

# ANATOMY OF THE BRAIN STEM (EXTERNAL FEATURES)

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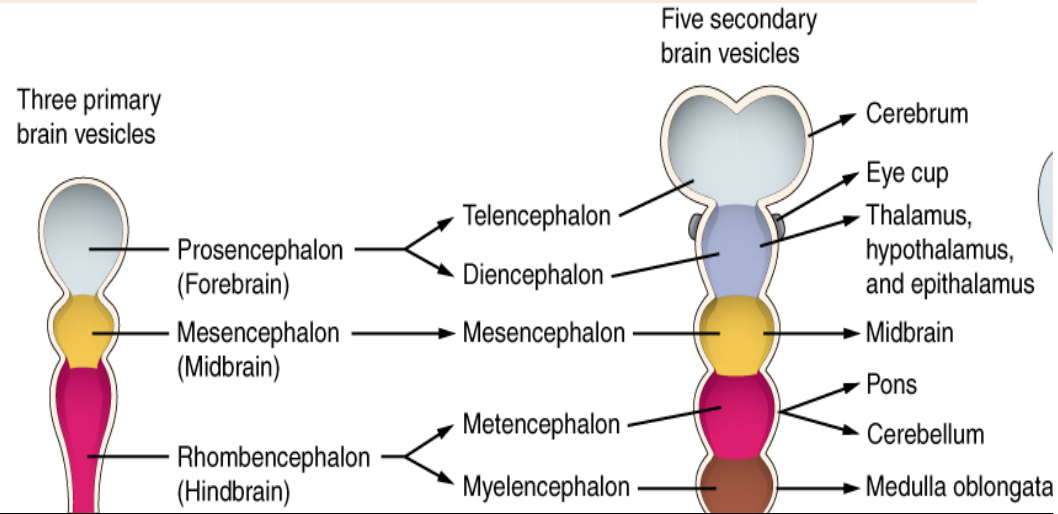
# OBJECTIVES

**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:



**FOREBRAIN:** subdivides into:

**1-Telencephalon :** Two cerebral hemispheres

(cavities: 2 lateral ventricles)

**2-Diencephalon (cavity: 3<sup>rd</sup> ventricle) :**

*thalamus, hypothalamus, epithalamus & subthalamus*

**MIDBRAIN (cavity: cerebral aqueduct).**

**HINDBRAIN (cavity: 4<sup>th</sup> 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:**

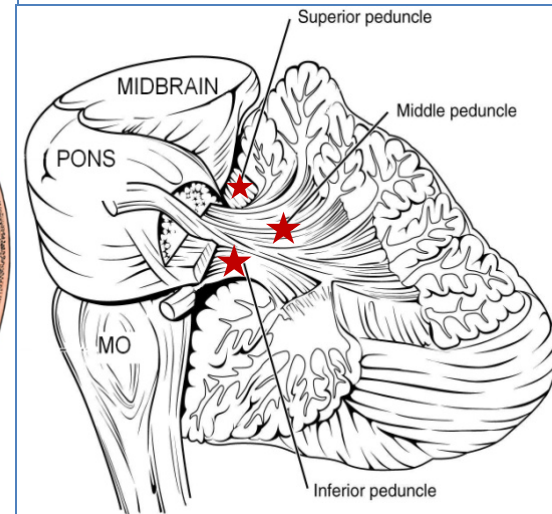
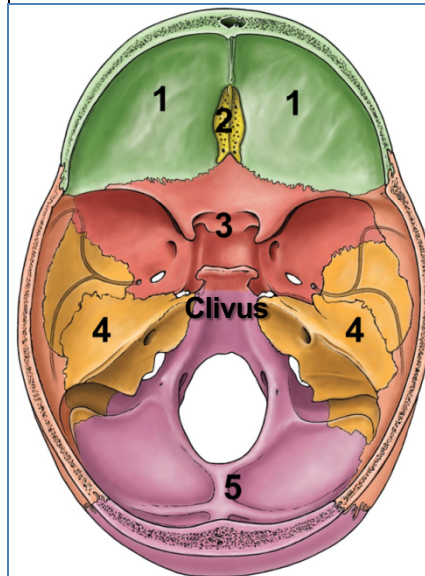
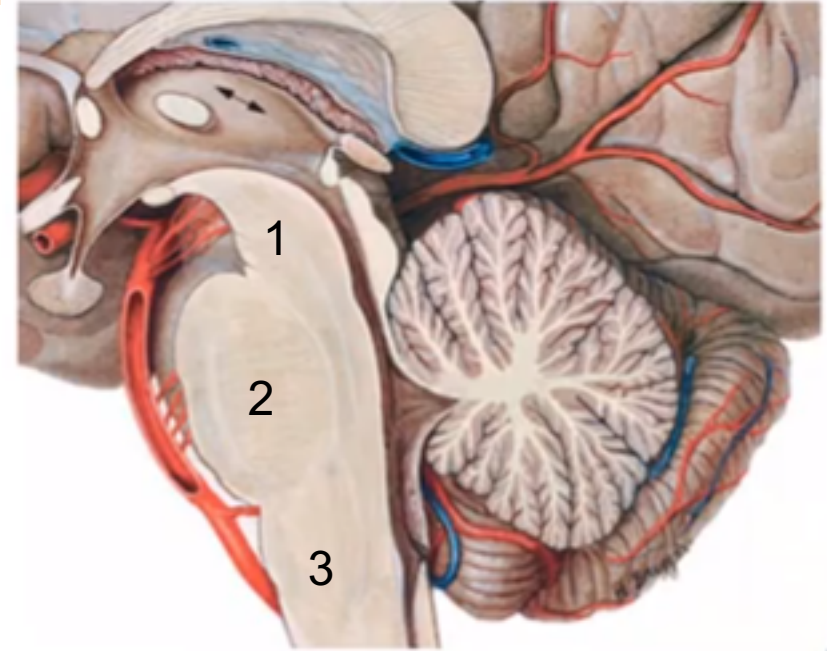
- It lies on the **basilar part of occipital bone (clivus)**

❑ **PARTS:** *From above downwards:*

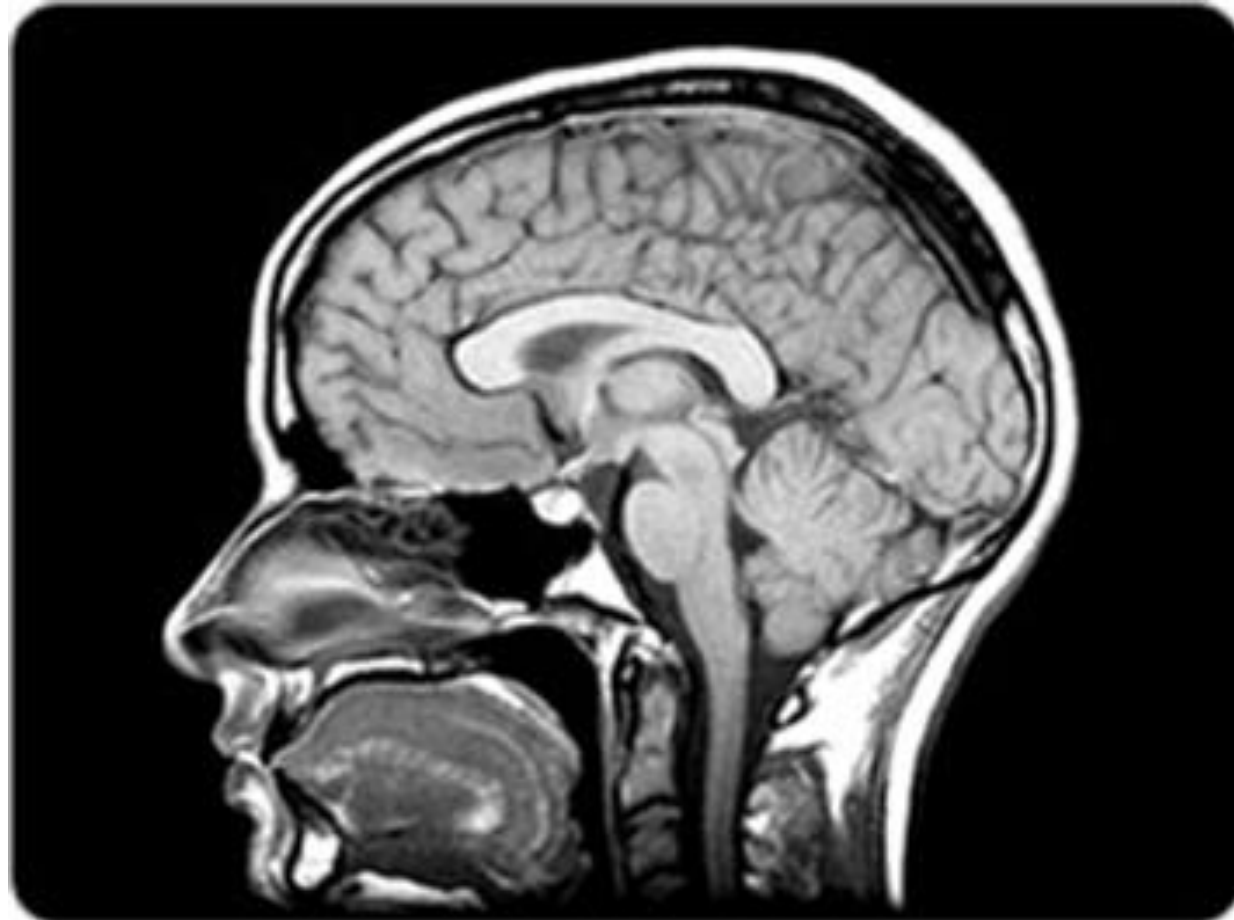
- *Mid brain, pons & medulla oblongata*

❑ **CONNECTIONS WITH CEREBELLUM:**

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

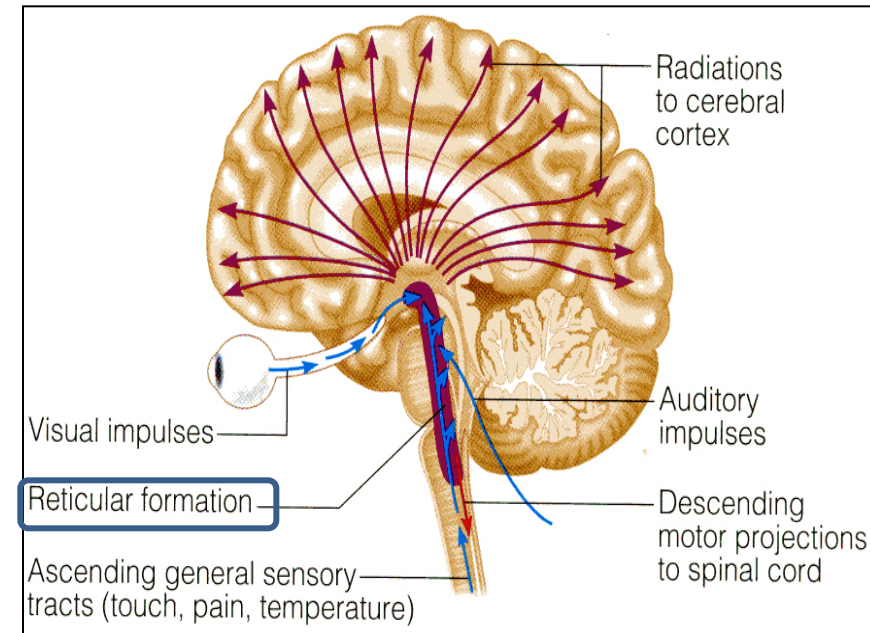
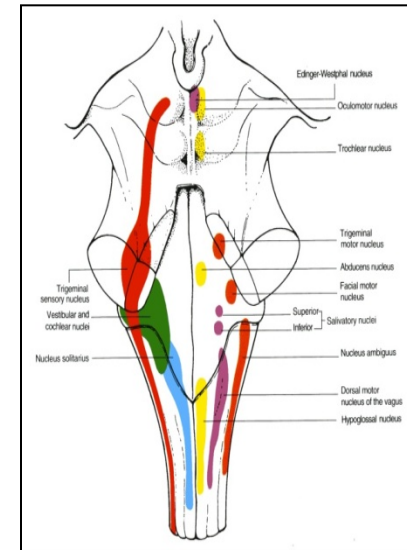
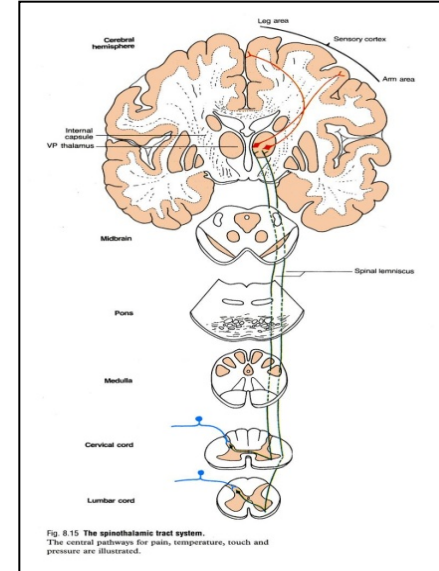


# BRAIN STEM PARTS

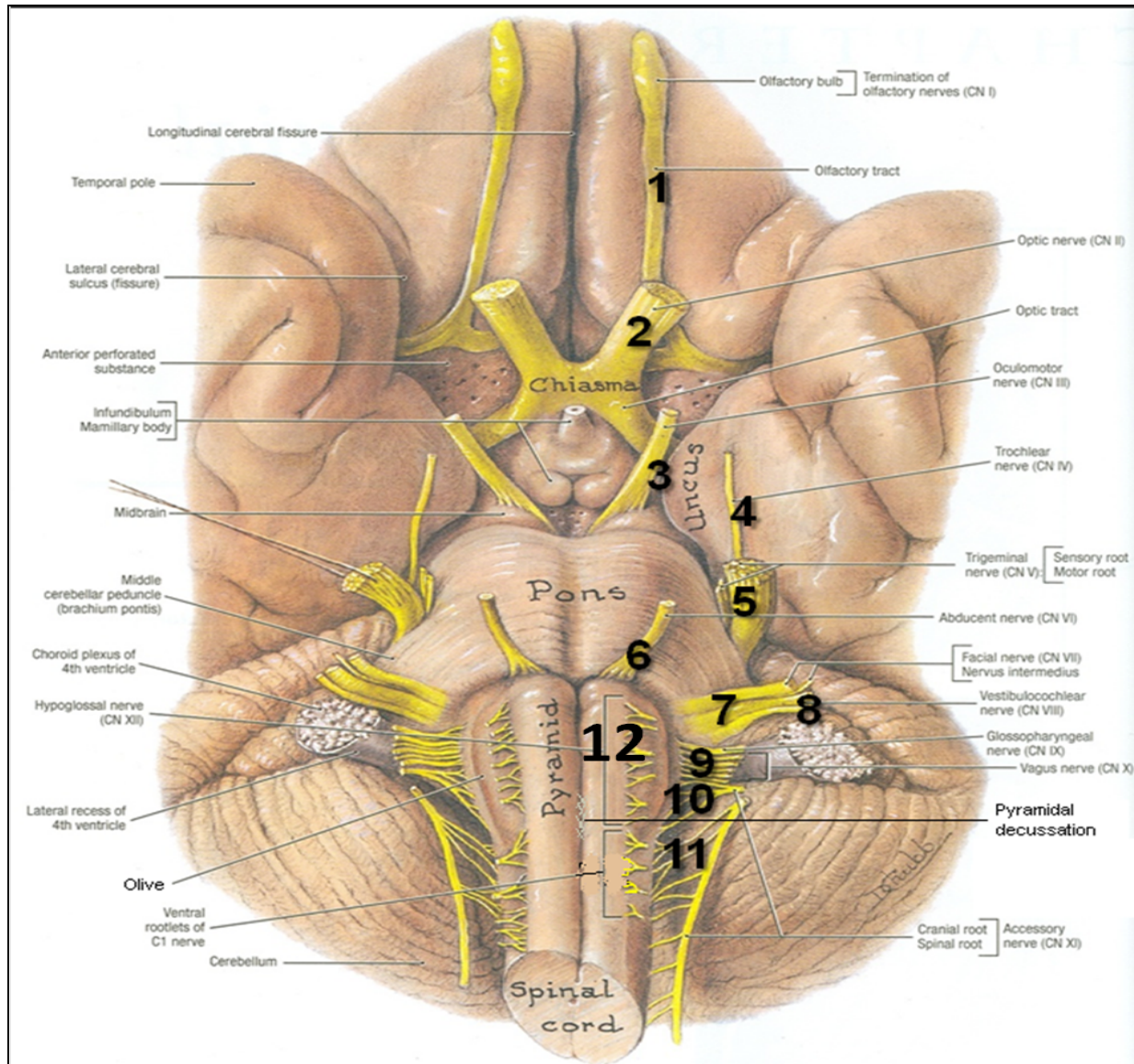


# FUNCTIONS OF BRAIN STEM

1. **Pathway of tracts** between cerebral cortex & spinal cord
2. Site of origin of **nuclei of cranial nerves** (from 3<sup>rd</sup> to 12<sup>th</sup>)
3. Site of emergence of **cranial nerves** (from 3<sup>rd</sup> to 12<sup>th</sup>)
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



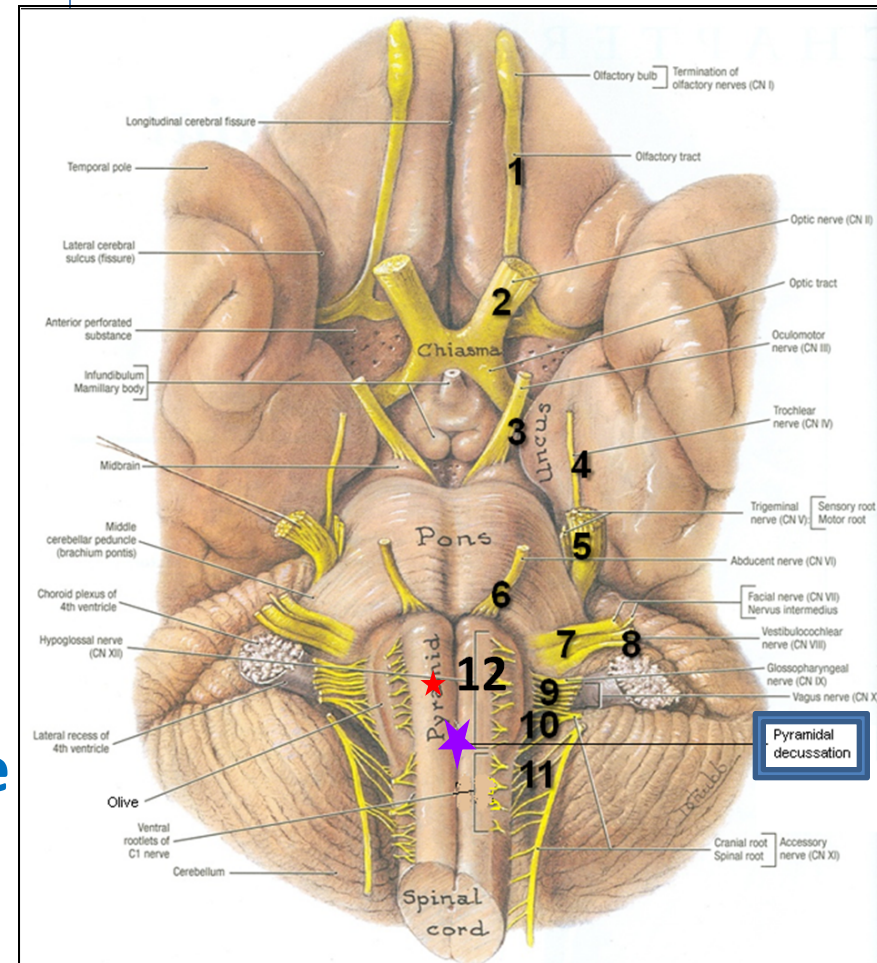
# MEDULLA – VENTRAL SURFACE

## ❑ **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**



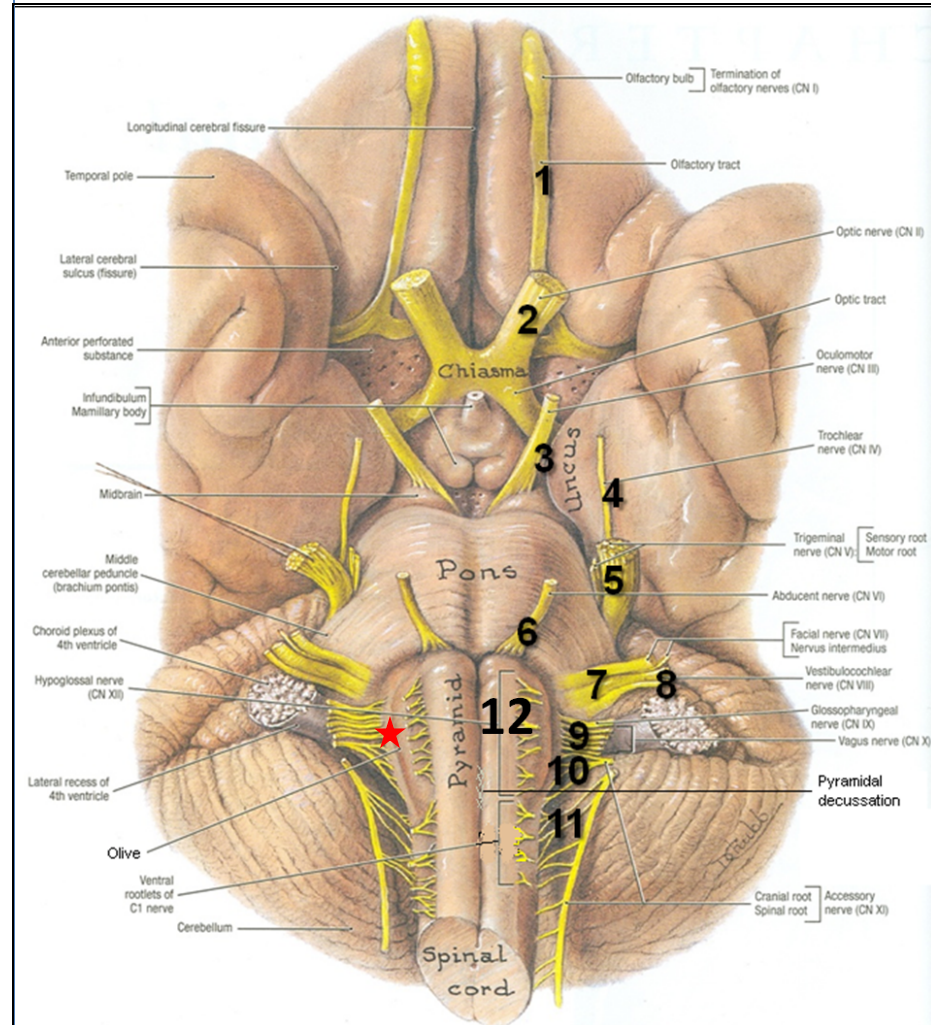


## □ Olive: ★

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

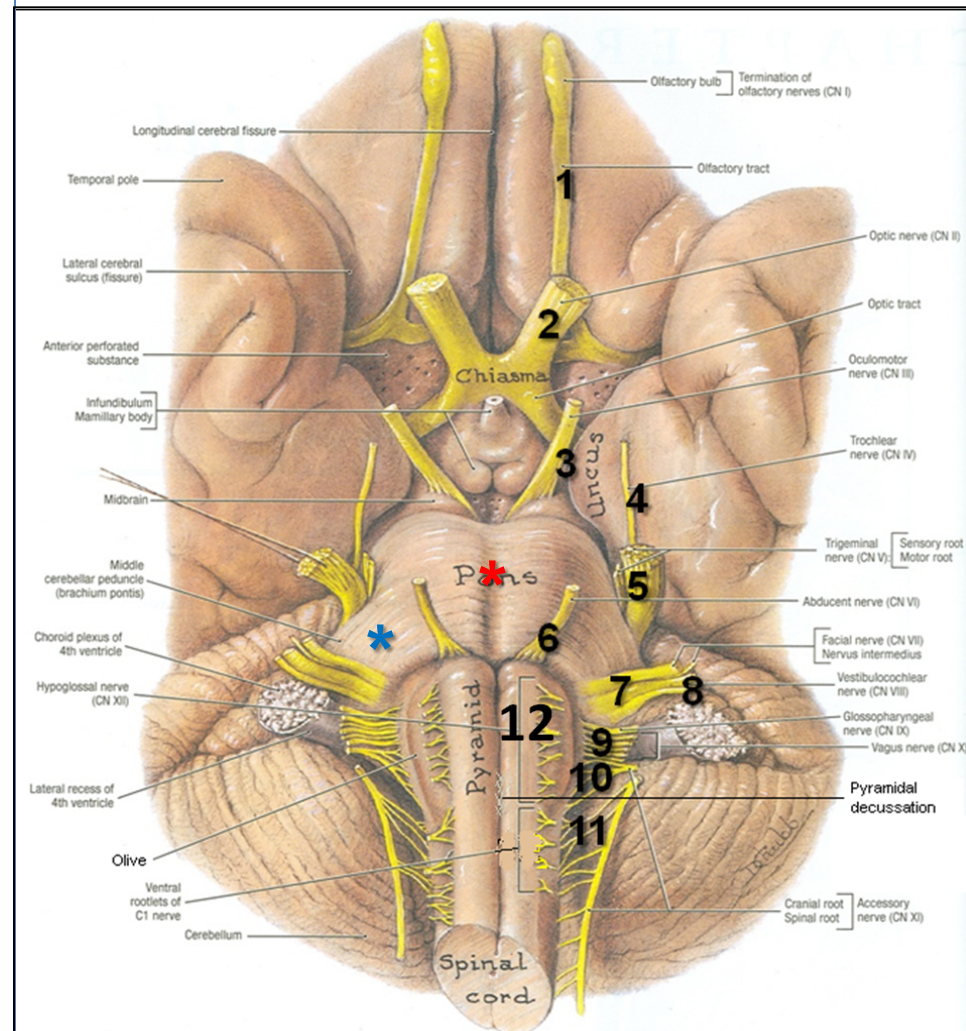
## □ Nerves emerging from Medulla (4 nerves):

- Hypoglossal (12<sup>th</sup>): from sulcus between pyramid & olive
- Glossopharyngeal (9<sup>th</sup>), vagus (10<sup>th</sup>) & cranial part of accessory (11<sup>th</sup>): 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):

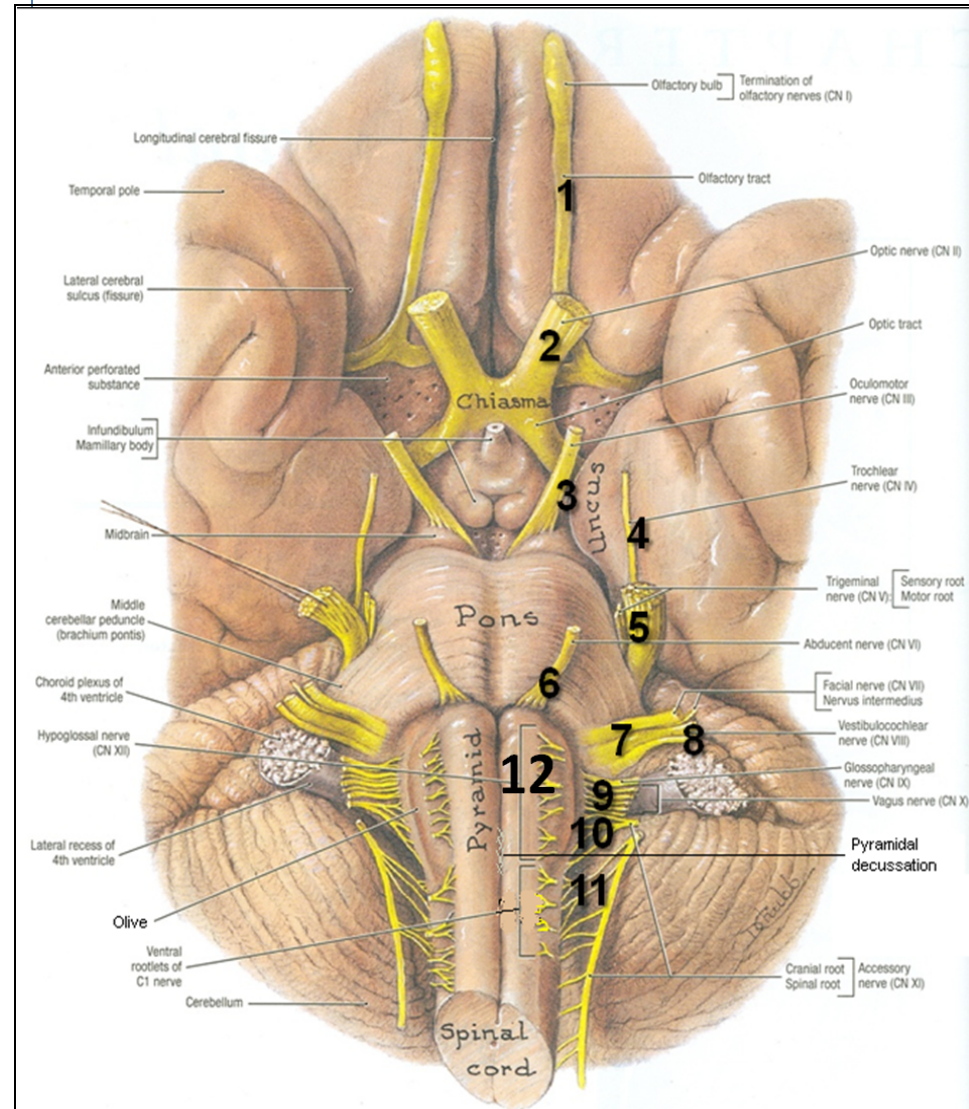
**Trigeminal (5<sup>th</sup>):** from the middle of ventrolateral aspect of pons, as 2 roots: a small medial **motor** root & a large lateral **sensory** root

**Abducent (6<sup>th</sup>):** from sulcus between pons & pyramid

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

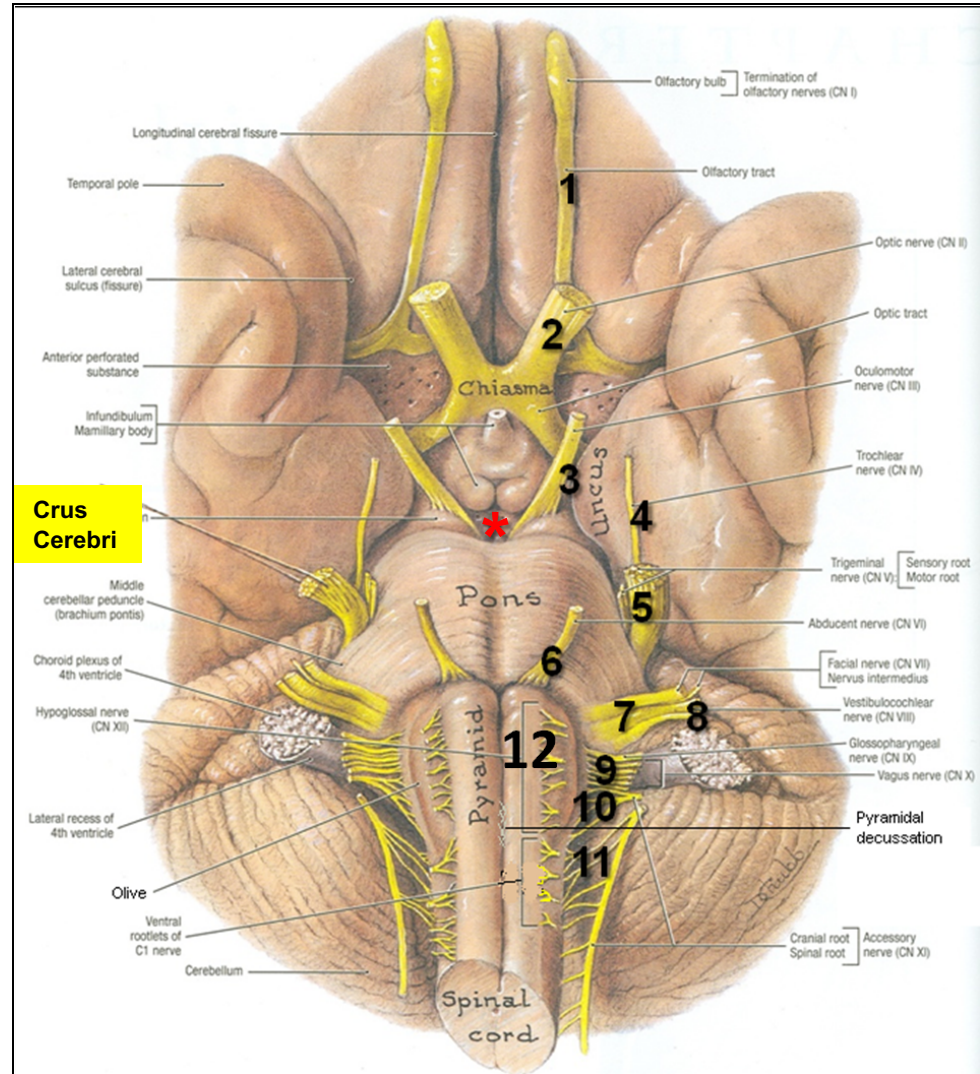
Both nerves emerge as 2 roots: from medial to lateral:

**motor** root of 7<sup>th</sup>, **sensory** root of 7<sup>th</sup> **vestibular** part of 8<sup>th</sup> & **cochlear** part of 8<sup>th</sup>



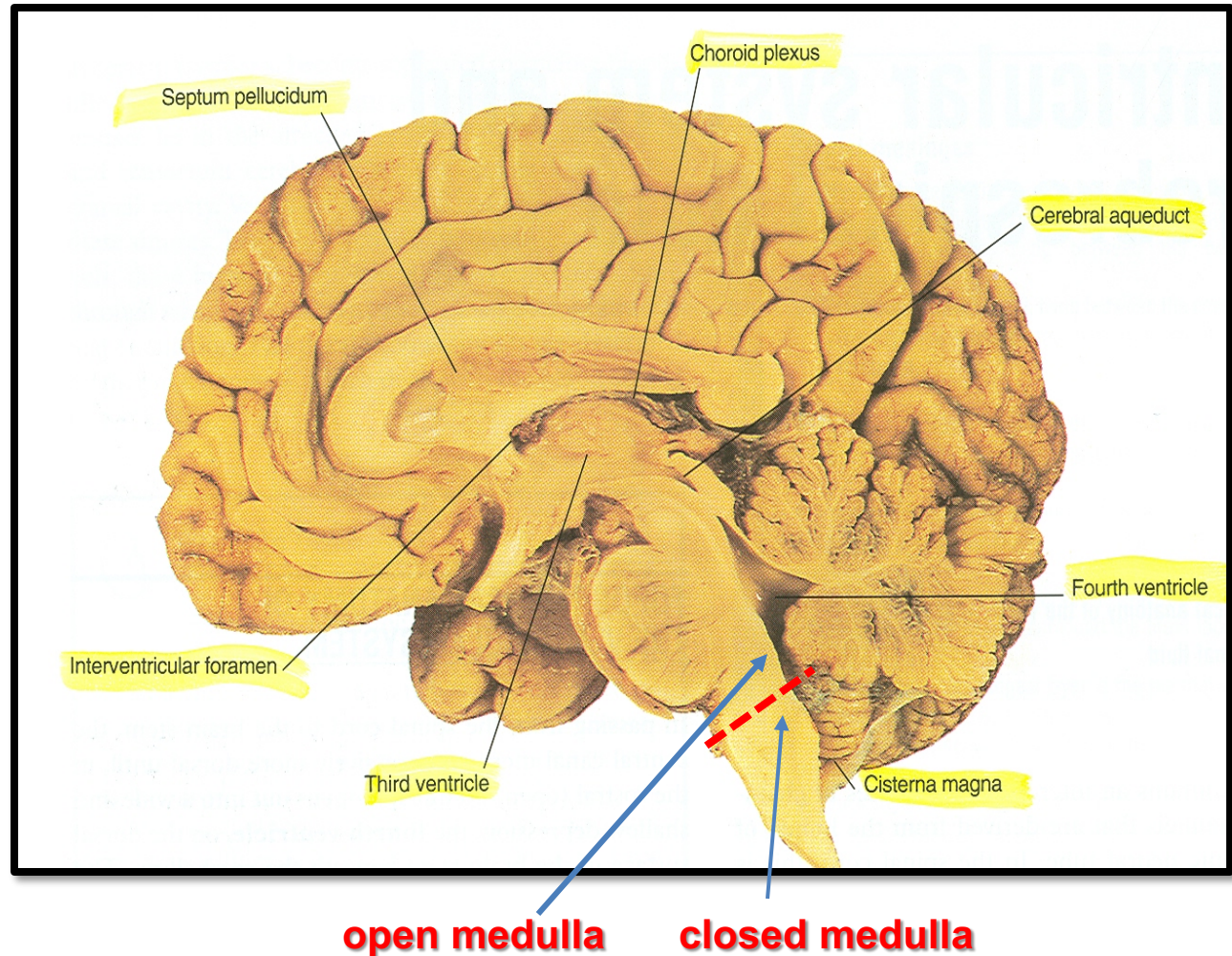
# MID BRAIN – VENTRAL SURFACE

- 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 (3<sup>rd</sup>):** from medial aspect of crus cerebri.



# MEDULLA – DORSAL SURFACE

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

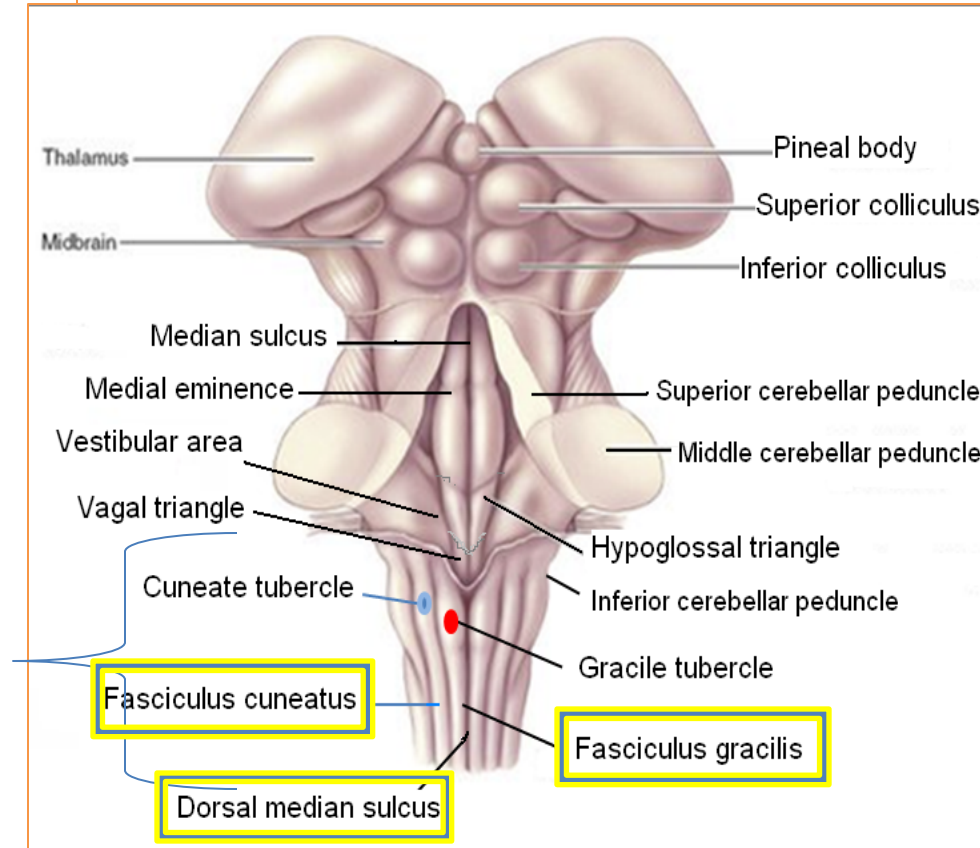


## □ Cavity: central canal

Composed of:

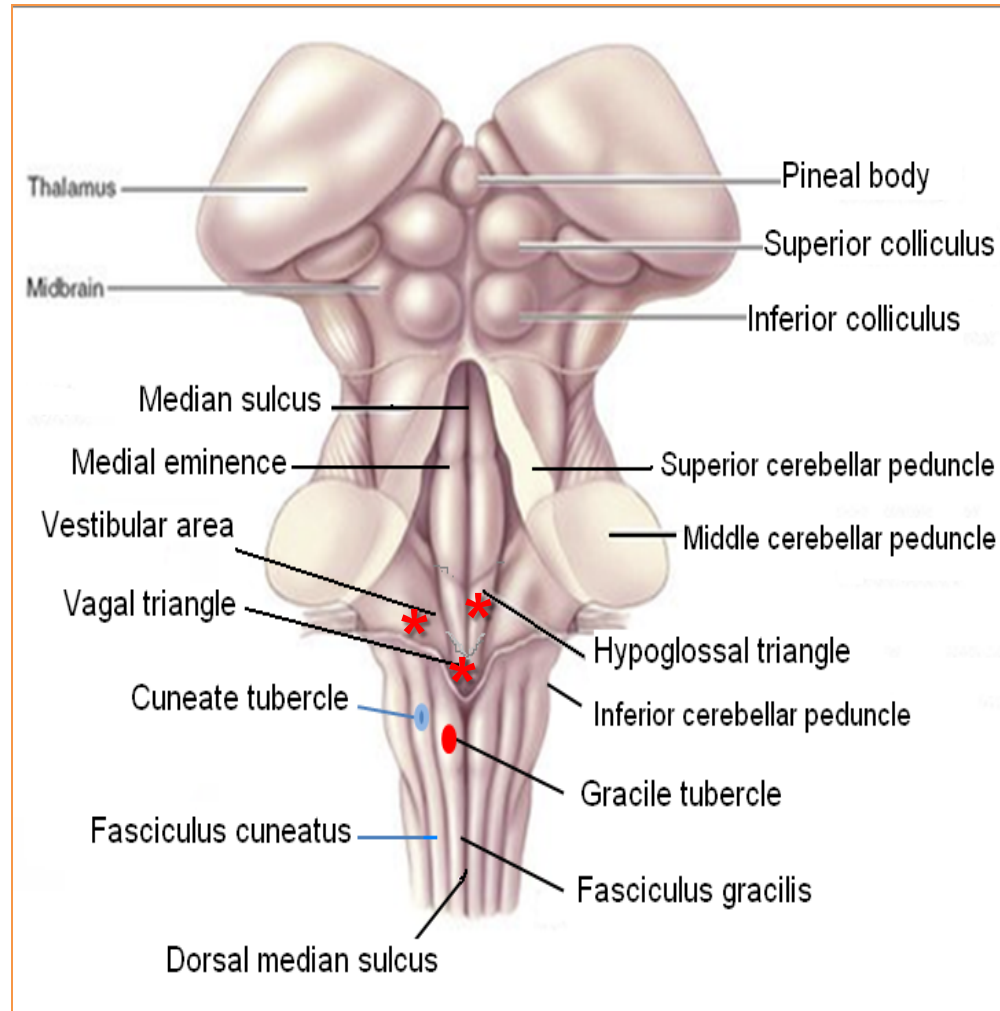
- **Dorsal median sulcus:** divides the closed medulla into 2 halves
- **Fasciculus gracilis:** on either side of dorsal median sulcus
- **Gracile tubercle:** an elevation produced at the upper part of fasciculus gracilis, marks the site of gracile nucleus
- **Fasciculus cuneatus:** on either side of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

## CLOSED MEDULLA



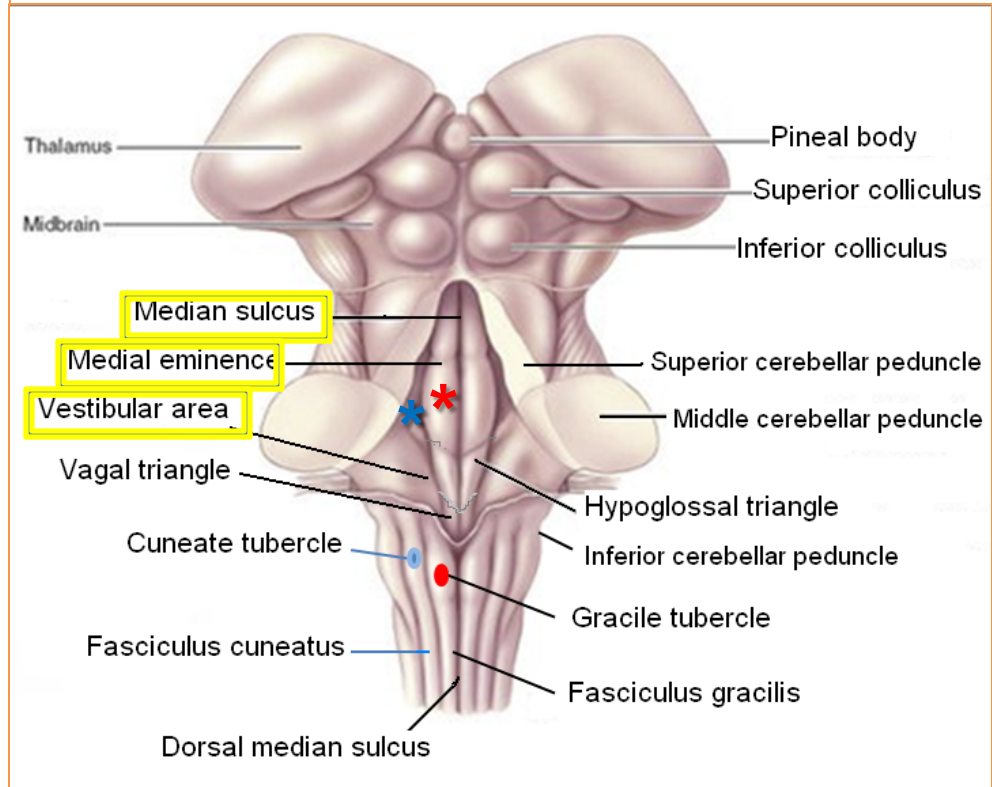
# OPEN MEDULLA

- **Cavity: 4<sup>th</sup> 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.**



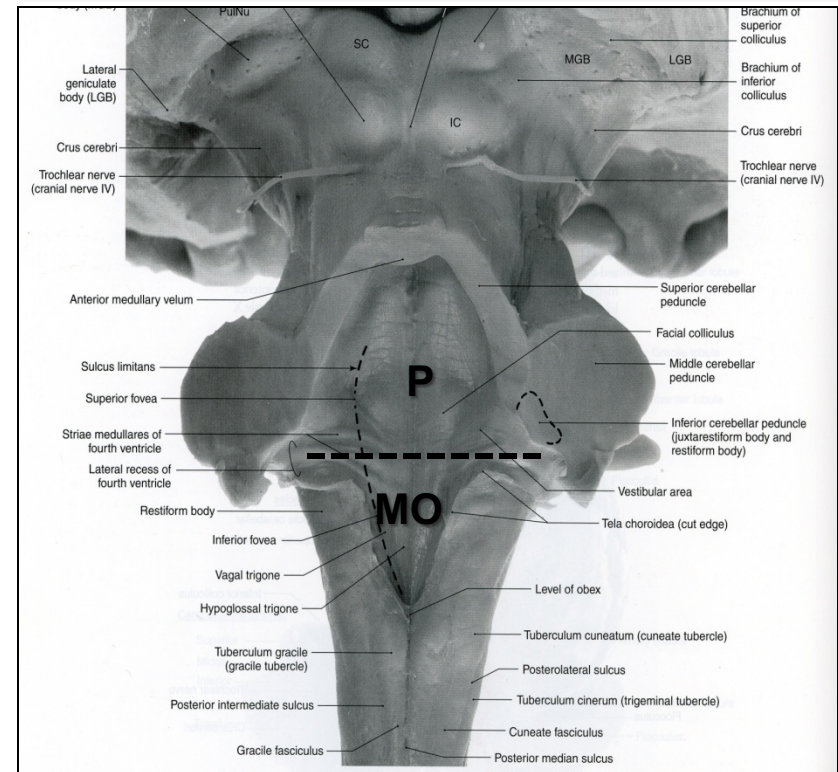
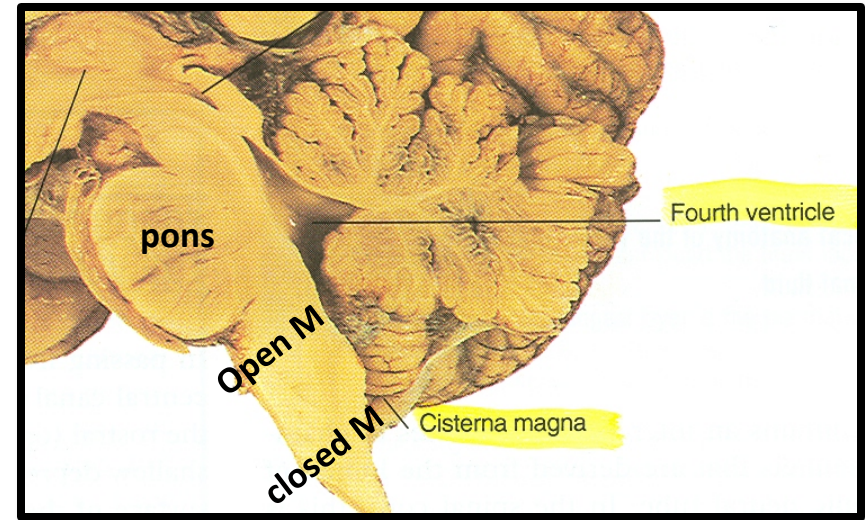
# PONS – DORSAL SURFACE

- ❑ 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.



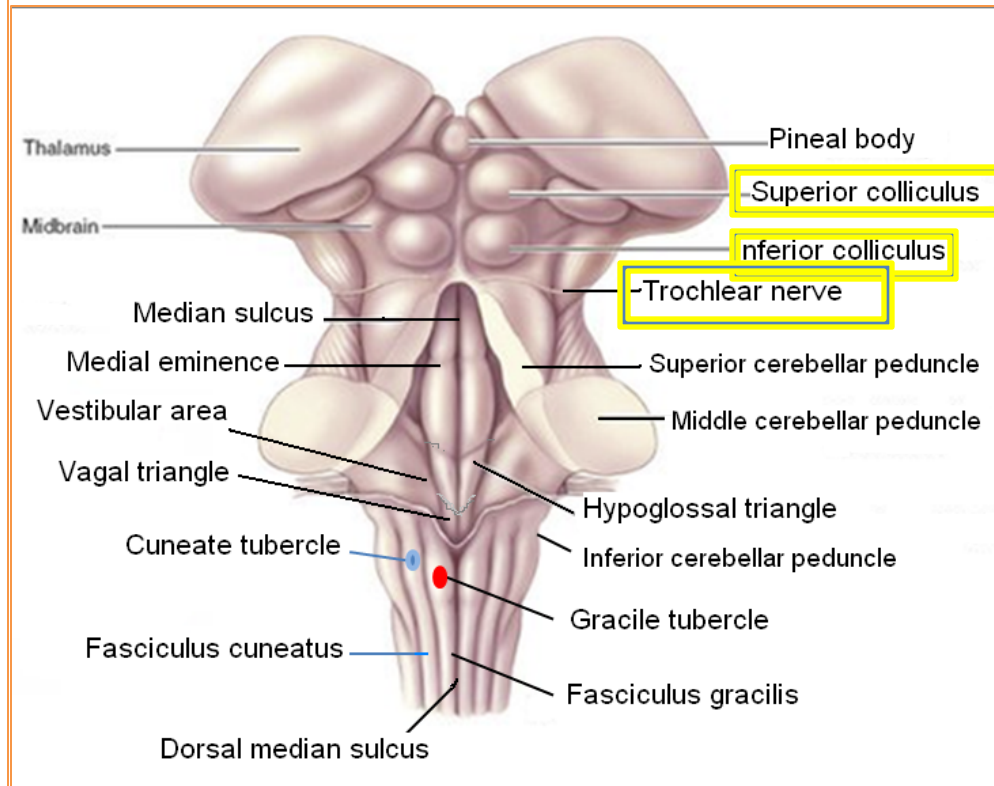


- The dorsal surfaces of **open medulla** and **pons** lie in the **caudal 1/3<sup>rd</sup>** and the **rostral 2/3<sup>rd</sup>** of the **floor of the 4<sup>th</sup> ventricle** respectively.



# 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 (4<sup>th</sup>):** 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 3<sup>rd</sup> to 12<sup>th</sup>).
- ❑ Cranial nerves (with the exception of 4<sup>th</sup>) emerge from ventral surface of brain stem.

Which Cranial Cavity does the Brainstem lie in?

The Posterior Cranial Fossa

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

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

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

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

What is the function of the Medullary Pyramids?

These are Descending Motor Fibers

What is the function of the Decussation of the Pyramids?

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

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

The Closed Part

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

The 4th Ventricle (IV Ventricle)

*Sore Today,  
Strong Tomorrow*

**THANK YOU**