

# CNS

Doctor 2021



## Anatomy Sheet (8)

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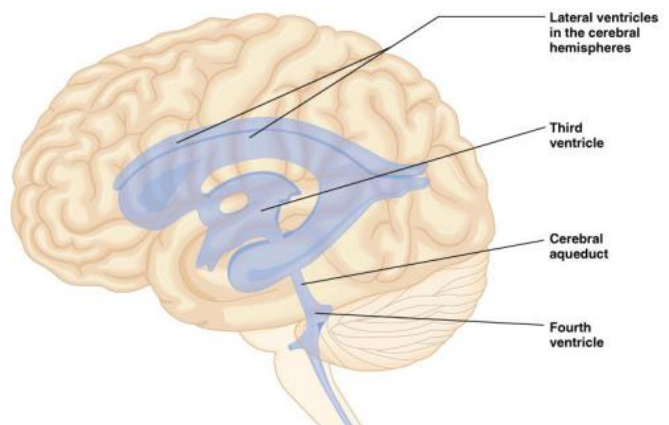
**Doctor:** Mohammed Alsalem

# Ventricles and location of CSF

- slides will be in pink, doctor's notes in black.

In the last lectures we studied thalamus & basal nuclei, in this lecture we will discuss ventricles of the brain, their walls and the cerebrospinal fluid.

This picture shows the hollow spaces in the brain (ventricles). We have 4 ventricles. 2 laterals; one in each hemisphere, they open into the 3<sup>rd</sup> ventricle in the midline (cavity of diencephalon), which opens into the 4<sup>th</sup> ventricle which is continuous with the central canal of the spinal cord.



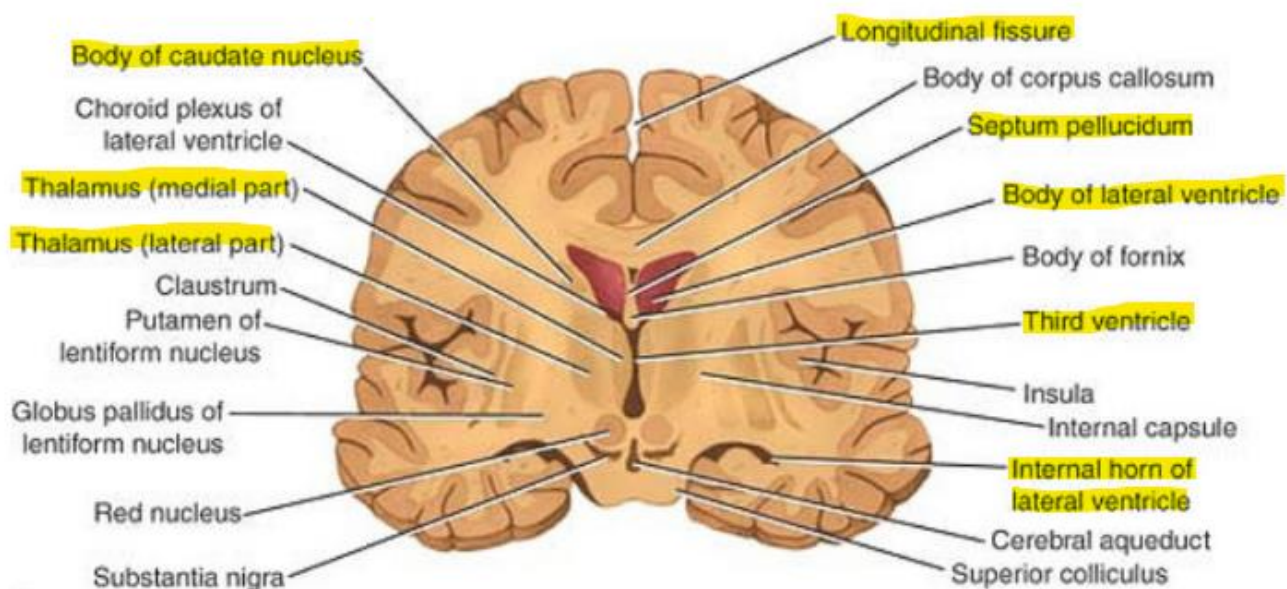
The lateral ventricle is C shaped, divided into anterior horn, body, posterior horn & inferior horn. There are no anatomical borders, but by definition; the anterior horn is found in the frontal lobe. The body in the parietal lobe. The posterior horn in occipital lobe and the inferior horn in temporal lobe.

## - **Body of the lateral ventricle**

Extends from the interventricular foramen (anterior end of thalamus) to the posterior end of the thalamus.

- ✓ Roof: undersurface of the corpus callosum
- ✓ Floor: body of the caudate nucleus and the lateral margin of the thalamus
- ✓ Medial wall septum pellucidum

- The coronal section below shows a coronal section, notice the longitudinal fissure & the lateral fissure. In the center you can see the body of the lateral ventricle (remember we have 2 lateral ventricles one right & one left).
- *Thalamus is exactly at level of body, so if you see the thalamus in any section, definitely you are at the body of lateral ventricle.*
- The roof is corpus callosum (commissural fiber connecting Rt. Hemisphere with Lt. hemisphere).
- Part of the floor is from thalamus and the other is from caudate nucleus (c shaped, follows the contour of the lateral ventricle).
- The tail of caudate forms the roof of inferior horn of lateral ventricle.
- The cavity in the center is the 3<sup>rd</sup> ventricle (slit like cavity of diencephalon) and on either side we have thalamus.
- Lateral ventricle opens into 3<sup>rd</sup> ventricle through foramen of Monro (interventricular foramen).
- The medial wall is called septum pellucidum, piece of gray & white matter, separating the two lateral ventricles.



## - Anterior horn of the lateral ventricle

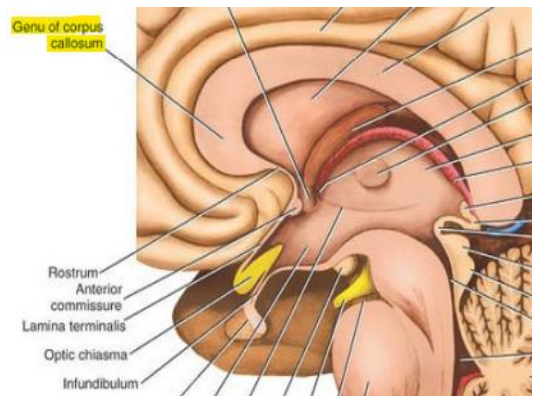
Anterior end: frontal lobe

Posterior end: continuous with the body of the ventricle

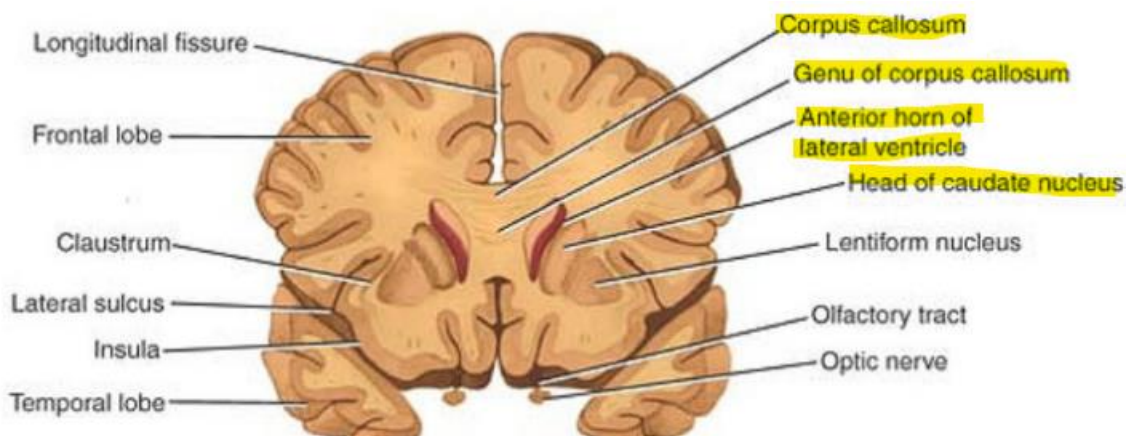
- ✓ Roof: anterior part of the corpus callosum
- ✓ Floor: head of the caudate nucleus
- ✓ Medial wall: superior surface of the rostrum of the corpus callosum, septum pellucidum and the anterior column of the fornix

- In roof we have corpus callosum appearing with genu (made by the anterior part of corpus callosum). It's between the two lateral ventricles.

You can see it in the mid-sagittal in the figure on the right:



- In floor we have caudate nucleus.
- On the medial wall we have rostrum of corpus callosum and part of septal pellucidum & finally the anterior collum of the formix (remember formix extends from hippocampus to hypothalamus).
- Notice we cannot see the thalamus in the section, since here it's behind the section at level of 3<sup>rd</sup> ventricle and body of lateral ventricle.
- We cannot see the 3<sup>rd</sup> ventricle as well at this level.





## - Posterior horn of lateral ventricle

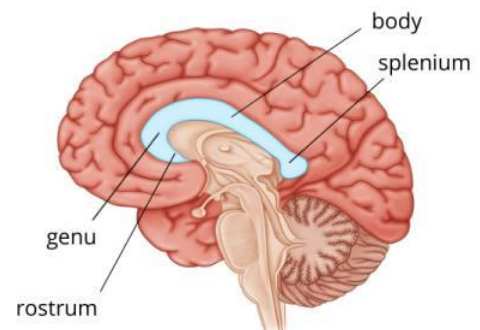
Anterior end: continuous with the body of the ventricle

Posterior end: occipital lobe

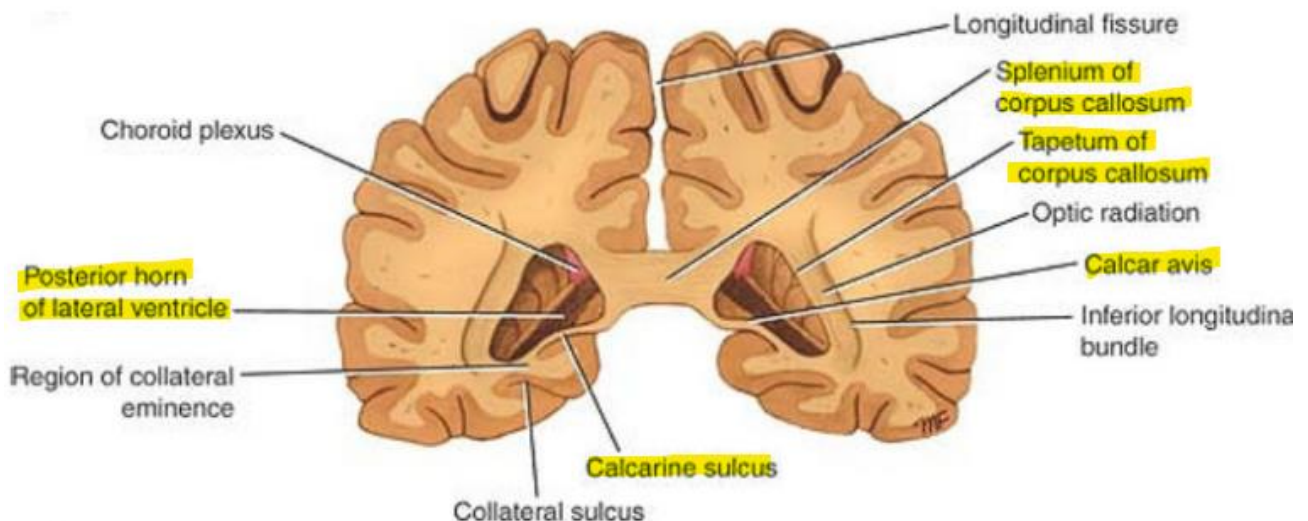
- ✓ Roof and lateral wall: tapetum of the corpus callosum
- ✓ Medial wall:
  - Superior: splenial fibers of the corpus callosum, forceps major
  - Inferior: calcar avis

- Tapetum, which is part of corpus callosum, forms the roof & the lateral wall.

- Medial wall has superiorly splenial fibers of corpus callosum, notice the figure on the right, the most posterior of corpus callosum is splenium.



- Inferiorly we can see calcar avis, it's "نتوء داخلي", invagination inside, and it's found corresponding to calcarine sulcus externally.



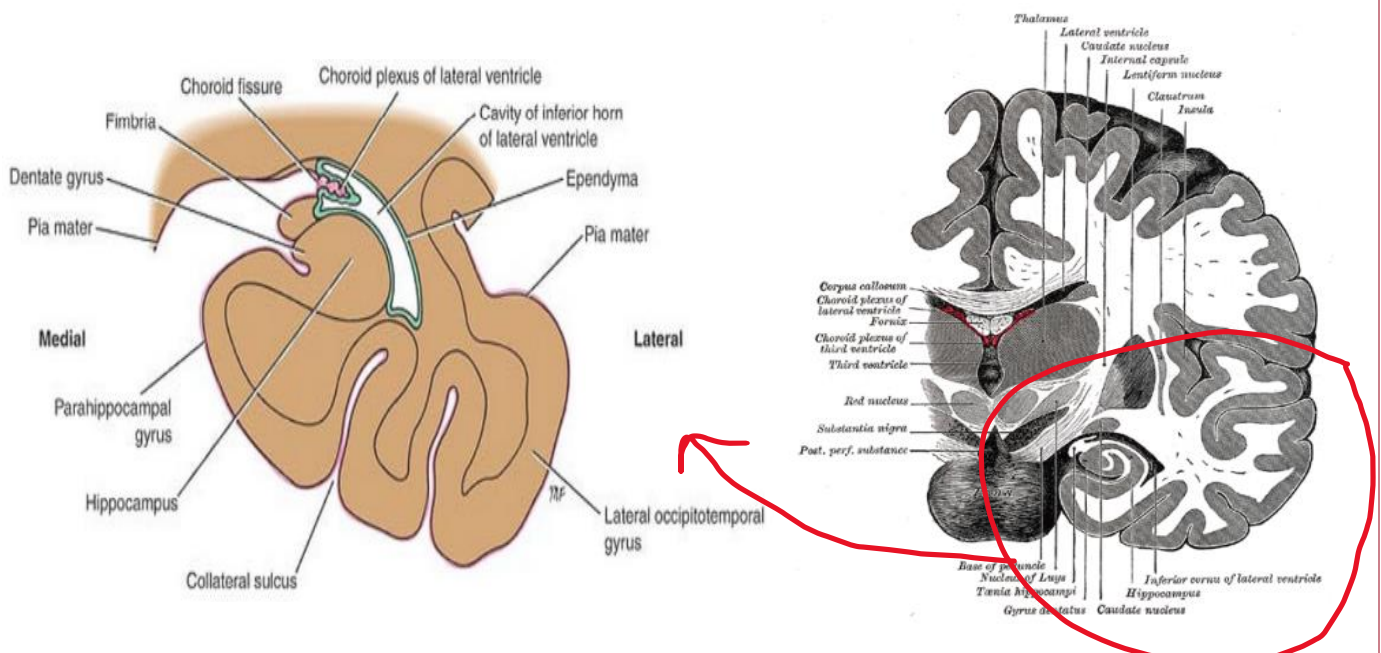
## - Inferior horn of lateral ventricle

Anterior end: temporal lobe

Posterior end: continuous with the body of the ventricle

- ✓ Roof: inferior surface of the tapetum of the corpus callosum, tail of the caudate nucleus and amygdaloid nucleus
- ✓ Floor:
  - Laterally: collateral eminence
  - Medially: hippocampus

- The roof is part of tapetum, corpus callosum and tail of caudate (C shaped area), at the end of the tail anteriorly amygdaloid nucleus is found.
- The floor has two parts: collateral eminence and hippocampus. Hippocampus forms the majority of floor medially. Collateral eminence is like calcar avis “invagination inside” corresponding to the collateral sulcus.
- Note: the floor of the inferior horn is the hippocampus, and this is very important part of limbic system.



The picture on the left is zoomed in to the area down in the picture on the right. On the right you can see the thalamus, the body and the inferior horn.

## - Third ventricle

Third ventricle is a single slit like cavity, thalamus found laterally on both sides of 3<sup>rd</sup> ventricle.

The picture shows a sagittal section. It shows the lateral wall of the 3<sup>rd</sup> ventricle which is thalamus.

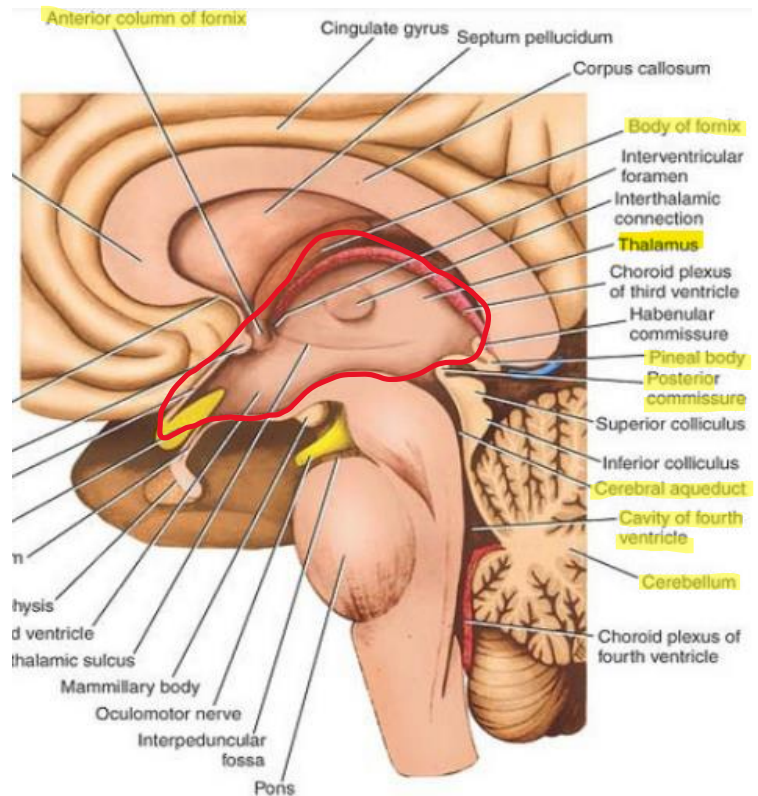
The floor of 3<sup>rd</sup> ventricle is hypothalamus (single structure contains fornix).

✓ **Anterior wall:** lamina terminalis (thin sheet of gray matter) crossed by anterior commissure which is situated anterior to the anterior columns of the fornix.

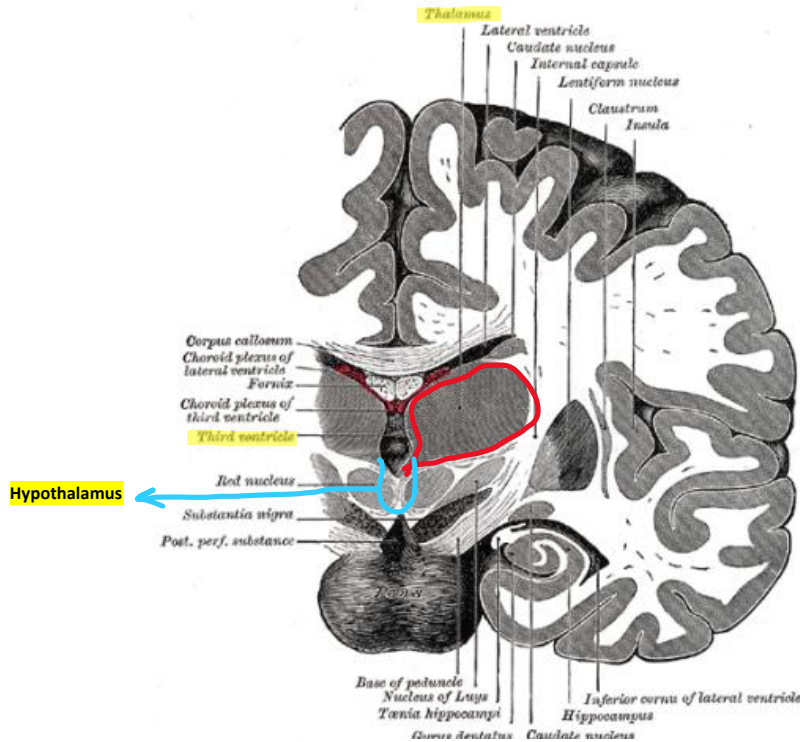
✓ **Posterior wall:** opening of cerebral aqueduct (passageway between 3<sup>rd</sup> & 4<sup>th</sup> ventricles), posterior commissure, pineal recess (important for circadian rhythm), pineal body, habenular commissure.

✓ **Lateral wall:** it's the one surrounded by red

- superiorly: medial surface of the thalamus.
- Inferiorly:
  - hypothalamus
  - hypothalamic sulcus “groove between thalamus & hypothalamus”
  - the interthalamic connection “connector between the two thalami, it's not found in all people, there is a variation”
  - stria medullaris thalami (bundle of nerve fibers, which are afferent fibers to the habenular nucleus)

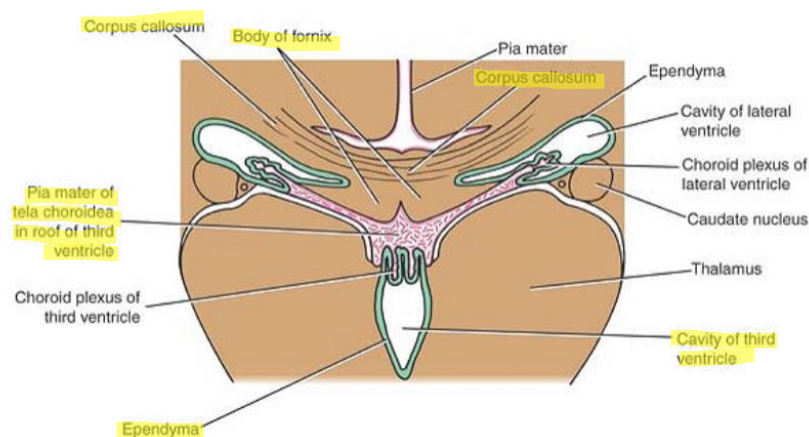


- Clarification of position of hypothalamus: thalamus is paired structure, while hypothalamus is single structure, it's not flat; it has horizontal part & vertical part. The one appearing in the picture above is the vertical part.



### ✓ Roof:

- **Layer of ependyma** “ependymal cells are glial cells lining the ventricles and hollow spaces in CNS.”
- **Tela choroidea: two-layered fold of pia mater** “blood vessels surrounded by layers of pia mater, they have important role in secretion of CSF.” Blood vessels entering brain are coming from subarachnoid space, and they take a fold of pia mater with the.
- fornix and corpus callosum



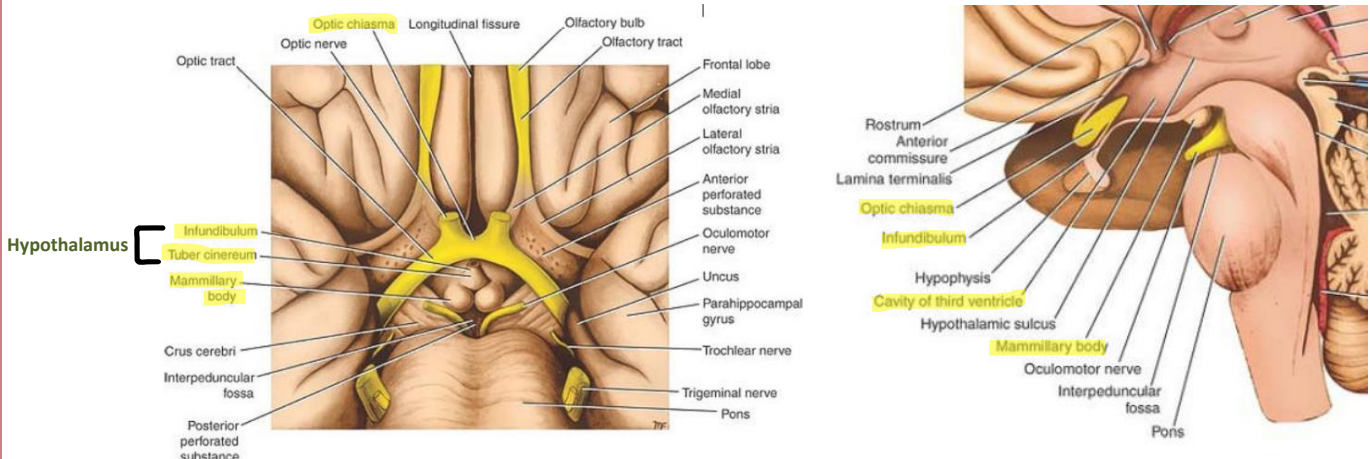


✓ **Floor:**

- **Optic chiasma**
  - **The tuber cinereum**
  - **The infundibulum**
- } **Structures of Hypothalamus**

**“Pituitary gland arises from both infundibulum & tuber cinereum”**

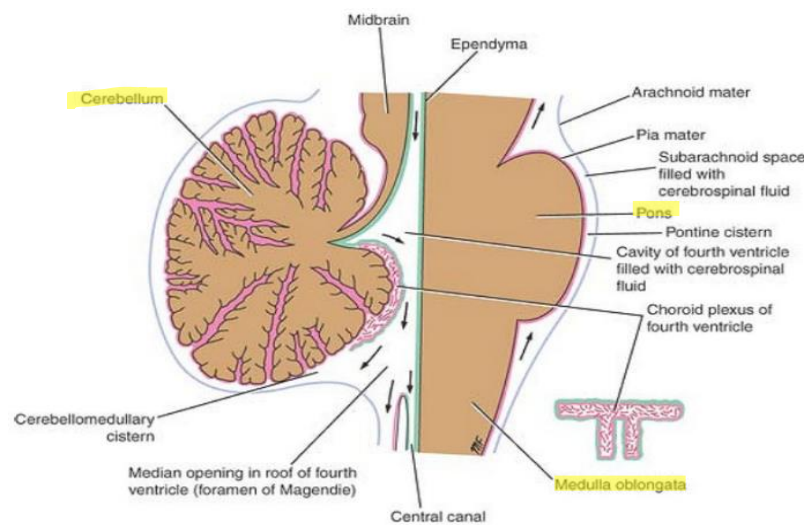
- **Mammillary bodies**



**- Forth ventricle**

- ✓ **Anteriorly: pons and the superior half of the medulla oblongata**
- ✓ **Posteriorly: cerebellum**

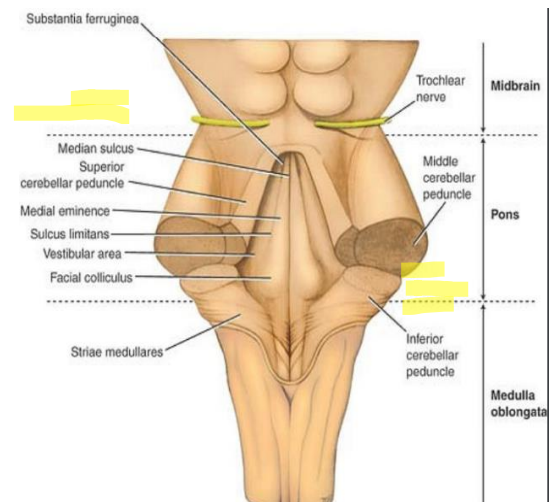
**4rth ventricle found between pons & medulla oblongata anteriorly (the floor of the ventricle) and cerebellum posteriorly (the roof of the ventricle), it looks like the tent.**



✓ **Lateral Boundaries:**

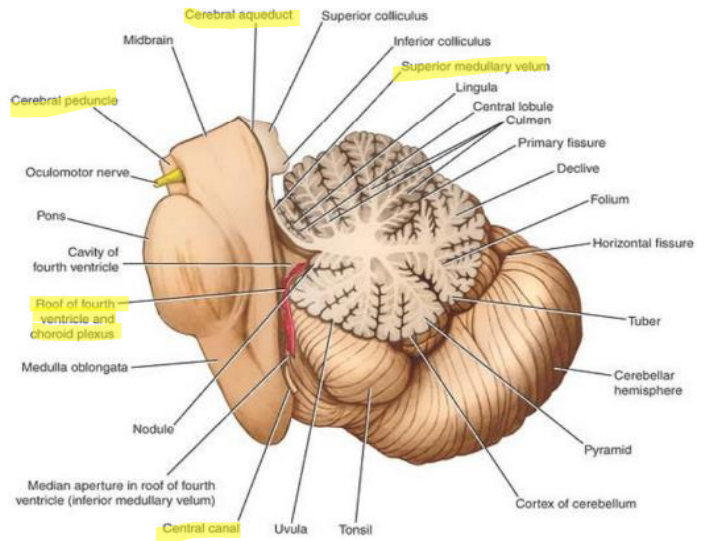
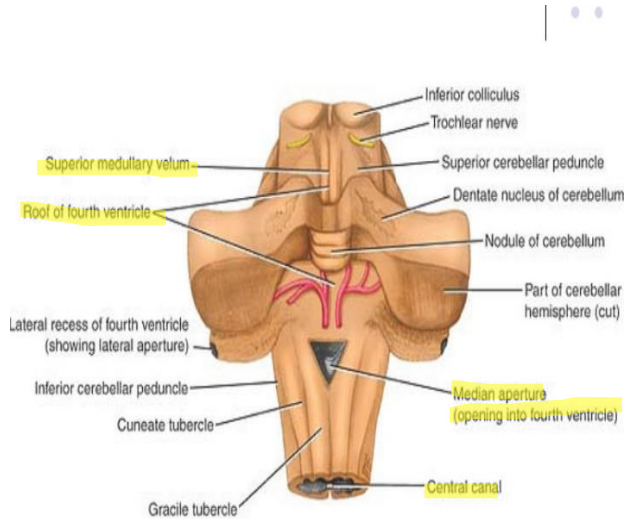
- **Superiorly: Superior cerebellar peduncle**
- **Inferiorly: Inferior cerebellar peduncle**

The picture shows a posterior view of the 4th ventricle, the floor appears here, and we called it **Rhomboid fossa**, it's diamond like.



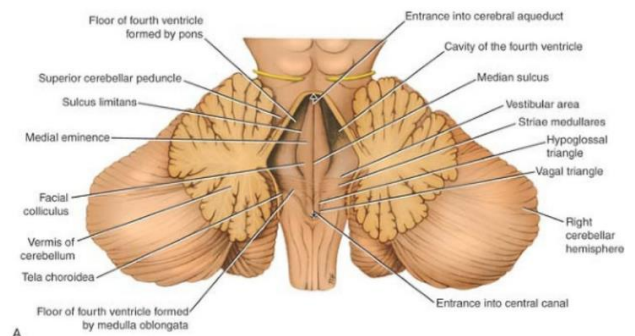
- **4<sup>th</sup> ventricle: roof or posterior wall**

- ✓ **Superiorly: two superior cerebellar peduncles and superior medullary velum (connecting sheet of white matter) extension of Arbor vitae of cerebellum.**
- ✓ **Inferiorly: Inferior medullary velum**
- ✓ **Median aperture (foramen of Magendie), there is only one.**
- ✓ **Foramina of Luschka: lateral openings of the fourth ventricle they are two.**
- **The lateral ventricle is opened to the 3rd ventricle through foramen of Monro, 3<sup>rd</sup> ventricle is opened to 4<sup>th</sup> ventricle through cerebral aqueduct, 4<sup>th</sup> is continuous inferiorly with spinal cord through central canal.**
- **In addition to ventricles (within the brain), CSF circulates in subarachnoid space around the brain (between arachnoid & pia).**
- **CSF leaves ventricles to subarachnoid space through two foramens: one at midline (foramen of Magendie) and one lateral (foramina of Luschka). They allow CSF to circulate in subarachnoid space around the brain.**

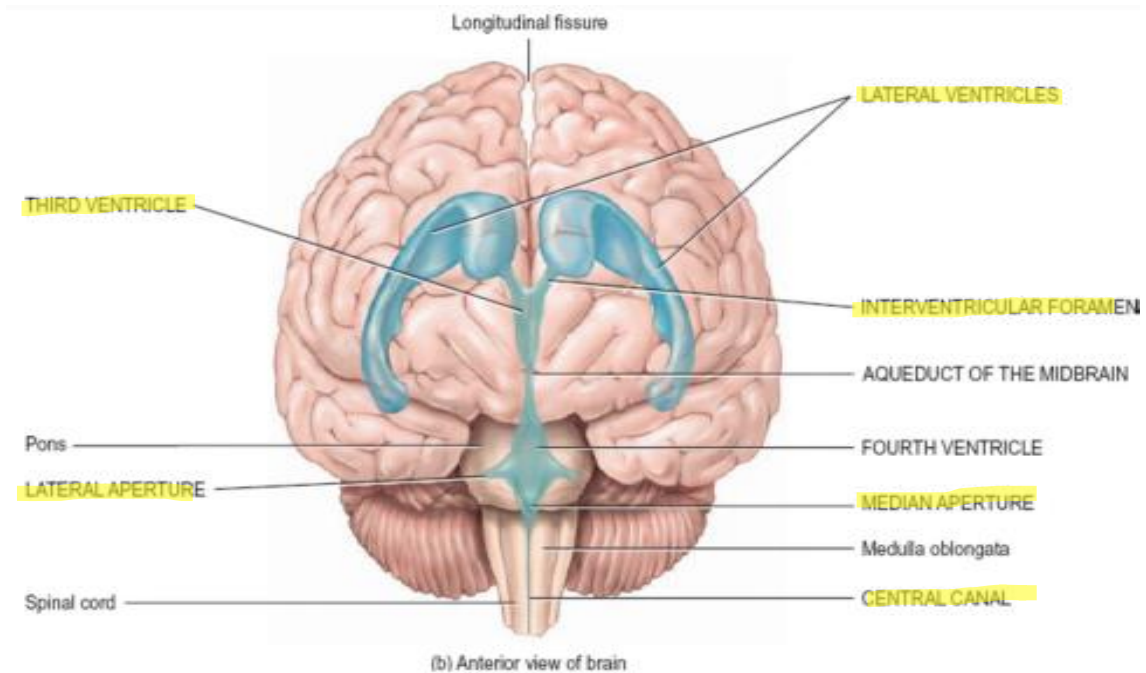


## - 4<sup>th</sup> ventricle: floor or rhomboid fossa

- ✓ Diamond-shaped.
- ✓ Formed by posterior surface of the pons and the cranial half of the medulla oblongata.
- ✓ Upper half is related to pons & the lower to medulla oblongata.



- Interventricular foramina “foramen of Monro”: narrow, oval openings, between the two lateral ventricles and the third ventricle.
- The aqueduct of the midbrain (cerebral aqueduct): passes CSF from third ventricle through the midbrain, into the fourth ventricle.
- CSF enters the subarachnoid space through three openings in the roof of the fourth ventricle: a single median aperture “foramen of Magendie” and paired lateral apertures “foramina of Luschka”.



## - Cerebrospinal fluid

- ✓ Similar to blood plasma composition, it's colorless. However, the concentration of glucose is less than plasma.
- ✓ Formed by the choroid plexus (networks of modified blood capillaries in the walls of the ventricles).

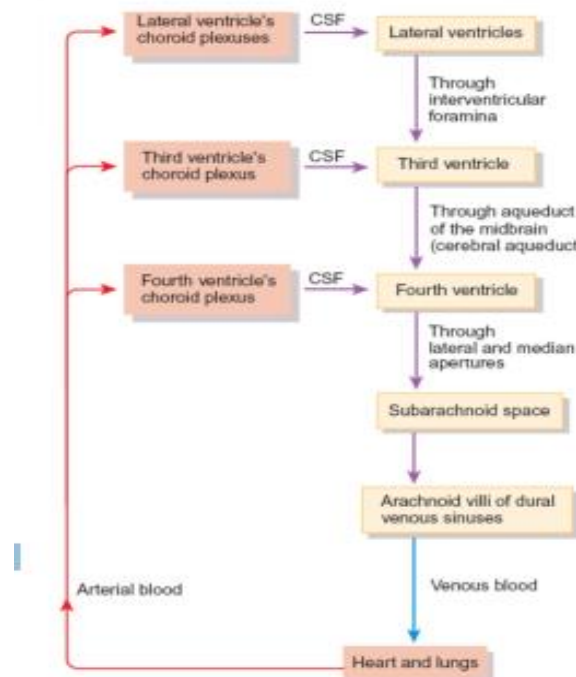
To imagine the picture of choroid plexus, blood vessels enter brain tissue and take a layer of pia with them. Those blood vessels branch and give capillaries which make fingerlike projections, those are covered with pia & the other most layer is ependymal cells, and they work as a machine for CSF secretion (500 ml/ day). CSF secretion is continuous "secretion & absorption" to keep balance, and at a moment there are 150 ml in human body.

- ✓ Forms a watery cushion to protect the brain.
- ✓ Circulated in arachnoid space, ventricles, and central canal of the spinal cord.
- ✓ CSF is gradually reabsorbed into the blood through arachnoid villi, fingerlike extensions of the arachnoid that project into the dural venous sinuses, especially the superior sagittal sinus.

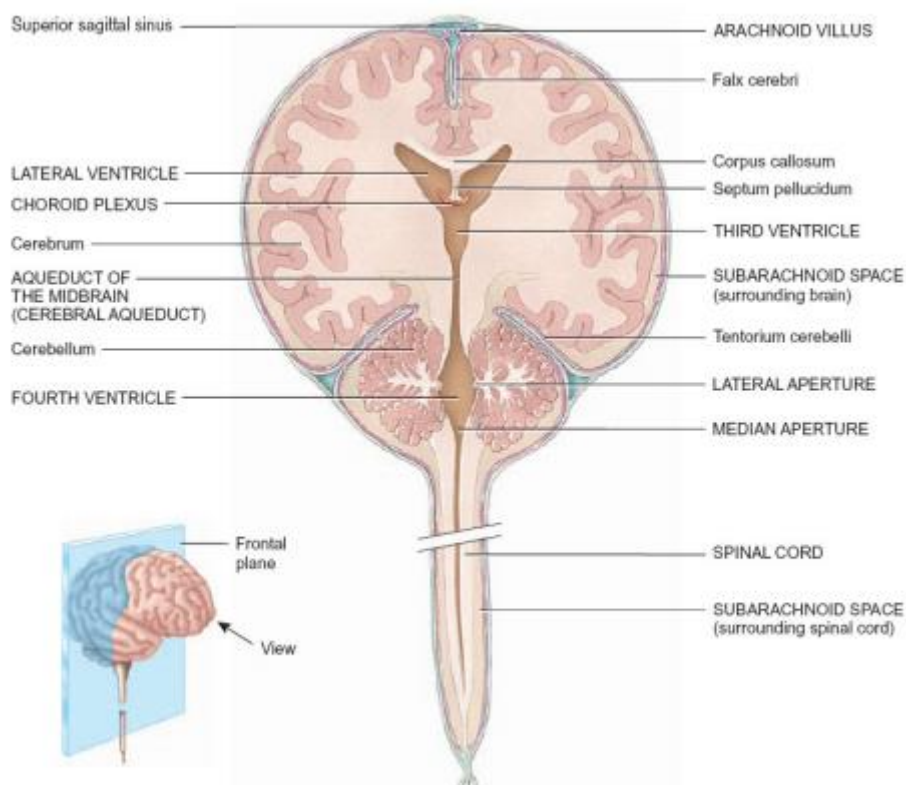


- Dura is formed from two layers:
  1. Outer layer called endosteal layer.
  2. Inner layer called meningeal layer.

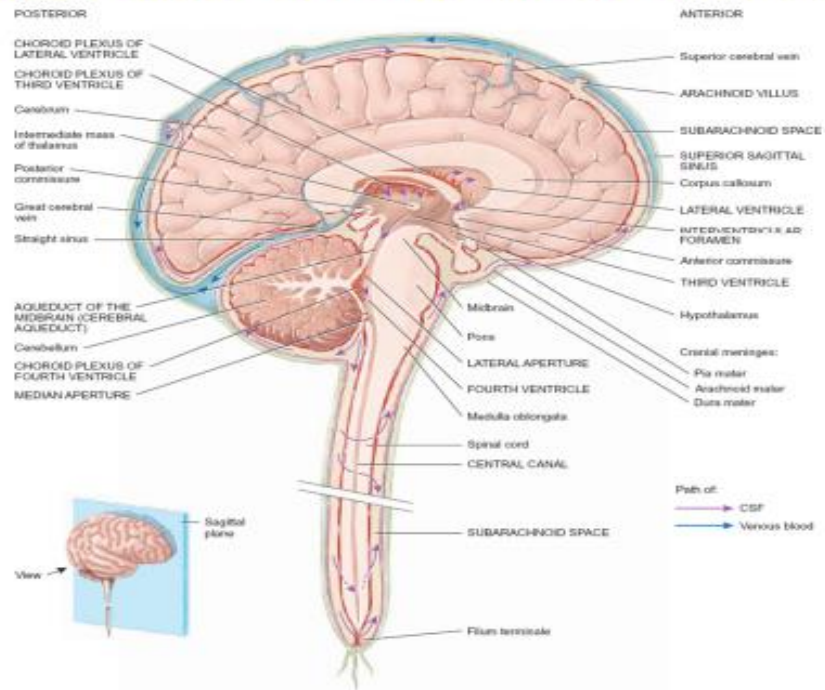
In all areas of brain they are continuous with each other, but they split in some places forming spaces. Sinuses and veins pass through those spaces. We see arachnoid villi in those spaces as well, where CSF is reabsorbed again to circulation.



(d) Summary of the formation, circulation, and absorption of cerebrospinal fluid (CSF)



# Ventricles and Location of the Cerebrospinal Fluid |



# V1