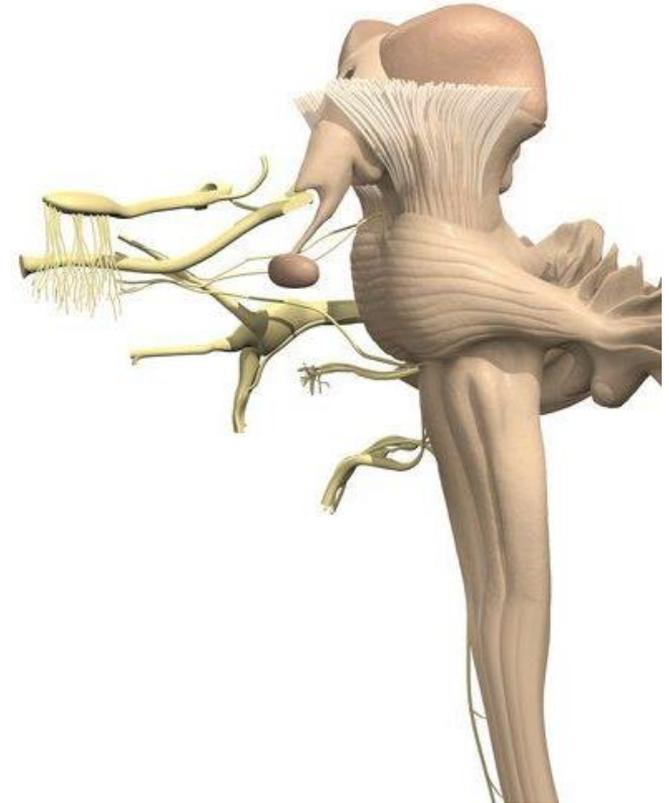


BRAIN STEM I

BY

DR. DALIA M.BIRAM



BRAIN STEM

□ SITE:

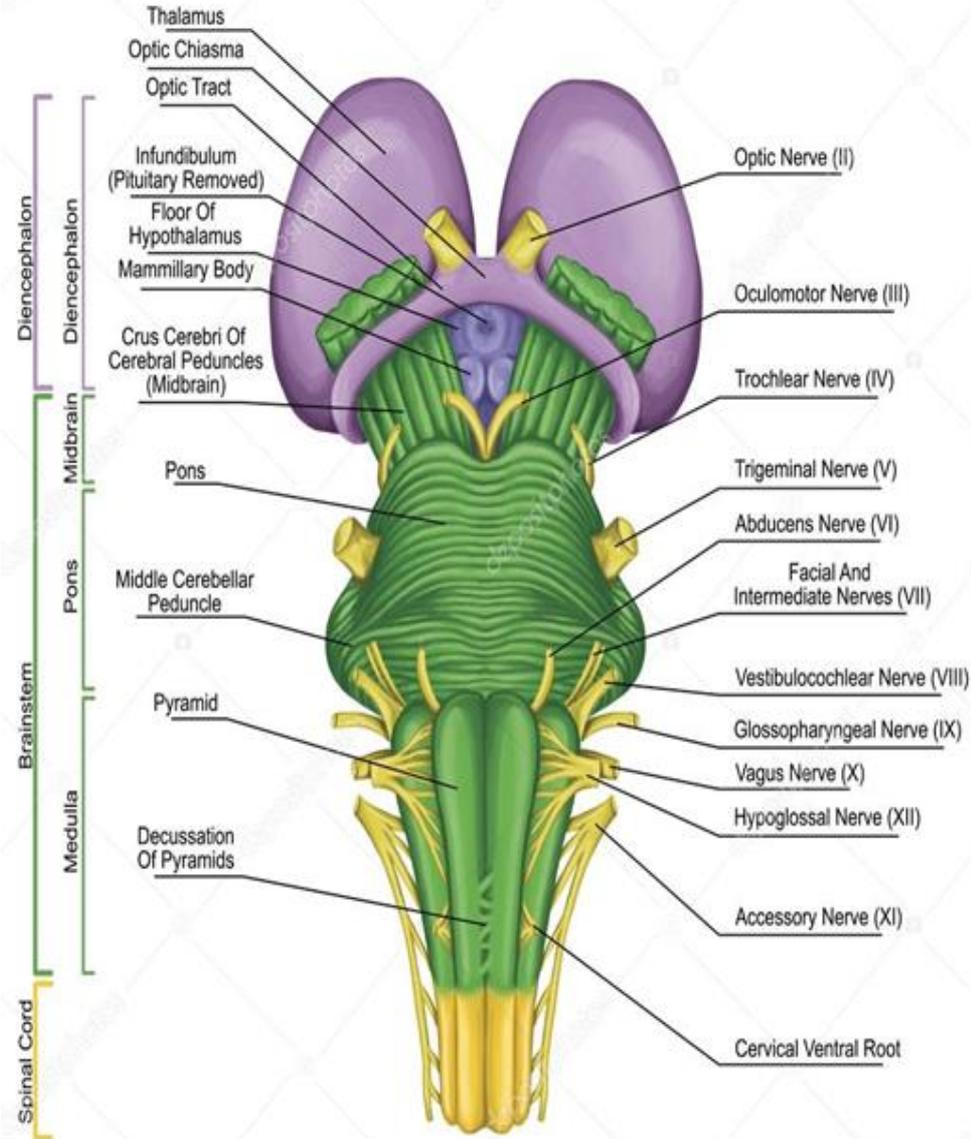
- It lies posterior to the basilar part of occipital bone (clivus).

□ PARTS: From above downwards:

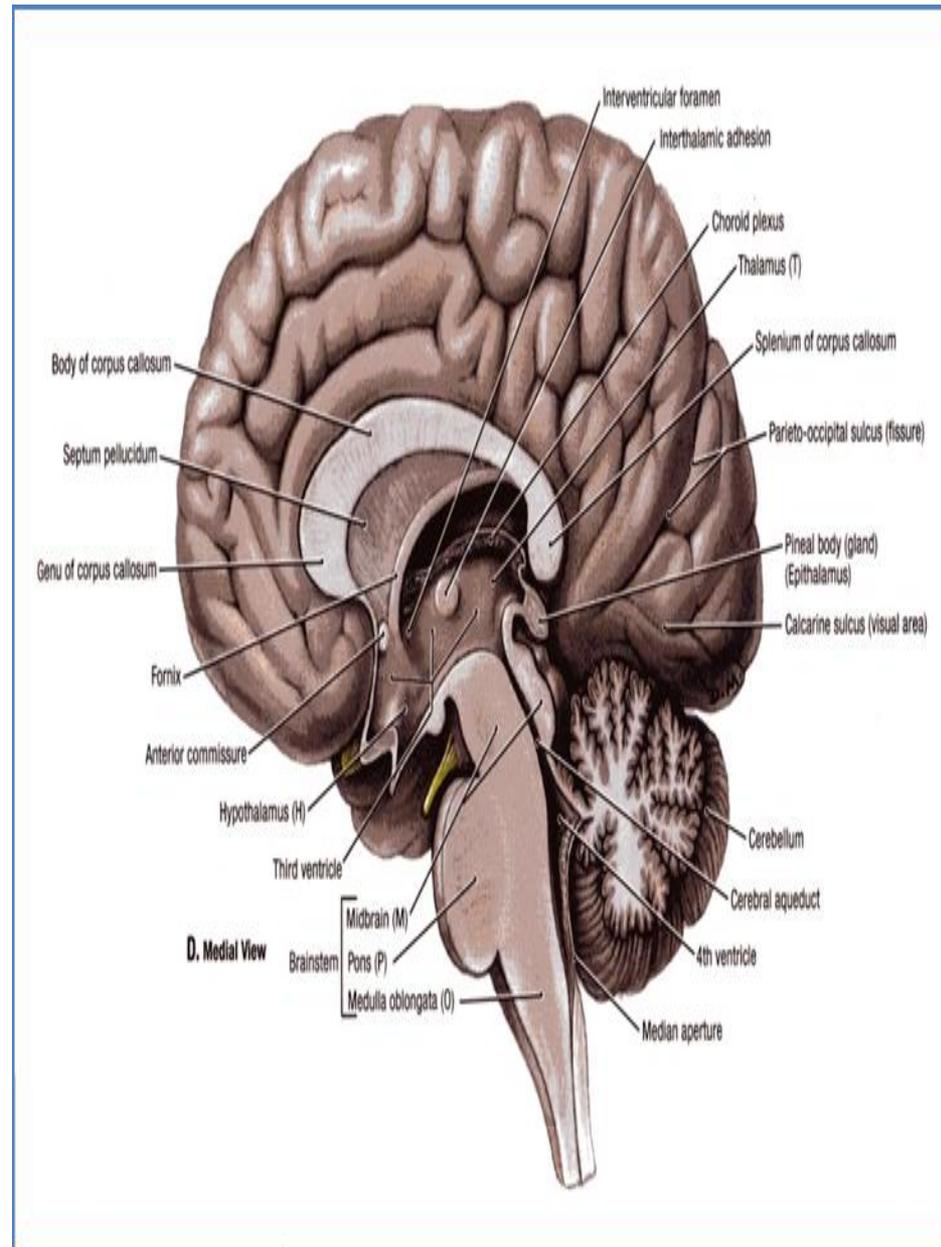
- *Mid brain, pons & medulla oblongata*

□ CONNECTIONS WITH CEREBELLUM:

- Each part of the brain stem is connected to cerebellum by cerebellar peduncles (superior, middle & inferior).

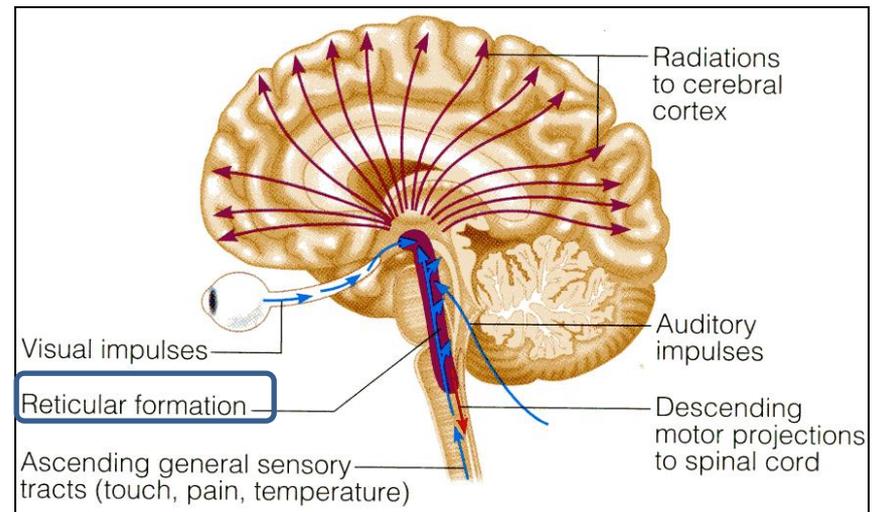
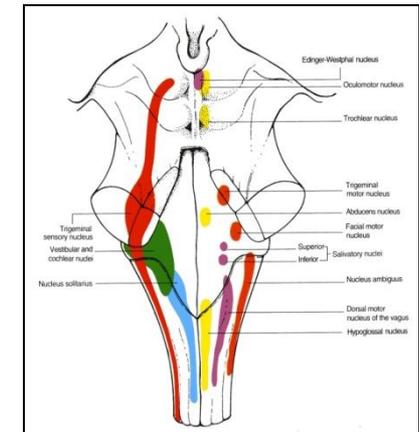
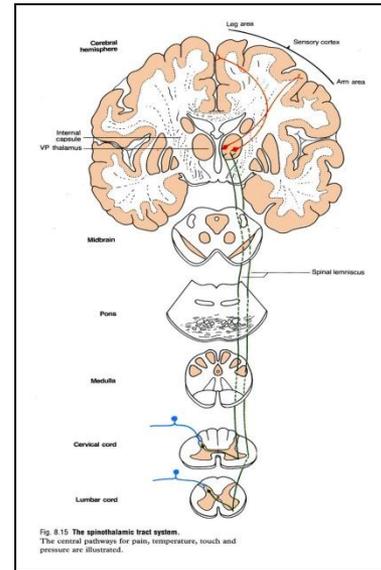


- **Above** it is directly continuous with the **diencephalon**.
- **Below** it is directly continuous with the **spinal cord**.
- It **connects** the spinal cord (below) with the diencephalon and cerebrum (above).



FUNCTIONS OF BRAIN STEM

1. Pathway of tracts between cerebral cortex & spinal cord.
2. Site of origin of nuclei of cranial nerves (from 3rd to 12th).
3. Site of emergence of cranial nerves (from 3rd to 12th).
4. Contains groups of nuclei & related fibers known as reticular formation responsible for: *control of level of consciousness, perception of pain, regulation of cardiovascular & respiratory systems.*



Medulla Oblongata

It is about 3 cm long.

Shape: conical in shape.

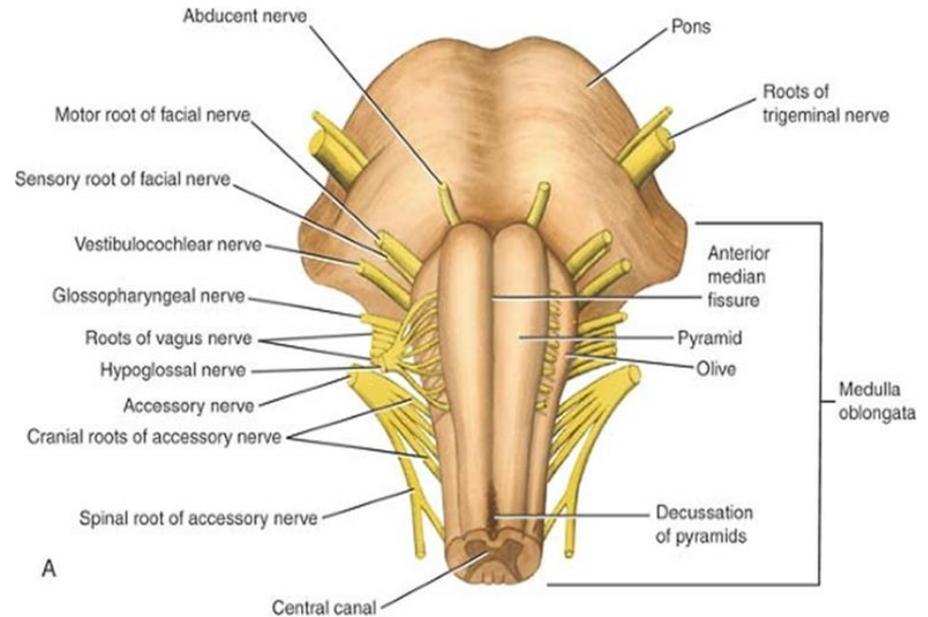
Extension: Above it is continuous with the lower border of the pons, while below it is continuous with the spinal cord at the lower border of the foramen magnum.

It is related anteriorly to the basilar part of occipital bone of the skull.

Parts:

a-Open medulla (upper 1/2): Is related posteriorly to the 4th ventricle. Its posterior surface forms the lower part of the floor of the 4th ventricle.

b-Closed medulla (lower 1/2): Contains a central canal which is continuous above with the 4th ventricle and is continuous below with the central canal of the spinal cord.



A



B

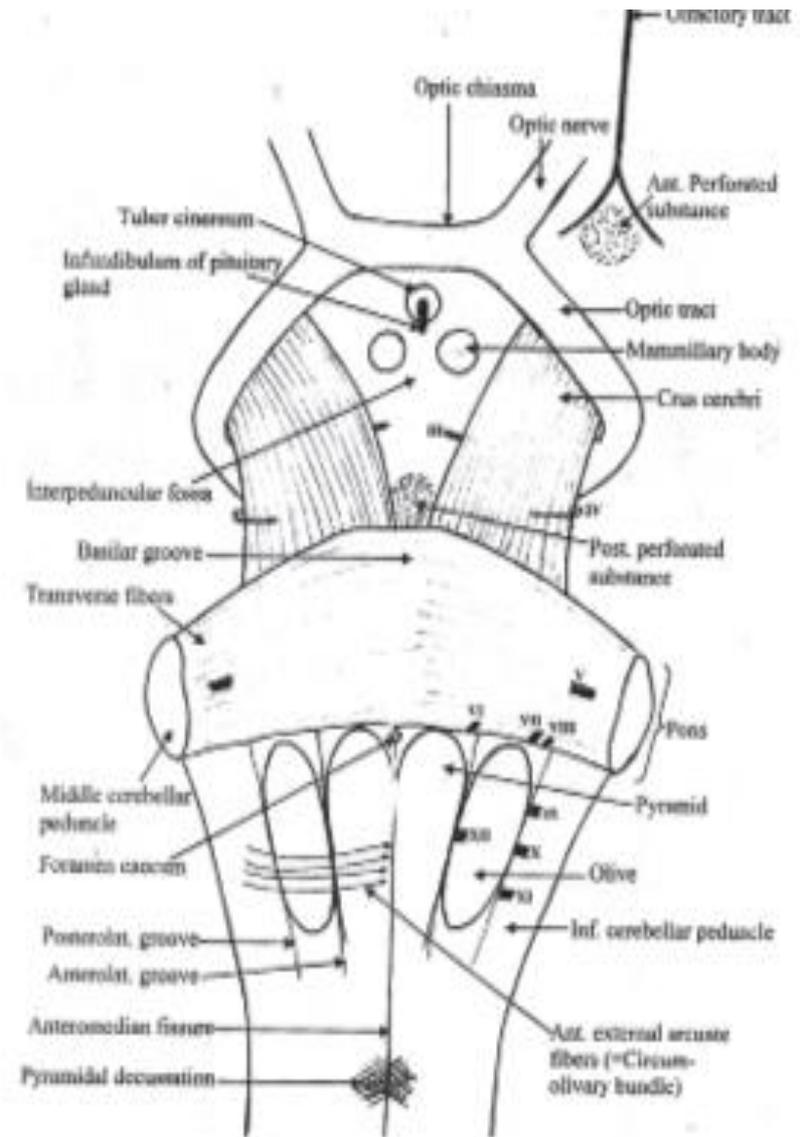
External features of the medulla

- I) Anterolateral surface: (presents 1 fissure, 2 sulci & 3 elevations)

1. Anterior median fissure:

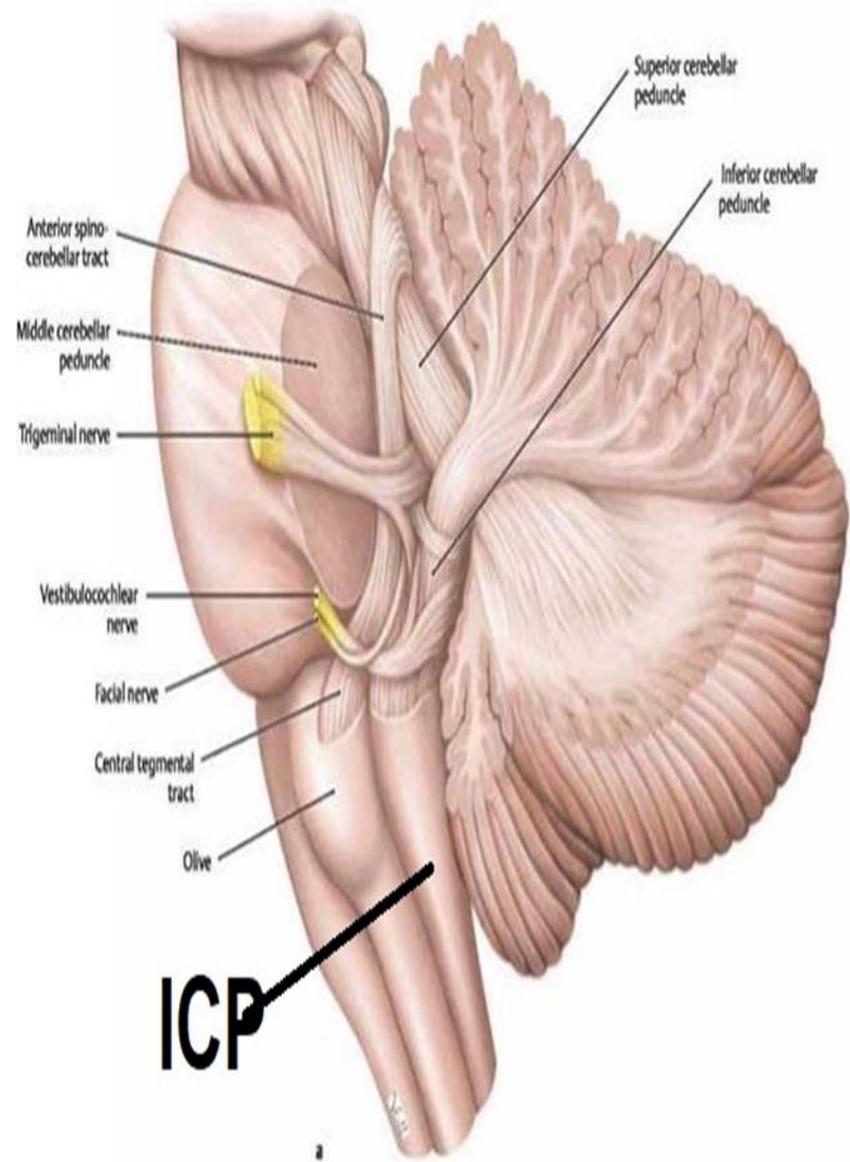
continuous below with that of the spinal cord and is obliterated in its lower part by the pyramidal (motor) decussation.

- ## 2. The pyramid:
- It is an elevation produced by the pyramidal (corticospinal) tract, lying on each side of the anterior median fissure.



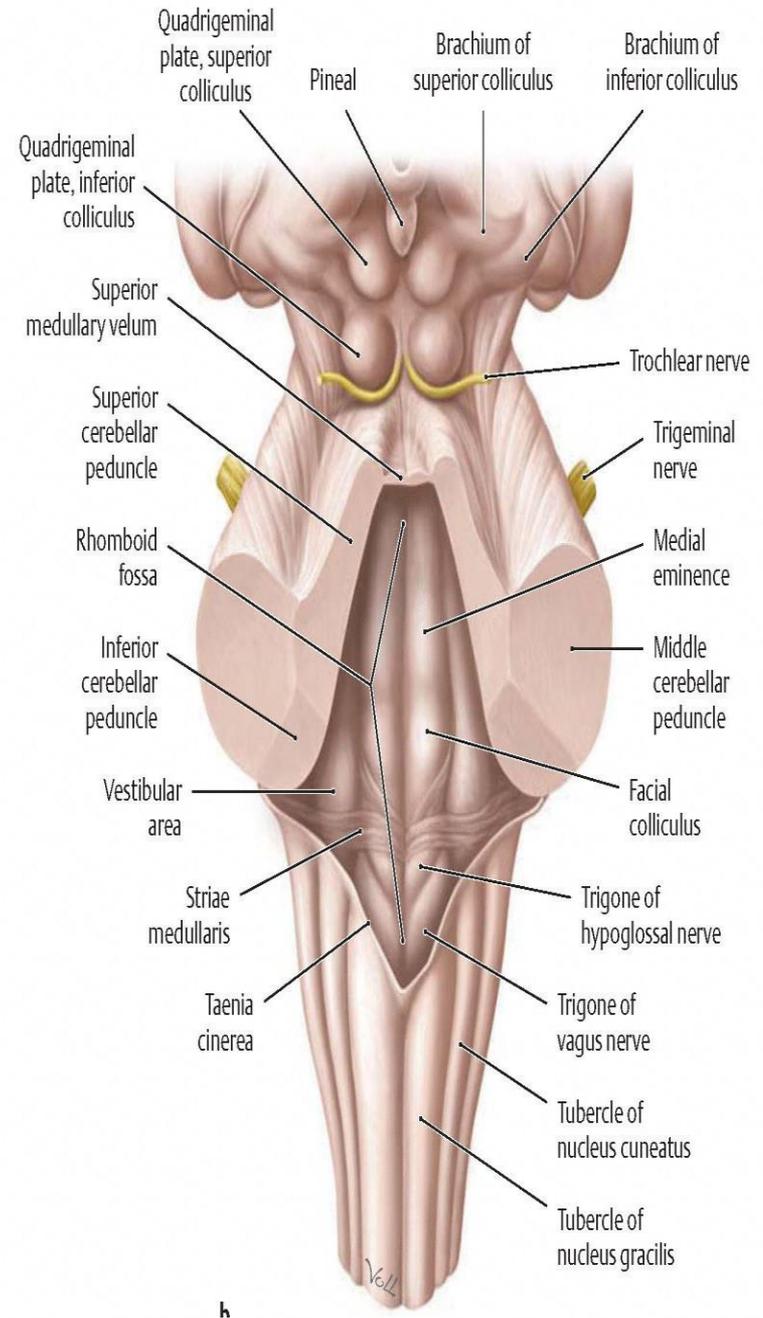
3- The olive: It is oval elevation produced by the inferior olivary nucleus. It lies lateral to the pyramid on either side, being separated from the pyramid by anterolateral sulcus; along which emerge the rootlets of the 12th (hypoglossal) nerve.

4. The inferior cerebellar peduncle: It is a bundle of nerve fibers connecting the medulla with the cerebellum. It is separated from the olive by posterolateral sulcus; from which emerge the rootlets of the 9th (glossopharyngeal), the 10th (vagus) and the cranial root of the 11th (accessory) cranial nerves.

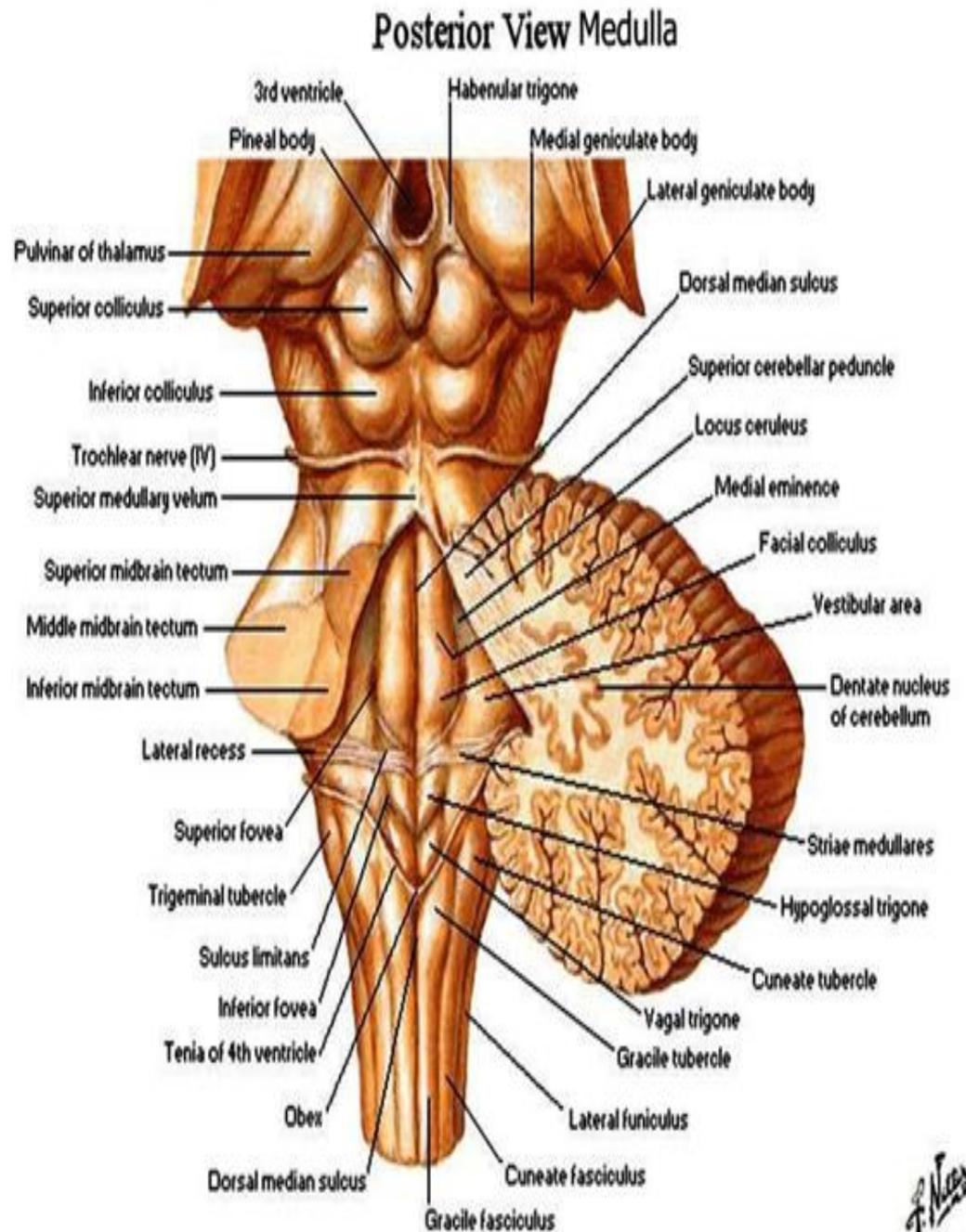


B. Dorsal surface:

- A) The posterior surface of the closed medulla:
 - It is directly continuous with the posterior surface of the spinal cord and presents:
- A **posterior median sulcus** which is an upwards extension of that of the spinal cord.
- The **gracile and cuneate tracts** of the spinal cord ascend as 2 distinct ridges on either side of the posterior median sulcus and end on the posterior surface of the medulla in 2 elevations called the **gracile (medially) and cuneate (laterally) tubercles** produced by gracile & cuneate nuclei respectively.

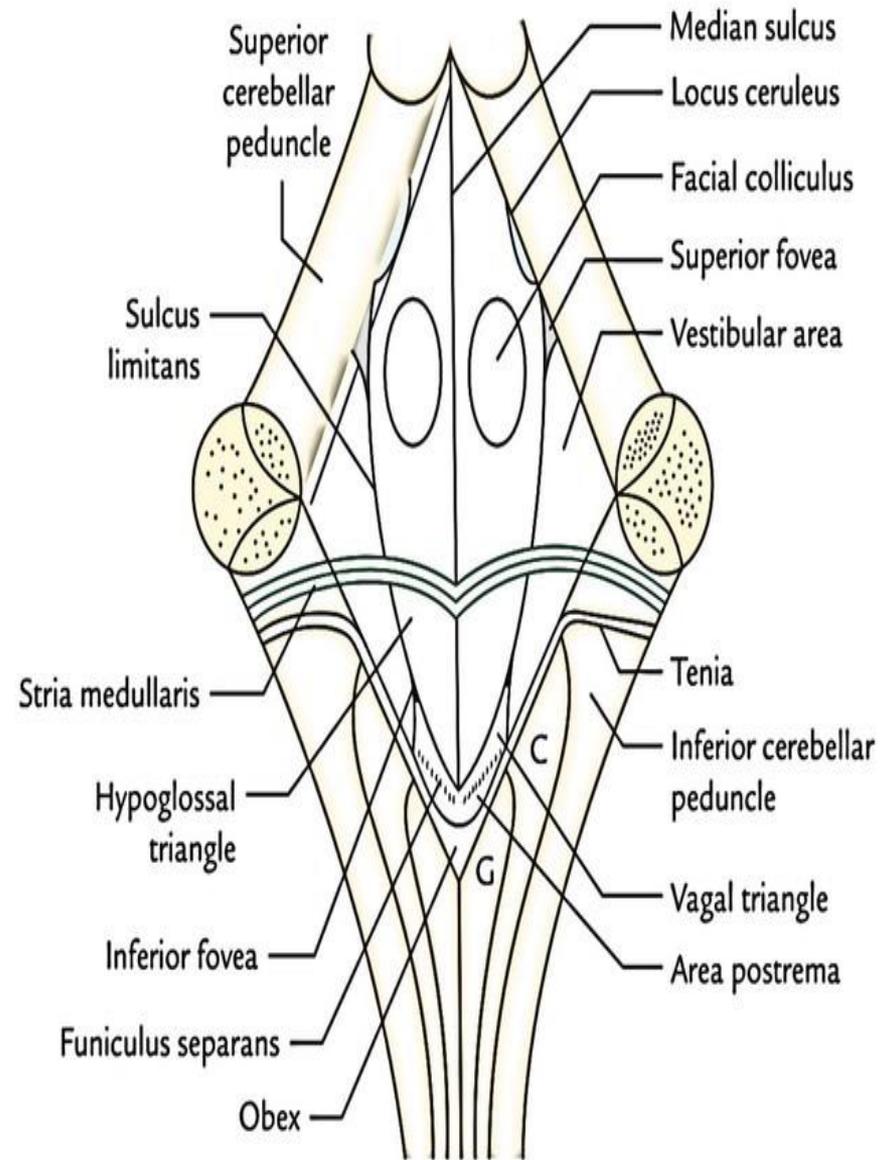


- On the dorso-lateral aspects of the medulla projects the **inferior cerebellar peduncle** on either side as 2 large nerve bundles which extend upwards and laterally along the sides of the 4th ventricle till they reach the lower border of the pons where they bend sharply backwards **between the middle (laterally) and the superior cerebellar peduncles (medially) to enter the cerebellum.**



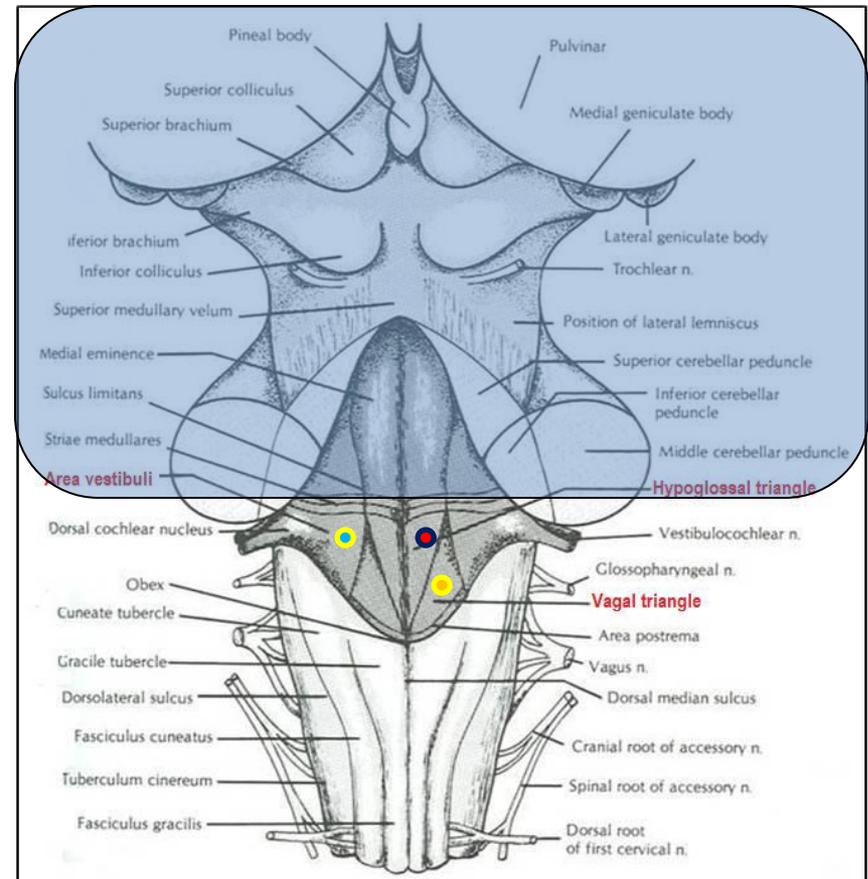
2-OPEN MEDULLA

- It forms the lower part of the floor of the 4th ventricle.
- It is triangular in shape with its apex directed downwards and continuous with the central canal of the closed medulla and its base directed upwards at the ponto-medullary junction.
- The medullary part of the floor of 4th. ventricle is bounded on either side by the gracile and cuneate tubercle and the inferior cerebellar peduncle



- It shows the following features:
 - 1) The medullary stria: nerve bundles running transversely at the ponto-medullary junction.
 - 2) On either side of the median posterior sulcus, below medullary stria, shows the followings:
 - a) A small inverted V-shaped depression called the inferior fovea, with its apex close to the medullary stria.
 - b) The inferior fovea divides the medullary part of floor of 4th. ventricle into 3 triangular areas, from medial to lateral:
 - ▪ **Hypoglossal trigone:** medial to the inferior fovea; overlies the nucleus of the 12th (hypoglossal) nerve.
 - ▪ **Vagal trigone:** between the limbs of the inferior fovea; overlies the dorsal nucleus of the 10th (vagus) nerve.
 - ▪ **Medullary vestibular area:** lies lateral to the inferior fovea; overlies the medial, inferior and lateral vestibular nuclei.

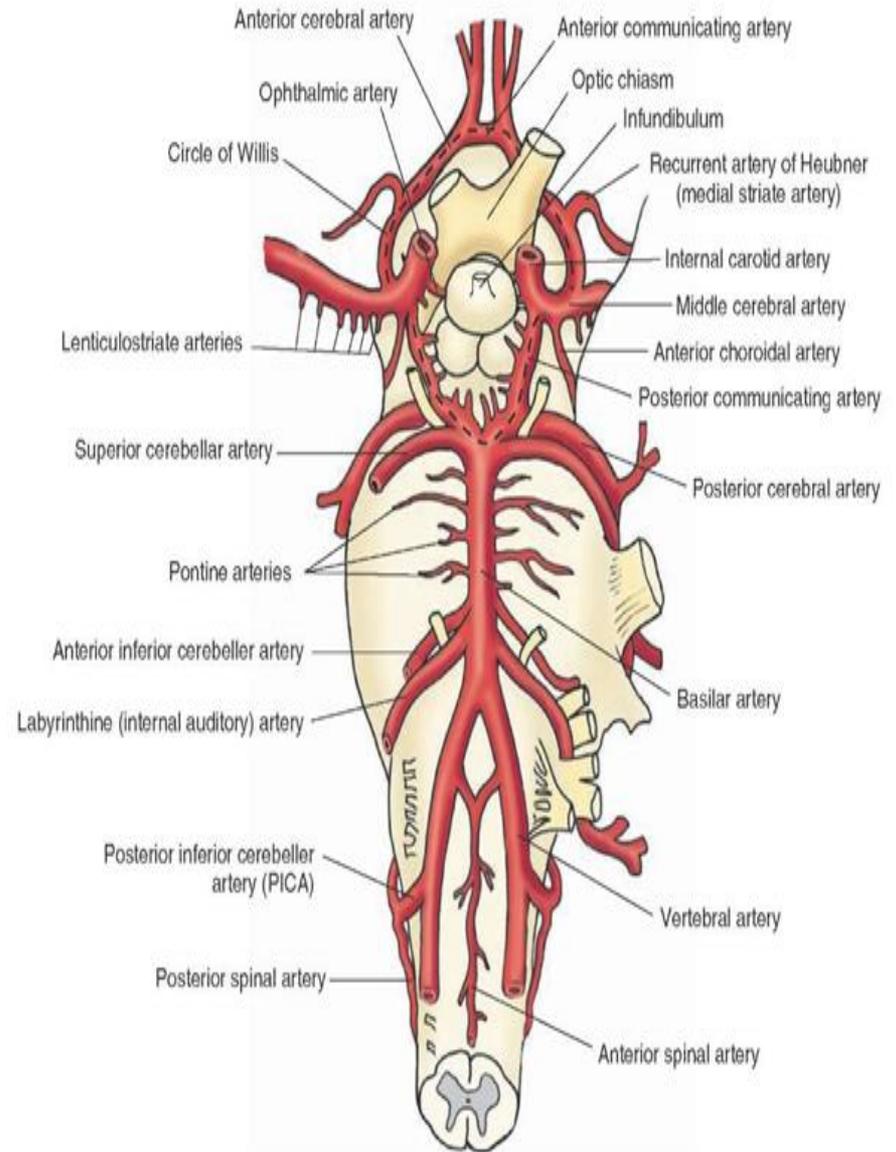
OPEN MEDULLA



Shown after removing cerebellum

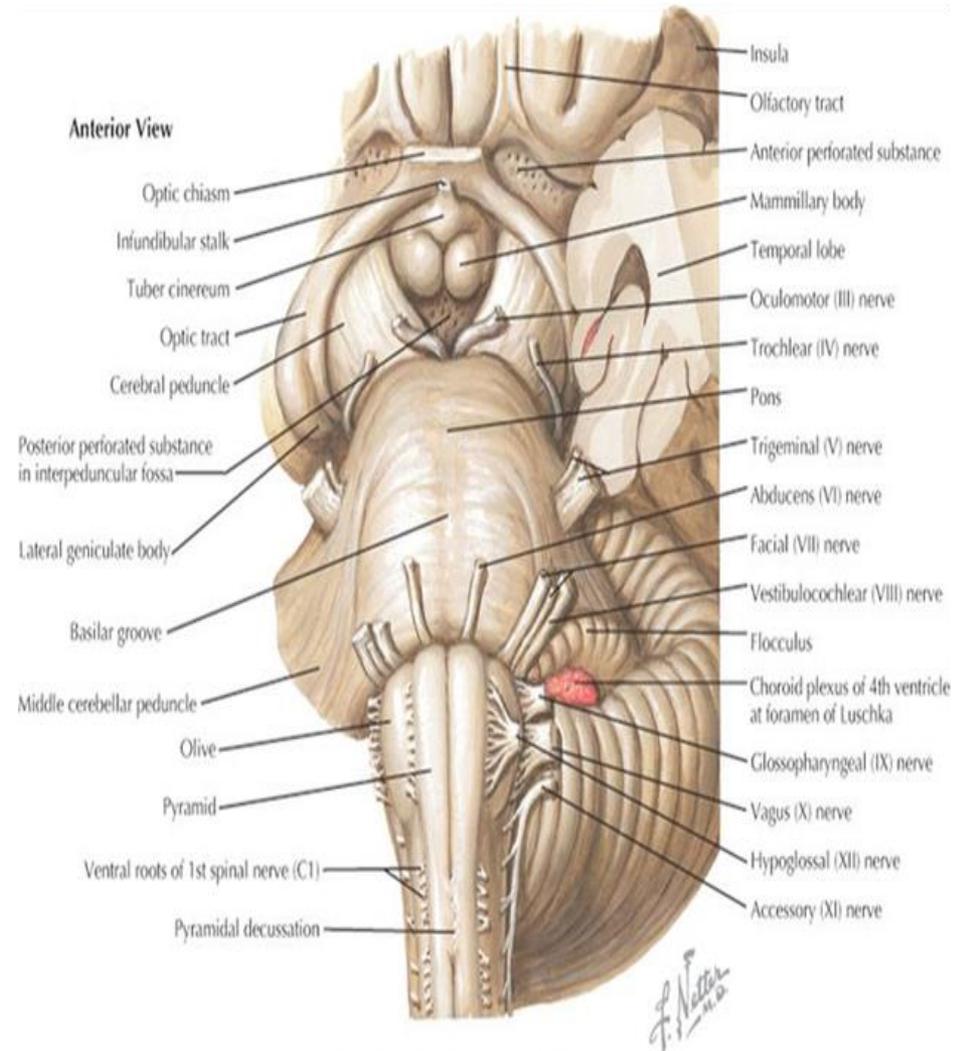
★ **Blood supply of the medulla:**

- Anterolateral surface: supplied by **anterior spinal and 4th part of vertebral** arteries.
- Postero-lateral surface: supplied by **posterior inferior cerebellar** artery.
- Gracile and cuneate tracts and nuclei: supplied by **posterior spinal** artery.



Pons

- ★ **It is one inch long.**
- ★ **Extension and site:**
 - **It is the middle part of the brain stem which lies between the medulla (below) and the midbrain (above) and in front of the cerebellum.**
- ★ **It is called pons because its anterior surface is convex like a bridge connecting the 2 cerebellar hemispheres**
- ★ **Its convex anterior surface is related to the clivus in the base of the skull.**



External features of the pons

1. The ventral surface :

The pons is divided into 2 parts, as follows:

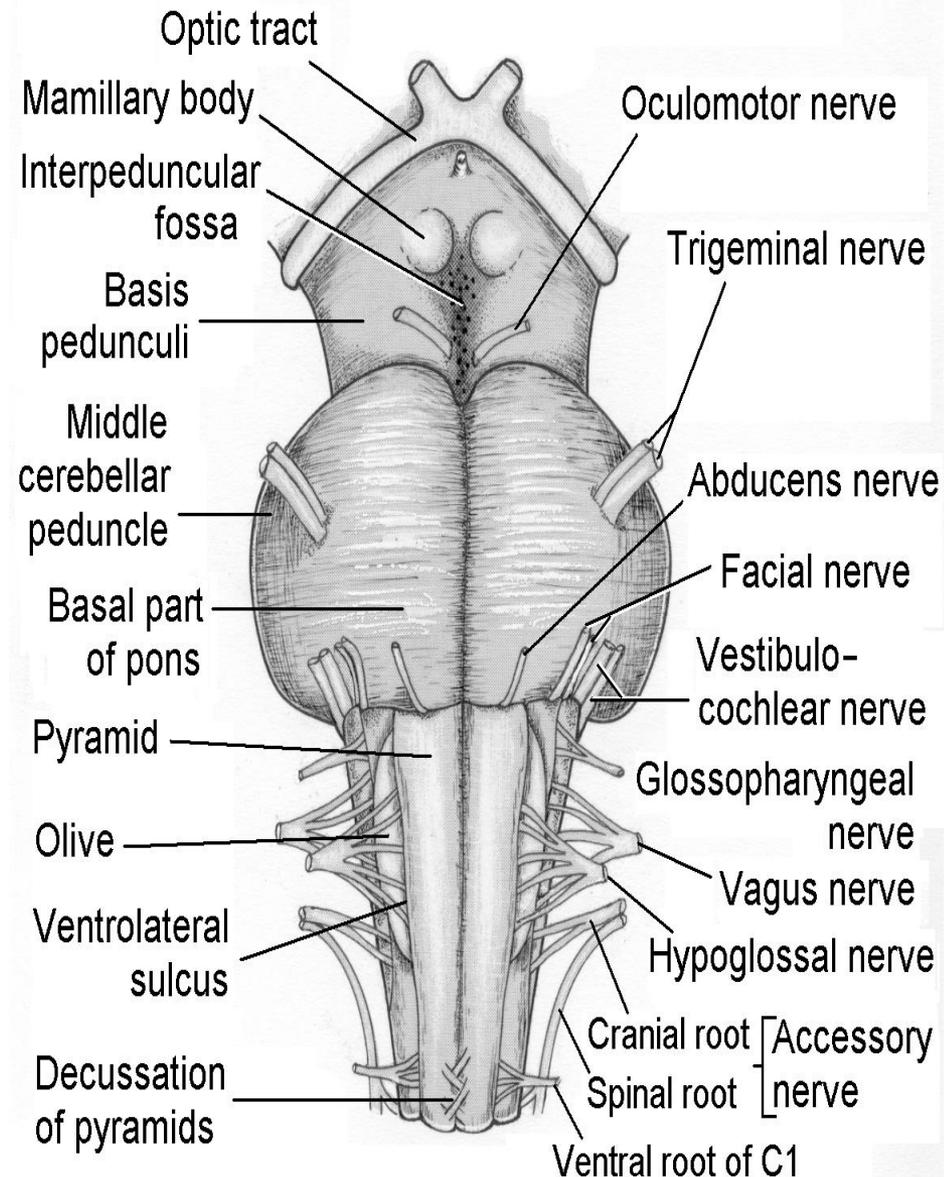
A) Anterior (Basilar) part: (also called basis pontis)

- It is convex from side to side and from above downwards.
- It presents the following features:

1) **Basilar sulcus or groove:** A median longitudinal groove related to the basilar artery.

2) On each side of the basilar groove, there are bundles of **transverse pontine fibers**.

3) The transverse pontine fibers collect on either side to form the which turns backwards to enter **middle cerebellar peduncle** into the corresponding cerebellar hemisphere.

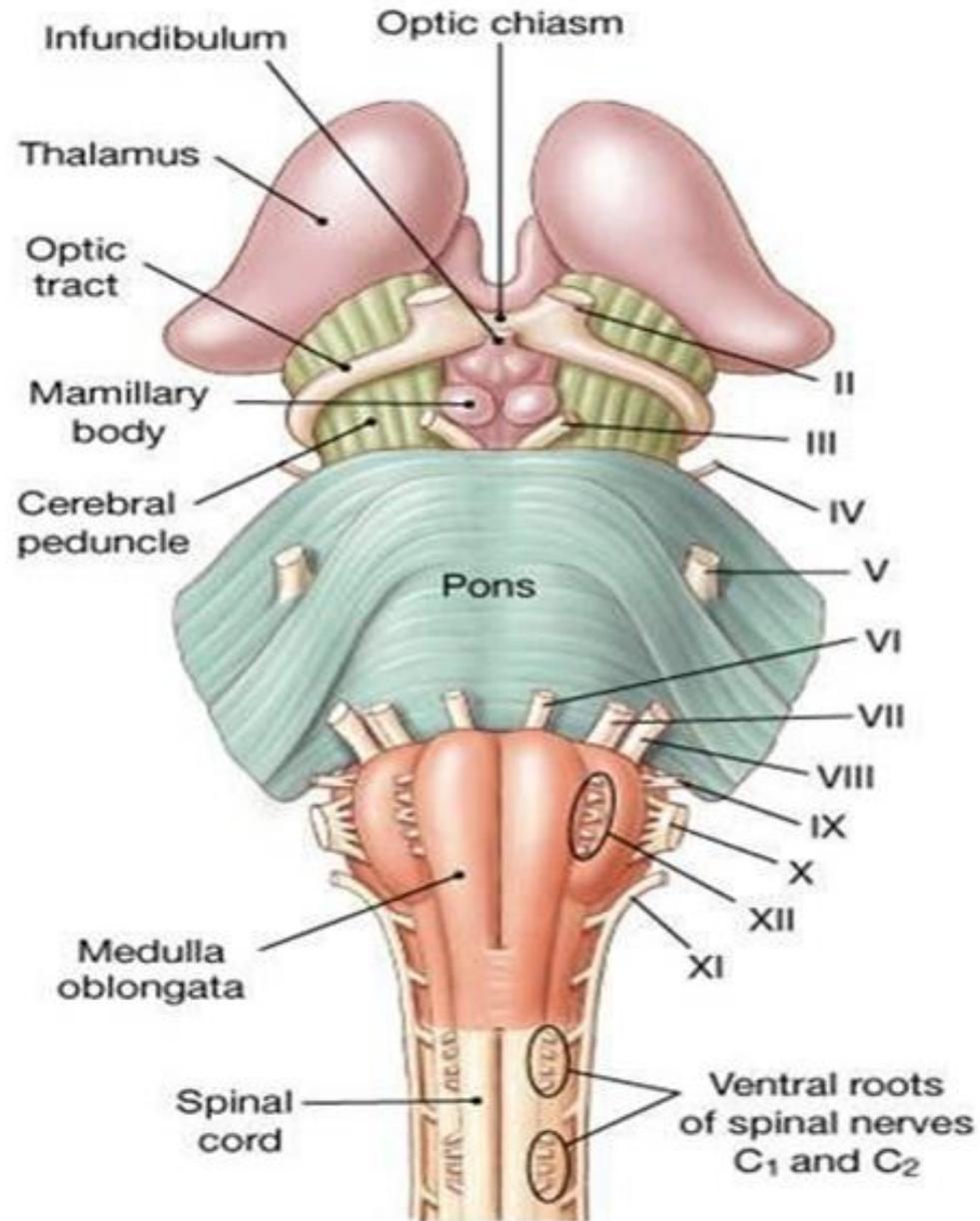


4) Exit of the middle four cranial nerves:

a- The large sensory root (lateral) and the small motor root (medial) of the trigeminal (5th) nerve emerge from the junction between the basilar part & middle cerebellar peduncle.

b- The 6th (abducent) nerve emerges from the sulcus between the pons and the medulla (ponto-medullary junction) near the middle line.

c- The 7th (facial) and 8th (vestibule-cochlear) nerves (arranged from medial to lateral) also emerge as the 6th nerve but more laterally at the ponto-cerebellar angle which is the triangular space between the lower border of the middle cerebellar peduncle, the cerebellum and the upper part of the inferior cerebellar peduncle.

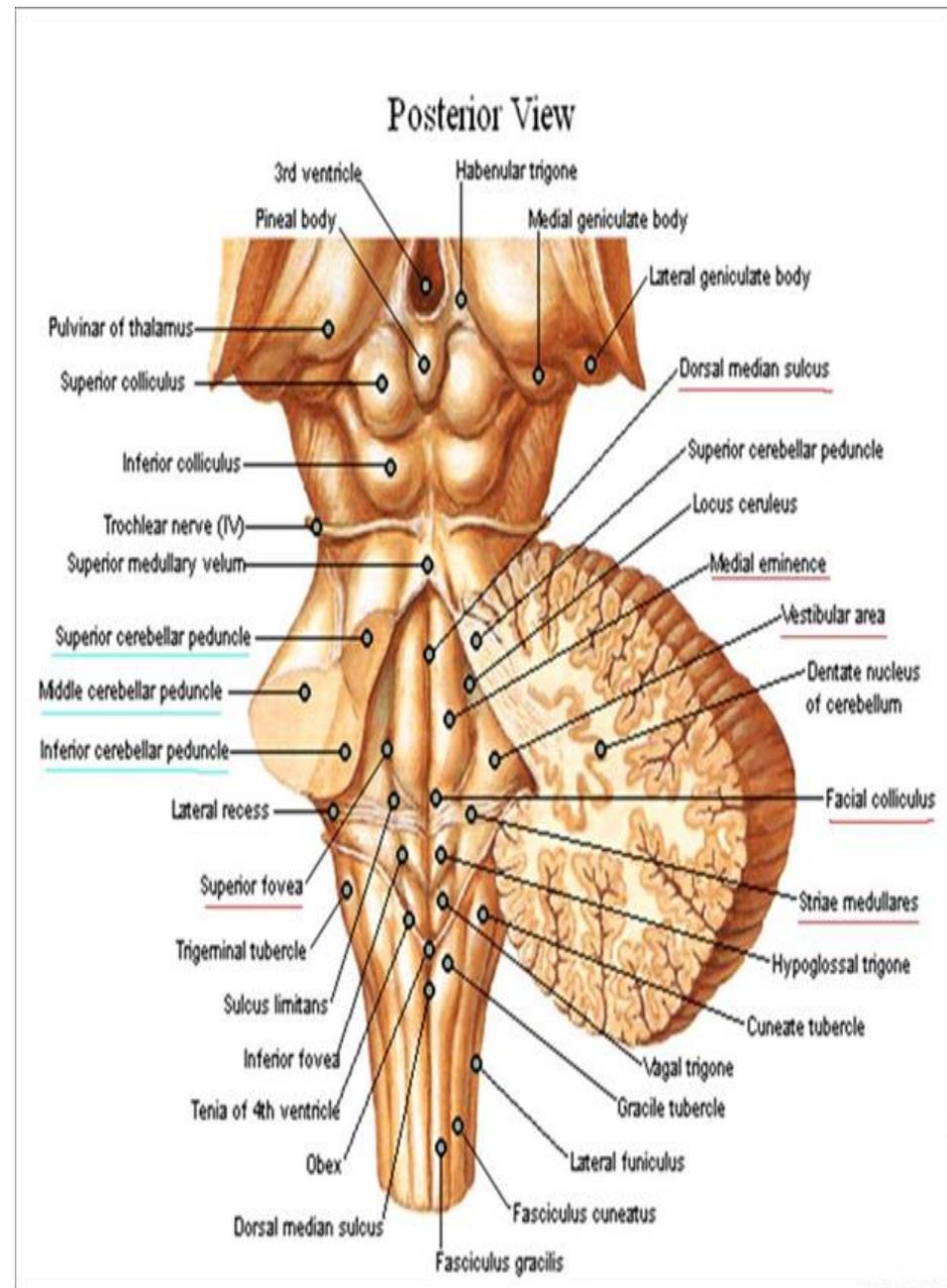


(b) Anterior view

- **B) Posterior (tegmental) part:**

- It is triangular in shape with its apex upwards continuous with the cerebral aqueduct of Sylvius, its base downwards at the medullary stria and bounded on both sides by the superior cerebellar peduncles.

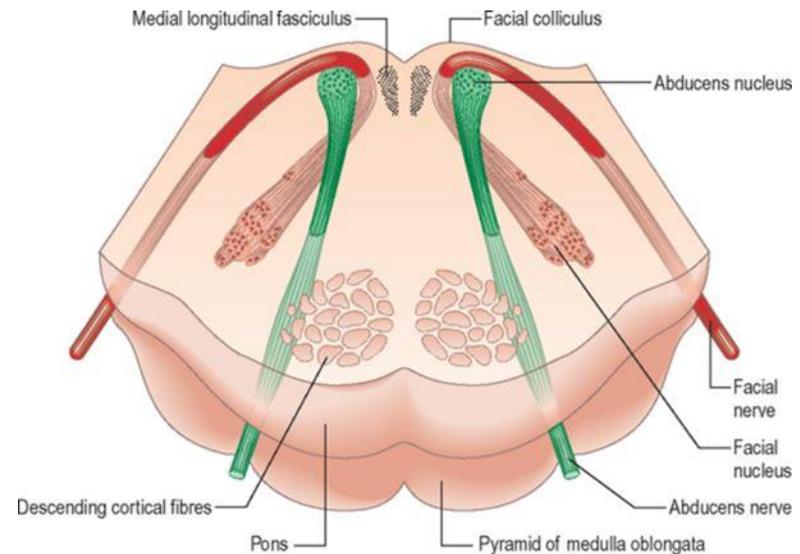
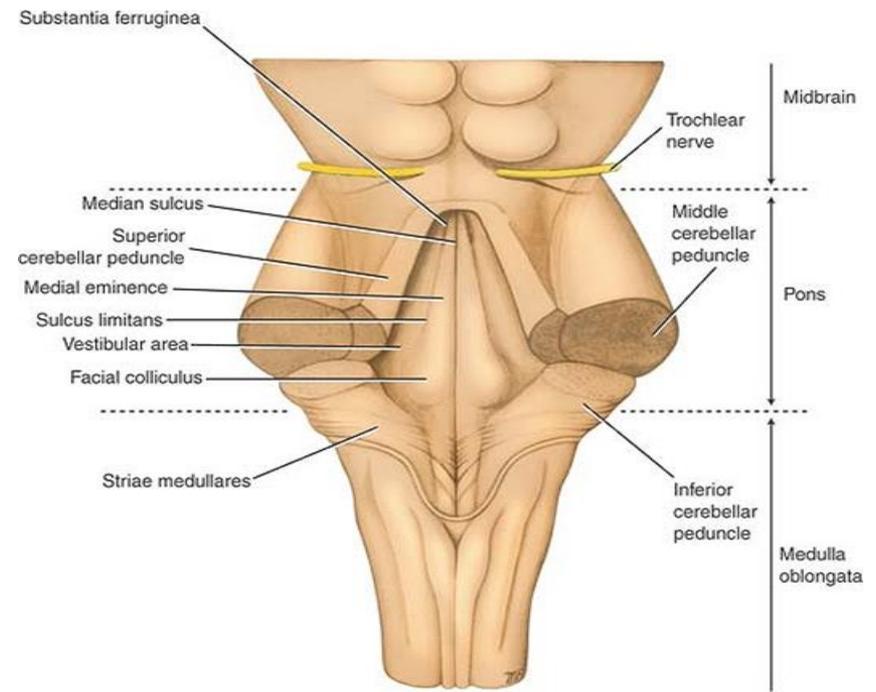
- It forms the upper part of the floor of the 4th ventricle above the medullary stria and shows the following features:



1-A smooth longitudinal elevation on either side of the posterior median sulcus called the medial eminence.

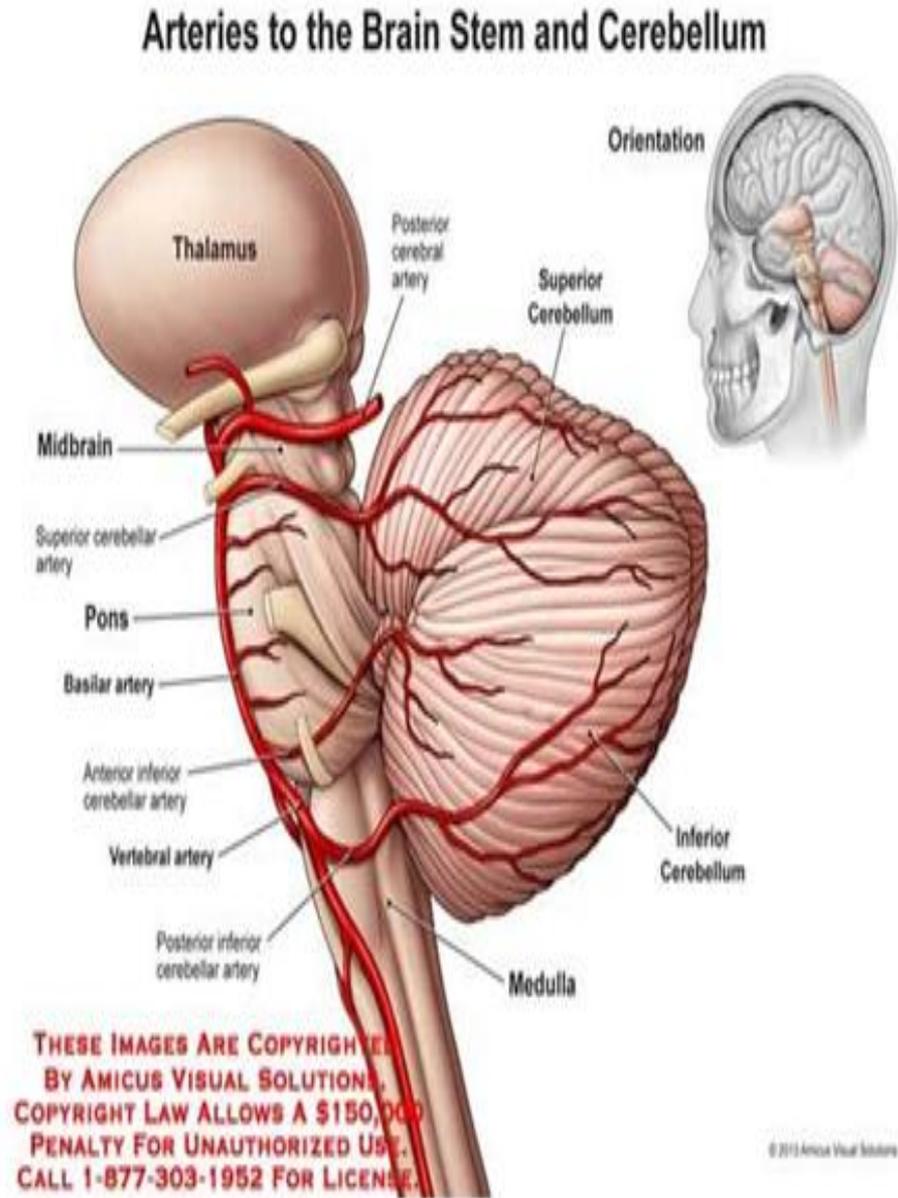
2- On the medial eminence, just above the medullary stria, there is a small rounded elevation called the facial colliculus which is caused by the facial nerve fibers as they turn around the abducent nucleus.

- 1. Sulcus limitans:** lies lateral to medial eminence and its upper part form area called locus seruleus.
- 2. The facial colliculus** is bounded laterally by the lower part of sulcus limitans which form a crescentic depression called-the superior fovea.
- 3. Pontine (upper) vestibular area:** lies lateral to the superior fovea. It overlies The the lateral and superior vestibular nuclei vestibular nuclei.



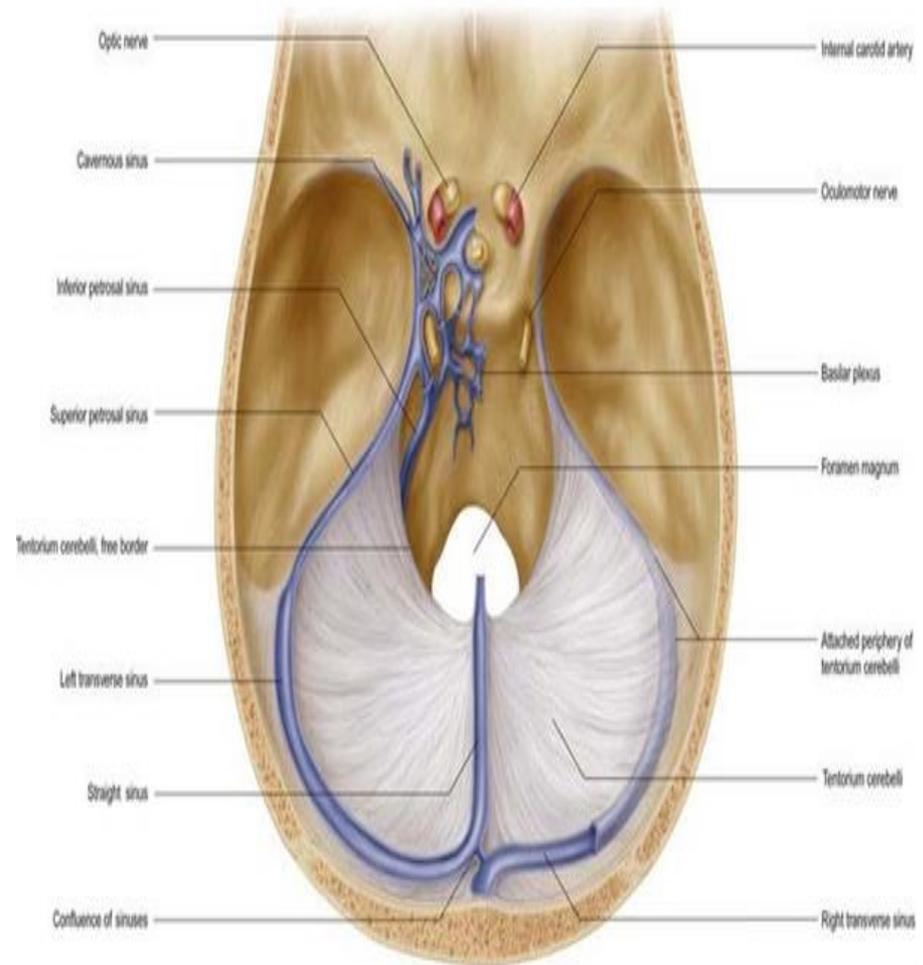
Blood supply of the pons:

- **Basis pontis:** is supplied by the pontine branches of the basilar artery.
- **Tegmentum:**
 - In lower pons: by the anterior inferior cerebellar artery.
 - In upper pons: by the superior cerebellar artery.



Midbrain

- ★ It is 2 cm long
- ★ It is the upper part of the brain stem and it lies between the pons (below) and the diencephalon (above).
- ★ It occupies **the notch of the tentorium cerebelli** where it is related on each side to the temporal lobe of the brain.
- ★ The posterior part of brain stem is traversed longitudinally by a narrow canal call cerebral aqueduct of Sylvius which connect the 3rd. ventricle (above) and the 4th ventricle (below).
- ★ The part of the midbrain posterior to the cerebral aqueduct is small and called tectum while its anterior part is large and called cerebral peduncles.



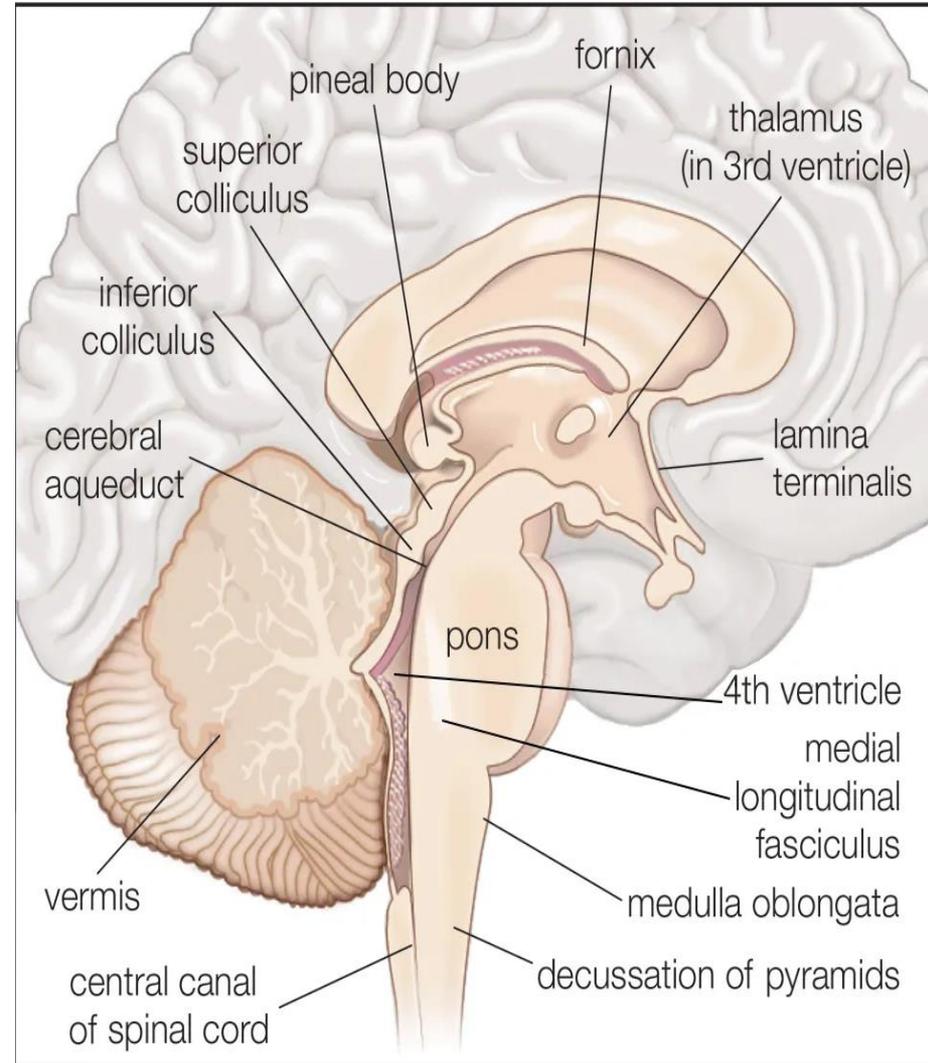
External features of the midbrain

➤ The midbrain presents a narrow lumen called cerebral aqueduct (aqueduct of sylvius). A coronal plane passing through the cerebral aqueduct divides the midbrain into two divisions:

- A. Ventral part: Called **cerebral peduncle**.
- B. Dorsal part: Called **tectum**.

A. Cerebral peduncle: The two peduncles form the posterolateral boundaries of a depression on the base of the brain called interpeduncular fossa. The cerebral peduncle is differentiated into 3 parts:

- 1 . **Crus cerebri (Basis pedunculi)**.
- 2 . **Substantia nigra**.
- 3 . **Tegmentum**.



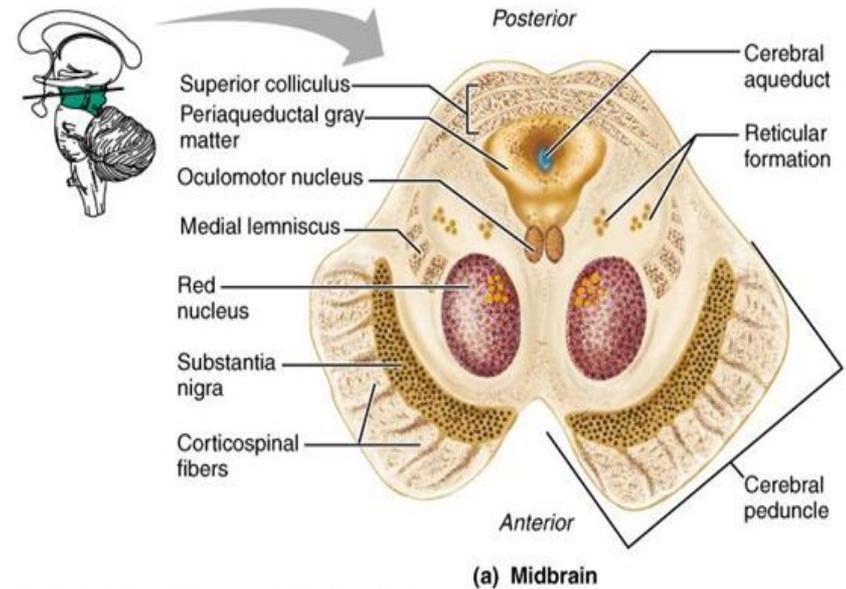
1 . Crus cerebri This is formed of bundles of nerve fibers descending from the cerebral cortex to lower levels of the brain stem and spinal cord. These fibers constitute the corticopontine, corticonuclear and corticospinal fibers.

The crus cerebri is crossed by:

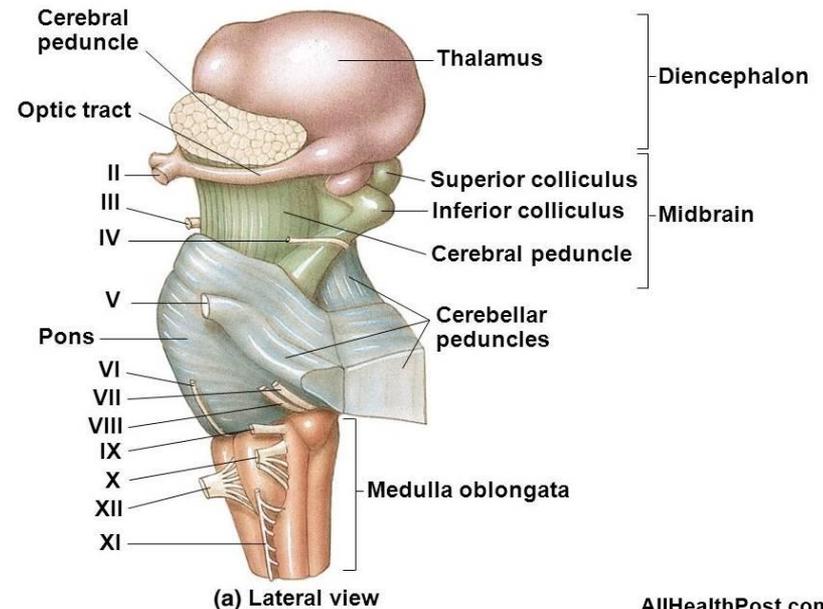
- a. Basal vein.
- b. Superior cerebellar artery.
- c. Posterior cerebral artery.
- d. Trochlear nerve.
- e. Optic tract.

2 . Substantia nigra: It is a lamina of pigmented grey matter containing melanin pigment.

3. Tegmentum: This is the posterior part of the cerebral peduncle and is continuous inferiorly with the tegmentum of the pons.



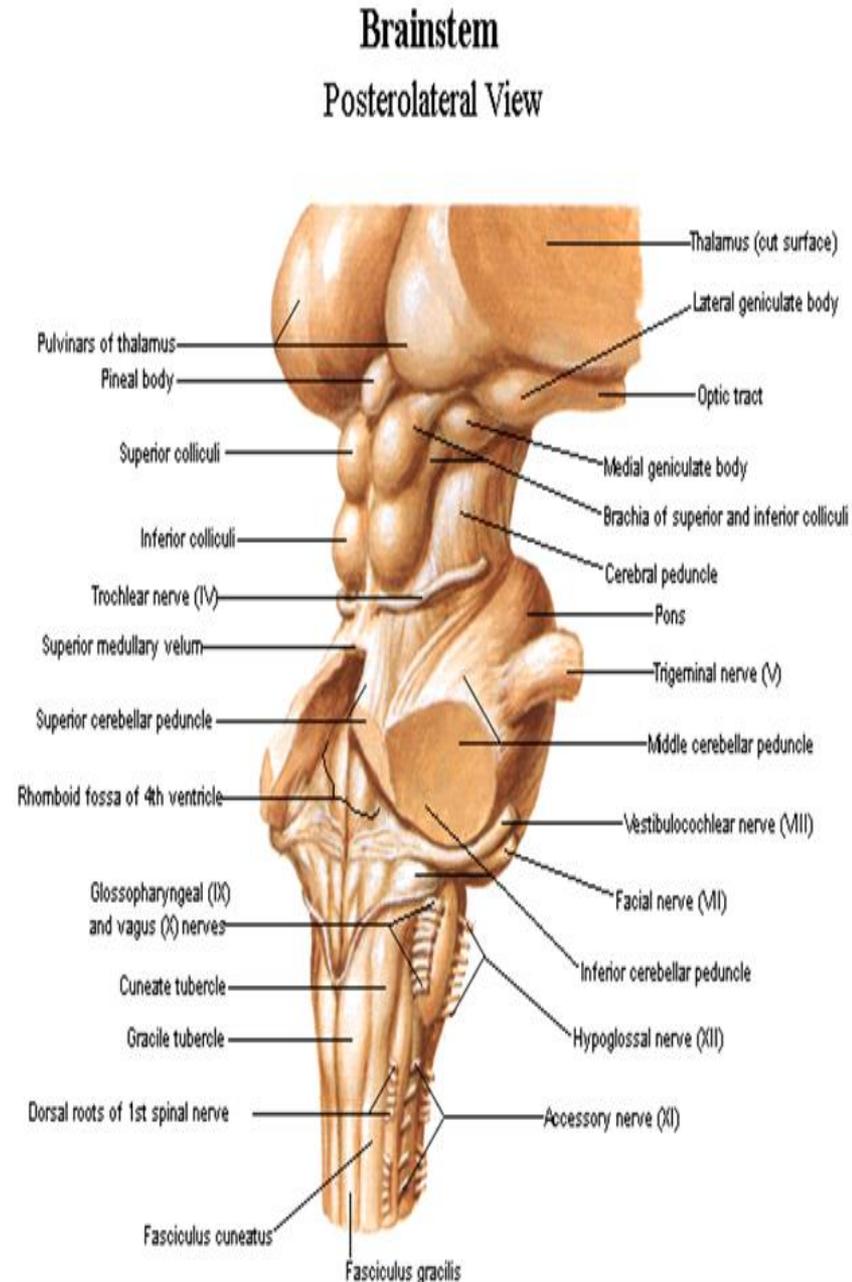
Copyright © 2001 Benjamin Cummings, an imprint of Addison Wesley Longman, Inc.



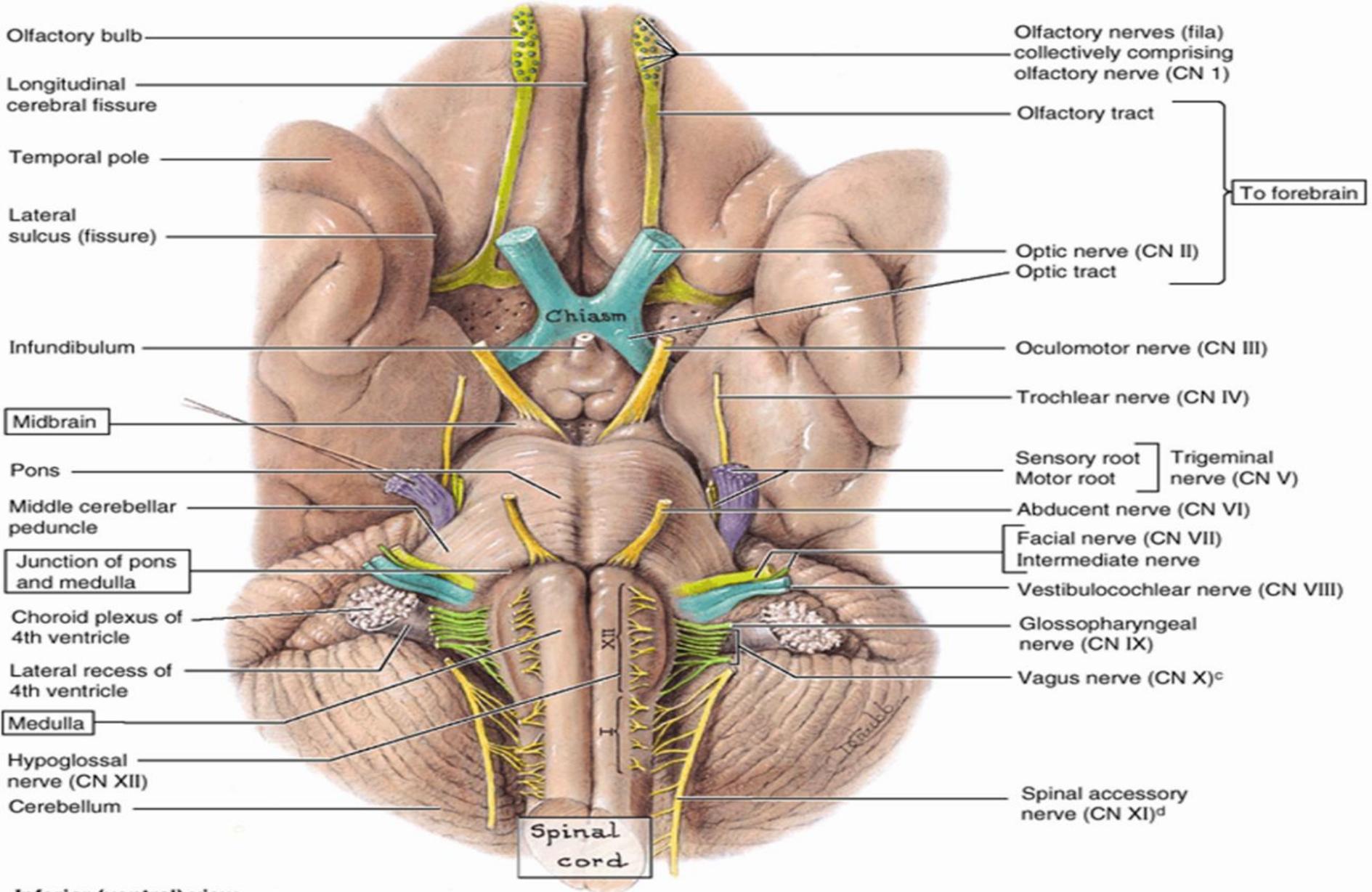
B. Tectum : This is the smaller dorsal part of the midbrain. The tectum is formed of four Knob-like elevation called **colliculi**. They are arranged as two superior and two inferior colliculi.

- Each colliculus gives rise to a **brachium** from its lateral side. The superior brachium connects the superior colliculus with the lateral geniculate body. The inferior brachium connects the inferior colliculus with the medial geniculate body.

- • The 4th cranial (trochlear) nerve emerges from the back of the midbrain immediately below the inferior colliculi by piercing the superior medullary velum where it decussates with its fellow of the opposite side and curves around the lateral aspect of the midbrain to reach its anterior aspect

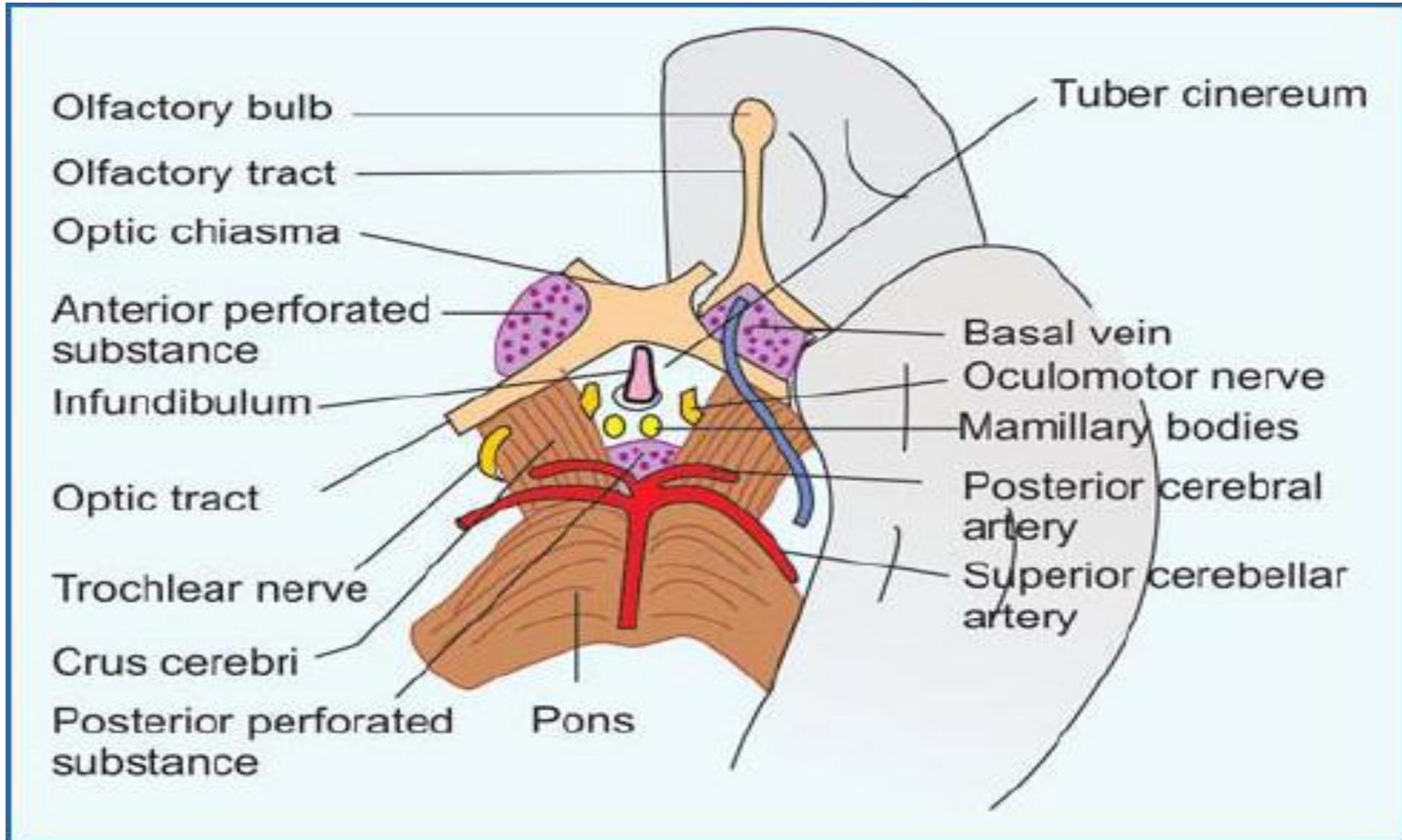


EXIT OF CRANIAL NERVES FROM



Inferior (ventral) view

Interpeduncular Fossa



Interpeduncular Fossa

* **Shape and site:** this is a diamond shaped depression at the base of the brain between the two cerebral peduncles.

* **Boundaries:**

1- Anteriorly, Optic chiasma.

2- Posteriorly, Upper border of the pons.

3- Anterolaterally, Optic tracts.

4- Posterolaterally, crus cerebri.

• **Contents:**

1-Tuber cinereum

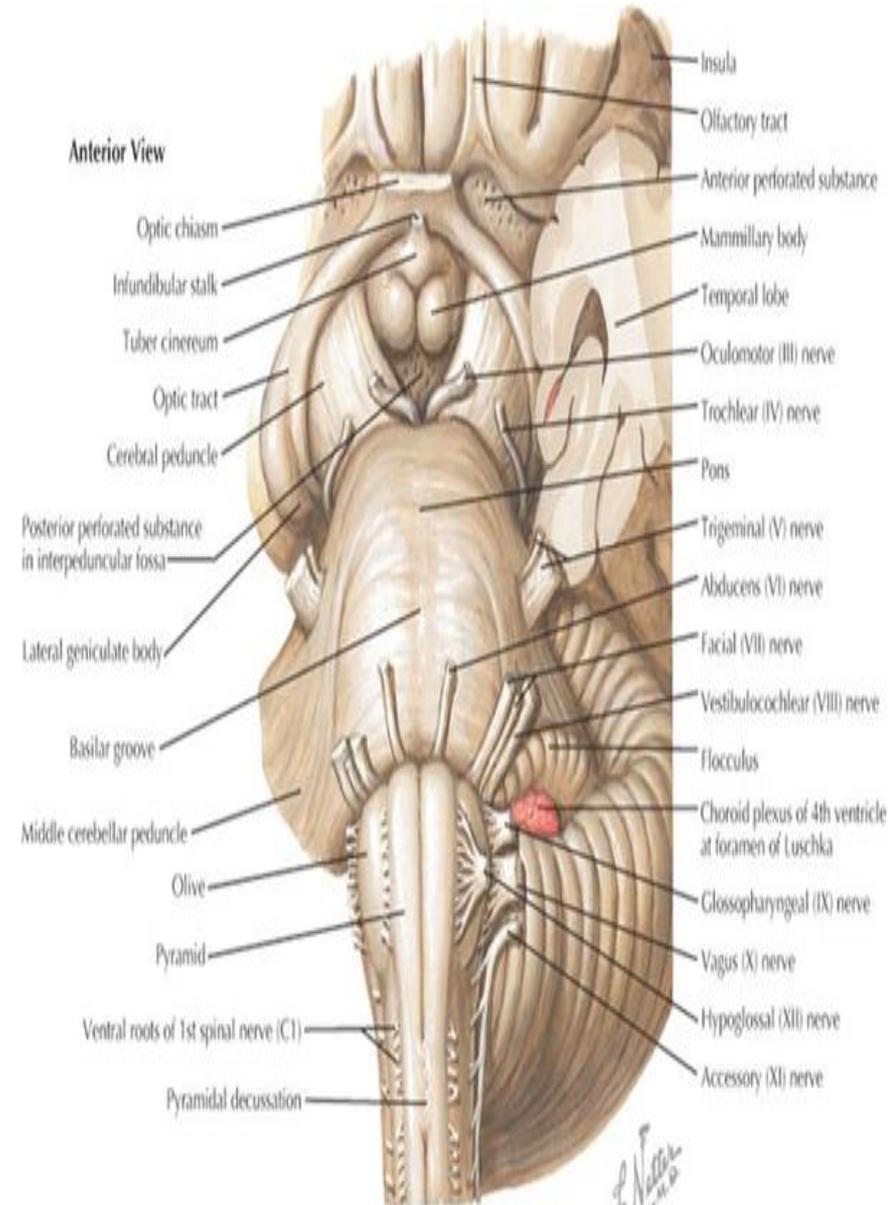
2- Infundibulum.

3- Mammillary bodies.

4- Posterior perforated substances

5- The oculomotor (3rd) cranial nerve exits through the medial sides of the cerebral peduncles.

6- Interpeduncular cistern contains: C S F



Fourth ventricle

It is a tent-like cavity of the hindbrain. It lies between the pons & medulla anteriorly and the cerebellum posteriorly.

Shape:

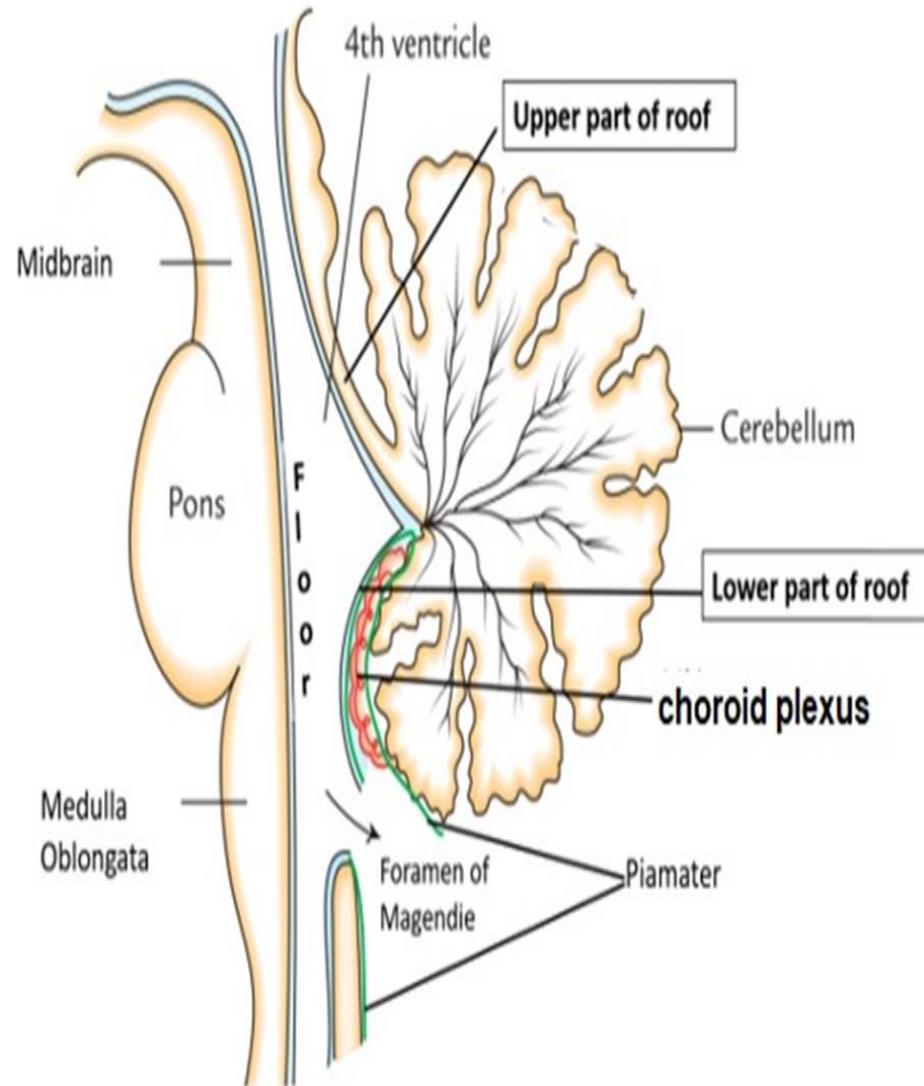
- It is diamond or rhomboid-shaped when seen from behind but is tent-shaped when seen from the side.

It has four angles:

Upper angle: continuous with the aqueduct of sylvius

Lower angle: continuous with the central canal of the closed medulla.

2 lateral angles: each angle lies at the meeting of the superior and inferior cerebellar peduncles.



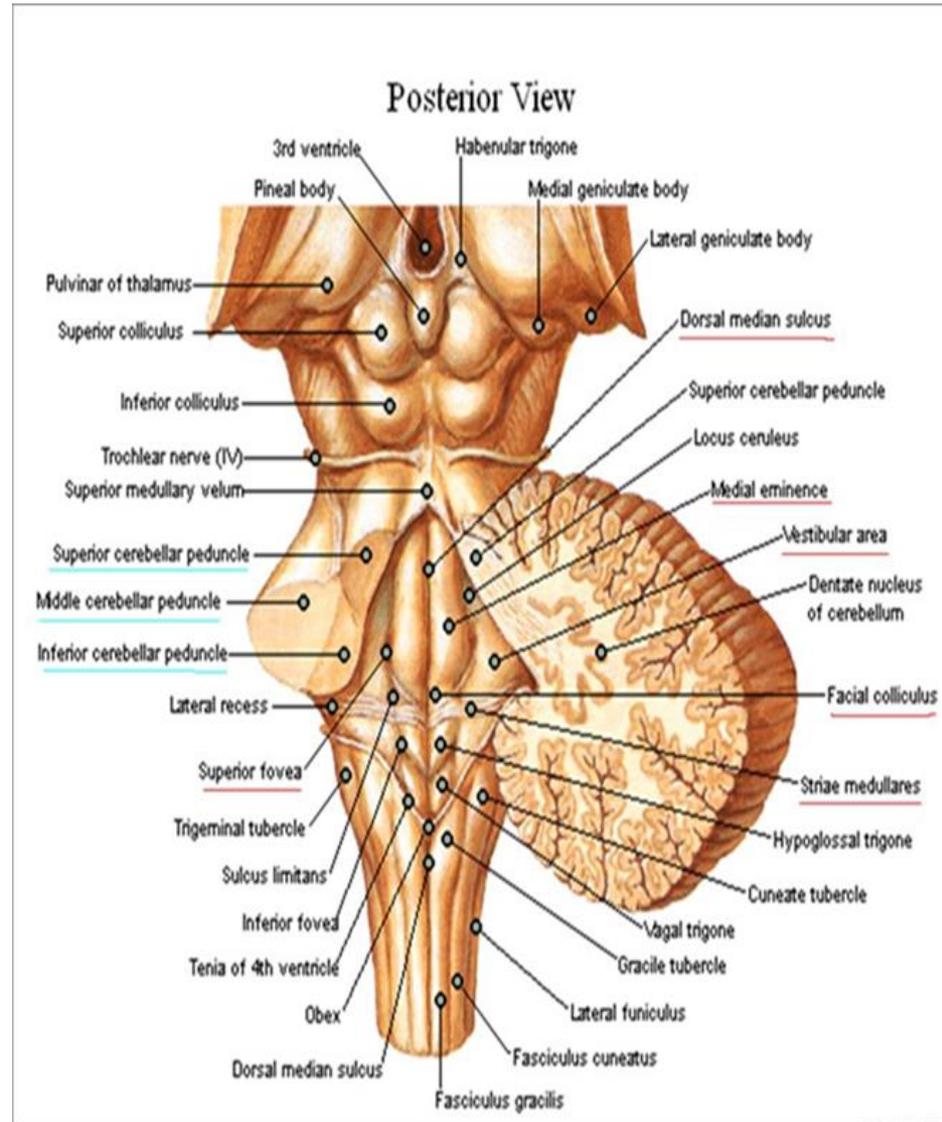
Boundaries of the 4th ventricle

I- Lateral boundaries: It is bounded on each side by:

- **Above and lateral:** Superior cerebellar peduncles.

- **In the middle** the lateral angles forming lateral recesses. .

- **Below and lateral:** Inferior cerebellar peduncle, cuneate and gracile tubercles.



II- Floor (Rhomboidal fossa)

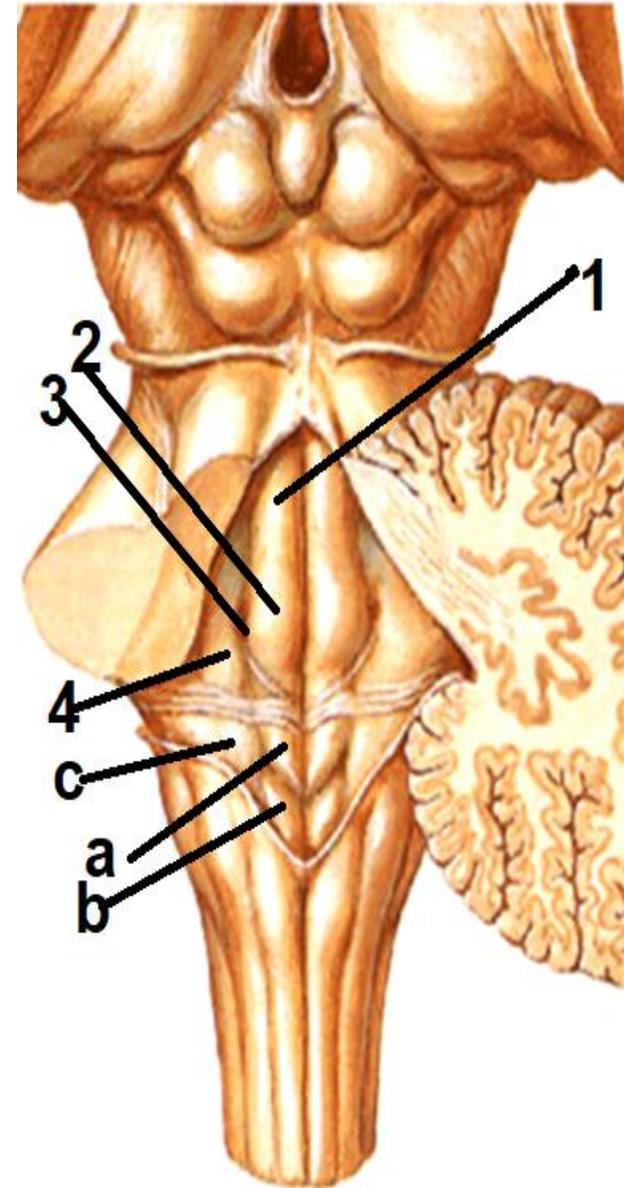
- Stria medullaris divides the floor into upper part (**pontine**) and lower part (**medullary**).

A- The medullary (lower) part presents on each side of the median sulcus,

- An inverted V shaped groove called inferior fovea.
a- Hypoglossal area (trigone) medial to inferior fovea.
b- Vagal area (trigone) between 2 limbs of inferior fovea.
c- Vestibular area (trigone) lateral to inferior fovea.
overlies superior, lateral and upper 1/2 of medial vestibular nuclei.

B- The pontine (Upper) part presents on each side of the median sulcus,

1- Medial eminence: a longitudinal elevation on each side of the median sulcus,
2- Facial colliculus; a round swelling on the lower part of the medial eminence.
3- Superior fovea, a groove lateral to the facial colliculus.
4- Vestibular area, lateral to superior fovea. It overlies the inferior and lower 1/2 of medial vestibular nuclei.



III) The roof of the 4th ventricle:

A) **The upper part of the roof:** consists of

- The superior medullary velum stretched between the 2 superior cerebellar peduncles.

B) **The lower part of the roof:** It is divided into 2 areas:

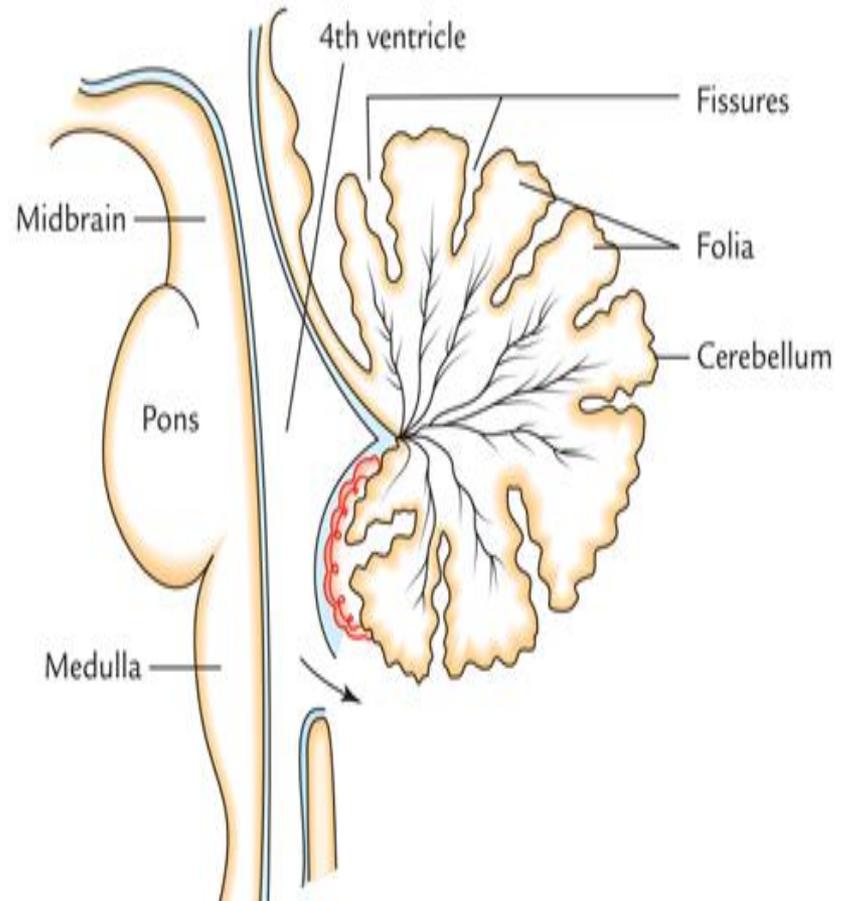
- **Upper area** formed by the nodule of the cerebellum (in the median plane) and the inferior medullary velum on each side of the nodule.

- **Lower area** consists of:

Ependyma and pia mater in contact with each other.

This thin area is invaginated into the cavity of the ventricle by the choroid plexus of the 4th ventricle.

The lowest part of this area of the roof show a median aperture (foramen of Magendi) which connects the 4th V to the subarachnoid space.



- **Connection (openings) of the fourth ventricle**

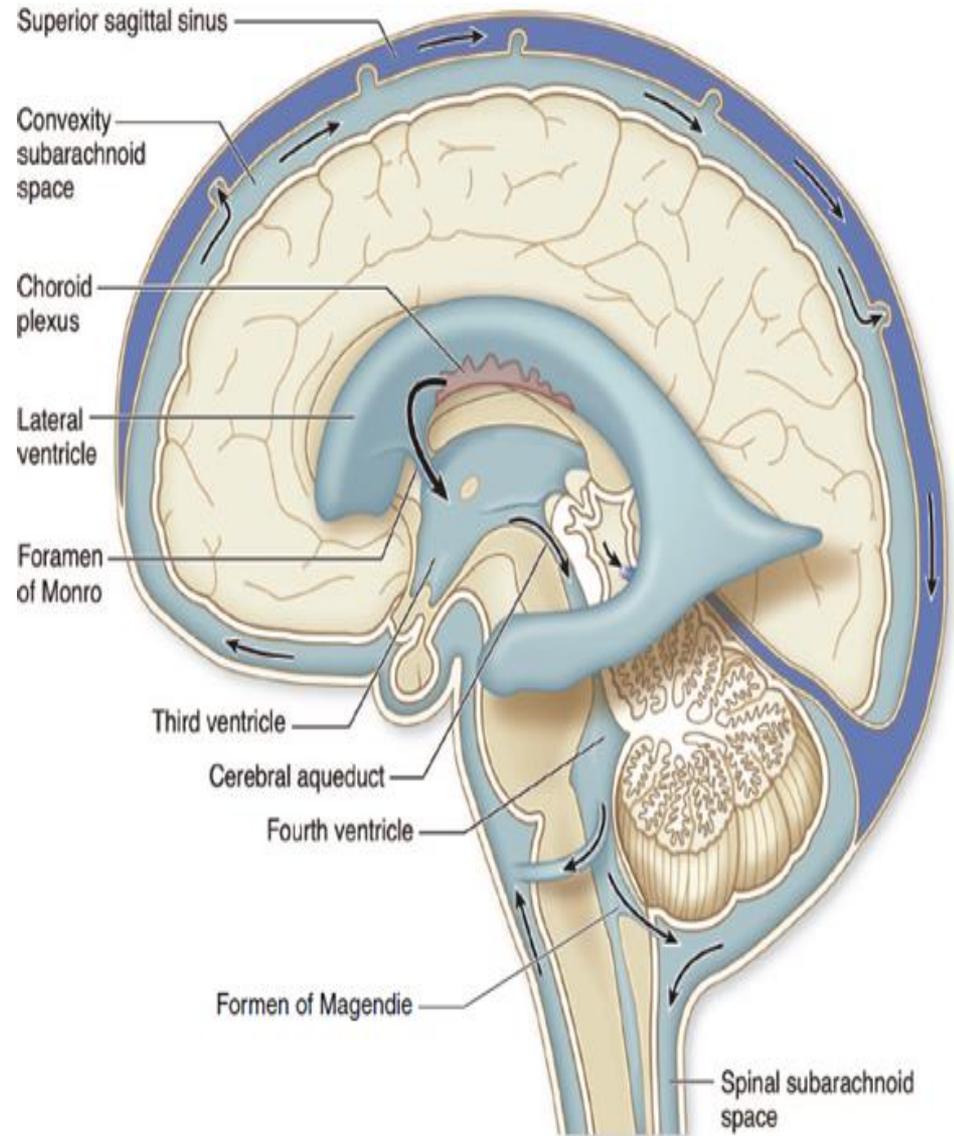
1- **Superior angle** is continuous with **cerebral aqueduct**.

2- **Inferior angle** is continuous with the central canal of the closed medulla.

3- three openings in the lower part of the roof which transmit cerebrospinal fluid to the subarachnoid space.

a- One Median opening (foramen of Magendie) in the lower part of the roof.

b- Two Lateral openings (foramen of Luschka) one in each lateral recess.



- **Recesses of the fourth ventricle:**

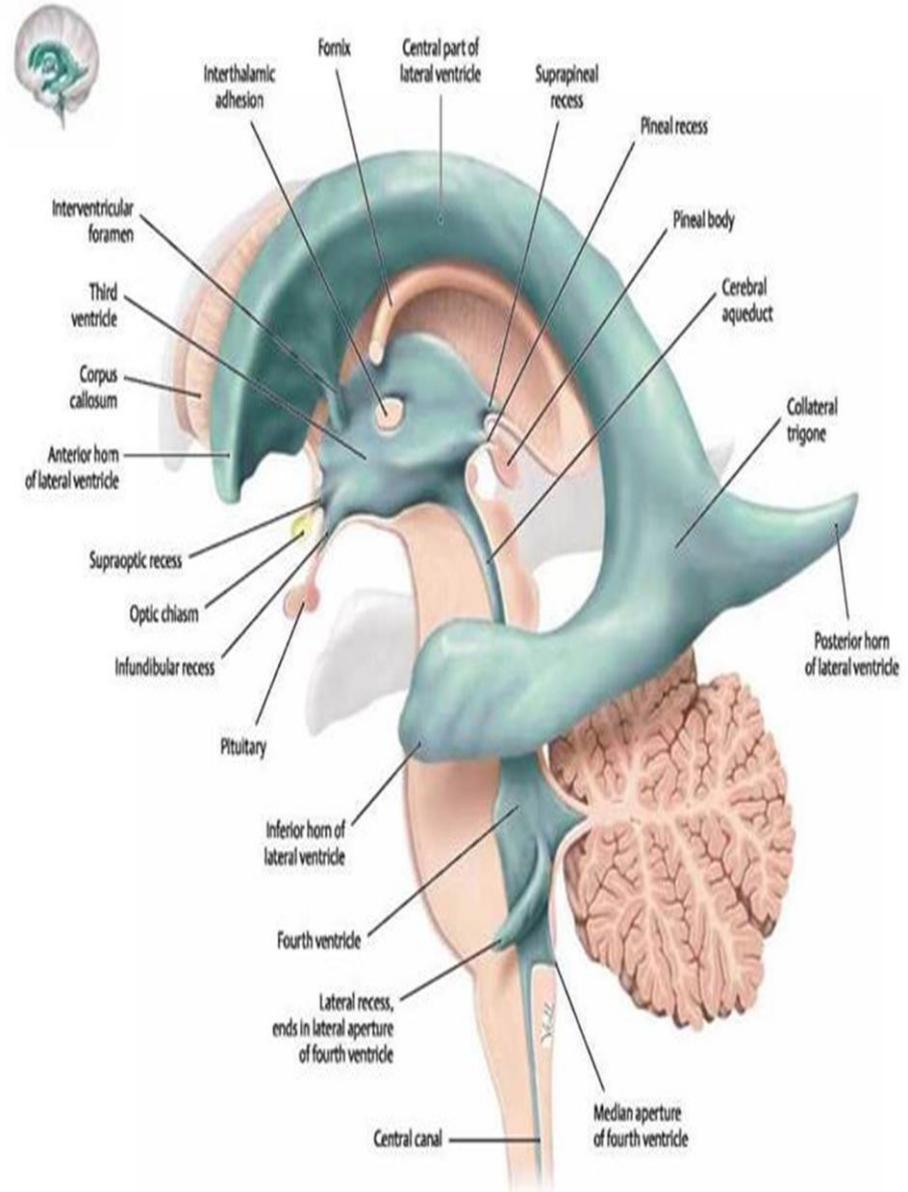
- **1) Median recess:**

- The roof of the 4th ventricle extends backwards towards the cerebellum; forming a median recess.

- **2) Two lateral recesses:**

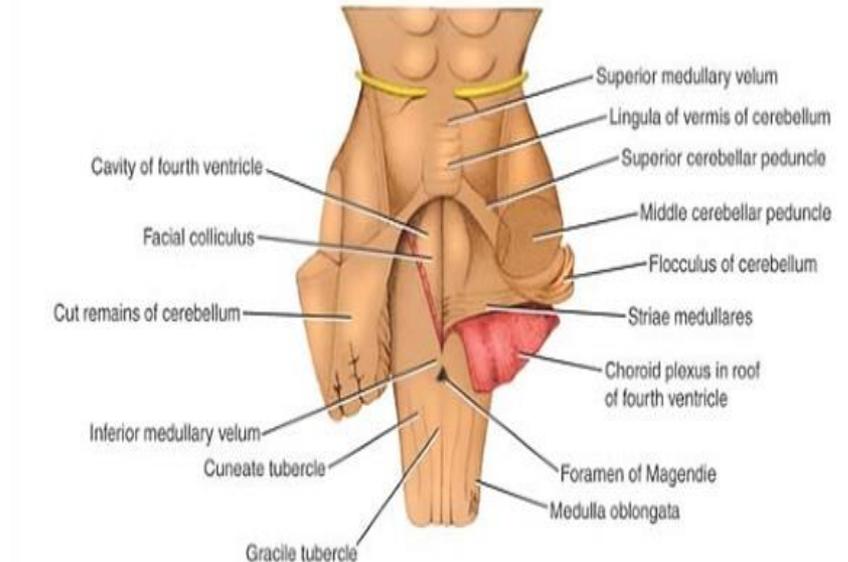
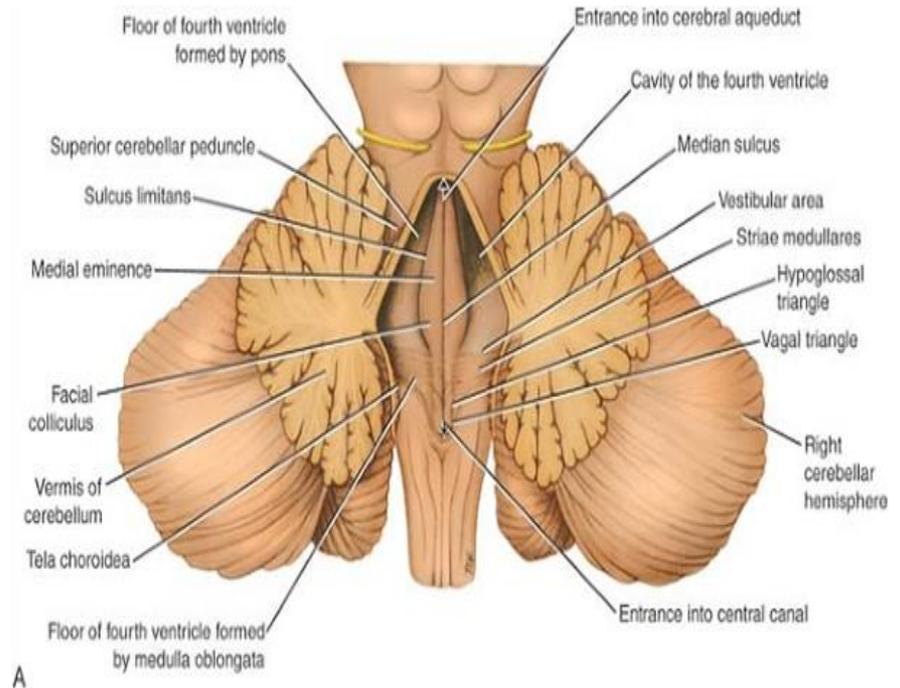
- At the lateral angles of the 4th ventricle, the roof is drawn laterally and forwards to form tubular pouch on either side called the lateral recess.

- Each lateral recess opens at its extremity into the subarachnoid space by a lateral aperture (foramen of Luschka).



★ **Choroid plexus of the 4th ventricle :**

- **Site:** it invaginates the lowermost area of the roof of 4th ventricle above the median aperture of magendie.
- **Shape: T shaped** with a median stem and 2 arms extending to the lateral recess
- **Blood supply: posterior inferior cerebellar arteries**



THANK YOU

BEST WISHES