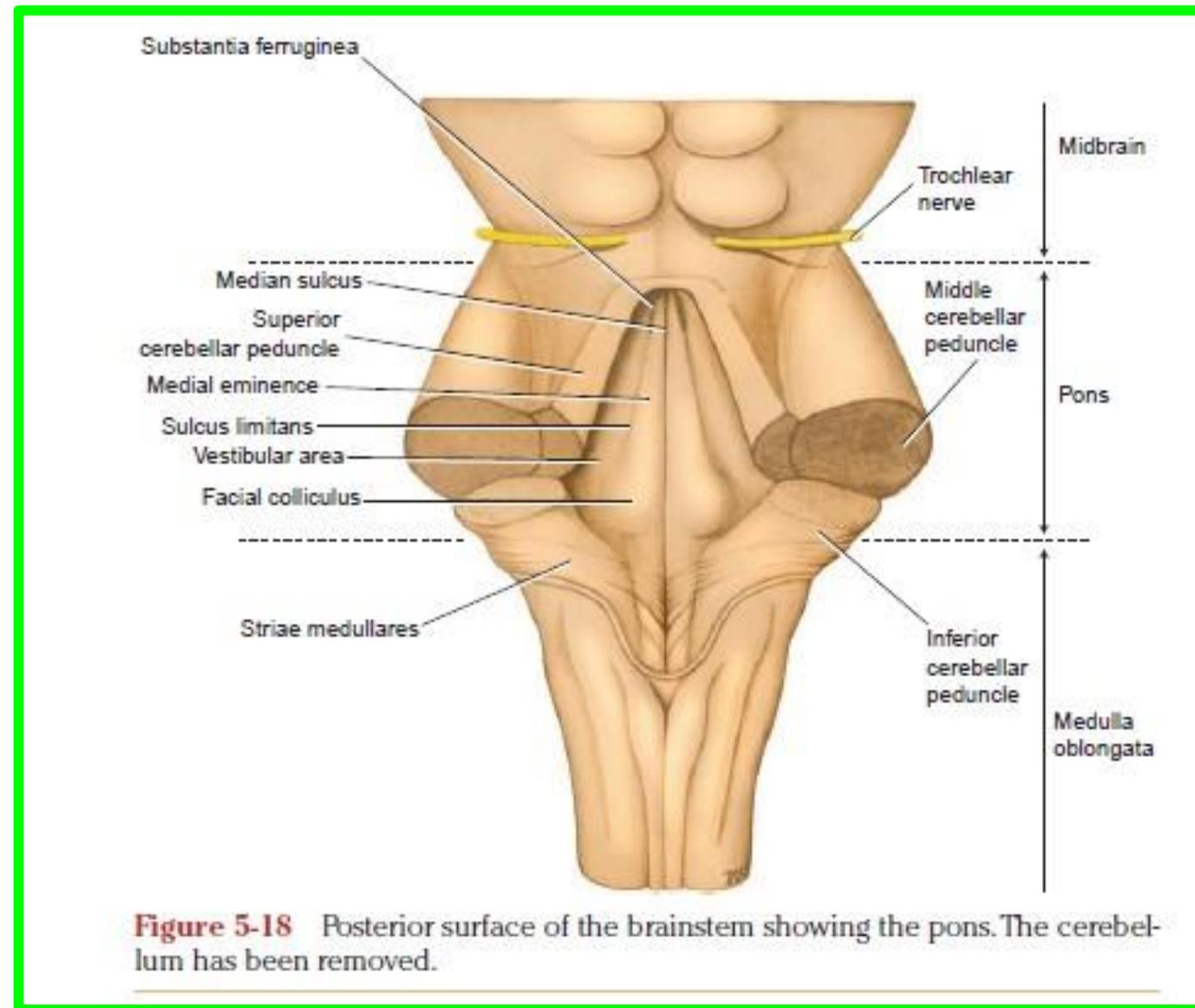
# The Medulla Oblongata

## \*\* Parts:

**A. Lower half (closed medulla),** contains **the central canal** which continues with the central canal of the spinal cord.

**B. Upper half (open medulla)** is related posteriorly to **the 4th ventricle**.

**\*\* Dimensions: 3 cm long, 2 cm transverse diameter, 1 cm anteroposterior diameter.**



# • External features

## A. The anterior surface:

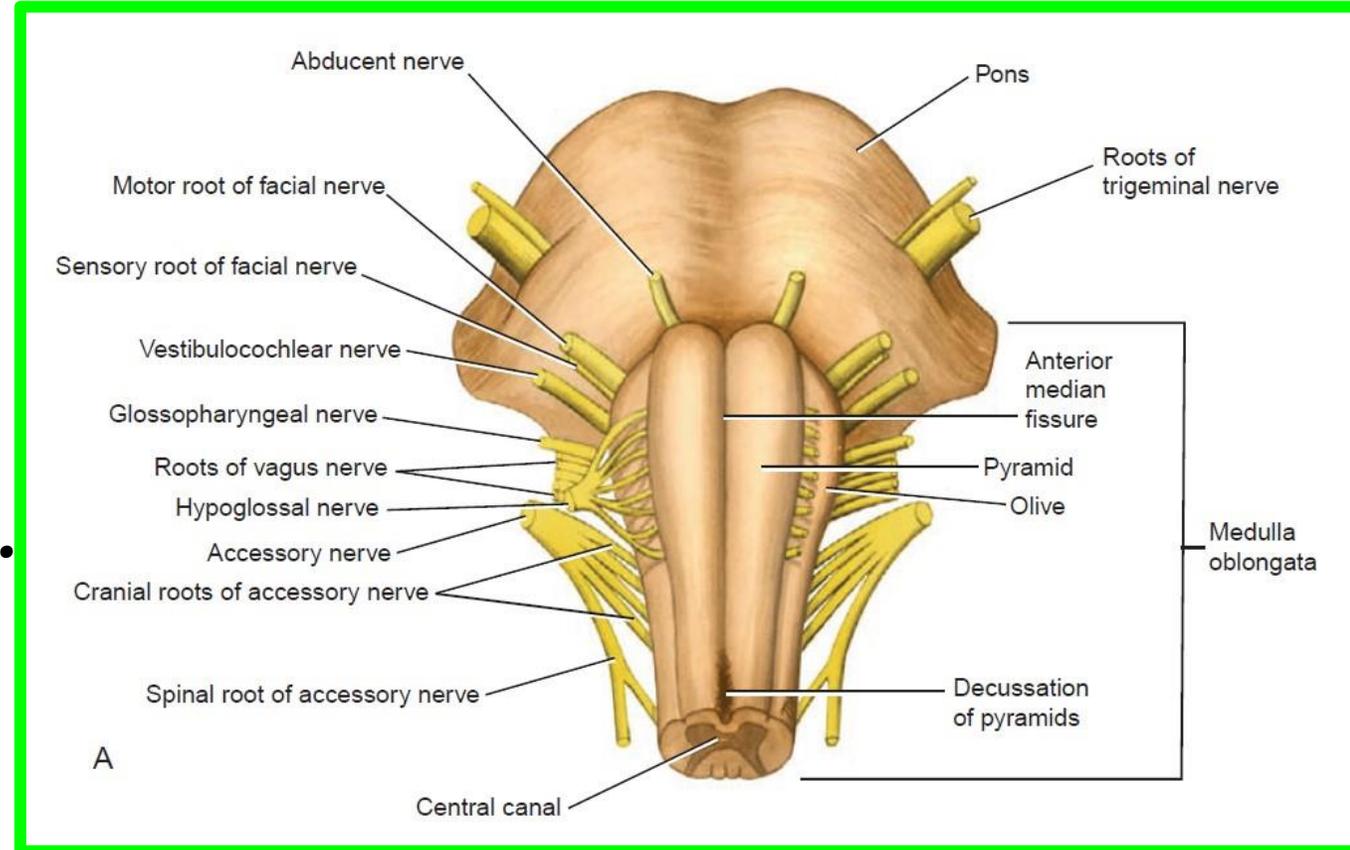
✓ It present following features from the median plane to the lateral aspect:

**1. Anterior median fissure;** a longitudinal fissure in the middle line.

▪ Its lower part is interrupted by **pyramidal (motor) decussation**.

**2. Pyramid;** an elevation on each side of the anterior median fissure.

▪ The pyramid is formed by the **pyramidal tract fibers** before decussation

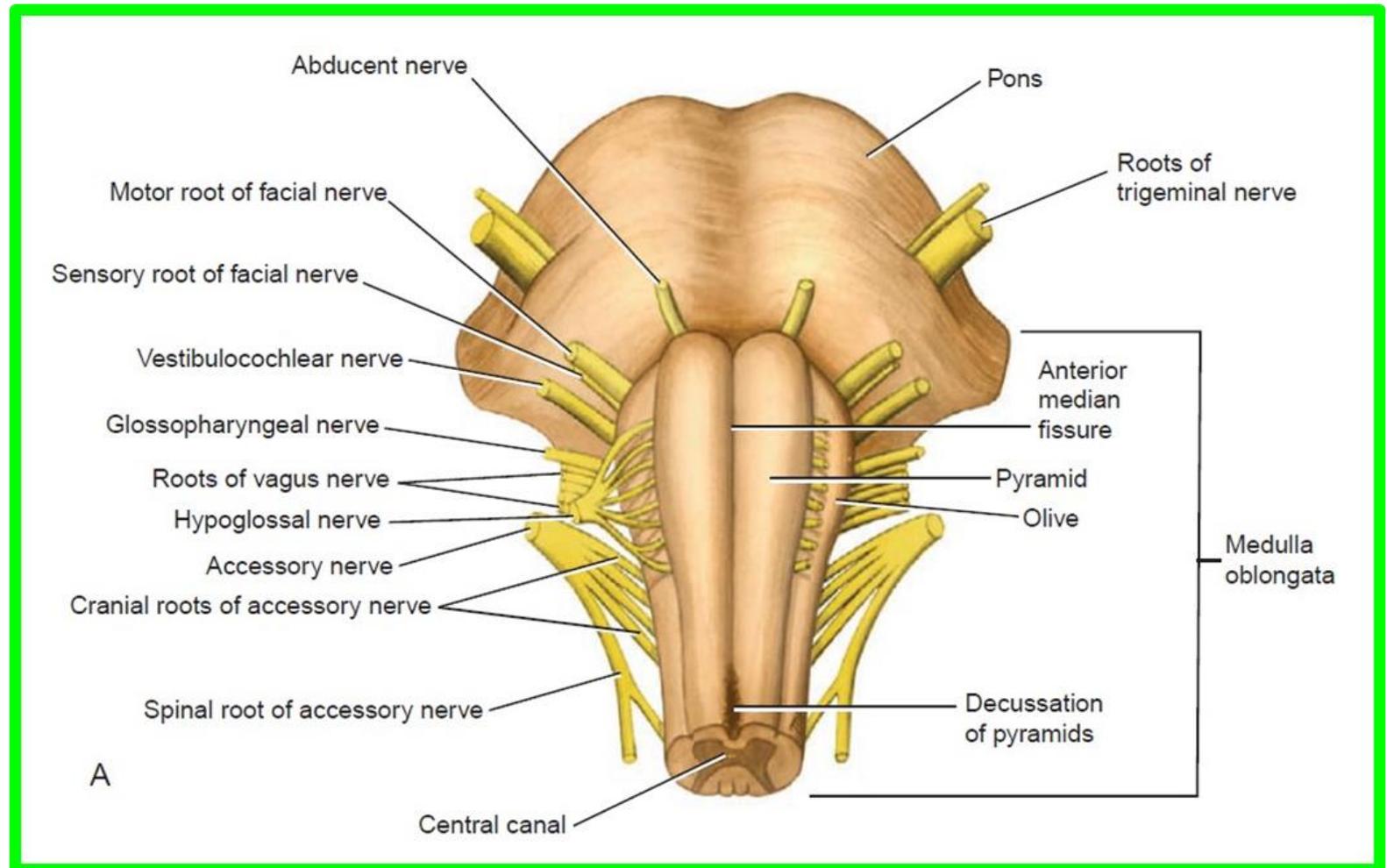


## • External features

**3. Anterolateral sulcus:** It is the groove on the lateral side of the pyramid and gives exit for the rootless of **hypoglossal nerve (XII)**.

**4. Olive:** it is the oval elevation lateral to the pyramid.

- It is formed by the bulging of the **Inferior olivary nucleus**.

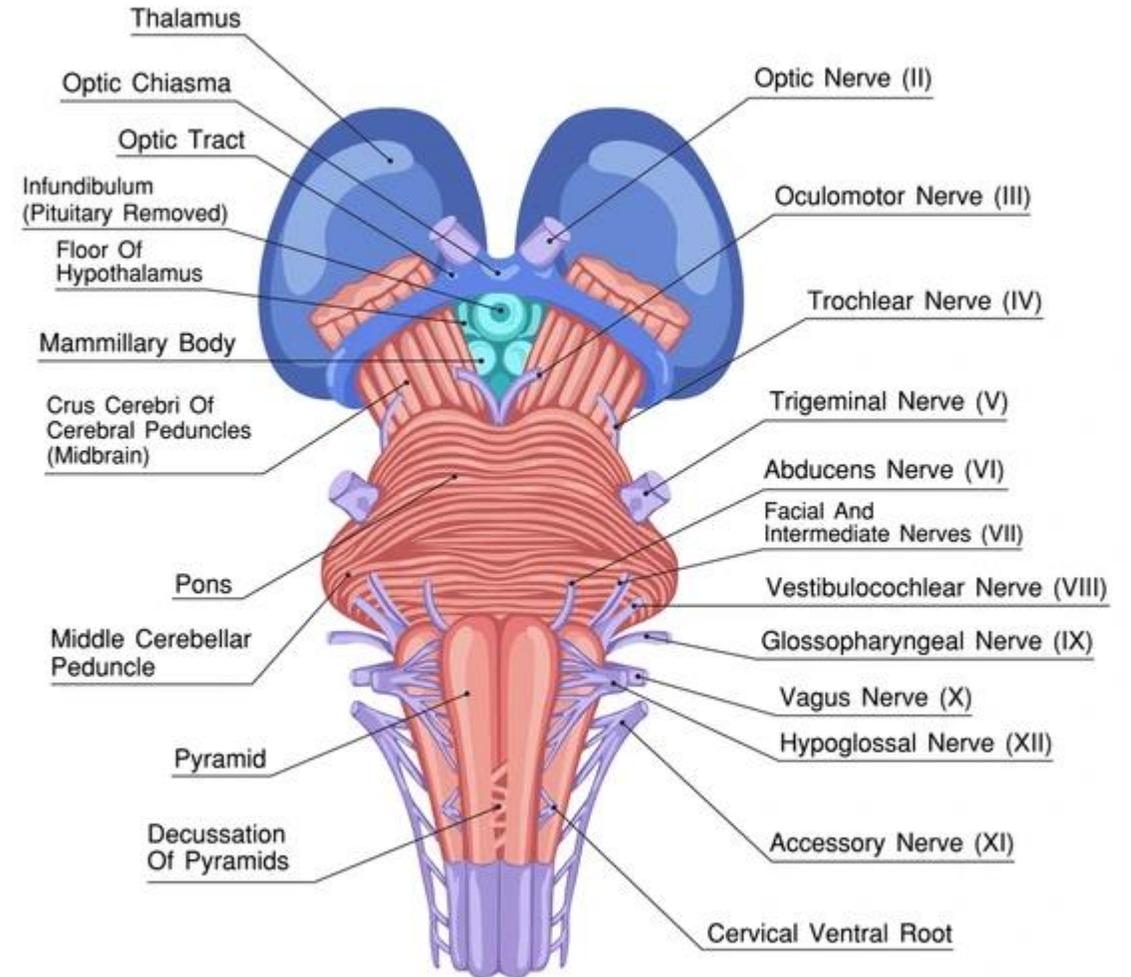


## • External features

**5. Posterolateral sulcus:** lateral to the olive.

- It give exist to the **glossopharyngeal (IX), vagus (X) and cranial accessory (XI) nerves** arranged from above downwards.

**6. Inferior cerebellar peduncle:** connects the medulla oblongata with the cerebellum. It contains afferent and efferent cerebellar fibers.



## ● External features

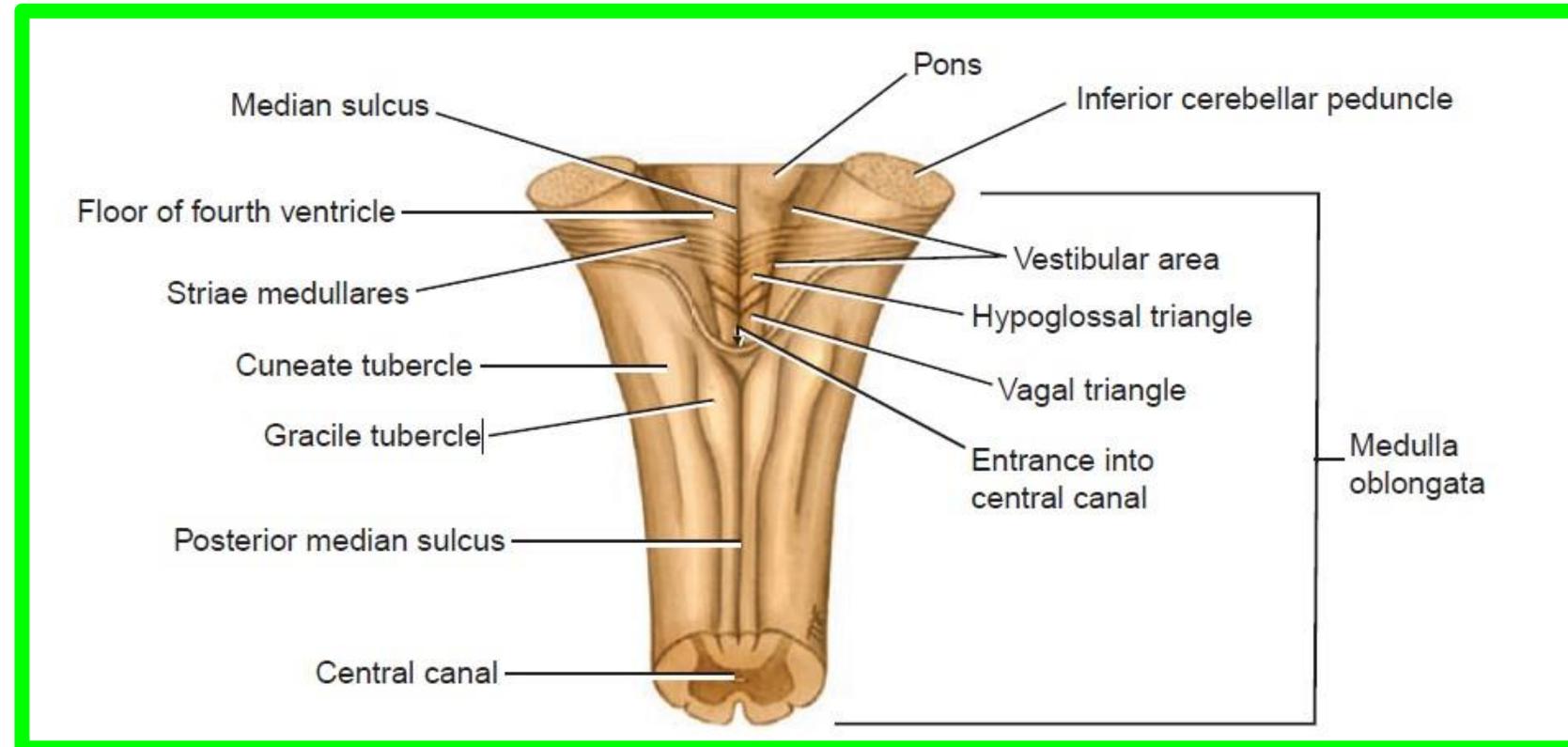
### B. The posterior surface of the closed medulla:

✓ It presents the following features from medial to lateral

1. **Posterior median sulcus.**

2. **Gracile tract:** forming the longitudinal elevation lateral to the posterior median sulcus.

❖ The upper end of **the gracile tract** expands to form **the gracile tubercle** which **overlies the gracile nucleus**



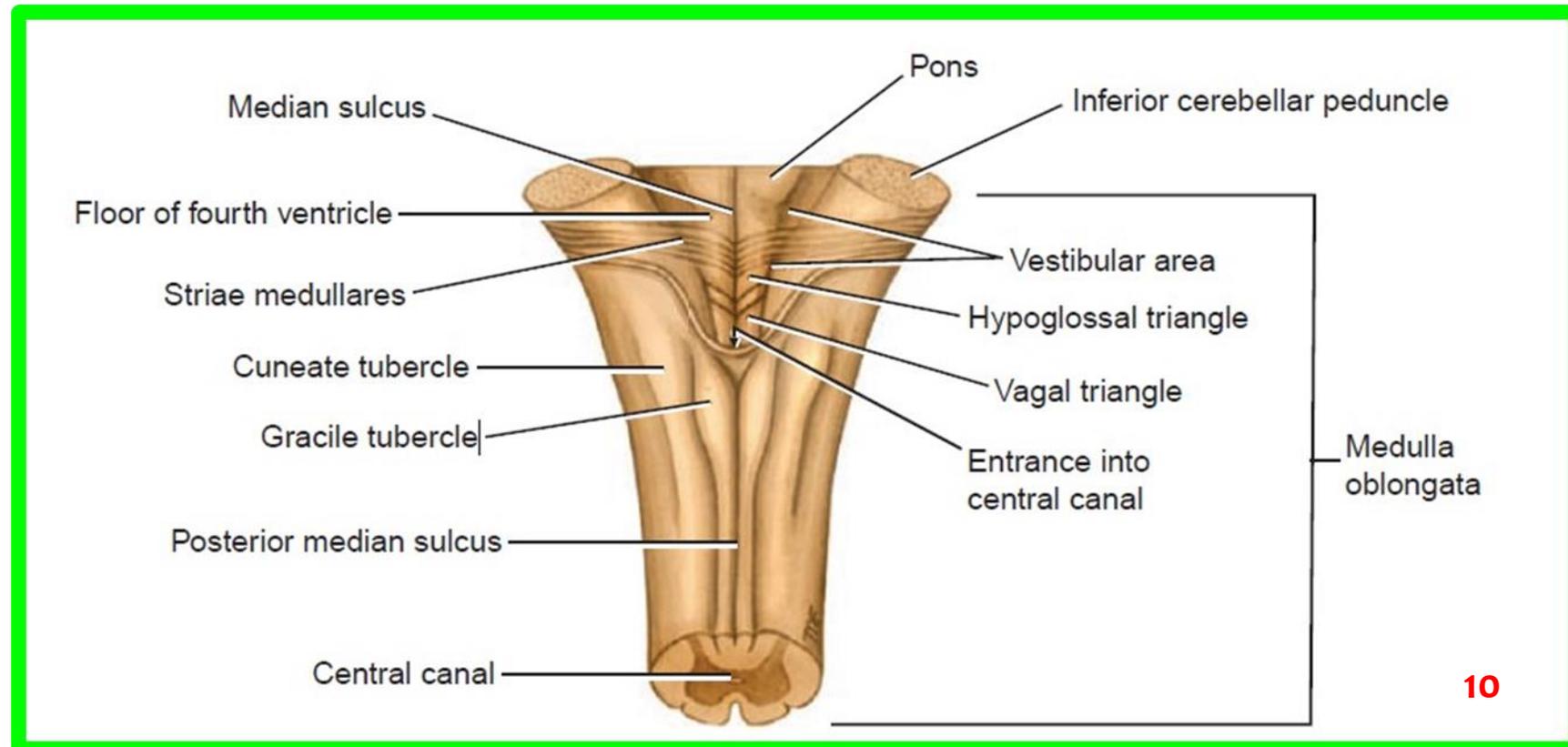
## • External features of Medulla oblongata

3. **Cuneate tract:** a longitudinal elevation lateral to the gracile tract.

- The upper end of the cuneate tract expands to form **the cuneate tubercle** which **overlies the cuneate nucleus**.

N.B; The cuneate tubercle is lateral and extends to a higher level than the gracile.

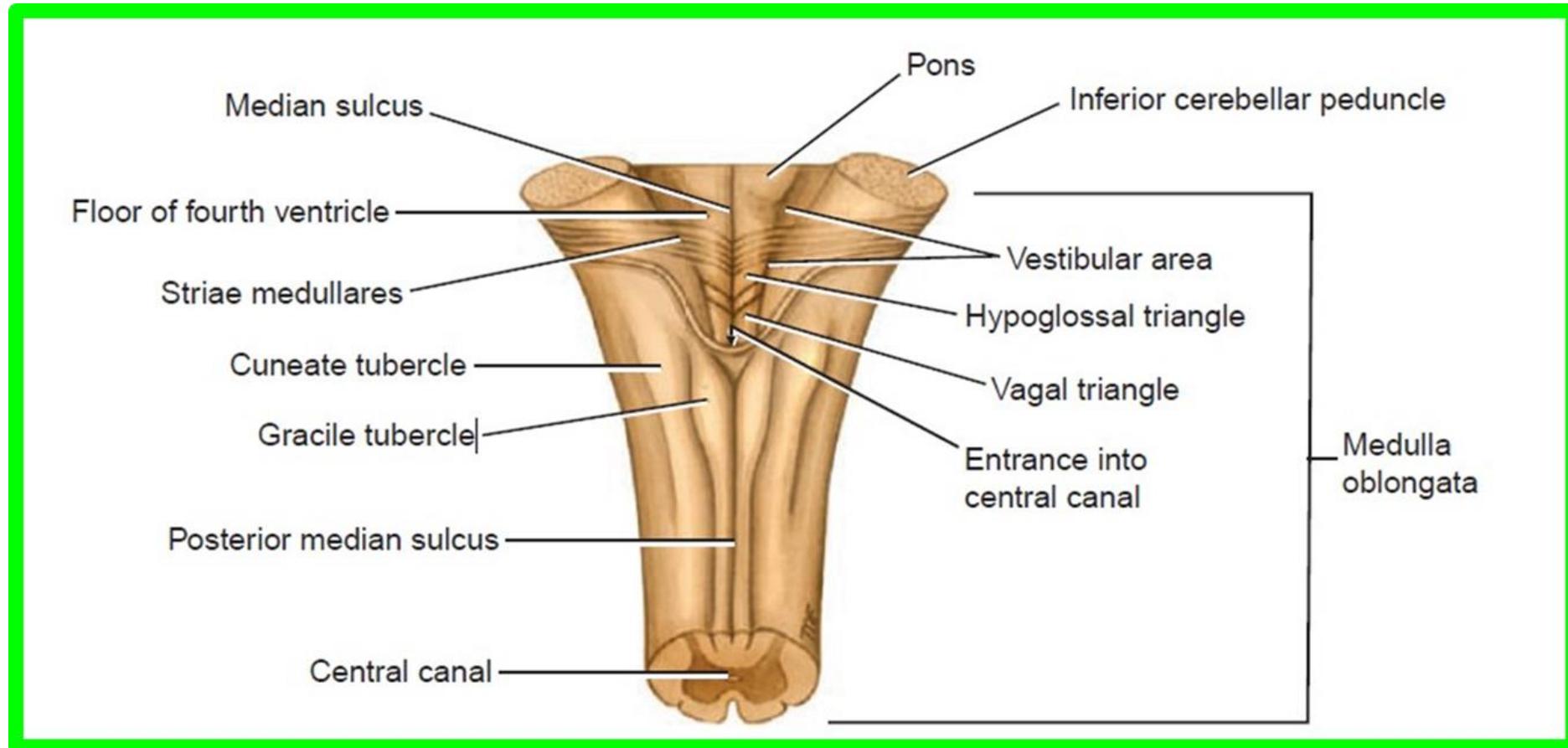
4. **Spinal tract of trigeminal and its nucleus:** a slight elevation lateral to the cuneate tract.



## • External features

### C. Posterior surface of the opened medulla:

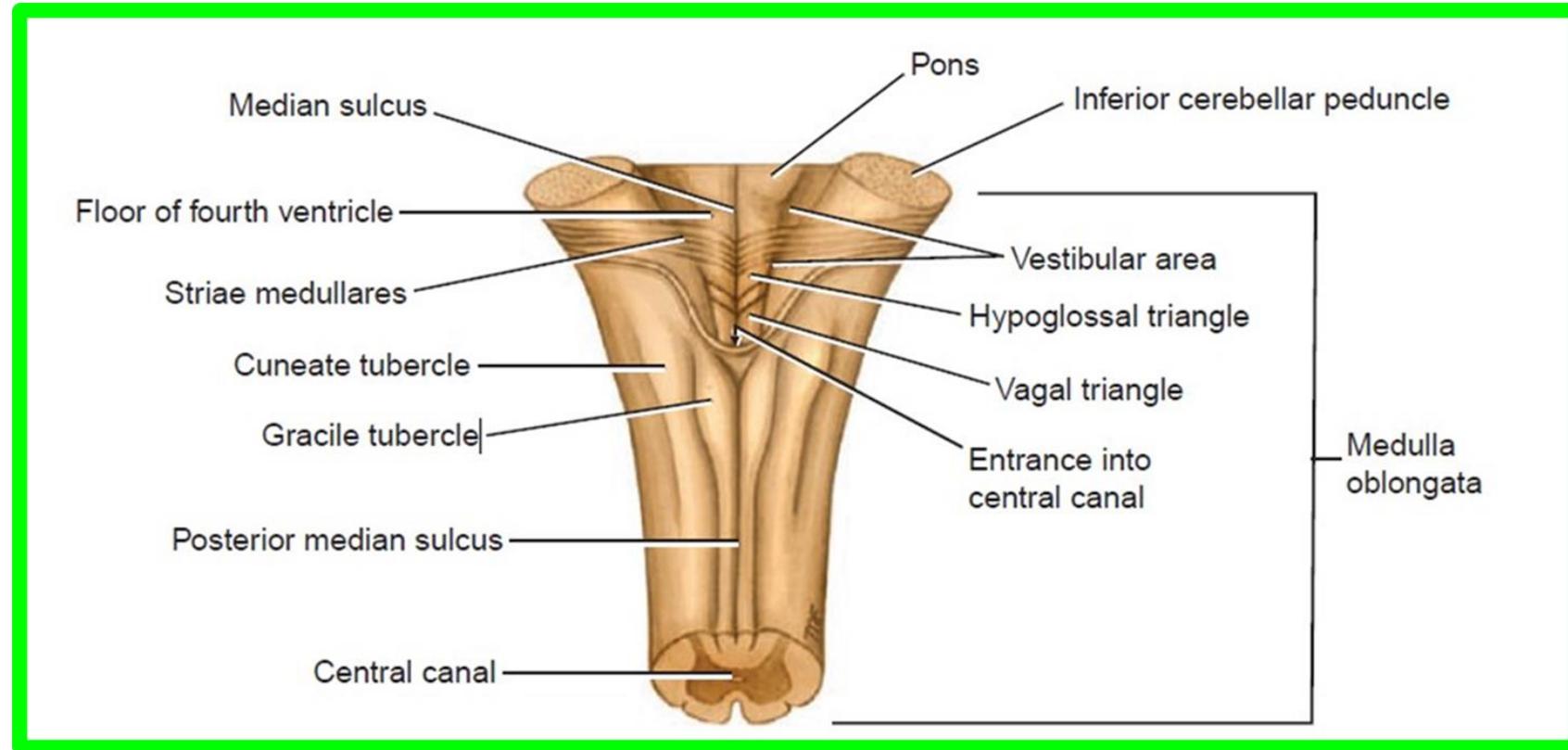
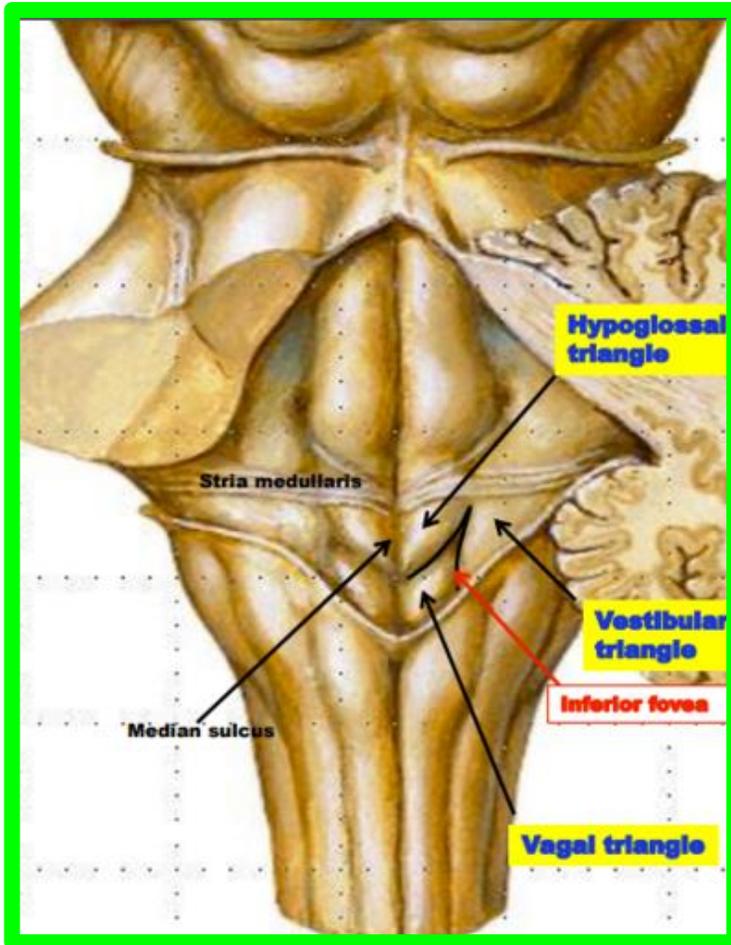
- ❖ It forms the lower part of the **floor of the 4th ventricle**, and it is separated from the pons by a **medullary stria**.



# External features of Medulla oblongata

❖ It presents the following features:

1. A median longitudinal fissure.
2. An inverted V shaped depression called the inferior fovea.



## • External features of Medulla oblongata

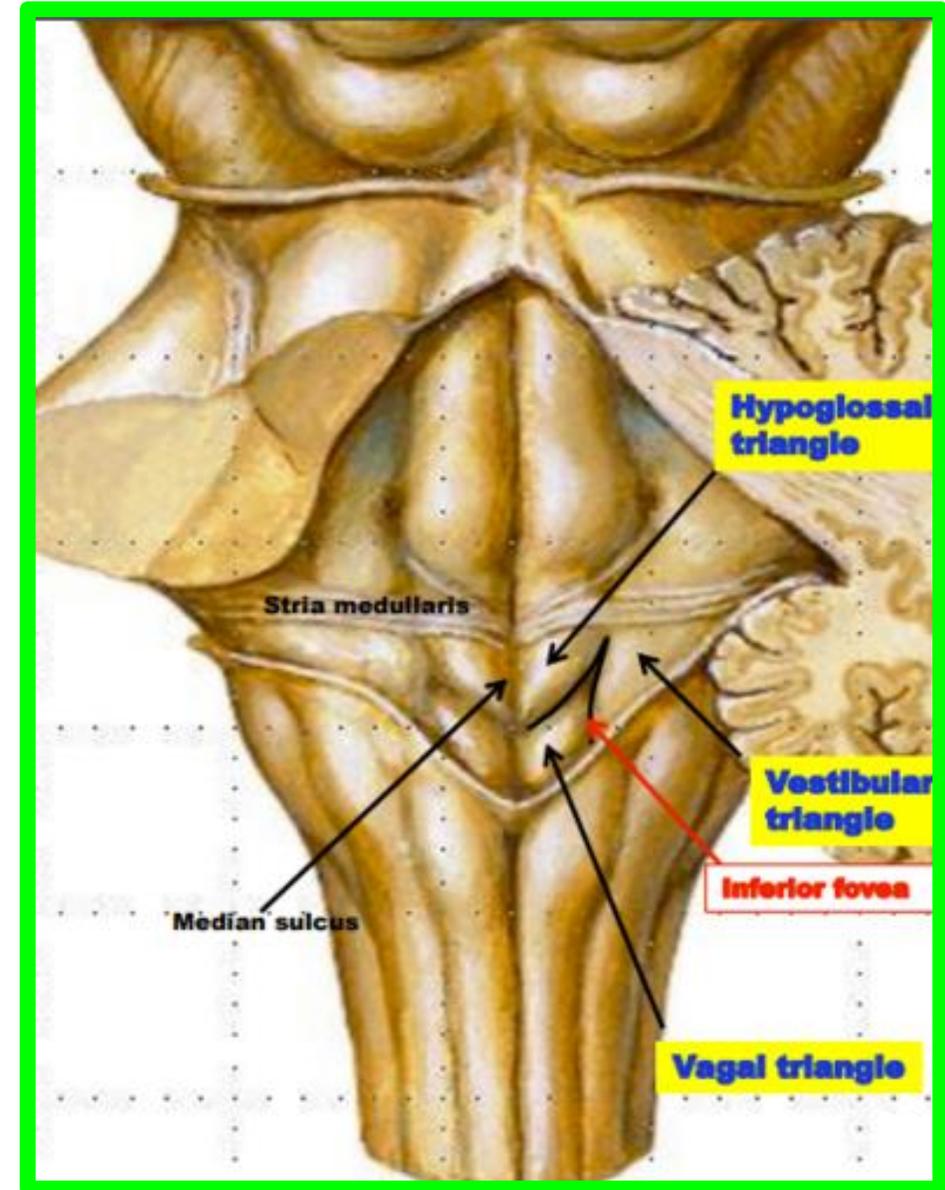
3. **Hypoglossal area (trigone)**; between the median sulcus and the inferior fovea. It overlies the hypoglossal nucleus.

4. **Vagal area (trigone)**: between the two limbs of the inferior fovea.

✓ It overlies the dorsal nucleus of the vagus.

5. **Vestibular area (trigone)**: lies lateral to the inferior fovea.

✓ It overlies inferior vestibular nucleus.



# • External features

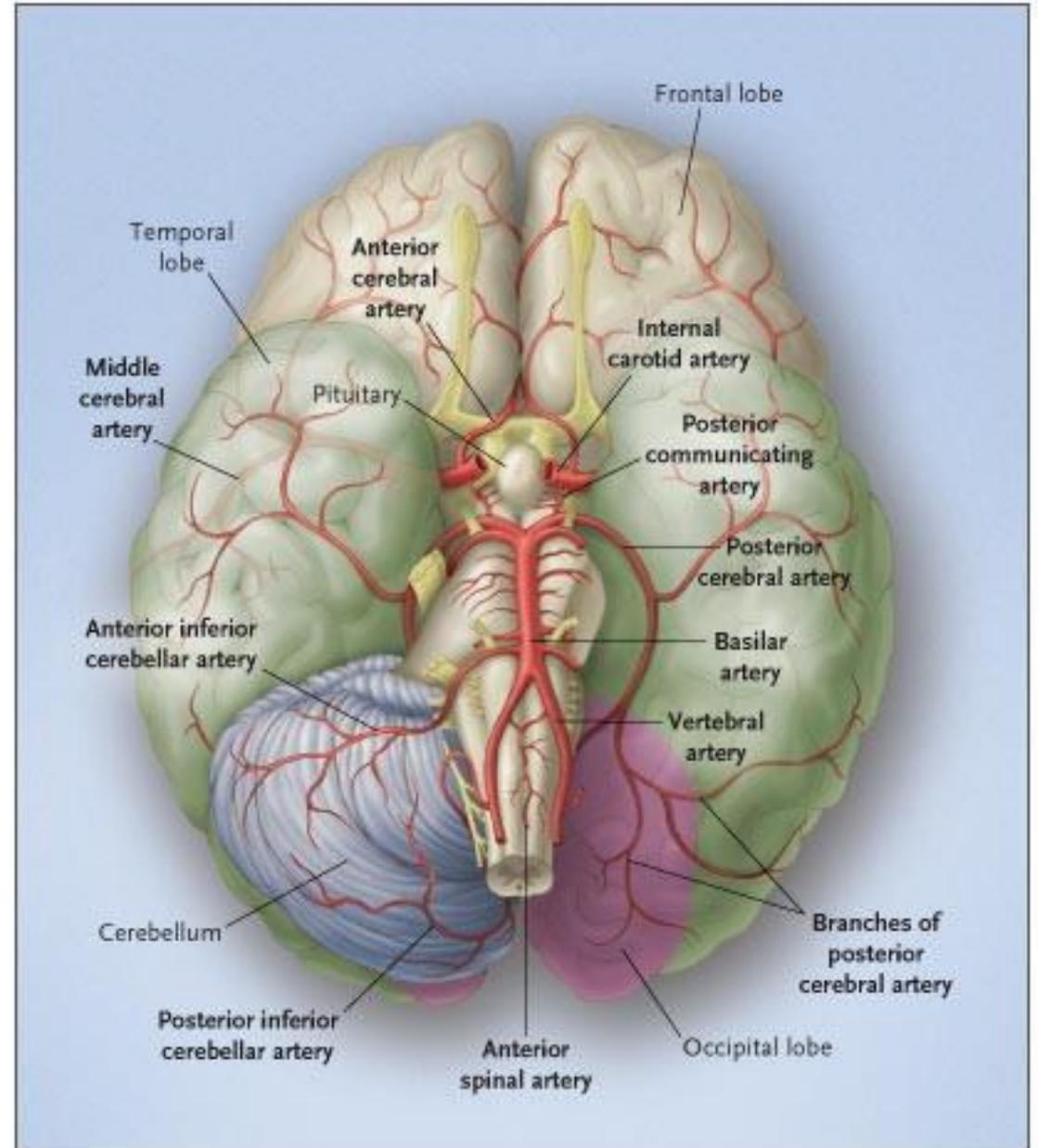
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## Blood supply:

1. Medullary branch from **the vertebral artery**.

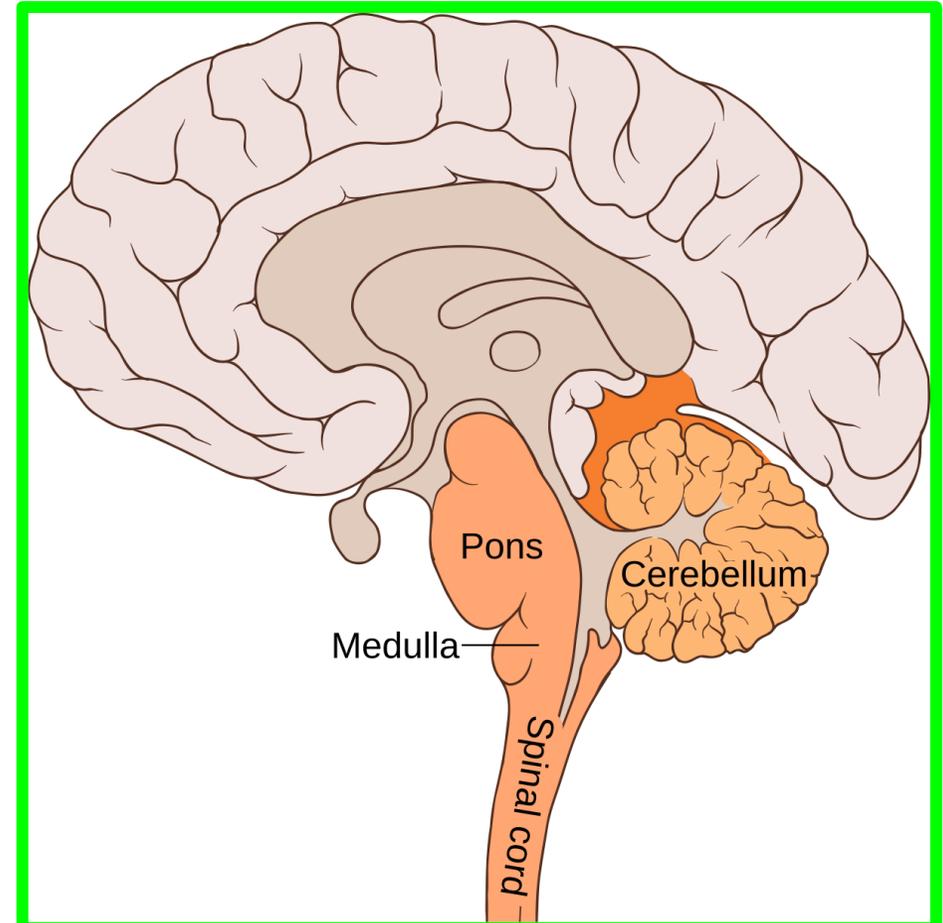
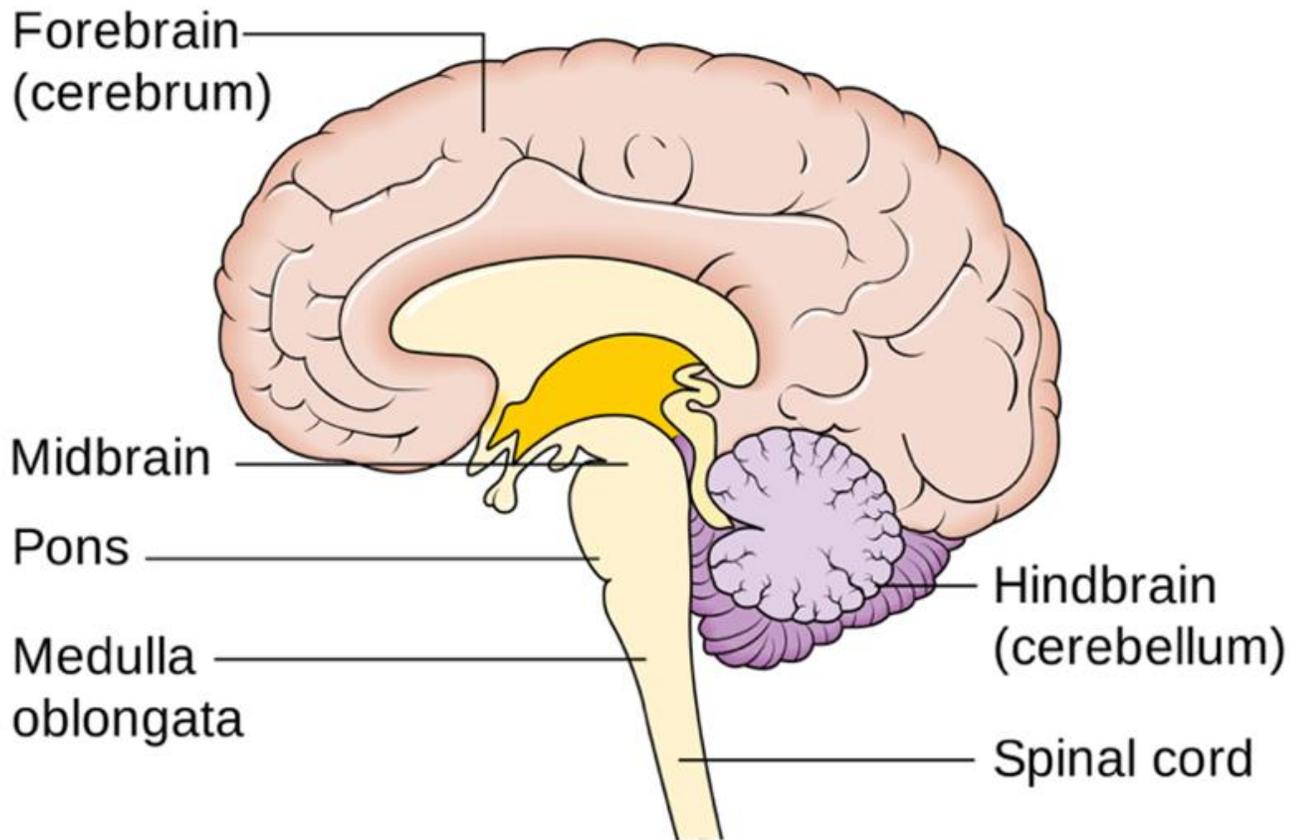
2. Medullary branch from **posterior inferior cerebellar artery** (from vertebral artery).

Venous drainage into adjacent venous sinuses.



# ● Pons

- \*\* **Extent:** it is the middle part of the brain stem.
- ✓ **Superiorly:** it continues with the midbrain
- ✓ **Inferiorly:** it continues with the medulla oblongata



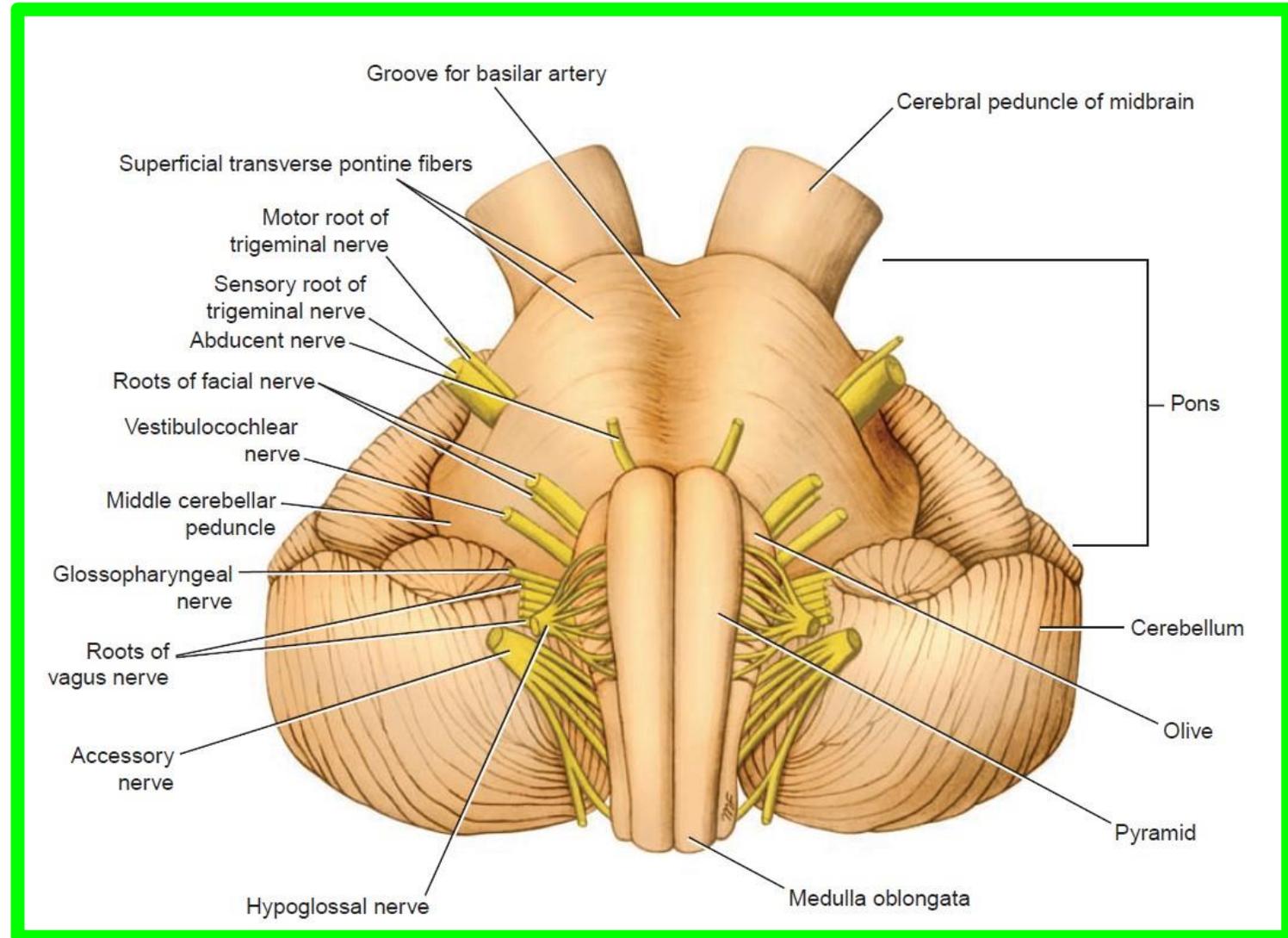
# • Pons

## • External features of the Pons

**A. Anterior surface:**  
presents;

**1- Basilar sulcus:** a longitudinal groove in the middle line for the basilar artery.

**2. Basis pontine (raised ridge):** on each side of the basilar sulcus. It is formed by fibers of the pyramidal tract.

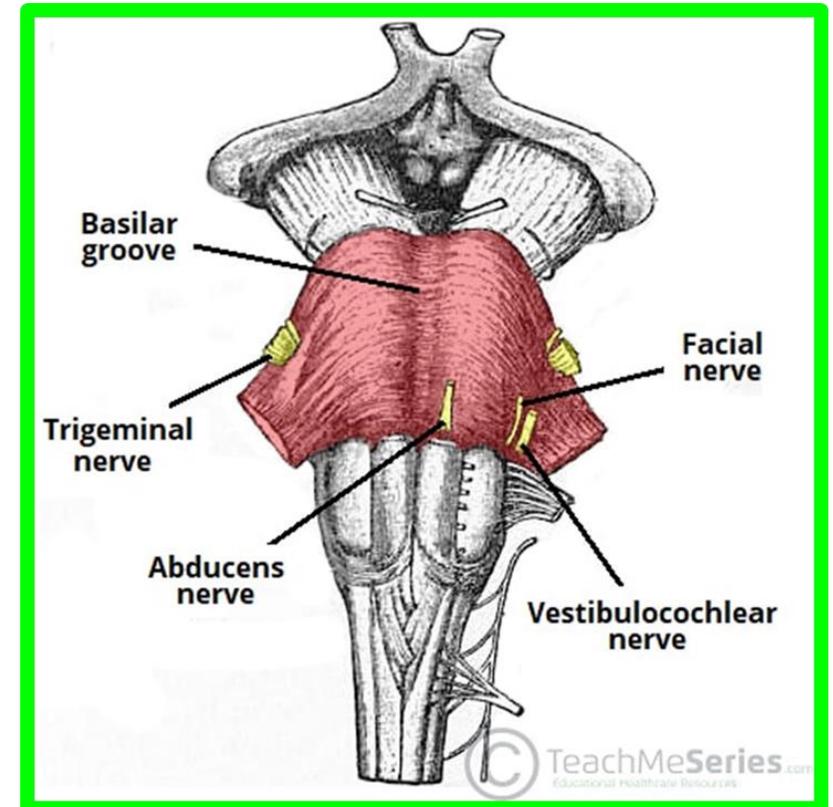
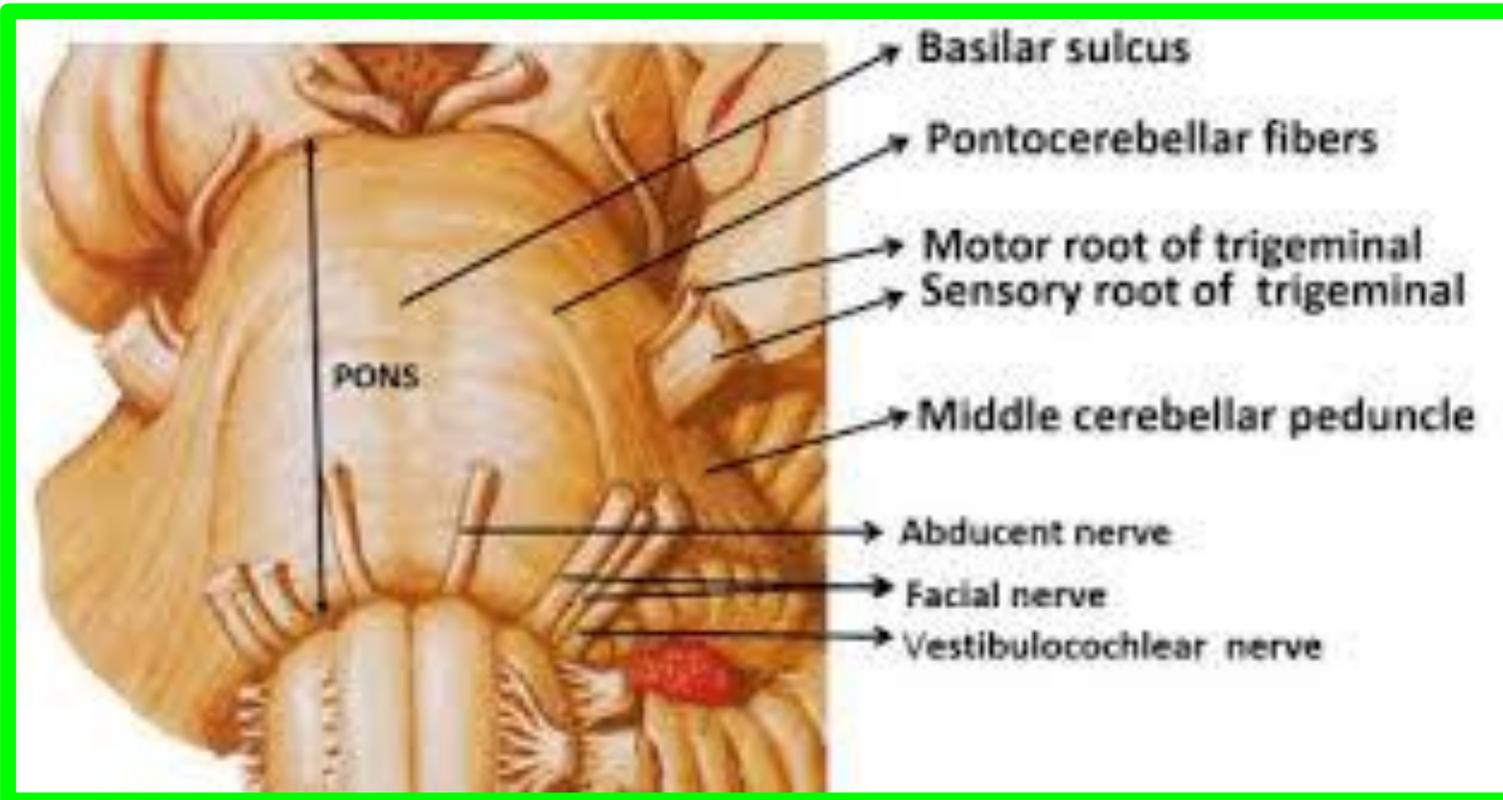


## • External features of the Pons

### 3. Transverse fibers: on each side.

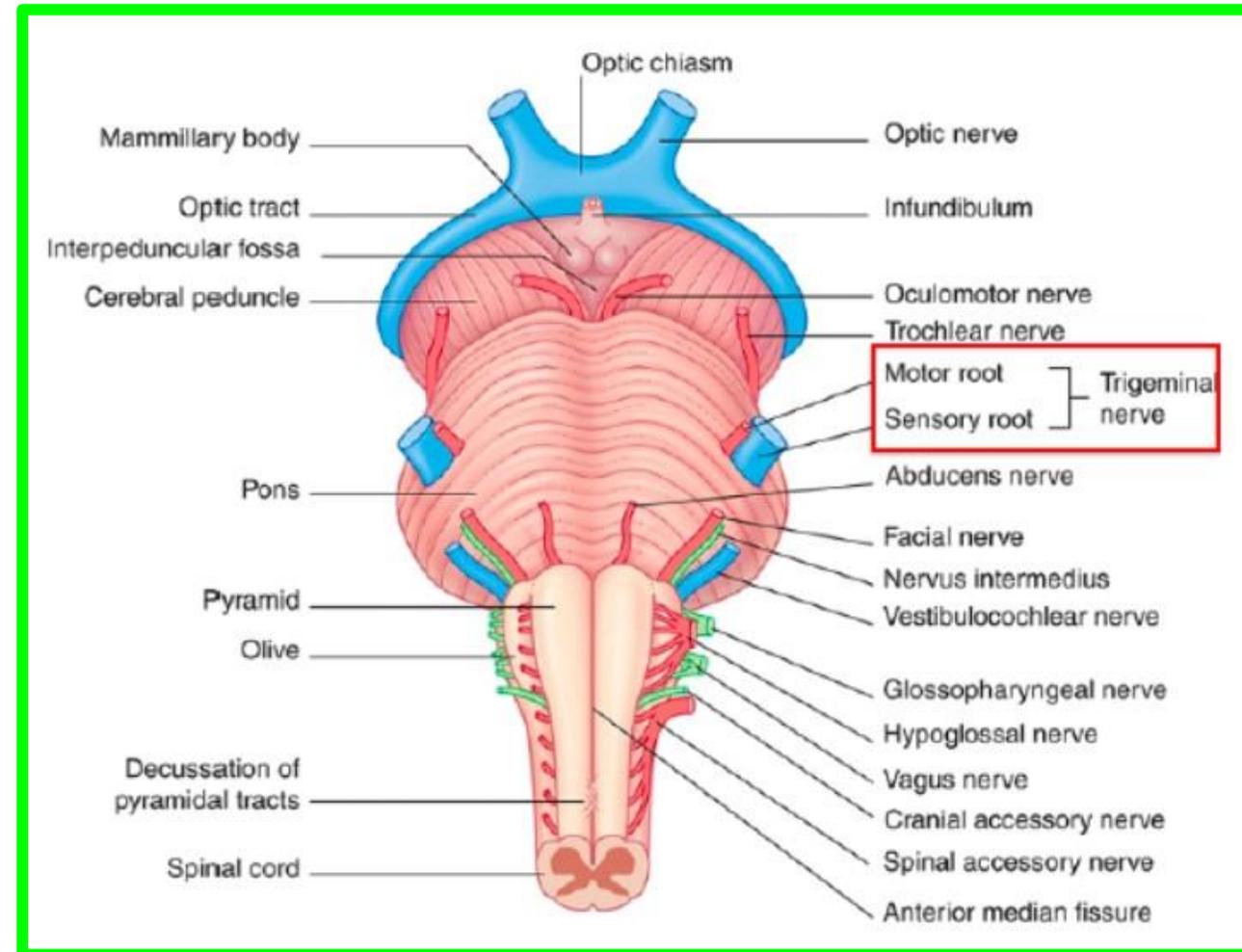
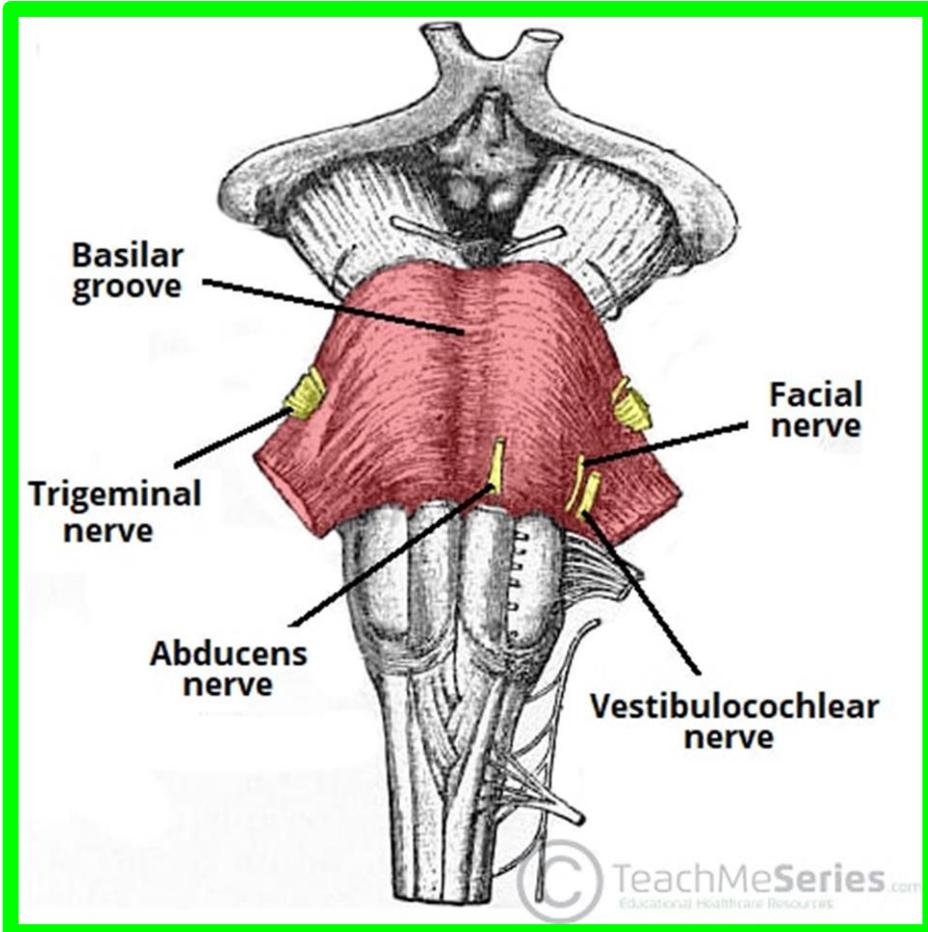
- It is produced by the ponto-cerebellar fibers that collect to form the middle cerebellar peduncle.

### 4. Middle cerebellar peduncle: connect the pons with the cerebellum.



# External features of the Pons

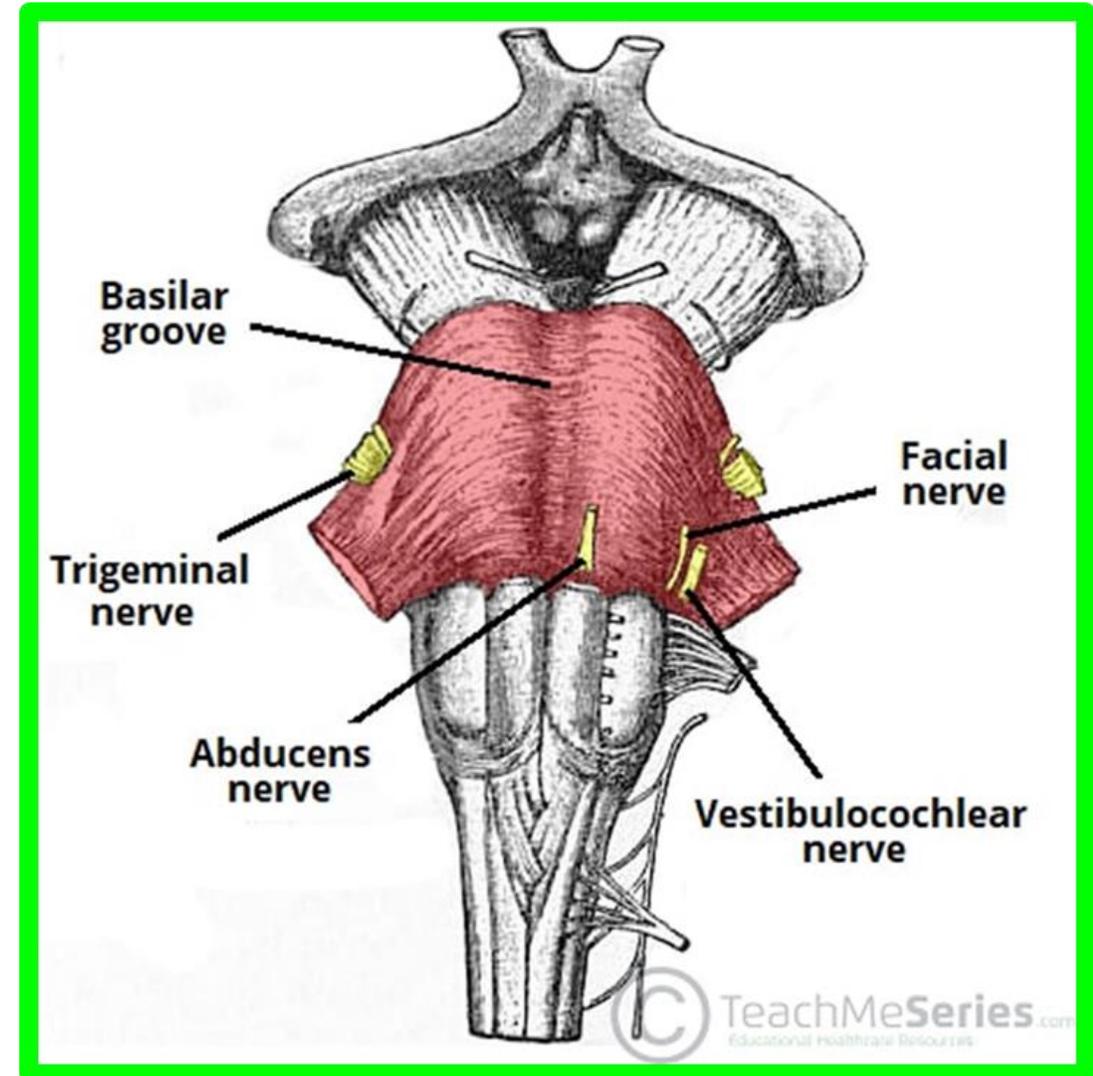
**5. Trigeminal nerve:** arise by a **large sensory root** and **small motor root** from the lateral part of the anterior surface at its junction with the middle cerebellar peduncle.



## • External features of the Pons

6. The abducent nerve (6<sup>th</sup>); emerges from the groove between the pons and pyramid of the medulla.

7. The facial and Vestibulo-cochlear nerves (7<sup>th</sup> & 8<sup>th</sup>); emerge from the groove between the pons and medulla lateral to abducent nerve.



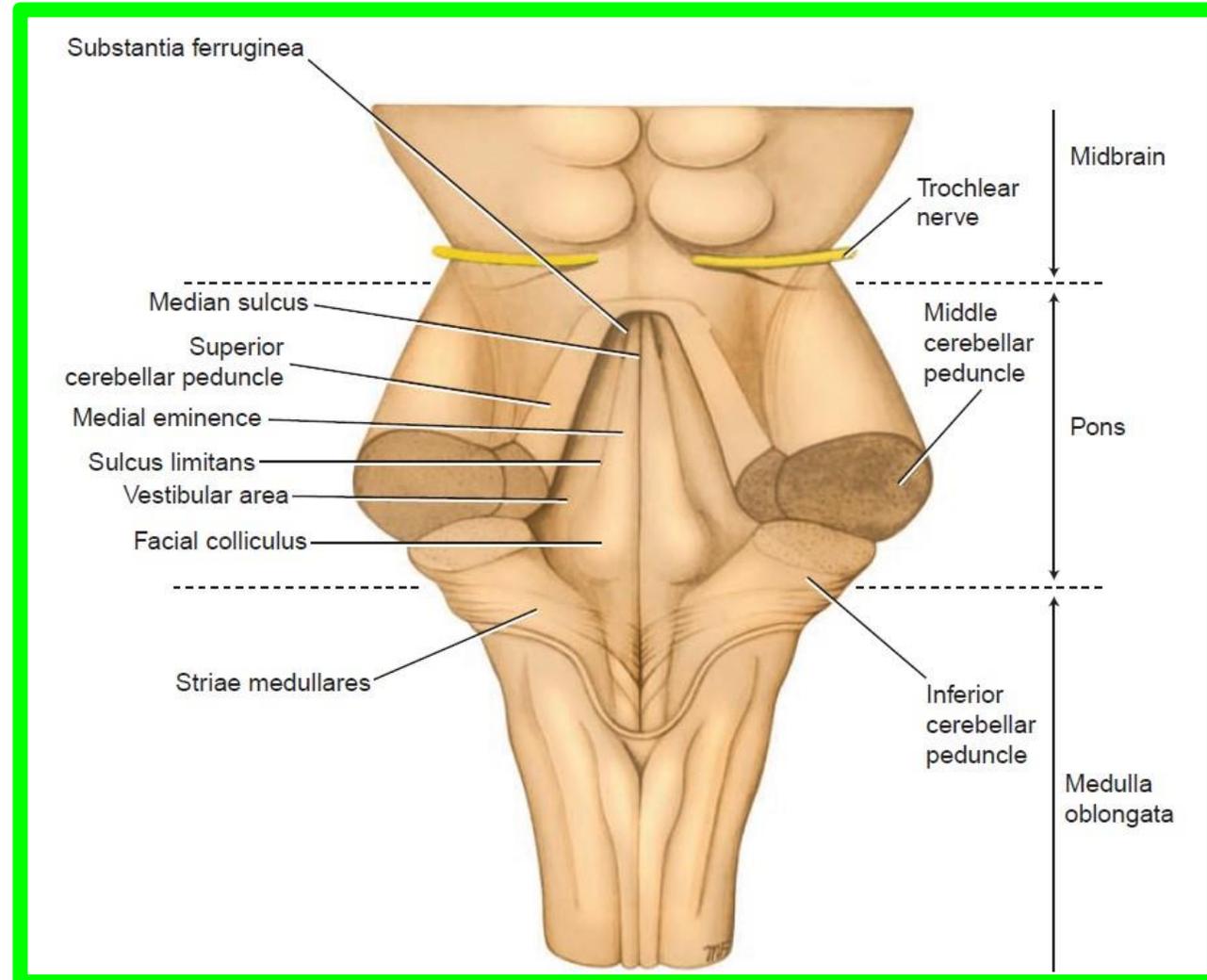
# • External features of the Pons

## B. Posterior surface:

✓ It forms the upper part of the floor of the **4th ventricle** and presents the following features;

**1. Median longitudinal sulcus; in the middle line.**

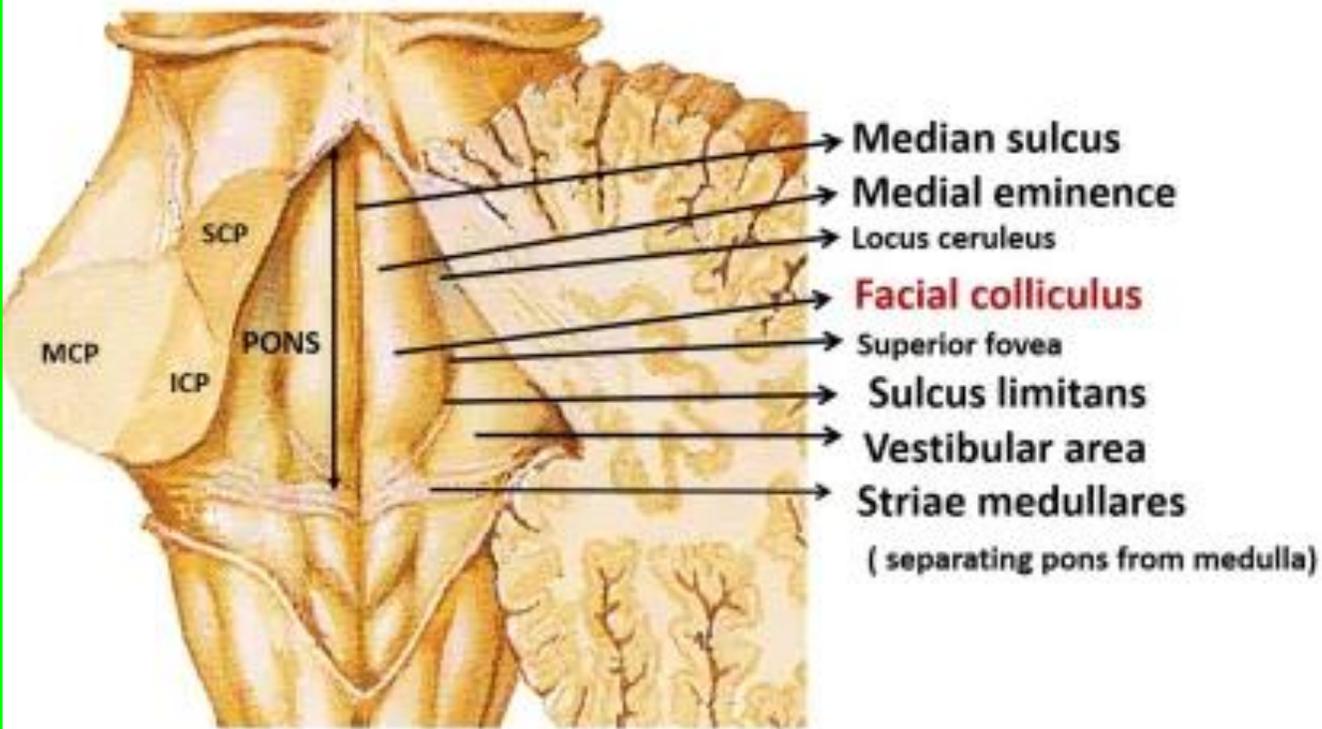
**2. Medial eminence: a longitudinal elevation on each side of the median sulcus, produced by the abducent nerve.**



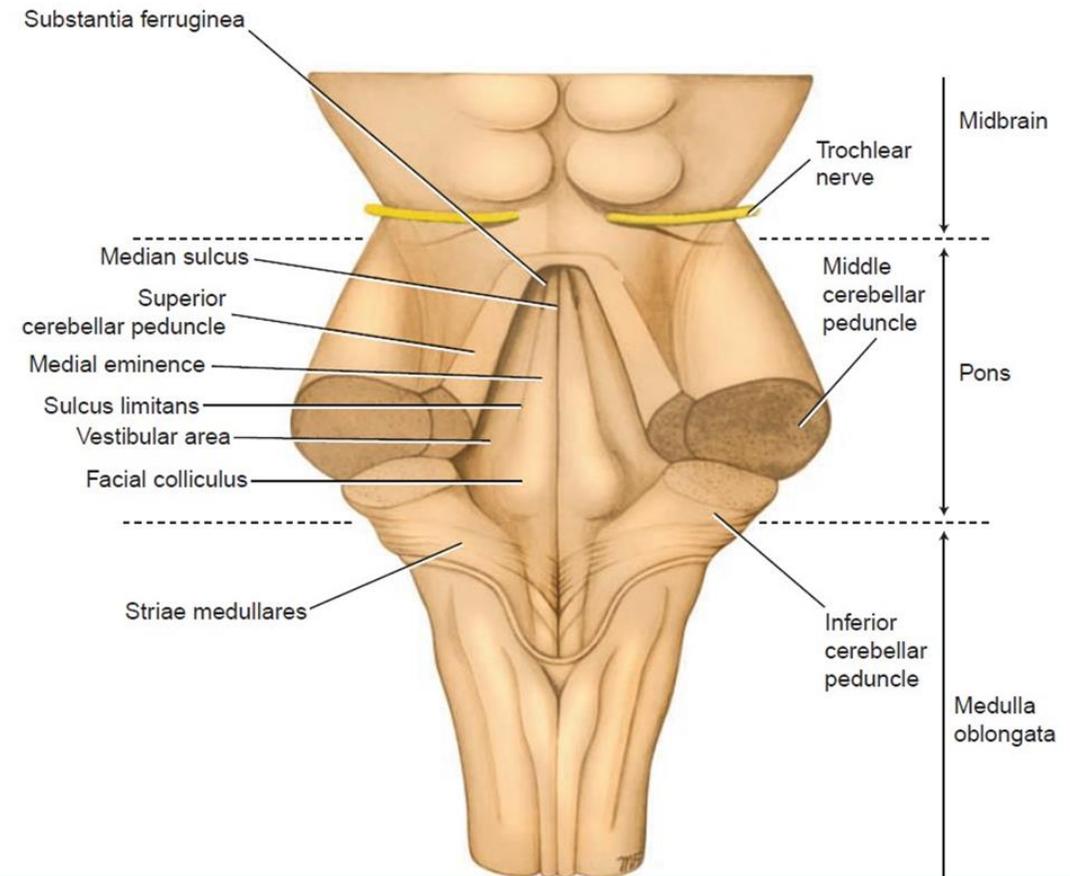
## External features of the Pons

- 3. Facial colliculus:** a round swelling on the lower part of the medial eminence.
  - ❖ It is produced by the facial nerve which encircles the abducent nucleus.
- 4. Superior fovea:** a groove lateral to the facial colliculus.

Forms upper part of floor of 4<sup>th</sup> ventricle



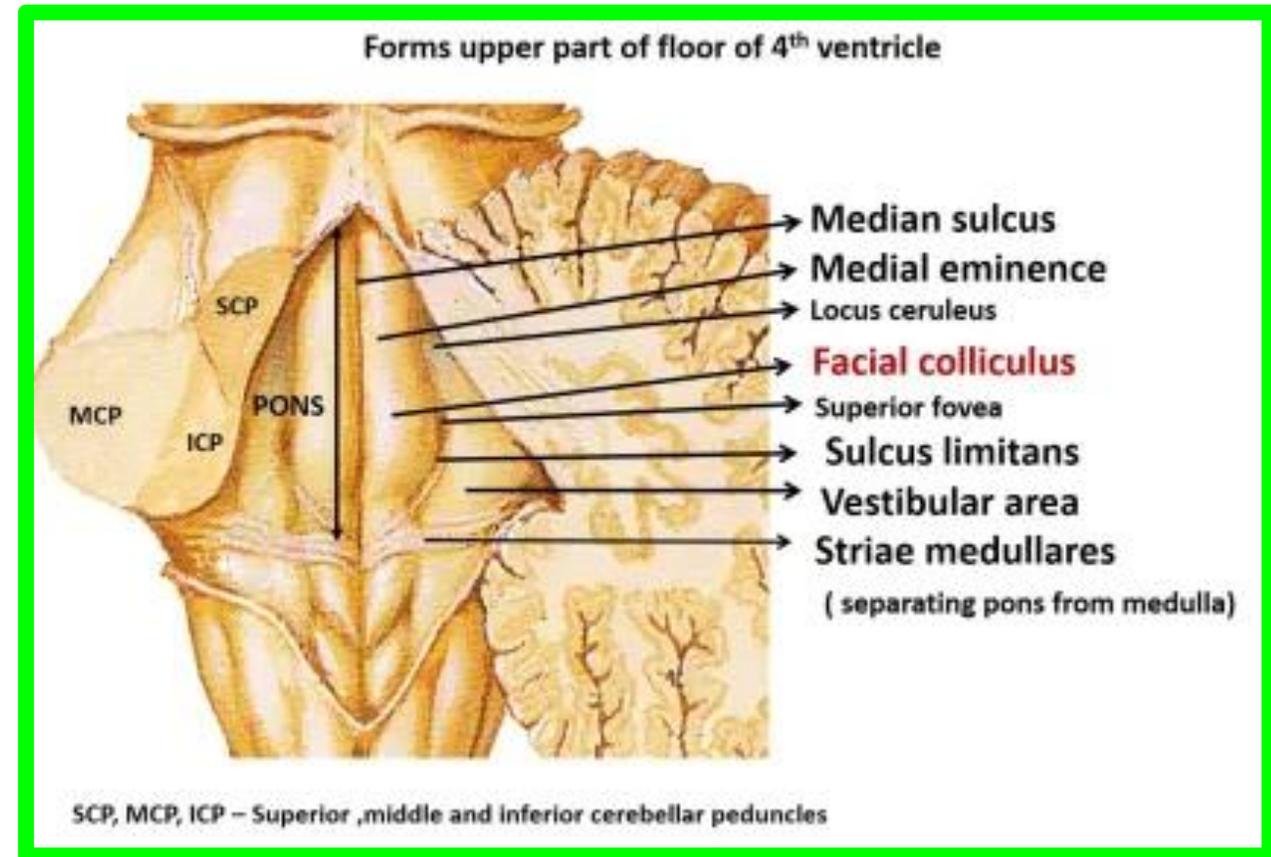
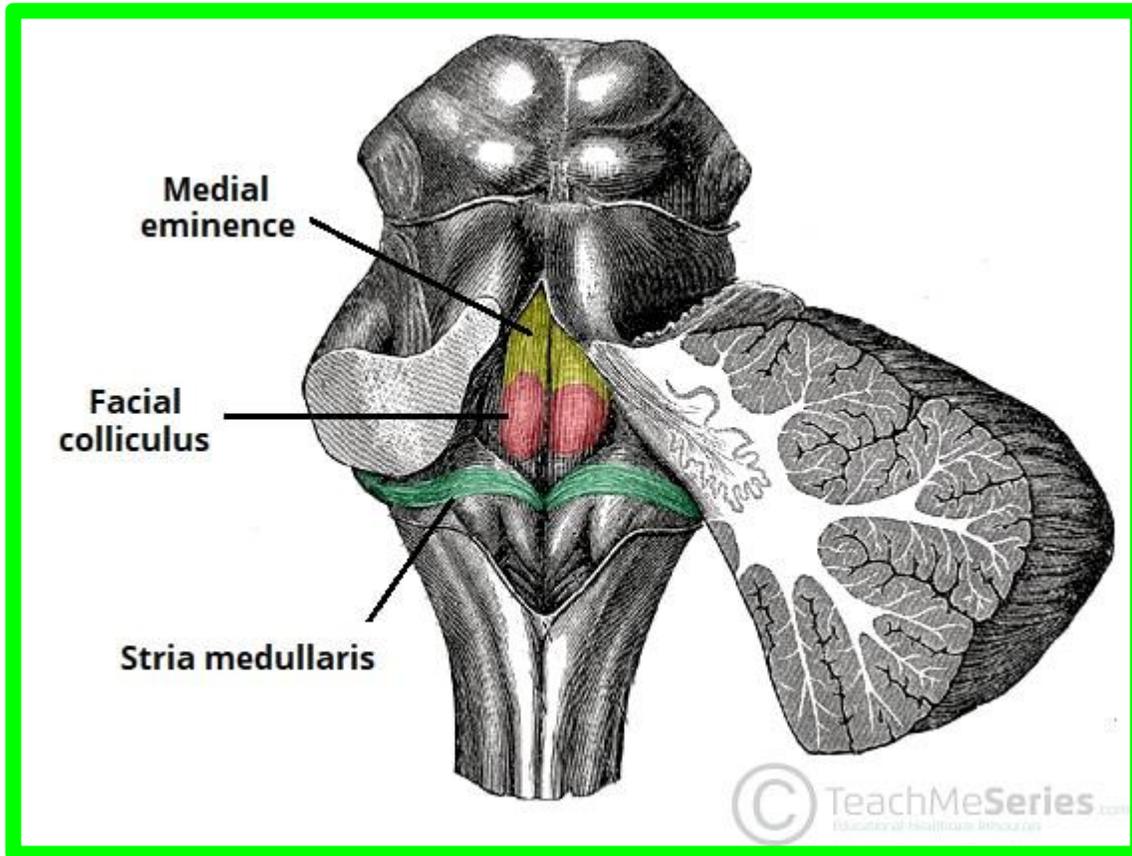
SCP, MCP, ICP – Superior, middle and inferior cerebellar peduncles



## • External features of the Pons

5. **Vesibular area:** lateral to the superior fovea. It overlies the **vestibular nuclei**.

6. **Stria medullaries:** Transverse fibers which separate the pons from the medulla.



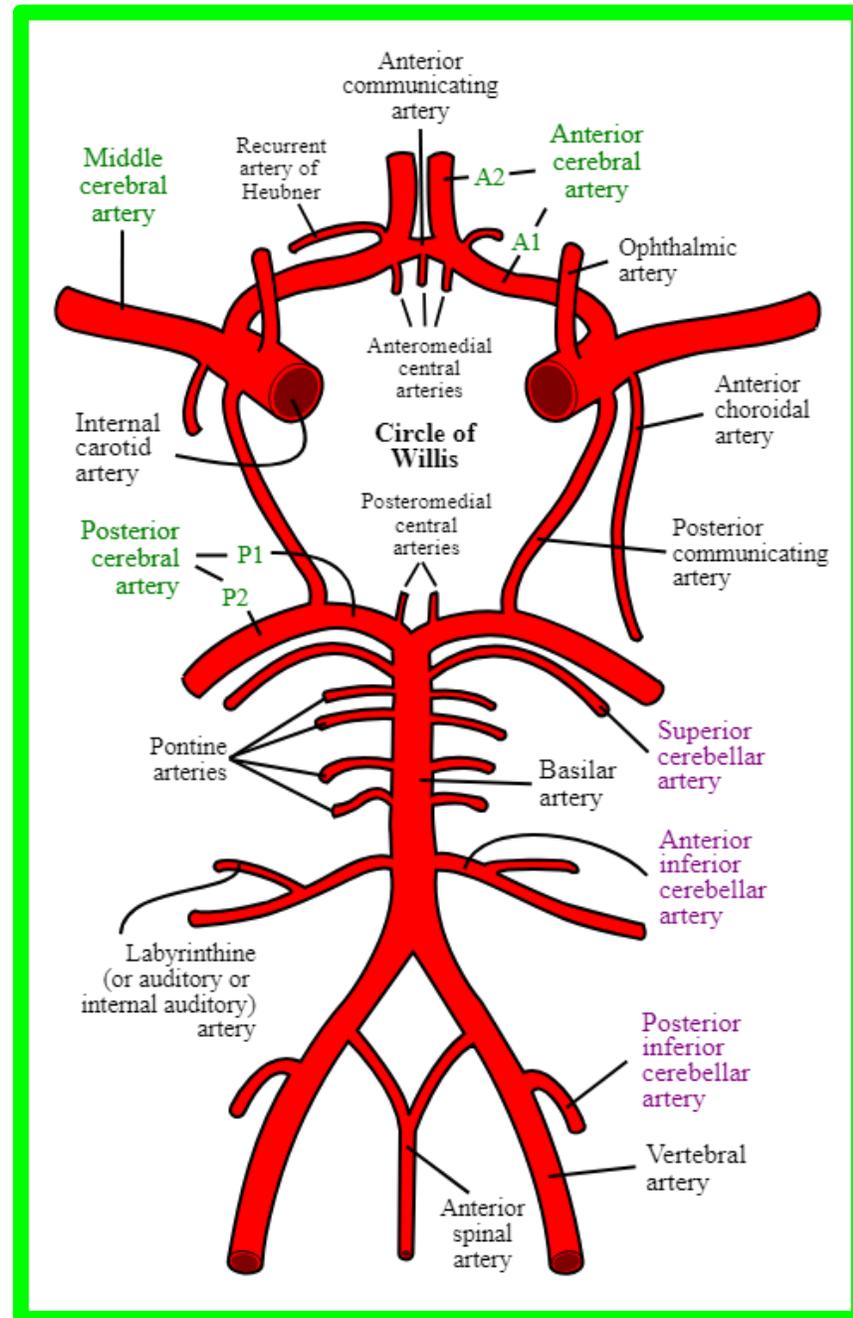
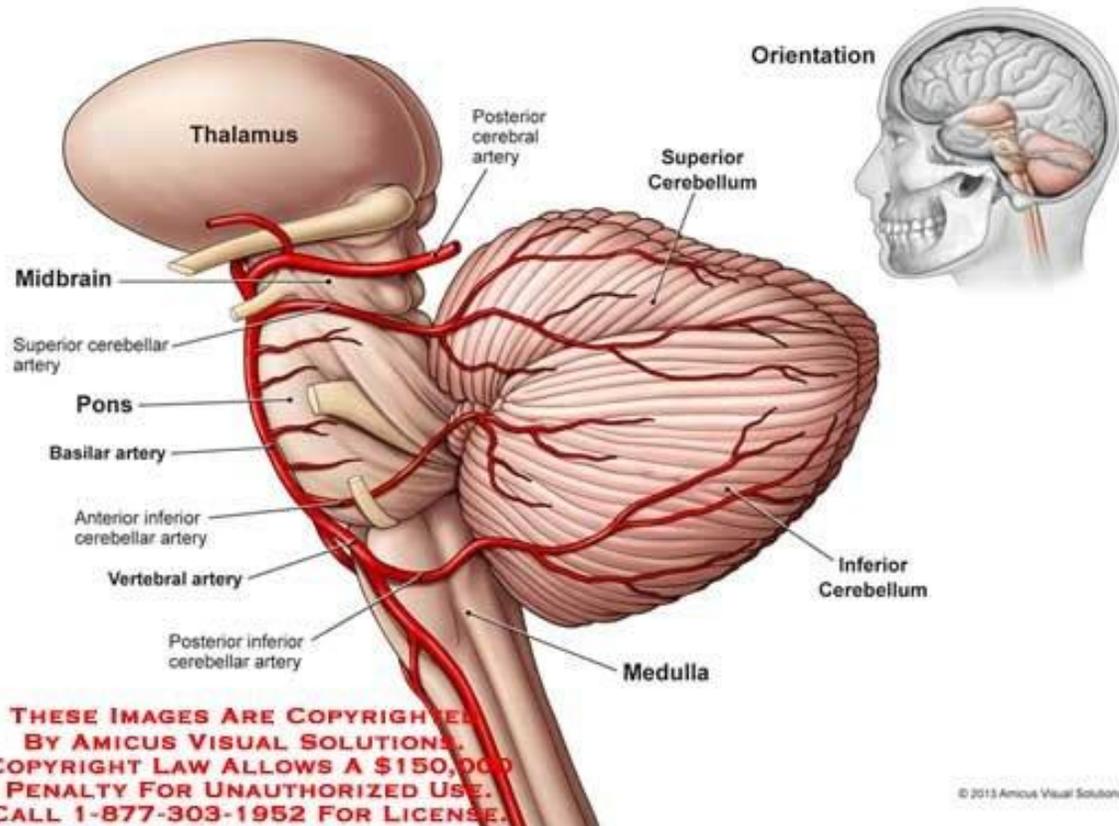
# External features of the Pons

**\*\* Blood supply:**

☐ Pontine branches from the basilar artery.

☐ Venous drainage to the Dural venous sinuses.

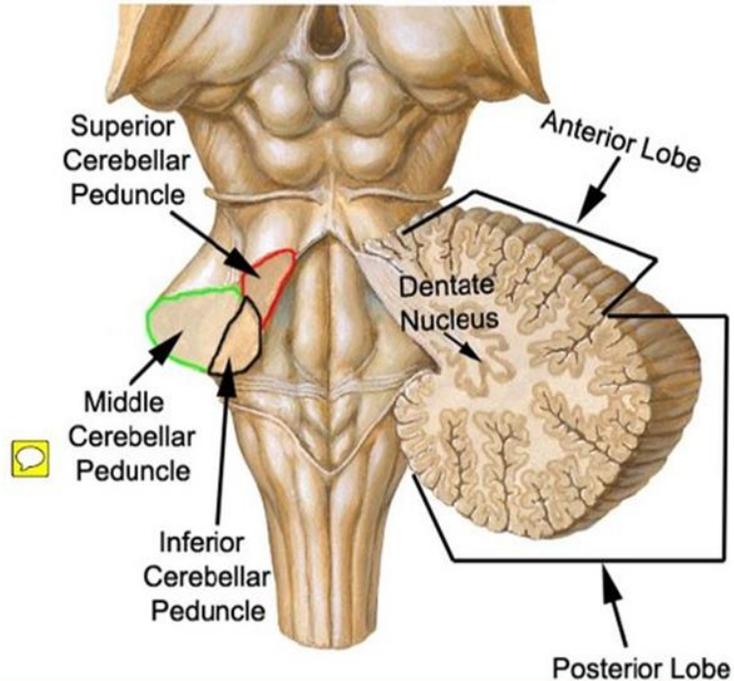
Arteries to the Brain Stem and Cerebellum



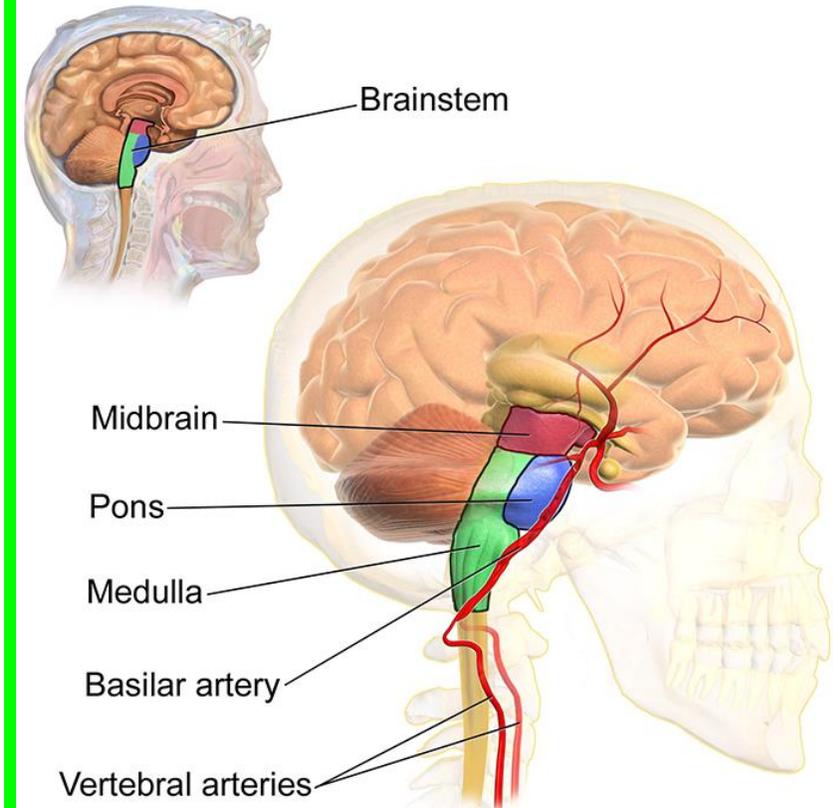
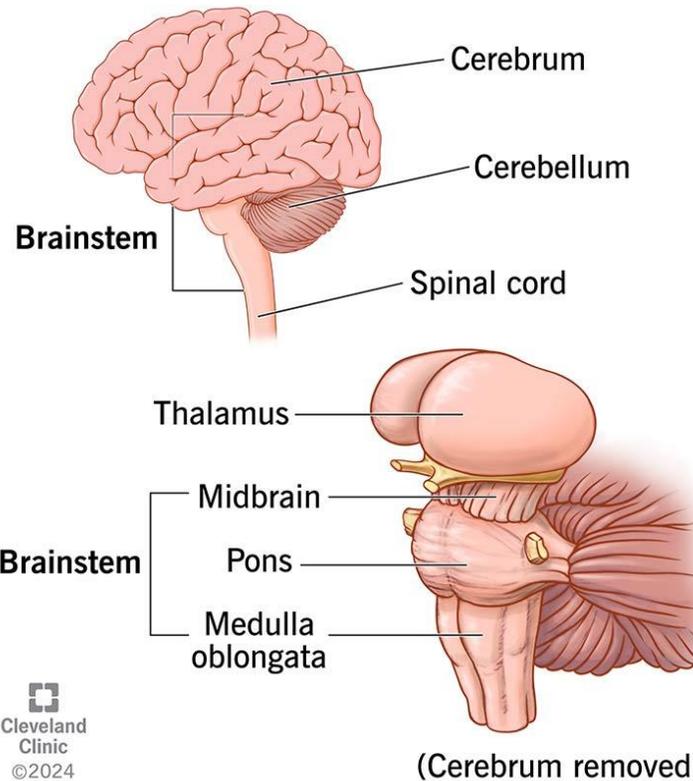
# • Midbrain

- ❖ It is the uppermost and shortest part of the brain stem.
- ❖ It connects the pons and cerebellum to the forebrain.
- ❖ It is connected to the cerebellum by **2 superior cerebellar peduncles**.

Posterior view of the Brainstem  
with part of the Cerebellum removed



Brainstem

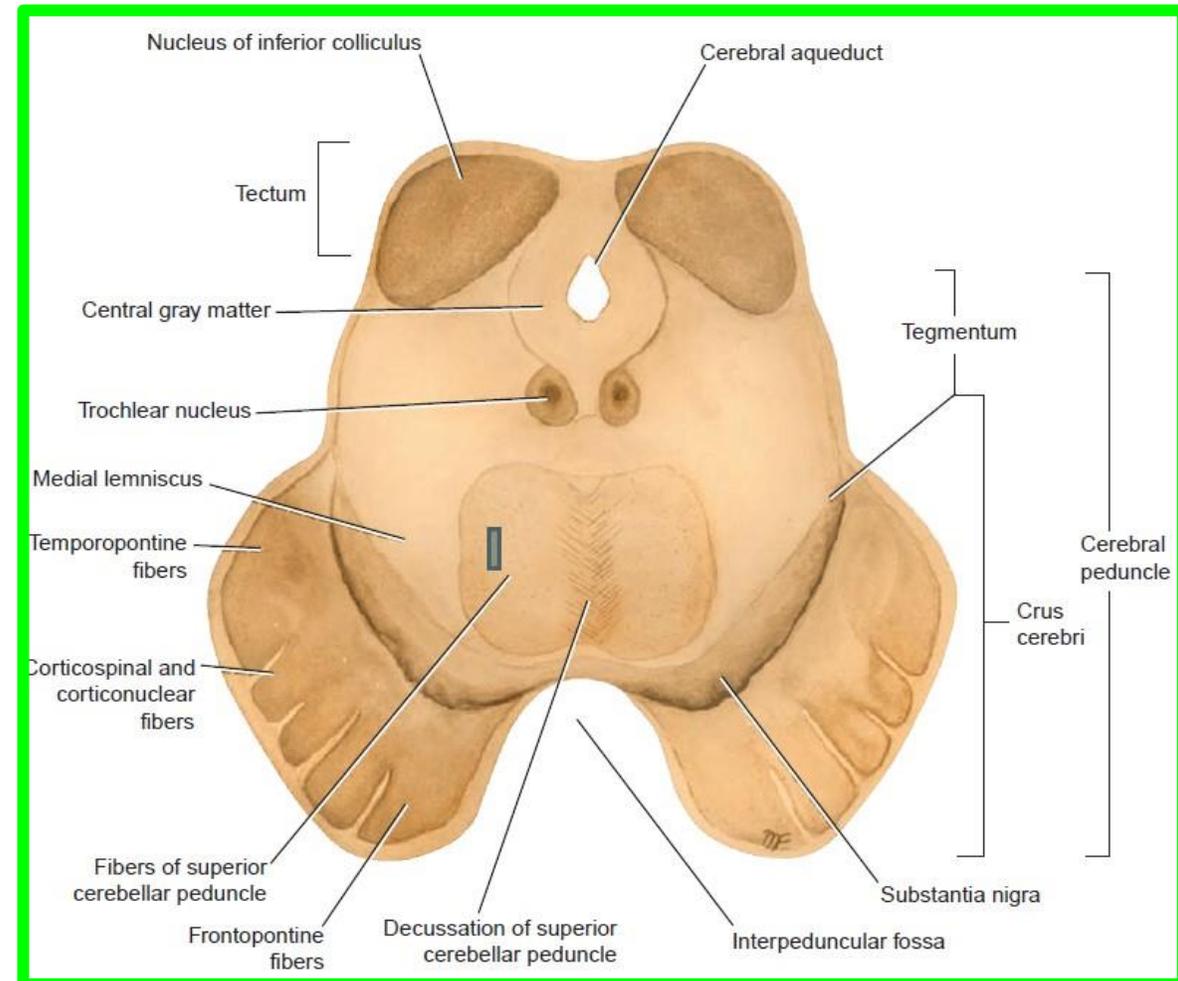


# • External features of midbrain

## \*\* Division of the Midbrain

❖ The cerebral aqueduct (aqueduct of Sylvius) divides the midbrain into two divisions:

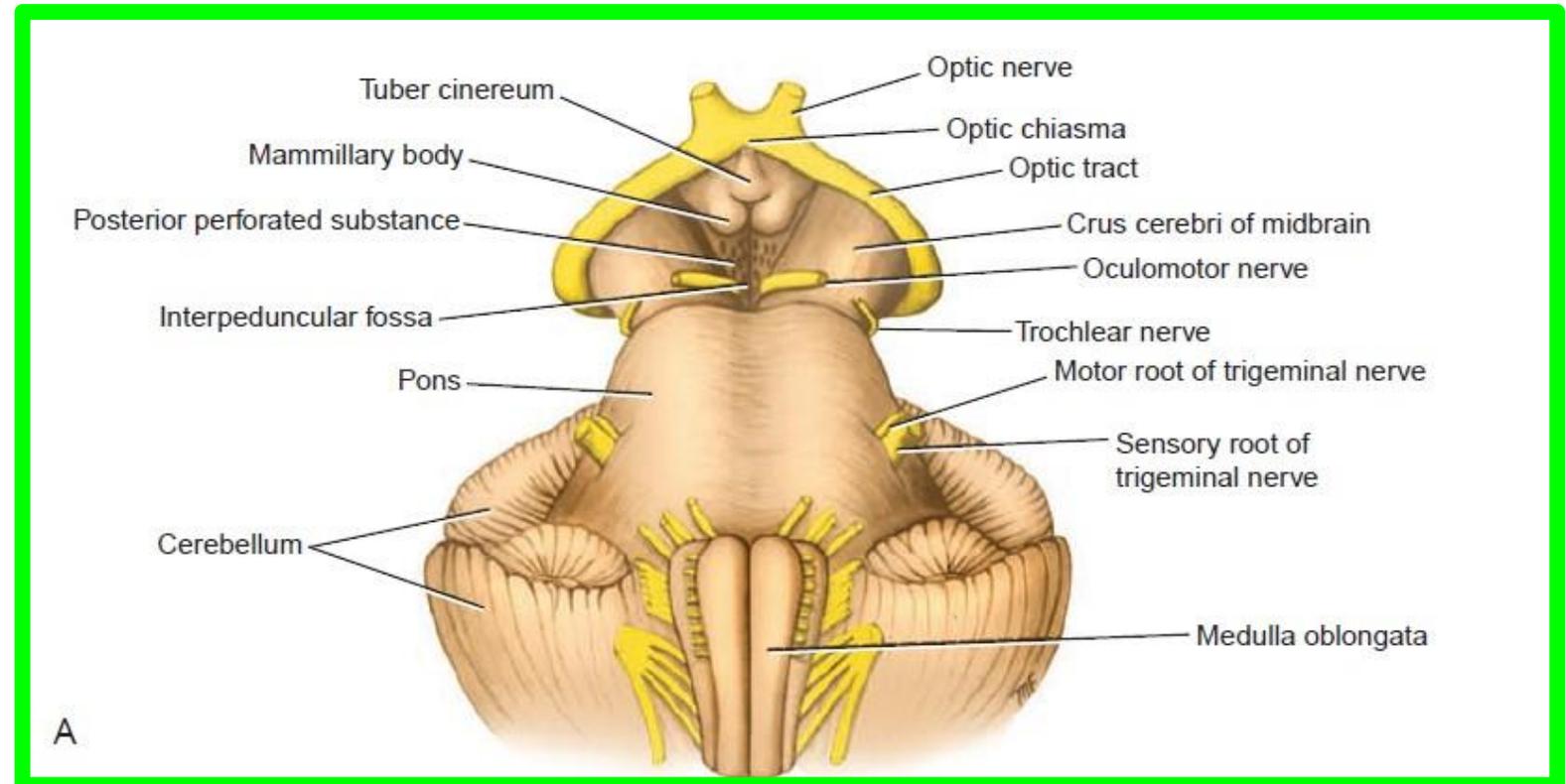
- A. Anterior part (cerebral peduncles).
- B. Posterior part (Tectum).



## • External features of midbrain

### A. Cerebral Peduncles (anterior surface)

- ❖ They consist of 2 thick bands which descend from the cerebral hemispheres to the pons.
- ❖ The two peduncles are separated by **the interpeduncular fossa**.
- ❖ The fossa is related to **Circle of Willis**
- ❖ **The oculomotor nerve (III)** exits from the medial aspect of each cerebral peduncle



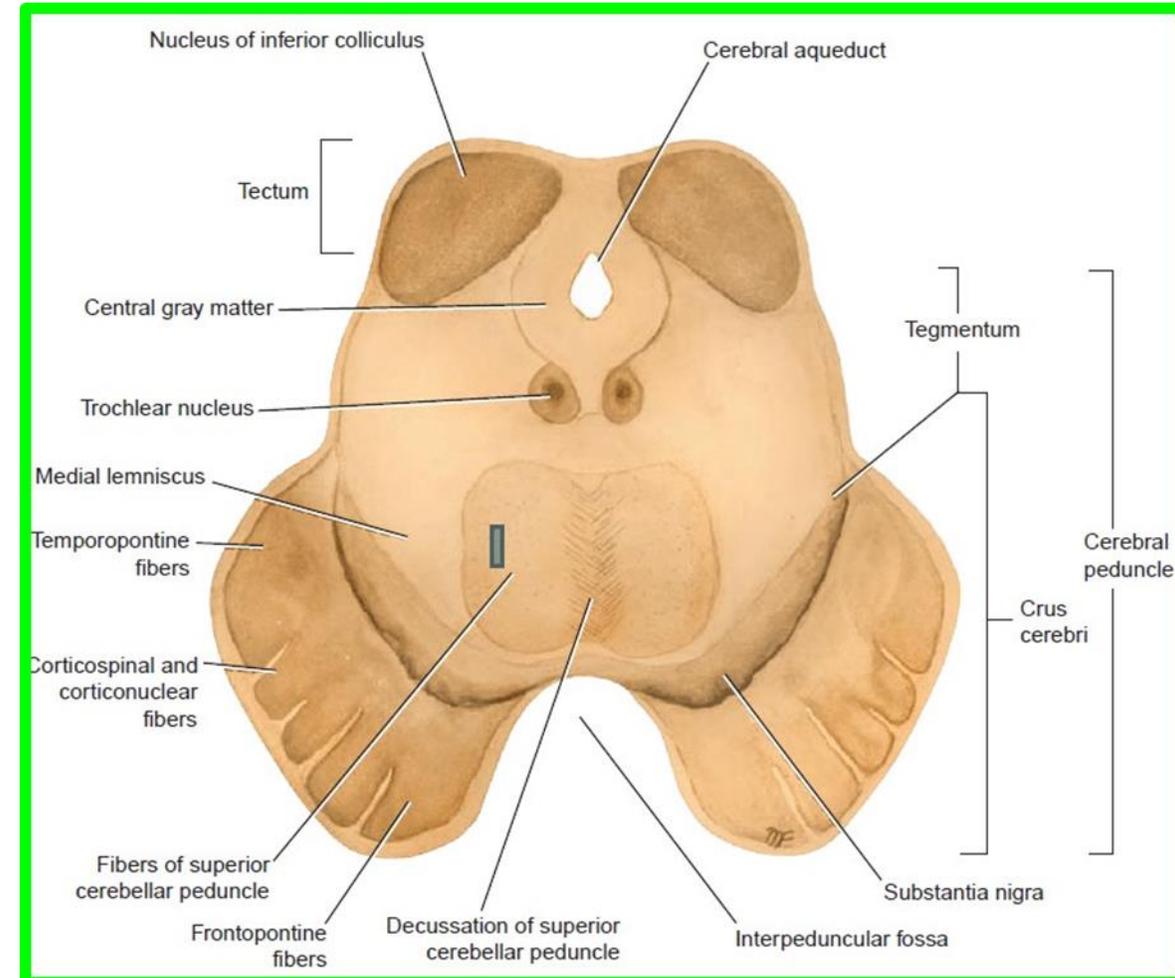
## • External features of midbrain

❖ Each **cerebral peduncle** consists of **3 parts**:

**A. Anterior part (crus cerebri):** It is formed by the fibers of pyramidal tract.

**B. Middle part (substantia nigra):** It is one of the extrapyramidal nuclei.

**C. Posterior part (tegmentum):** contains the nuclei and tracts of midbrain



# • External features of midbrain

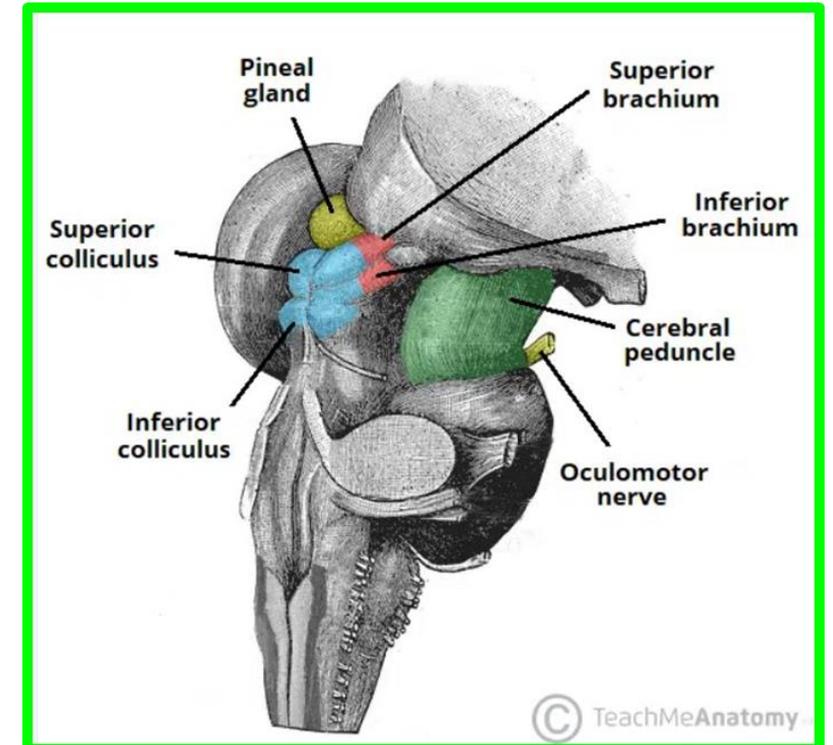
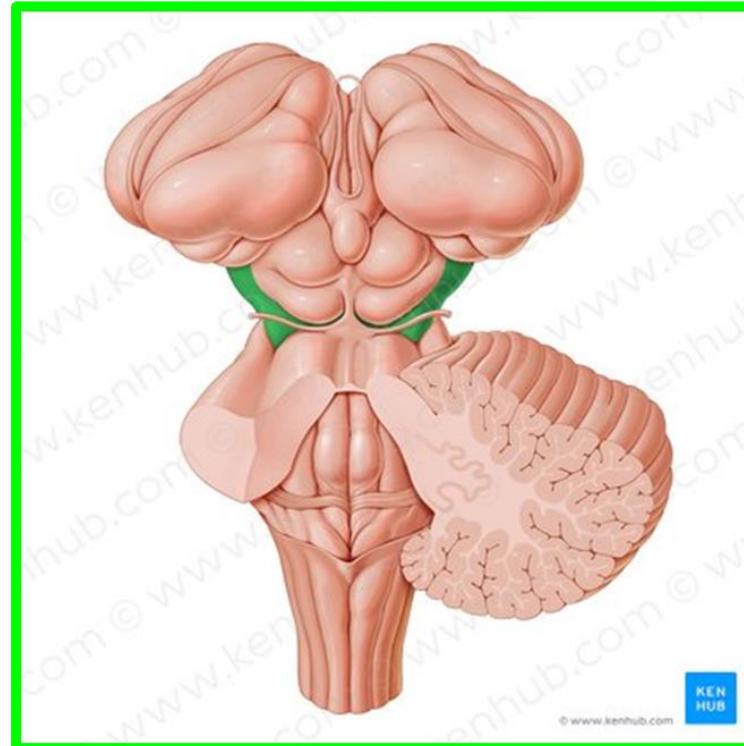
## B. Tectum (posterior surface)

1. **Four Knob-like elevations** called the **colliculi**; **two superior** and **two inferior**.

✓ The 4 colliculi are separated by a **cruciform sulcus**.

**A. 2 superior colliculi:** which are the **centers of visual reflex**.

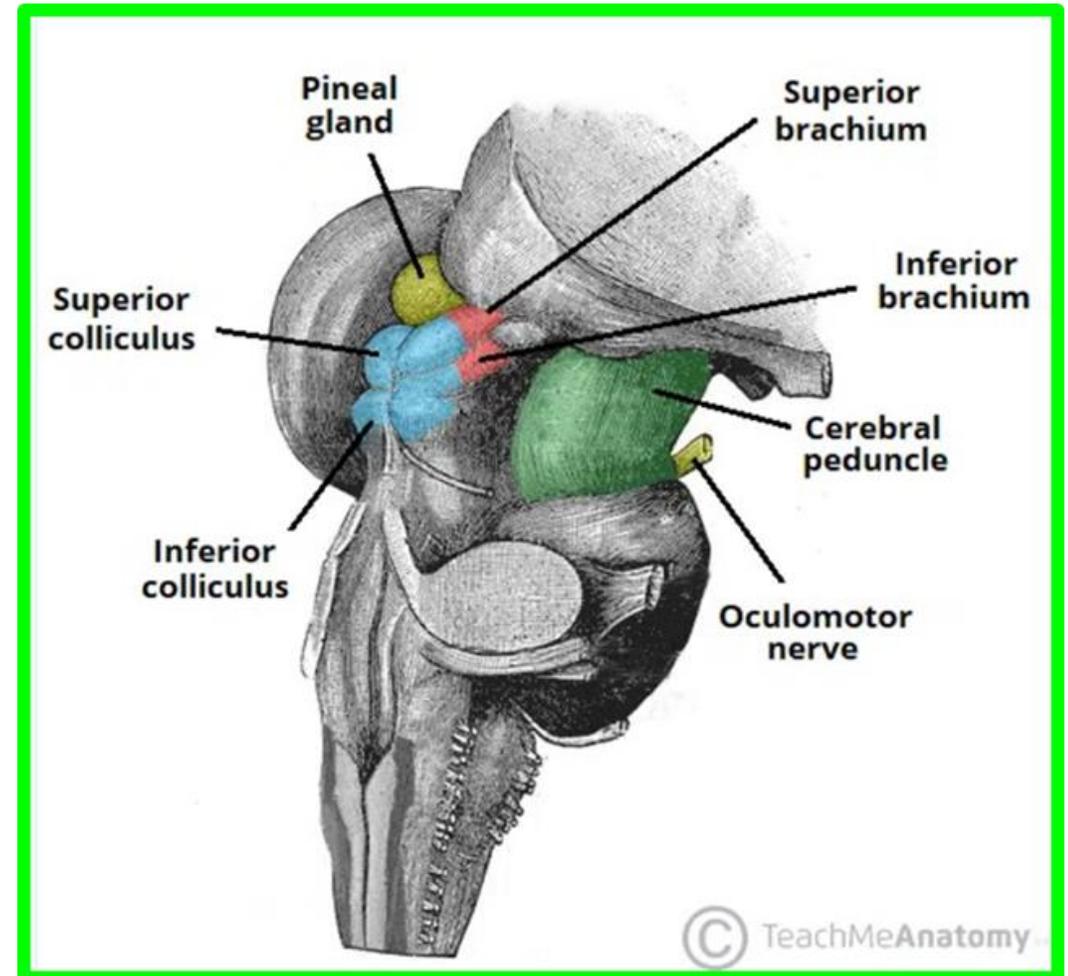
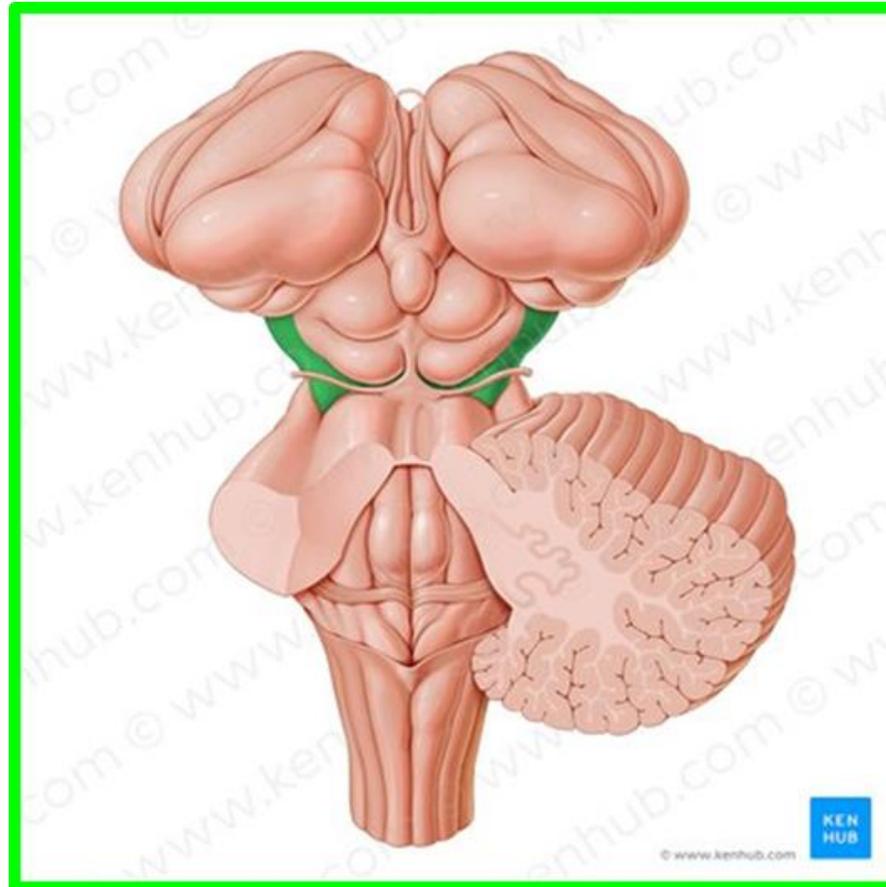
✓ Each of them is connected to **the lateral geniculate body (L.G.B)** by **superior brachium**.



## • External features of midbrain

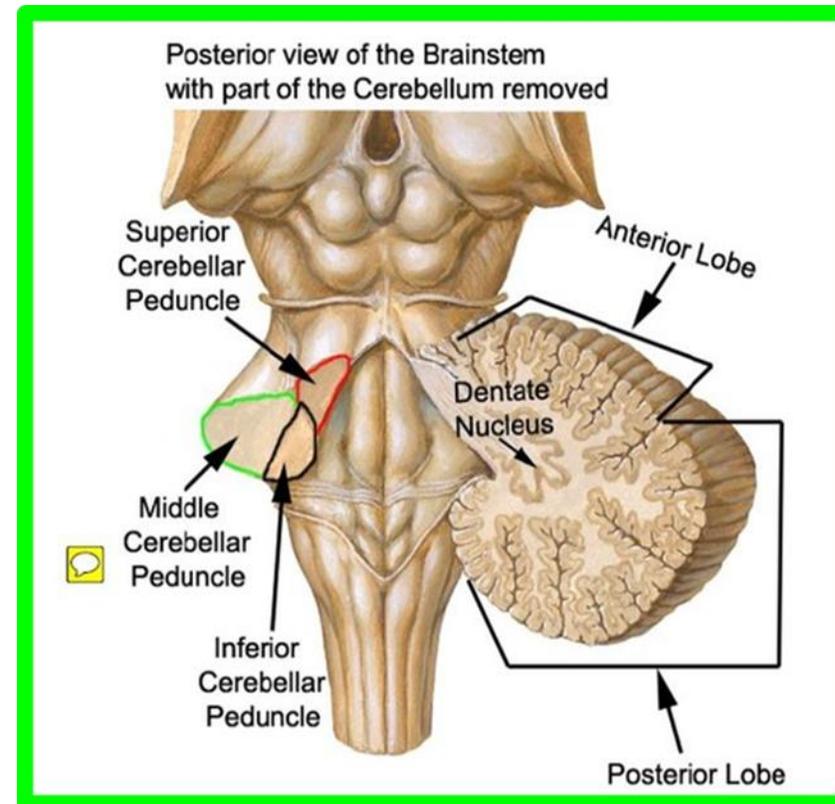
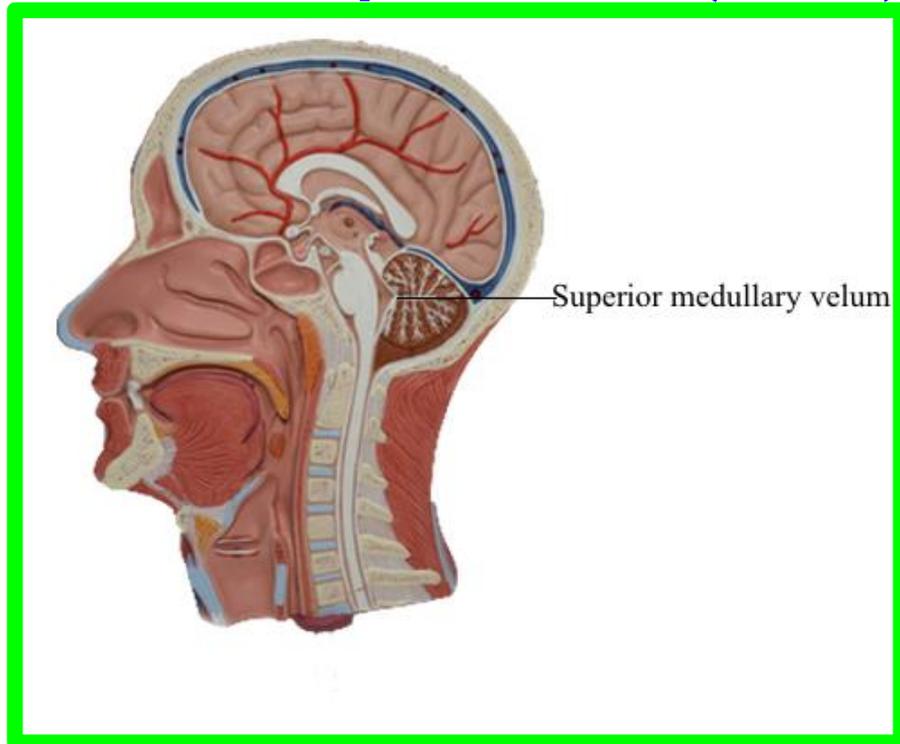
**B. 2 inferior colliculi;** which are the **centers of auditory reflex.**

- ✓ Each of them is connected to **the medial geniculate body (M.G.B)** by **inferior brachium.**



## • External features of midbrain

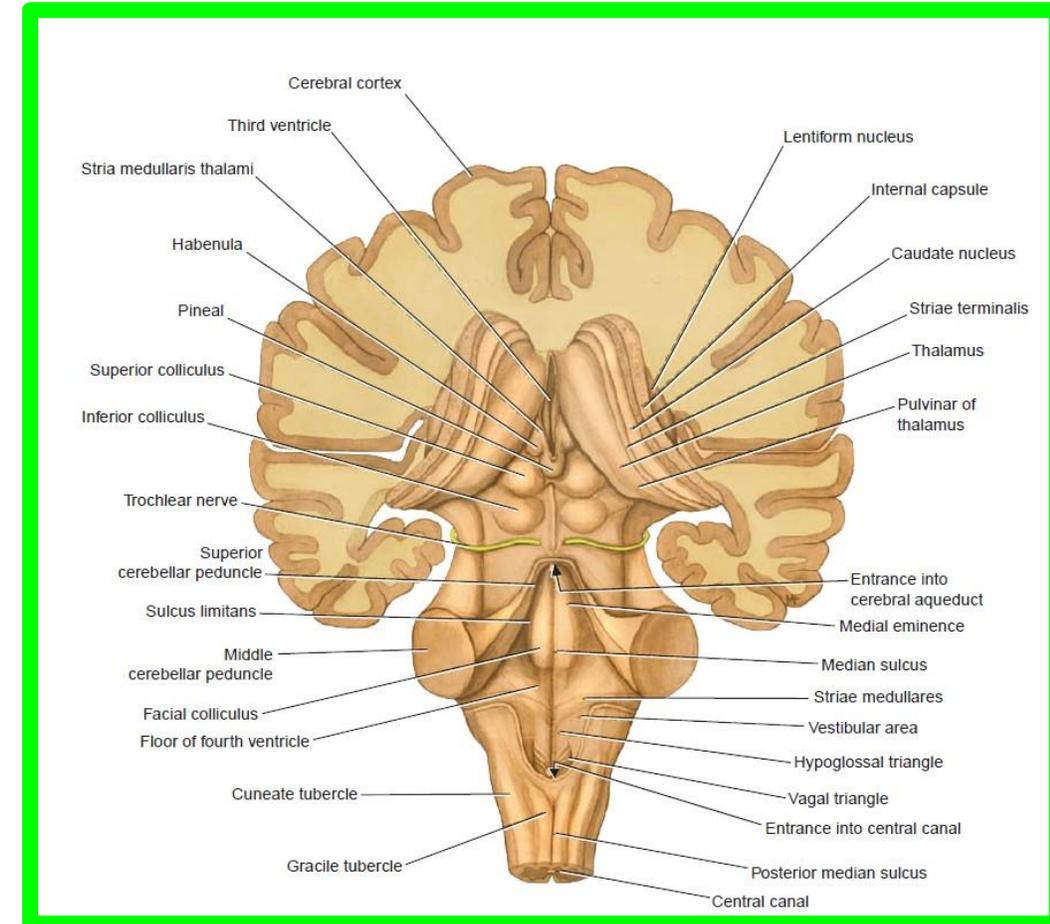
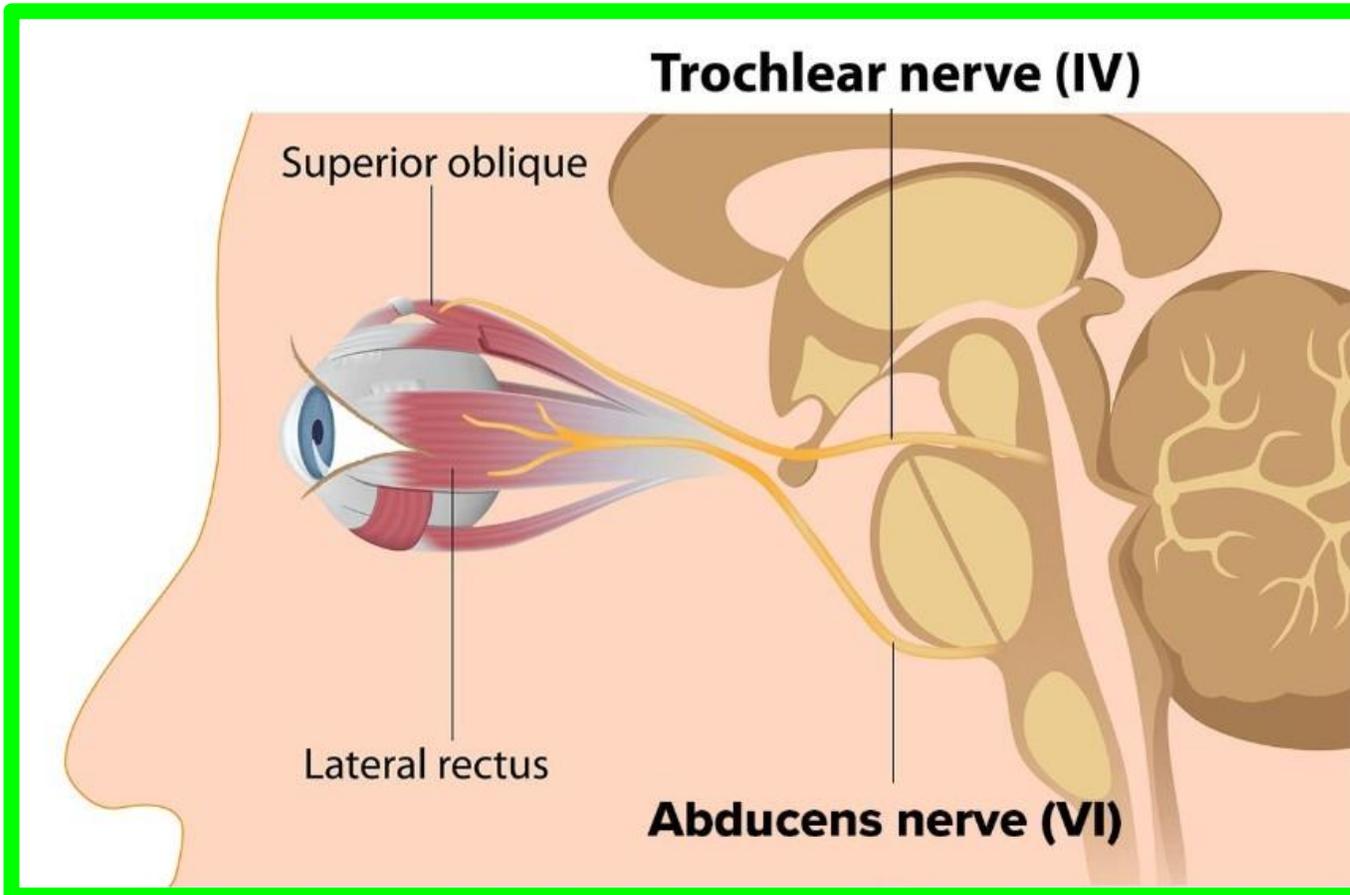
2. 2 superior cerebellar peduncle (S.C.P) emerge from the posterior surface of the midbrain and run downward, backwards and laterally along the sides of the upper part of the fourth ventricle to enter the cerebellar hemisphere.
3. Superior medullary velum is the membrane which stretches between the 2 superior cerebellar peduncles (S.C.P).



## • External features of midbrain

**4. The trochlear nerve (IV):** on each side, emerges from the lowermost part of the back of the midbrain.

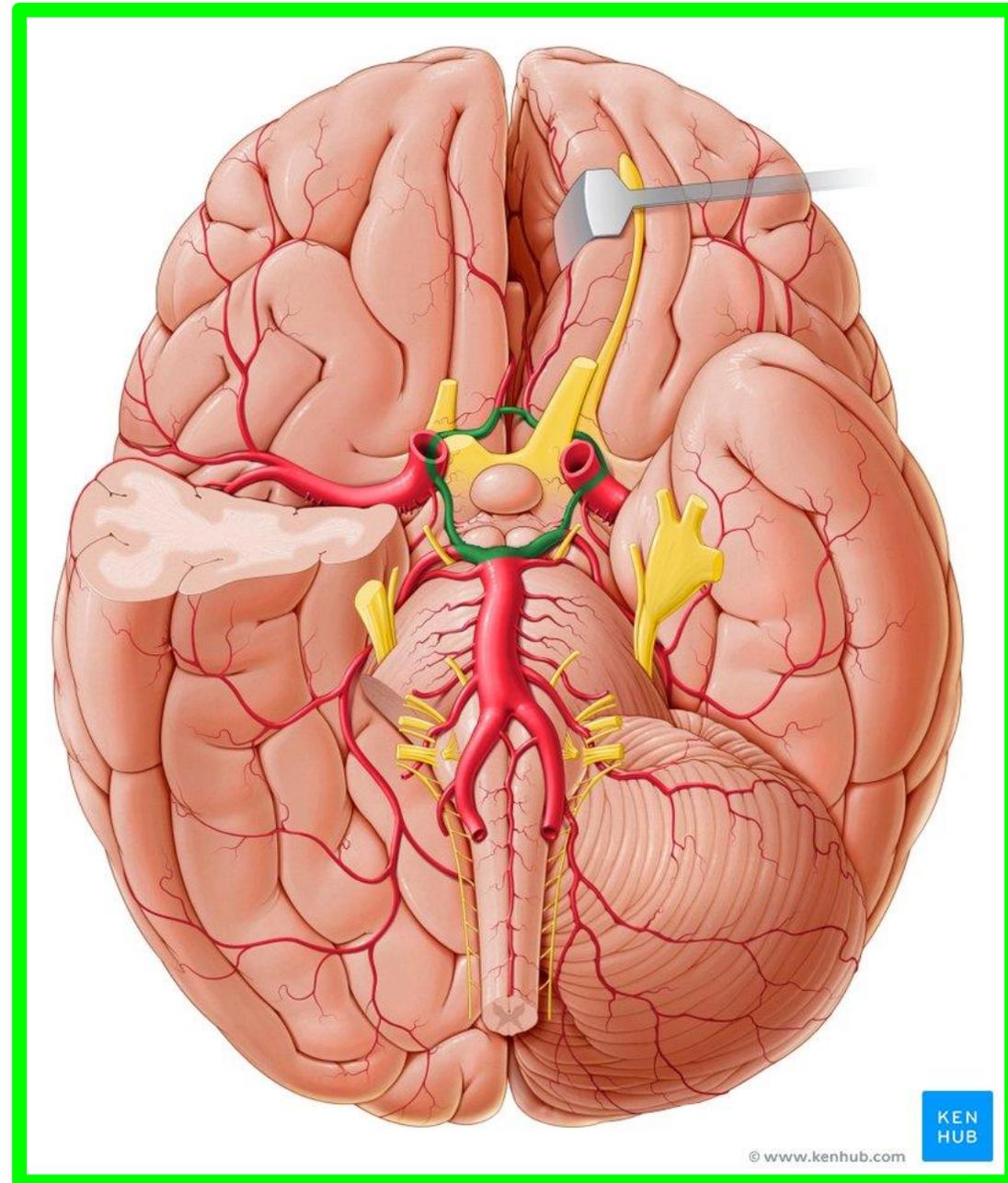
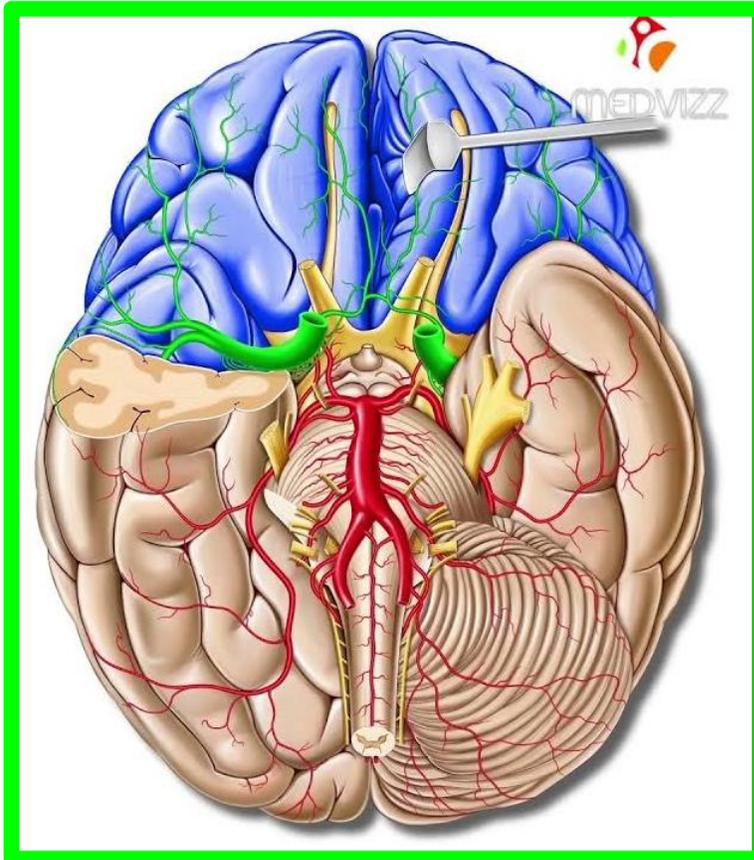
✓ It is the only cranial nerve which emerges from the back of the brain stem.



## • External features of midbrain

\*\* Blood supply:

- ✓ Arterial from circle of Willis.
- ✓ Venous drainage to the great cerebral vein or basal vein.



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# Fourth Ventricle

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**\*\*Position:** bet. The pons & upper medulla **anteriorly** and the cerebellum **posteriorly**.

**\*\*Shape:**

✓ It is tent-shaped when seen from side

✓ Diamond-shaped from when seen from behind

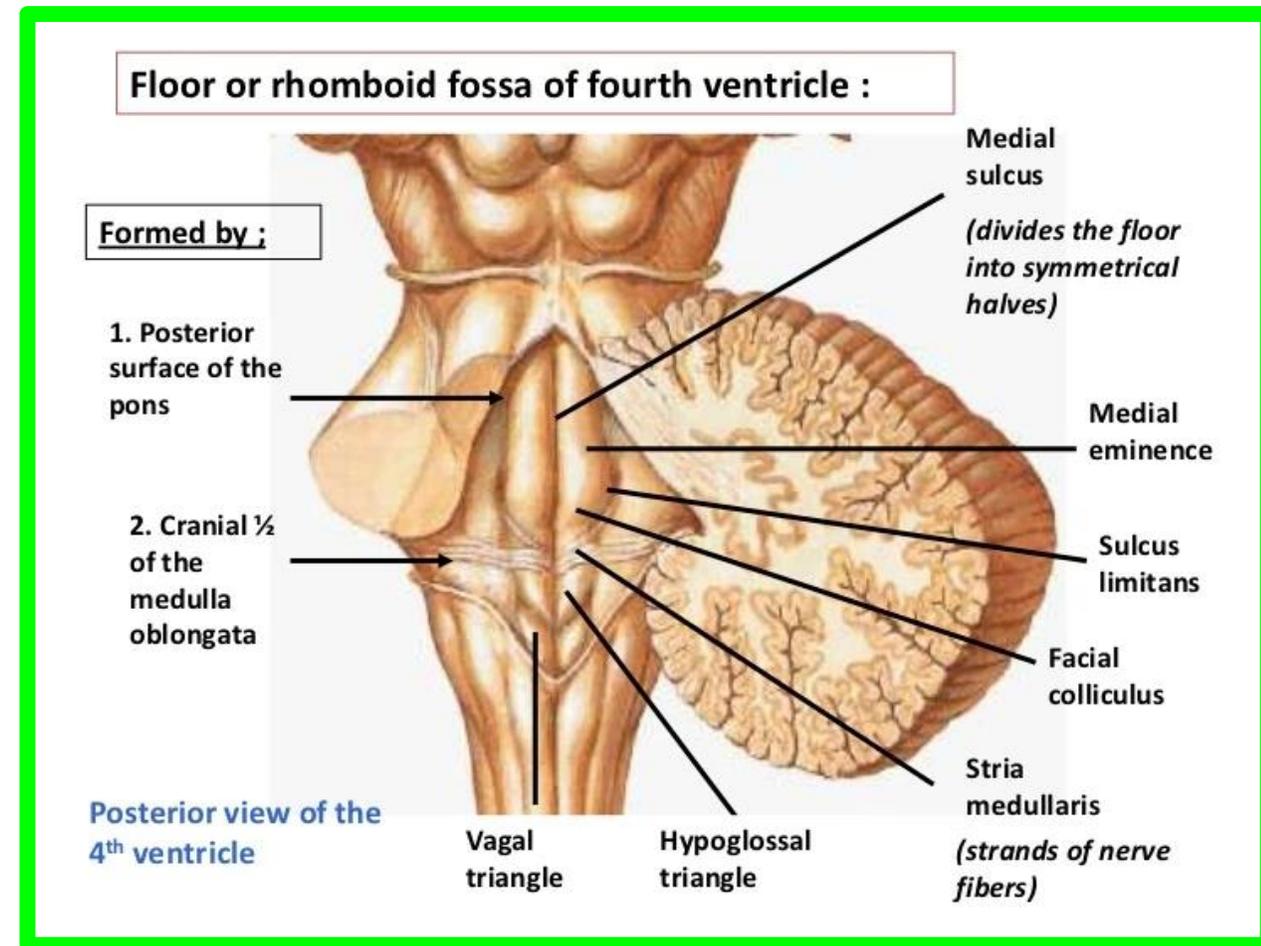
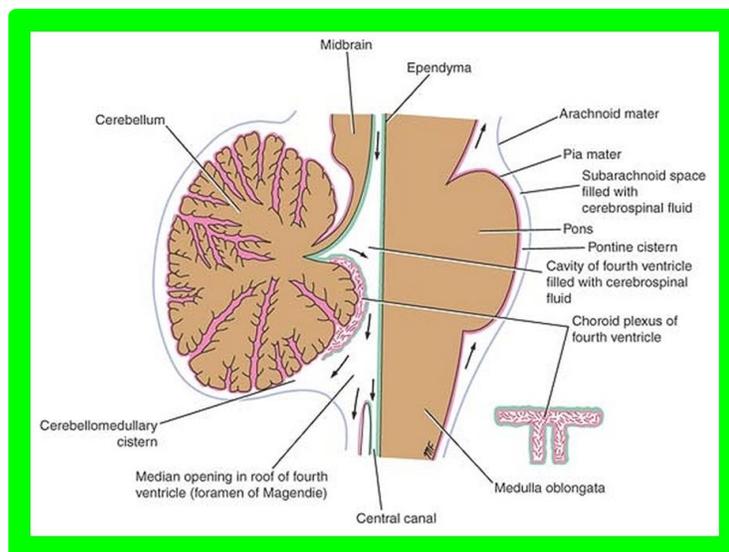
**\*\*It has:**

\*A floor anteriorly

\*A roof posteriorly

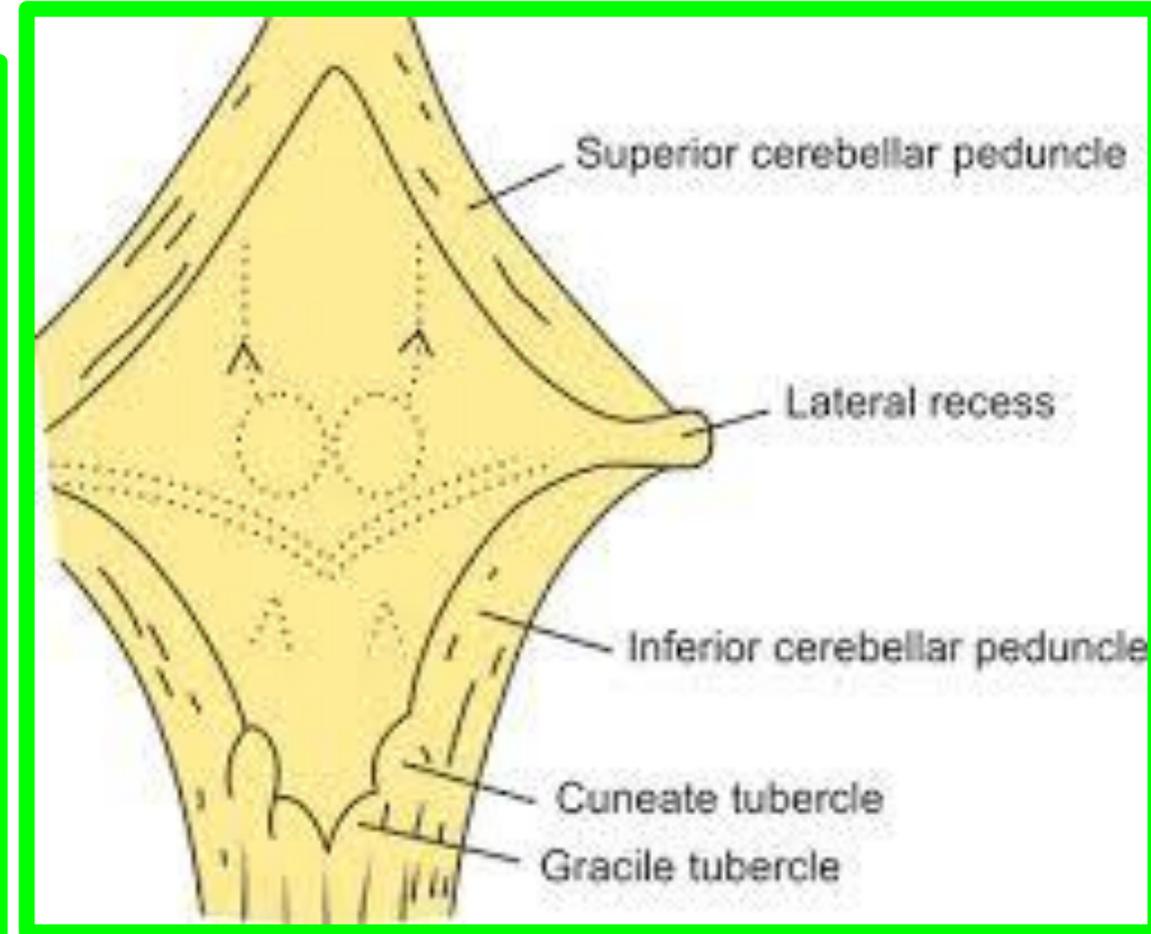
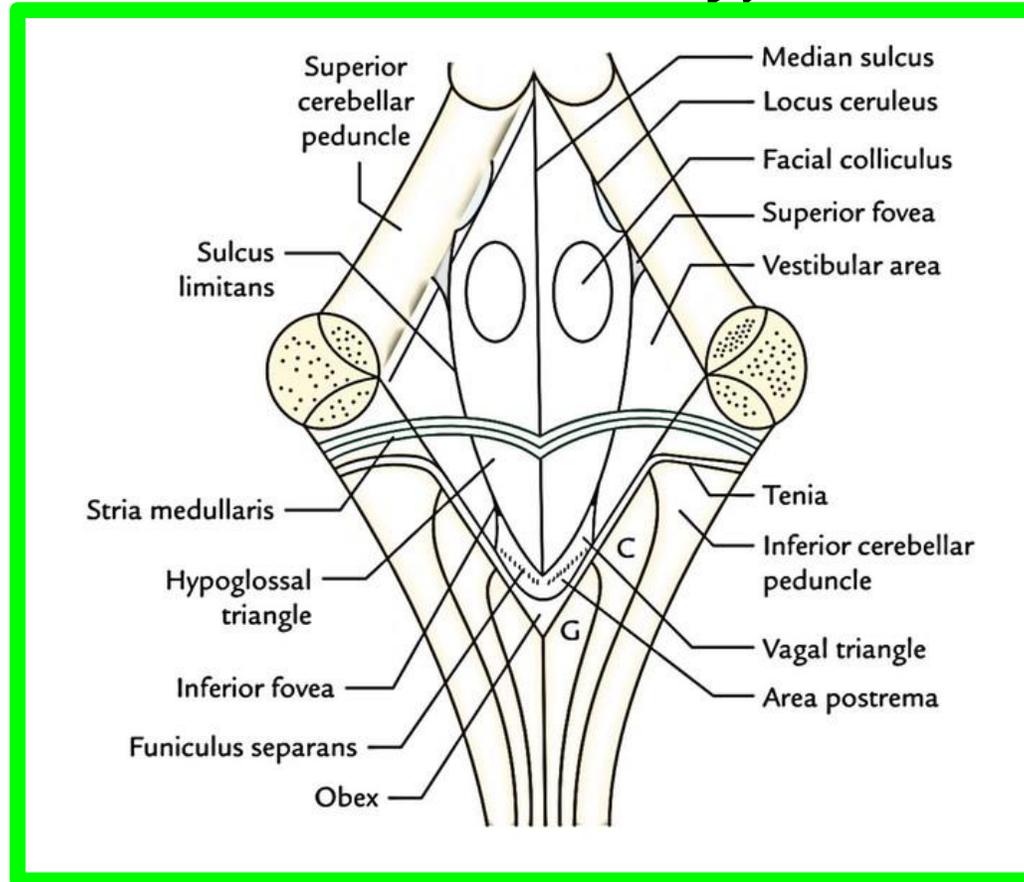
\*4 Lateral boundaries

\*4 Angles( sup. , inf. , 2 lateral angles)



# Boundaries of the 4<sup>th</sup> ventricle

1. The **sup. Cerebellar peduncle** on each side (form the upper lat. Boundary)
2. The **inf. Cerebellar peduncle, Cuneate & Gracile tubercles** on each side (form the lower lat. Boundary)



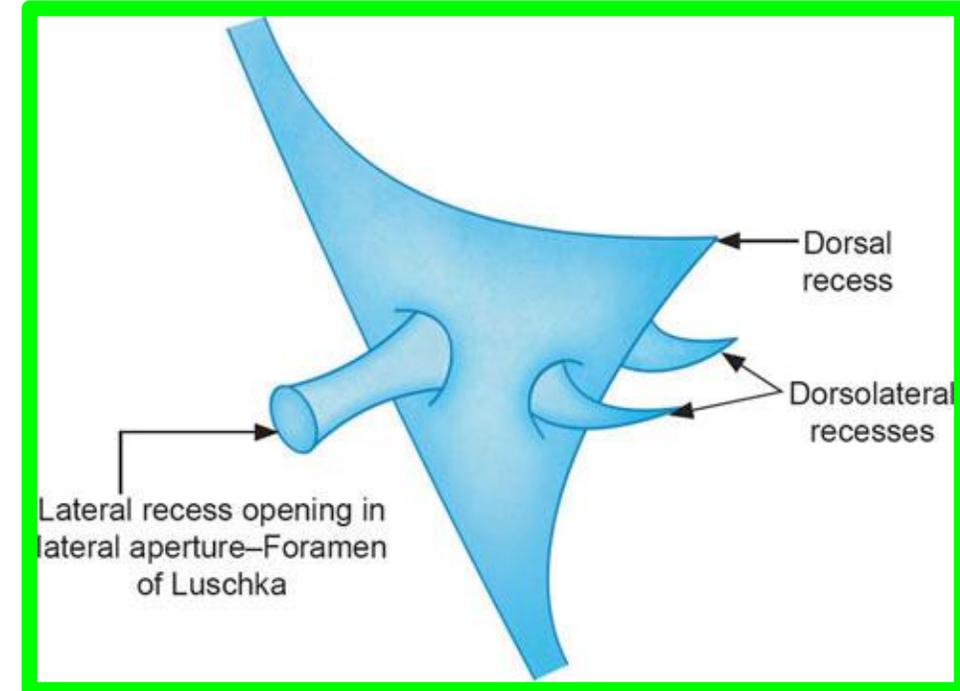
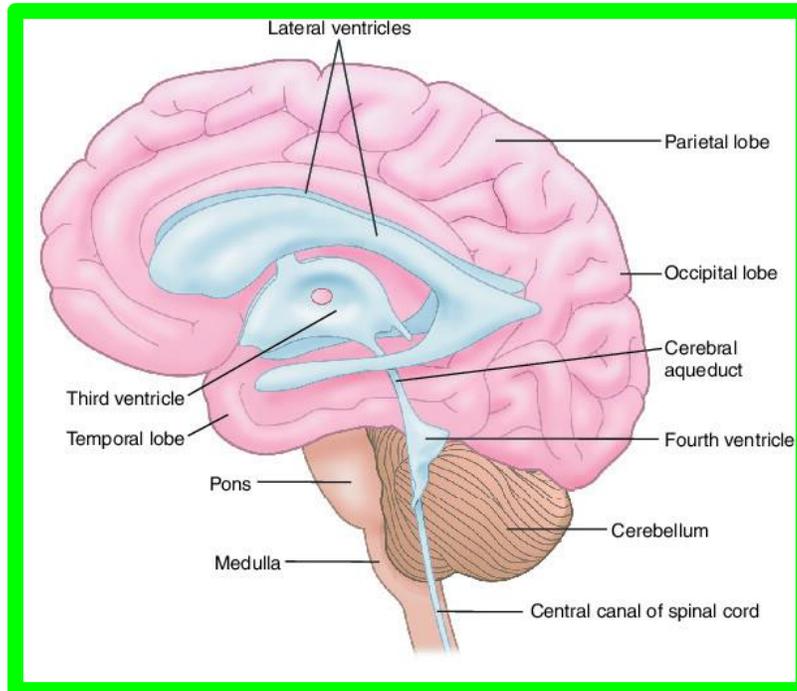
# Angles of the 4<sup>th</sup> ventricle

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- ❖ **Superior angle:** Where the ventricle continuous with cerebral aqueduct of Sylvius of the midbrain
- ❖ **Inferior angle:** Where ventricle continuous with central canal of closed medulla
- ❖ **2 Lateral angle:** Where cavity of the ventricle pulled laterally to form 2 lat. Recesses, each one open into the subarachnoid space.

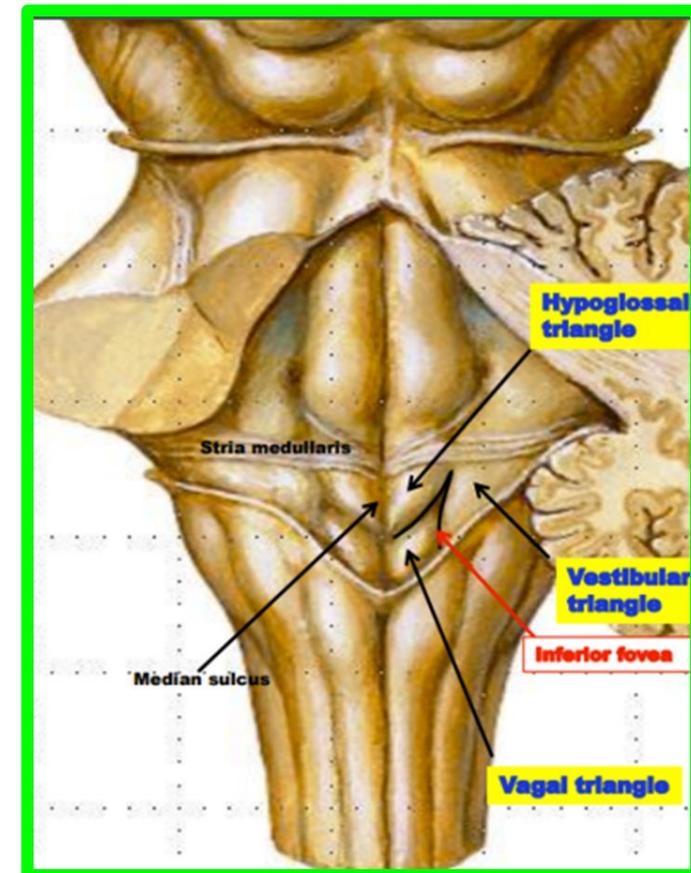
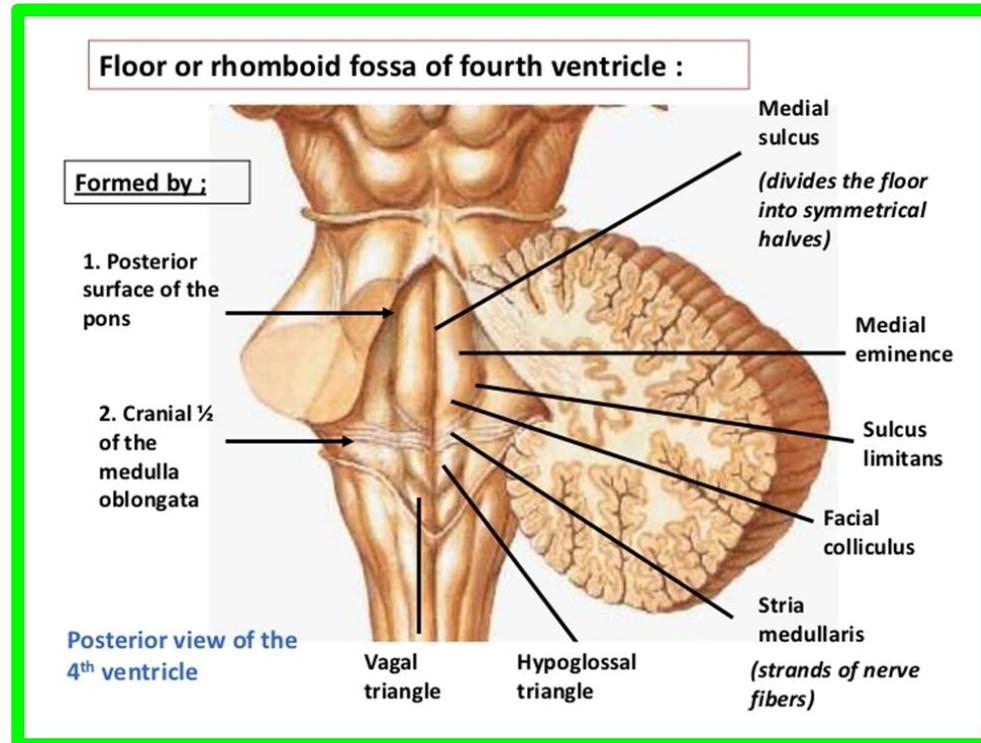


# Floor of the 4<sup>th</sup> ventricle

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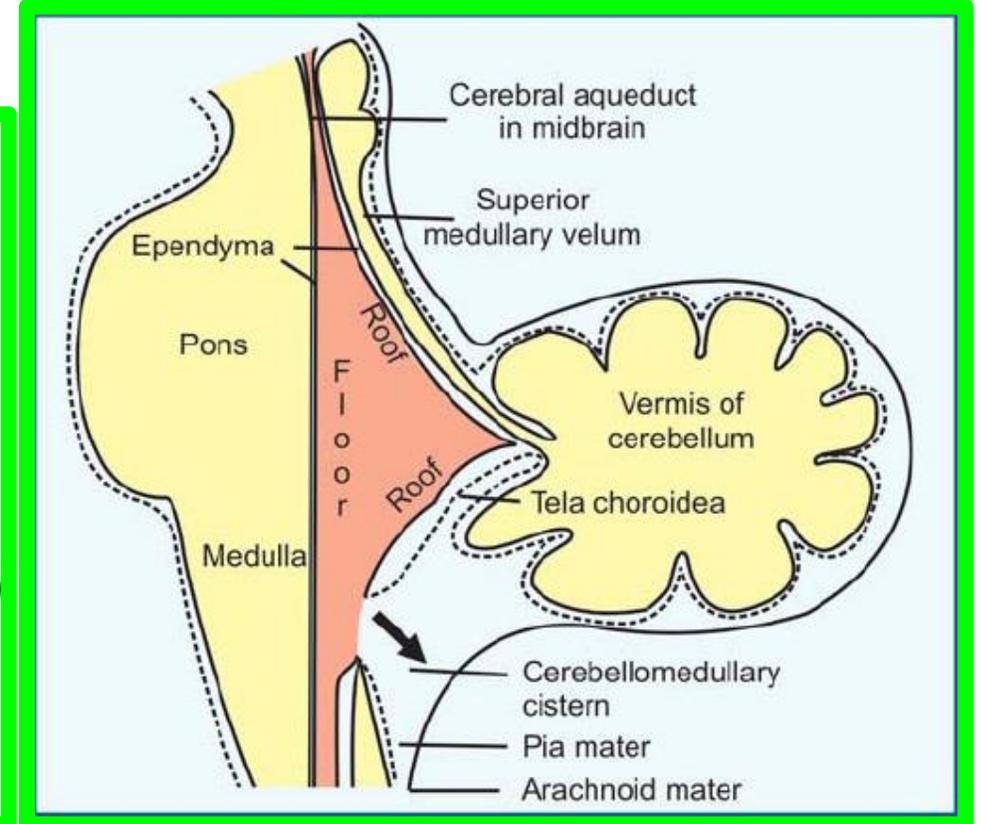
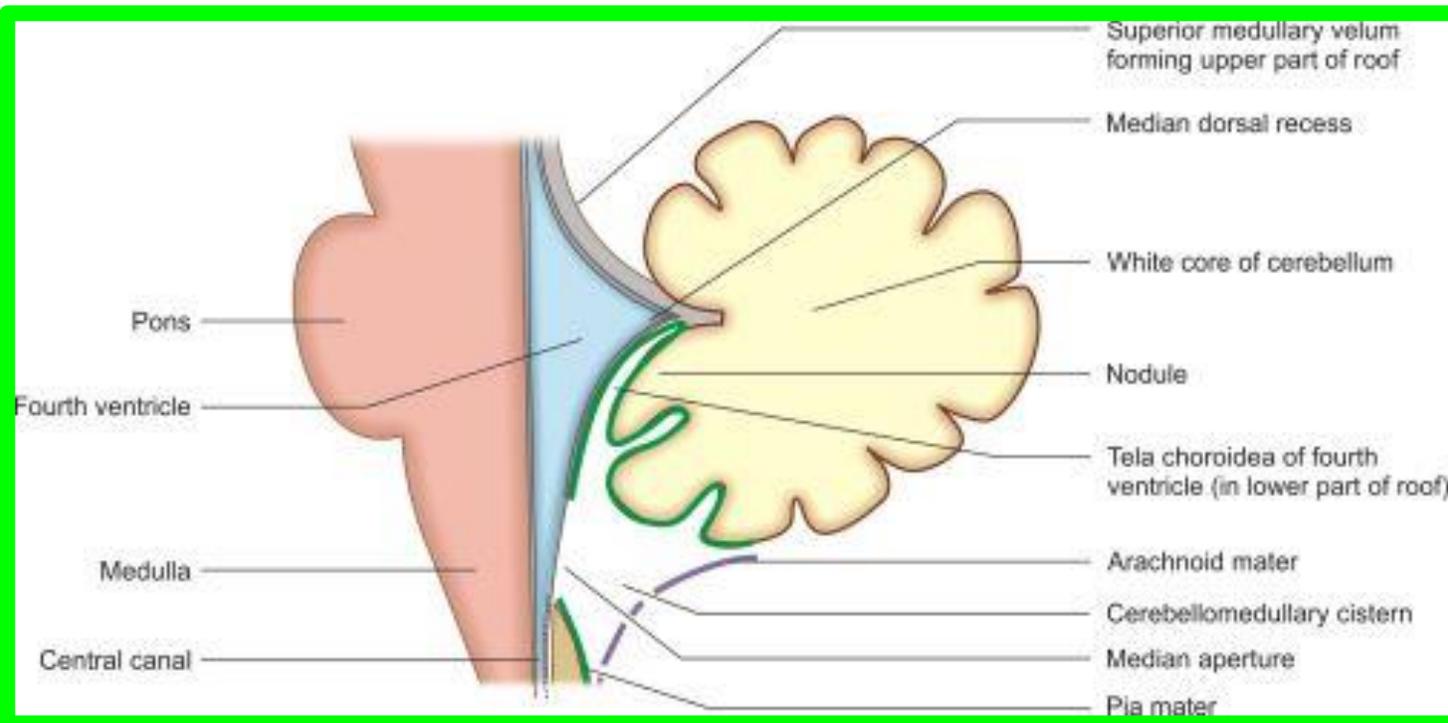
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- \* Diamond shaped
- \* Formed above by **post. Surface of pons** & below by the **open medulla**
- \* Subdivided into **2 identical Rt. & Lt. halves** by the **median sulcus**
- \* It is crossed by fibers of **medullary stria** which divided the floor into:
  - ✓ **An upper pontine part**
  - ✓ **Lower medullary part**



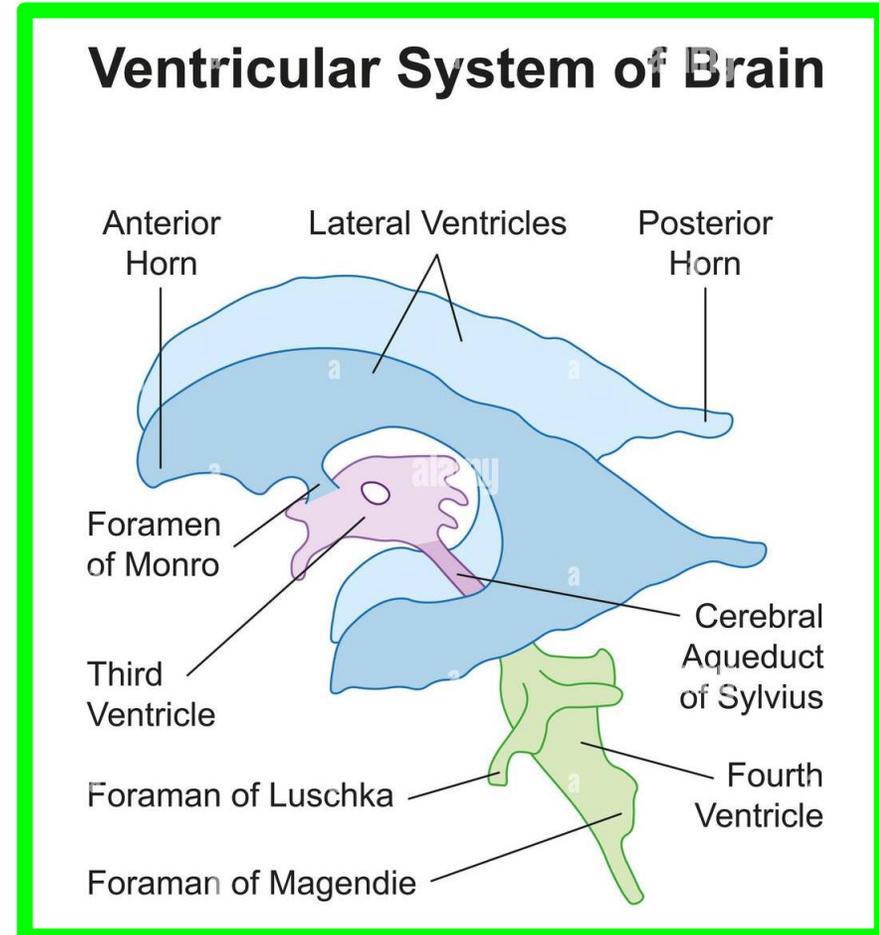
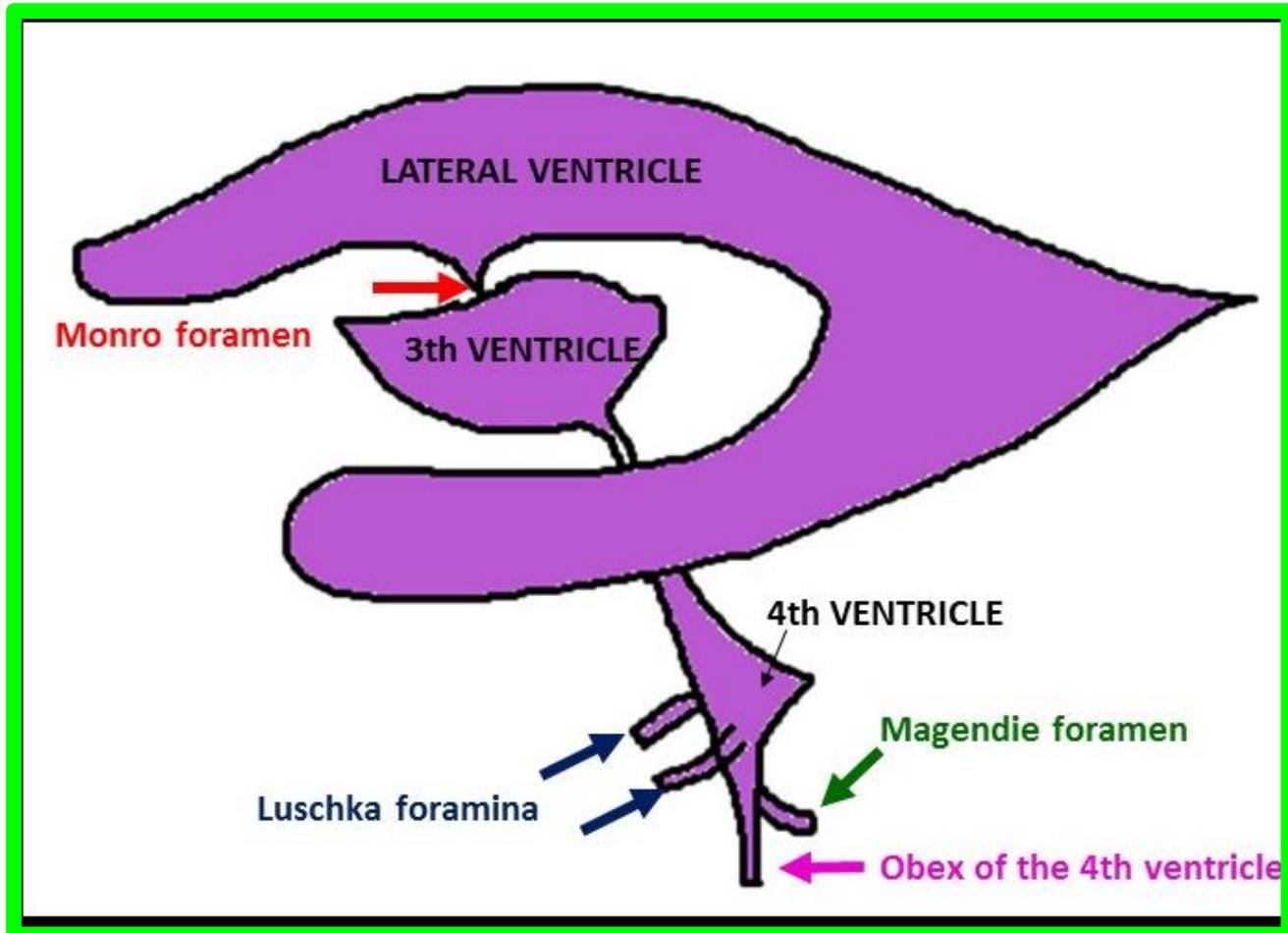
# Roof of the 4<sup>th</sup> ventricle

- ✓ **The upper part:** is formed by the medial borders of the **two superior cerebellar peduncles** and a connecting sheet of white matter called the **superior medullary velum**
- ✓ **Middle part:** formed by the vermis of cerebellum
- ✓ **Lower part:** is formed by the **inferior medullary velum** connecting the **2 inf. Cerebellar peduncles** invaginated by **choroid plexuses** (Secreting C.S.F)



# Openings of the 4<sup>th</sup> ventricle

1. Median apertures (**foramen of Magendi**) in the lower part of inf. Medullary velum
2. 2 Lateral apertures (**foramen of Luschka**) one on each lateral recesses





**Dr. Aiman Qais Al Maathidy**  
**Thursday 11 December 2025**