ANATOMY OF THE BRAIN STEM

(EXTERNAL FEATURES)

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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:

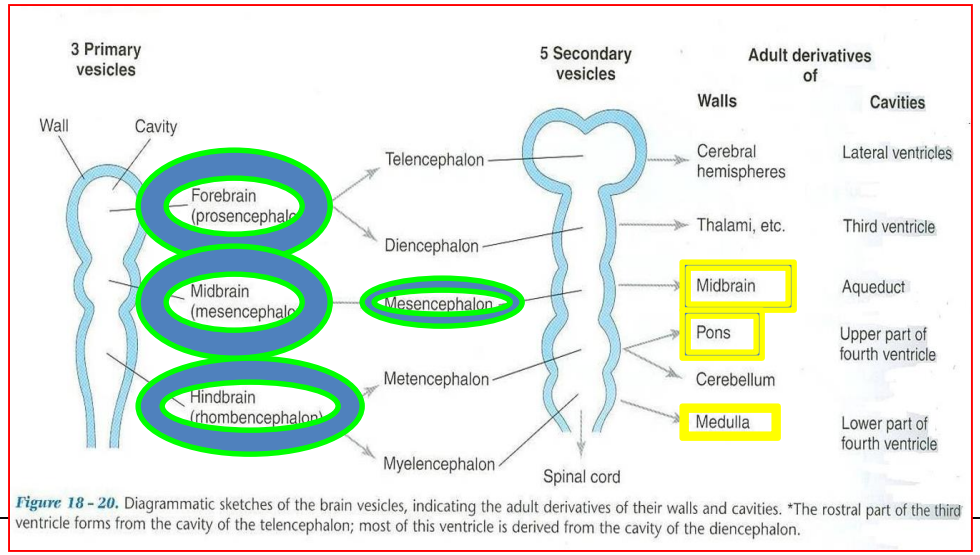


Figure 18 - 20. Diagrammatic sketches of the brain vesicles, indicating the adult derivatives of their walls and cavities. *The rostral part of the third ventricle forms from the cavity of the telencephalon; most of this ventricle is derived from the cavity of the diencephalon.

FOREBRAIN: subdivides into:

1-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

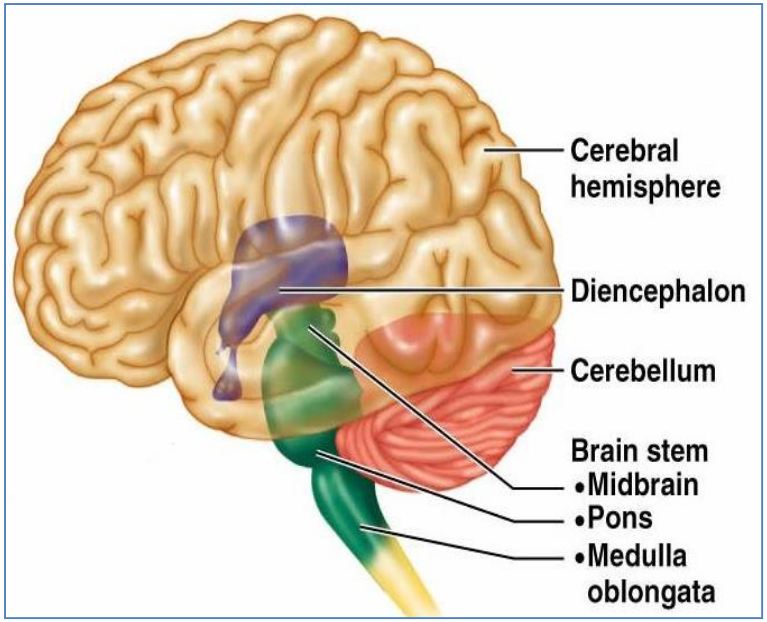
1-Pons.

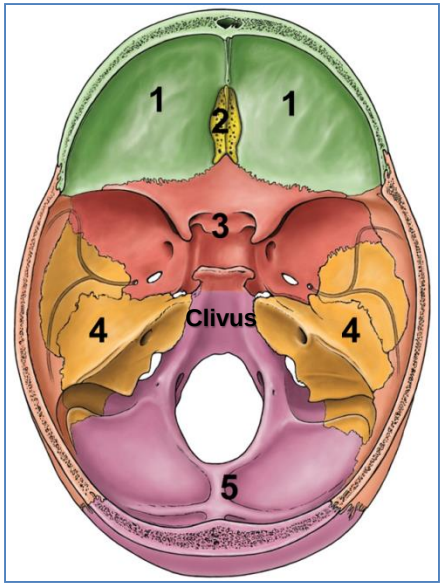
2-Cerebellum.

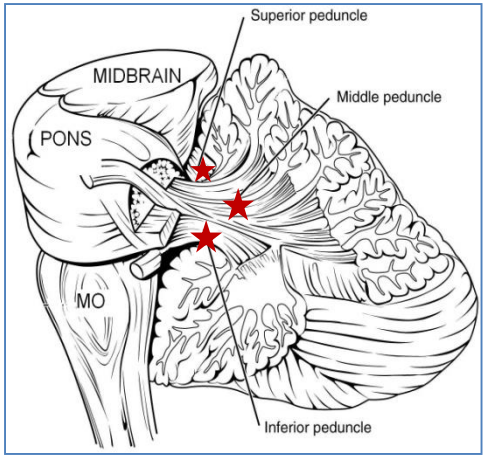
3- Medulla oblongata.

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).







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.***

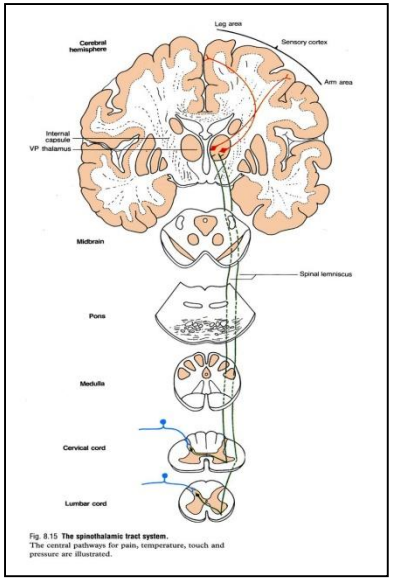
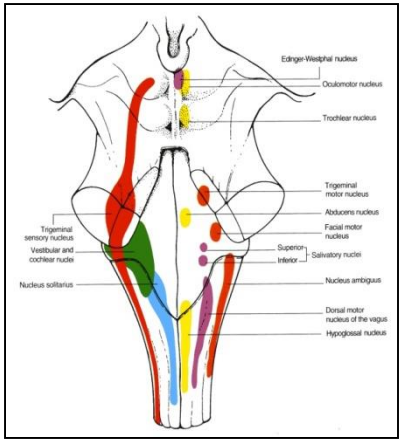
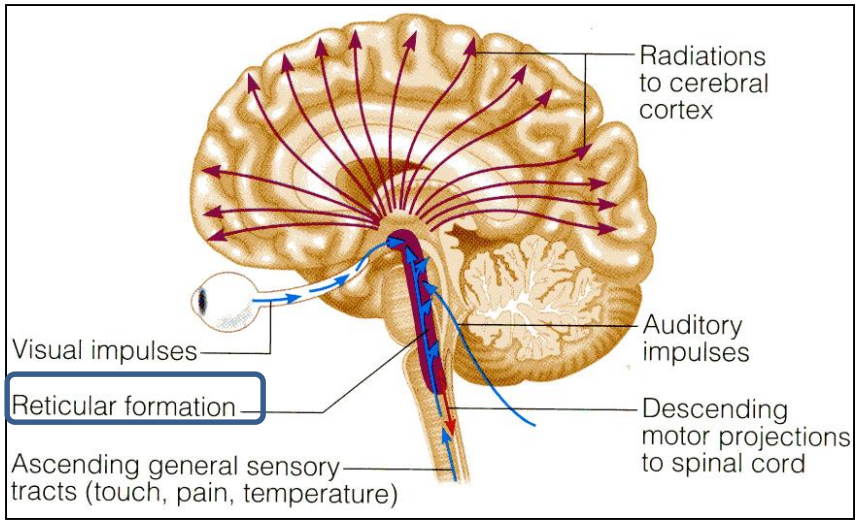
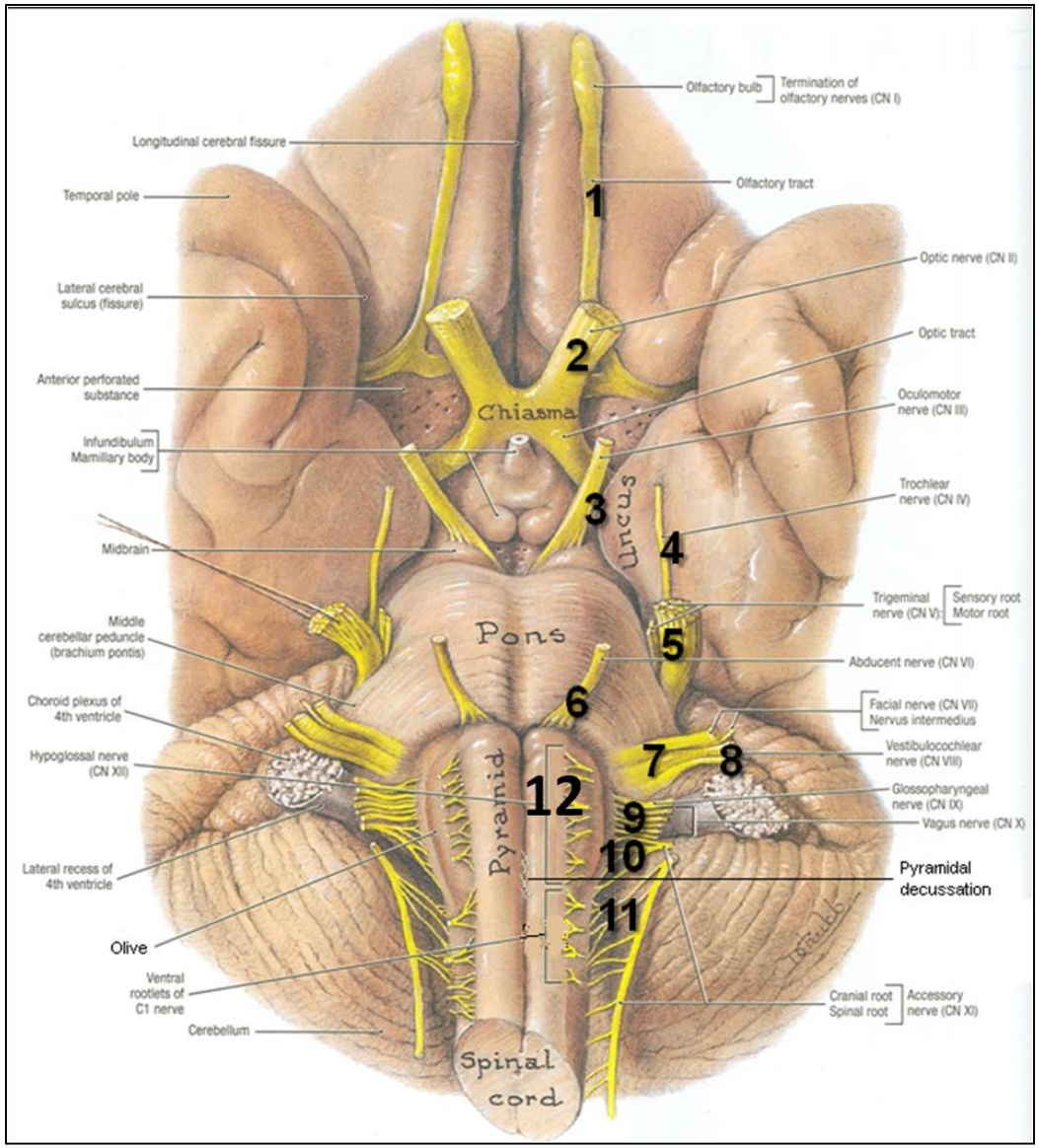


Fig. 8.15 **The spinothalamic tract system.** The central pathways for pain, temperature, touch and pressure are illustrated.



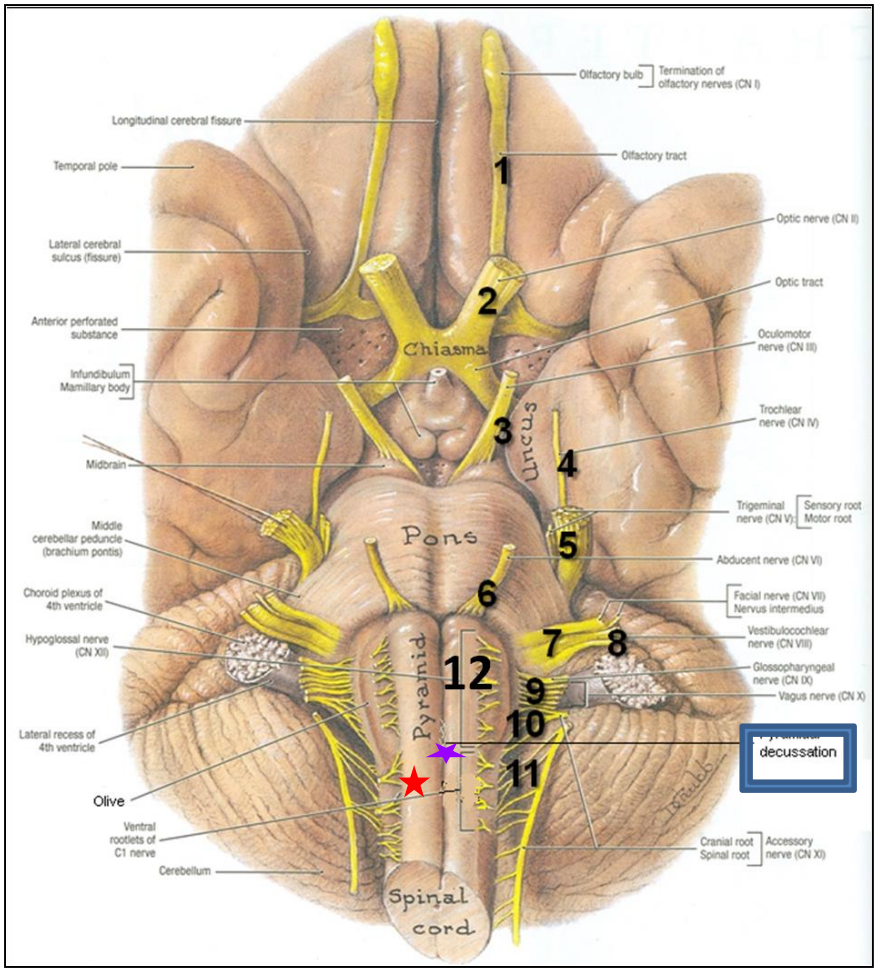


BRAIN – VENTRAL SURFACE

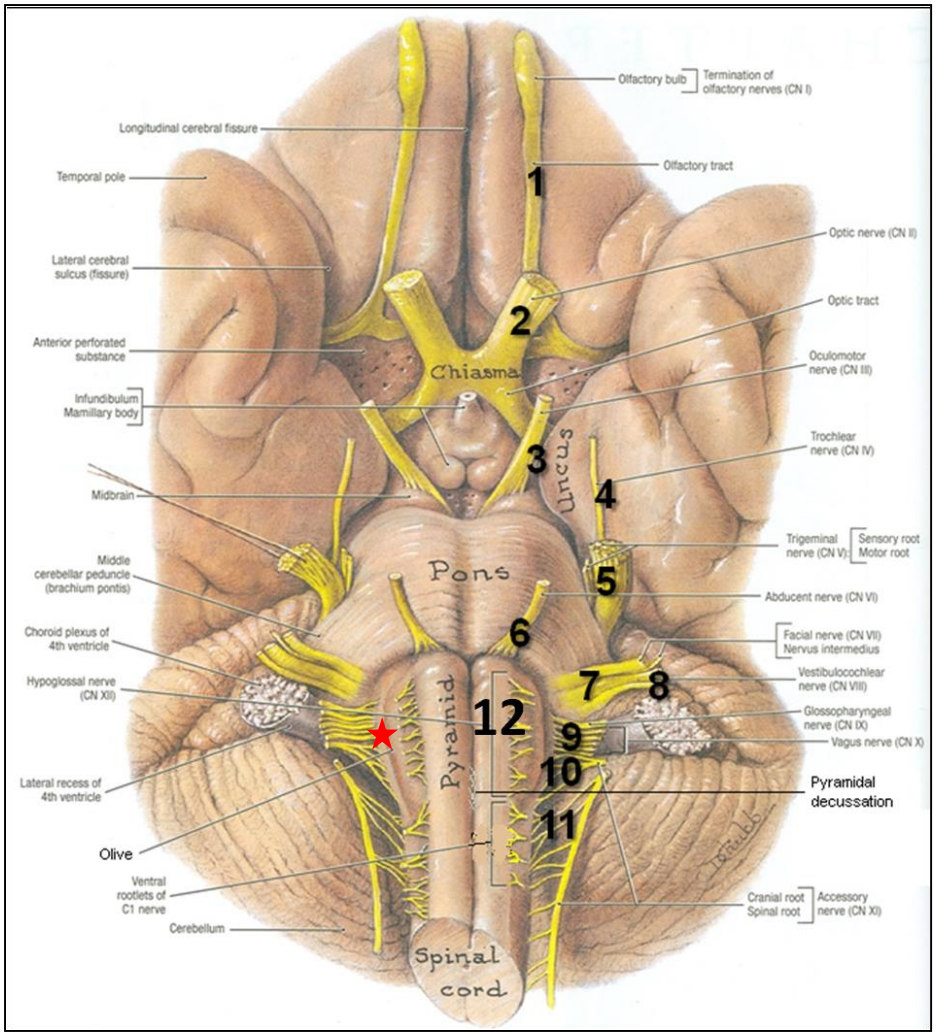


MEDULLA – VENTRAL SURFACE

- **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.

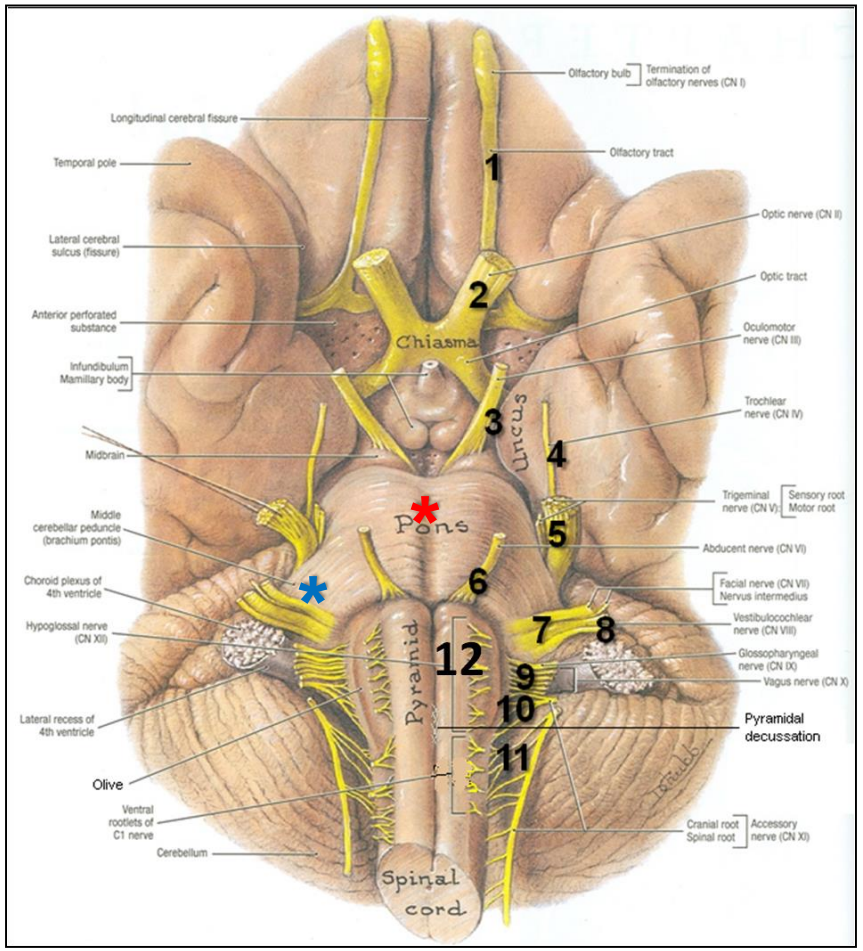


- **Olive:** ★
- An elevation, lies lateral to the pyramid.
- Produced by inferior olivary nucleus (important in control of movement).
- **Nerves emerging from Medulla (4 nerves):**
- Hypoglossal (12th): from sulcus between pyramid & olive
- Glossopharyngeal (9th), vagus (10th) & cranial part of accessory (11th): from sulcus dorsolateral to olive (from above downwards)



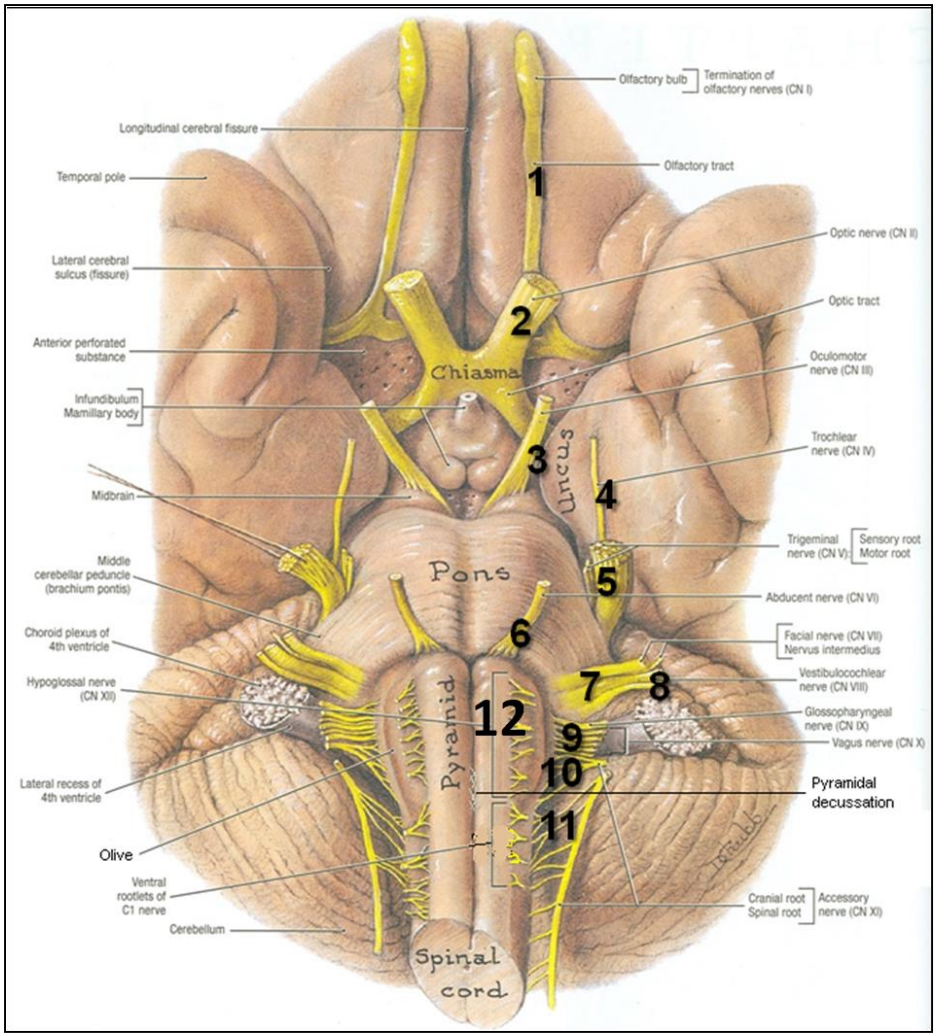
PONS – VENTRAL SURFACE

- **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.



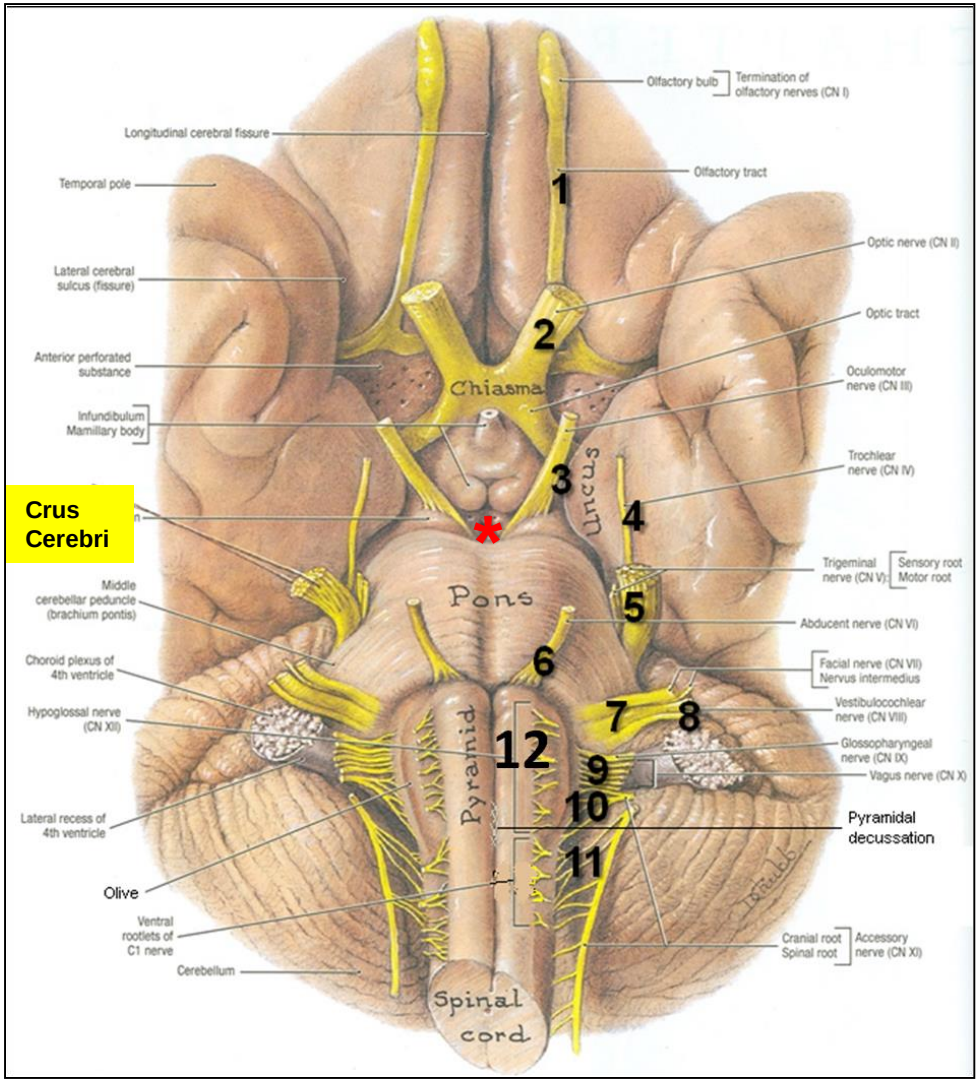
- **Nerves emerging from Pons (4 nerves):**

- **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**



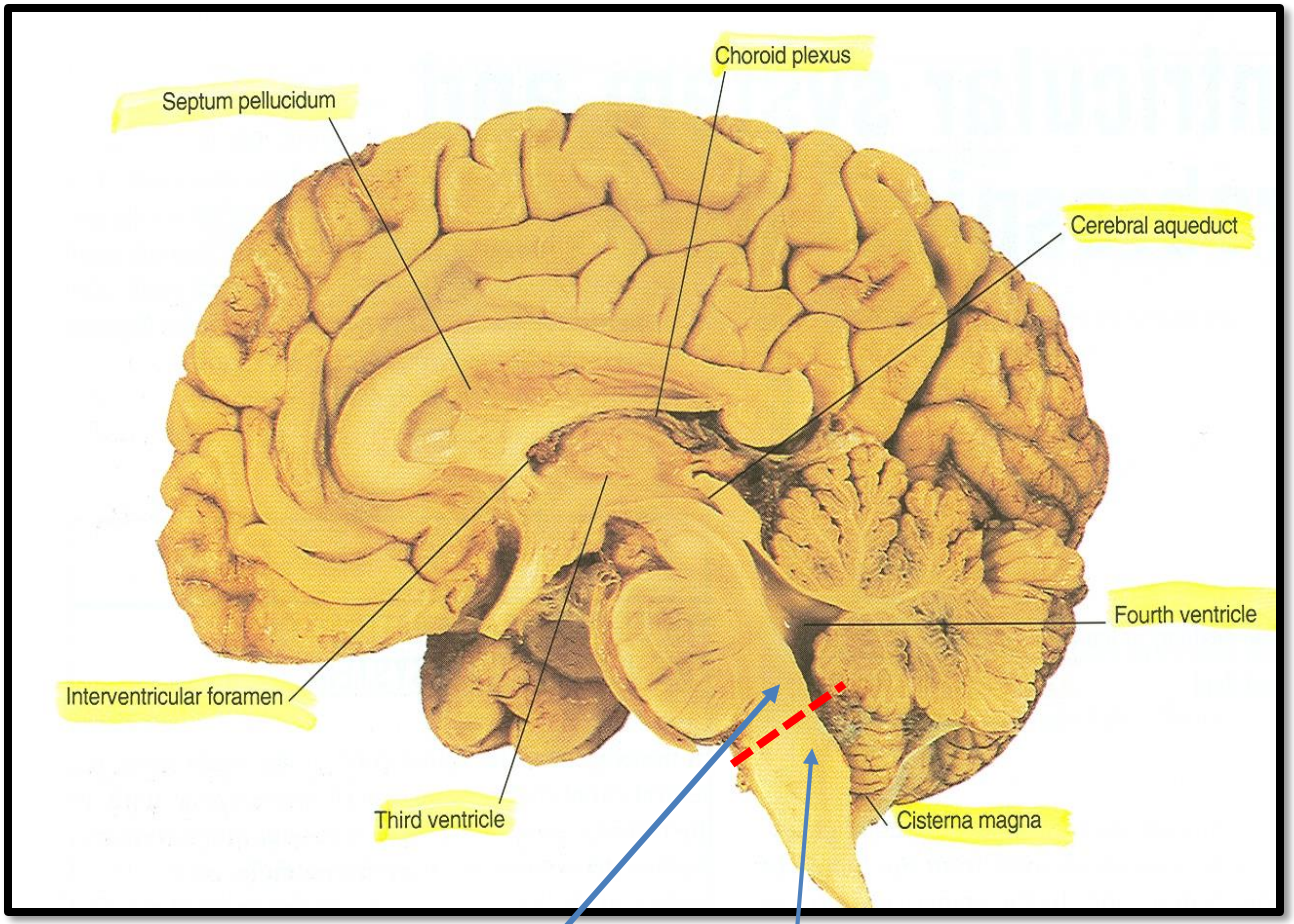
MID BRAIN – VENTRAL SURFACE

- 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.



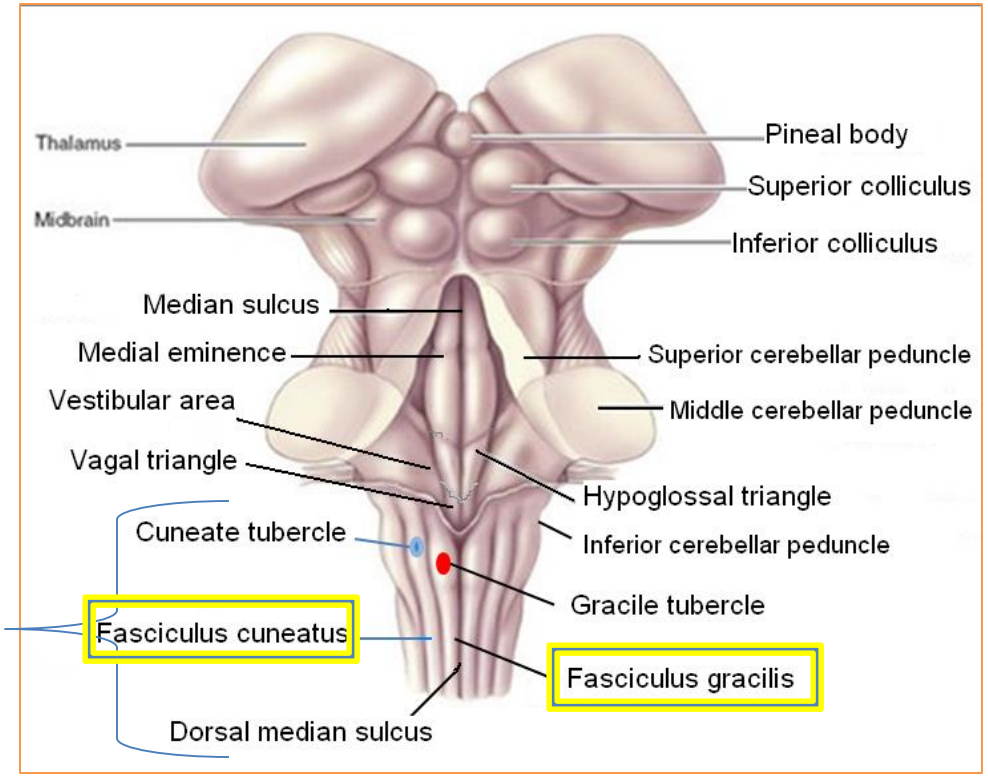
MEDULLA – DORSAL SURFACE

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



CLOSED MEDULLA

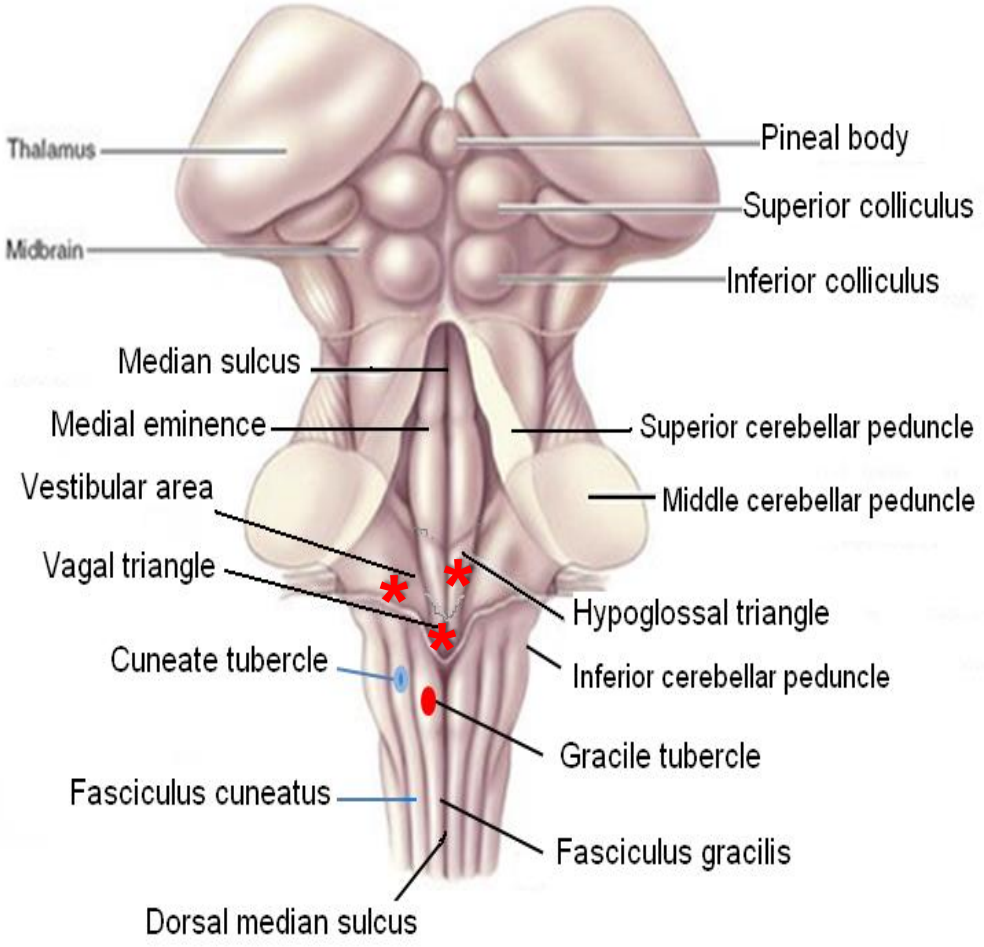
- **Cavity:** central canal.
- Composed of:
- **Dorsal median sulcus:** divides the closed medulla into 2 halves.
- **Fasciculus gracilis:** on either side of dorsal median sulcus.
- **Gracile tubercle:** an elevation produced at the upper part of fasciculus gracilis, marks the site of gracile nucleus.
- **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.



OPEN MEDULLA

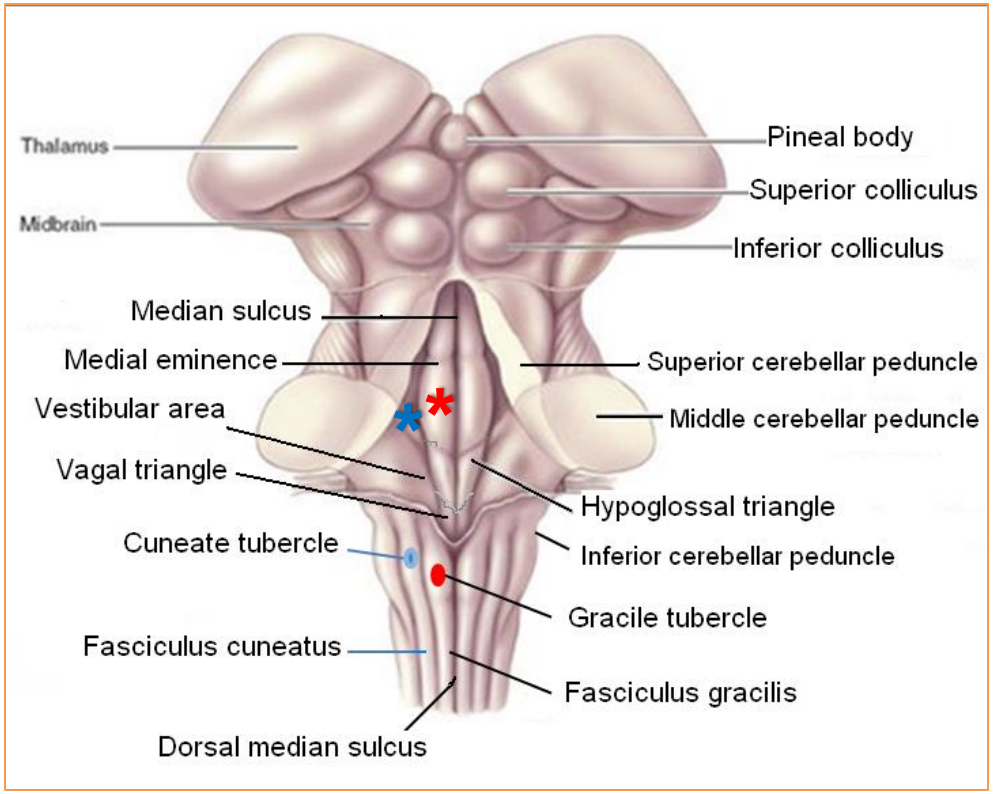
- **Cavity: 4th ventricle**
- **On either side, an inverted V-shaped sulcus divides the area into 3 parts *(from medial to lateral):***

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

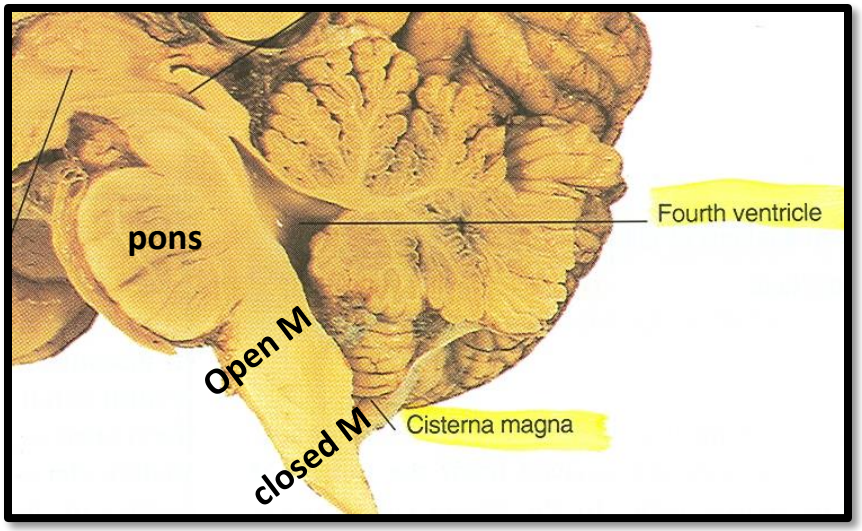


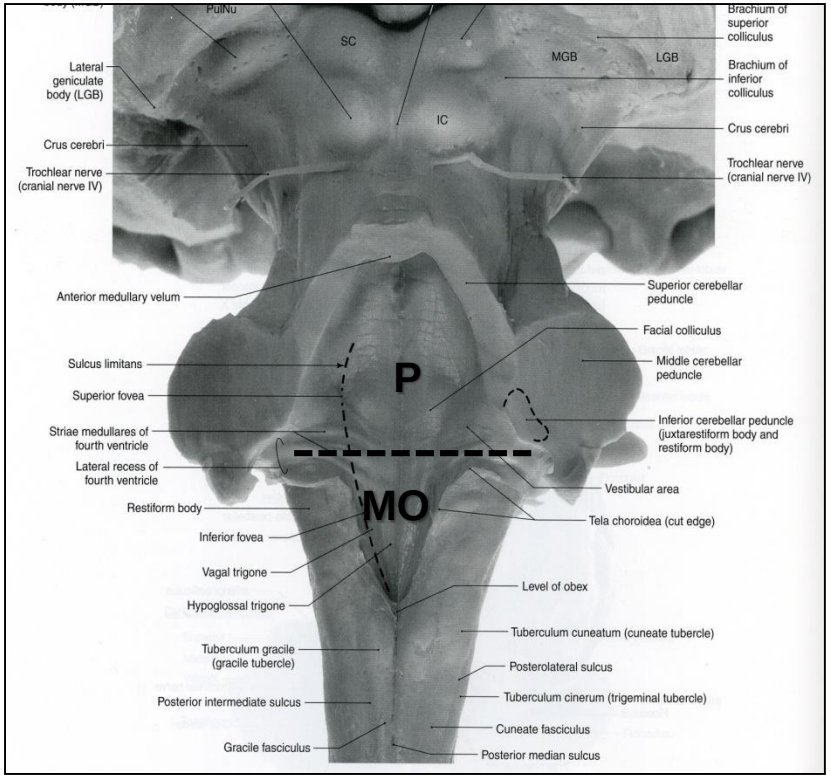
PONS – DORSAL SURFACE

- 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.





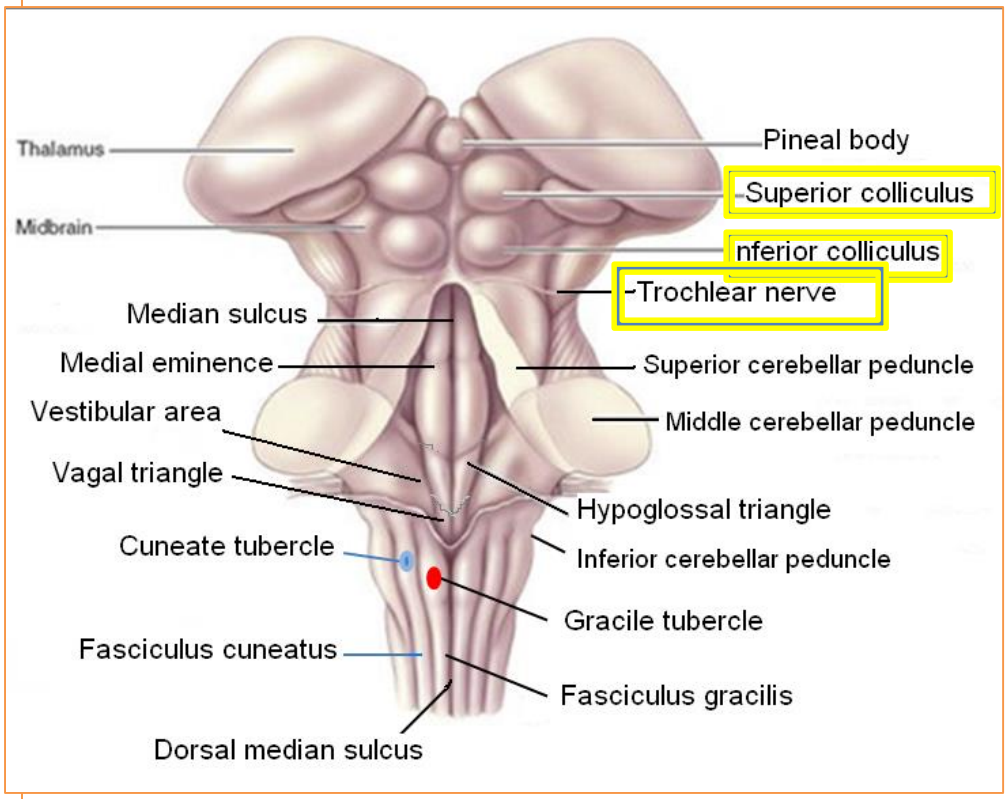
MID BRAIN – DORSAL SURFACE

- 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).



THANK YOU

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.

QUESTION 1

- The cranial nerve that emerges from dorsal surface of midbrain is:

1. Occulomotor (3rd).
2. Trochlear (4th). ⟵
3. Abducent (6th).
4. Facial (7th).

QUESTION 2

❑Regarding the medulla oblongata:

1. The pyramid is lateral to olive.
2. The hypoglossal nerve is the most lateral nerve emerging from it.
3. The cuneate tubercle is lateral to gracile tubercle. ⟵
4. The cerebellum is connected to it by middle cerebellar peduncle.