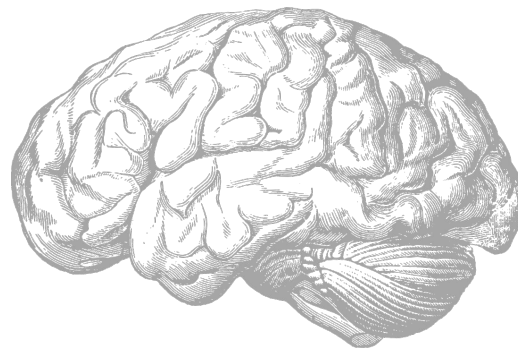




Anatomy of Brainstem

CNS Block



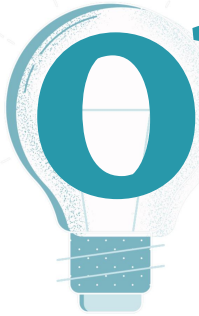





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- ◆ Drs' Notes
- ◆ Important
- ◆ Extra info

[The Editing File](#)



Objectives

-  List the **components** of brainstem.
-  Describe the **site** of brainstem.
-  Describe the **relations** between components of brainstem & their **relations** to cerebellum.
-  Describe the **external features** of both ventral dorsal surfaces of brainstem.
-  List **cranial nerves** emerging from brainstem.
-  Describe the **site of emergence** of each cranial nerve.



You can find helpful video by [Clicking HERE!](#)



You can find Atlas by [Clicking HERE!](#)

Development of Brain

The brain develops from the **cranial part of neural tube**. The cranial part divides into 3 parts:

Forebrain

Subdivides into:

Telencephalon

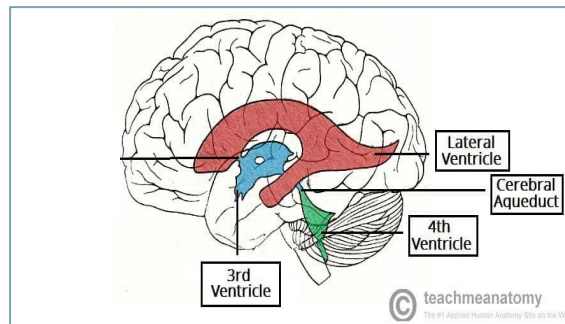
Two cerebral hemispheres (cavities: 2 lateral ventricles)

Diencephalon

(Cavity: 3rd ventricle):
Thalamus, hypothalamus, epithalamus, subthalamus

Midbrain

(Cavity: cerebral aqueduct)



Hindbrain

(Cavity: 4th ventricle)

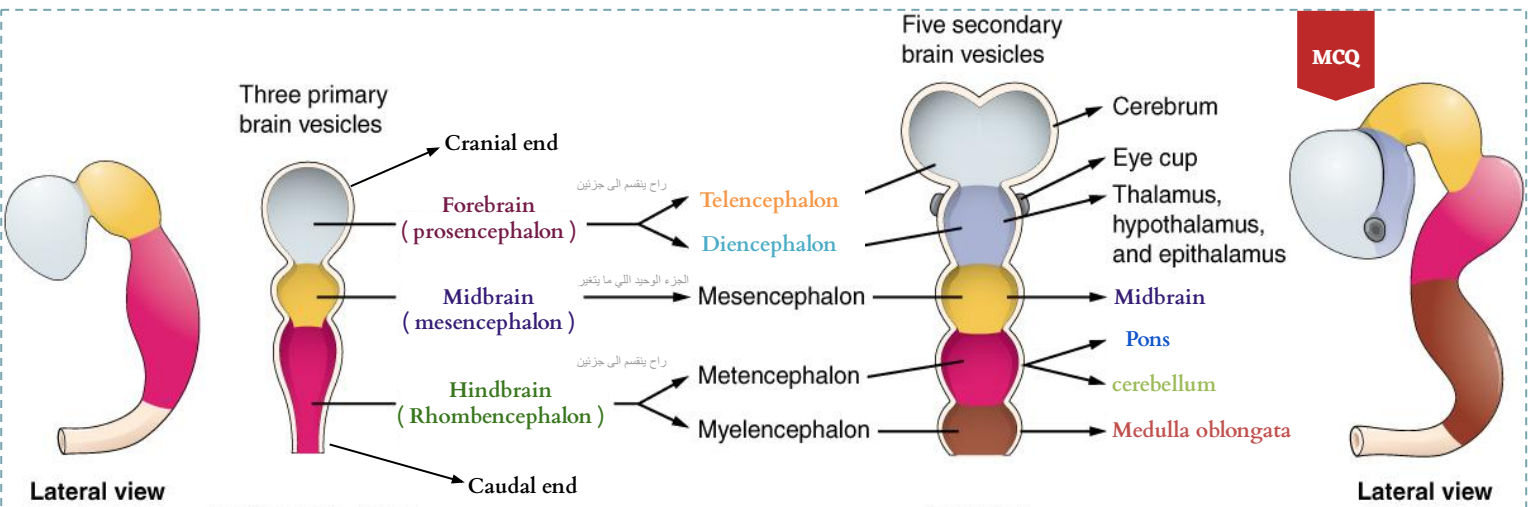
Subdivides into:

Pons

Cerebellum

Medulla oblongata

Same embryological origin



Brainstem

The brainstem is the region of the brain that **connects** the cerebrum of brain to the spinal cord and cerebellum

Site

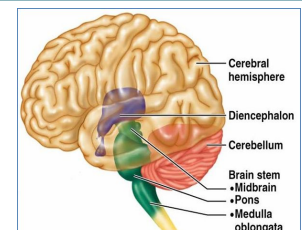
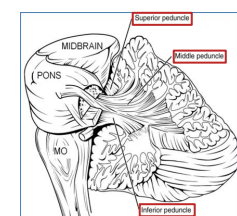
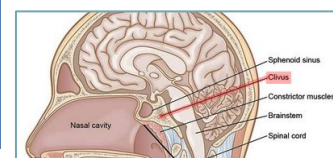
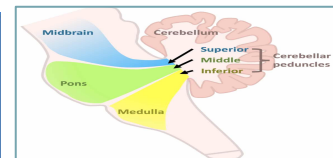
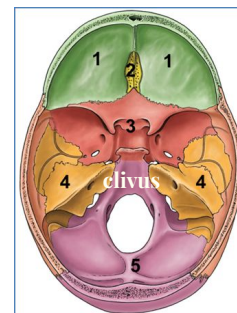
It lies on the basilar part of occipital bone (clivus).

Parts

From above downwards: **Midbrain, pons & medulla oblongata**

Connection with cerebellum

Each part of brainstem is connected to cerebellum by **cerebellar peduncles/fibers** (superior, middle & inferior).



Function of Brainstem

Pathway of tracts between cerebral cortex & spinal cord.

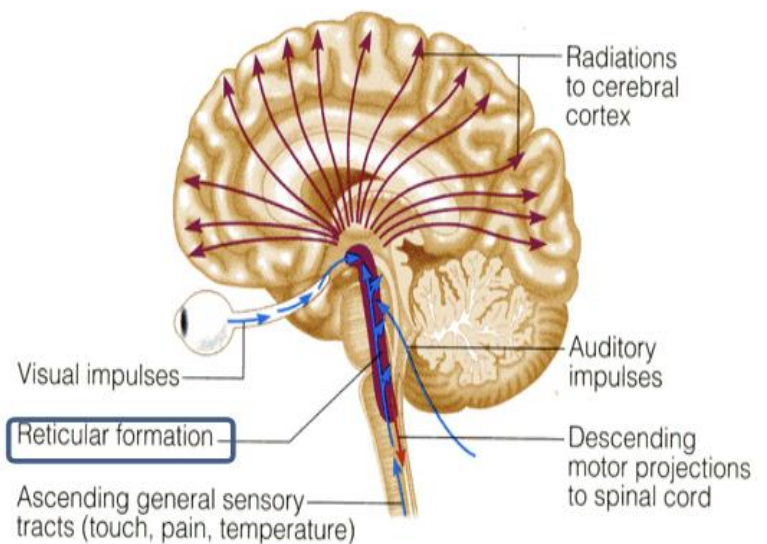
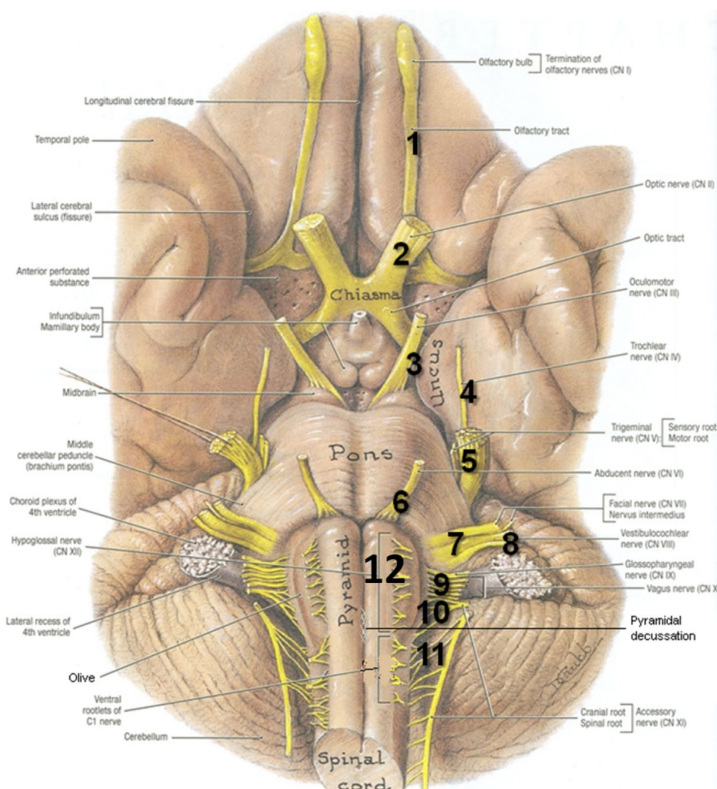
Site of origin of nuclei of cranial nerves (from 3rd to 12th).

Site of emergence of cranial nerves (from 3rd to 12th).

بمعنى أن تظهر وتطلع في brainstem

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.

- A vehicle for sensory information.



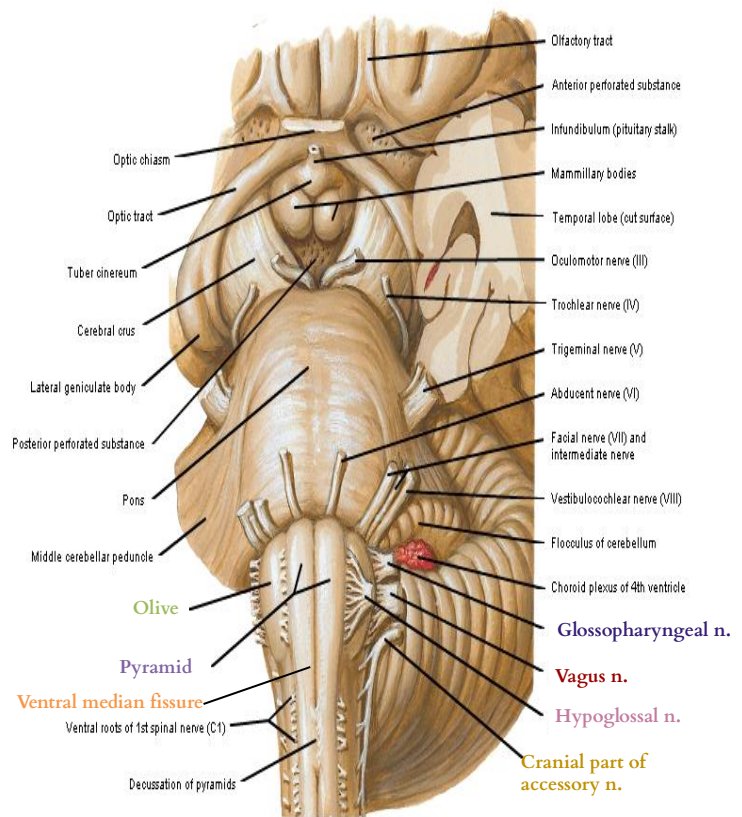
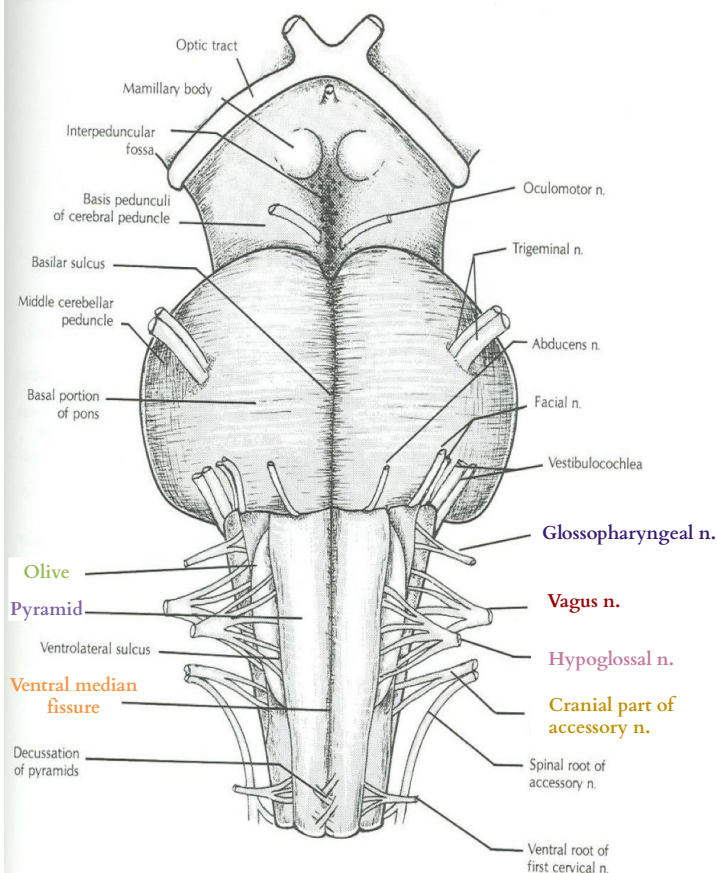
Ventral Surface of Medulla

Ventral median fissure

- Continuation of ventral medial fissure and divides the medulla into 2 halves.
- Its lower part is marked by **decussation** of most of pyramidal (corticospinal) fibers (75%–90%).

Pyramid

- It lies on either side of ventral median fissure.
- It is an elevation produced by corticospinal tract.
- These pyramids are **descending motor fibers**.



Olive

- It lies lateral to the pyramid.
- It is an elevation produced by inferior olivary nucleus (important in control of movement).

Nerves emerging from medulla

4 Nerves :

- **Hypoglossal (12th)**: from sulcus between pyramid and olive.
- **Glossopharyngeal (9th), vagus (10th), cranial part of accessory (11th)**: from sulcus dorsolateral to olive (from above downwards)

Dorsal Surface of Medulla

The features differ in the caudal part (**closed medulla**) and the cranial part (**open medulla**).

Closed medulla
(Caudal)

Cavity: central canal, is composed of:

Dorsal median sulcus: divides the closed medulla into 2 halves

Fasciculus gracilis: on either side of dorsal median sulcus

Gracile tubercle: an elevation produced at the upper part of fasciculus gracilis, marks **the site of gracile nucleus**

Fasciculus cuneatus: on either side of fasciculus gracilis

Cuneate tubercle: an elevation produced at the upper part of fasciculus cuneatus, marks the site of **cuneate nucleus**

Opened medulla
(Rostral)

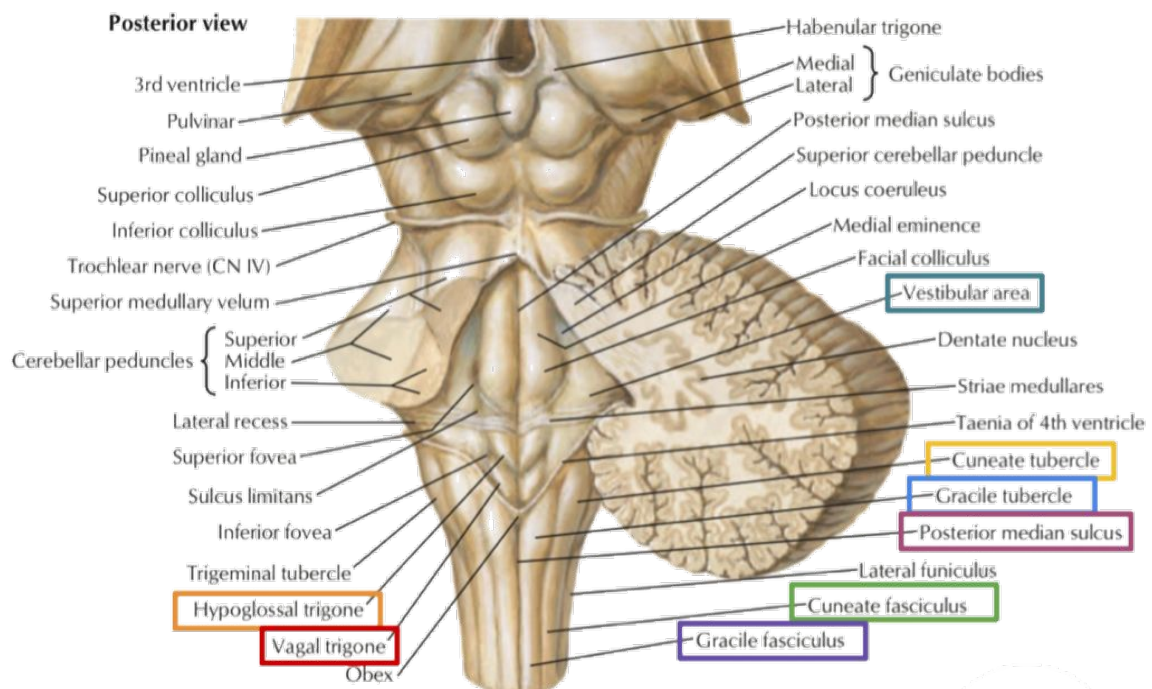
Cavity: 4th ventricle

On either side, an inverted V-shaped sulcus divides the area into 3 parts (from medial to lateral):

Hypoglossal triangle: overlies hypoglossal nucleus.

Vagal triangle: overlies dorsal vagal nucleus.

Vestibular area: overlies vestibular nuclei.



Ventral Surface of Pons

Basilar sulcus

Divides the pons into 2 halves, occupied by **basilar artery**.

Transverse pontine (pontocerebellar) Fibers

Originate from **pontine nuclei**, cross the midline & pass through the **contralateral** middle cerebellar peduncle to enter the **opposite** cerebellar hemisphere. The pontocerebellar fibers are the second order neuron fibers of the corticopontocerebellar tracts that cross to the other side of the pons and run within the middle cerebellar peduncles, from the pons to the contralateral cerebellum

Nerves emerging from pons

Trigeminal (5th)

from the middle of ventrolateral aspect of pons, as 2 roots: a small medial motor root & a large lateral sensory root

Abducent (6th)

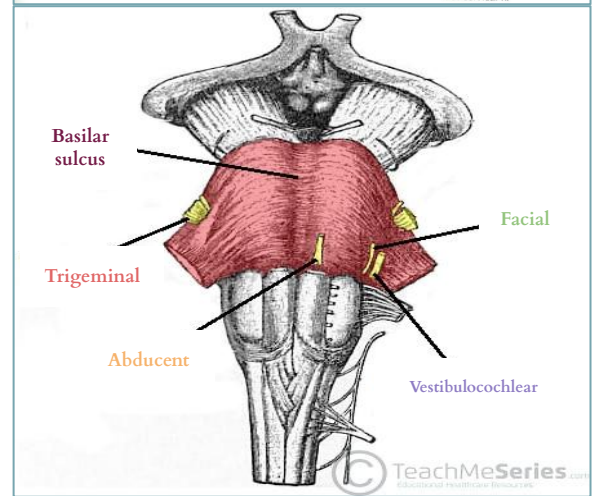
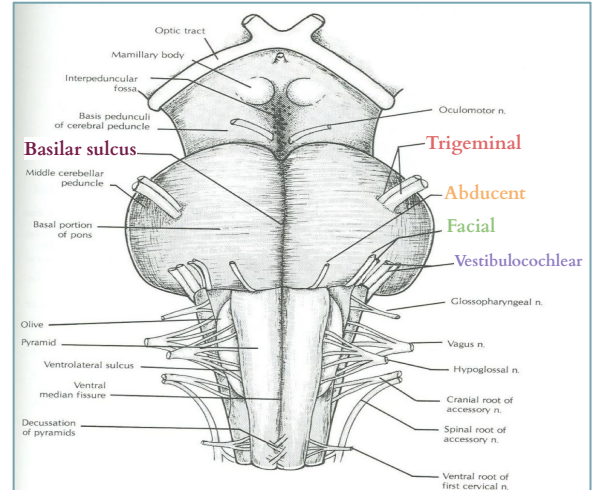
at **junction/sulcus** between pons & pyramid

Facial (7th)

at cerebellopontine angle (junction between medulla, pons & cerebellum). Both nerves emerge as 2 roots: from medial to lateral:

motor root of 7th, sensory root of 7th, vestibular part of 8th & cochlear part of 8th.

Vestibulocochlear (8th)



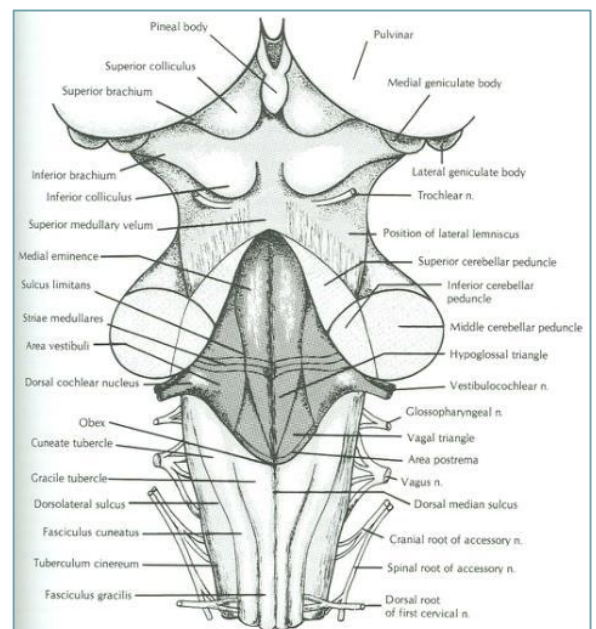
Dorsal Surface of Pons

The dorsal surfaces of open medulla and pons lie in the caudal 1/3rd and the rostral 2/3rd of the floor of the 4th ventricle respectively.

Separated from open medulla by an imaginary line passing between the margins of middle cerebellar peduncle.

On either side of median sulcus, it divides into 2 parts (from medial to lateral):

- Medial eminence & facial colliculus: overlies abducent (VI) nucleus.
- Vestibular area : overlies vestibular nuclei



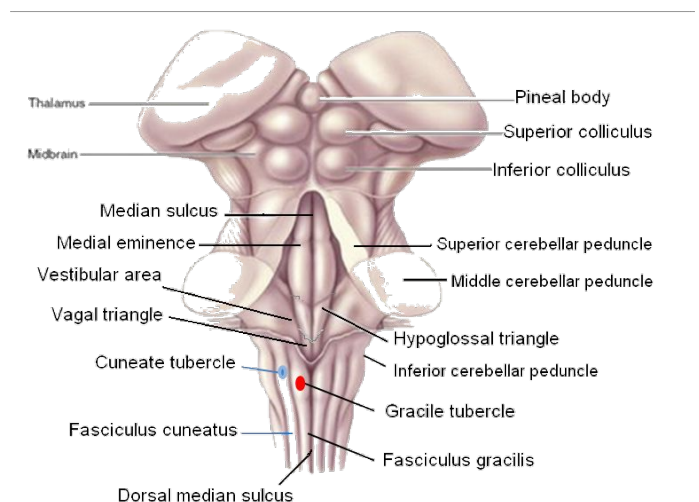
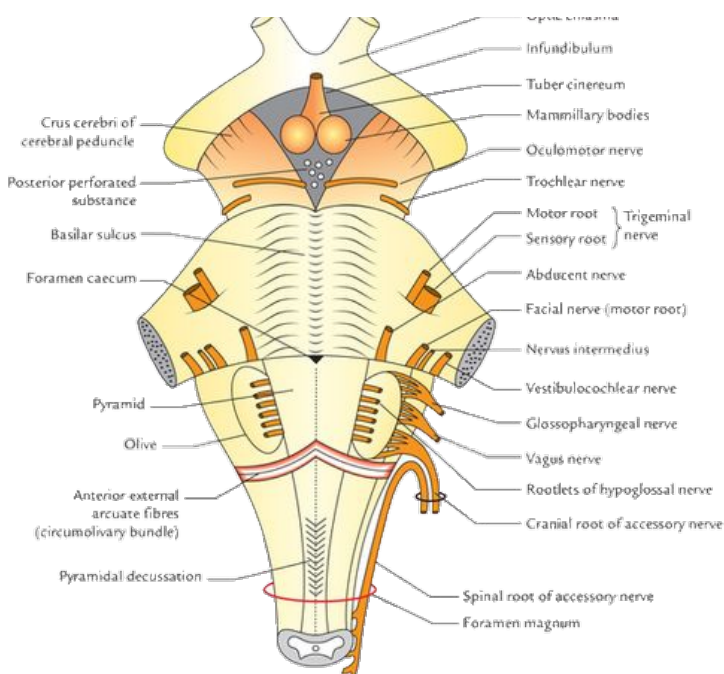
Midbrain

Ventral Surface:





- It is formed of a large column of **descending** fibers (**crus cerebri** or **basis pedunculi**), on either side, separated by a depression called the **interpeduncular fossa**.
- Nerve emerging from Midbrain (one):
 - **Oculomotor (3rd)**: from medial aspect of crus cerebri.

Dorsal Surface:

- Marked by 4 elevations:
 - Two **superior colliculi**: concerned with **visual reflexes**
 - Two **inferior colliculi**: forms part of **auditory pathway**
- Nerve emerging from Midbrain (one):
 - **Trochlear (4th)**: just caudal to inferior colliculus (The only cranial nerve emerging from dorsal surface of brainstem)



Summary

-  The brainstem is composed (from above downwards) of midbrain, pons & medulla oblongata which are continuous with each other, with diencephalon above & with spinal cord below.
-  The brainstem is connected with cerebellum through three pair of cerebellar peduncles.
-  The brainstem is the site of cranial nuclei, the pathway of important ascending & descending tracts & the site of emergence of cranial nerves (from 3rd to 12th).
-  Cranial nerves (with the exception of 4th) emerge from ventral surface of brainstem.

Questions

Q1. Which Cranial Cavity does the Brainstem lie in?

The posterior cranial fossa.

Q2. Embryologically, which 2 Vesicles of the Neural Tube give rise to the Brainstem?

The mesencephalon (the midbrain), the rhombencephalon (the hindbrain).

Q3. What are the Cavities (of the Ventricular System) which lie within the Brainstem?

The cerebral aqueduct, the 4th ventricle (IV ventricle).

Q4. What is the function of the Medullary Pyramids?

They are descending motor fibers.

Q5. What is the function of the Decussation of the Pyramids?

This is where the descending motor fibers cross over to the contralateral side.

Q6. Is the Inferior part of the Posterior Medulla the "Open" or the "Closed" part?

The closed part.

Q7. What structure does the "Open" part of the Posterior Medulla open onto?

The 4th ventricle (IV ventricle).

MCQs

Q1. Which one of the following cranial nerves emerges from ventral surface of midbrain?

- | | | | |
|---------------------|--------------------|-------------------|-----------------|
| A. Oculomotor (3rd) | B. Trochlear (4th) | C. Abducent (6th) | D. Facial (7th) |
|---------------------|--------------------|-------------------|-----------------|

Q2. Regarding the medulla oblongata, which one of the following is correct?

- | | | | |
|-------------------------------------|--|---|---|
| A. The pyramid is lateral to olive. | B. The hypoglossal nerve is the most lateral nerve emerging from it. | C. The cuneate tubercle is lateral to gracile tubercle. | D. The cerebellum is connected to it by middle cerebellar peduncle. |
|-------------------------------------|--|---|---|

Q3. Which one of the following is the site of the inferior colliculus?

- | | | | |
|---|--|--|--|
| A. In the ventral surface of medulla, lateral to the olive. | B. In the dorsal surface of medulla, medial to the vagal triangle. | C. In the ventral surface of midbrain, lateral to the medial eminence. | D. In the dorsal surface of midbrain, above the trochlear nerve. |
|---|--|--|--|

Q4. are a large column of descending fibers in the Midbrain separated by the interpeduncular fossa.

- | | | | |
|-----------------------|-----------------------|-----------------|----------------------|
| A. Superior colliculi | B. Inferior colliculi | C. Crus cerebri | D. Cerebral aqueduct |
|-----------------------|-----------------------|-----------------|----------------------|

Q5. The cavity of the closed Medulla is:

- | | | | |
|------------------|------------------|------------------|------------------|
| A. Central Canal | B. Median sulcus | C. 3rd ventricle | D. 4th ventricle |
|------------------|------------------|------------------|------------------|

Q6. .CN arises from the junction between the Pons & pyramids.

- | | | | |
|-------------------|-----------------|---------------|--------------------------|
| A. Trigeminal (5) | B. Abducens (6) | C. Facial (7) | D. Vestibulocochlear (8) |
|-------------------|-----------------|---------------|--------------------------|

A1. A A2. C A3. D A4. C A5. A A6. B

FOR ANKI FLASHCARDS





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◆ **Special Thanks to Aleen Alkulyah for the Wonderful Design!**



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