Lateral ventricle &CSF

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Intended Learning Outcomes (ILOs)

1. Identify the parts of the lateral ventricles
2. Recognize the boundaries of each part of the lateral ventricle
3. List the choroid plexuses of the lateral ventricle
4. Enumerate the formations ,circulation and functions of the CSF.
5. Explain the clinical importance of CSF.

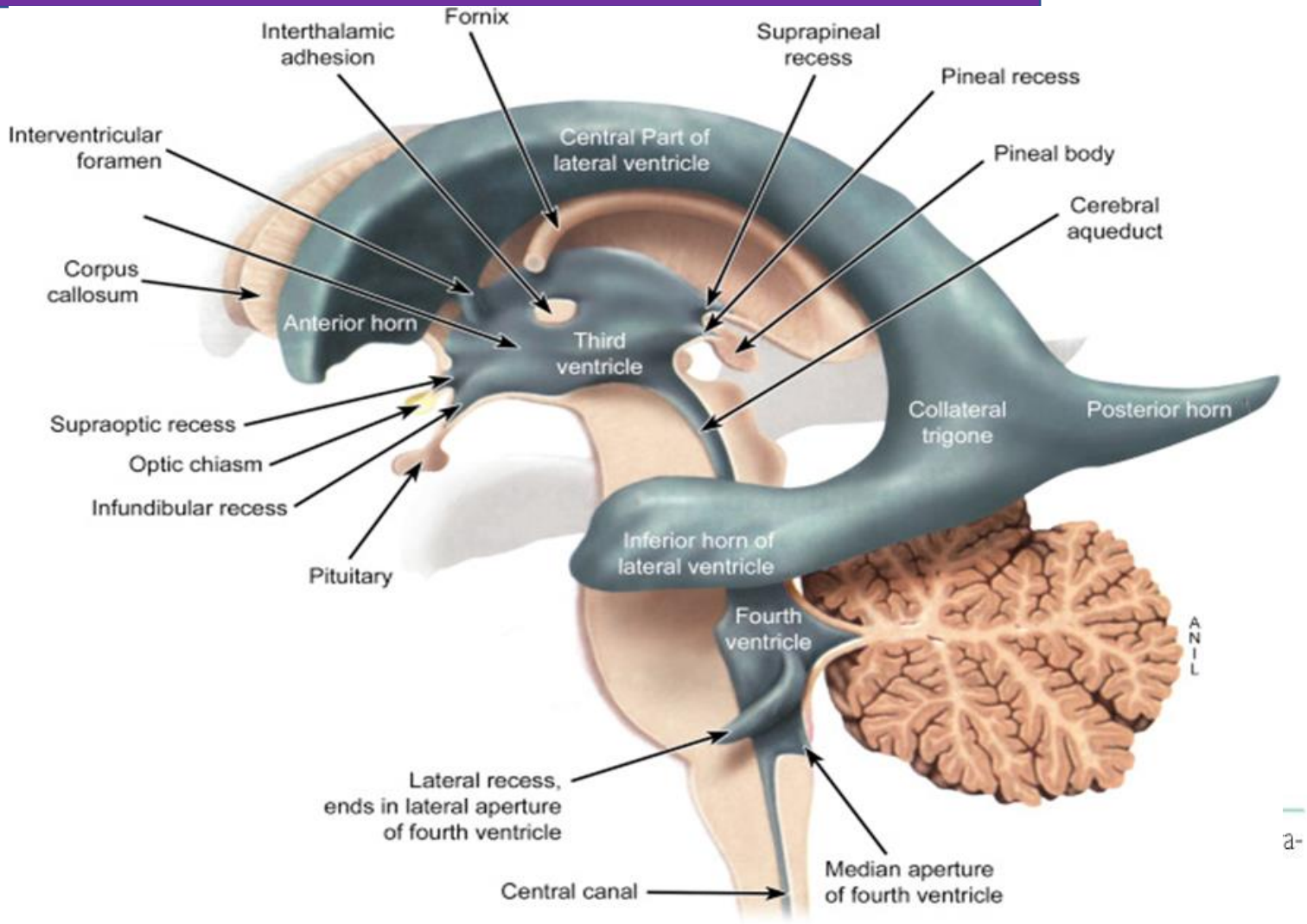
Agenda

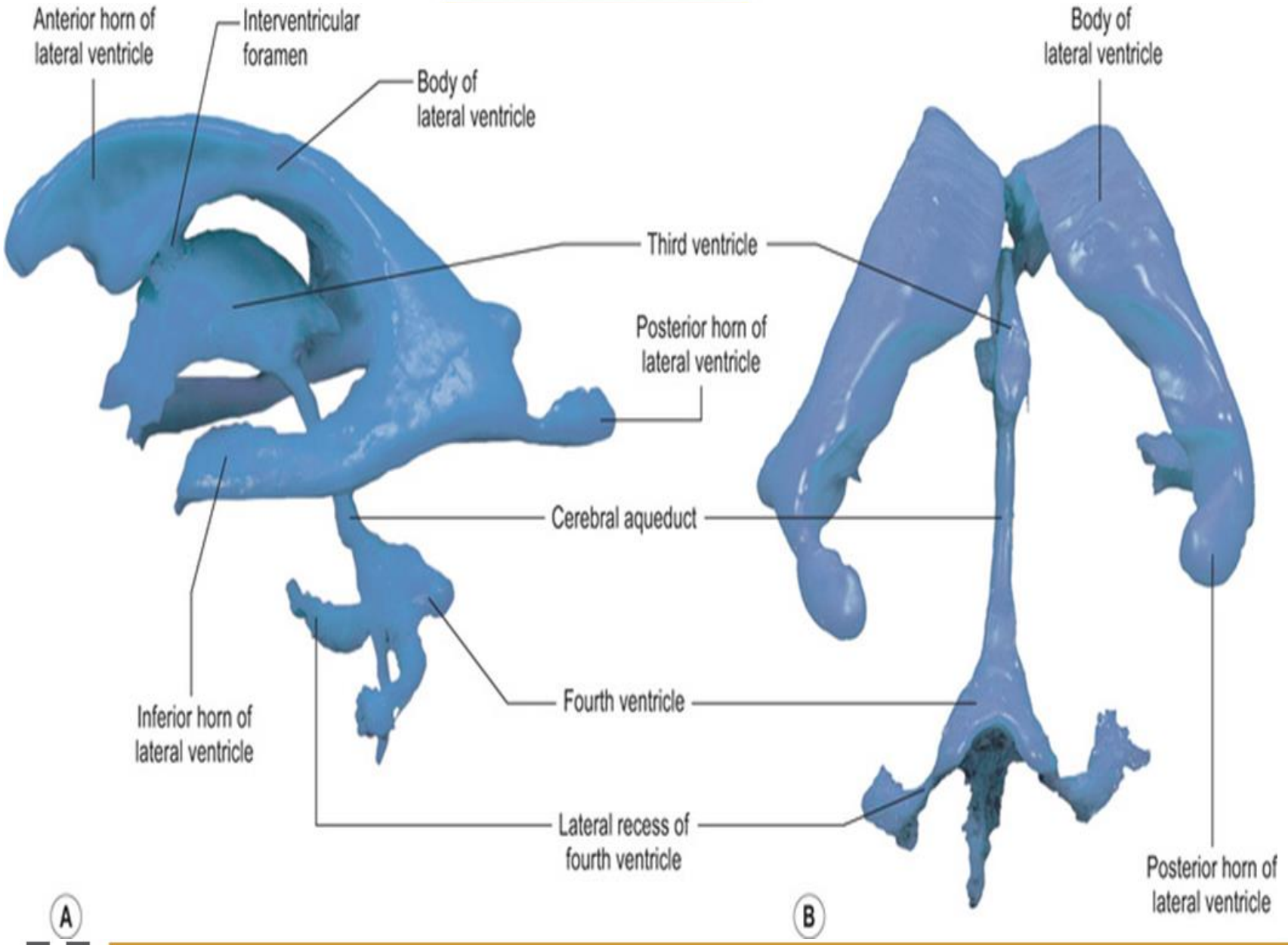
1. Parts and boundaries of the parts of the lateral ventricle.

2. Formation, circulations ,and different functions of the CSF.

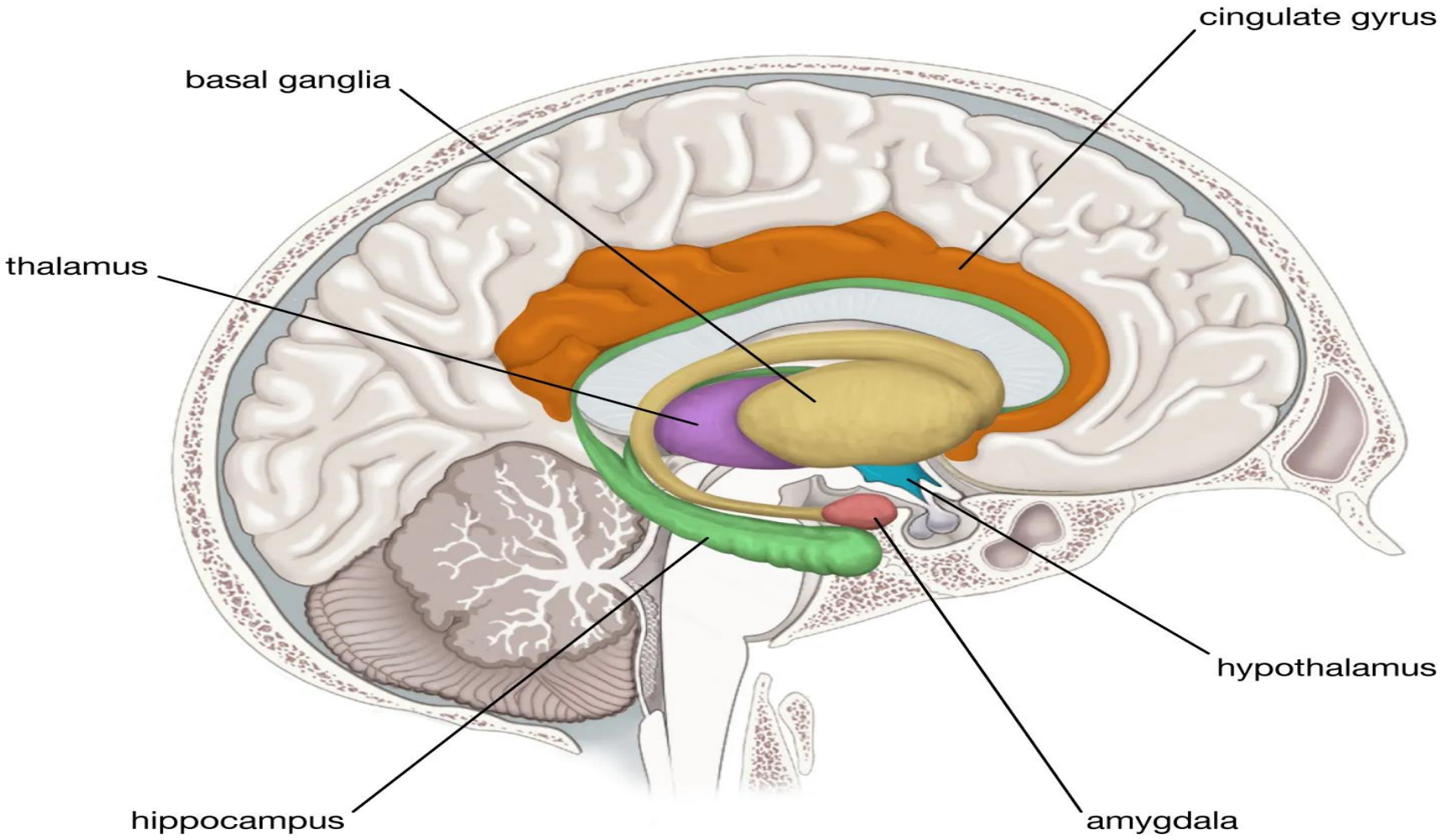
Lateral ventricle

- **The lateral ventricle**
- **Definition:** is the cavity of the cerebral hemisphere.
- **Shape:** it is a C-shaped cavity filled with the CSF.
- **Divisions:** It is divided into **Central Part and 3 Horns:** anterior, posterior and inferior




Anterior horn of lateral ventricle
Interventricular foramen
Body of lateral ventricle
Third ventricle
Posterior horn of lateral ventricle
Cerebral aqueduct
Inferior horn of lateral ventricle
Fourth ventricle
Lateral recess of fourth ventricle
A
Body of lateral ventricle
Posterior horn of lateral ventricle
B

Primary components of the limbic system



Lateral ventricle

A.Anterior Horn:

- **Extension:** extends into the frontal lobe anterior to the interventricular foramen.
- **Relations:**

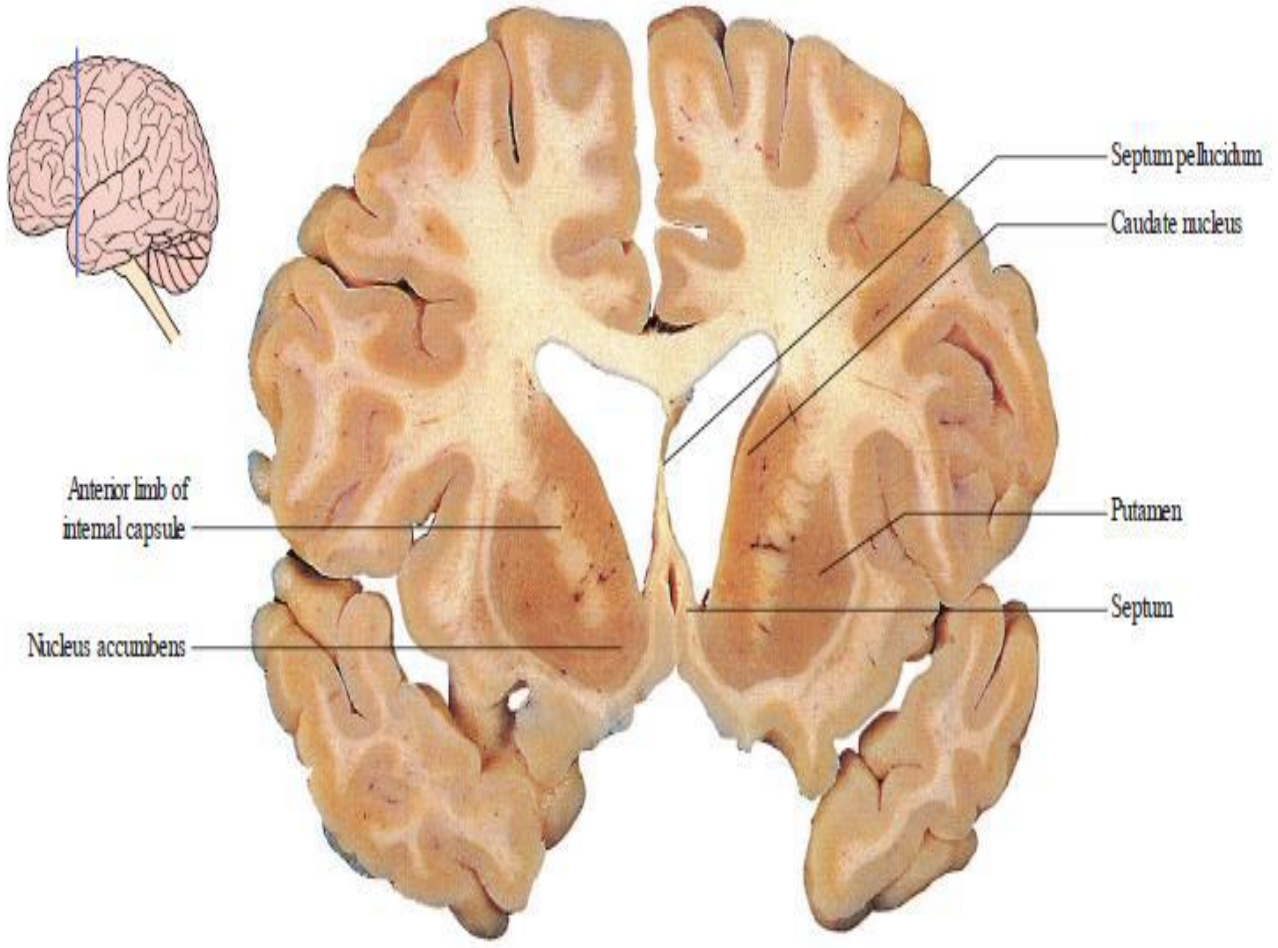
1.Anterior end: genu of the corpus callosum.

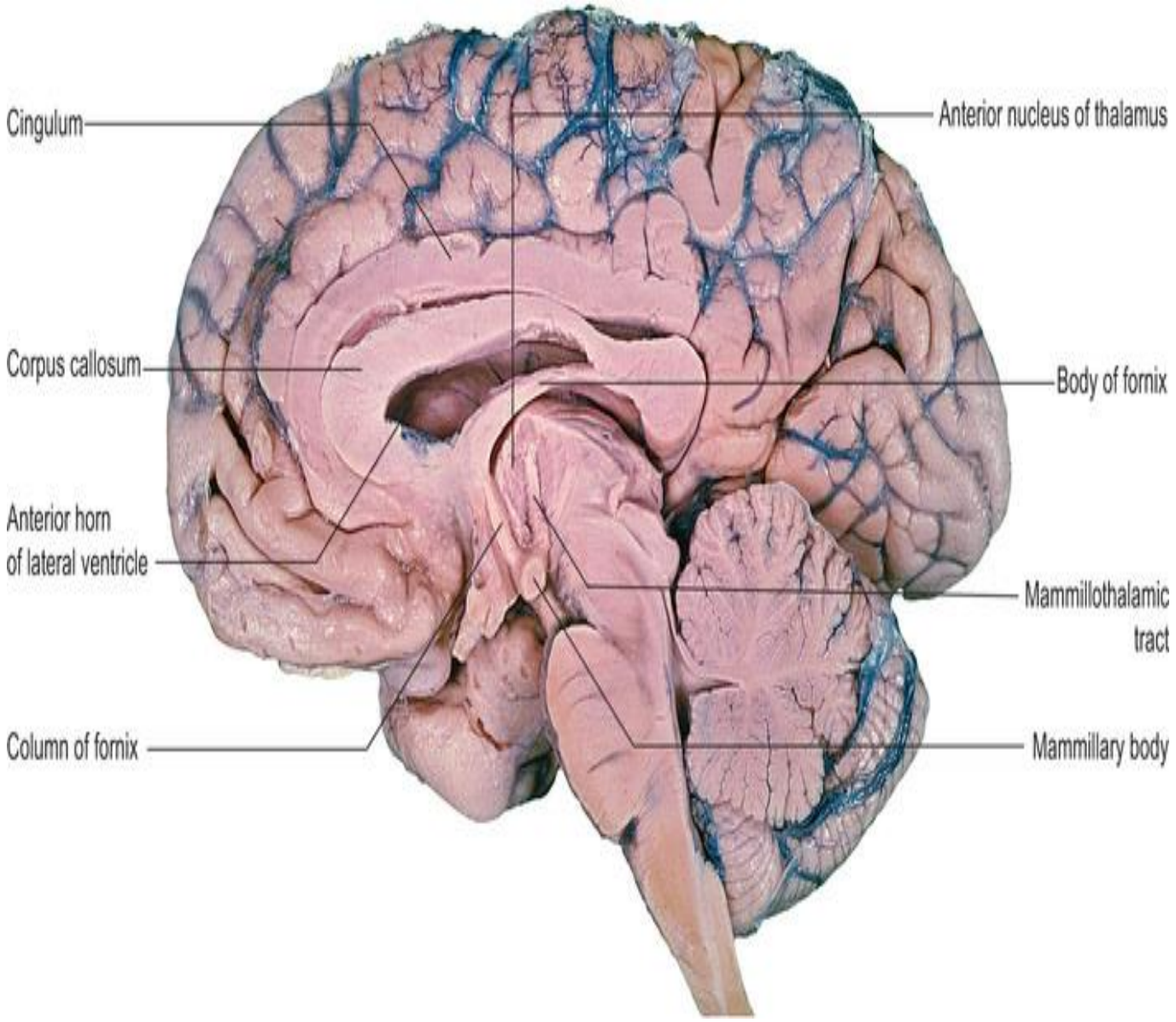
2.Roof: body of the corpus callosum.

3.Floor: rostrum of the corpus callosum.

4.Medial wall: septum pellucidum.

5.Lateral wall: head of the caudate nucleus.




Cingulum
Anterior nucleus of thalamus
Corpus callosum
Body of fornix
Anterior horn
of lateral ventricle
Mammillothalamic
tract
Column of fornix
Mammillary body

Lateral ventricle

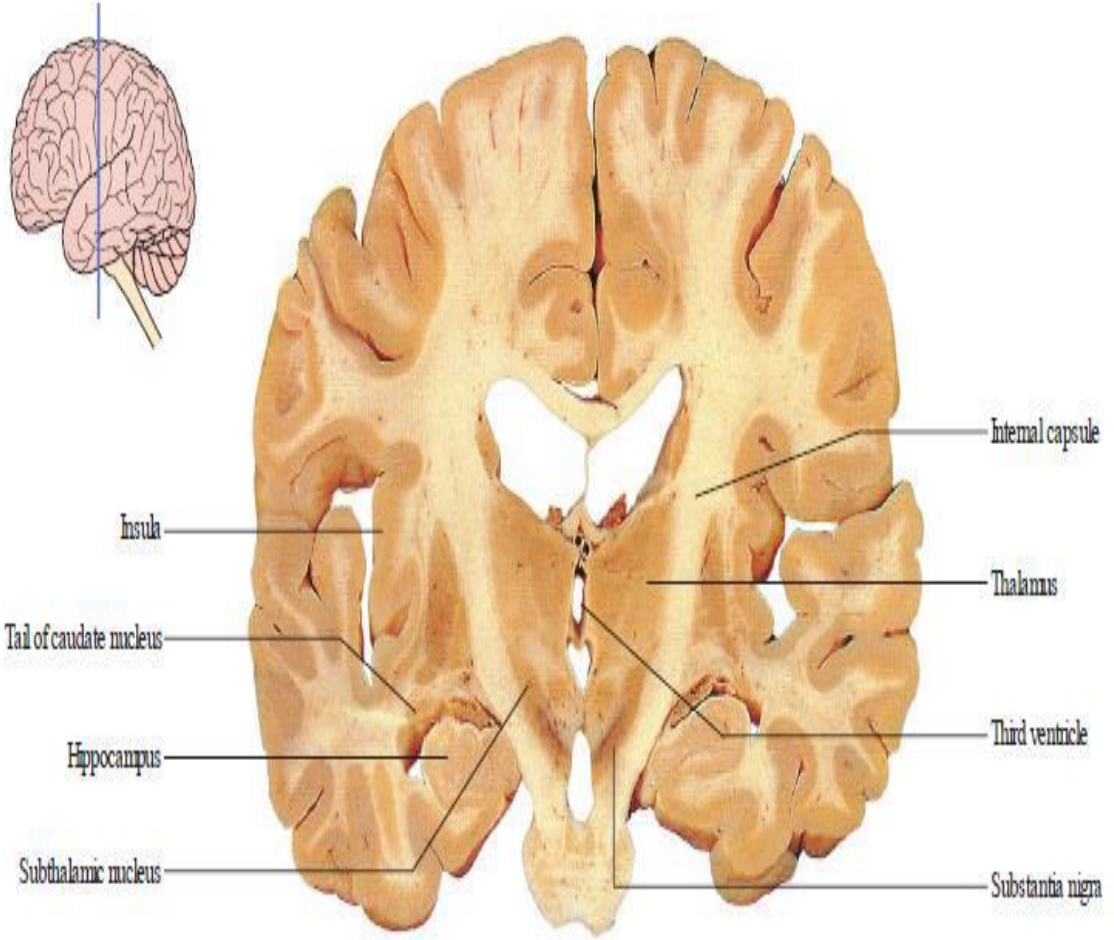
B. Central Part (Body):

- **Extension:** In the parietal lobe from the interventricular foramen to the splenium of the corpus callosum.
- **Relations:**

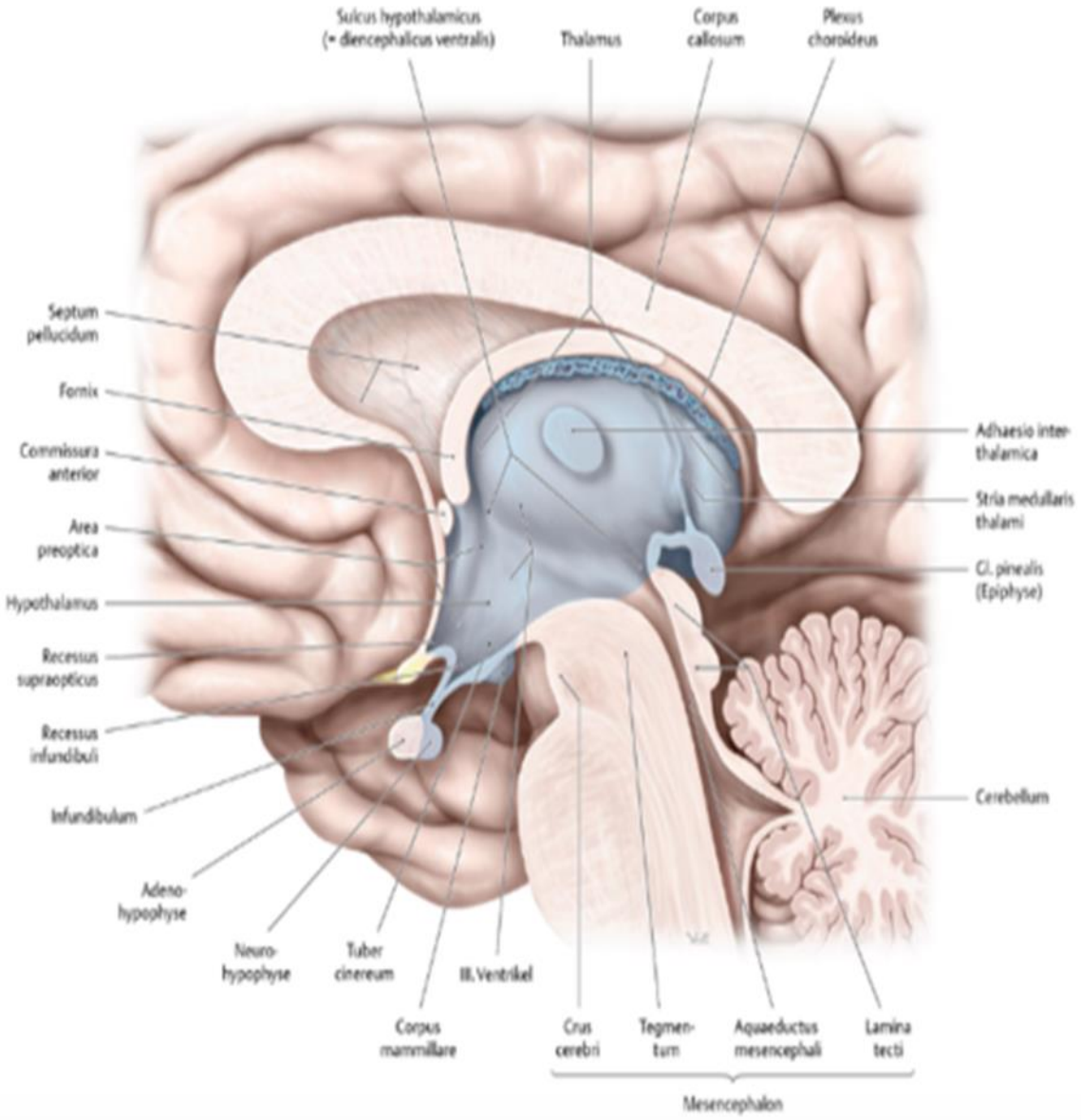
•**Roof:** body of the corpus callosum.
•**Medial wall:** the septum pellucidum.
•**Floor:** from the lateral to the medial side:

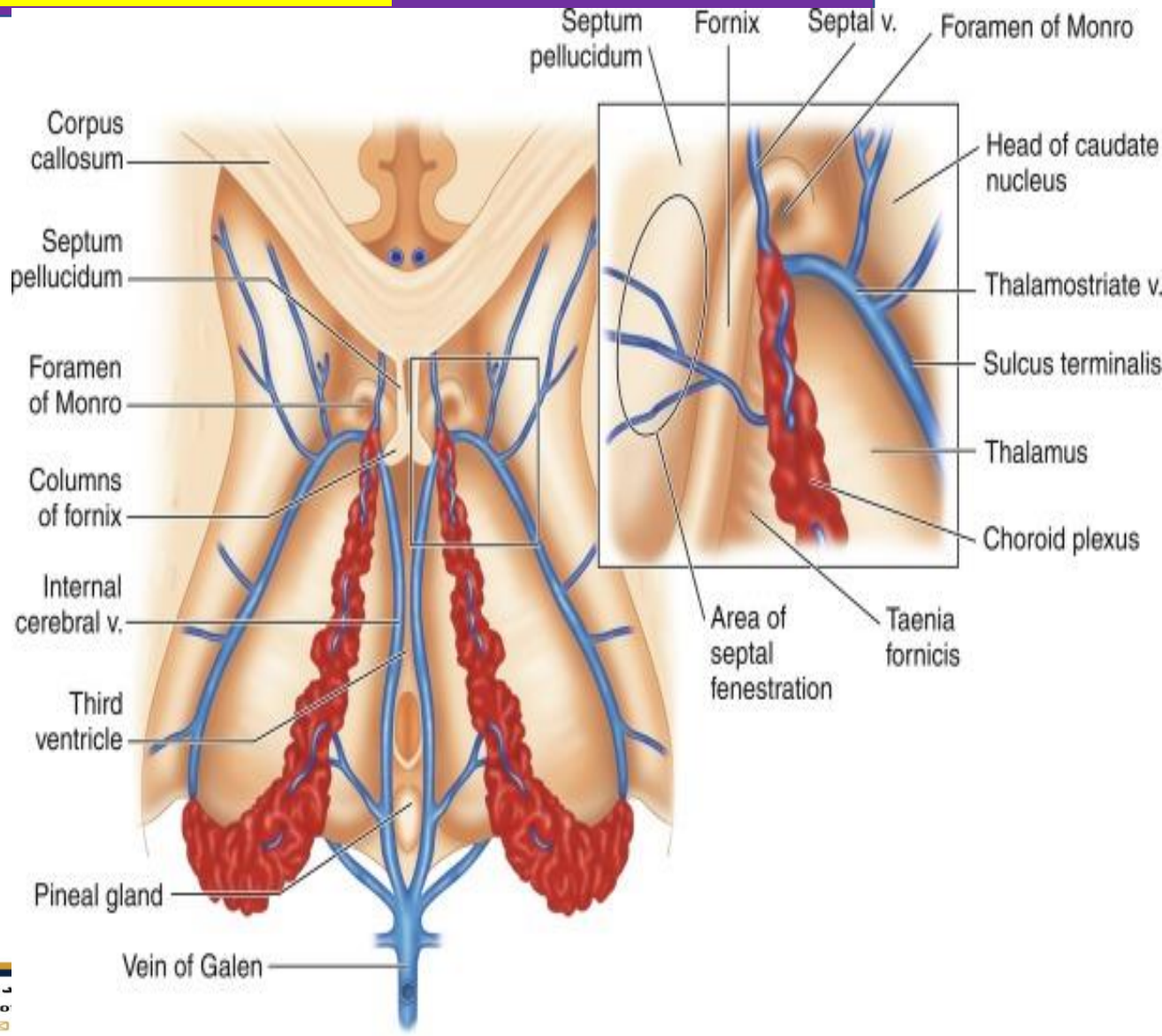
1. **Body** of the caudate nucleus.
2. Thalamostriate vein.
3. **Stria terminalis** is a slender **bundle of fibers** originating in the **amygdaloid body** in the temporal lobe.
4. **thalamus**
5. **Choroid plexus** in the choroid fissure.
6. **Body of the fornix**.

•**Lateral wall:** meeting the roof with the floor.



Lateral ventricle





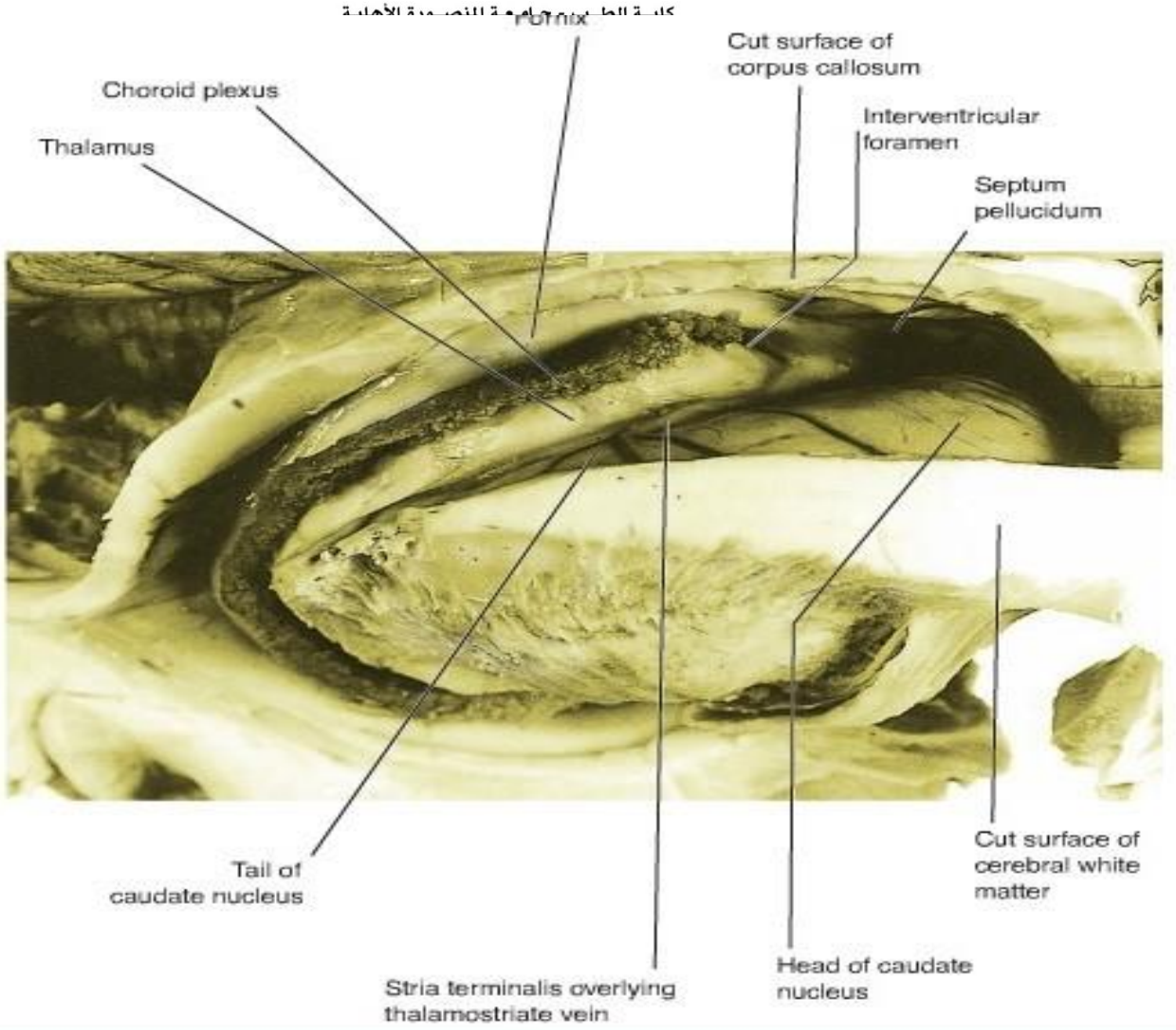
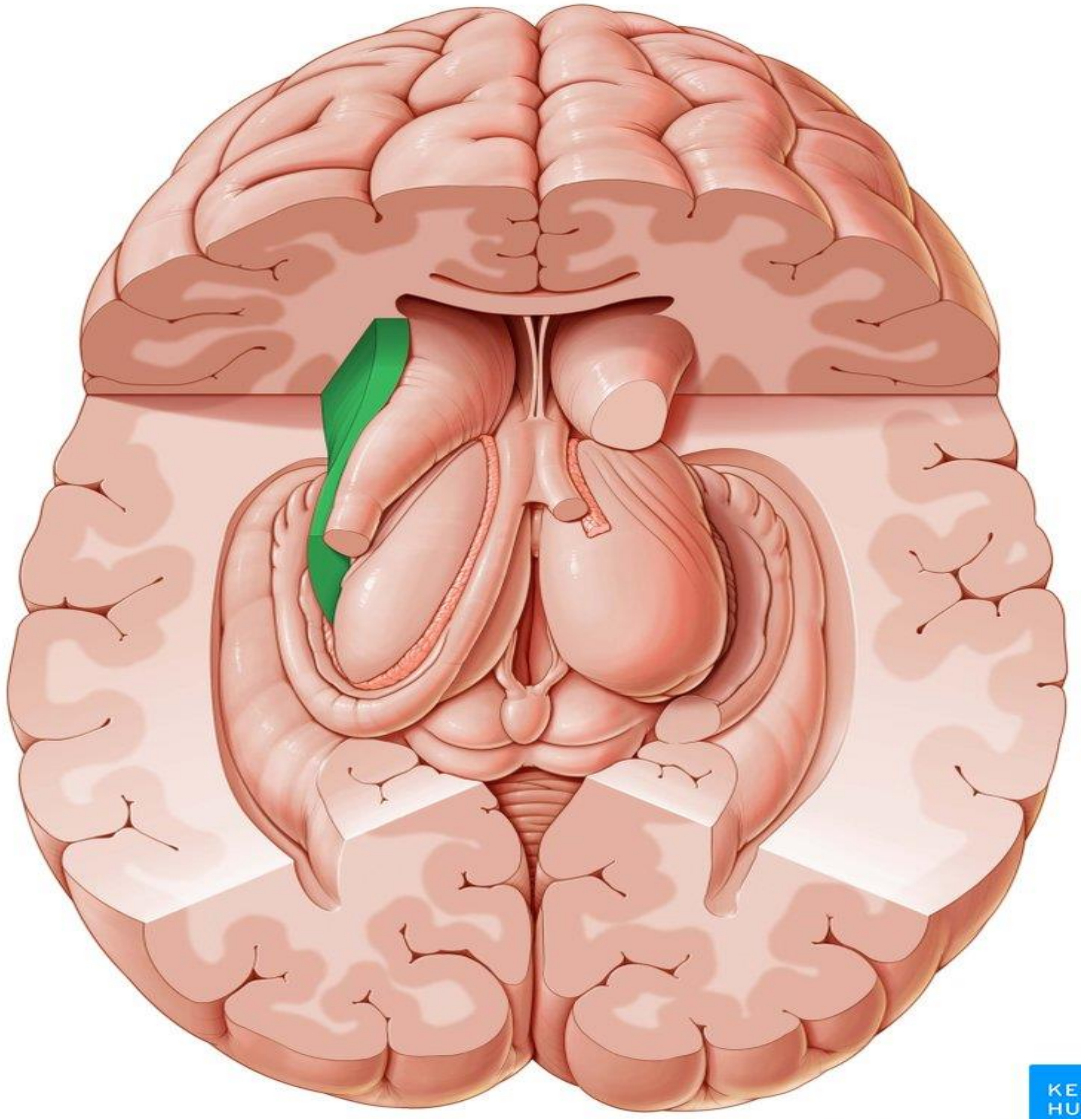
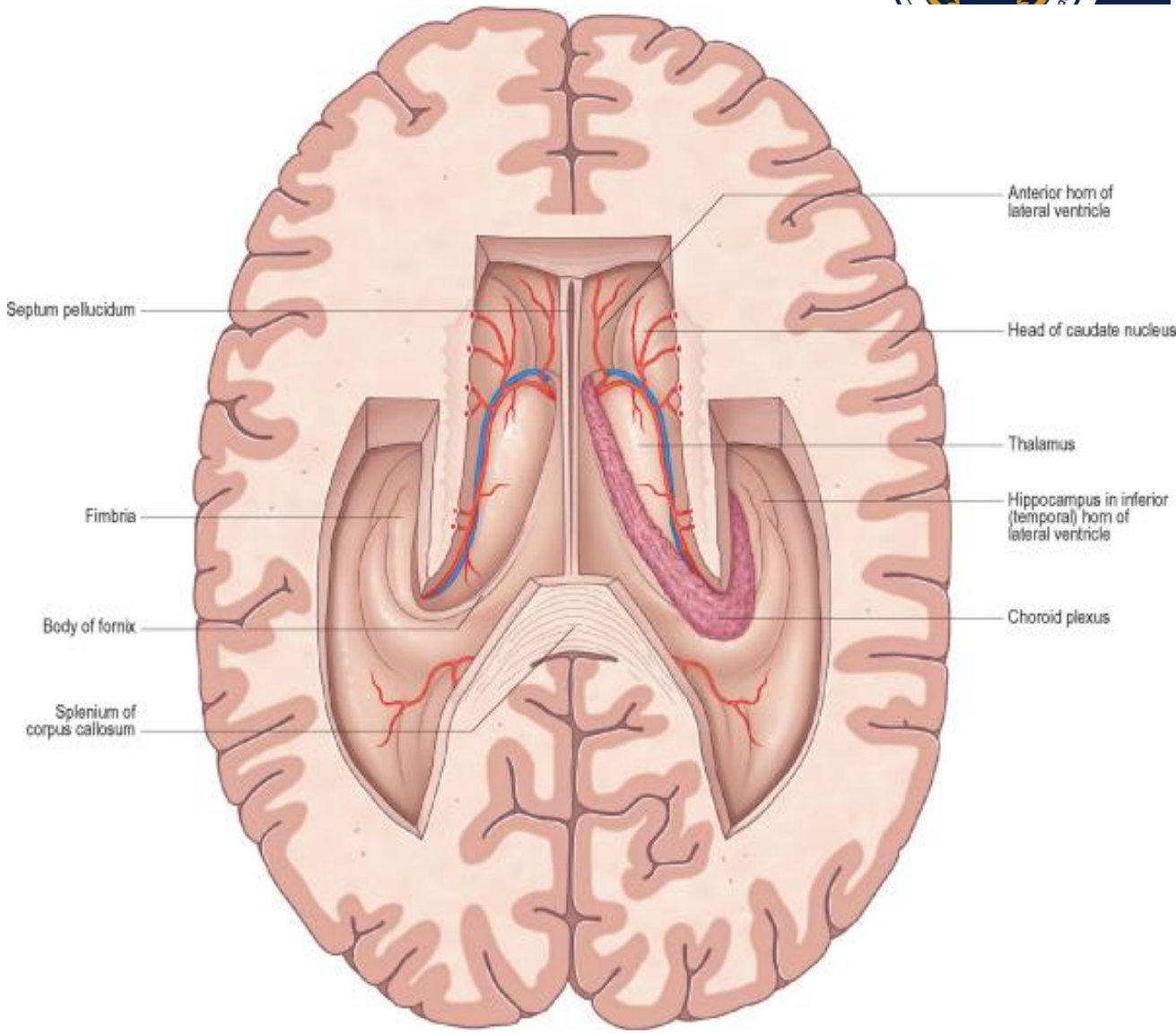


FIGURE 16-9 Dissection of the right cerebral hemisphere: dorsolateral view. The roof of the lateral ventricle has been removed.





Lateral ventricle

C.Posterior Horn:

- **Extension:** extends in the occipital lobe behind the splenium of the corpus callosum.
- **Relations:**

•**Roof:** tapetum of the corpus callosum.

•**Floor:** collateral trigone produced by the collateral sulcus.

•**Medial wall:** has two elevations:

1.Bulb of the posterior horn: superior and produced by the forceps major.

2.Calcar avis: inferior and produced by the calcarine sulcus.

•**Lateral wall:** from **medial to lateral:**

1.Tapetum of the corpus callosum.

2.Optic radiation.

3.Inferior longitudinal fasciculus.

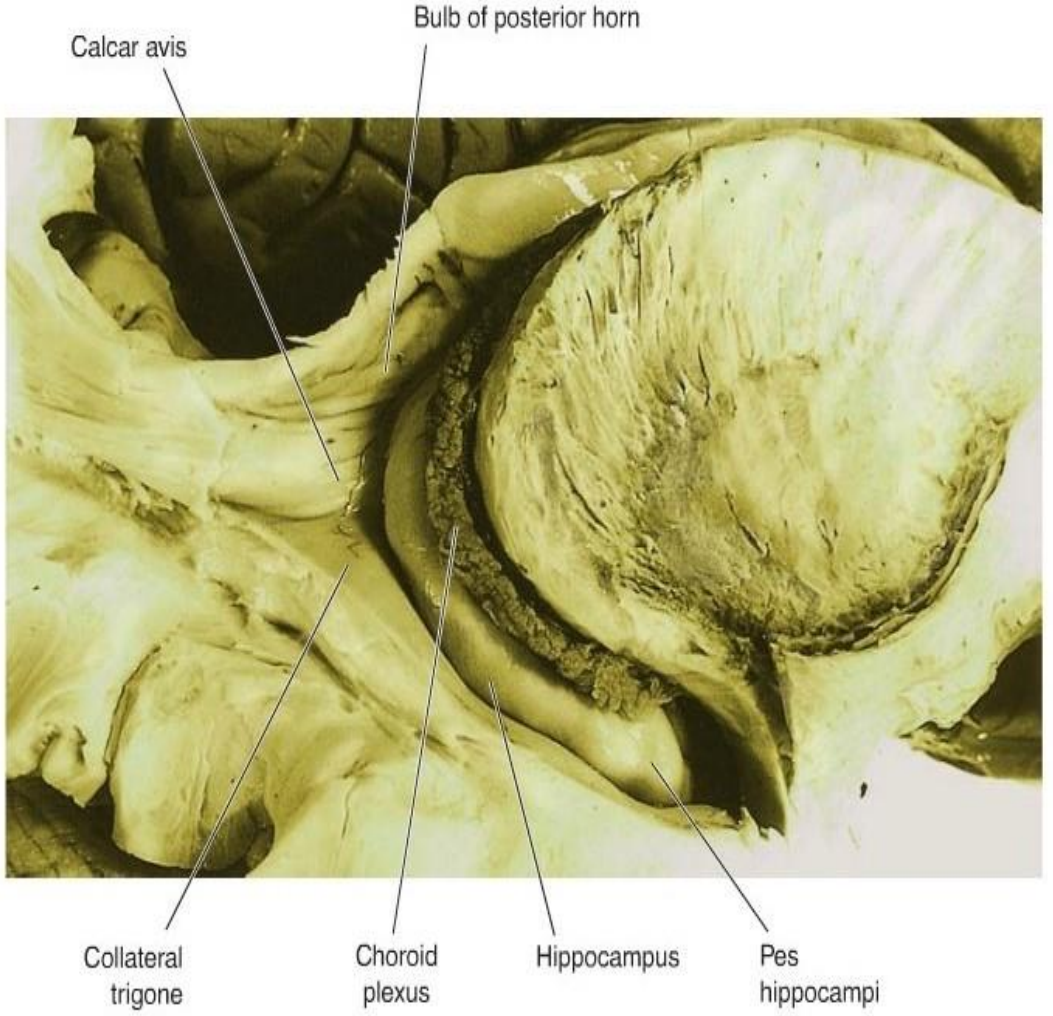


FIGURE 16-10 Dissection of the right cerebral hemisphere: lateral view showing the occipital and temporal horns

Lateral ventricle

D.Inferior Horn:

The temporal horn extends to within about 3 cm of the temporal pole. A triangular area, called the collateral trigone, is found in the floor of the ventricle where the occipital and temporal horns diverge from the central part of the ventricle.

A substantial part of the choroid plexus of the lateral ventricle rests on the trigone .

Extension: it winds around thalamus and extends anteriorly into the temporal lobe.

Relations:

- **Roof: 3**

1.Tail of the caudate nucleus and amygdaloid nucleus.

2.Thalamostriate vein.

3.Stria terminalis

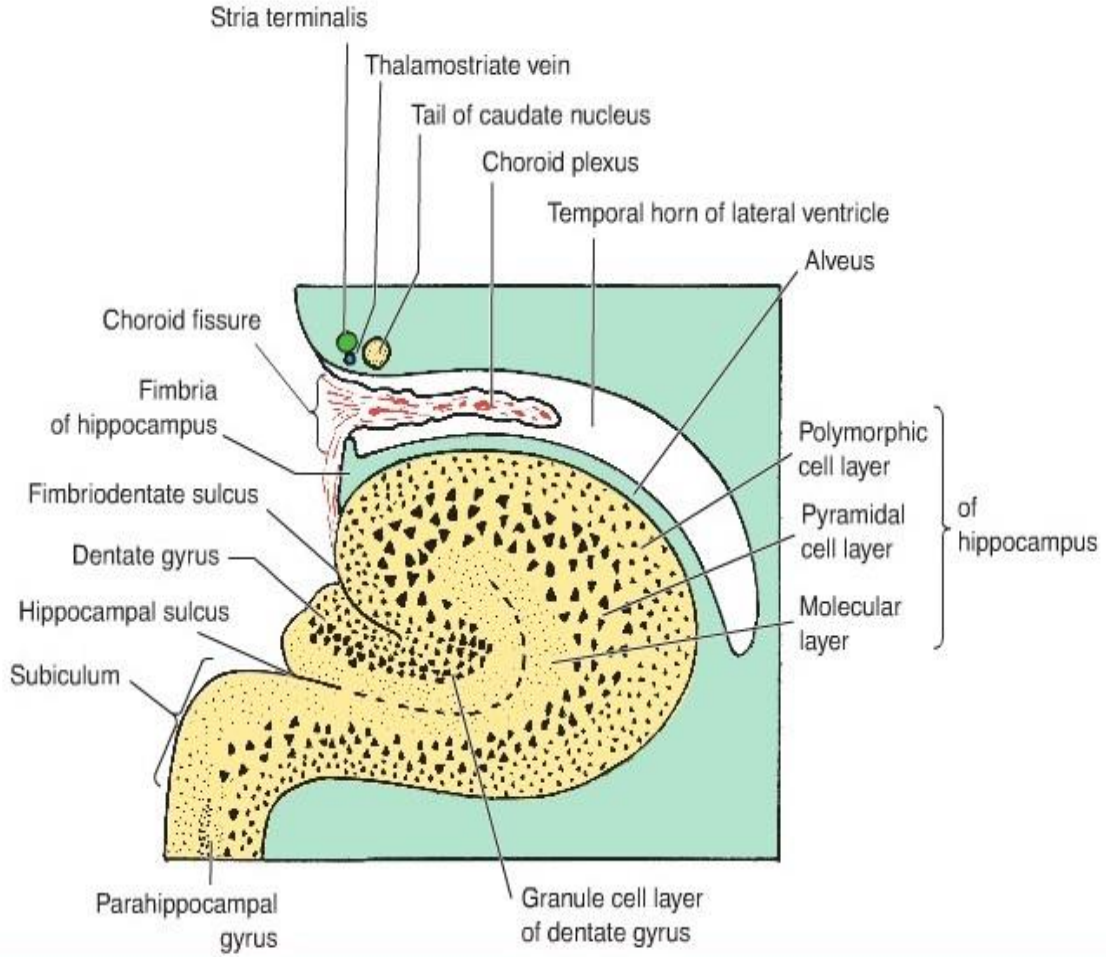


FIGURE 18-2 Simplified coronal section through the hippocampal formation (medial surface at the left).

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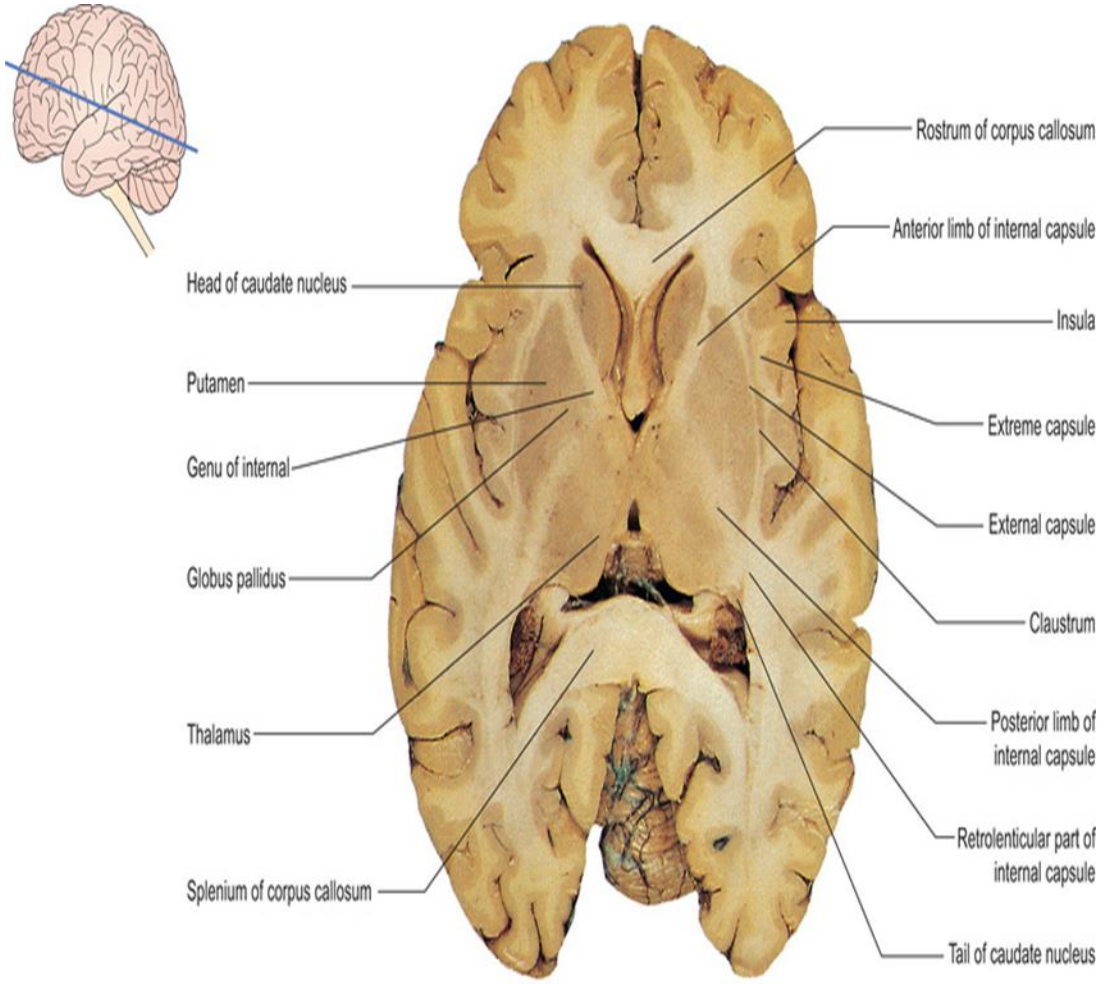
Lateral ventricle

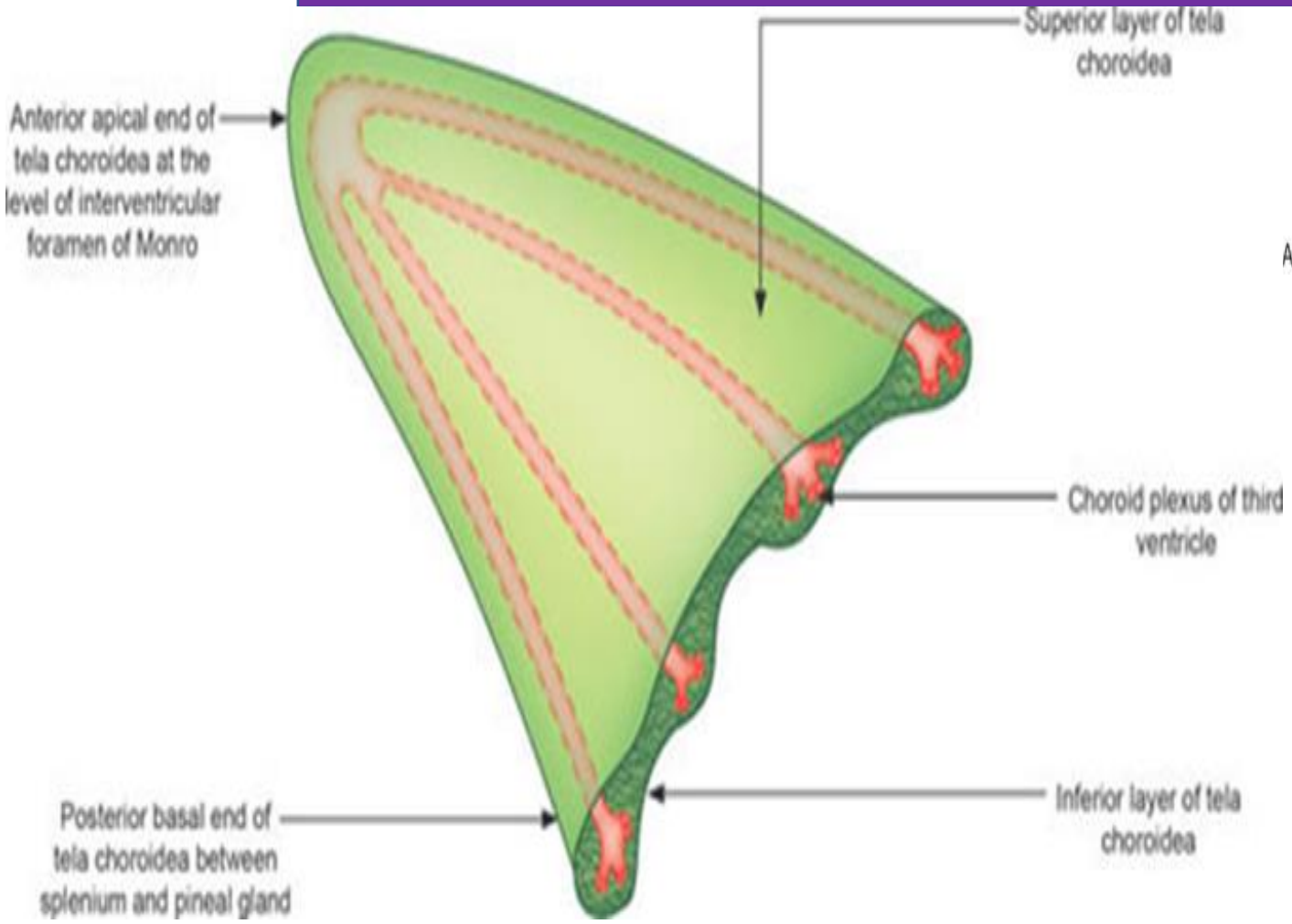
- •**Floor: 3,** from the medial to the lateral side:
- **1.Fimbria:** arises from the hippocampus and continues backward as the fornix.
- **2.Hippocampus:** its anterior end is enlarged to form the pes hippocampi.
- **3.Collateral eminence**: is produced by the collateral sulcus.
- •**Medial wall:** the choroid plexus of the inferior horn.
- •**Lateral wall:** tapetum of the corpus callosum.
- **Communication:**

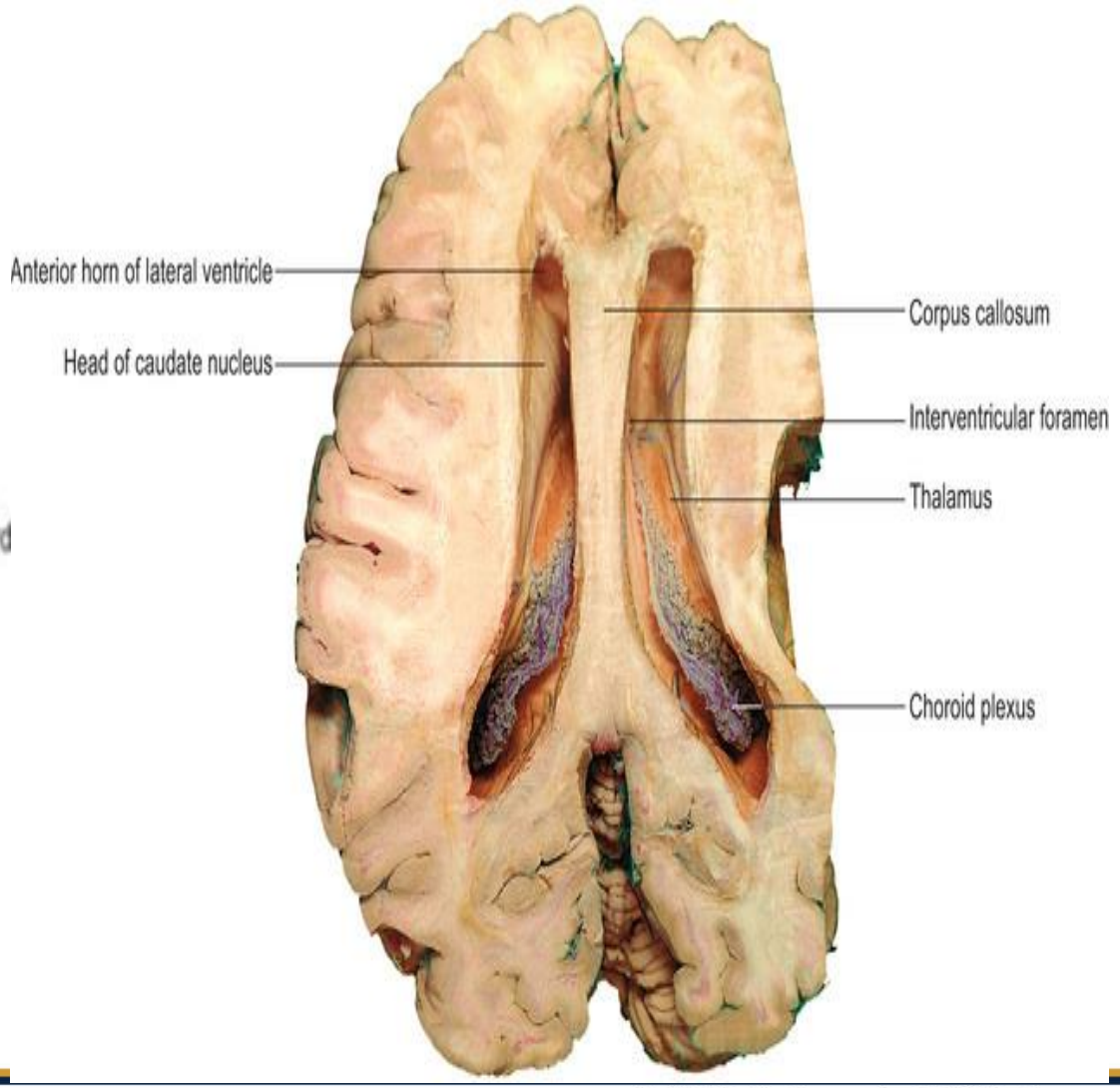
With the third ventricle through the interventricular foramen of Monro.

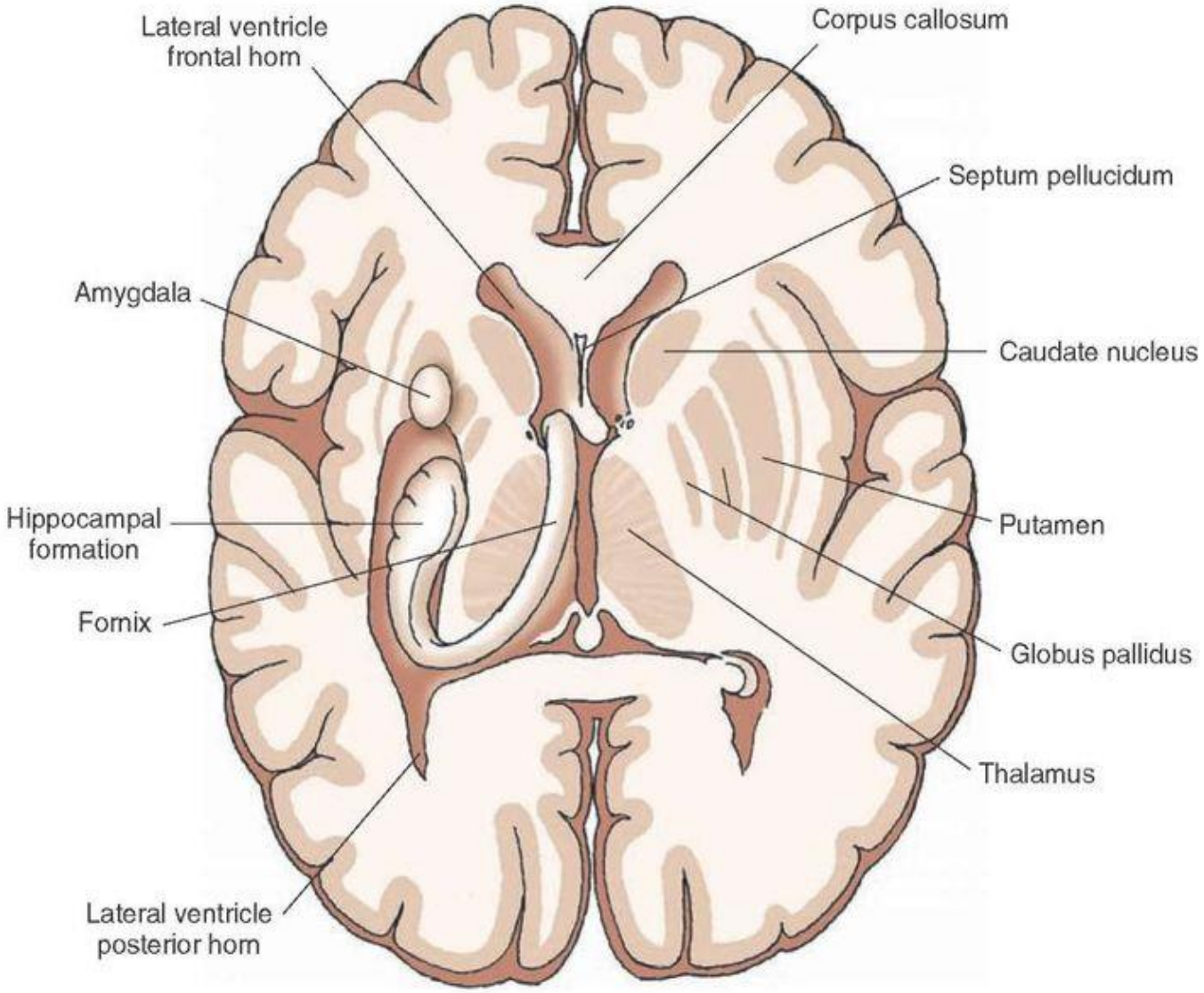
- **Choroid Plexus: Site:** in the body and the inferior horn of the lateral ventricle.
- **Arterial supply:** supplied by the **anterior & posterior** choroidal arteries:

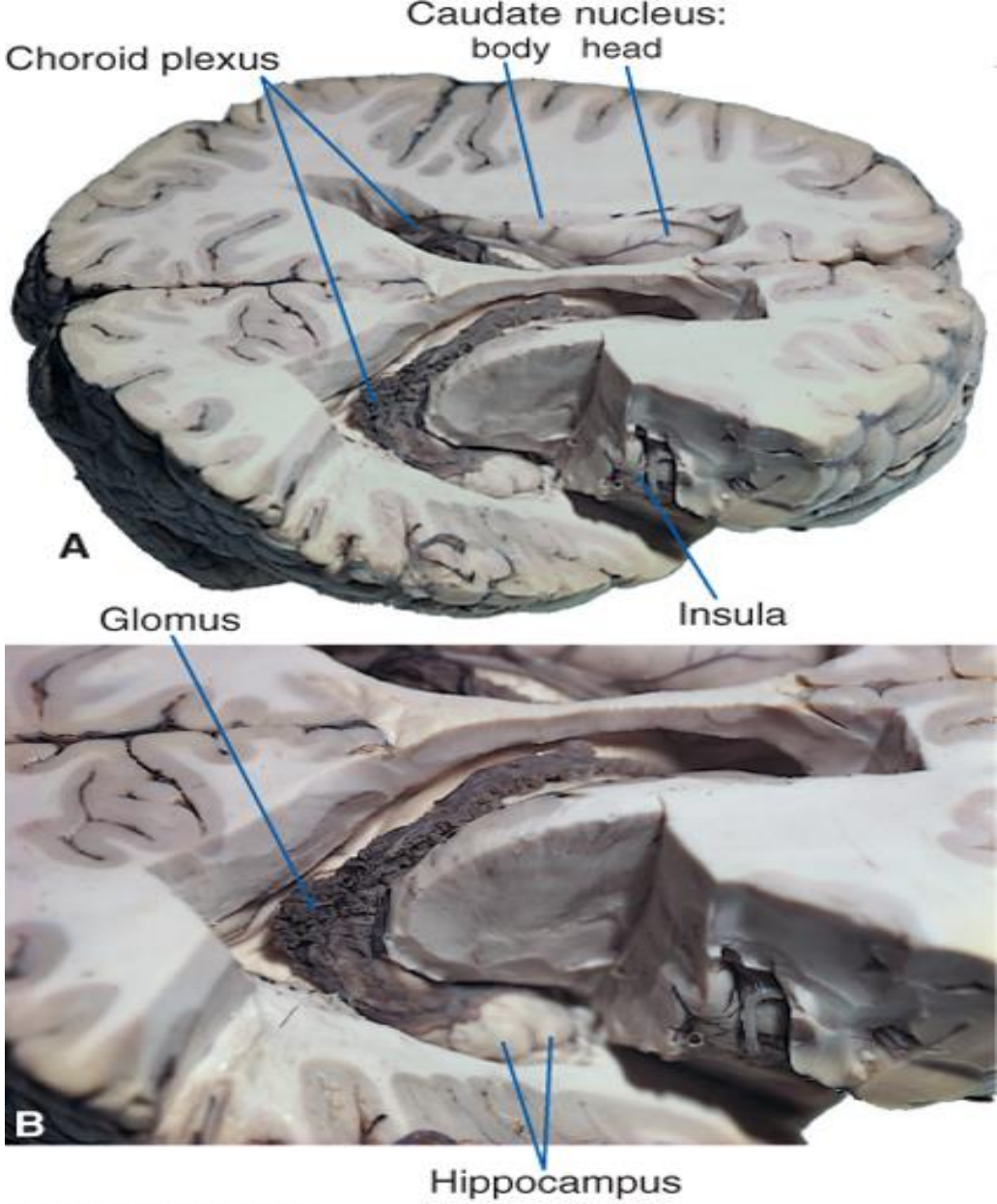


Lateral ventricle









Nolte: The Human Brain.

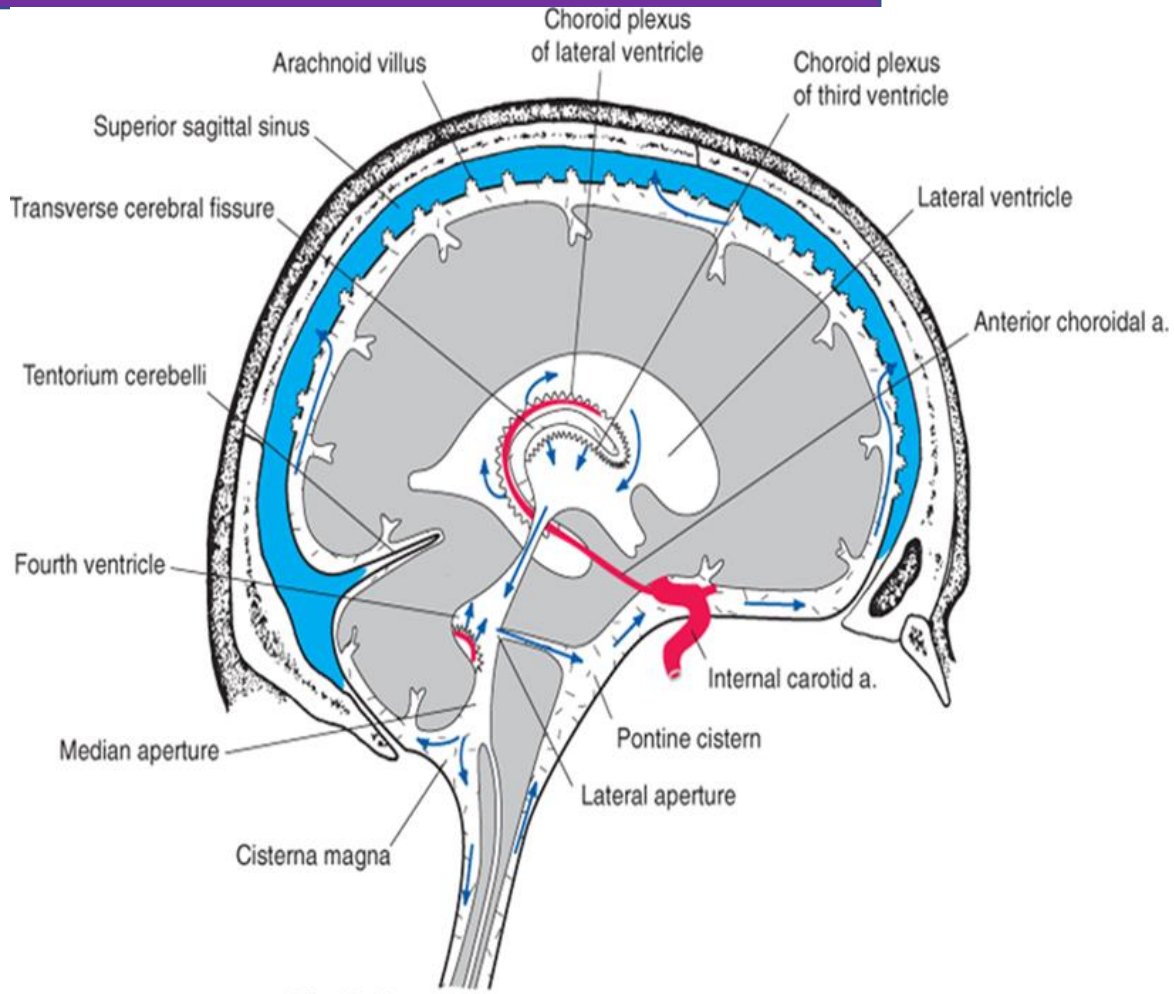
Cerebro-Spinal Fluid(CSF)

Cerebrospinal fluid (CSF):

Definition: it is the fluid that fills the ventricles of the brain and the subarachnoid space.

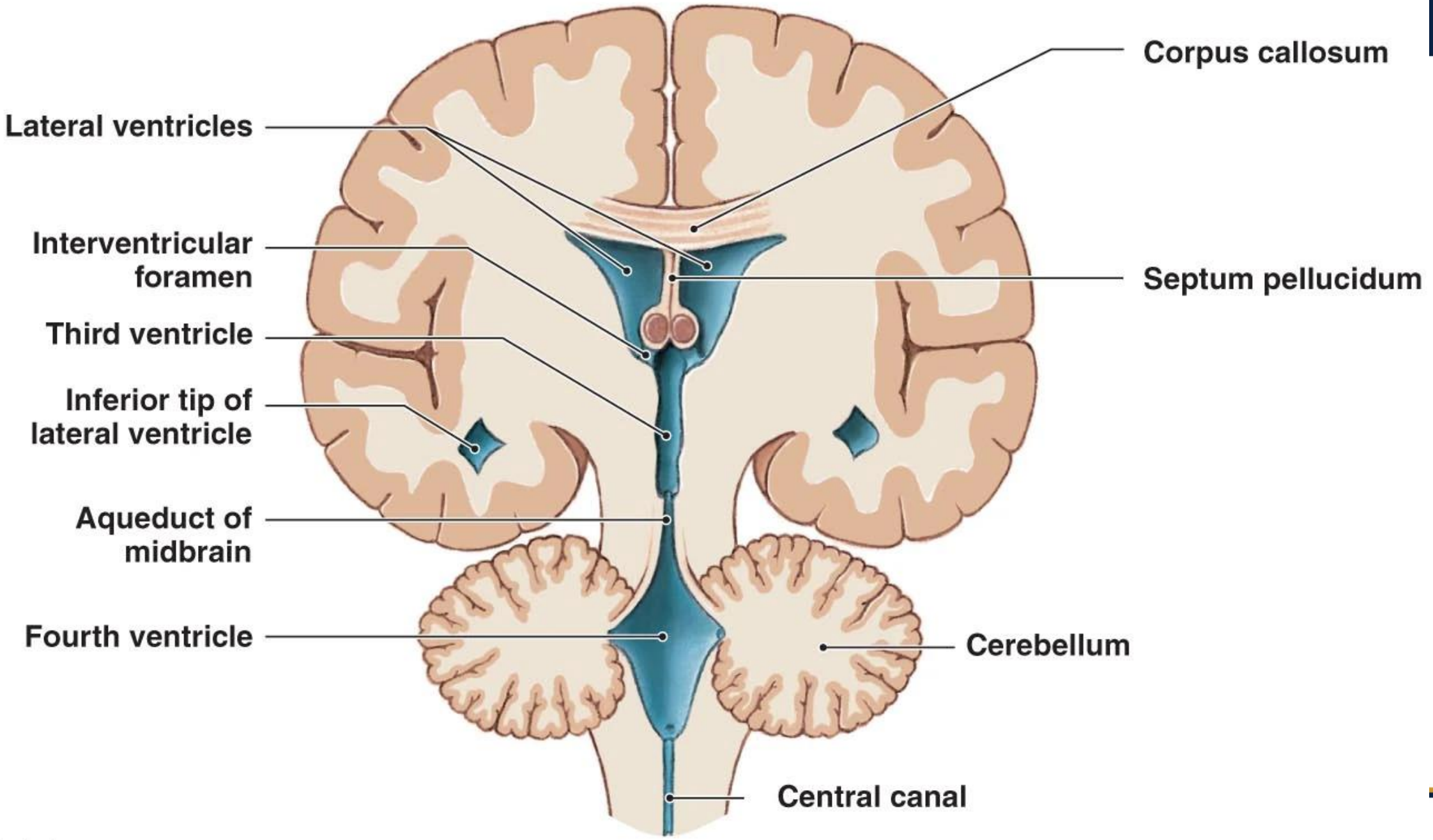
Volume: about 130 ml **(30 ml in the ventricles and 100 ml in the subarachnoid space).**

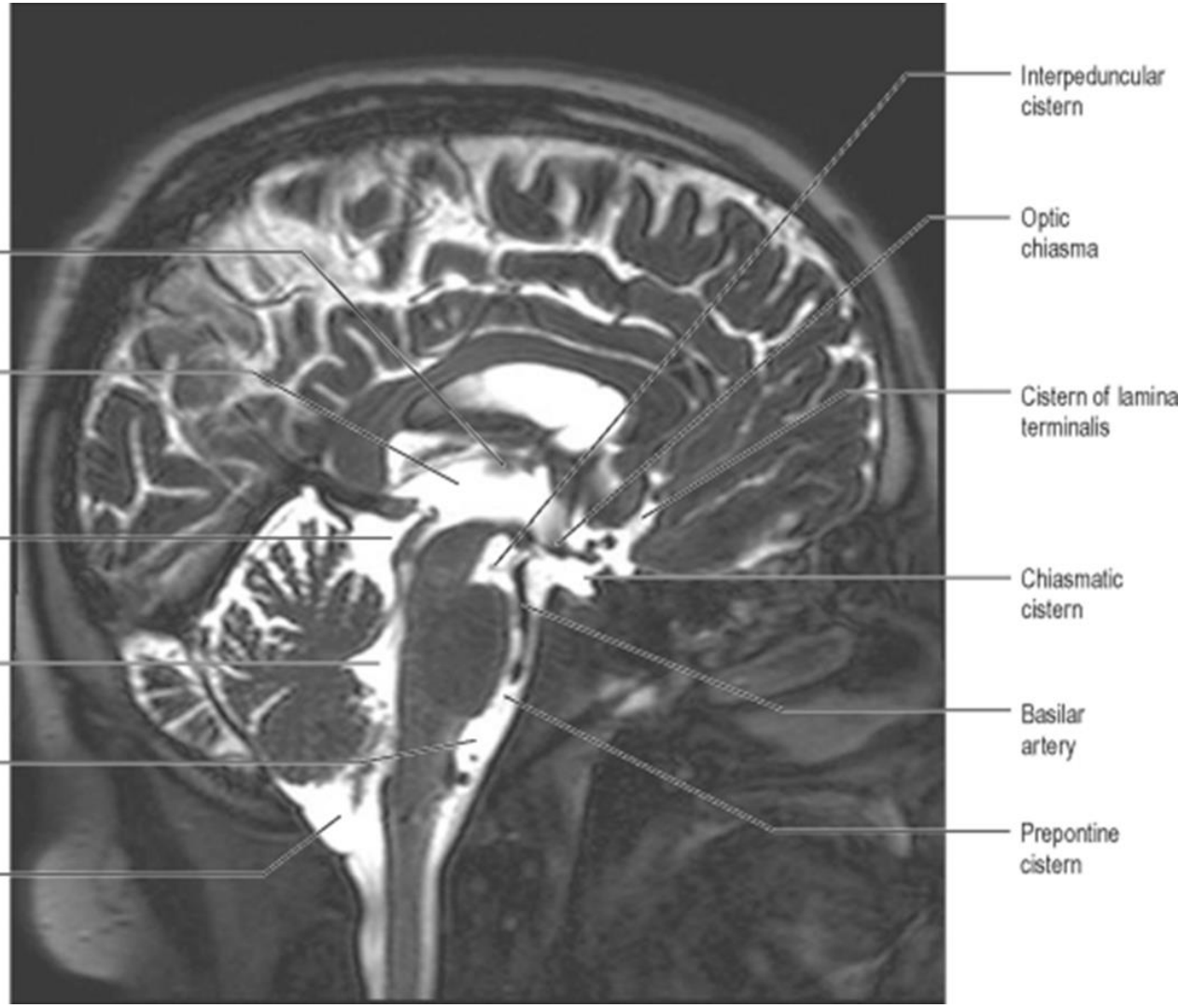
- It is a colorless fluid containing little protein and few cells.
- CSF is **produced continuously**, at a rate sufficient to fill these spaces several times each day.
- CSF is **similar to blood plasma** although it contains **less albumin and glucose.**



Nolte: The Human Brain.

Two views of the ventricles, which are filled with cerebrospinal fluid




Massa intermedia
Third ventricle
Supratectal cistern
Fourth ventricle
Pontomedullary cistern
Cisterna magna
Interpeduncular cistern
Optic chiasma
Cistern of lamina terminalis
Chiasmatic cistern
Basilar artery
Prepontine cistern

Cerebro-Spinal Fluid(CSF)

❑ Formation:

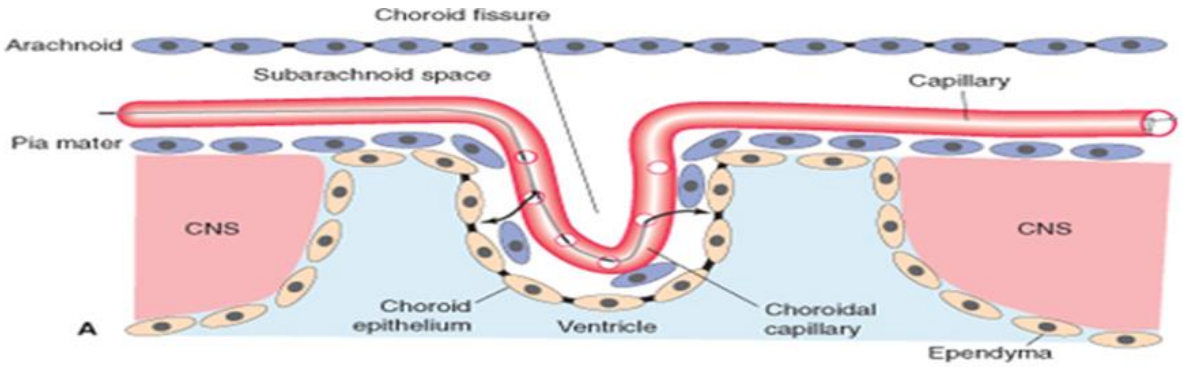
formed by active secretion and by diffusion from:

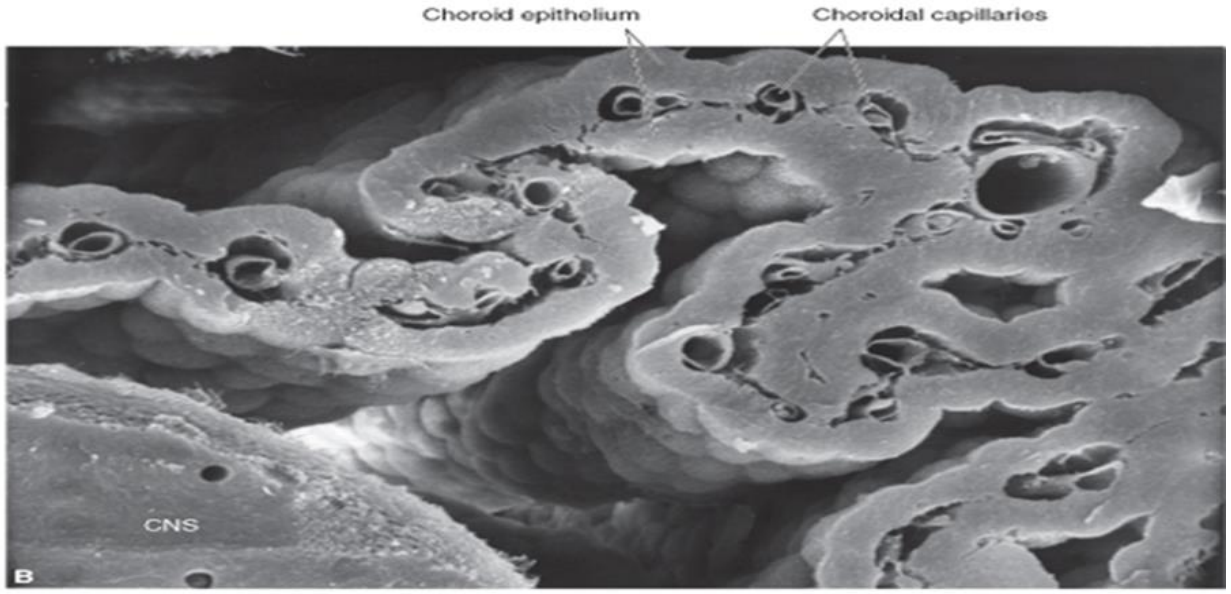
1.Choroid plexus: is the main source of the CSF (70%). Mostly in the lateral ventricle.

2.Ependymal lining of the ventricles: add CSF to the ventricles.

3.Cells of the pia mater: add CSF to the subarachnoid space.

The Choroid Plexus a series of modified ependymal cells responsible for producing 0.5 L of cerebrospinal fluid (CSF) a day in adults.





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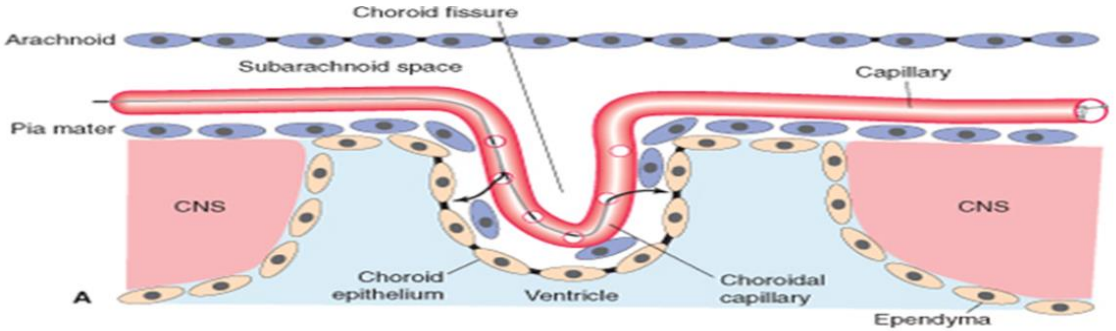
Cerebro-Spinal Fluid(CSF)

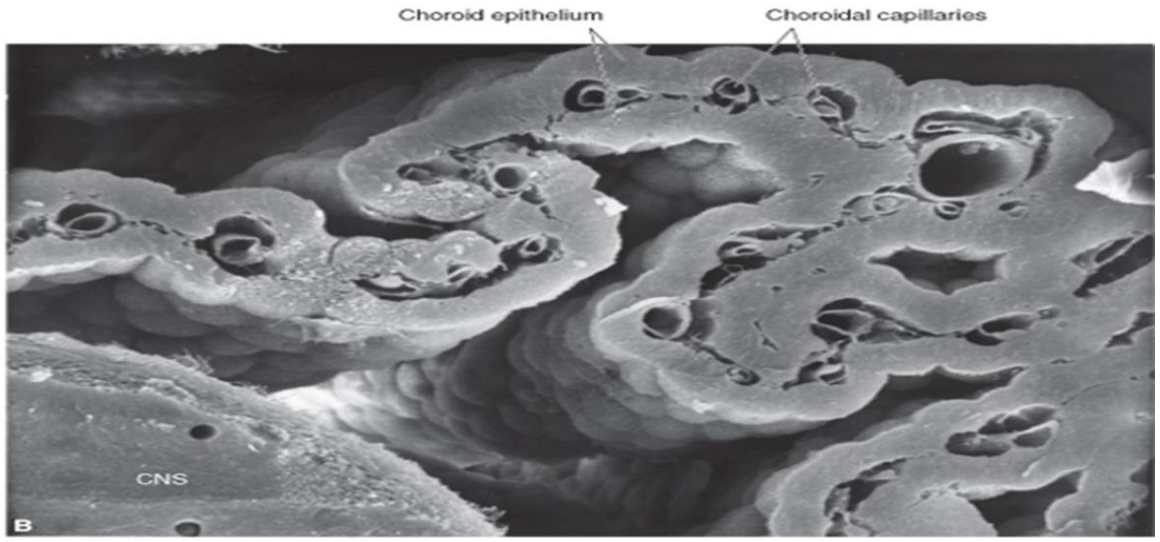
- The choroid plexus of each lateral ventricle is formed by an invagination of vascular pia mater (the tela choroidea) on the medial surface of the cerebral hemisphere.
- The vascular connective tissue picks up a covering layer of epithelium from the ependymal lining of the ventricle.

Each choroid plexus, which has a minutely folded surface, consists of a core of connective tissue containing many wide capillaries and a surface layer of cuboidal or low columnar epithelium .

- Movement of CSF is assisted by the pulsation of arteries, especially in the subarachnoid space around the spinal cord.
- The absorptive mechanism depends on the hydrostatic pressure of the CSF being higher than that of the venous blood in the dural sinuses.
- An increase in venous pressure collapses the extracellular channels of the villus, preventing the reflux of blood into the subarachnoid space.

Cerebro-Spinal Fluid(CSF)





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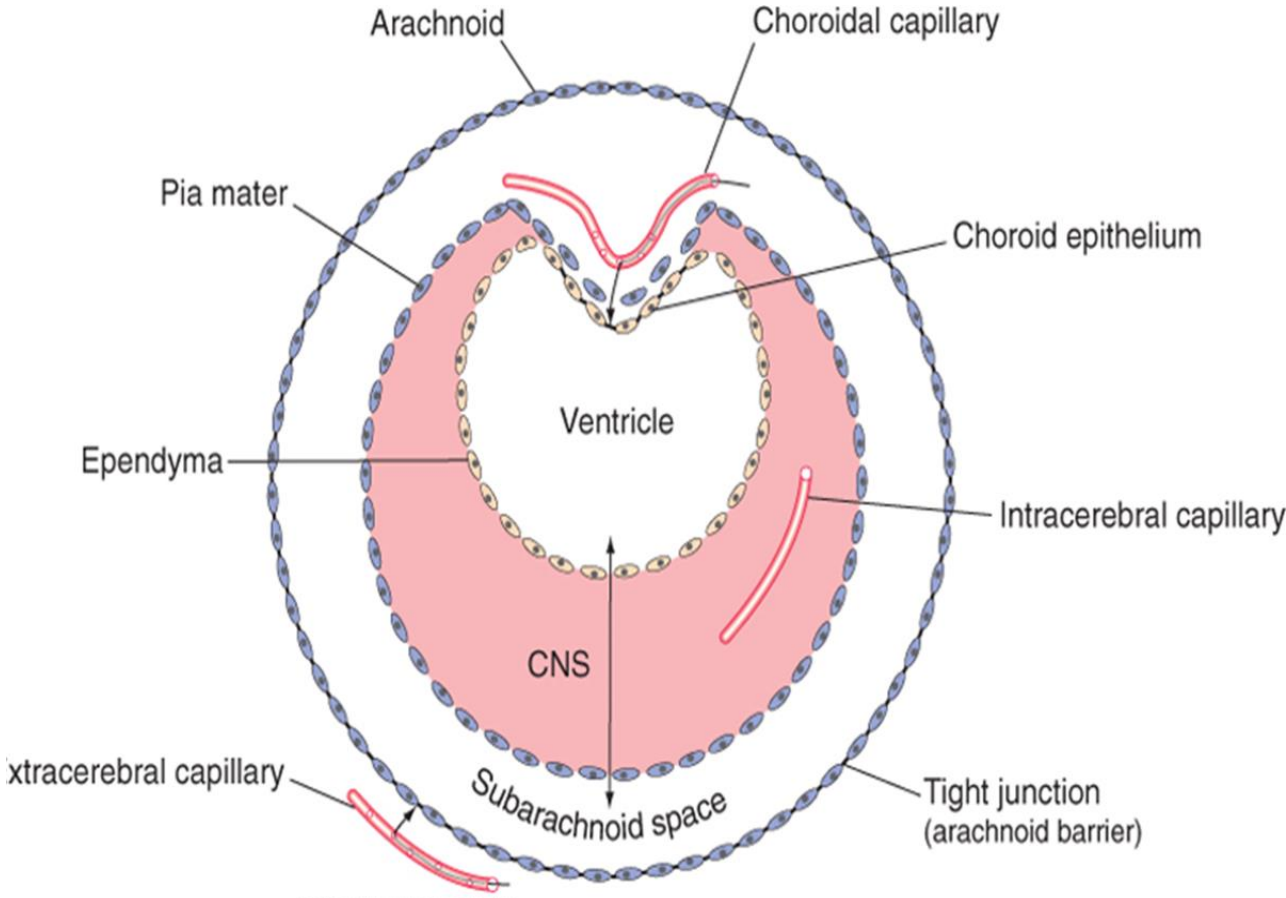

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Cerebro-Spinal Fluid(CSF)

Circulation:

1.It flows from the lateral ventricles to the third ventricle through the interventricular foramina of Monro, then to the fourth ventricle through the aqueduct of Sylvius.

2.More CSF is added in each ventricle.

3.It leaves the fourth ventricle to the subarachnoid space through the median foramen of Magendie and the lateral foramina of Luschka.

4.A small amount flows to the central canal of the spinal cord.

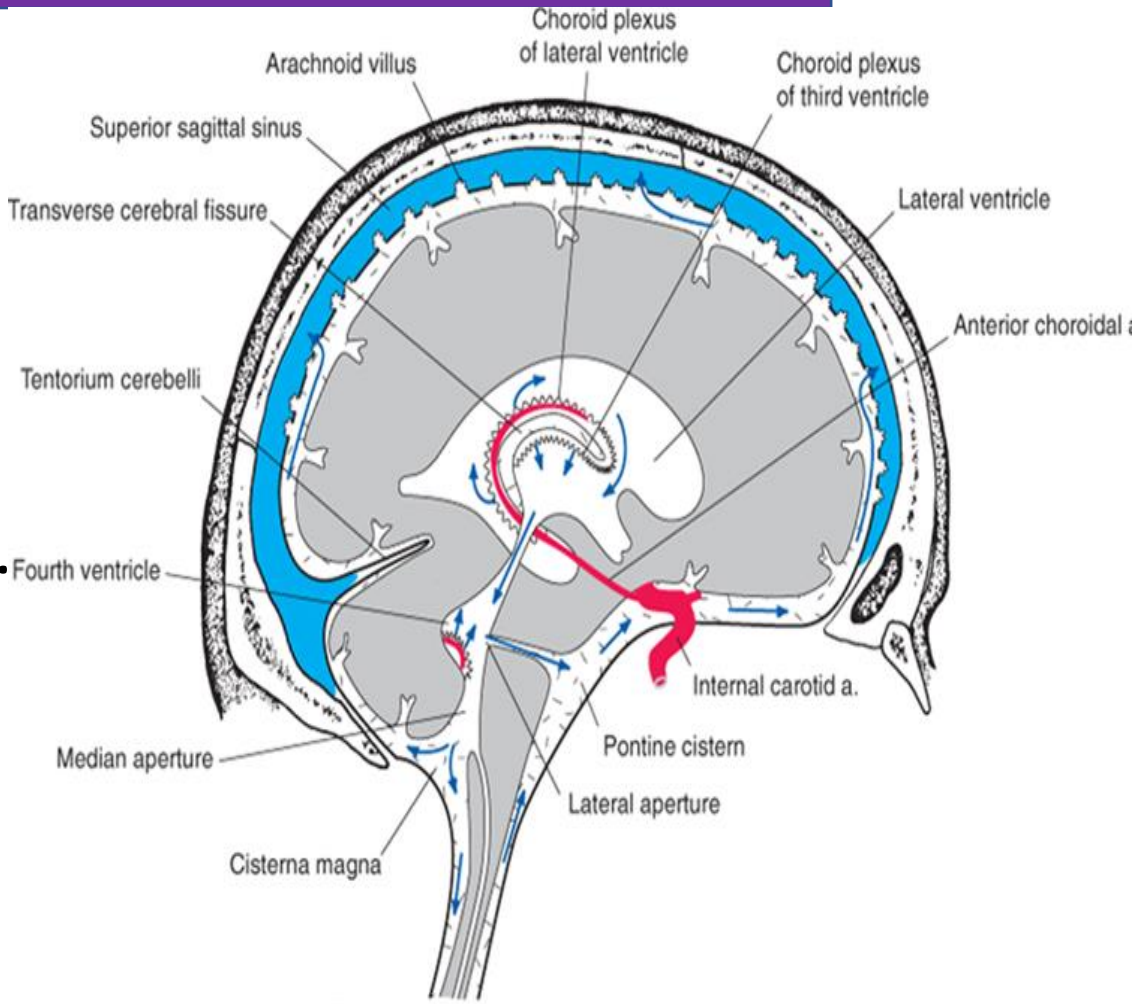
5.The CSF flows in the subarachnoid space around the brain and the spinal cord.

6.The following factors facilitate the CSF circulation:

1-Pulsations of the arteries in the subarachnoid space.

2-Movements of the cilia of the ependymal cells.

3-Positive and negative pressure created by continuous production and absorption.



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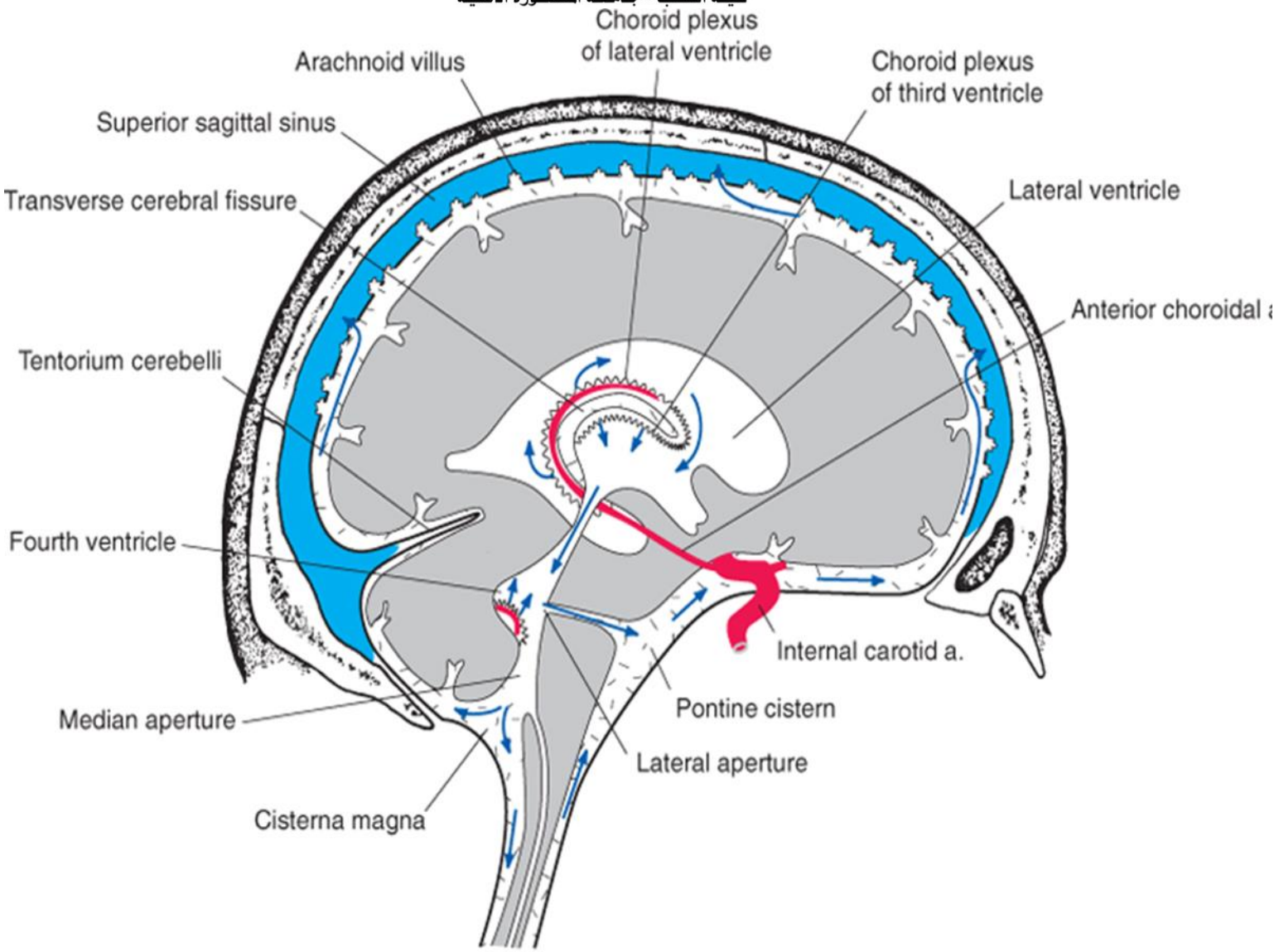

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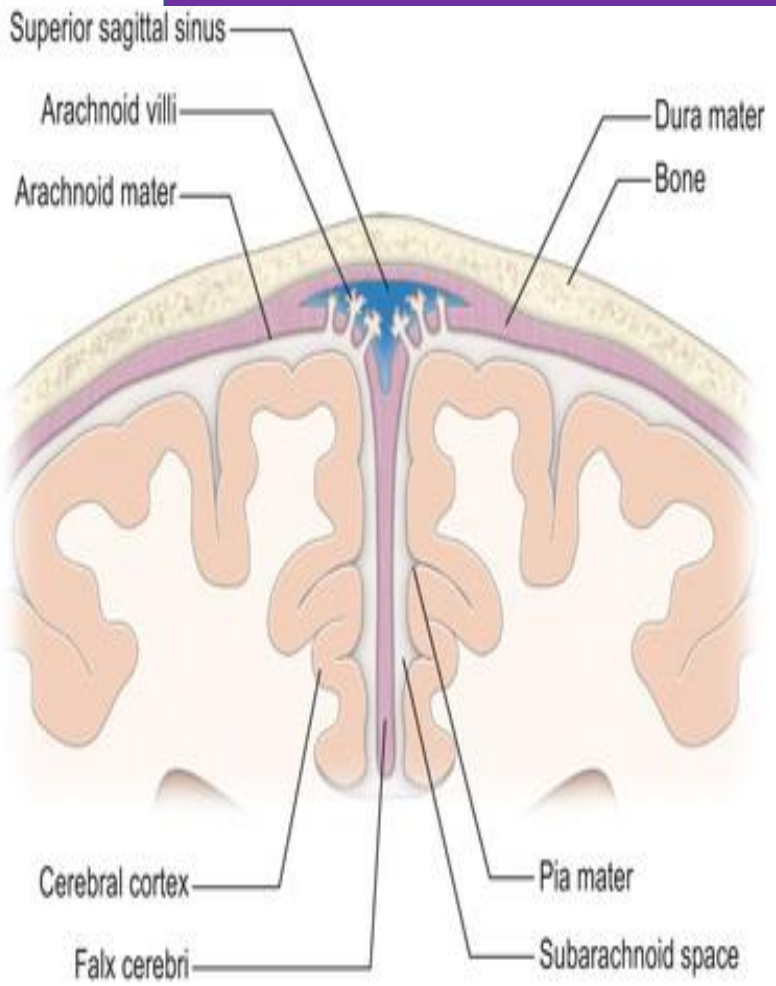
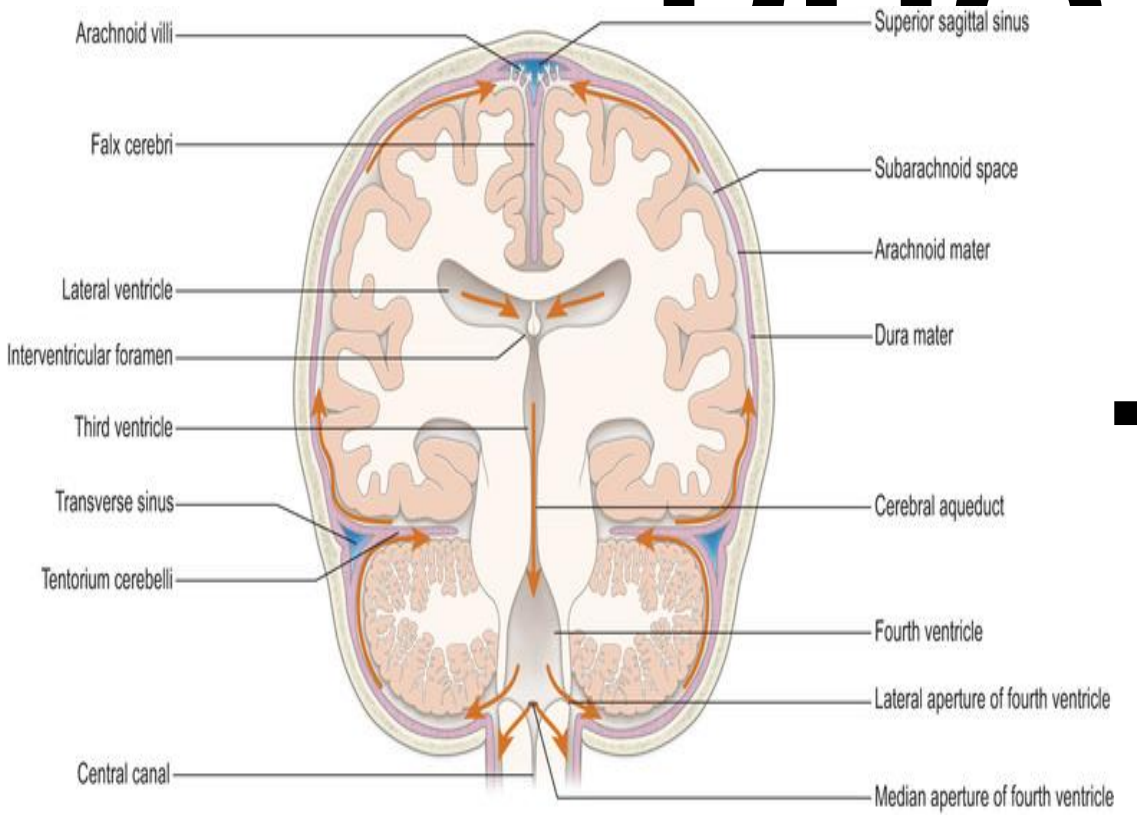
Lateral ventricle





PLOTO

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Cerebro-Spinal Fluid(CSF)

Absorption:

1.Main site for drainage: arachnoid villi & granulations.

Arachnoid granulations are minute pouches of the arachnoid membrane projecting through the dura into the venous sinuses.

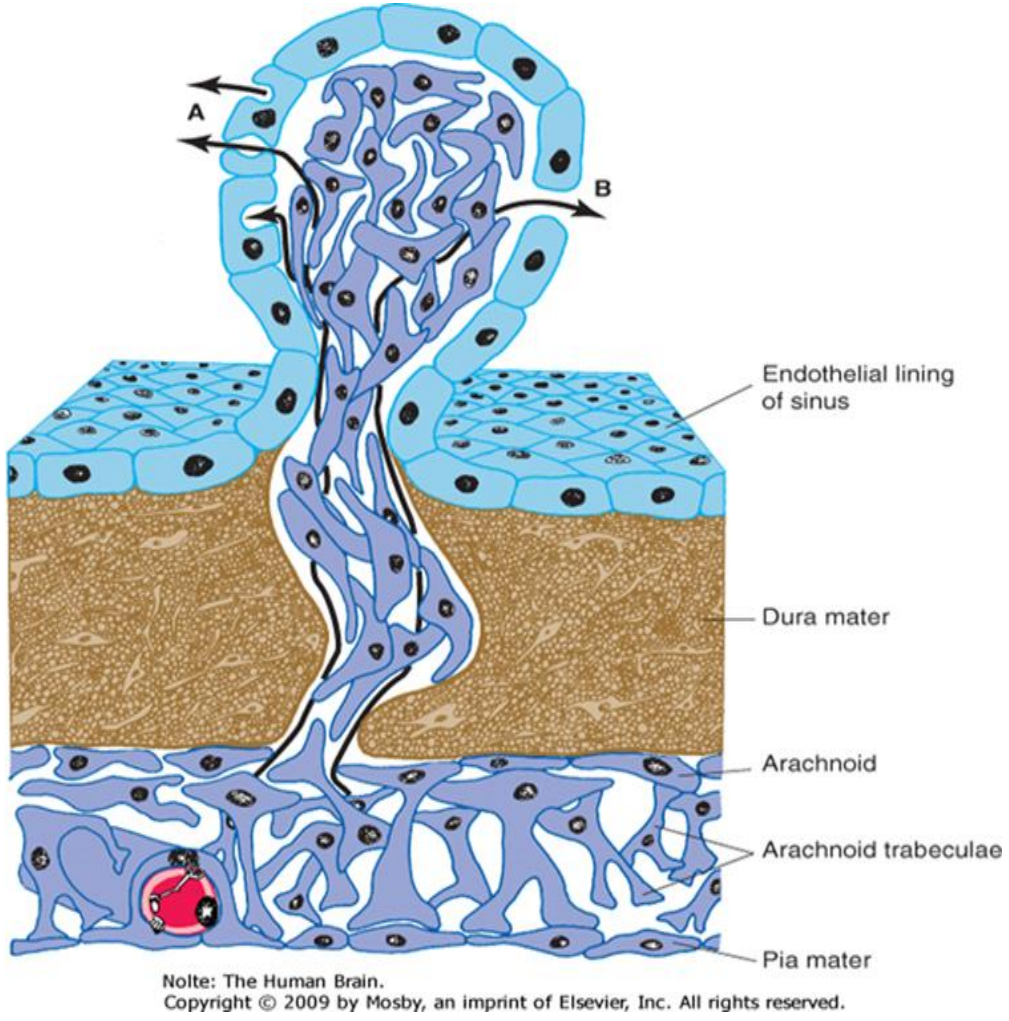
They drain the CSF into the venous blood of the dural sinuses especially **the superior sagittal sinus.**

2.Gap junctions between ependymal cells & between pial cells back **to the brain tissue.**

3.Into the venous blood through **small veins** in the subarachnoid space.

4**.Into the perineural lymph vessels** around the cranial and spinal nerves.

Reabsorption occurs at these sites because the **hydrostatic pressure** in the subarachnoid space **is higher than that** in the lumen of the **sinus** and also because of the **greater colloid osmotic pressure of venous** blood compared with CSF.



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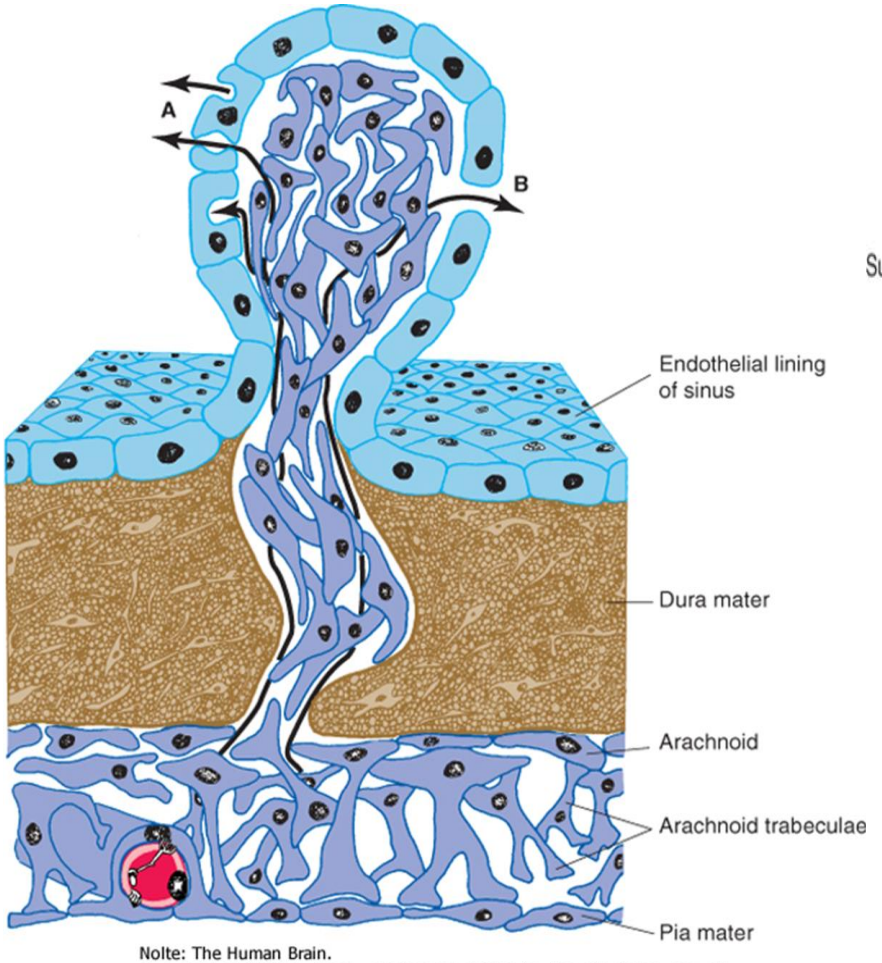

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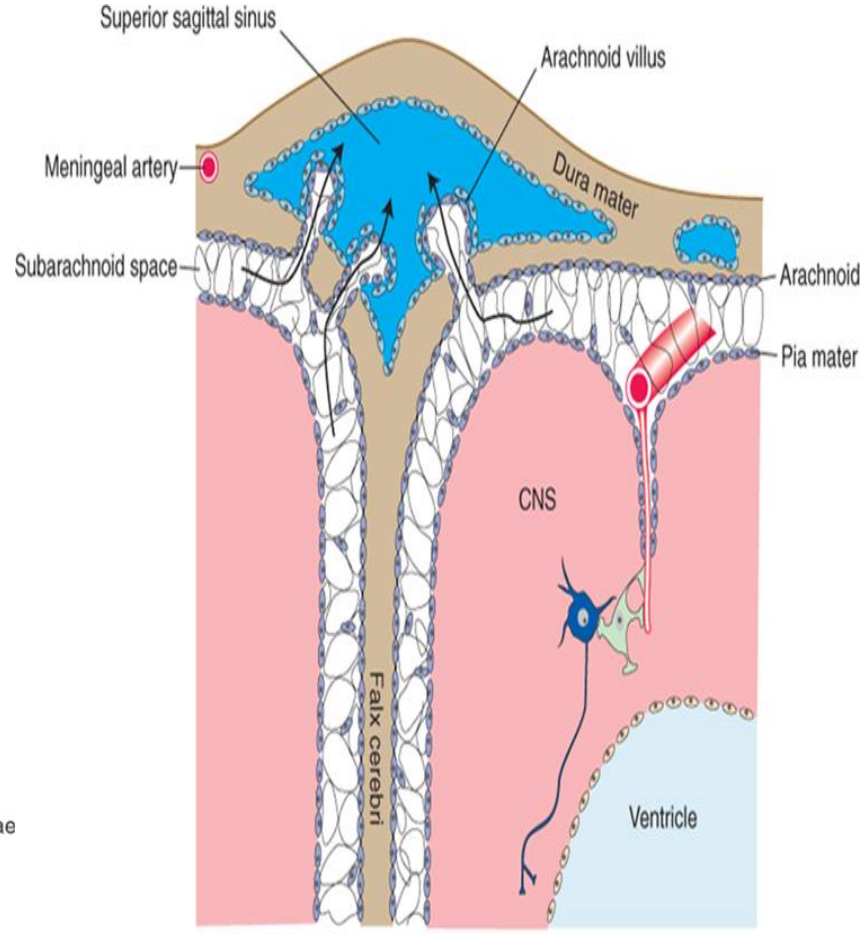

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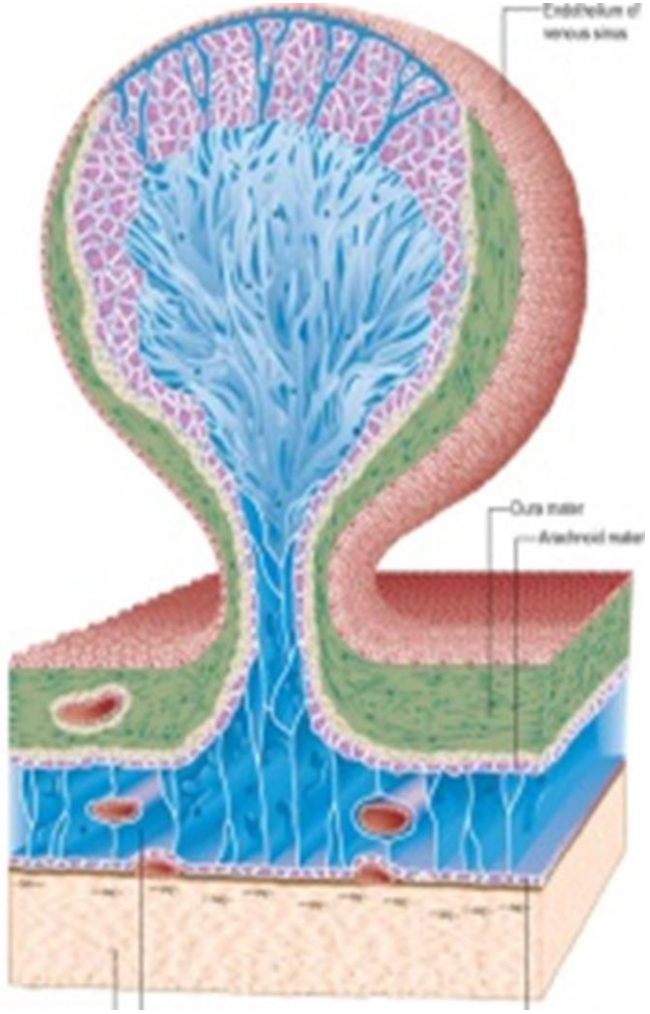


Cerebro-Spinal Fluid(CSF)

Functions of the CSF:

1. Reduces the brain weight 60 folds (from 1400 gm to 25 gm).
2. Protects the brain and the spinal cord.
3. Substitutes the lymphatic system in the CNS and provides a drainage system
4. Maintains the chemical environment for the CNS through communication with the brain extracellular space.
5. Regulation of the intracranial pressure.

Cerebro-Spinal Fluid(CSF)

Clinical Conditions Associated with the CSF

Hydrocephalus

•**Definition:** It is an abnormal increase in the volume of the CSF with dilatation of the ventricles and increase in size of the head.

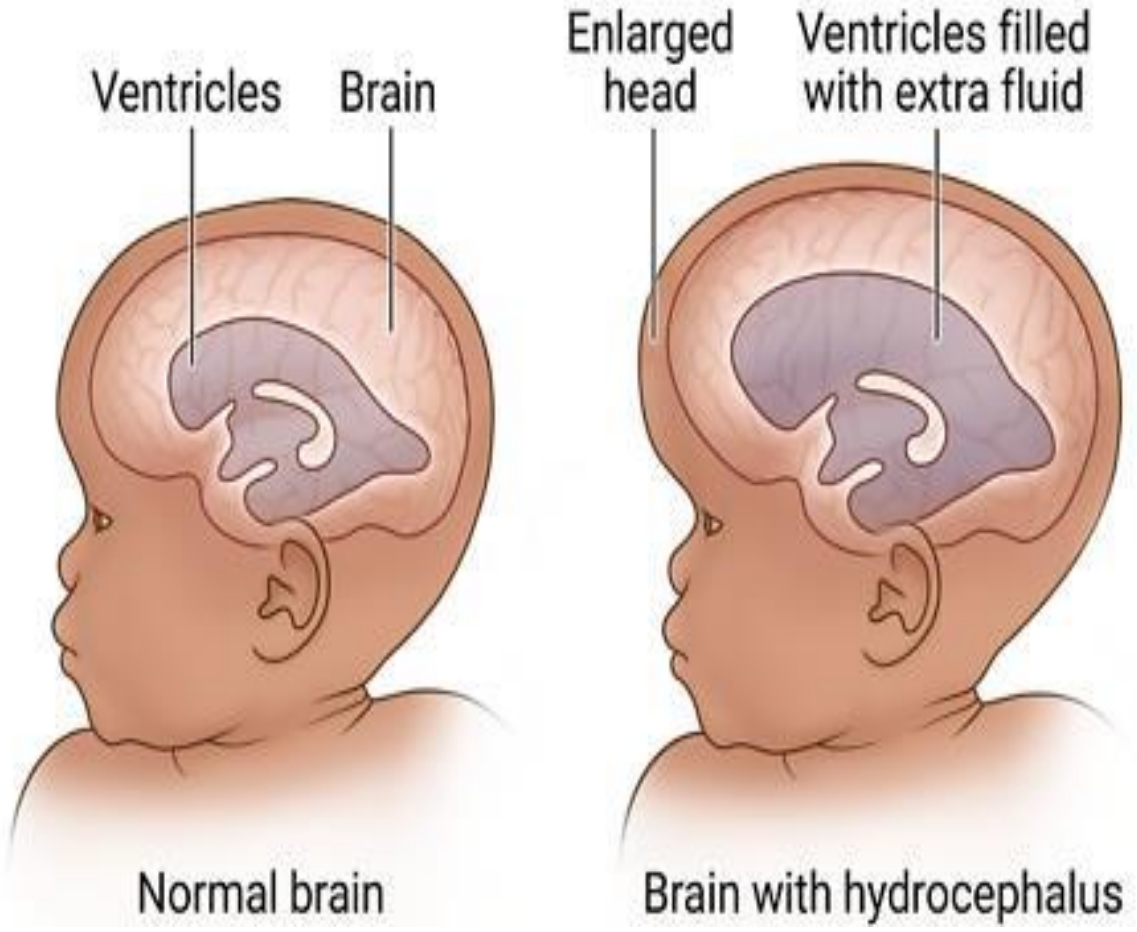
•**Causes:**

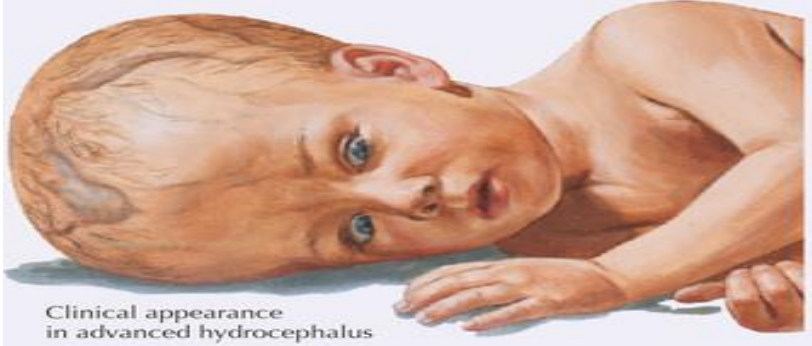
1.Obstruction to its circulation: It is the commonest cause. The commonest site of obstruction is the aqueduct of Sylvius . Other sites are interventricular foramina.

2.Overproduction of the CSF: by choroid plexus tumor (rare).

3.Inadequate drainage of the CSF: by thrombosis of the superior sagittal sinus.

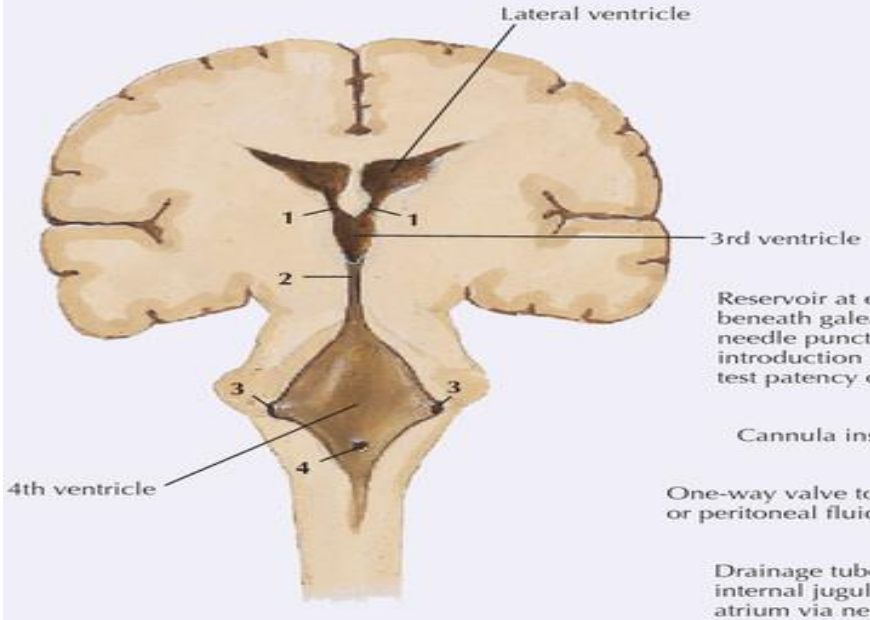
Decompression Of The Dilated Ventricles is achieved by inserting **a shunt connecting** the **ventricles** to the **jugular vein or the abdominal peritoneum.**





Clinical appearance
in advanced hydrocephalus

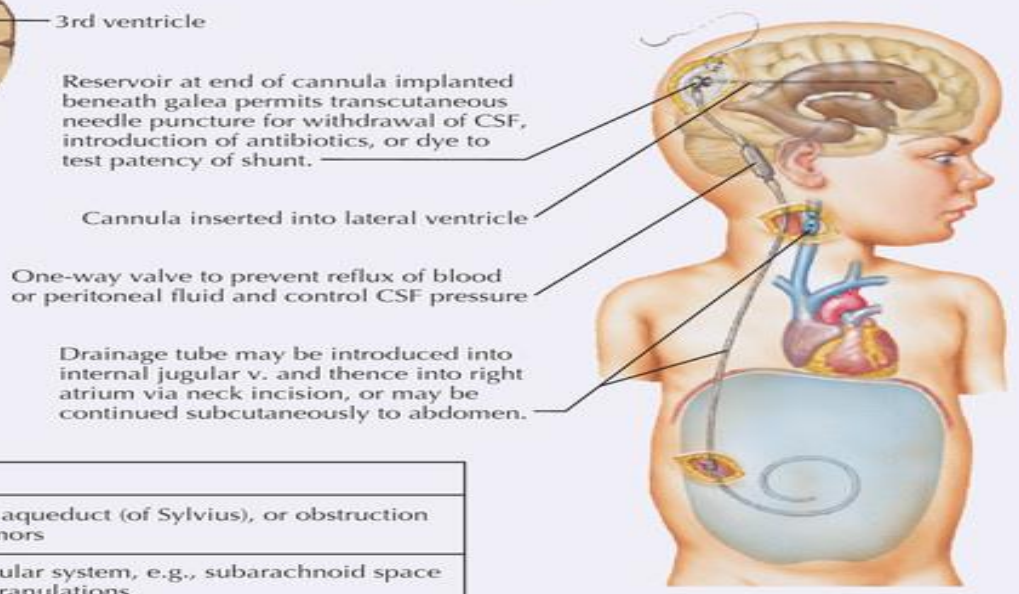
Section through brain showing marked dilatation of lateral and 3rd ventricles



Potential lesion sites in obstructive hydrocephalus

1. Interventricular foramina (of Monro)
2. Cerebral aqueduct (of Sylvius)
3. Lateral apertures (of Luschka)
4. Median aperture (of Magendie)

Shunt procedure for hydrocephalus



Type	Definition
Obstructive	Congenital stenosis of cerebral aqueduct (of Sylvius), or obstruction at other sites (illustrated) by tumors
Communicating	Obstruction outside the ventricular system, e.g., subarachnoid space (hemorrhage) or at arachnoid granulations
Normal pressure	Adult syndrome of progressive dementia, gait disorders, and urinary incontinence; computed tomography shows ventricular dilation and brain atrophy

Cerebro-Spinal Fluid(CSF)

- **Lumbar puncture:**

It means introducing a needle into the subarachnoid space for:1.Injecting drugs into the CSF such as anaethetics and antibiotics.

2.Obtaining a sample of CSF for analysis.

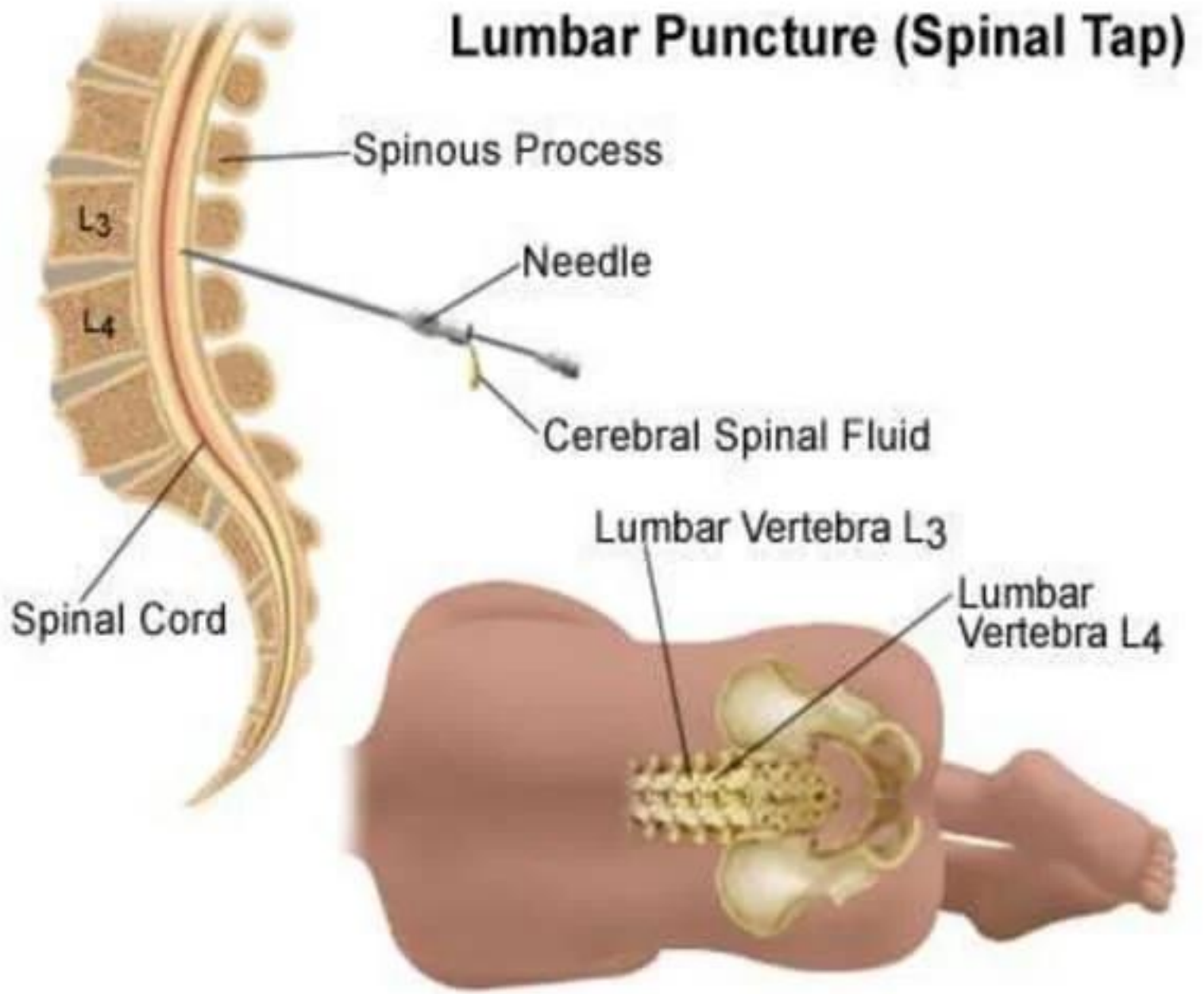
3.Measuring the CSF pressure by attaching a manometer to the needle.

- **Papilledema**: edema of the optic disc is seen on ophthalmoscopy.

The subarachnoid space extends around the optic nerve and the other cranial nerves.

Elevation of the CSF pressure compresses the optic nerve and the central retinal vein causing edema of the optic disc.

Lumbar Puncture (Spinal Tap)



Quiz

Which of the following form the lateral wall of anterior horn of lateral ventricle?

A. Body of the caudate nucleus
B. tail of caudate the nucleus
C. Body of the fornix
D. Septum pellucidum
E. head of the caudate nucleus

Answer:

Quiz

Which of the following is true as regards to the cerebrospinal fluid?

A. The main site of its formation is arachnoid villi and granulations.
B. The main factor facilitates the CSF circulation is pulsations of the arteries in the subdural space
C. The choroid plexus is the main source of the CSF (70%), Mostly in the lateral ventricle.
D. The ependymal cells are the main source of the CSF (70%), Mostly in the third ventricle
E. CSF is similar to blood plasma although it contains more albumin and glucose.

Answer:

References for further readings

Gray's anatomy for student 3rd Edition,


Thank
you!