

ANATOMY OF THE BRAIN STEM (EXTERNAL FEATURES)

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10 September 2018

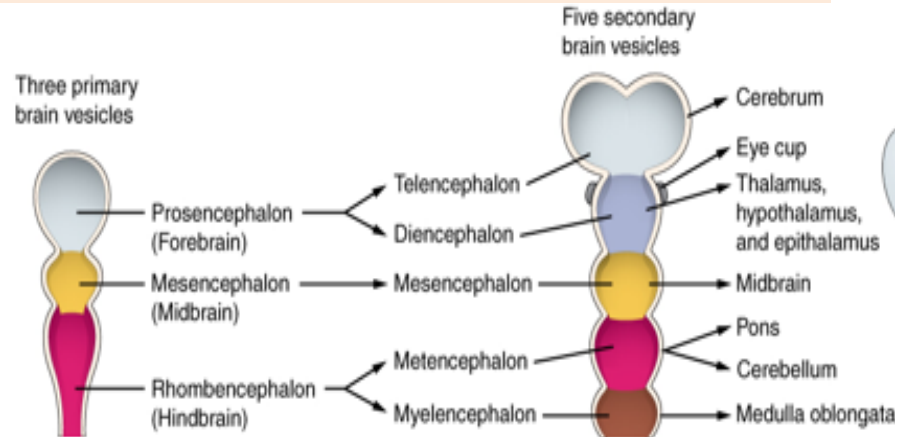
OBJECTIVES

At the end of the lecture, students should:

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

DEVELOPMENT OF BRAIN

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



FOREBRAIN: subdivides into:

1-Telencephalon : Two cerebral hemispheres

(cavities: 2 lateral ventricles)

2-Diencephalon (cavity: 3rd ventricle) :

thalamus, hypothalamus, epithalamus & subthalamus

MIDBRAIN (cavity: cerebral aqueduct).

HINDBRAIN (cavity: 4th ventricle): subdivides into

1-Pons

2-Cerebellum

3- Medulla oblongata

BRAIN STEM

❑ The brainstem is the region of the brain that **connects** the cerebrum with the spinal cord

❑ **SITE:**

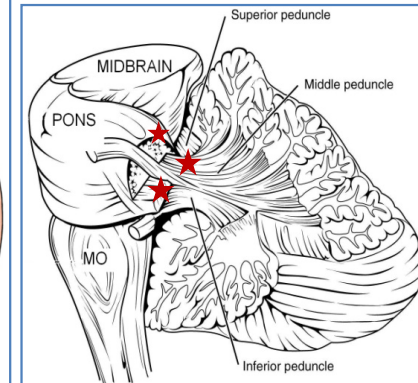
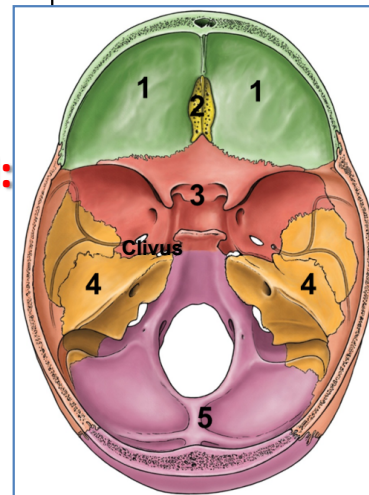
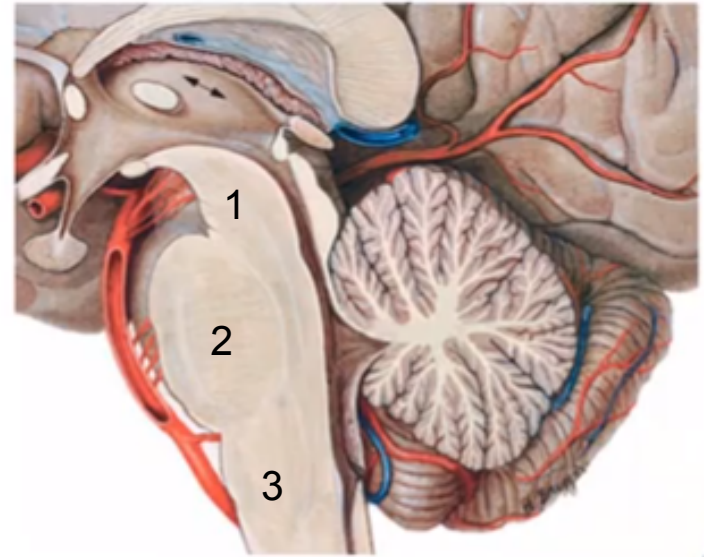
- It lies on the **basilar part of occipital bone (clivus)**

❑ **PARTS:** *From above downwards:*

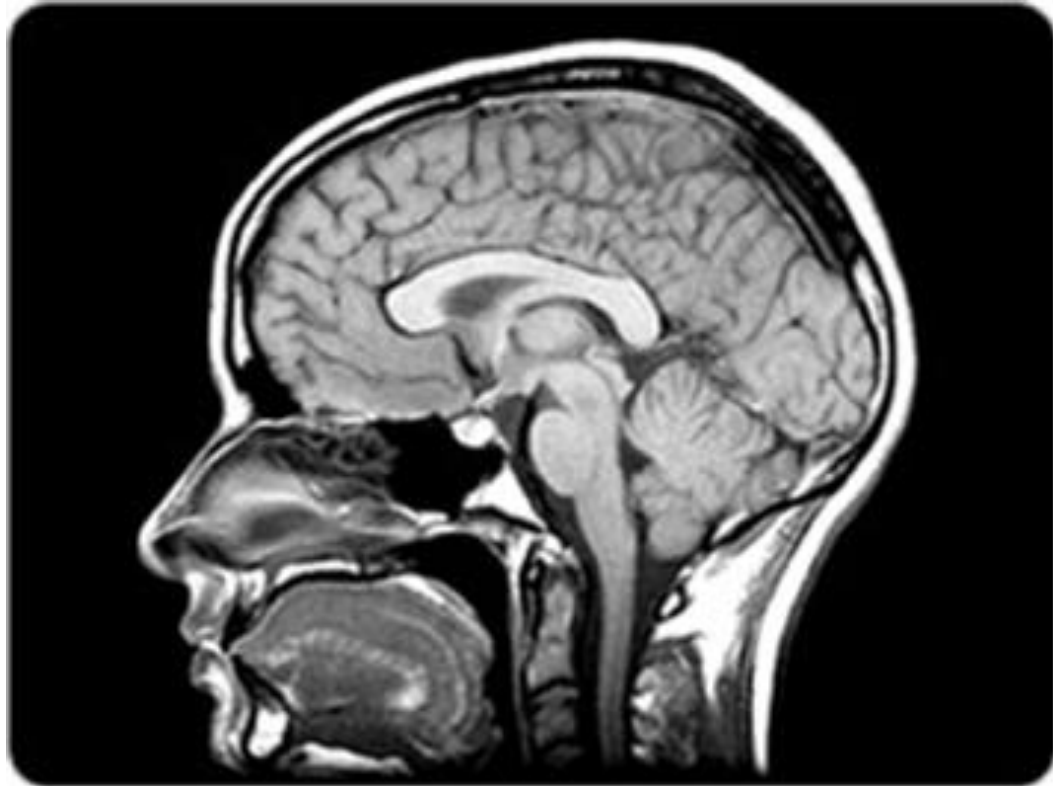
- *Mid brain, pons & medulla oblongata*

❑ **CONNECTIONS WITH CEREBELLUM:**

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

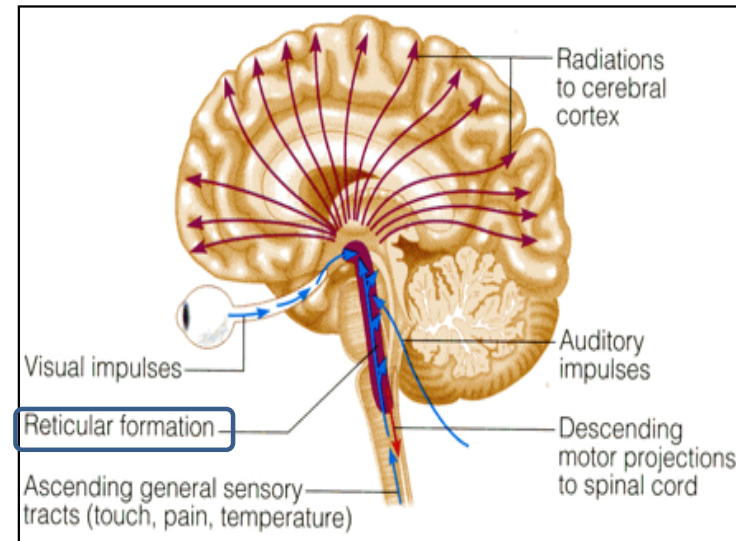
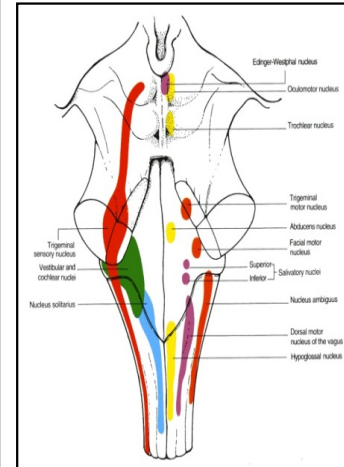
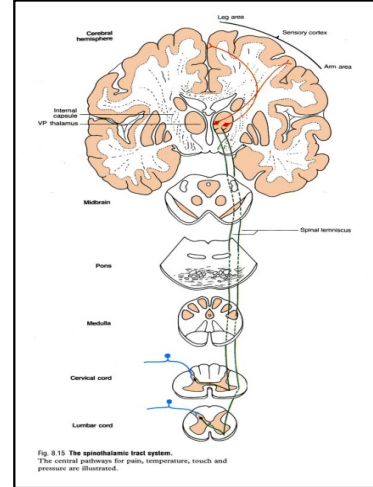


BRAIN STEM PARTS

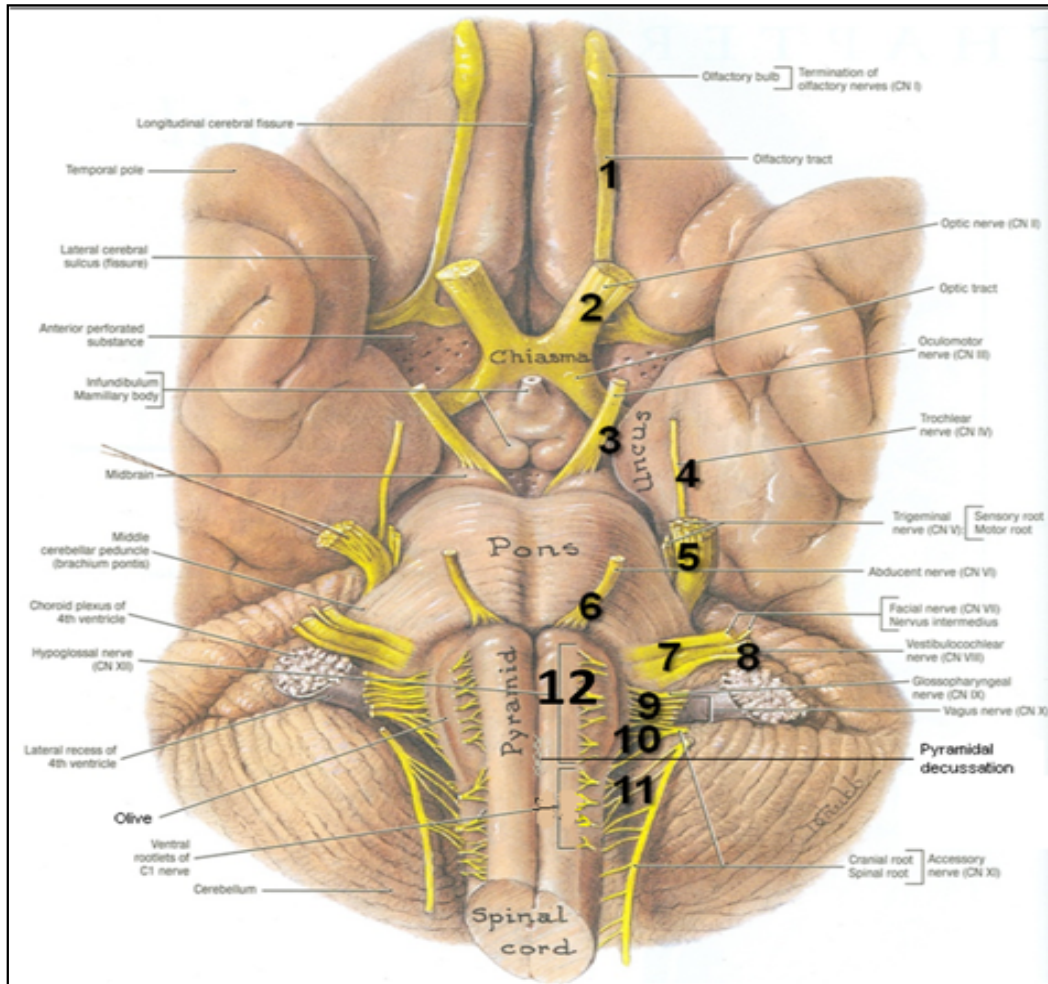


FUNCTIONS OF BRAIN STEM

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**
- **A vehicle for sensory information**



BRAIN – VENTRAL SURFACE



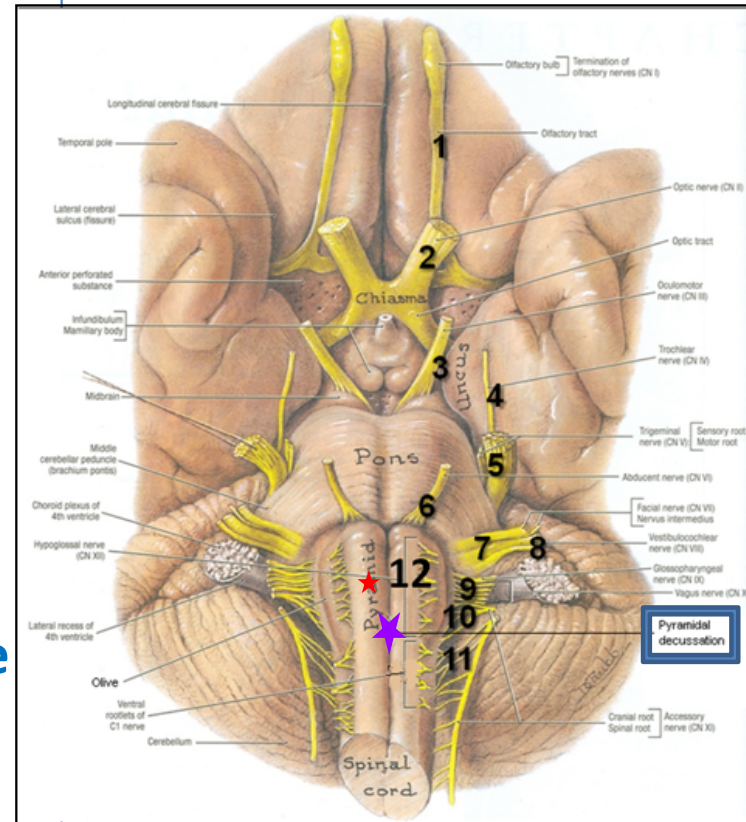
MEDULLA – VENTRAL SURFACE

❑ Ventral median fissure: ★

- Continuation of ventral median fissure of spinal cord
- Divides the medulla into 2 halves
- Its lower part is marked by decussation of most of pyramidal (corticospinal) ★ fibers (75%-90%)

❑ Pyramid: ★

- An elevation, lies on either side of ventral median fissure
- Produced by corticospinal tract
- These are Descending Motor Fibers

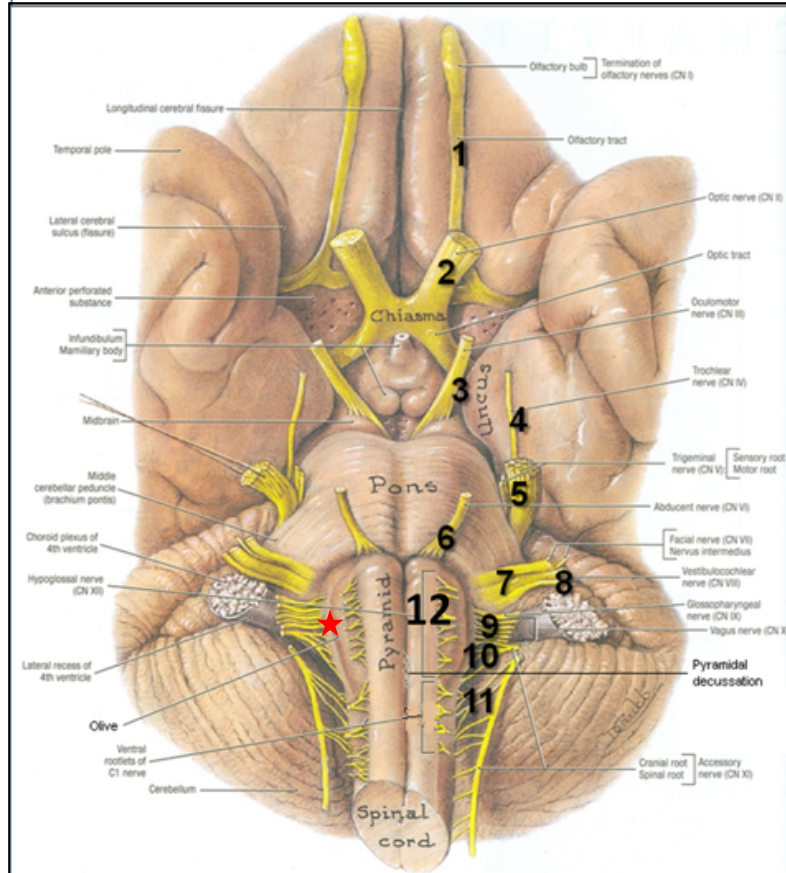


❑ Olive: ★

- An elevation, lies lateral to the pyramid.
- Produced by inferior olivary nucleus (important in control of movement)

❑ Nerves emerging from Medulla (4 nerves):

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



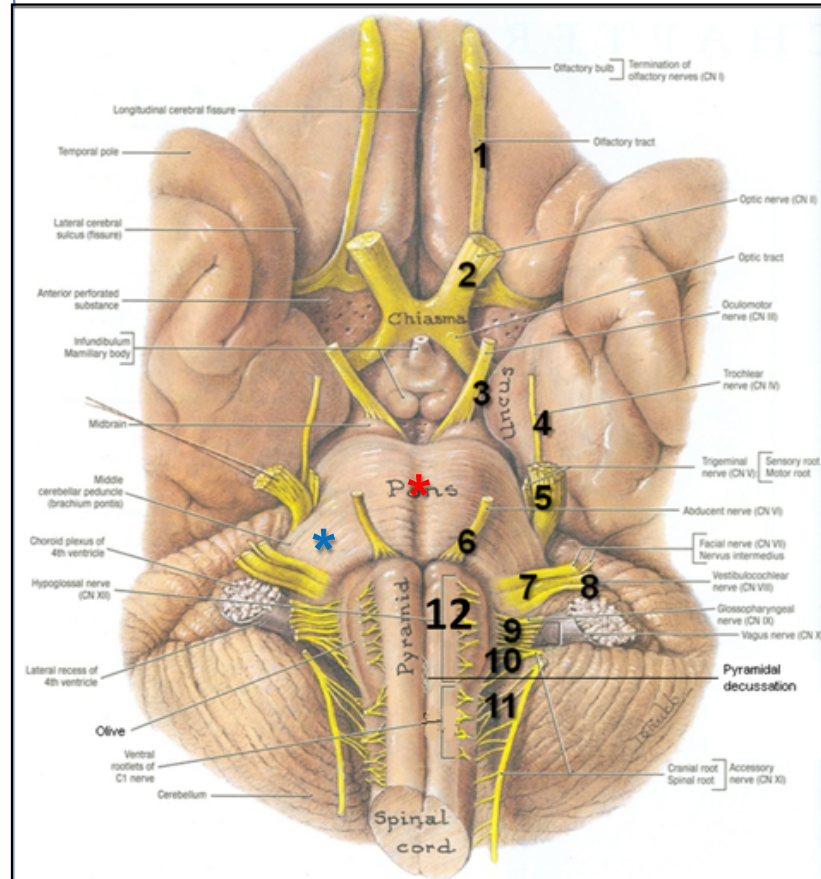
PONS – VENTRAL SURFACE

❑ 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**.



☐ Nerves emerging from Pons (4 nerves):

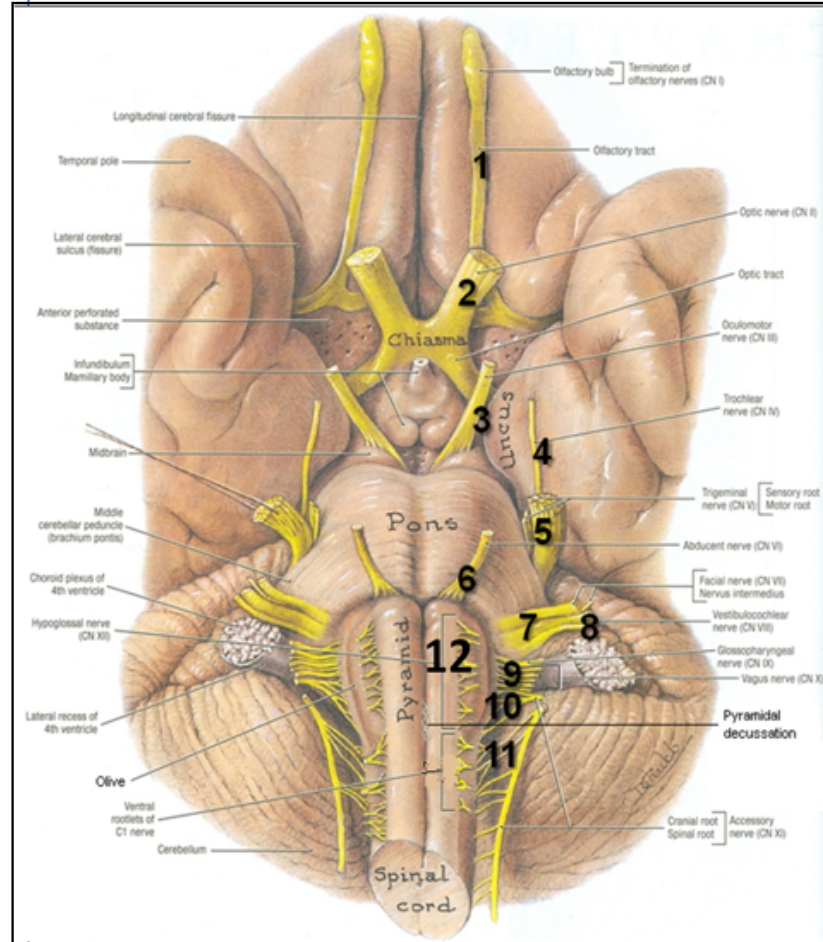
Trigeminal (5th): from the middle of ventrolateral aspect of pons, as 2 roots: a small medial **motor** root & a large lateral **sensory** root

Abducent (6th): from sulcus between pons & pyramid

Facial (7th) & vestibulocochlear (8th): at **cerebellopontine angle** (junction between medulla, pons & cerebellum)

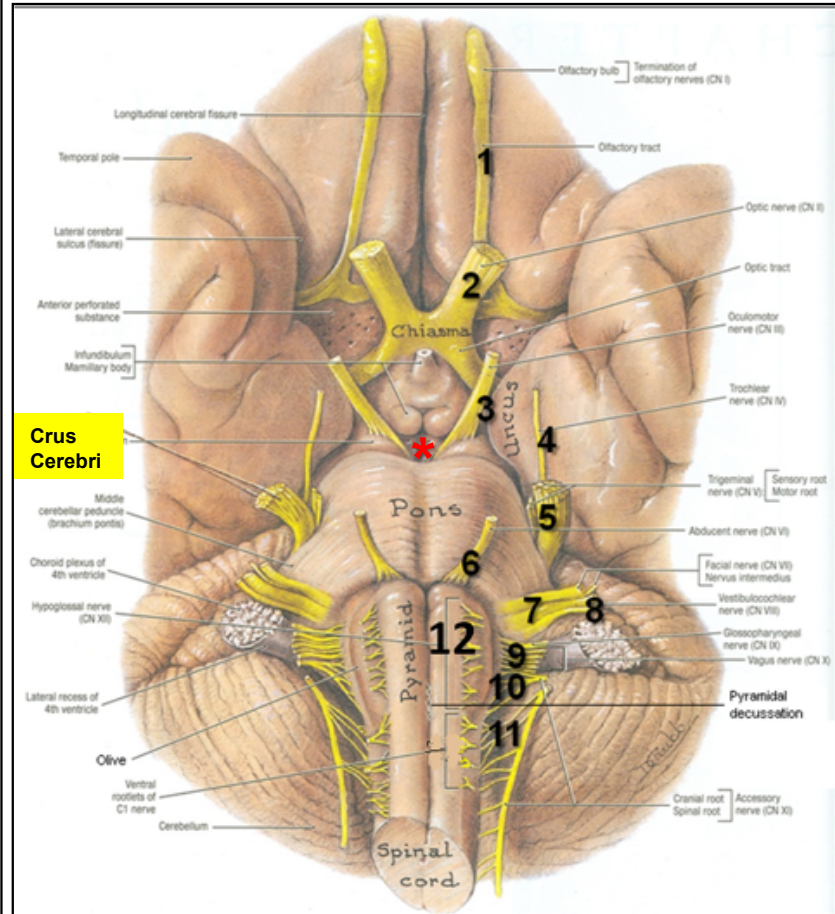
Both nerves emerge as 2 roots: from medial to lateral:

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



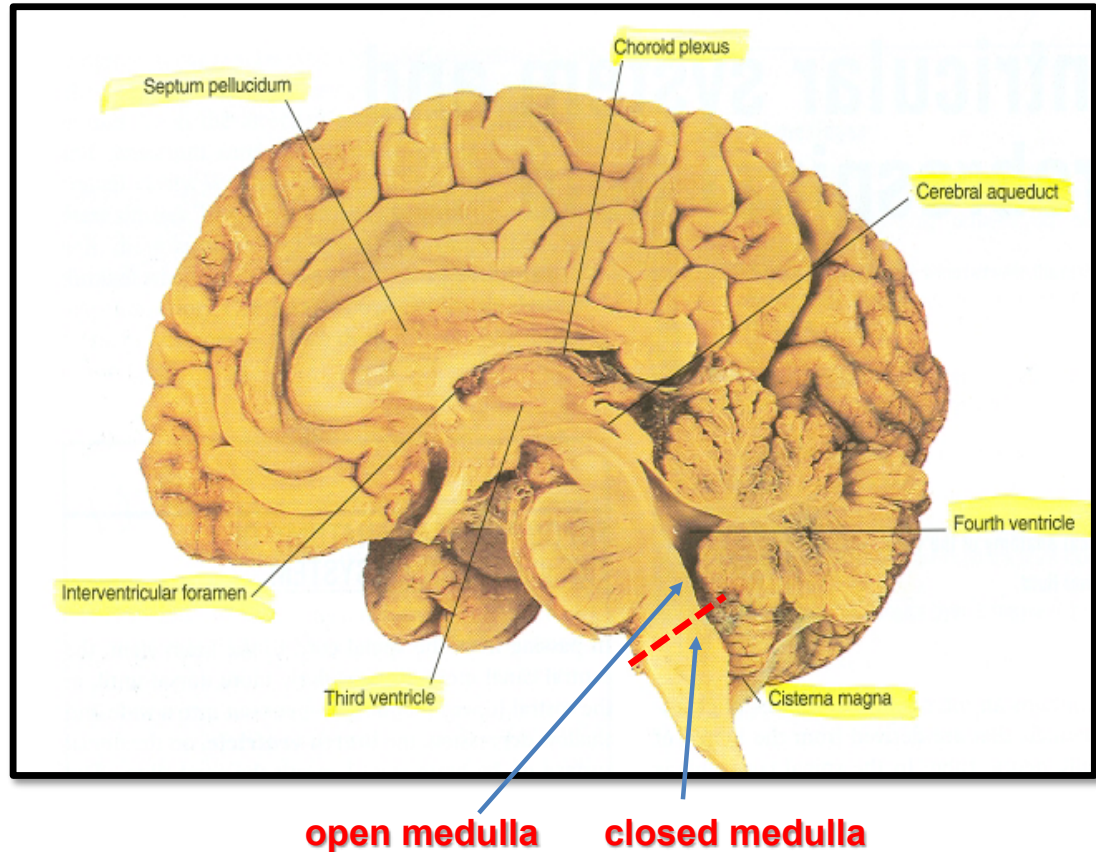
MID BRAIN – VENTRAL SURFACE

- 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):
 - **Occulomotor (3rd):** from medial aspect of crus cerebri.



MEDULLA – DORSAL SURFACE

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

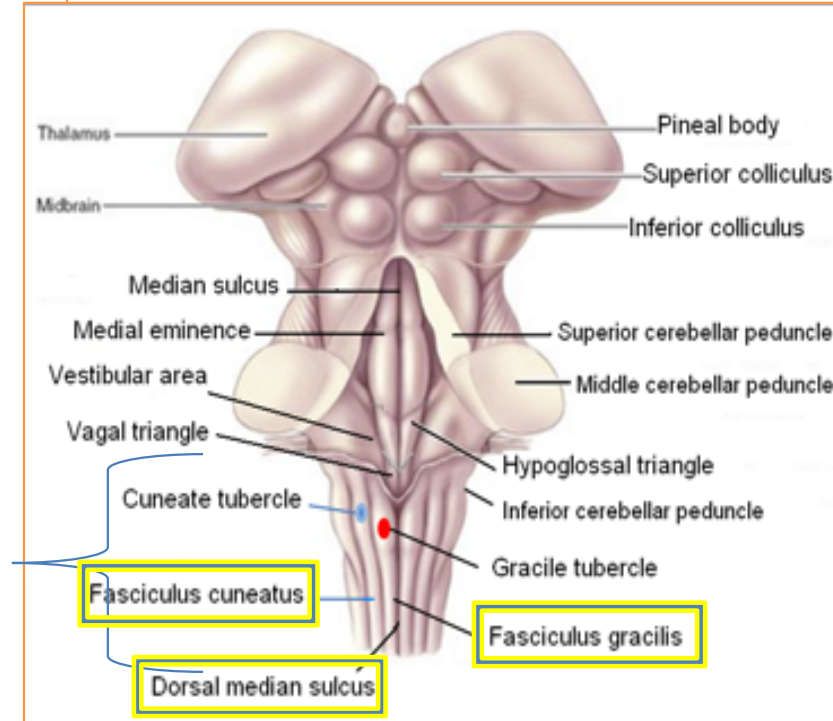


□ Cavity: central canal

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

CLOSED MEDULLA

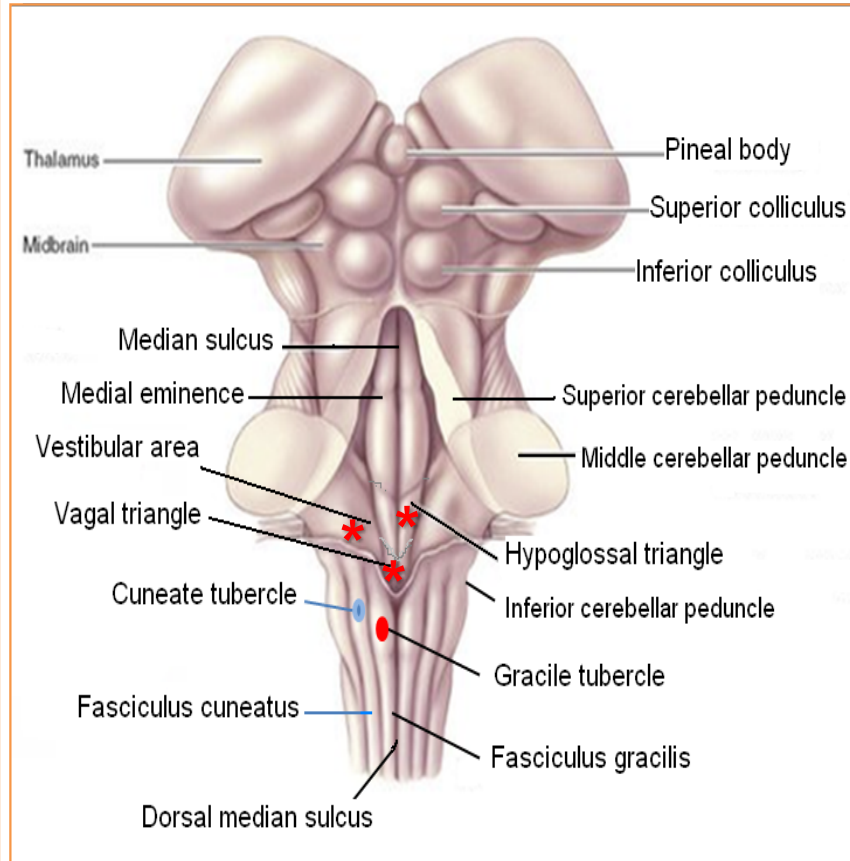


OPEN MEDULLA

□ **Cavity: 4th ventricle**

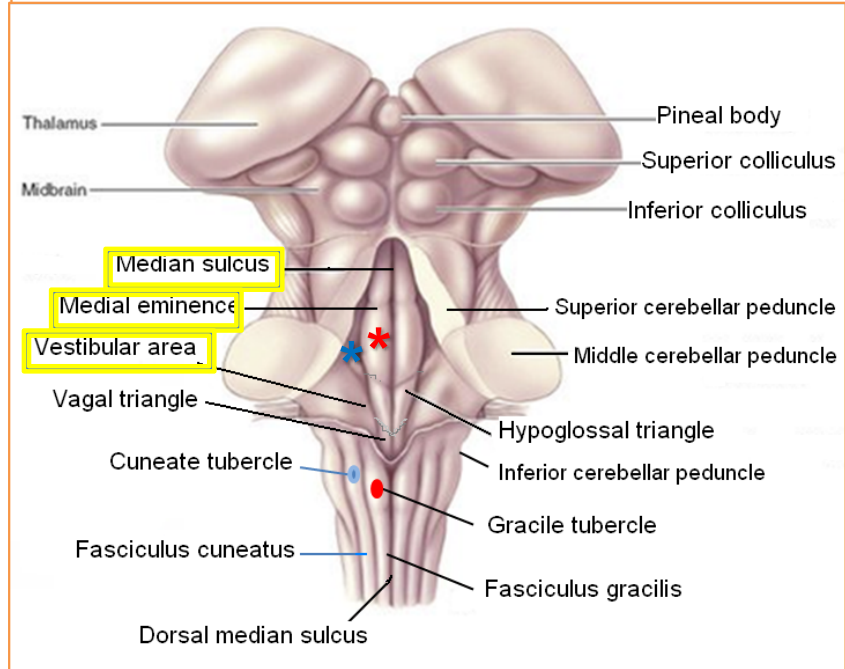
□ On either side, an inverted V-shaped sulcus divides the area into 3 parts (from medial to lateral):

1. **Hypoglossal triangle***: overlies hypoglossal nucleus.
2. **Vagal triangle***: overlies dorsal vagal nucleus.
3. **Vestibular area***: overlies vestibular nuclei.

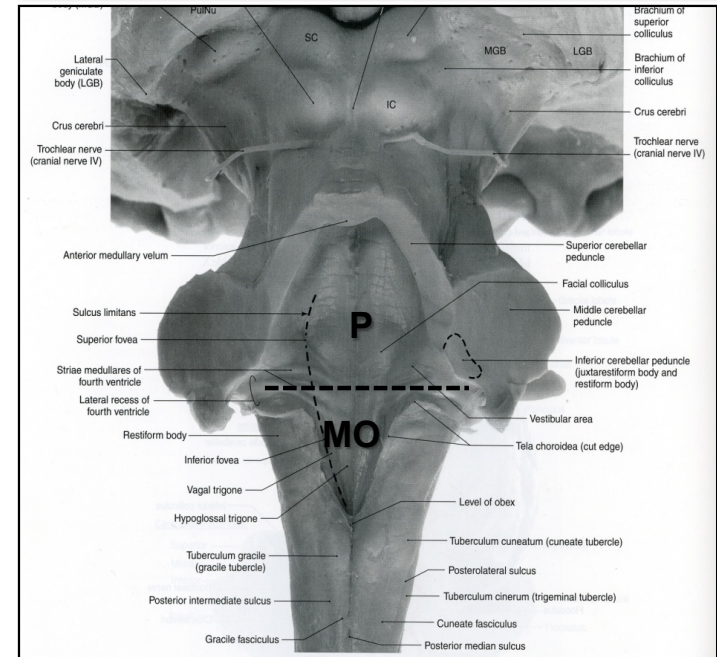
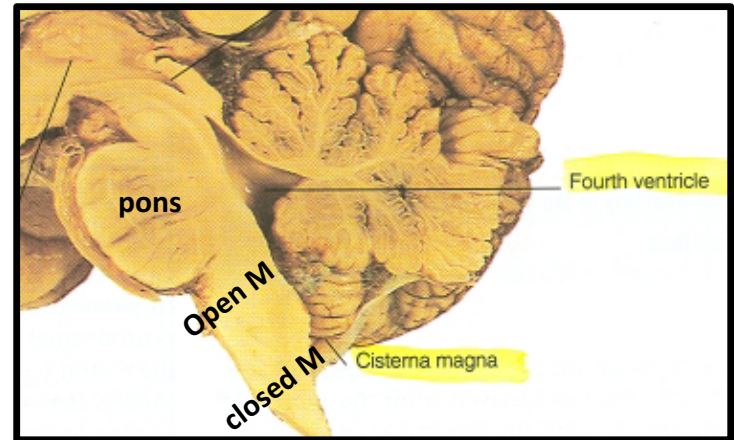


PONS – DORSAL SURFACE

- 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 nucleus.
 - **Vestibular area***: overlies vestibular nuclei.



- 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.



MID BRAIN – DORSAL SURFACE

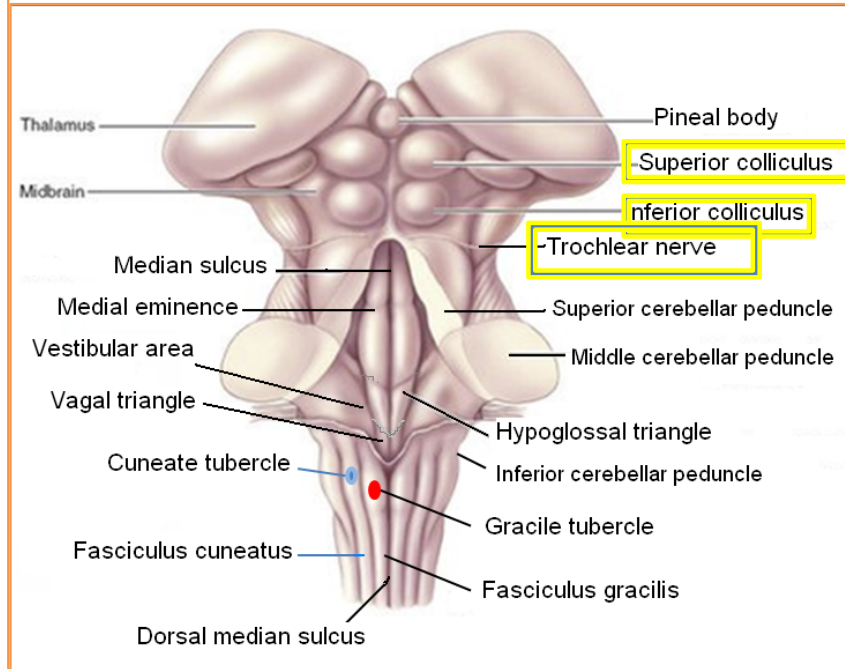
☐ Marked by 4 elevations:

1. **Two superior colliculi:** concerned with **visual reflexes**

2. **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 brain stem**)



SUMMARY

- ❑ The brain stem is composed (*from above downwards*) of: **midbrain, pons & medulla oblongata** which are continuous with each other, **with diencephalon above & with spinal cord below**.
- ❑ The brain stem is **connected with cerebellum** through three pair of cerebellar peduncles.
- ❑ The brain stem **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 brain stem.

Which Cranial Cavity does the Brainstem lie in?

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

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

What is the function of the Medullary Pyramids?

What is the function of the Decussation of the Pyramids?

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

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

The Posterior Cranial Fossa

1. The Mesencephalon (The Midbrain)
2. The Rhombencephalon (The Hindbrain)

1. The Cerebral Aqueduct
2. The 4th Ventricle (IV Ventricle)

These are Descending Motor Fibers

This is where the Descending Motor Fibers cross over to the Contralateral side

The Closed Part

The 4th Ventricle (IV Ventricle)

*Sore Today,
Strong Tomorrow*

THANK YOU