* BRAIN STEM EXTERNAL FEATURES

Prof. Ahmed Fathalla Ibrahim
Professor of Anatomy
College of Medicine
King Saud University
E-mail: ahmedfathala@gmail.com

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

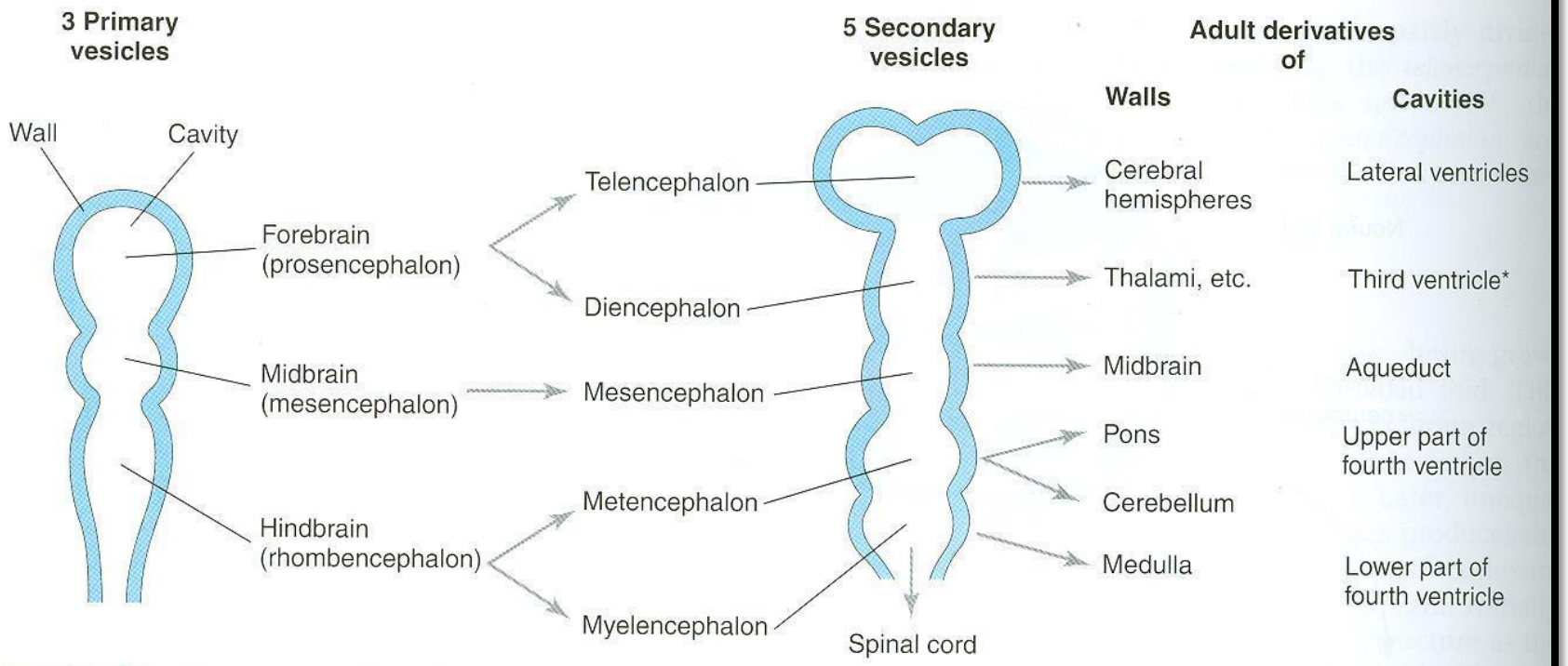


Figure 18 - 20. Diagrammatic sketches of the brain vesicles, indicating the adult derivatives of their walls and cavities. *The rostral part of the third ventricle forms from the cavity of the telencephalon; most of this ventricle is derived from the cavity of the diencephalon.

DEVELOPMENT OF BRAIN

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

*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

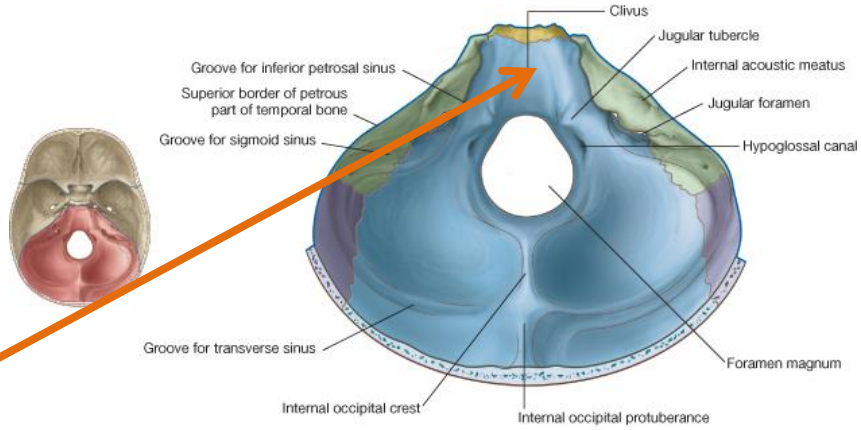
1-Pons.

2-Cerebellum.

3- Medulla oblongata.

BRAIN STEM

- **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).



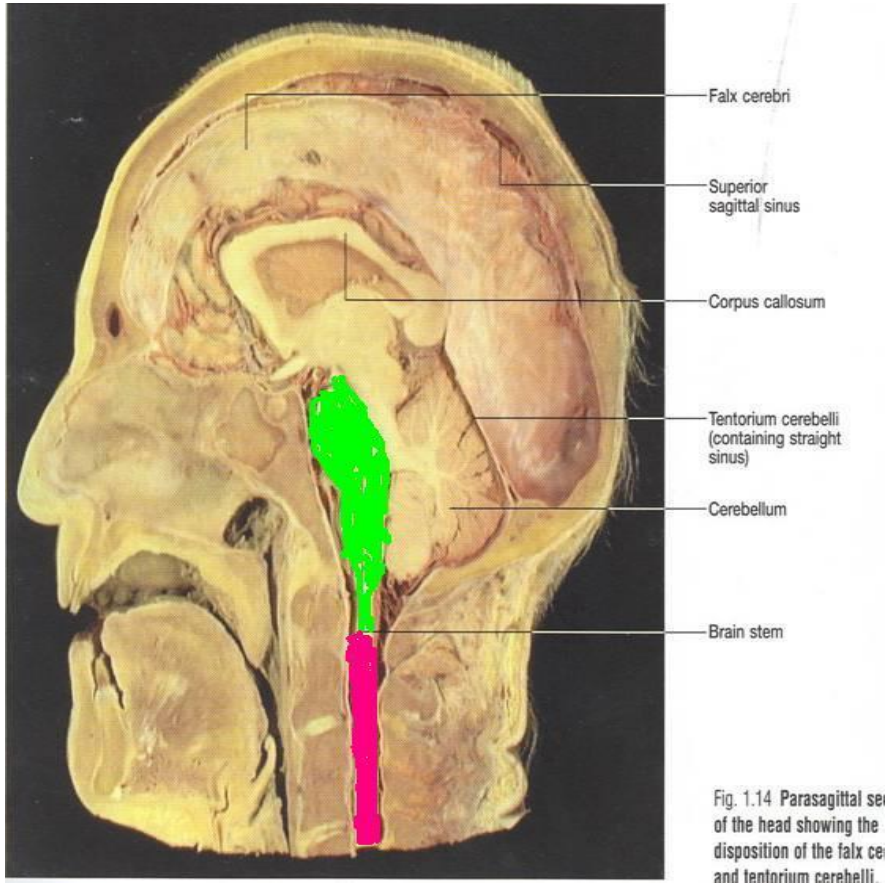
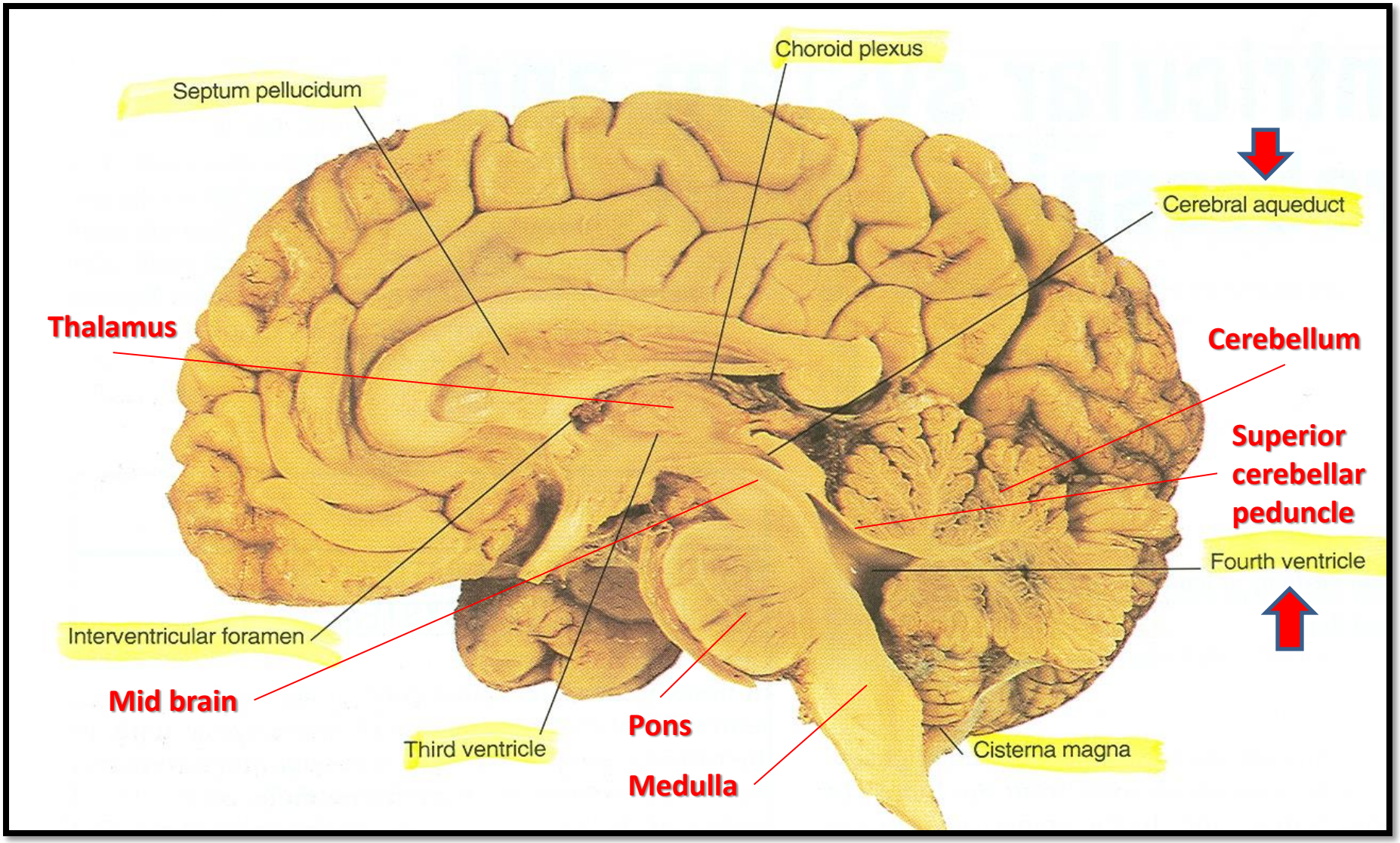


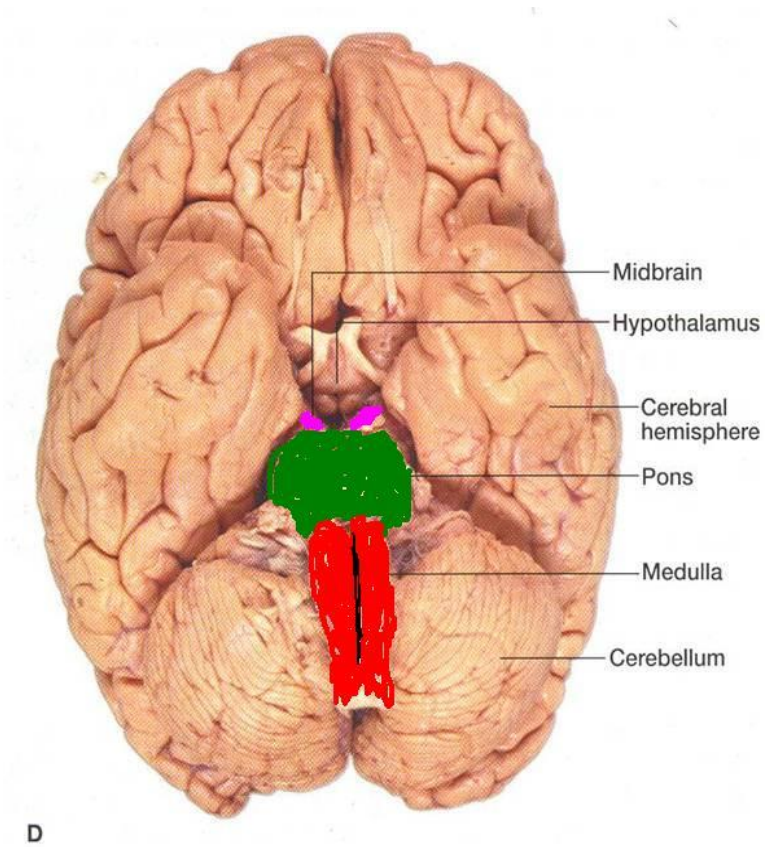
Fig. 1.14 Parasagittal se of the head showing the disposition of the falx ce and tentorium cerebelli

SAGITTAL SECTION OF BRAIN

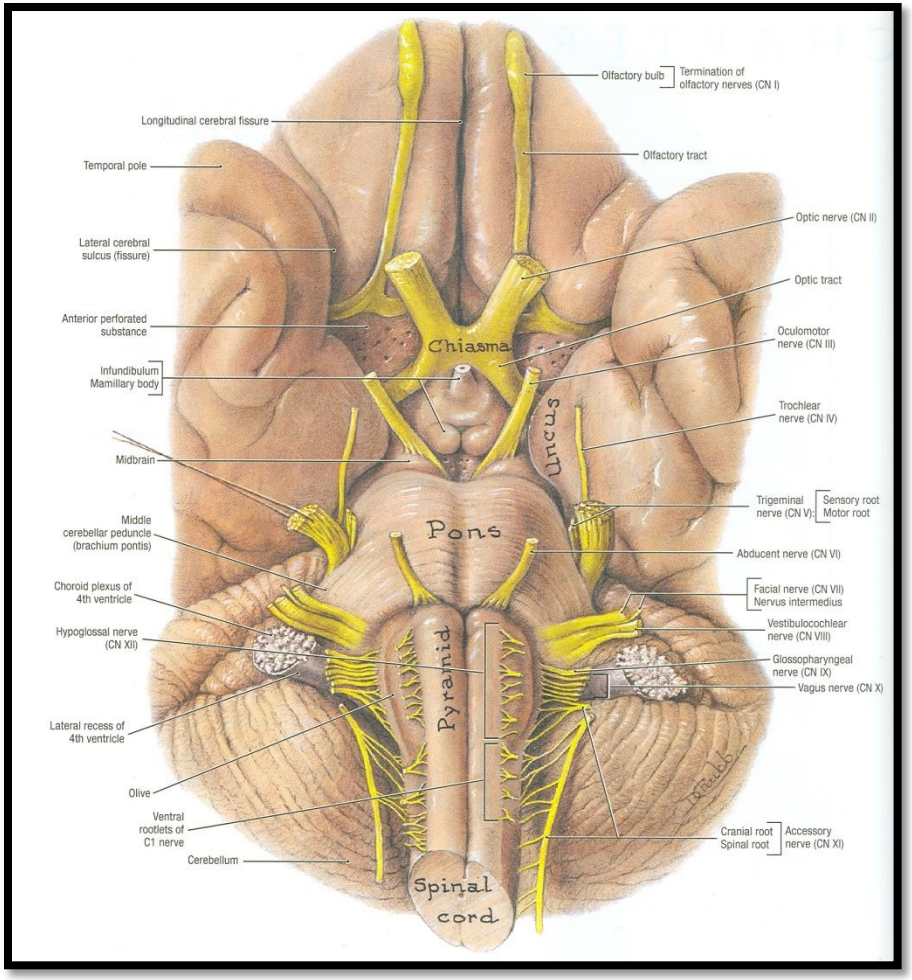


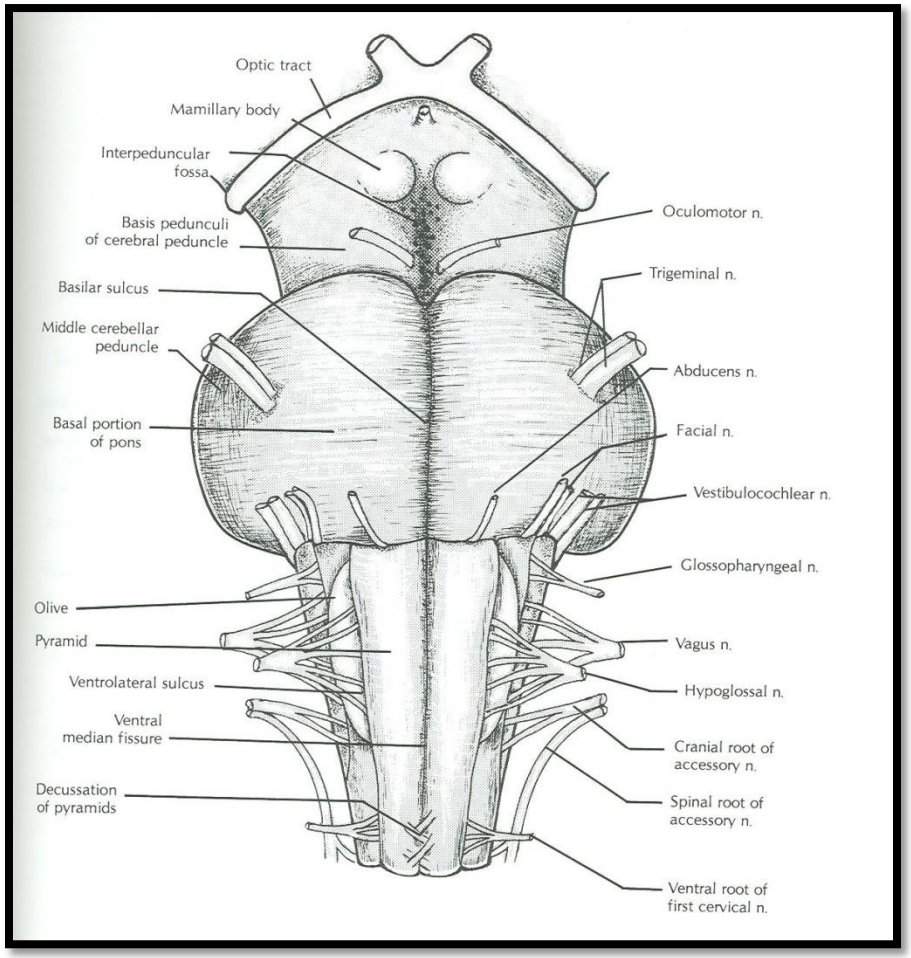
IMPORTANCE OF BRAIN STEM

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.***



BRAIN STEM – VENTRAL SURFACE





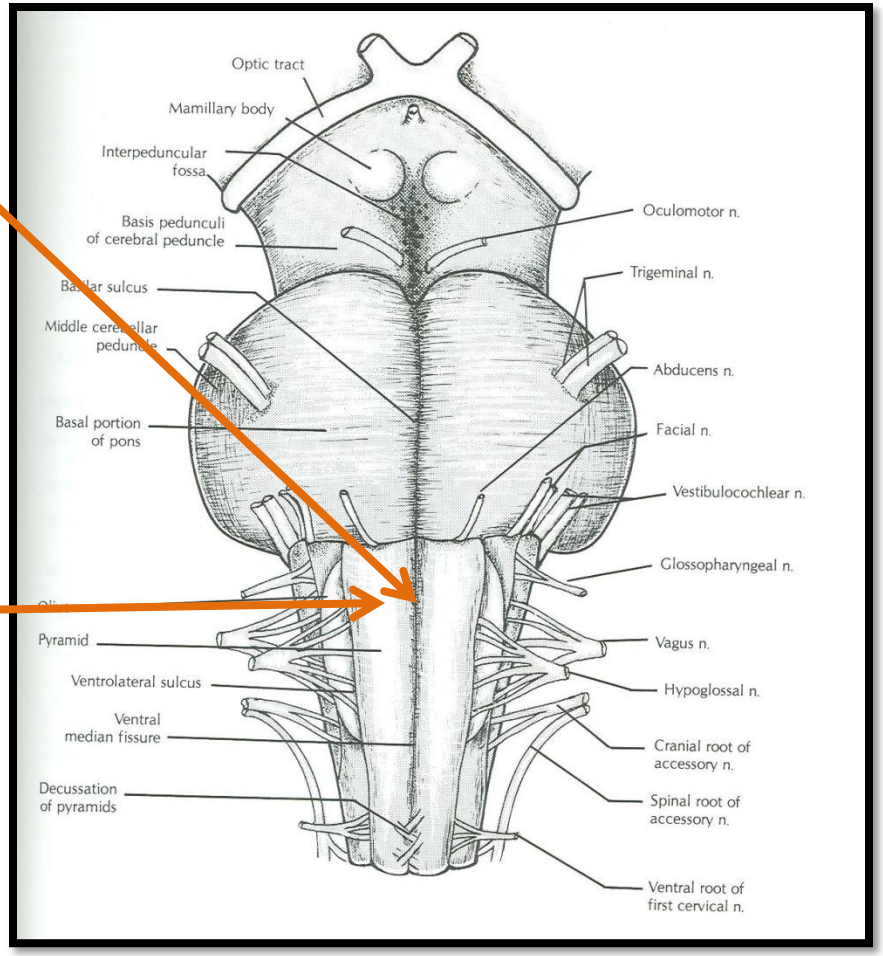
MEDULLA – VENTRAL SURFACE

- **Ventral median fissure:**

1. It divides the medulla into 2 halves
2. Its lower part is masked by decussation of most of pyramidal (corticospinal) fibers (75%-90%).

- **Pyramid:**

1. It lies on either side of ventral median fissure
2. It is an elevation produced by corticospinal tract.



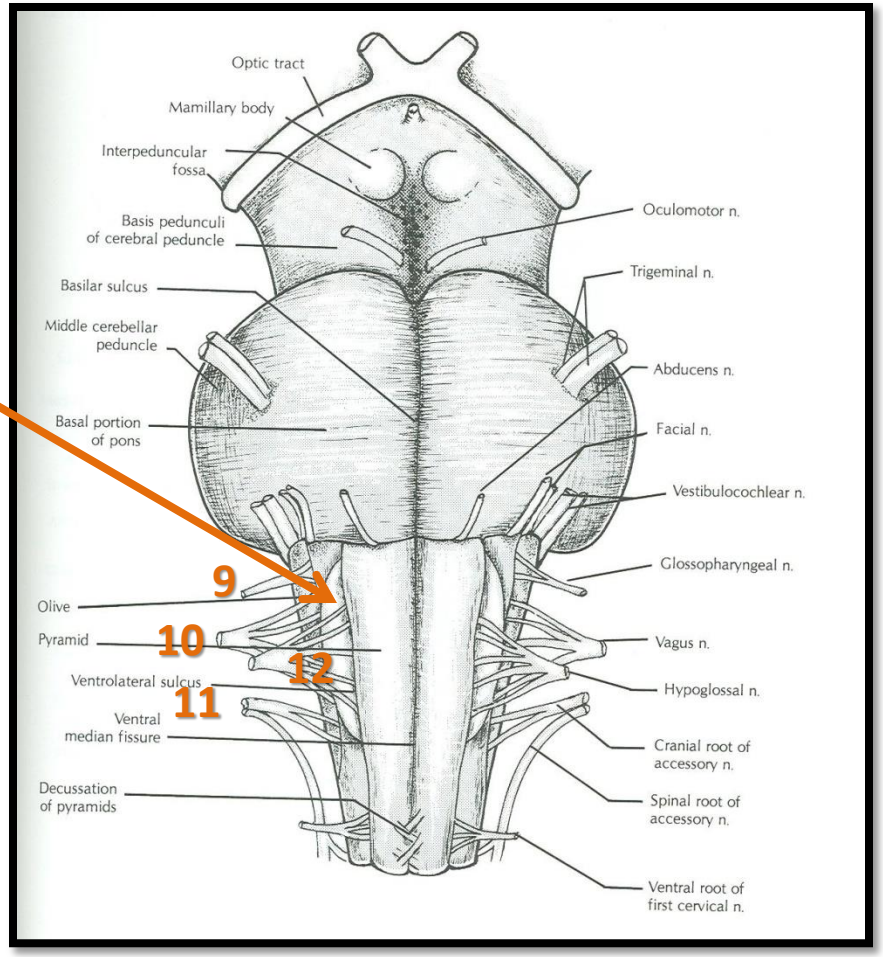
MEDULLA – VENTRAL SURFACE

- **Olive:**

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

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

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



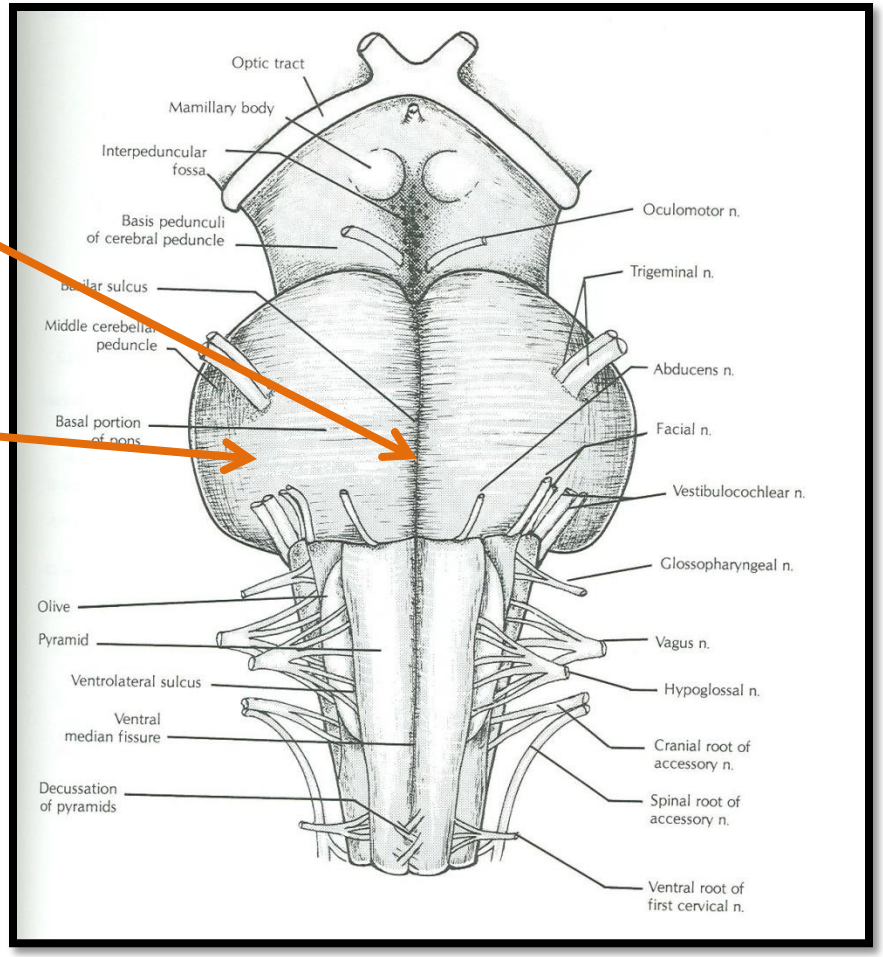
PONS – VENTRAL SURFACE

- **Basilar sulcus:**

1. It divides the pons into 2 halves.
2. It is occupied by basilar artery.

- **Transverse pontine (pontocerebellar) fibers:**

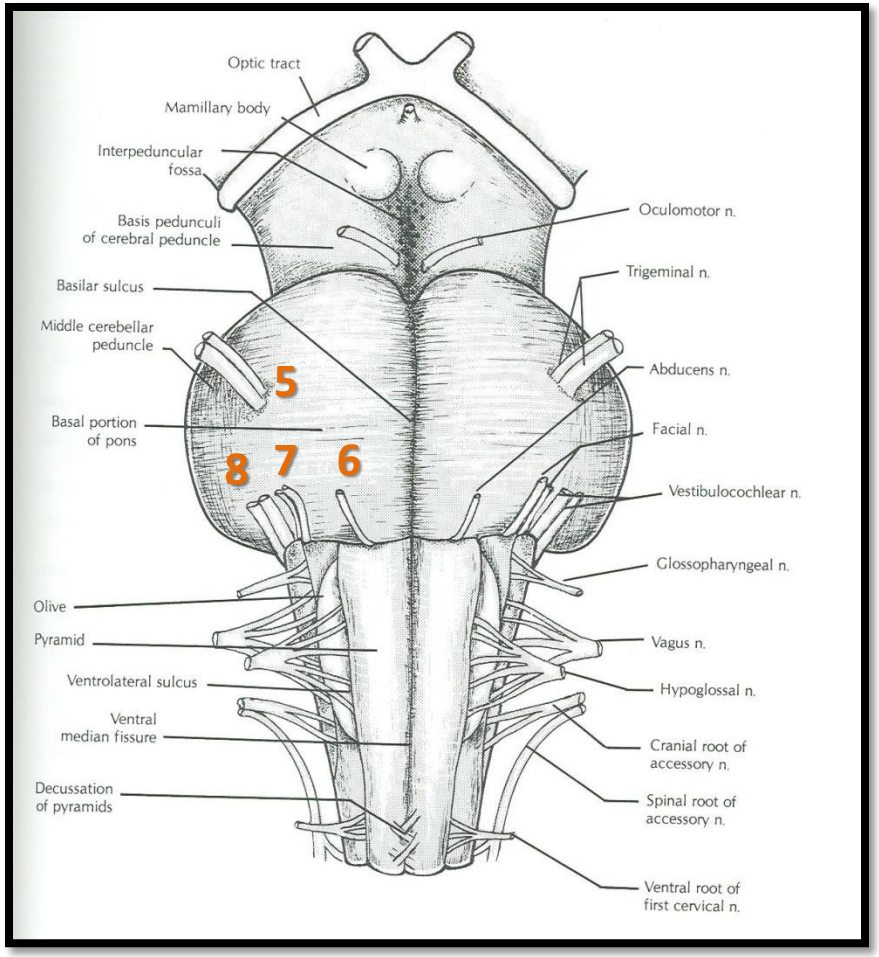
1. It originates from pontine nuclei.
2. It cross midline & pass through contralateral middle cerebellar peduncle to enter the opposite cerebellar hemisphere.



PONS – VENTRAL SURFACE

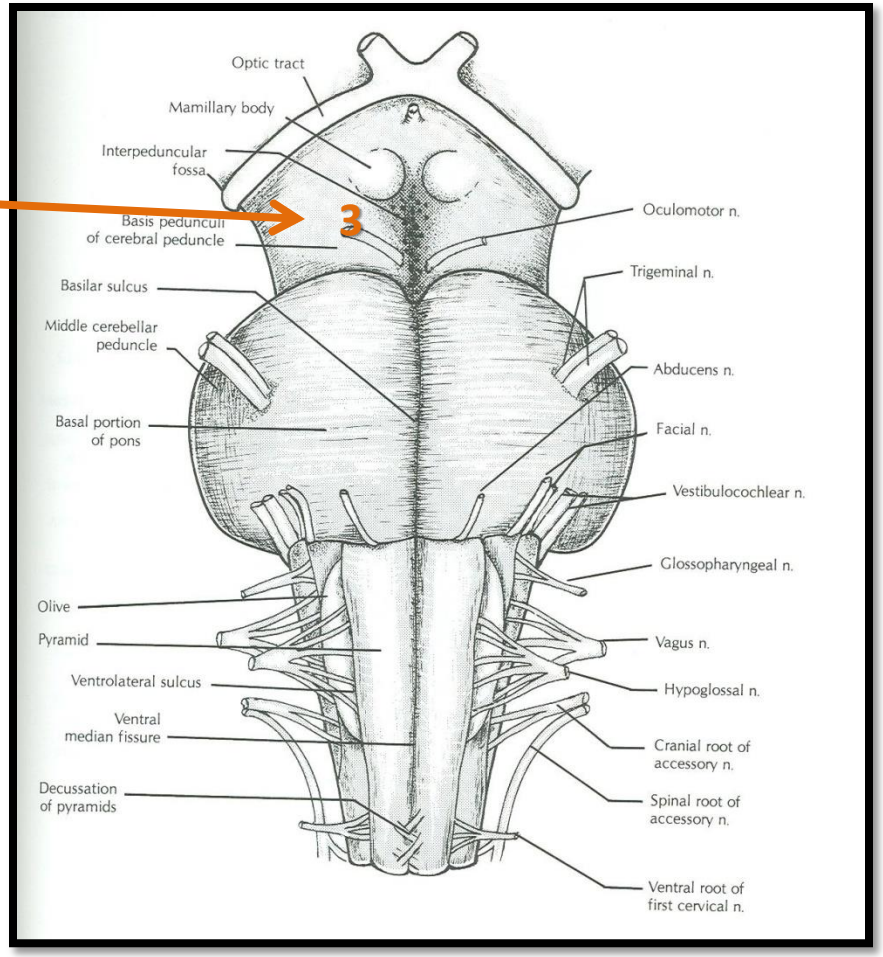
- **Nerves emerging from Pons (4 nerves):**

1. **Trigeminal (5th): from the middle of ventrolateral aspect of pons, as 2 roots: a small medial motor root & a large lateral sensory root.**
2. **Abducent (6th): at junction between pons & pyramid.**
3. **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**

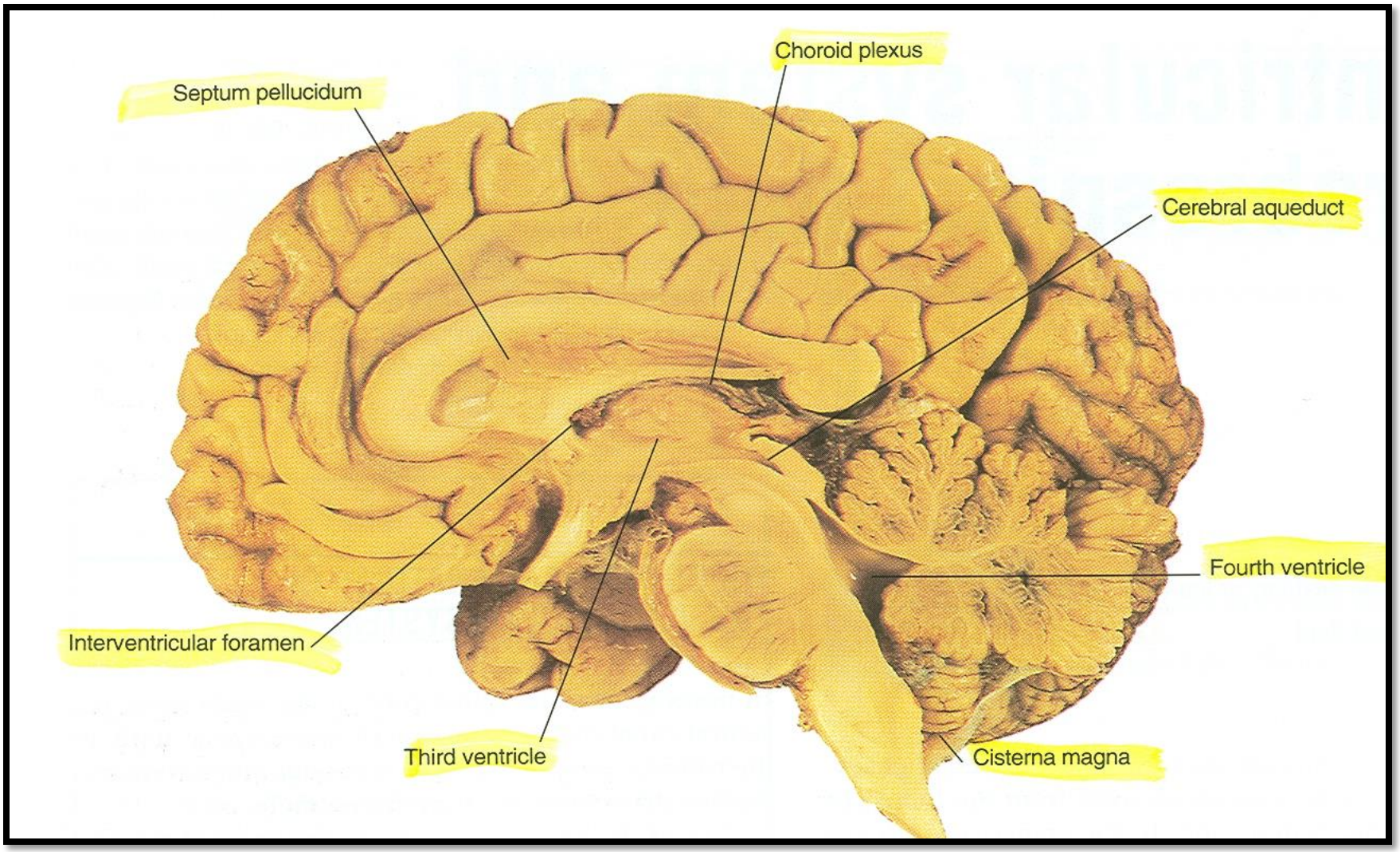


MID BRAIN – VENTRAL SURFACE

- It is formed of a large column of descending fibers (crus cerebri or basis pedunculi), on either side.
- The 2 crura cerebri are separated by a depression (interpeduncular fossa).
- Nerve emerging from Midbrain (one):
  - Occulomotor (3rd): from medial aspect of crus cerebri.



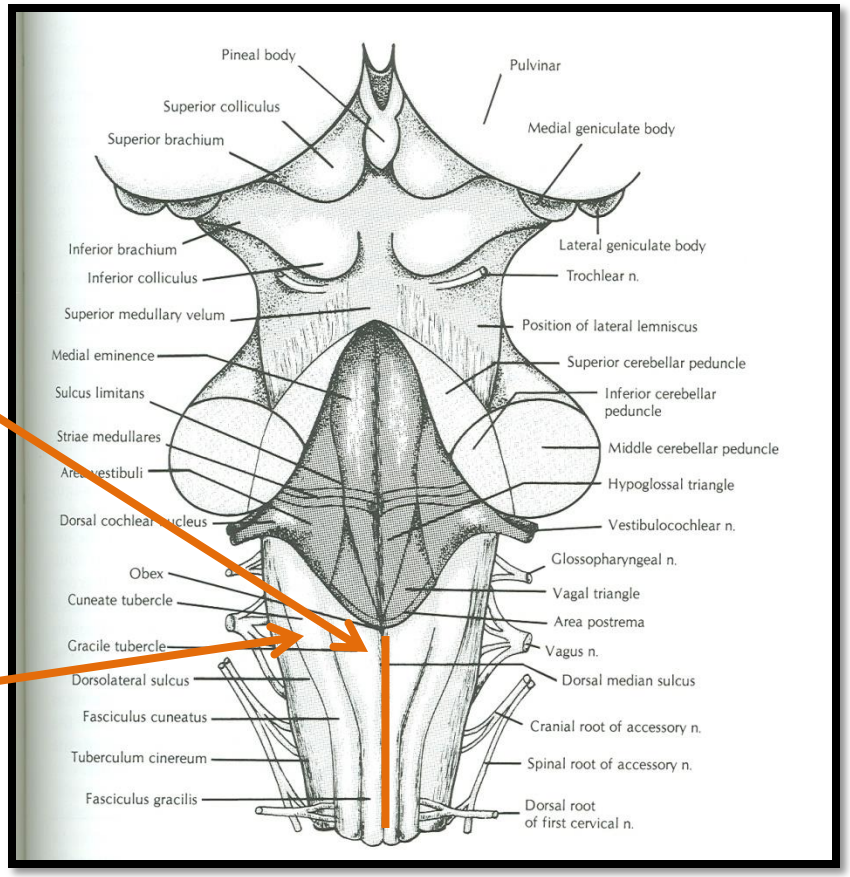
SAGITTAL SECTION OF BRAIN



CLOSED MEDULLA

- **Cavity: central canal.**
- **Composed of:**

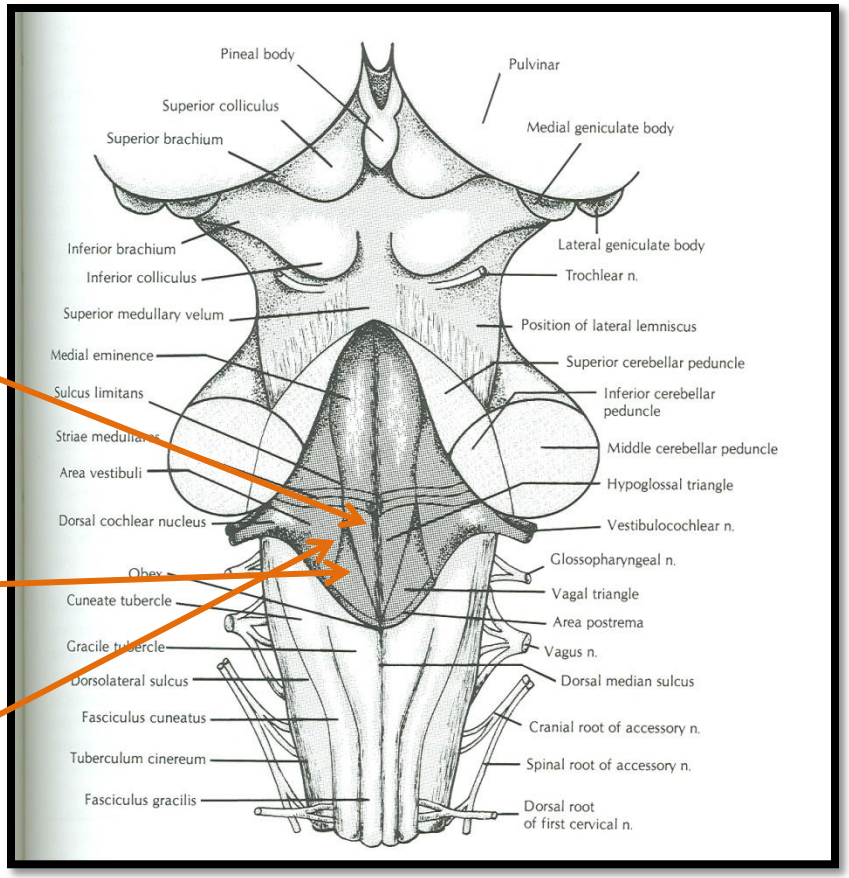
1. **Dorsal median sulcus:** divdes the closed medulla into 2 halves.
2. **Fasciculus gracilis:** on either side of dorsal median sulcus.
3. **Gracile tubercle:** an elevation produced at the upper part of fasciculus gracilis, marks the site of gracile nucleus.
4. **Fasciculus cuneatus:** on either side of fasciculus gracilis.
5. **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):***

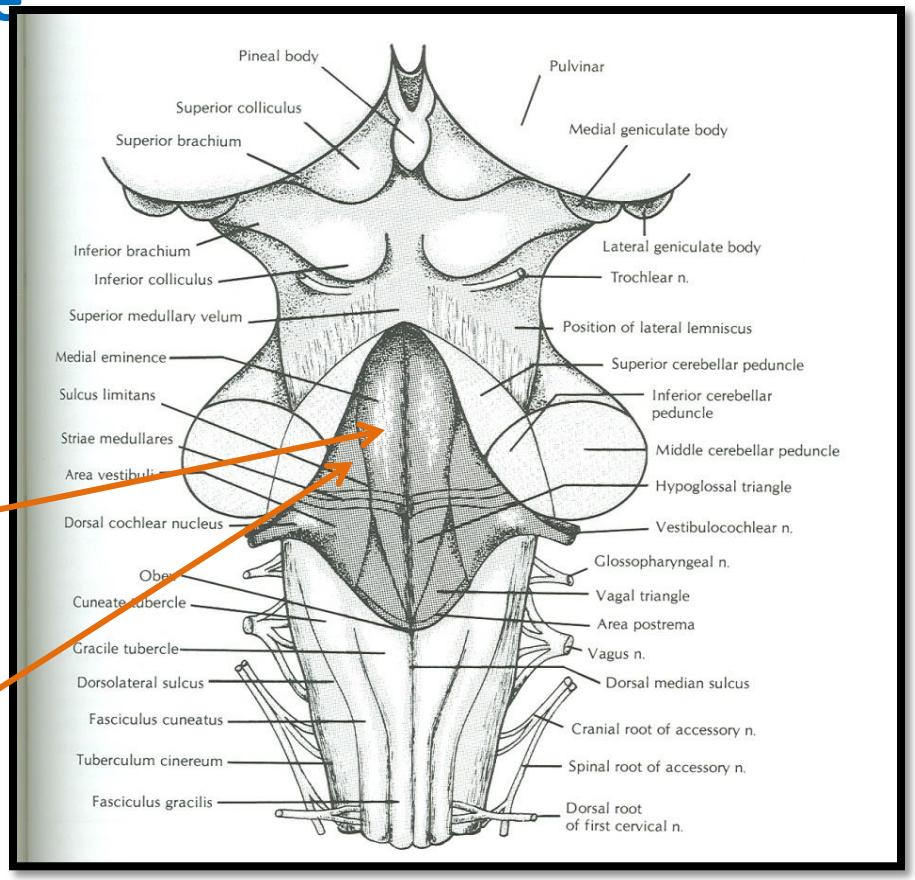
1. **Hypoglossal triangle: overlies hypoglossal nucleus.**
2. **Vagal triangle: overlies dorsal vagal nucleus.**
3. **Vestibular area: overlies vestibular nuclei.**



PONS – DORSAL SURFACE

- Separated from the medulla by an imaginary line passing between the caudal margins of middle cerebellar peduncle.
- On either side, a sulcus divides the area into 2 parts *(from medial to lateral):*

1. **Medial eminence:** overlies **abducent nucleus.**
2. **Vestibular area:** overlies **vestibular nuclei.**



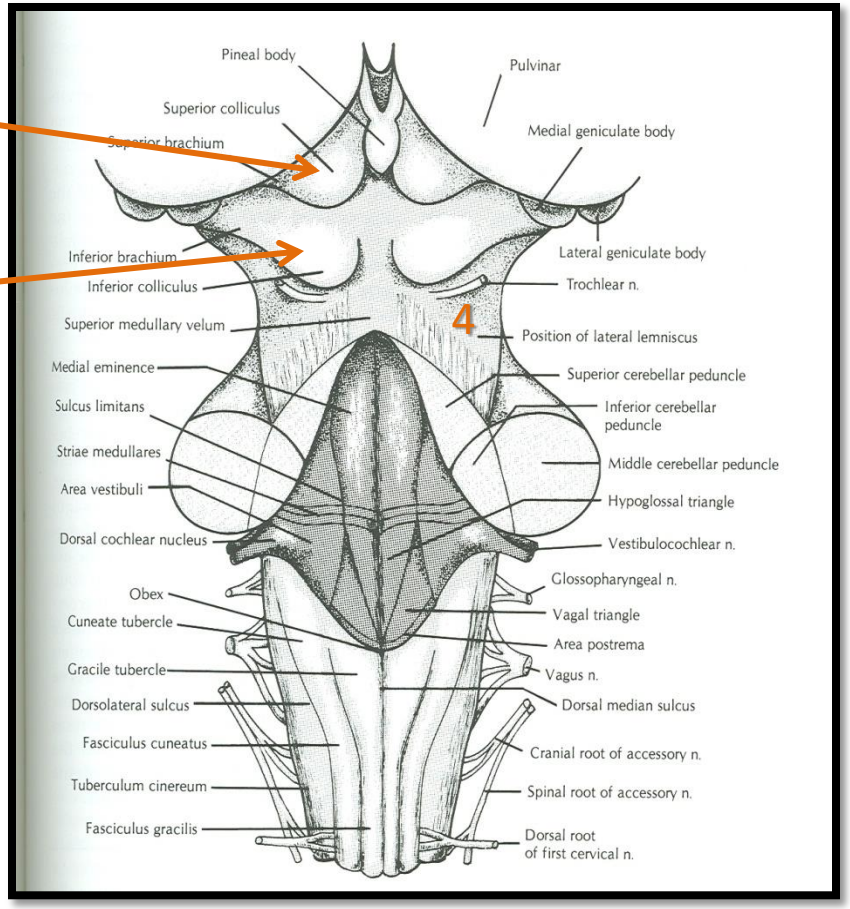
MID BRAIN – DORSAL SURFACE

- 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 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 3^{rd} to 12^{th}).
- Cranial nerves (with the exception of 4^{th}) emerge from ventral surface of brain stem.

QUESTION 1

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

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

QUESTION 2

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

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.

QUESTION 3

- Which one of the following is **the site of the inferior colliculus?**

1. In the ventral surface of medulla, lateral to the olive.
2. In the dorsal surface of medulla, medial to the vagal triangle.
3. In the ventral surface of midbrain, lateral to the medial eminence.
4. In the dorsal surface of midbrain, above the trochlear nerve.


THANK YOU