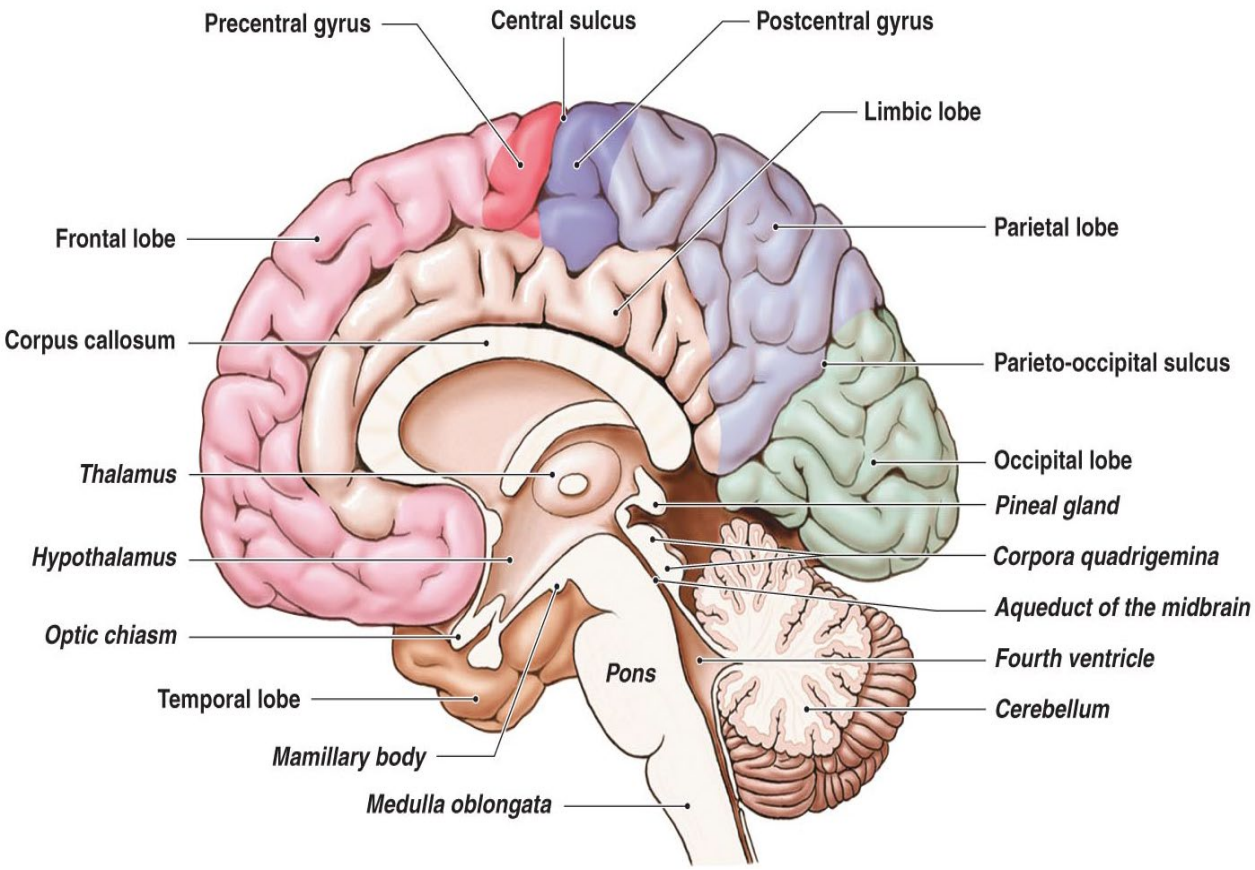
BRAIN

★ The brain **consists of**:

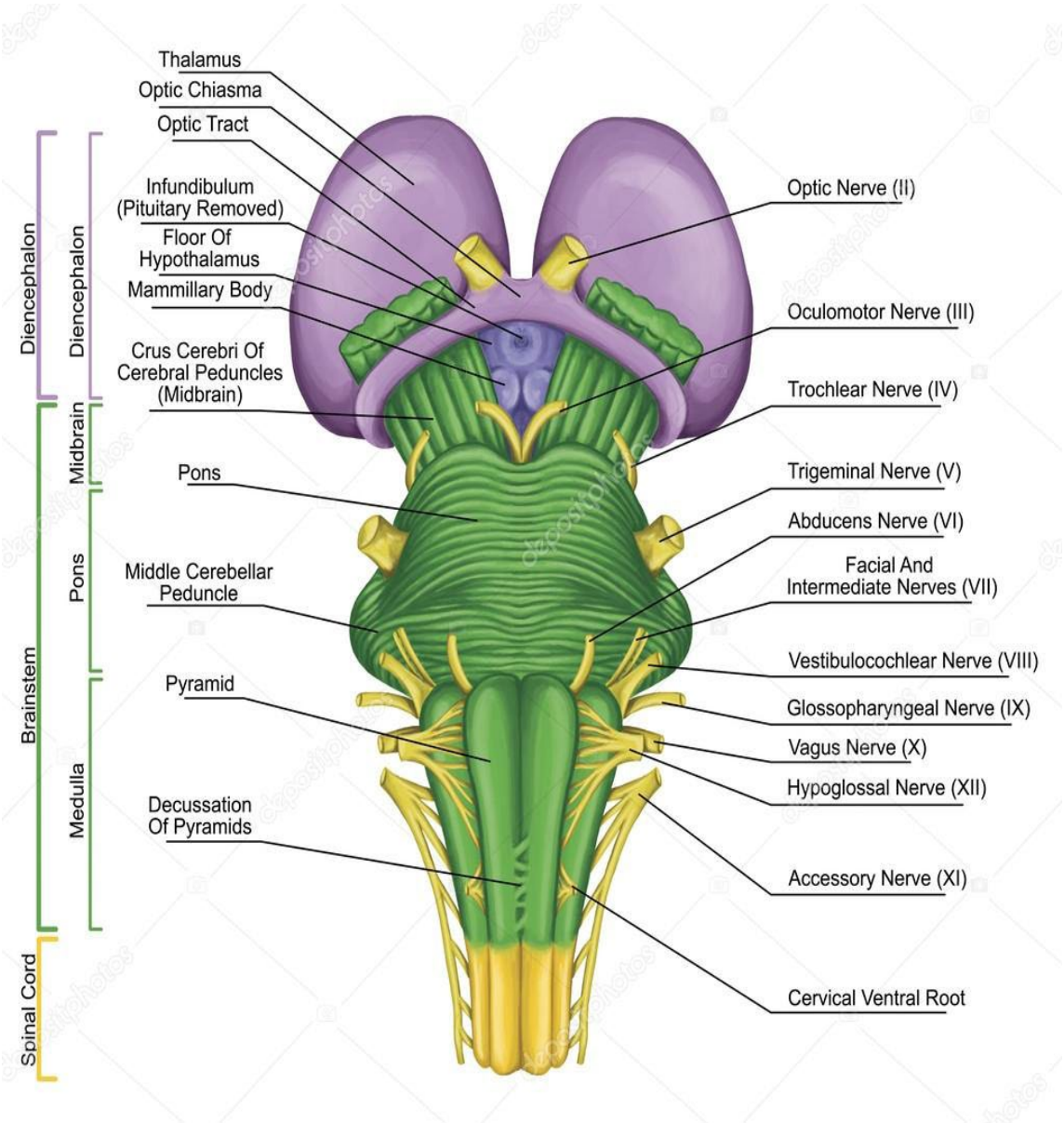
1. **Cerebrum:** Includes 2 cerebral **hemispheres** with the **diencephalon** in between.
2. **Brain stem:** From below upwards it is formed of:
   - Medulla oblongata.
   - Pons.
   - Midbrain.
3. **Cerebellum:** formed of 2 cerebellar hemispheres, separated from posterior surface of open medulla and pons by the 4th. ventricle.



THE BRAIN STEM

★ It is **formed of** medulla oblongata, pons and midbrain.

★ It **connects** the spinal cord (below) with the diencephalon and cerebrum (above).

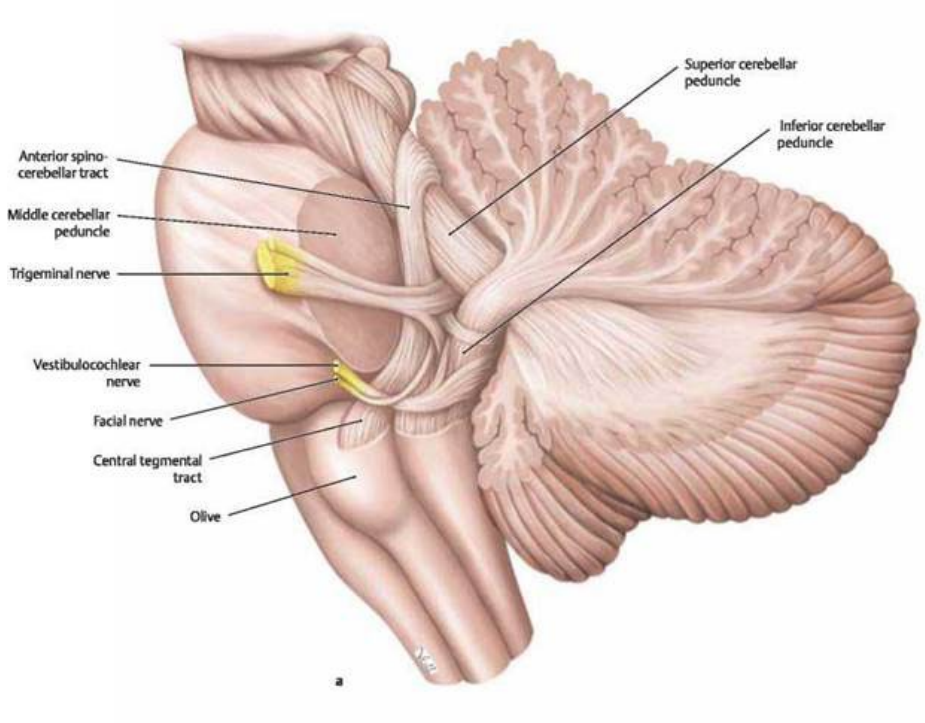


★ **The brain stem is connected to the cerebellum by 3 cerebellar peduncles:**

1) **Inferior cerebellar peduncle** connects the medulla with the cerebellum.
2) **Middle cerebellar peduncle** connects the pons with the cerebellum.
3) **Superior cerebellar peduncle** connects the midbrain with the cerebellum.

★ **Peduncle: a band of nerve fibers joining different parts of the brain e.g. cerebellar peduncle and cerebral peduncle.**

Cerebellar peduncles

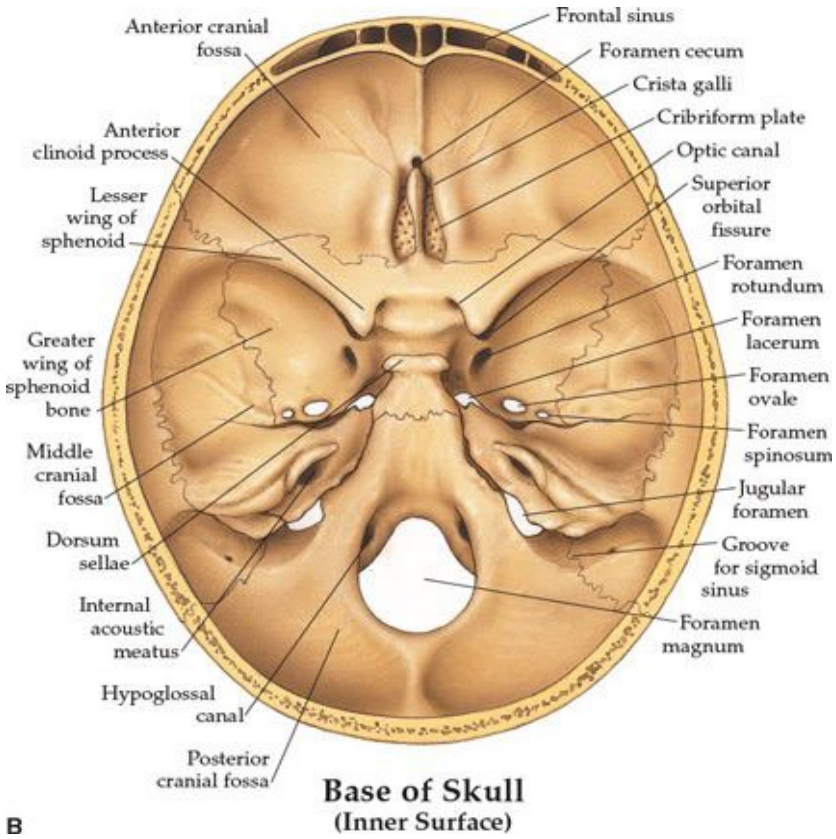


MEDULLA OBLONGATA

★ **Shape & length: conical** in shape, about **3 cm** long.

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

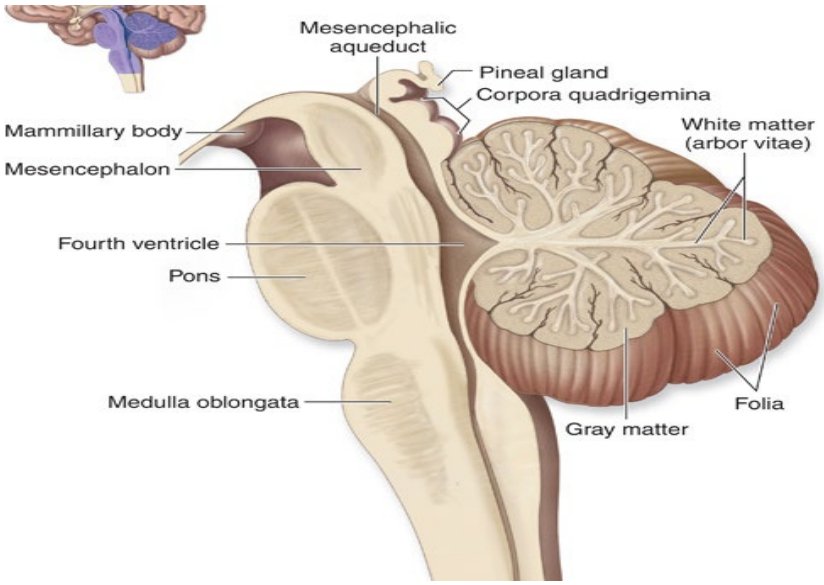
★ It is related **anteriorly** to the **basilar part of occipital** bone of the skull.



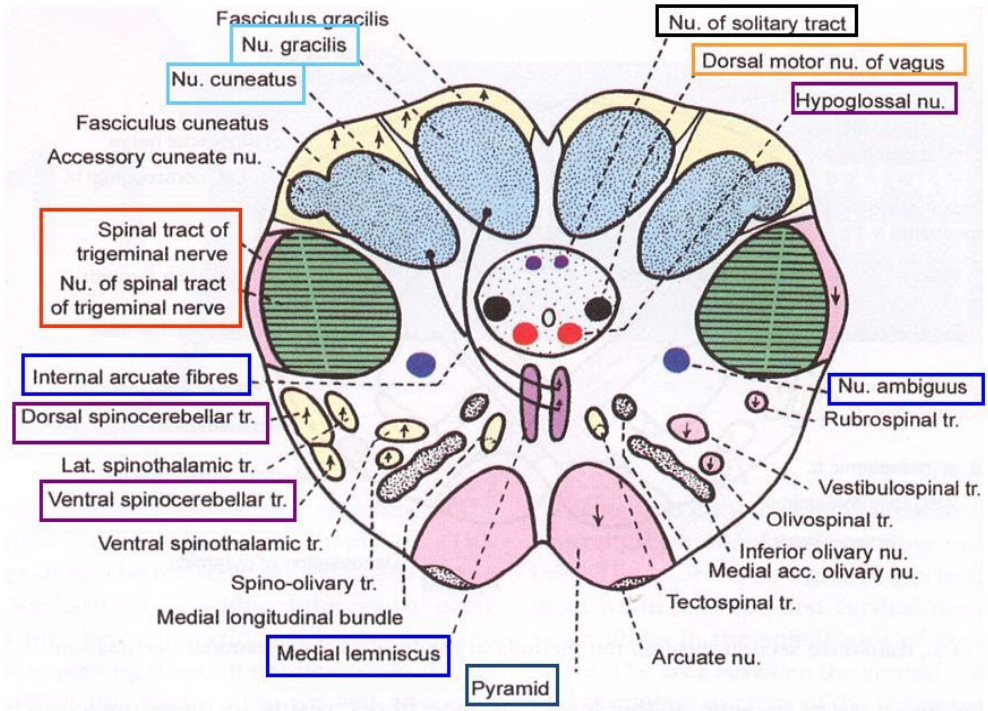
★ **Parts:**

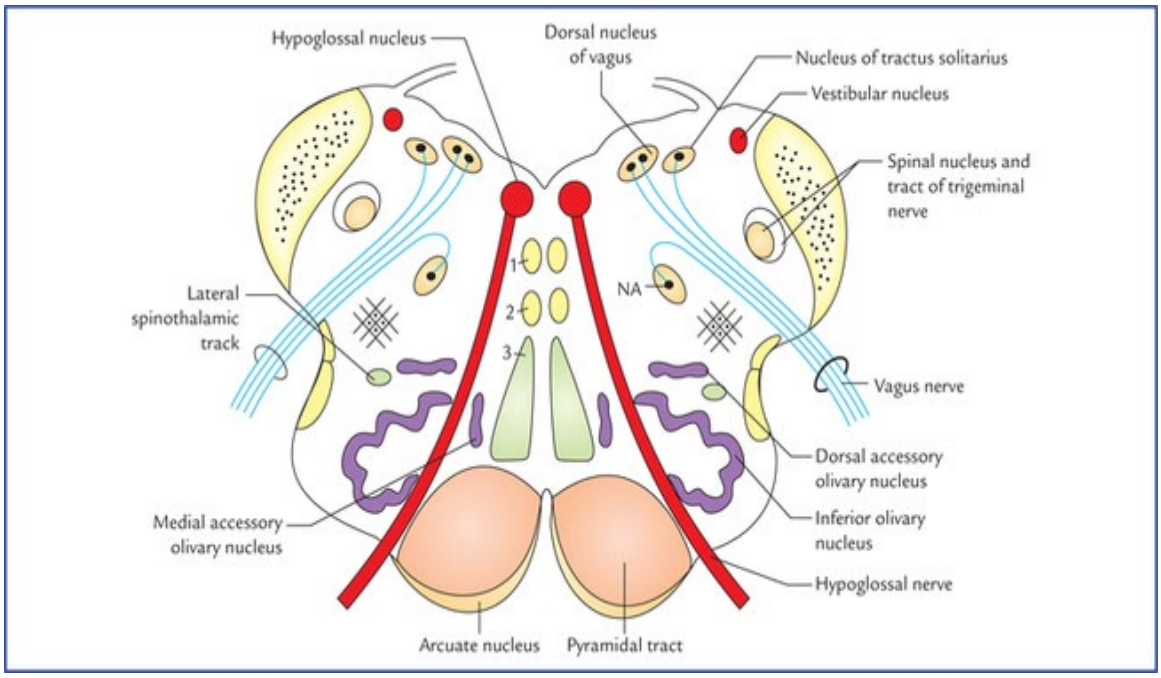
a- **Open medulla (upper 1/2):** Is related **posteriorly** to the **4th ventricle**.

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.



(II) C.S. at upper closed part of Medulla (above pyramidal decussation)-sensory decussation





★ External features:

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

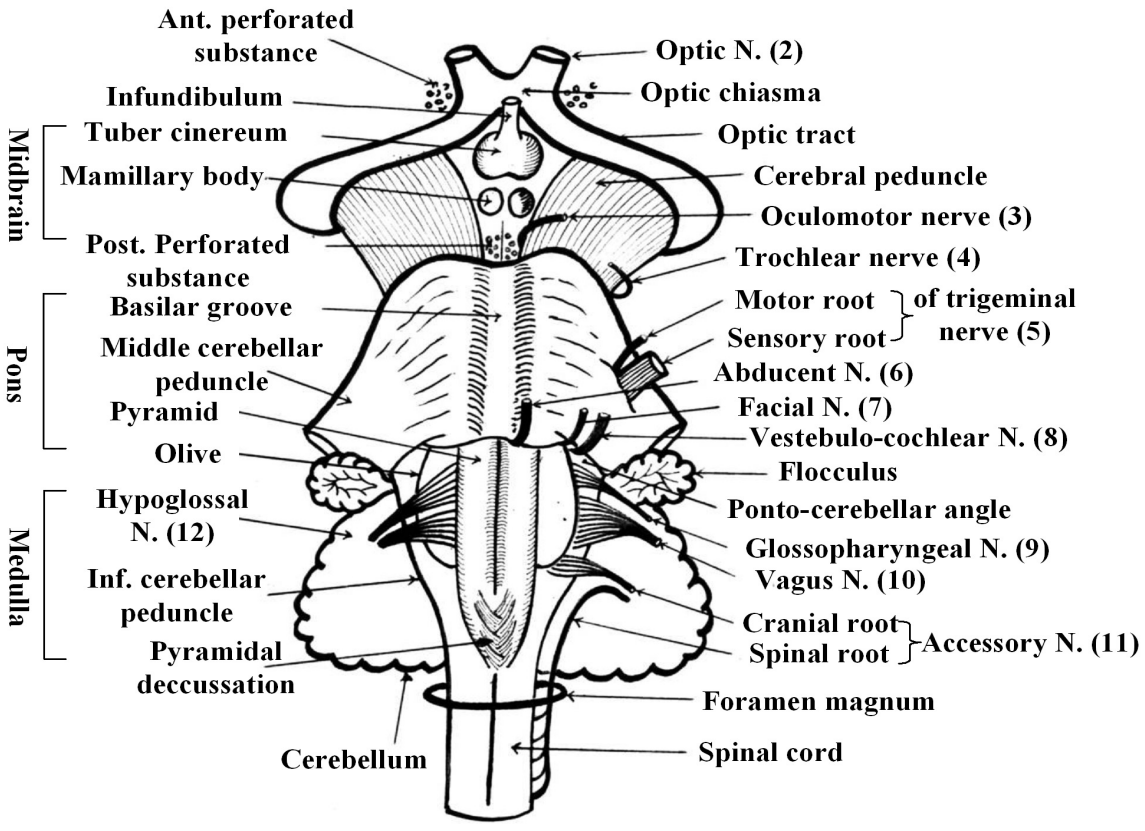
1- Anterior median fissure: continuous below with that of the spinal cord and is **obliterated** in its lower part by the pyramidal (motor) decussation.

2- The pyramid: It is an **elevation** produced by the **pyramidal tract,** on each side of the anterior median fissure.

3- Anterolateral sulcus:

- It lies lateral to the pyramids, separating it from the olive.
- The rootlets of the 12th (**hypoglossal**) nerve emerge from this sulcus.

4- The olive: It is **oval elevation** produced by the **inferior olivary nucleus**.



* Anterior Aspect of Brain Stem - Midrain
- Pons
- Medulla

* Superficial Attachment of Cranial Nerves

5- Posterolateral sulcus:

- It separates the olive from the inferior cerebellar peduncle.
- The rootlets of the **9th** (glossopharyngeal), the **10th** (vagus) and the **cranial root of the 11th** (accessory) cranial nerves emerges from this sulcus.

6- The inferior cerebellar peduncle:

- It **connects the medulla with the cerebellum** latera to posterolateral sulcus.

II- Posterior surface:

A) The posterior surface of the closed medulla:

- It is **continuous** downwards with the posterior surface of the spinal cord and presents:

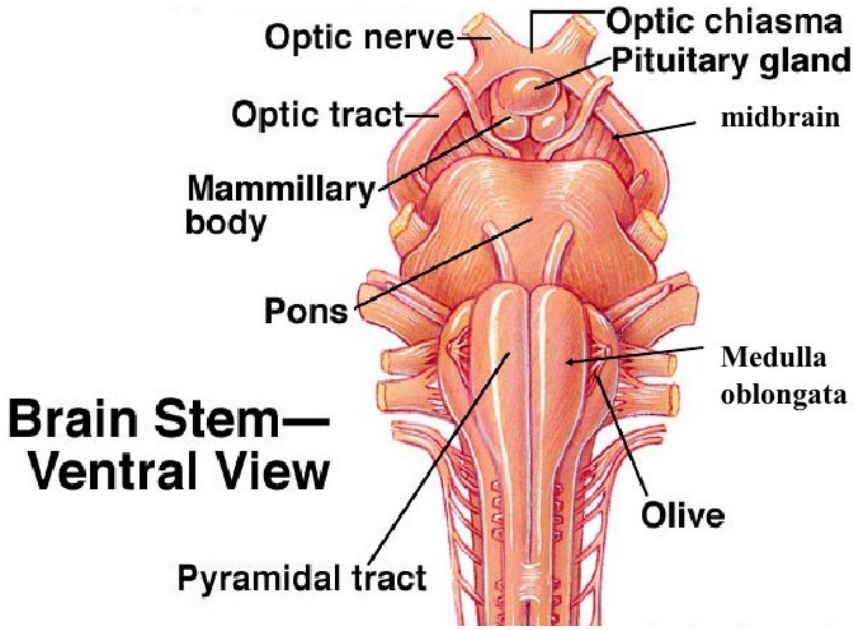
1-A **posterior median sulcus** which is an **upwards extension** of that of the spinal cord.

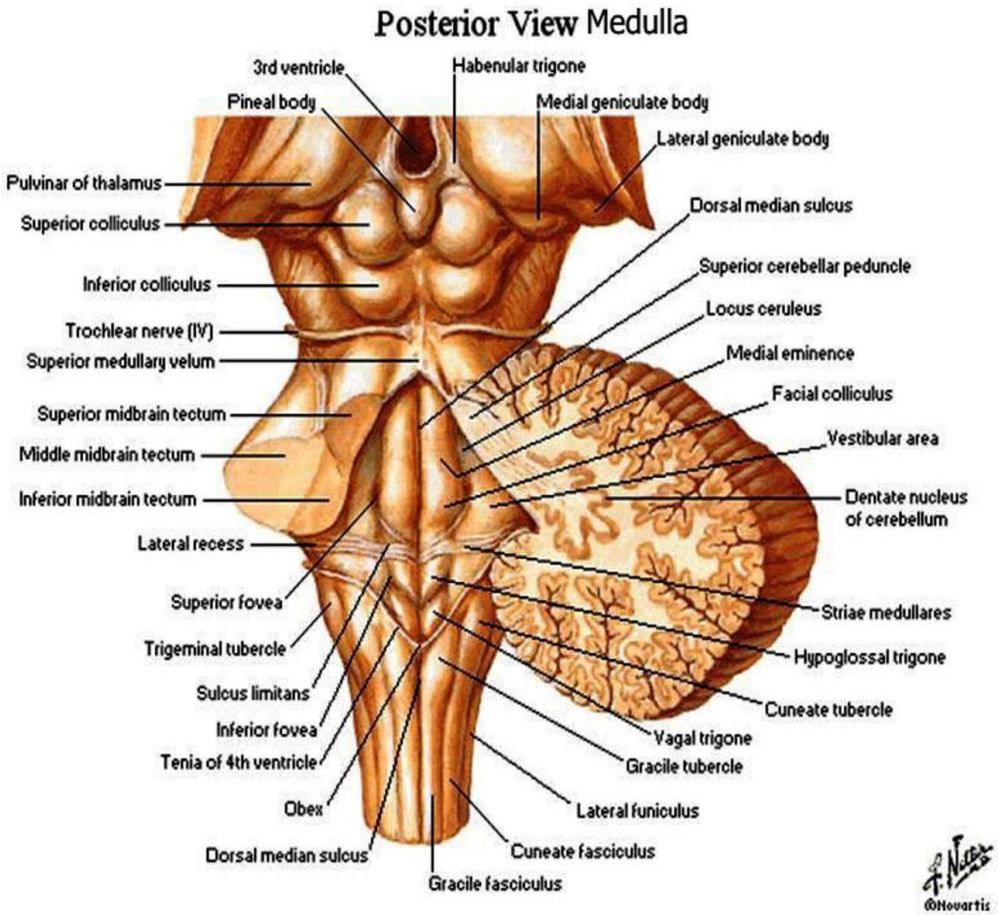
2-The **gracile and cuneate tracts** of the spinal cord ascend as 2 distinct ridges on either side of the posterior median sulcus and end in 2 elevations called the gracile (medially) and cuneate (laterally) **tubercles** produced by gracile & cuneate **nuclei** respectively**.**

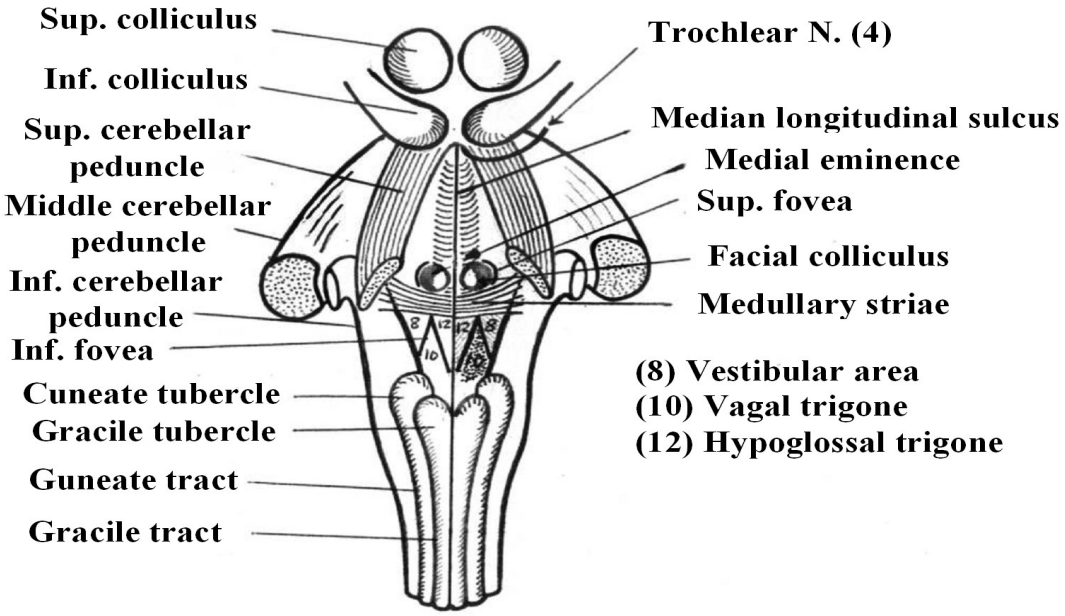
3-On the dorso-lateral aspects of closed medulla extend the **inferior cerebellar peduncle** upwards and laterally where they bend sharply backwards **between the middle (laterally) and the superior cerebellar peduncles (medially) to enter the cerebellum.**

B) The posterior surface of the open medulla:

- It forms the lower part of the **floor of the 4th ventricle (See later).**


Optic nerve
Optic chiasma
Pituitary gland
Optic tract
midbrain
Mammillary body
Pons
Medulla oblongata
Brain Stem—Ventral View
Olive
Pyramidal tract

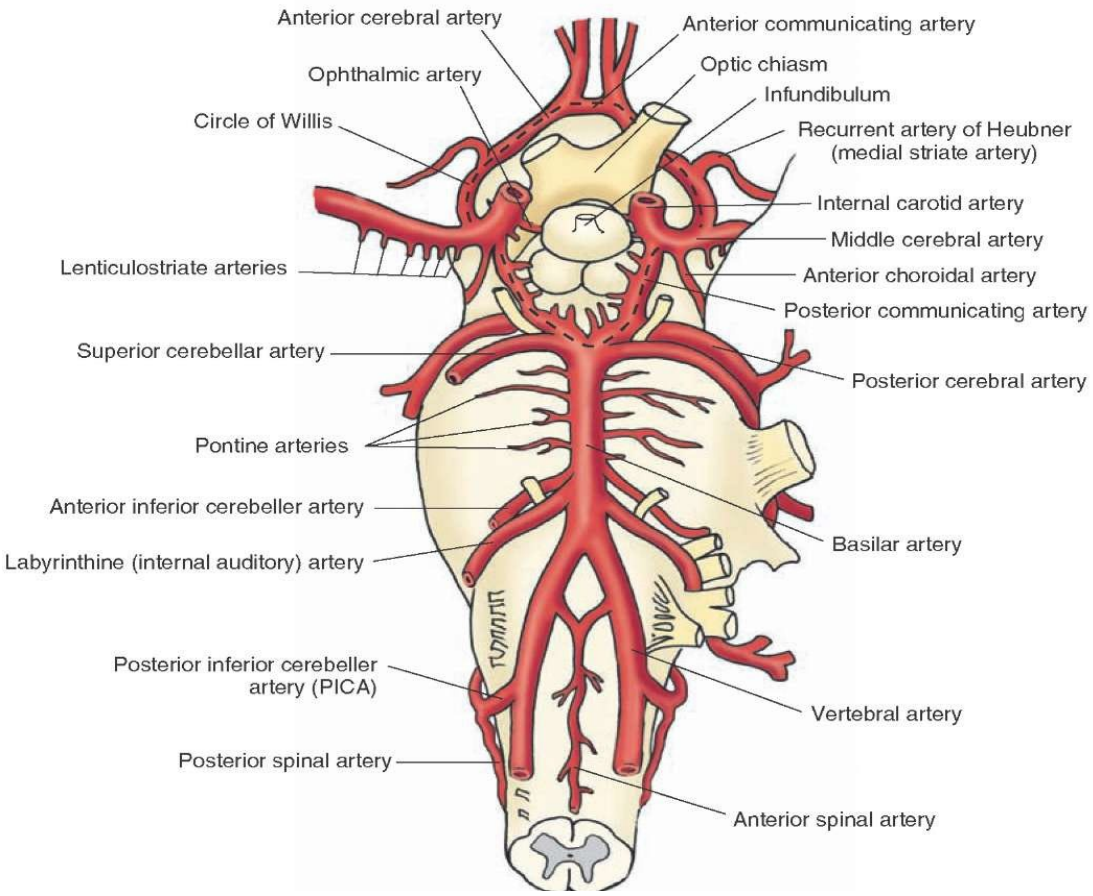

Posterior View Medulla
3rd ventricle
Habenular trigone
Pineal body
Medial geniculate body
Lateral geniculate body
Pulvinar of thalamus
Superior colliculus
Dorsal median sulcus
Inferior colliculus
Superior cerebellar peduncle
Locus ceruleus
Trochlear nerve (IV)
Superior medullary velum
Medial eminence
Facial colliculus
Superior midbrain tectum
Middle midbrain tectum
Vestibular area
Inferior midbrain tectum
Dentate nucleus of cerebellum
Lateral recess
Superior fovea
Striae medullares
Trigeminal tubercle
Hypoglossal trigone
Sulcus limitans
Cuneate tubercle
Inferior fovea
Vagal trigone
Tenia of 4th ventricle
Gracile tubercle
Obex
Lateral funiculus
Dorsal median sulcus
Cuneate fasciculus
Gracile fasciculus
©Novartis



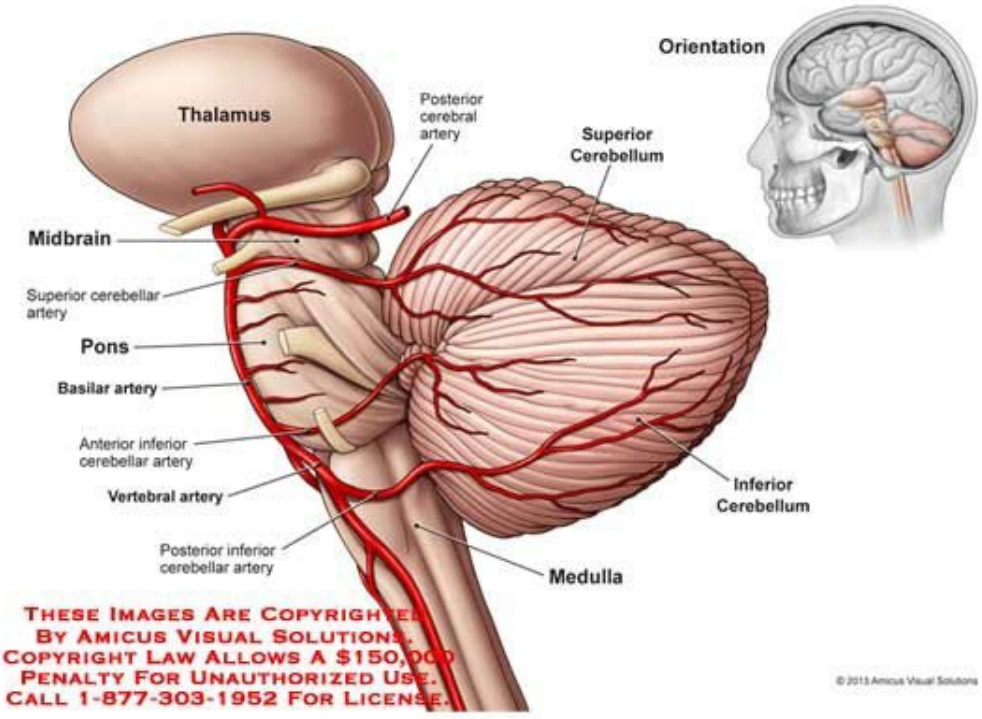
Floor of 4th Ventricle

★ **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**.**



Arteries to the Brain Stem and Cerebellum



PONS

★ **Length and site:**

- It is **one inch** long, lying as the **middle part** of the brain stem, **between** the **medulla** (below) and the **midbrain** (above) and **in front** of the **cerebellum**.
- The 2 **cerebral peduncles** of the midbrain emerge from its **upper aspect** while the 2 **pyramids** of the medulla emerge from its **lower border**.

★ 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** of base of the skull.

★ **External features:** The pons is divided into **2 parts**, as follows**:**

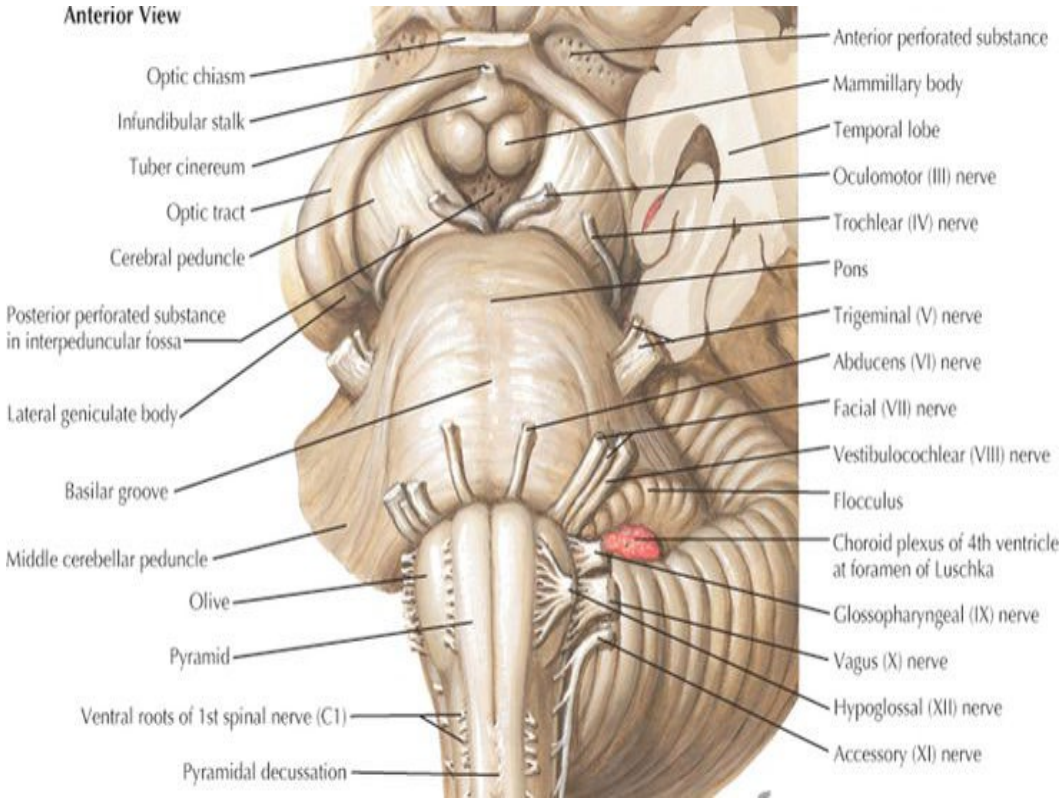
A) Anterior (Basilar) part: (also called **basis pontis**)

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

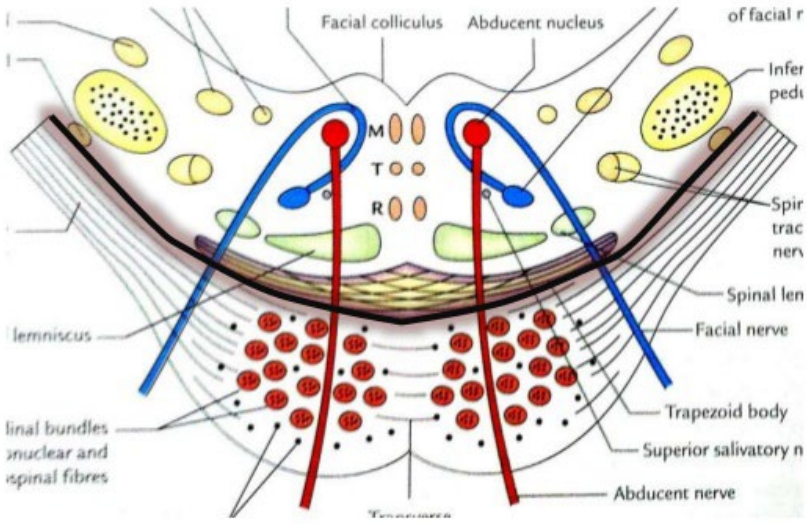
1) **Basilar sulcus or groove**: A median longitudinal groove related to the **basilar artery**.

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

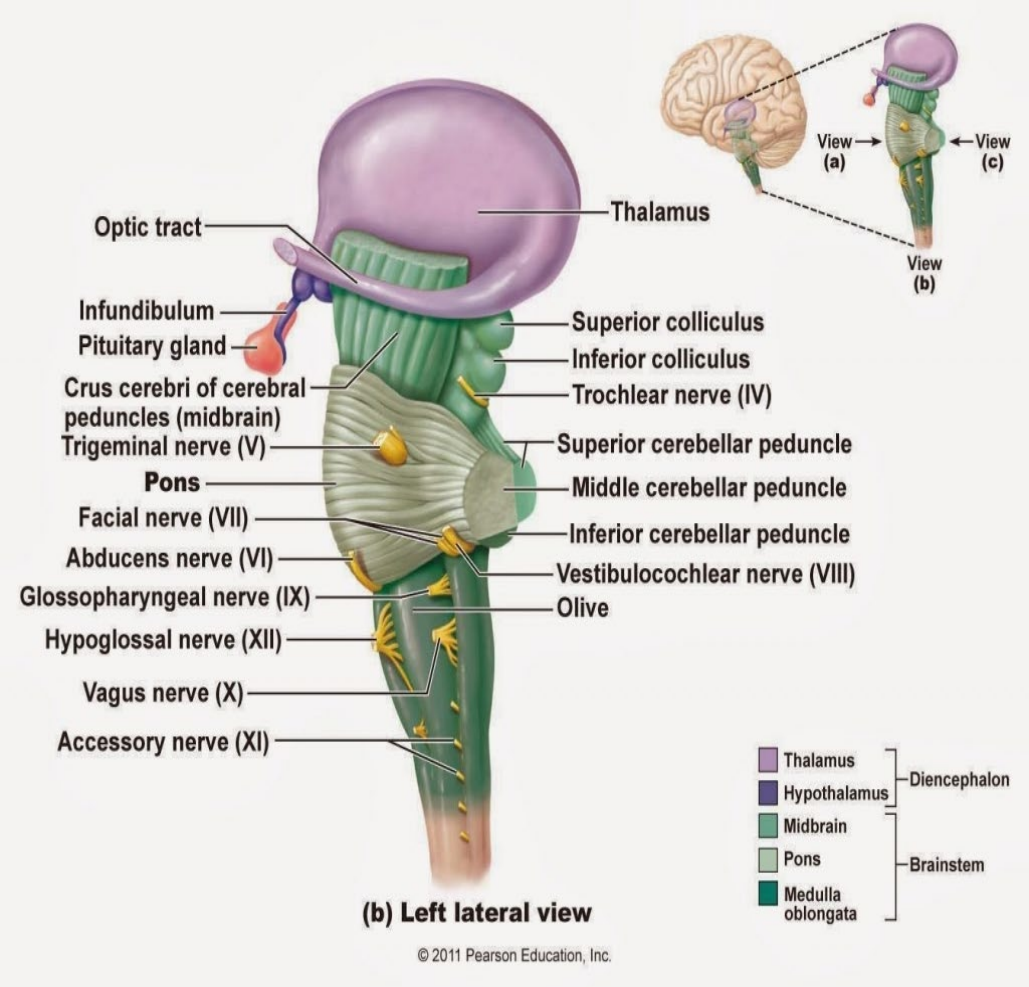
3) The transverse pontine fibers collect on either side to form the **middle cerebellar peduncle** which turns **backwards** to enter into the corresponding **cerebellar hemisphere**.



Internal = Basilar & Tegmental Part



The basilar (Ventral) part - Uniform structure throughout-
Tegmentum (dorsal) part - Differs in upper & lower part of - pons.

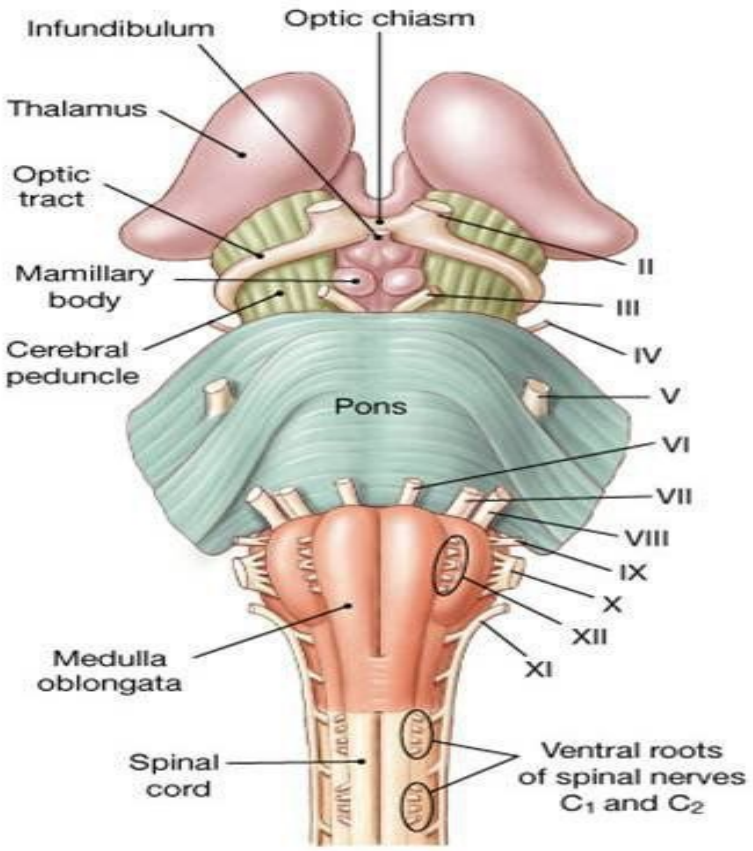


4) Exit of the middle four cranial nerves:

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 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.



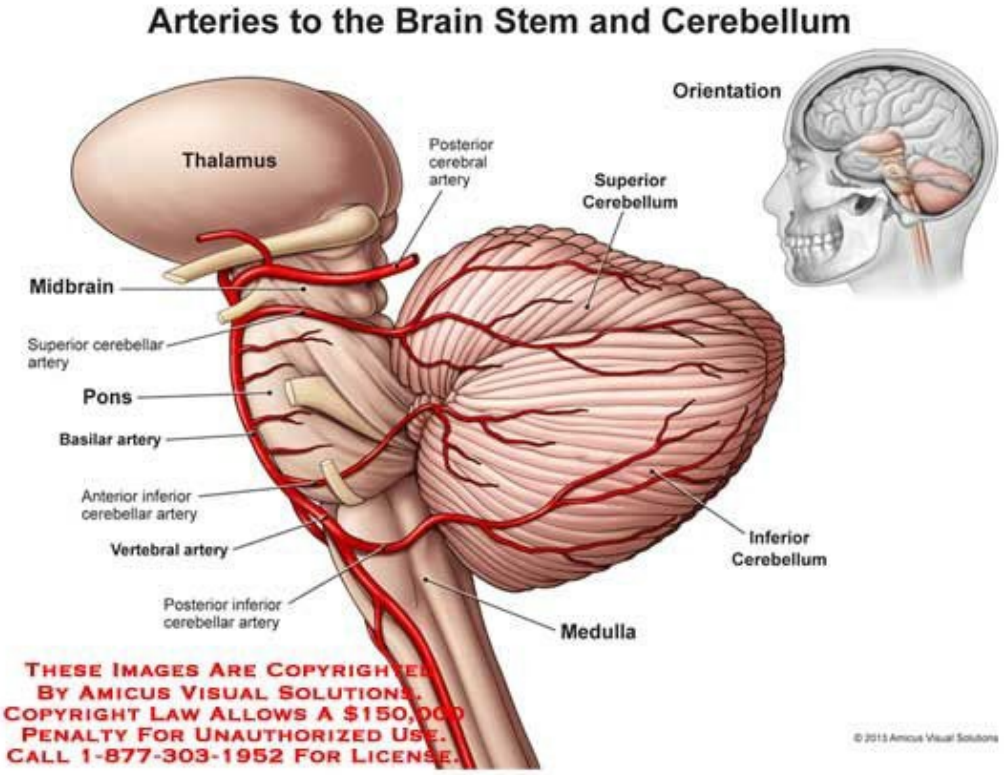
(b) Anterior view

B) Posterior (tegmental) part:

- It is **triangular** in shape with its **apex** upwards continuous with the cerebral aqueduct of Sylvius, its **base** downwards and bounded **on both sides** by the superior cerebellar peduncles.
- It forms the upper part of the **floor of the 4th** ventricle. (See later)

★ **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.

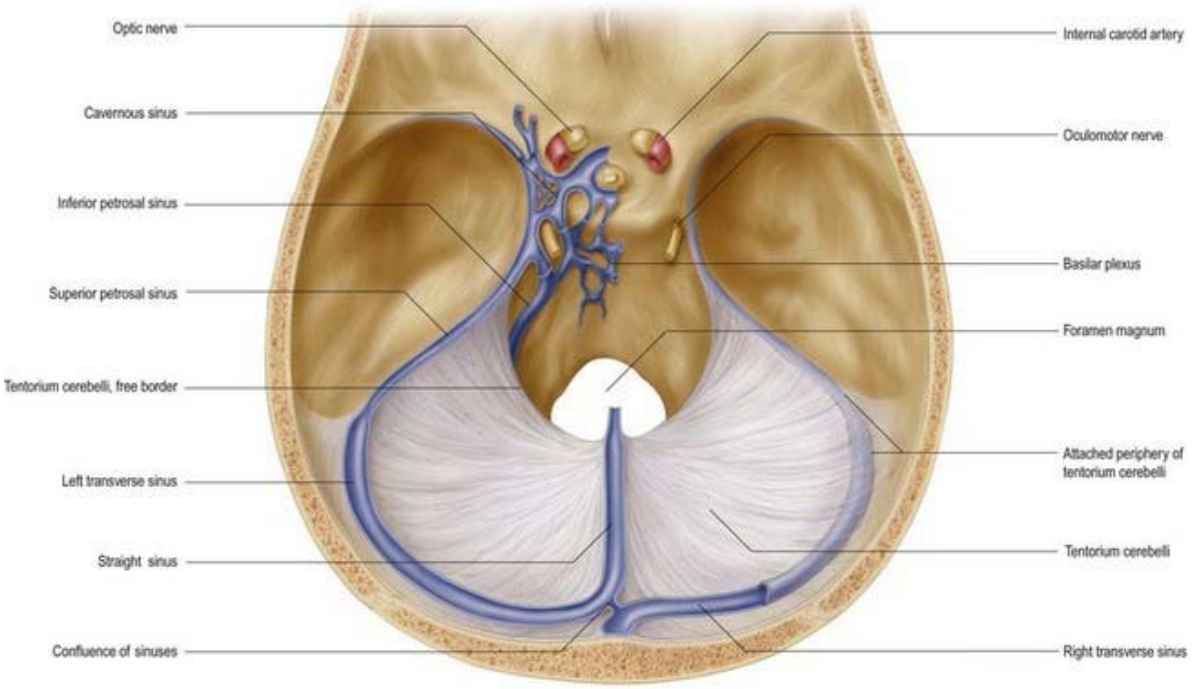

Arteries to the Brain Stem and Cerebellum
Orientation
Thalamus
Posterior cerebral artery
Superior Cerebellum
Midbrain
Superior cerebellar artery
Pons
Basilar artery
Anterior inferior cerebellar artery
Vertebral artery
Posterior inferior cerebellar artery
Inferior Cerebellum
Medulla
THESE IMAGES ARE COPYRIGHTED BY AMICUS VISUAL SOLUTIONS. COPYRIGHT LAW ALLOWS A $150,000 PENALTY FOR UNAUTHORIZED USE. CALL 1-877-303-1952 FOR LICENSE.
© 2013 Amicus Visual Solutions

MIDBRAIN

★ It is **2 cm** long

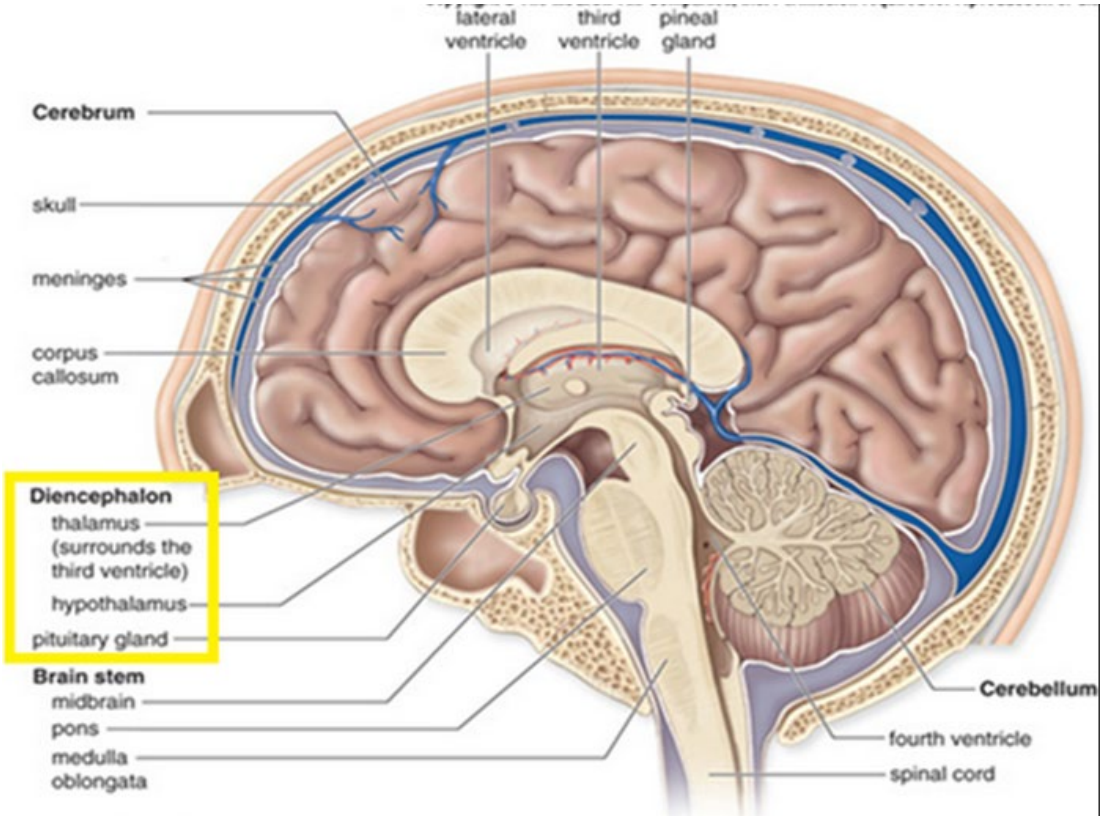
★ It is the upper part of the brain stem and it lies **between** the pons (below) and the diencephalon (above).

★ 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.**



★ **Features:**

I)The anterior surface: shows:

1- 2 cerebral peduncles which are the part of the midbrain anterior to the cerebral aqueduct and each consists of:

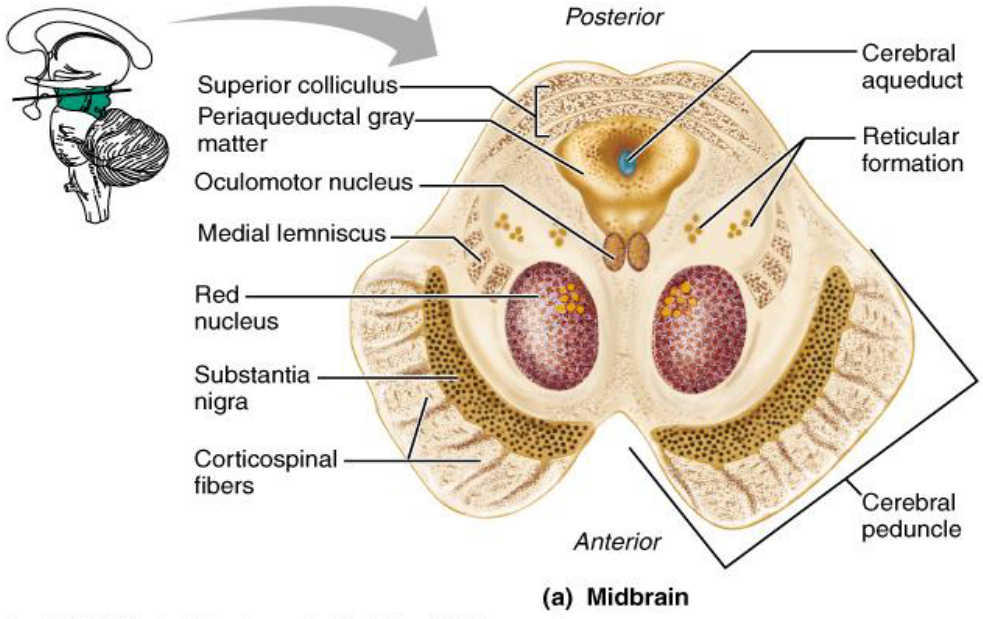
a- Crus cerebri: (anterior)

- **A large bundles** of nerve fibers that descend from **cerebral hemispheres** (above) to the upper border of the **pons** (below).
- **3rd (oculomotor) nerve** emerges **just medial** to the crus cerebri.

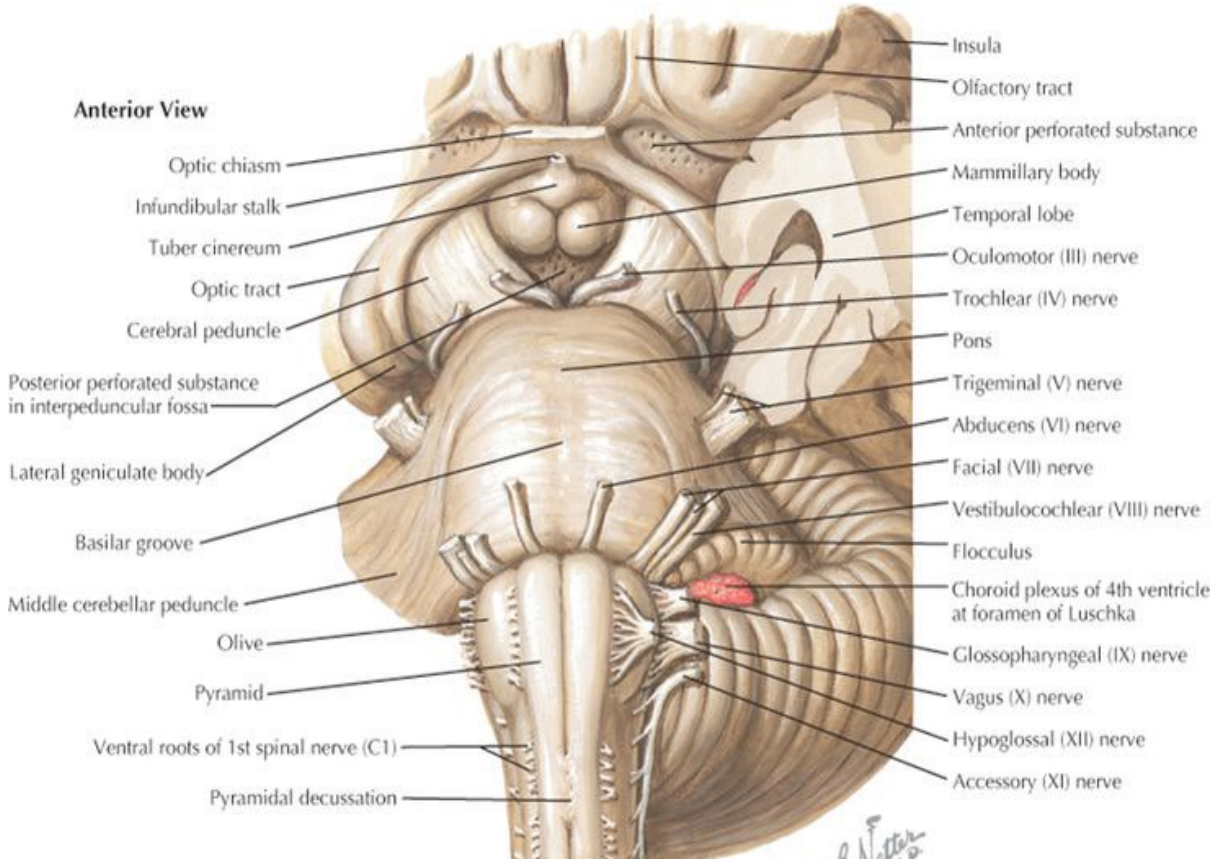
b-Substantia nigra: (in the middle)

- It is a lamina of black pigmented gray matter placed transversely in the midbrain.
- **Function:** It is an extrapyramidal center.

c-Tegmentum: (posterior)


Posterior
Superior colliculus
Periaqueductal gray matter
Oculomotor nucleus
Medial lemniscus
Red nucleus
Substantia nigra
Corticospinal fibers
Cerebral aqueduct
Reticular formation
Cerebral peduncle
Anterior

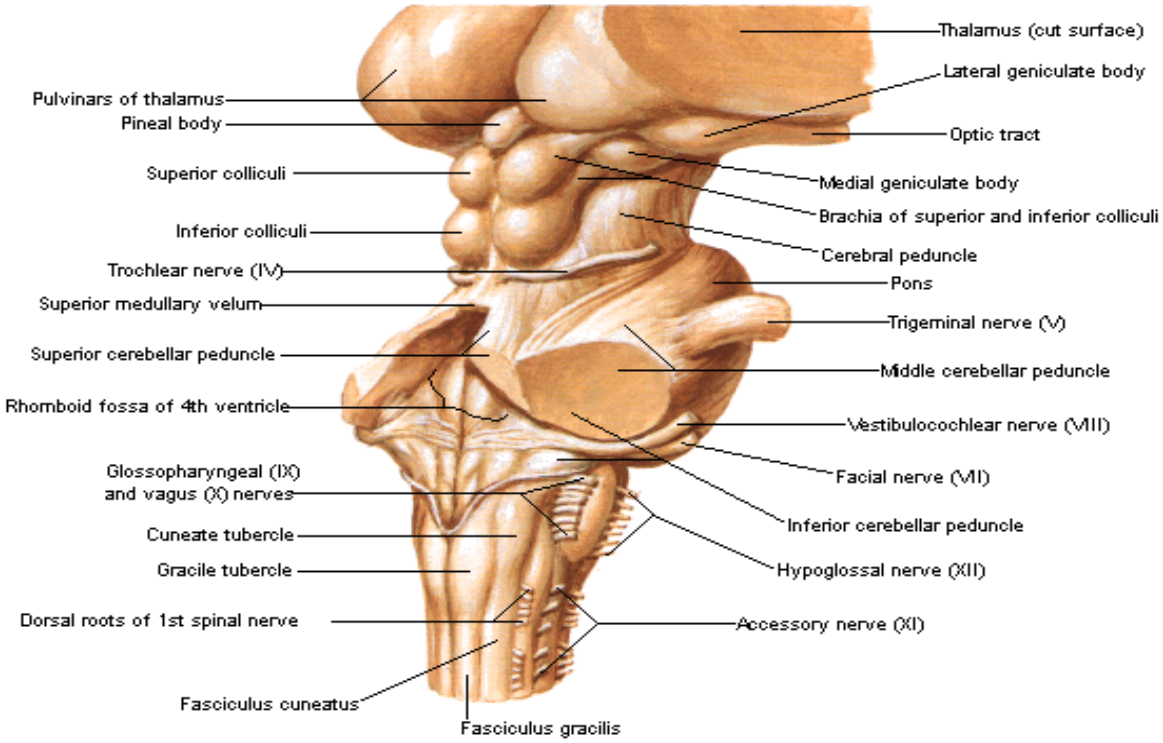
(a) Midbrain


Anterior View
Optic chiasm
Infundibular stalk
Tuber cinereum
Optic tract
Cerebral peduncle
Posterior perforated substance in interpeduncular fossa
Lateral geniculate body
Basilar groove
Middle cerebellar peduncle
Olive
Pyramid
Ventral roots of 1st spinal nerve (C1)
Pyramidal decussation
Insula
Olfactory tract
Anterior perforated substance
Mammillary body
Temporal lobe
Oculomotor (III) nerve
Trochlear (IV) nerve
Pons
Trigeminal (V) nerve
Abducens (VI) nerve
Facial (VII) nerve
Vestibulocochlear (VIII) nerve
Flocculus
Choroid plexus of 4th ventricle at foramen of Luschka
Glossopharyngeal (IX) nerve
Vagus (X) nerve
Hypoglossal (XII) nerve
Accessory (XI) nerve

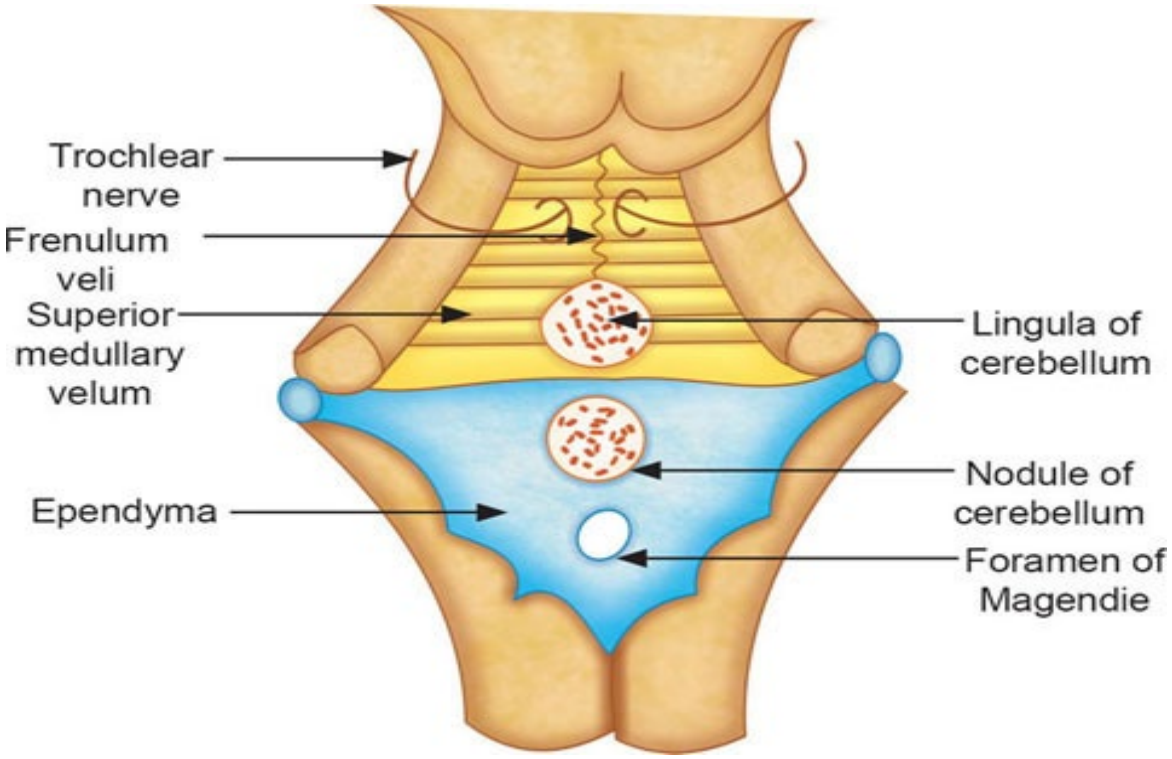
II) The posterior surface:

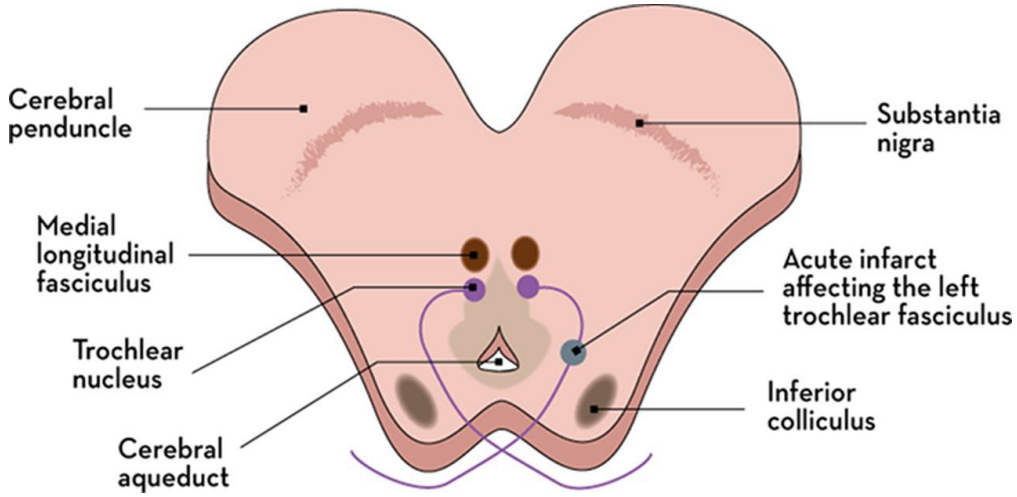
- The **tectum** is part of midbrain **behind** the cerebral **aqueduct**.
- The tectum shows **4 rounded elevations of gray matter** called the 4 **colliculi**:

Superior colliculi	Inferior colliculi
• It is the upper part of tectum.	• It is the upper part of tectum.
• Centers of **visual reflexes**	• Centers of **auditory reflexes**
• Connected to the **lateral geniculate body**	• Connected to the **medial geniculate body**
• **Afferent:** from optic tract and optic cortex.	• **Afferent:** from lateral lemniscus (carrying auditory fibers)
• **Efferent to:** 1) Tectobulbar (to brain stem) 2) Tectospinal	• **Efferent to:** 1) Medial geniculate body 2)Superior colliculi



- 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.

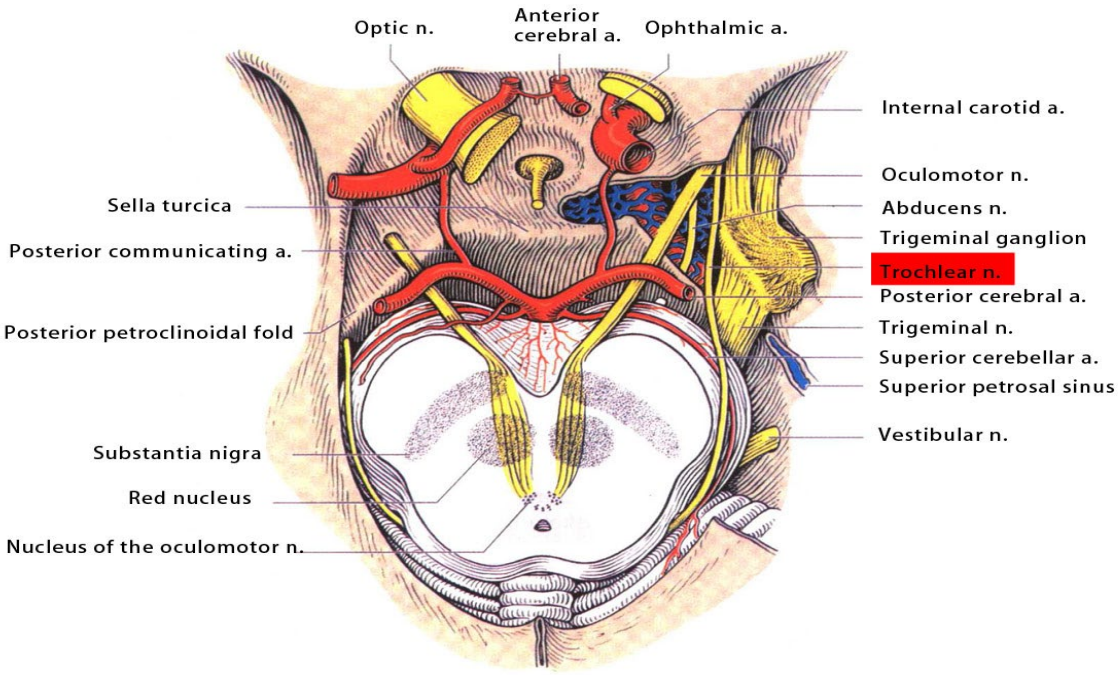




❖ **N.B: 4th cranial nerve is the smallest cranial nerve, the only nerve which emerges from the posterior aspect of the brain stem and the only cranial nerve which cross to the contralateral side.**

★ Blood supply of midbrain:

1. Central branches of **posterior cerebral artery**
2. **Superior cerebellar and posterior communicating**

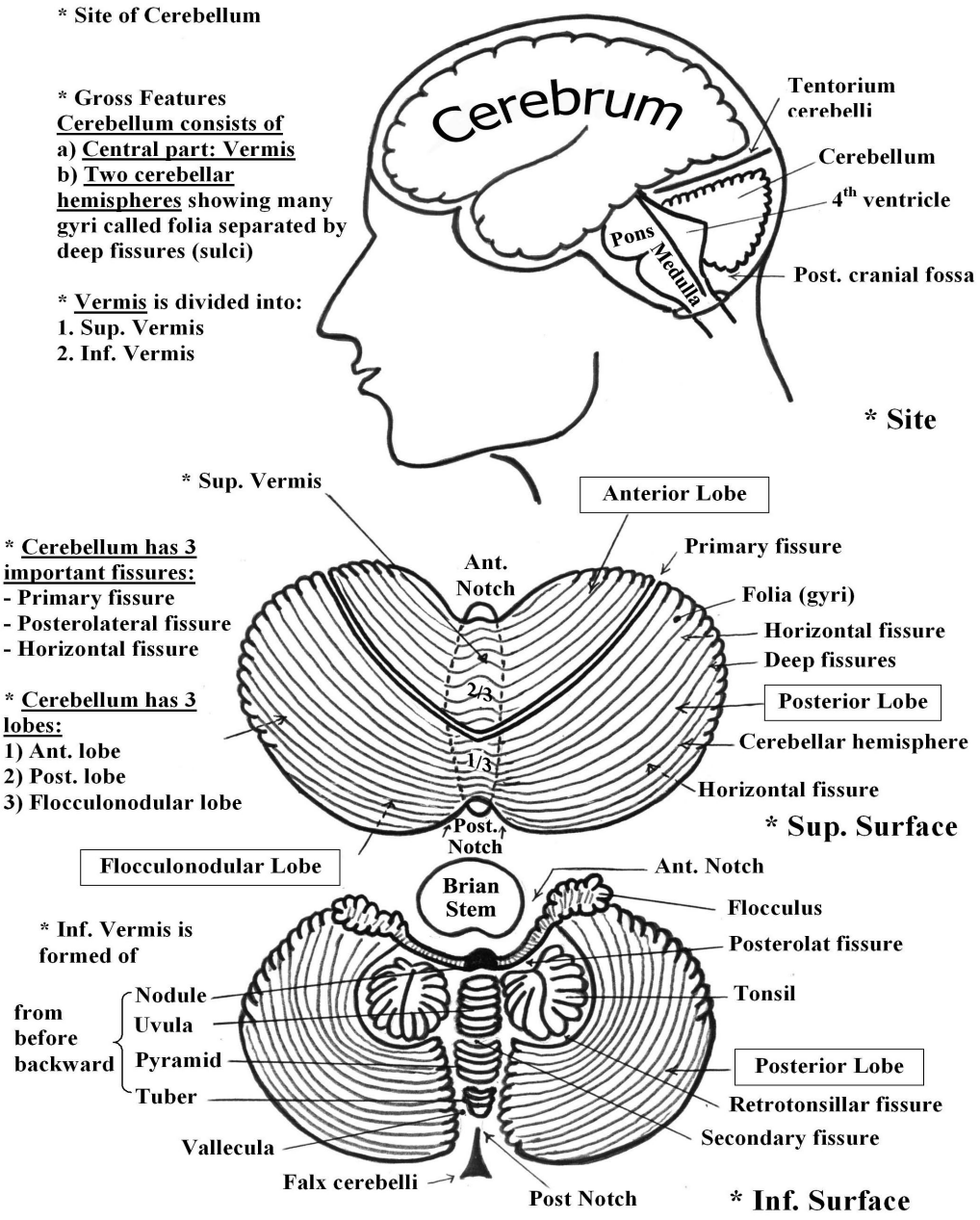


CEREBELLUM

★ The cerebellum lies in the lower part of **posterior cranial fossa** and is related:

a- Above: **To the** tentorium cerebelli **separating the cerebellum from the occipital lobes of cerebral hemispheres.**

b- In front: **To the back of** pons and medulla **being separated from them by the cavity of the** 4th ventricle**.**



★ It has **6 cerebellar peduncles** (3 on each side), connecting the cerebellum to the brain stem.

★ **Subdivisions of the cerebellum:**

I) Anatomical division:

- The **true anatomical division** of the cerebellum into **several lobes separated by** deep 2 **transverse fissures**.
- **Fissures:**
  1- **Postero-lateral fissure:** lies on the **inferior** surface. It **separates** the **flocculo-nodular lobe** from the main part of the cerebellum.
  2- **Primary fissure**:
  - **It is a** V**-shaped fissure passing in the** upper surface **of the cerebellum.**
  - **It** divides **the main part of the cerebellum into a** smaller anterior lobe **(in front of the fissure) and a** larger posterior lobe **(behind the fissure).**
- **Lobes:**

1- Flocculo-nodular lobe:

- It consists of **two flocculi** (one on either side) and a median **nodule** connecting them.

2- The anterior lobe: is the area **in front of the primary fissure**.

3- The posterior lobe: is the large area **behind the primary fissure.**

II) Functional division:

1) Archi-cerebellum	2) Paleo-cerebellum	3) Neo-cerebellum
• It is the **flocculo-nodular** lobe	• **It is the anterior lobe**	• **Remaining part of cerebellum**
• It is **Vestibular** part.	• It is the **spinal** part.	• It is **cerebral** part.
• It is connected with **vestibular nuclei** by means of the vestibule-cerebellar and cerebello-vestibular tracts.	• It receives **fibers from the** muscles, joints **the spino-cerebellar tracts** (dorsal and ventral) & **cuneo-cerebellar** fibers.	• It is connected mainly with motor and premotor **cerebral cortex receives impulses** cortico-ponto-cerebellar **pathway.**
• It is concerned with **equilibrium.**	• It is concerned with regulation of **muscle tone and muscle coordination.**	• It is concerned with **planning and control of movements.**