LECTURE 08

VENTRICULAR SYSTEM
(4th Ventricle)

By:

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INTRODUCTION TO 4TH VENTRICLE

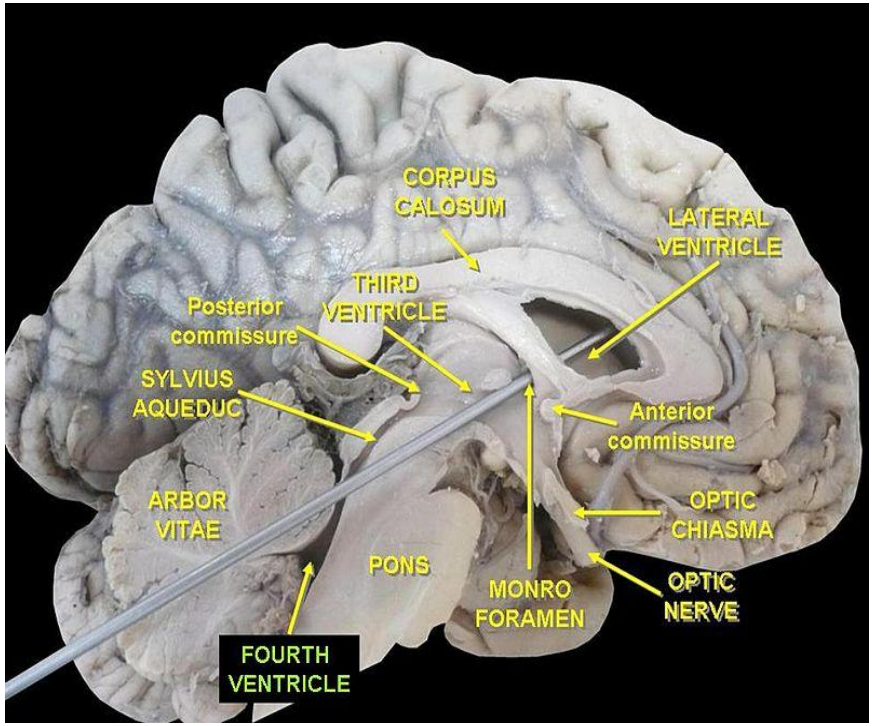
- The fourth ventricle is one of the interconnected fluid-filled cavities within the human brain.

- There are four of these cavities in the brain, three of which are located within the cerebrum:

✓ Lateral ventricles and

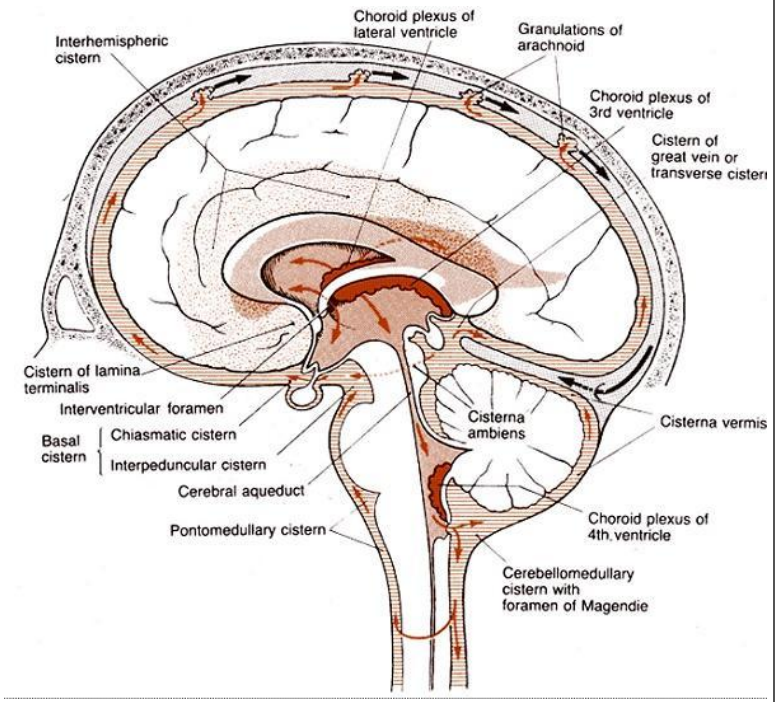
✓ Third ventricle.

- These cavities and their content constitute the ventricular system of the brain.



INTRODUCTION TO 4TH VENTRICLE……CON'T

- **LOCATION:**
- The fourth ventricle lies:



- ✓ Posterior/dorsal to the Pons and medulla (of the brainstem) and
- ✓ Anterior/ventral to the cerebellum.

- **Superiorly:**
- It extends from the cerebral aqueduct (aqueduct of Sylvius)
- **Inferiorly:**
- It extend into the central canal of brainstem and spinal cord.

- Its surface is lined by an **Epithelial layer** called the **Ependyma**, and is bathed with cerebrospinal fluid (CSF).

INTRODUCTION TO 4TH VENTRICLE……CON'T

- The fourth ventricle has an:

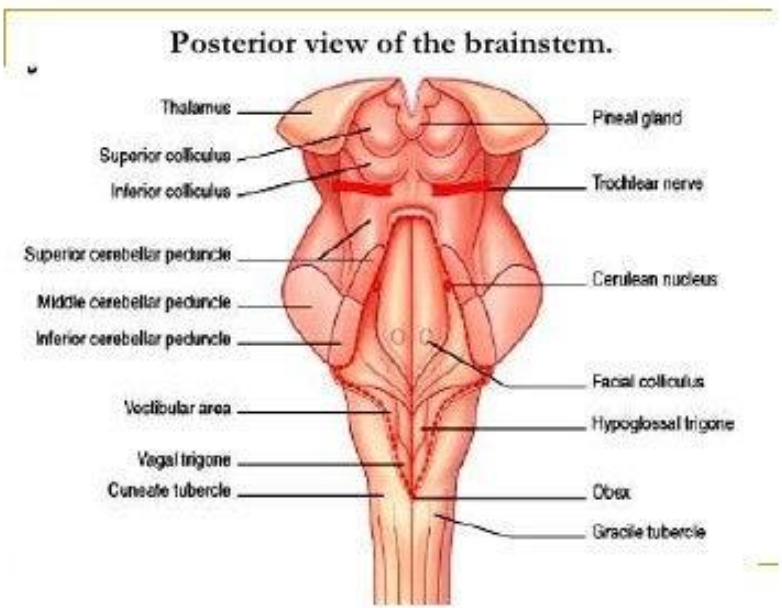
✓ **Anterior/ventral floor** with a characteristic diamond shape, named the rhomboid fossa, and a

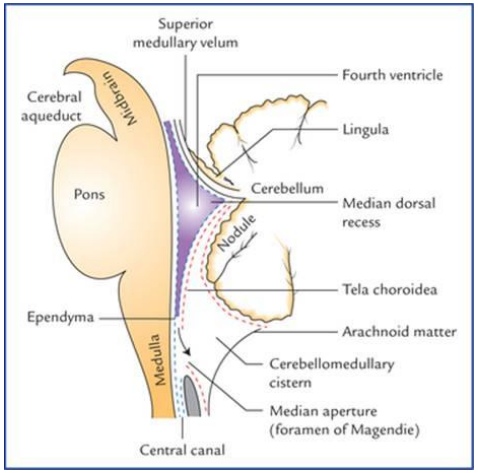
✓ **Posterior/dorsal** tent-shaped roof.

- CSF produced and/or flowing into the fourth ventricle can exit to the subarachnoid space.

✓ Lateral apertures and

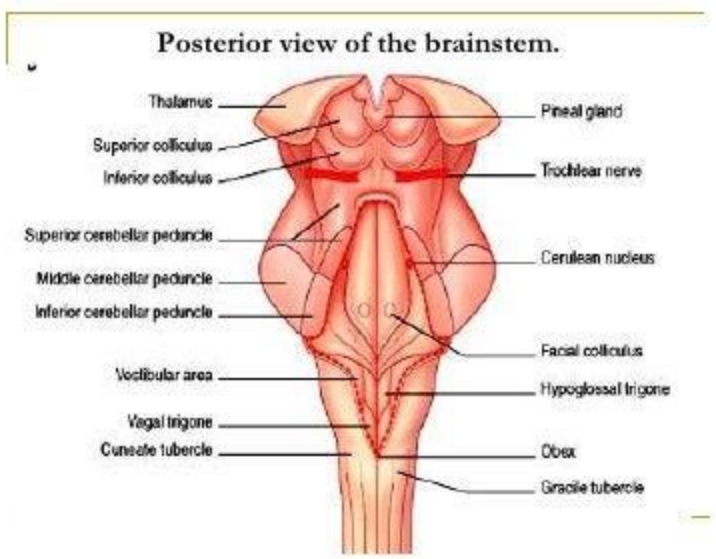
✓ A single median aperture located in the inferior portion of the roof.

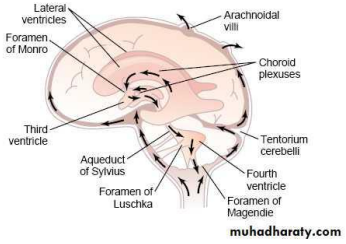


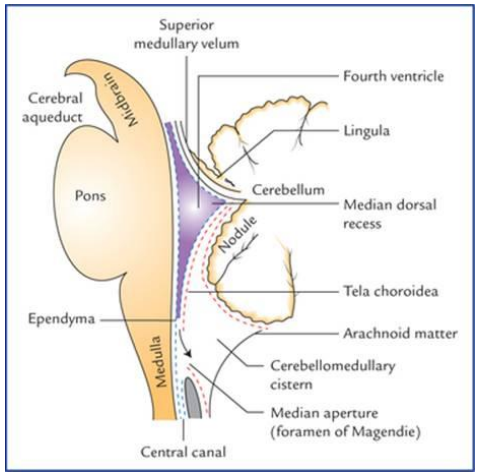


LATERAL WALL OF THE 4TH VENTRICLE

- Fourth ventricle is formed by the cerebellar peduncles.
- The **Superior part** of these walls is formed by the superior cerebellar peduncle.
- The **Inferior part** is formed by the inferior cerebellar peduncle and by the gracile and cuneate tubercles of the brainstem.
- It has two major extensions, known as the lateral recesses, one on either side of the midline.
- These recesses extend laterally between the inferior cerebellar peduncle and the peduncle of the flocculus of the cerebellum, to open into the subarachnoid space as the lateral apertures **(foramina of Luschka)**.







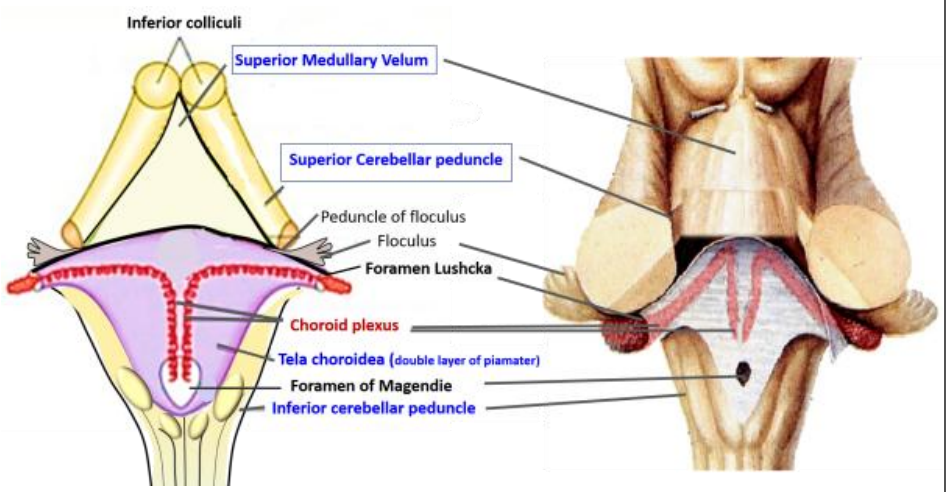
ROOF OF THE 4TH VENTRICLE

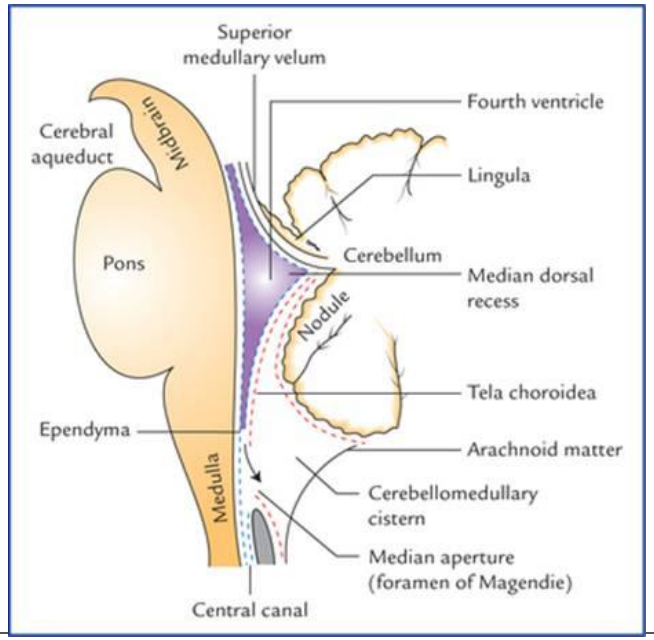
- The roof of the fourth ventricle has presents a 'tent-like' apex at the intersection of it's superior and inferior parts.

- This apex, also known as the fastigium, extends into the white core of the cerebellum.

- The superior part of the roof is formed by the superior cerebellar peduncles and the superior medullary velum (thin sheet of white matter).

- The inferior part of the roof is made of non-nervous tissue, the inferior medullary velum.





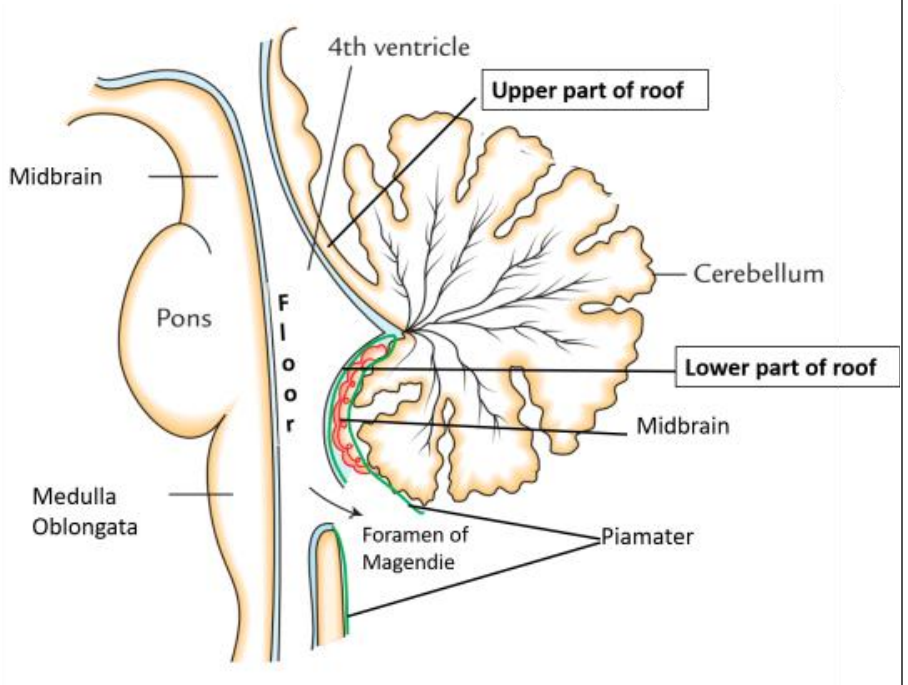
ROOF OF THE 4TH VENTRICLE

- However, like other parts of the ventricle,
- ✓ It is lined by a membrane consisting of ependyma and
- ✓ A double fold of pia mater which constitutes the tela choroidea of the fourth ventricle.

- Laterally on each side of the midline, this membrane extends and joins the inferior cerebellar peduncles.

- The lower part of the membrane has a large aperture, the foramen of Magendie.

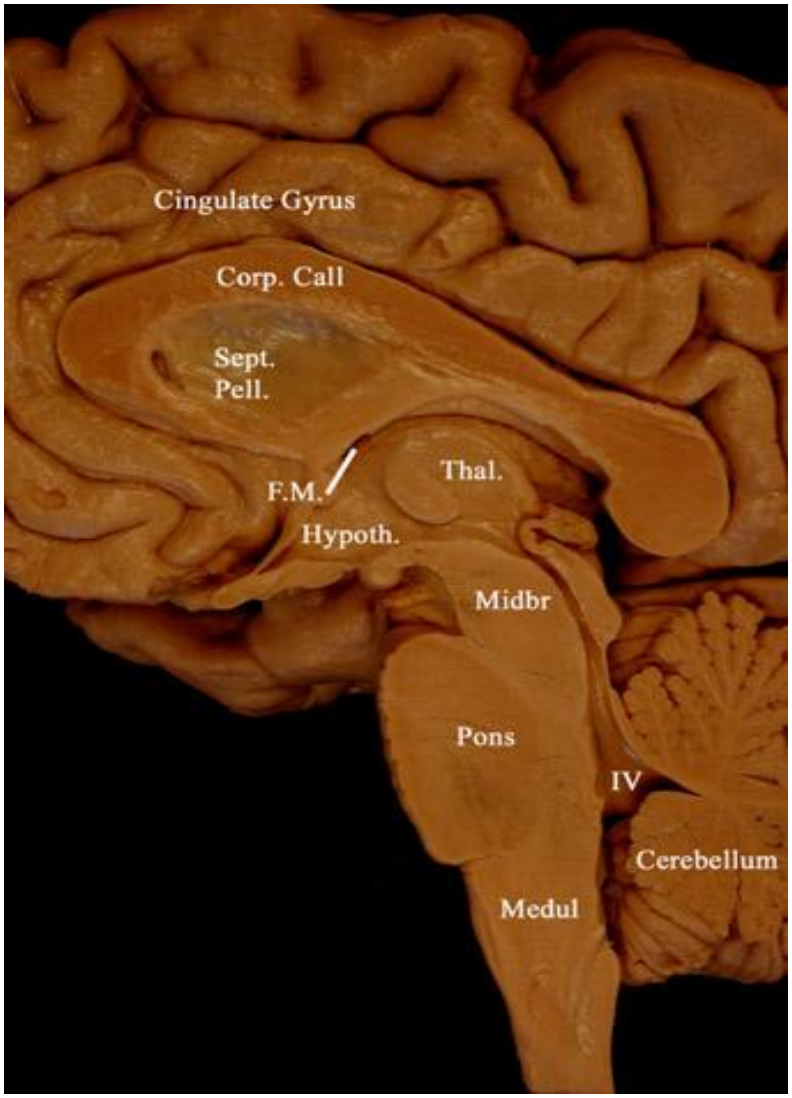
- This is the median aperture of the fourth ventricle, through which the entire ventricular system communicates.



CAVITY OF THE 4TH VENTRICLES

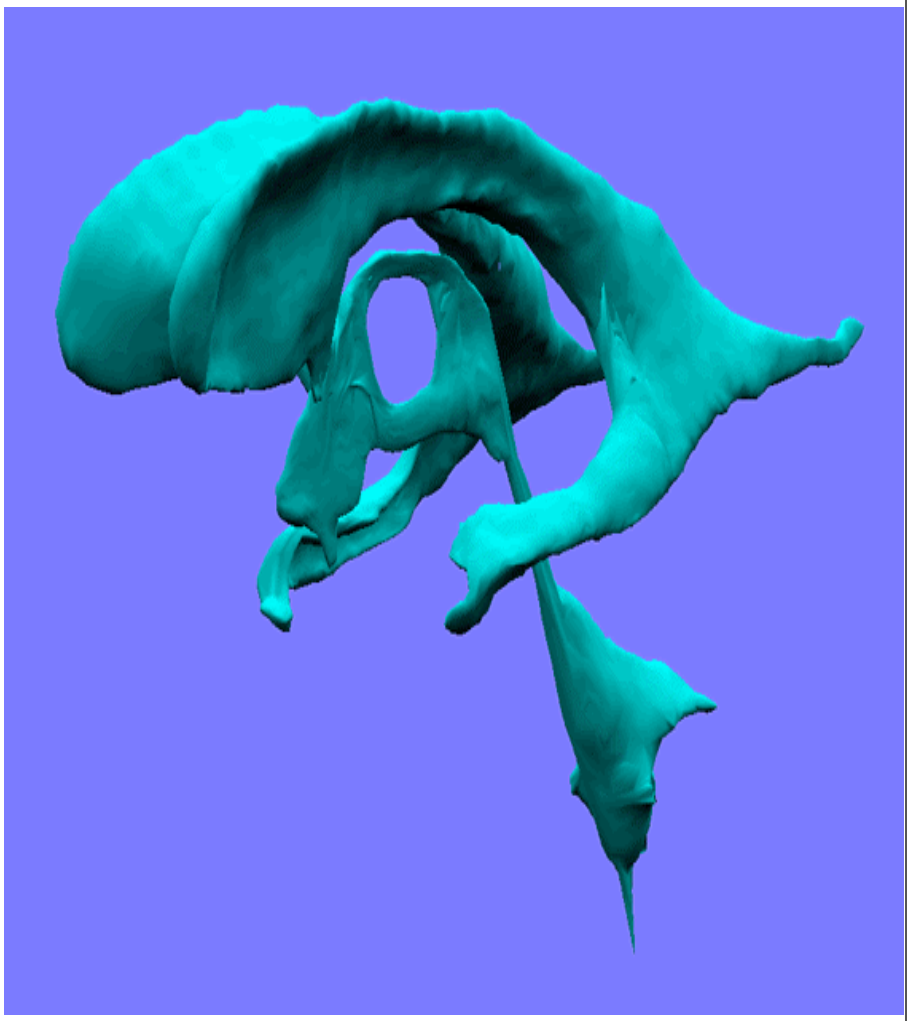
Communication of the Ventricles

- The cavity or fossa of the fourth ventricle communicates with the third ventricle superiorly as a continuation of the cerebral aqueduct.
- The inferior portion of the cavity is known as the obex, and extends into the central canal of the brainstem, which in turn runs through the vertebral column.
- The cavity also communicates with the subarachnoid space through the three apertures mentioned above.

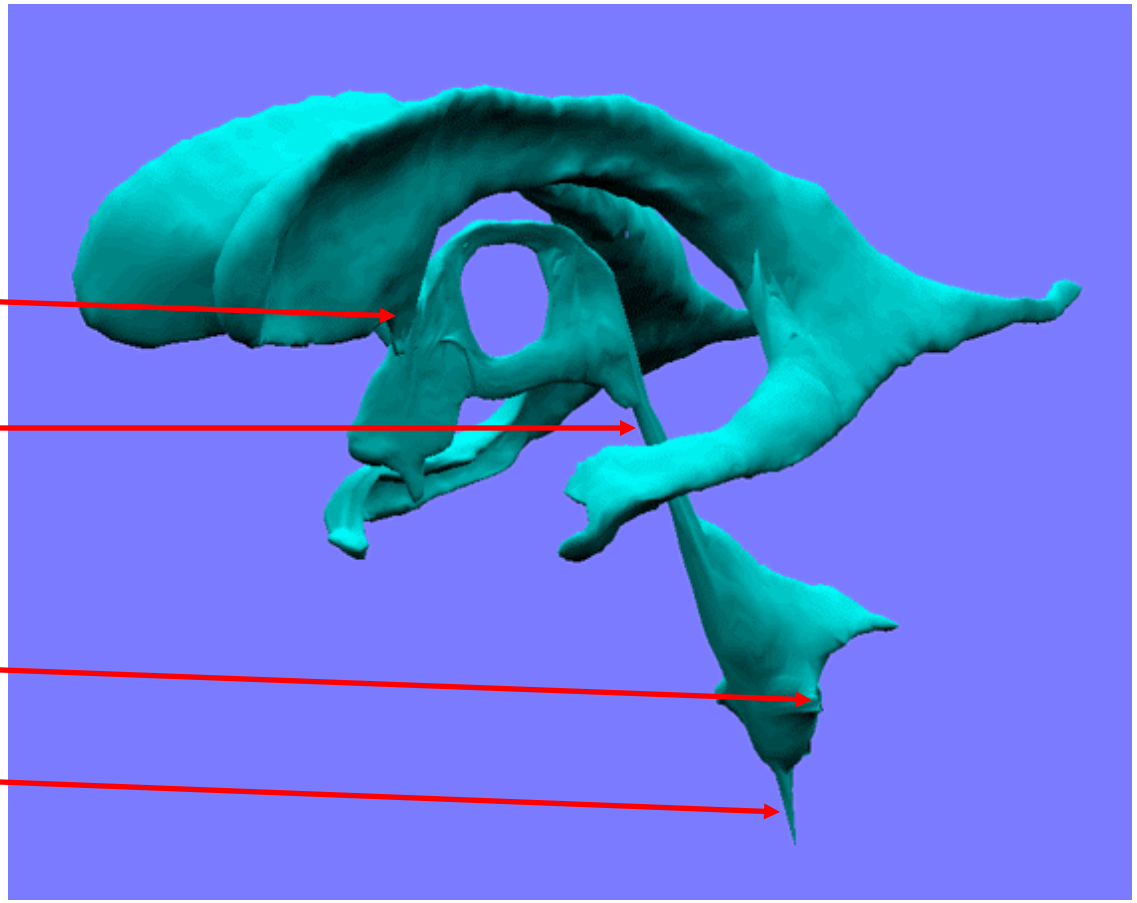


Ventricles are connected or communicate through

- Intraventricular Foramina (of Monroe)
  - It is a wide , oval hole which connects lateral Ventricles to Third Ventricle
- Cerebral Aqueduct (of Sylvius)
  - It is a long, thin channel connects third Ventricle to Fourth
- Foramen of Magendie
  - Median aperture -- Fourth ventricle to subarachnoid space
- Foramina of Luschka
  - Lateral apertures -- Fourth ventricle to subarachnoid space



VENTRICLES AND ITS COMMUNICATION



FLOOR OF THE 4TH VENTRICLE

- The floor of the fourth ventricle is also referred to as the rhomboid fossa because of its shape.
- It is divisible into:

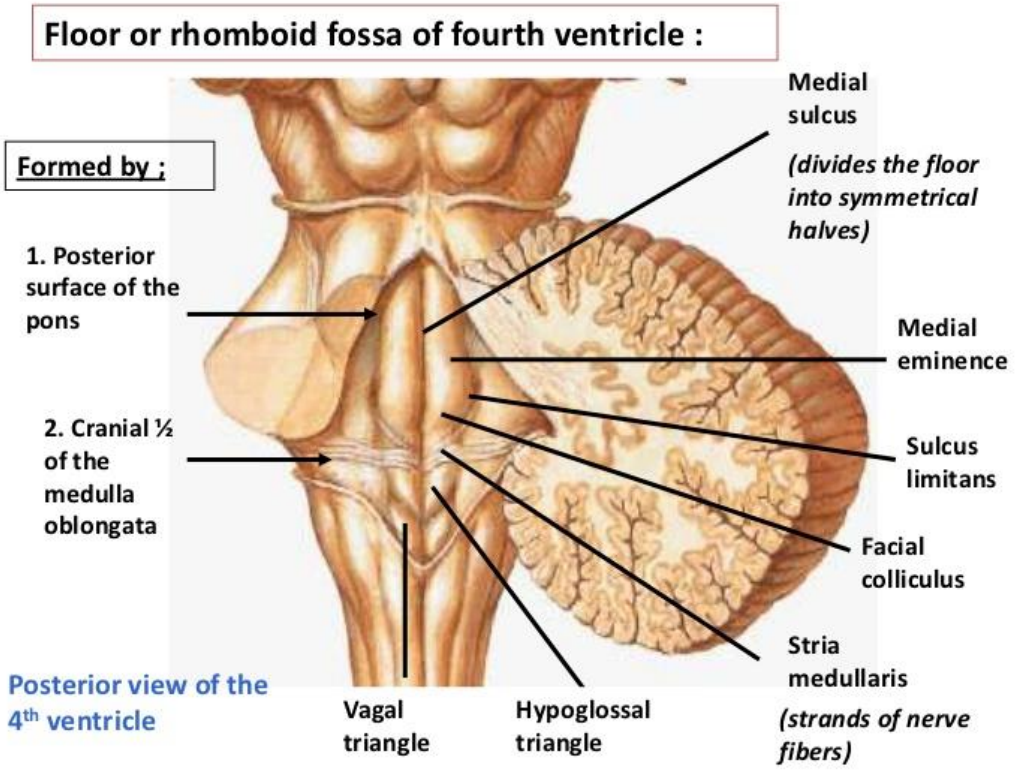
✓ Right and

✓ left half by the posterior median sulcus, and

And into a:

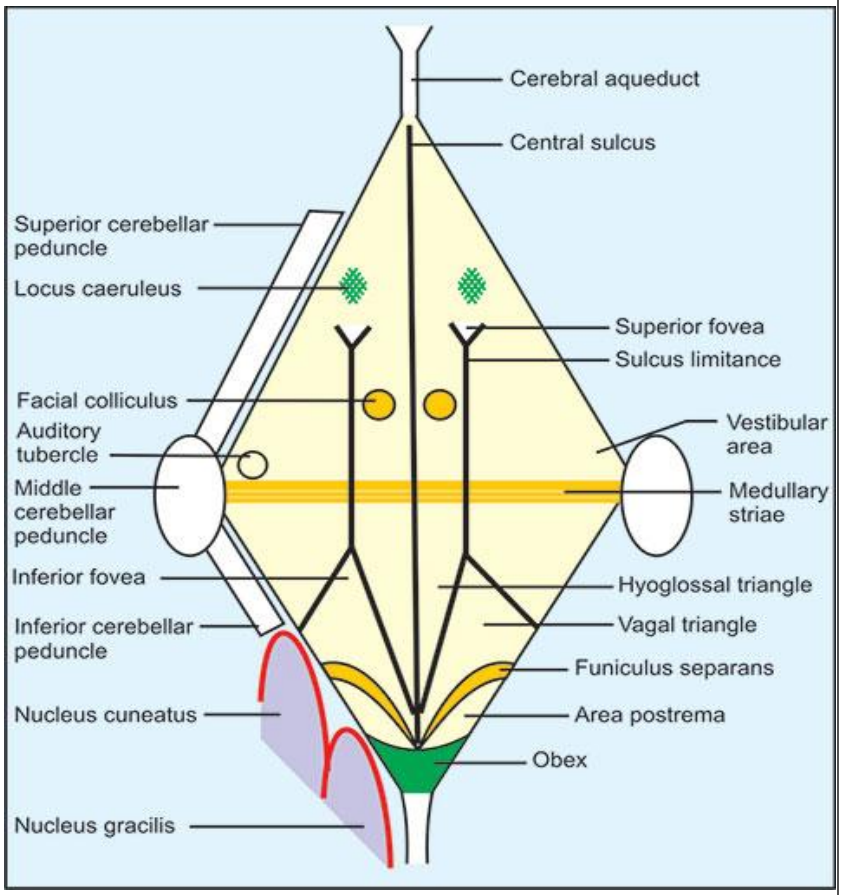
✓ Superior and

✓ Inferior triangle by the striae medullaris.



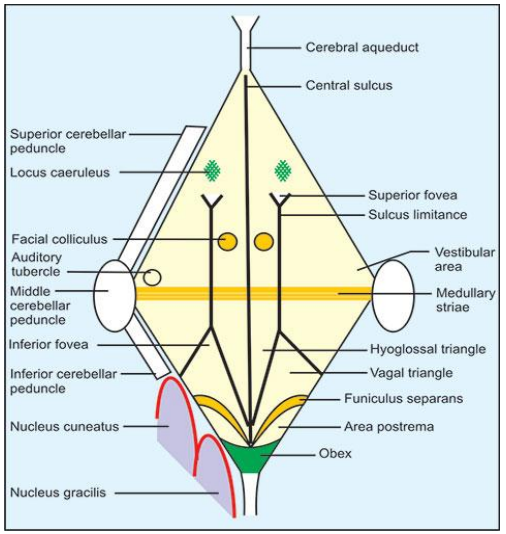
FLOOR OF THE 4TH VENTRICLE

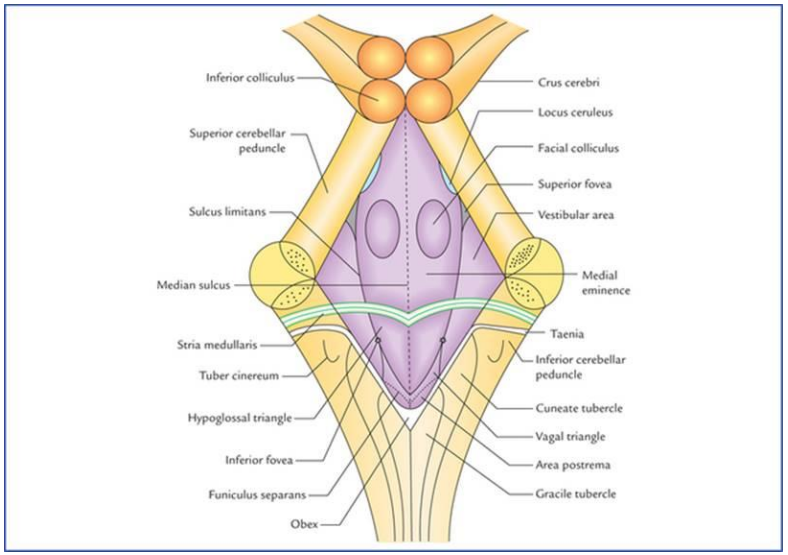
- Upper triangular part …… posterior surface of the pons.
- Lower triangular area…….upper part of the posterior surface of the medulla and
- An intermediate part at the junction of the medulla and pons make up the lower triangular part.
- The intermediate part is prolonged laterally over the inferior cerebellar peduncle as the floor of the lateral recess.
- Its surface is marked by the presence of delicate bundles of transversely running fibres that constitute the striae medullares.



FLOOR OF THE 4TH VENTRICLE

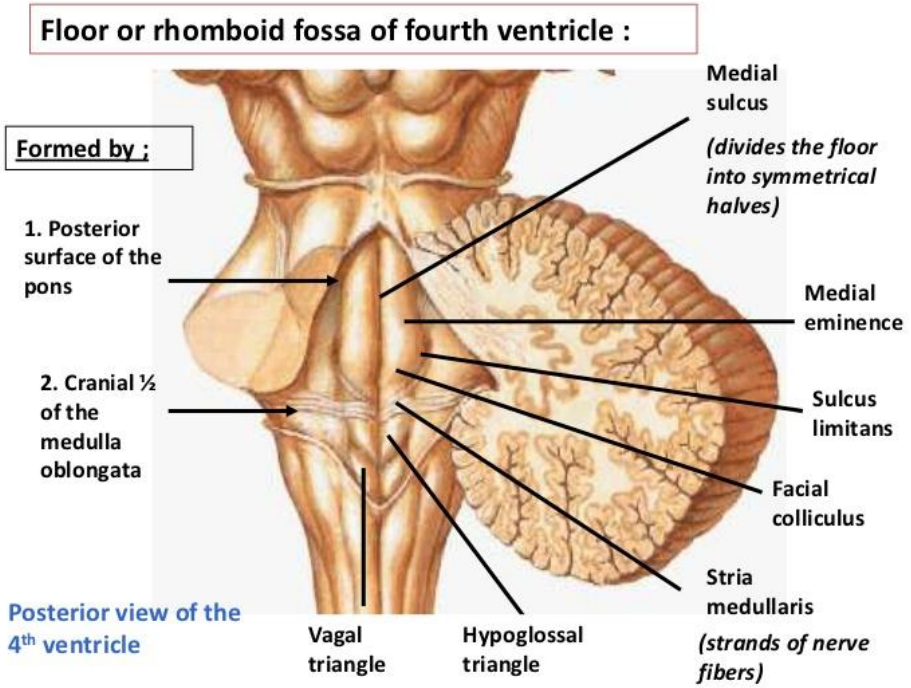
- The lowest part of the floor of the fourth ventricle is referred to as the **calamus scriptorius** as it resembles the TIP OF PEN.
- Each inferolateral margin of the floor is marked by a narrow white ridge called **taenia.**
- The right and left taeniae meet at the inferior apex of the floor to form a small fold called the obex.





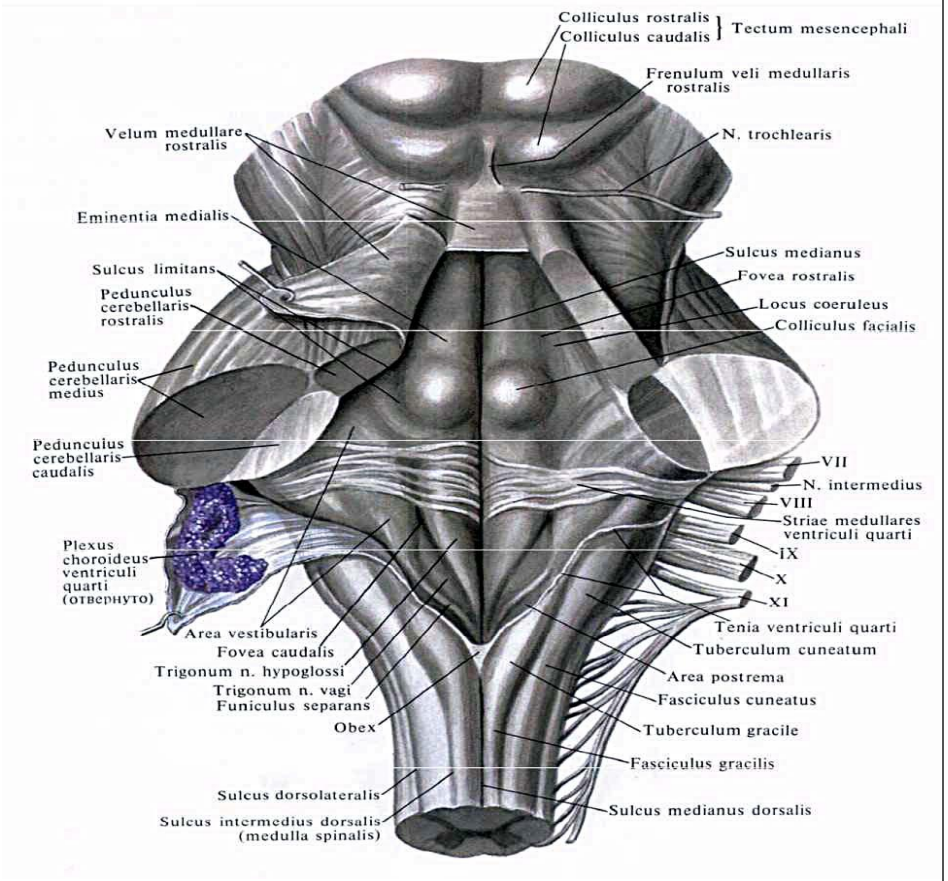
GROSS STRUCTURES OF THE FLOOR OF THE 4TH VENTRICLE

- For ease of description of the floor of the fourth ventricle, the median sulcus is used as a major feature.
- On either side of this sulcus lies a longitudinal elevation called the **medial eminence.**
- This eminence is limited laterally by the sulcus called as **sulcus limitans.**
- The area is called the vestibular area and houses the **vestibular nuclei.**
- Thus the vestibular area lies partly in the pons and partly in the medulla.



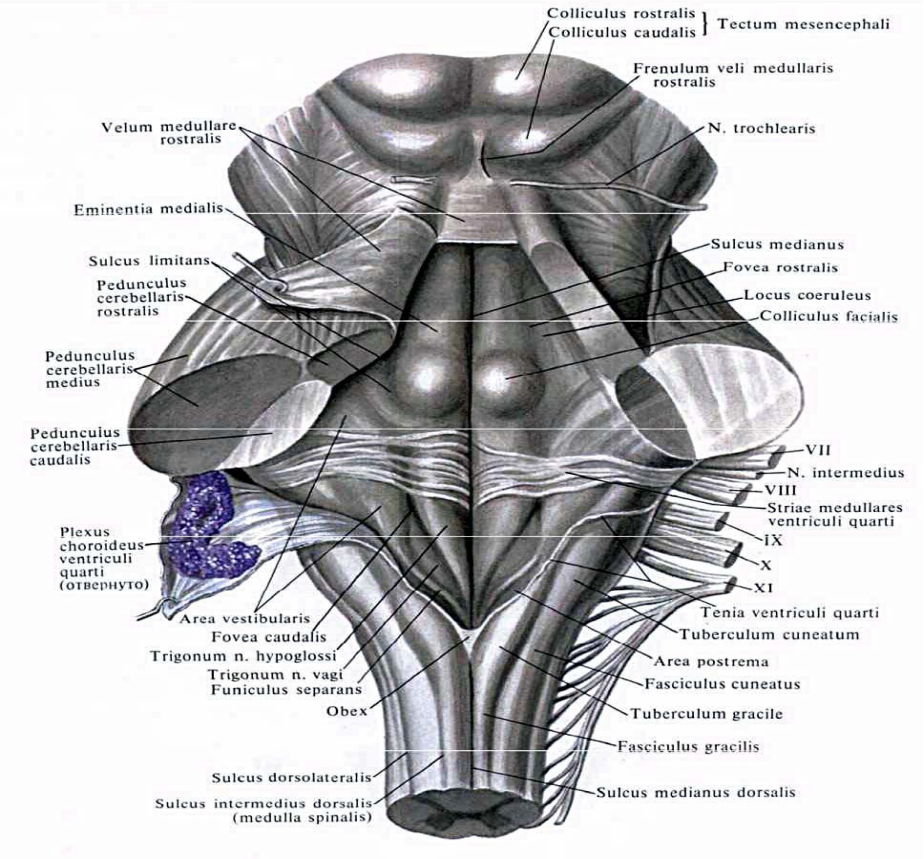
GROSS STRUCTURES OF THE FLOOR OF THE 4TH VENTRICLE.....CON'T

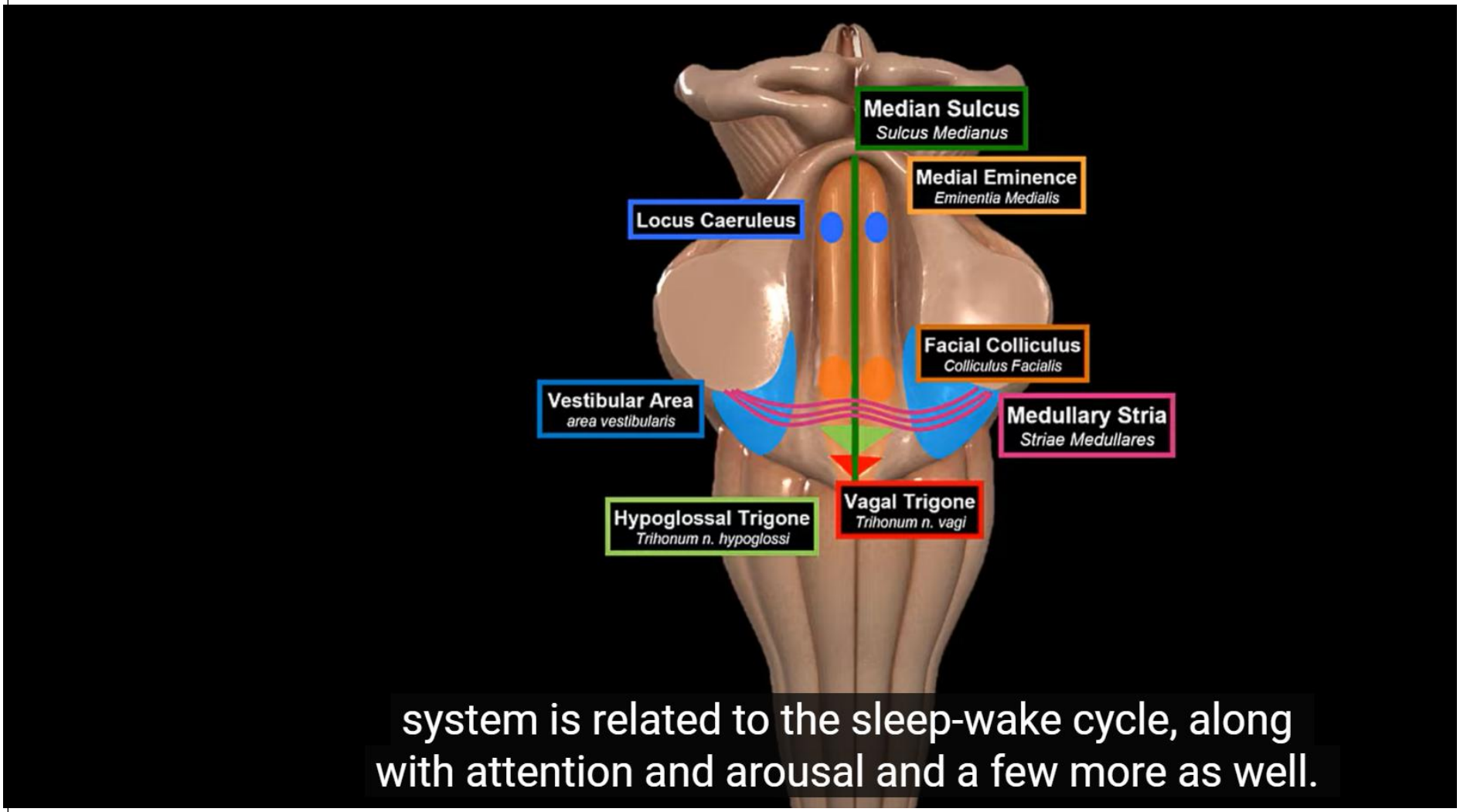
- The uppermost part of the sulcus limitans overlies an area called the **locus coeruleus**, deep to which there is a nucleus called the **Nucleus coeruleus** extending into the pontine tegmentum .
- Lower down the sulcus limitans is a depression referred to as the superior fovea.
- At the level of this depression, the median eminence shows a swelling called the **facial colliculus.**
- Within the medullary part of the floor, the sulcus limitans is marked by a depression, the inferior fovea.



GROSS STRUCTURES OF THE FLOOR OF THE 4TH VENTRICLE.....CON'T

- Inferior to this inferior fovea is an oblique sulcus running towards the midline and dividing the medial eminence into two triangles called the **hypoglossal** and **vagal** triangles (or the hypoglossal and vagal trigones).
- The hypoglossal triangle lies medial and the vagal, lateral.
- These triangles house the hypoglossal and vagal nuclei respectively.
- The vagal triangle defines an area with the gracile tubercle called the area postrema.





system is related to the sleep-wake cycle, along with attention and arousal and a few more as well.

RECESSES OF FOURTH VENTRICLE

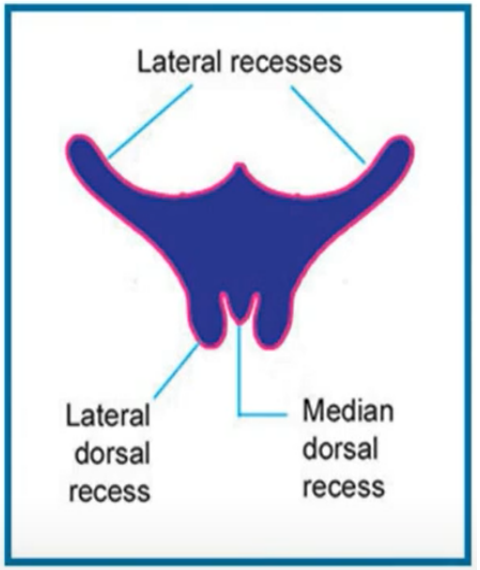
1. Lateral recess :

- two , one on each side

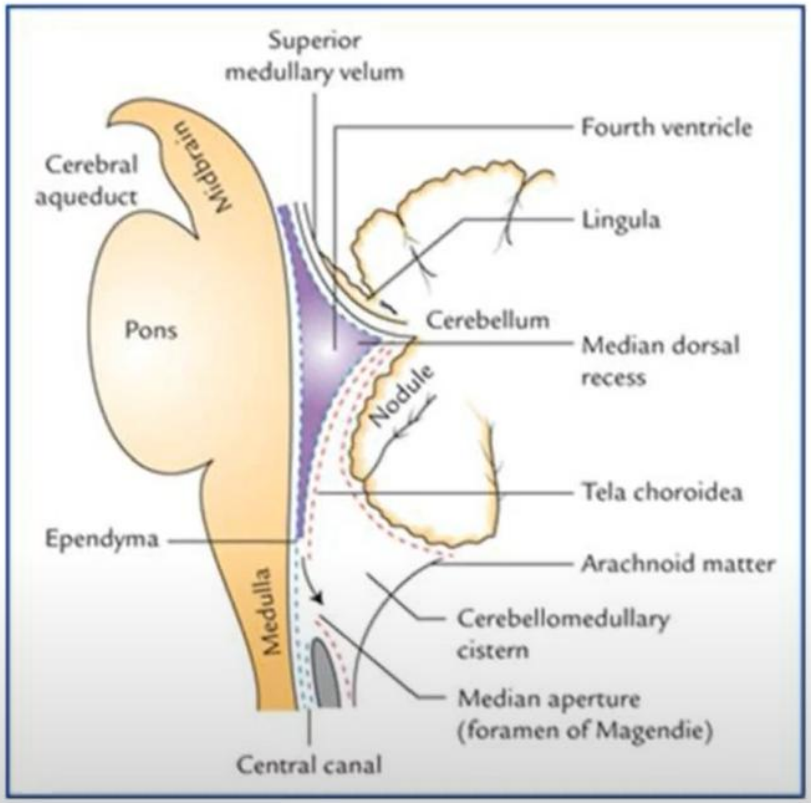
2. Median dorsal recess

3. Lateral dorsal recess :

- two , one on each side



ANGLES OF FOURTH VENTRICLE



SUPERIOR ANGLE

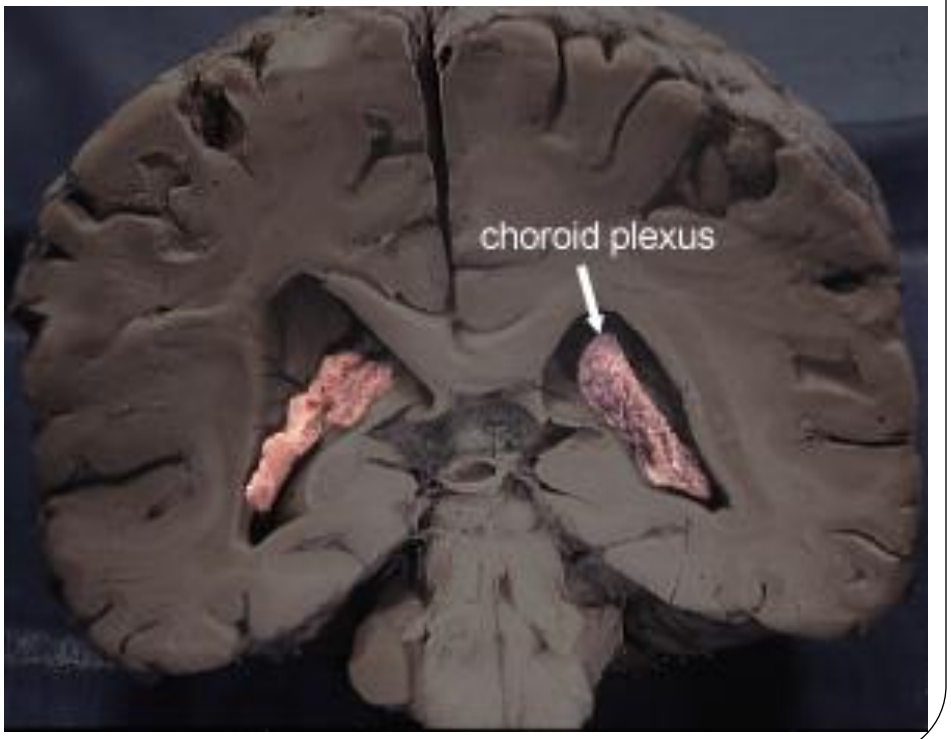
INFERIOR ANGLE

LATERAL ANGLE

Choroid Plexus and CSF

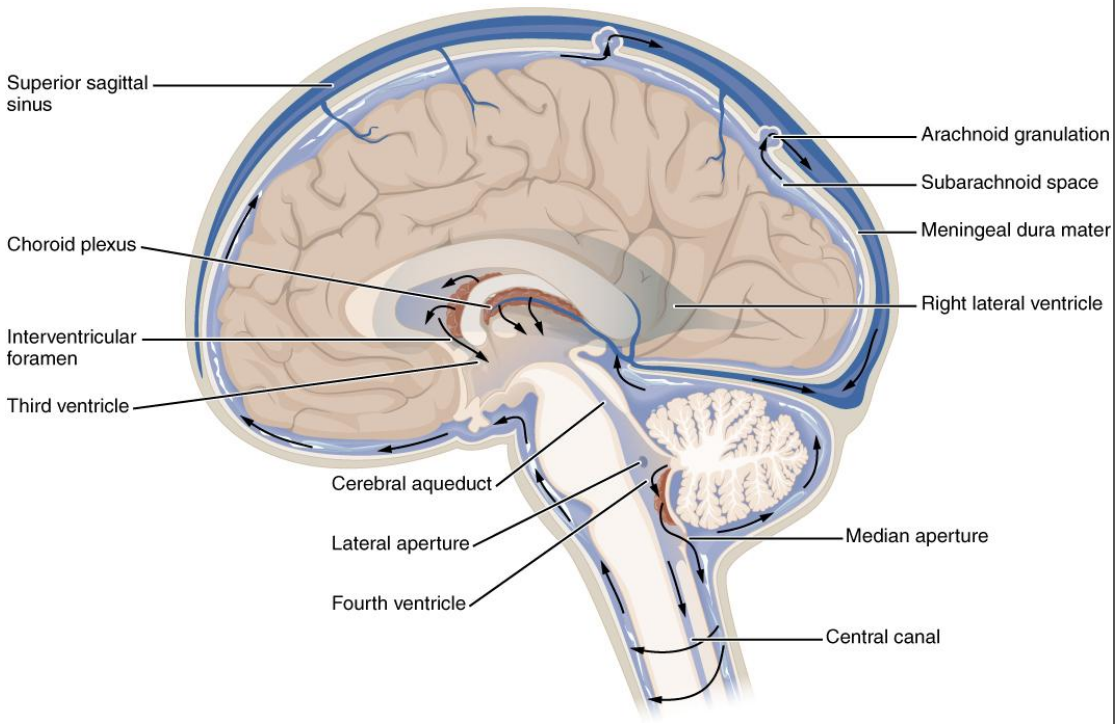
- Choroid Plexus
- It is two layered fold of pia mater that projects through the roof of the ventricular system and is covered by ependyma.

- Produces CSF
  - About .35 ml per minute
  - Total volume 70-120 ml

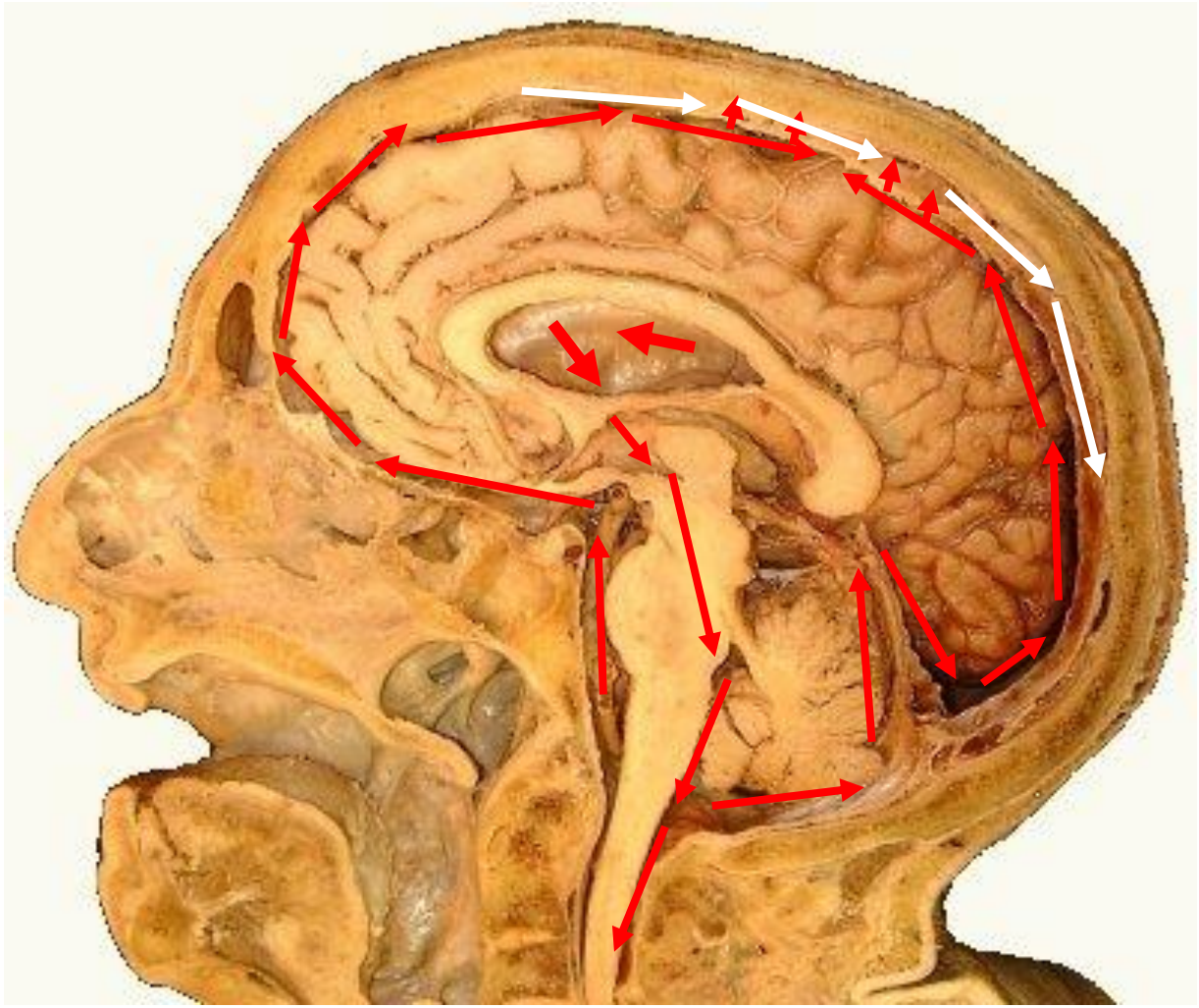


CSF FLOW

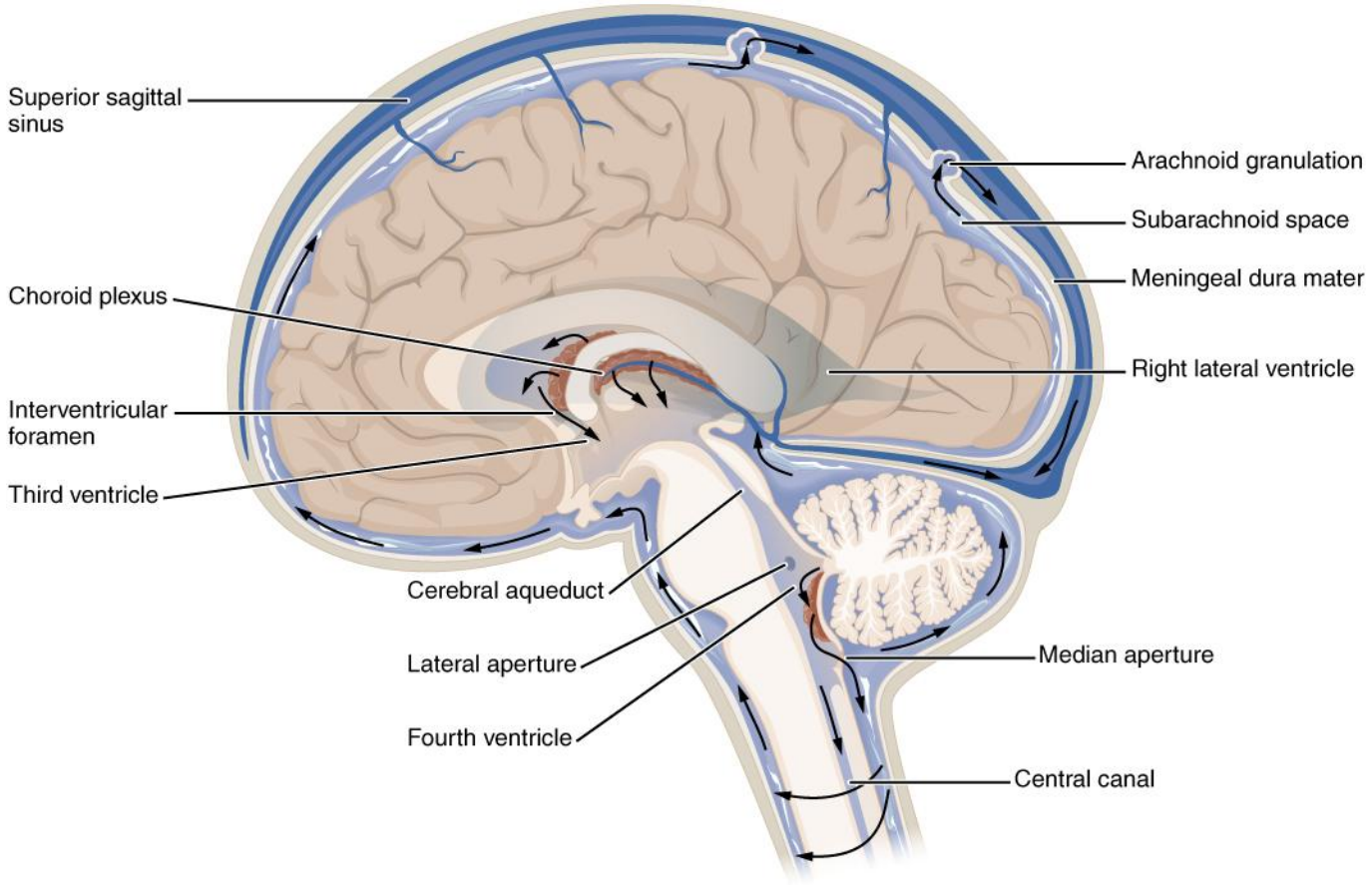
- Lateral ventricles
- Foramina of Monroe
- 3rd ventricle
- Aqueduct of Sylvius
- 4th Ventricle
- Foramen of Magendie/foramina of Lushka
- Subarachnoid Space
- Arachnoid granulations (absorption)
- Superior sagittal sinus



CSF FLOW



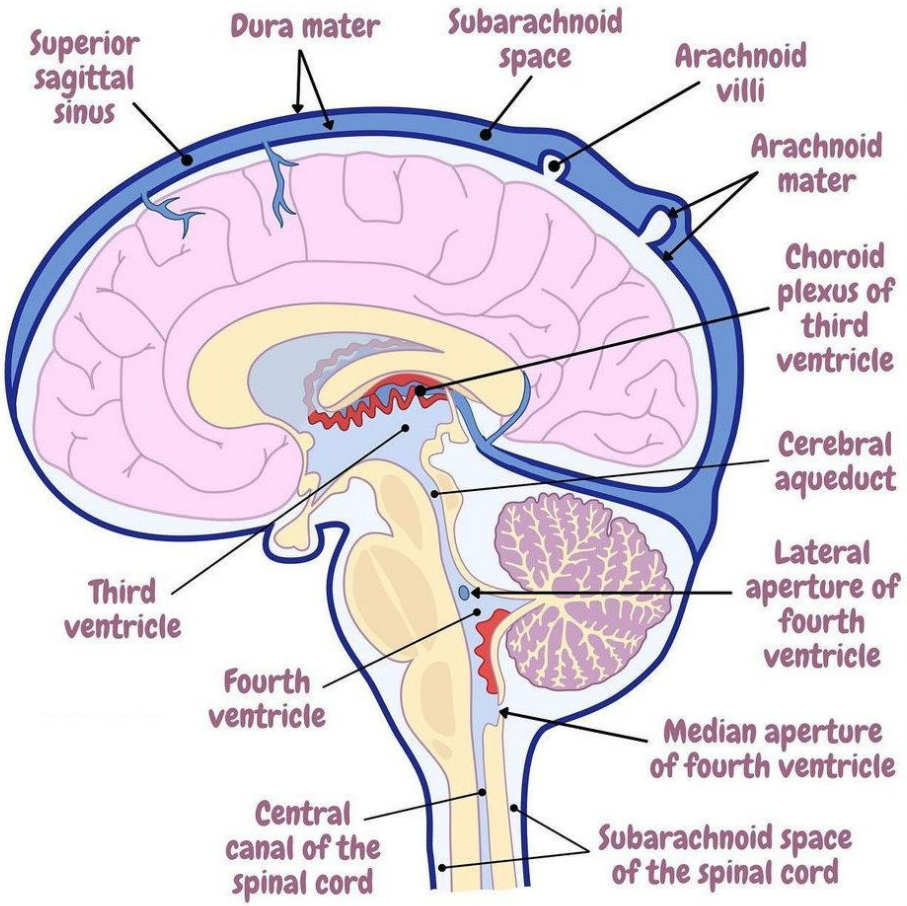
CSF ABSORPTION



- CSF flows to the dorsal surface of the brain.
- Where arachnoid granulations form a one-way valve and let the excess CSF enter the venous drainage of the superior sagittal sinus

Ventricular System - Pathway of CSF flow

1. CSF is produced and secreted by the choroid plexus of each lateral ventricle
2. CSF flows through interventricular foramina into the third ventricle
3. Choroid plexus of the third ventricle adds more CSF
4. CSF flows down cerebral aqueduct into the fourth ventricle
5. Choroid plexus of the fourth ventricle adds more CSF
6. CSF flows out the two lateral apertures and one median aperture
7. CSF fills the subarachnoid space and bathes the external brain & spinal cord
8. At the arachnoid villi, CSF is reabsorbed into the venous blood of the dural venous sinuses



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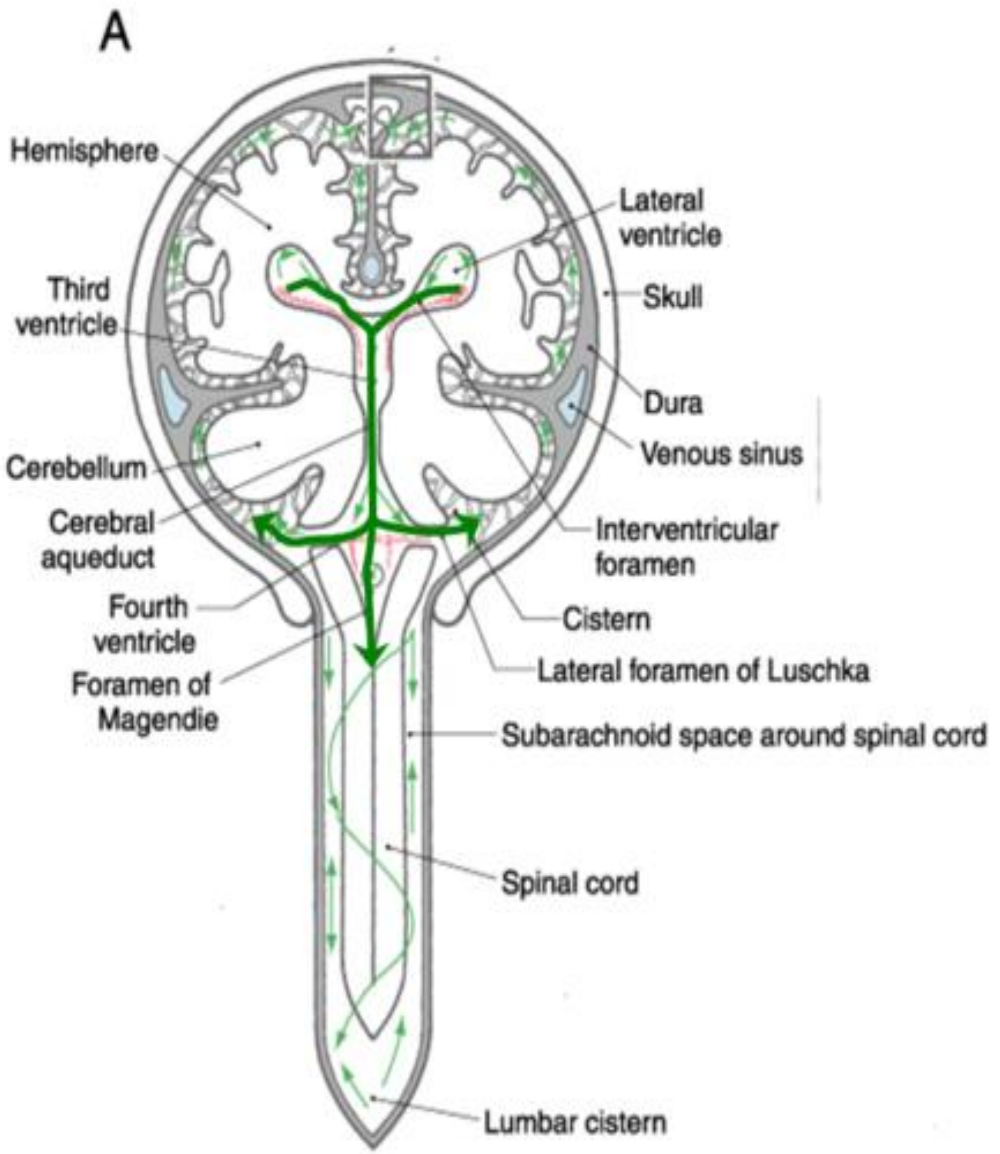

CLINICAL NOTES

HYDROCEPHALUS

- Hydrocephalus is one of the conditions that can result from blockage of the median and lateral apertures.
- In Arnold Chiari malformation (Type II Chiari malformation), the medulla and the tonsils of the cerebellum come to lie in the vertebral canal by descending through the foramen magnum.
- The median and lateral apertures are blocked by this condition leading to obstruction of CSF flow.
- This causes a type of hydrocephalus called internal hydrocephalus.
- Chiari II can also present with syringomyelia due to the development of CSF-filled cyst or syrinx.

MEDULLOBLASTOMA

- Medulloblastoma is the most common malignant brain tumour in children.
- It arises in the cerebellum and can therefore impinge on the roof of the fourth ventricle.
- The area postrema of the caudal region of the fourth ventricle is also of clinical significance because of its role in the control of vomiting.