CENTRAL NERVOUS SYSTEM

The Ventricular System & CSF Circulation

Dr. Aiman Qais Afar
Surgical Anatomist

College of Medicine / University of Mutah

2023-2024

Thursday 21 December 2023

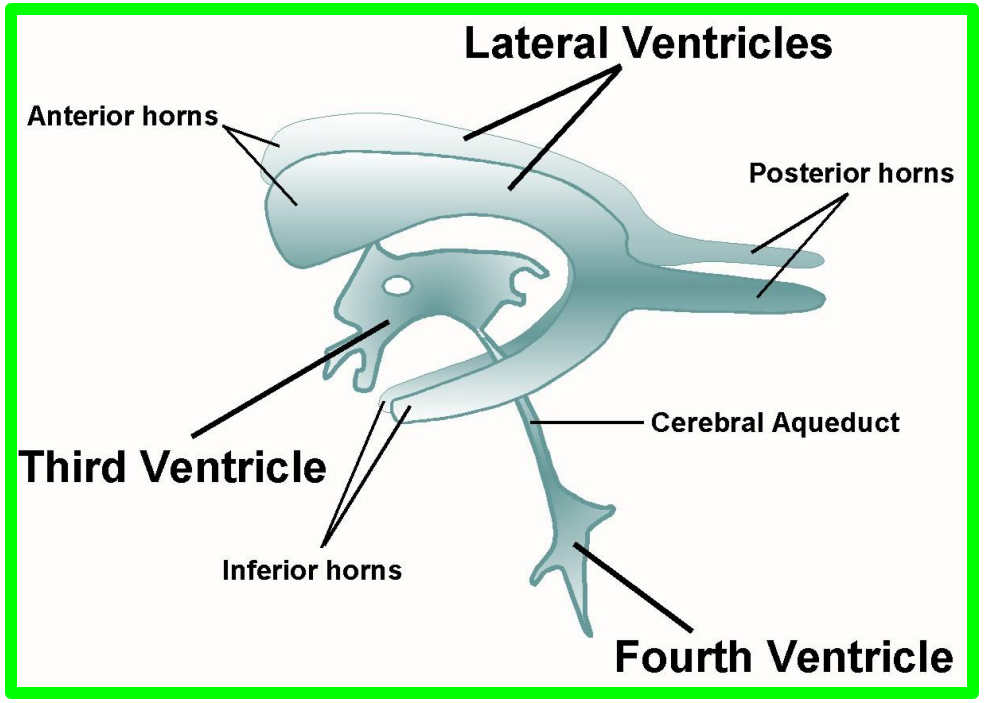
Ventricular System

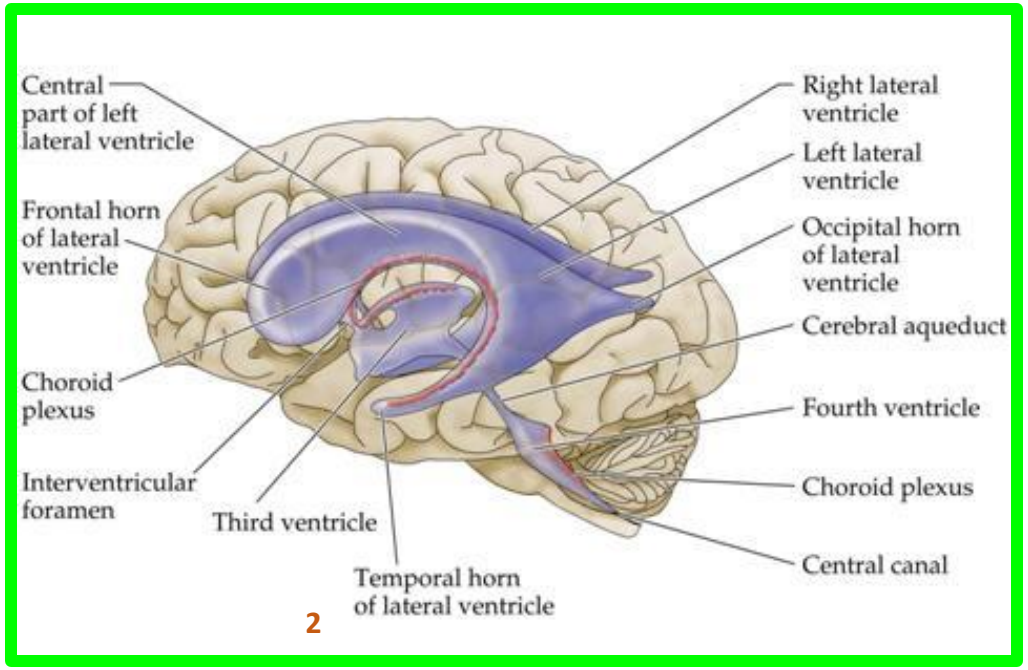
Dr. Aiman Qais Afar
Thursday 21 December 2023

❖*The ventricles are four fluid-filled cavities located within the brain; these are:*
- ❖*The two lateral ventricles,*
- ❖*The third ventricle, and*
- ❖*The fourth ventricle*

❖*The two lateral ventricles communicate through the interventricular foramina (of Monro) with the third ventricle.*

❖*The third ventricle is connected to the fourth ventricle by the narrow cerebral aqueduct (aqueduct of Sylvius).*

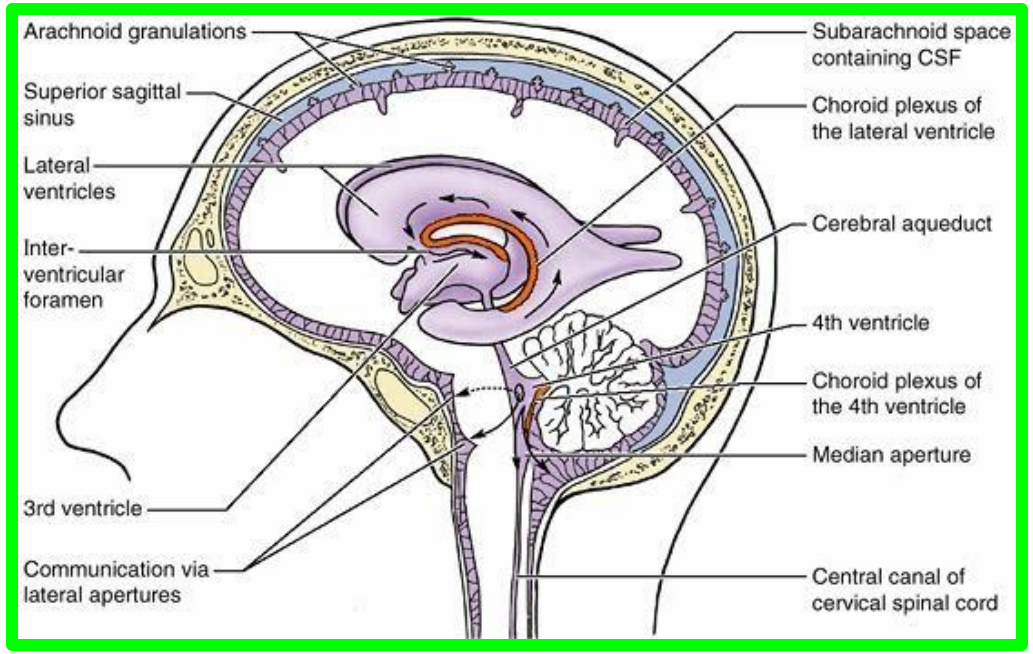




Ventricular System

Dr. Aiman Qais Afar

❖*The fourth ventricle, in turn, is continuous with the narrow central canal of the spinal cord and, through the three foramina in its roof, with the subarachnoid space.*



❖*The central canal in the spinal cord has a small dilatation at its inferior end, referred to as the terminal ventricle*

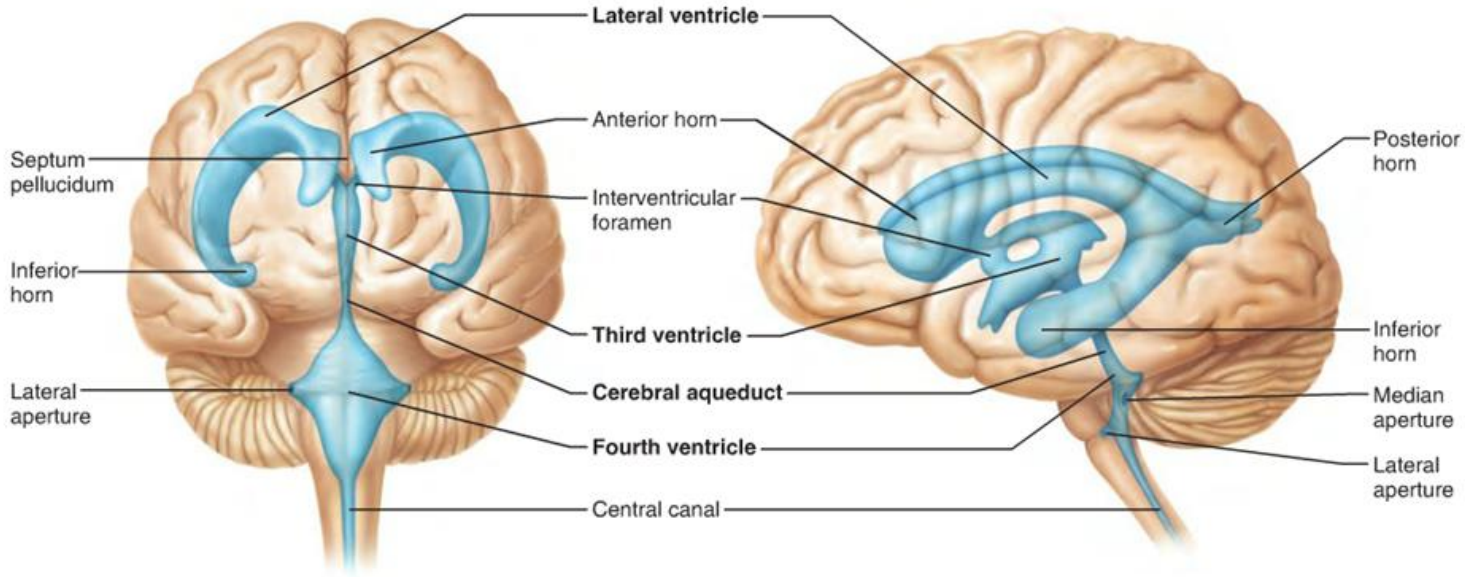
❖*The ventricles are lined throughout with ependyma and are filled with cerebrospinal fluid.*

Lateral Ventricles

✓There are two large lateral ventricles, and one is present in each cerebral hemisphere

✓The lateral ventricle communicates with the cavity of the third ventricle through the interventricular foramen

✓The ventricle is a roughly C-shaped cavity and may be divided into a body, which occupies the parietal lobe and from which anterior, posterior, and inferior horns extend into the frontal, occipital, and temporal lobes, respectively.

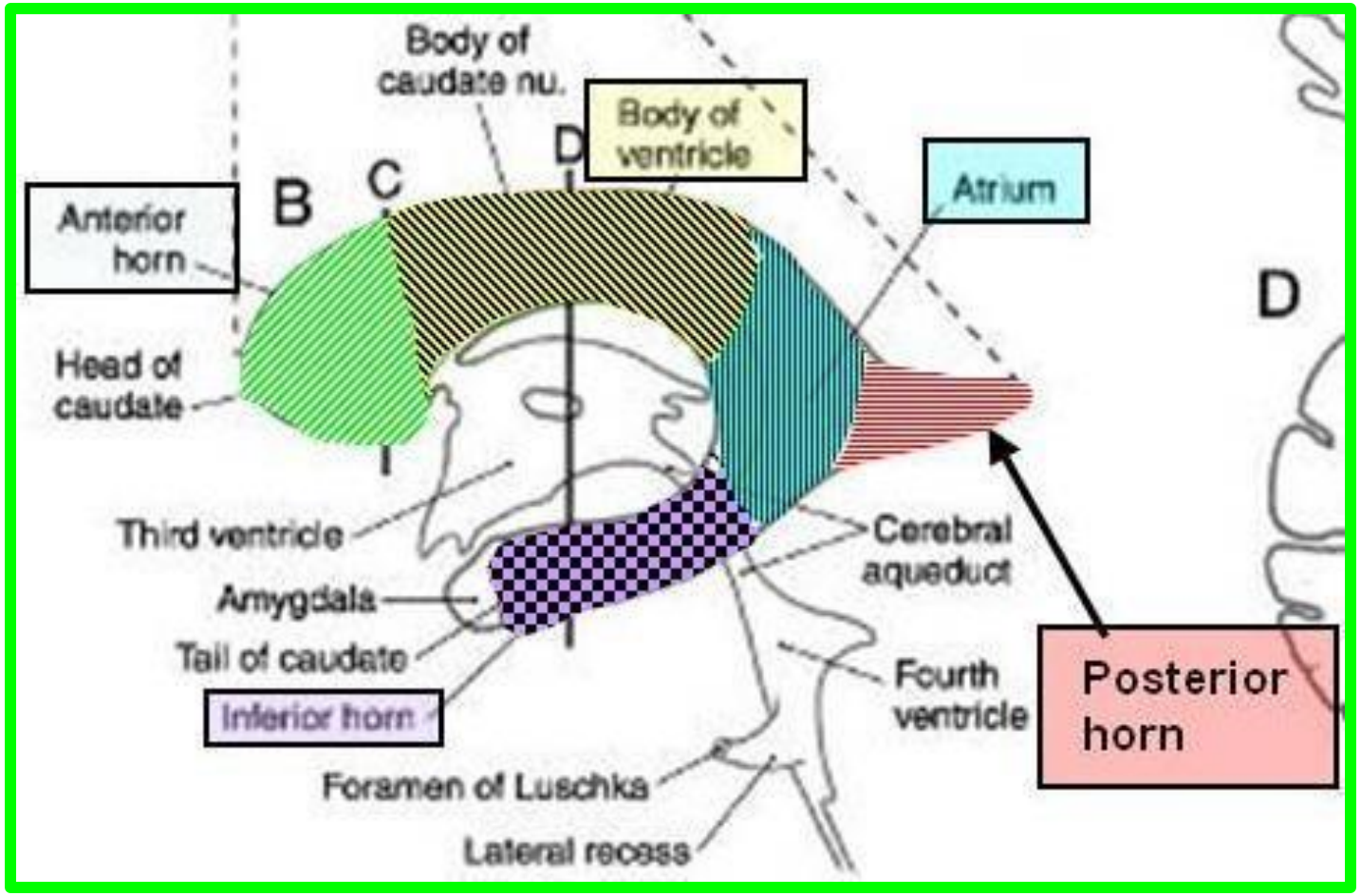


Lateral Ventricles

Dr. Aiman Qais Afar

❖*The body extends from the interventricular foramen posteriorly as far as the posterior end of the thalamus.*

❖*The anterior horn extends forward into the frontal lobe . It is continuous posteriorly with the body of the ventricle at the interventricular foramen.*



❖*The posterior horn extends posteriorly into the occipital lobe*

❖*The inferior horn extends anteriorly into the temporal lobe .*

Lateral Ventricles

Boundaries of the lateral ventricle

❑ *1-The body*

1- Roof, trunk of corpus callosum.

2- Floor: sloping and is formed by the following arranged from lateral to medial;

a- Body of caudate nucleus.

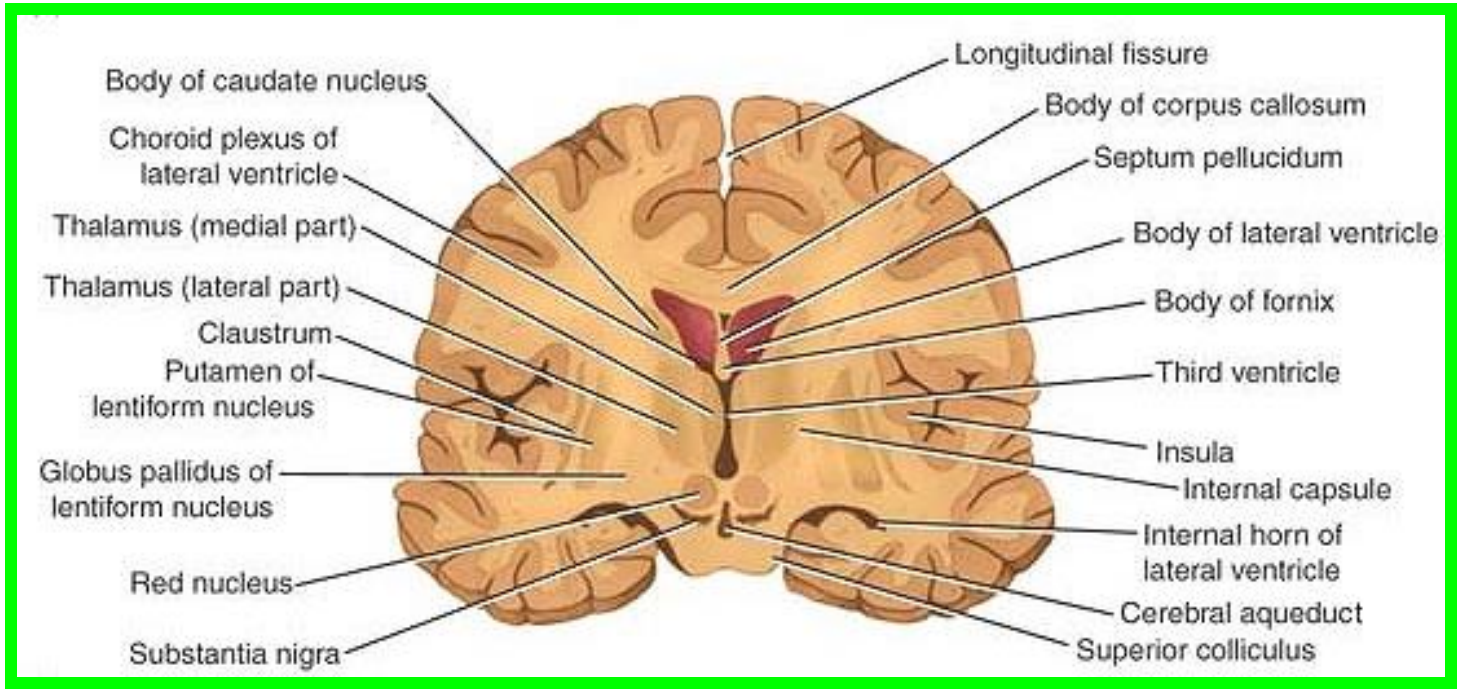
b- Stria terminalis and the thalamostriate vein.

c- Superior surface of the thalamus.

d- Choroid plexus of the lateral ventricle.

e- Lateral margin of the body of fornix.

3- Medial wall; is formed by the septum pellucidum

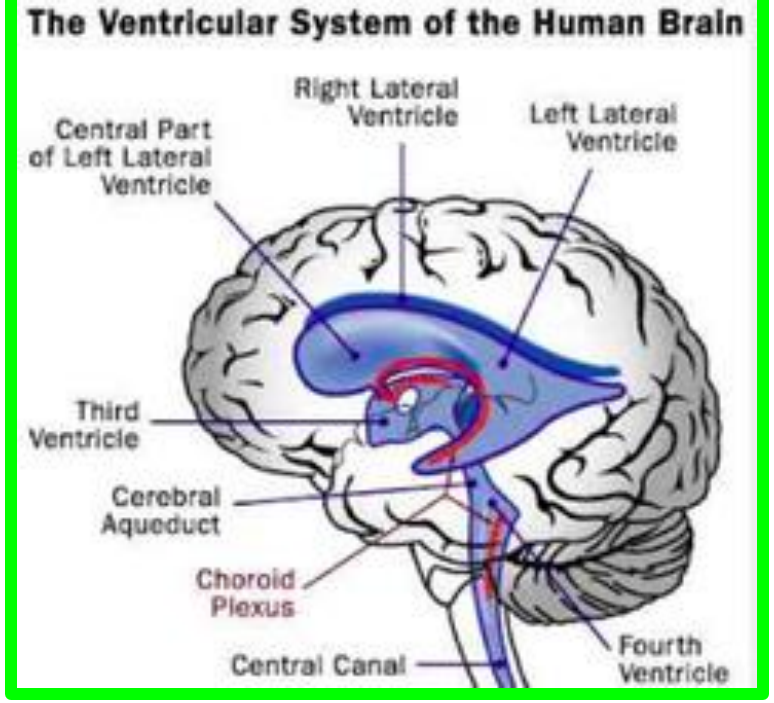


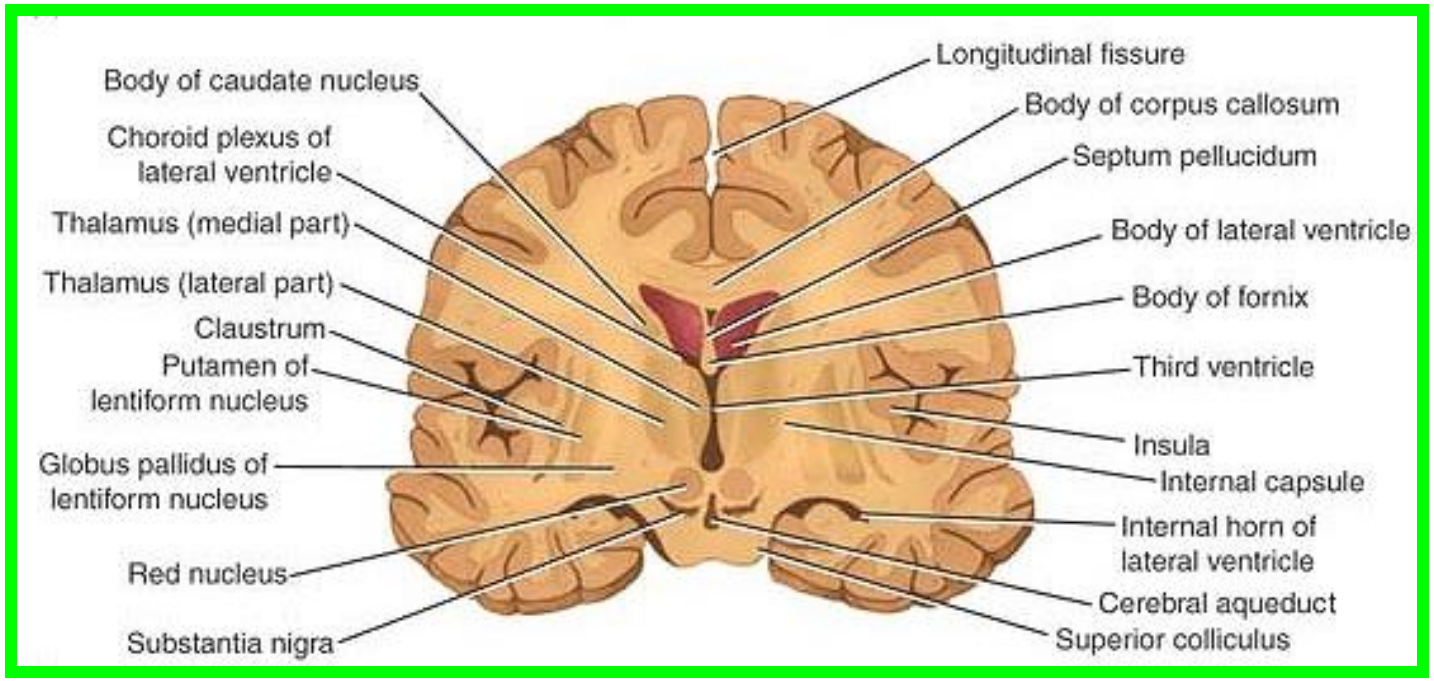
Lateral Ventricles

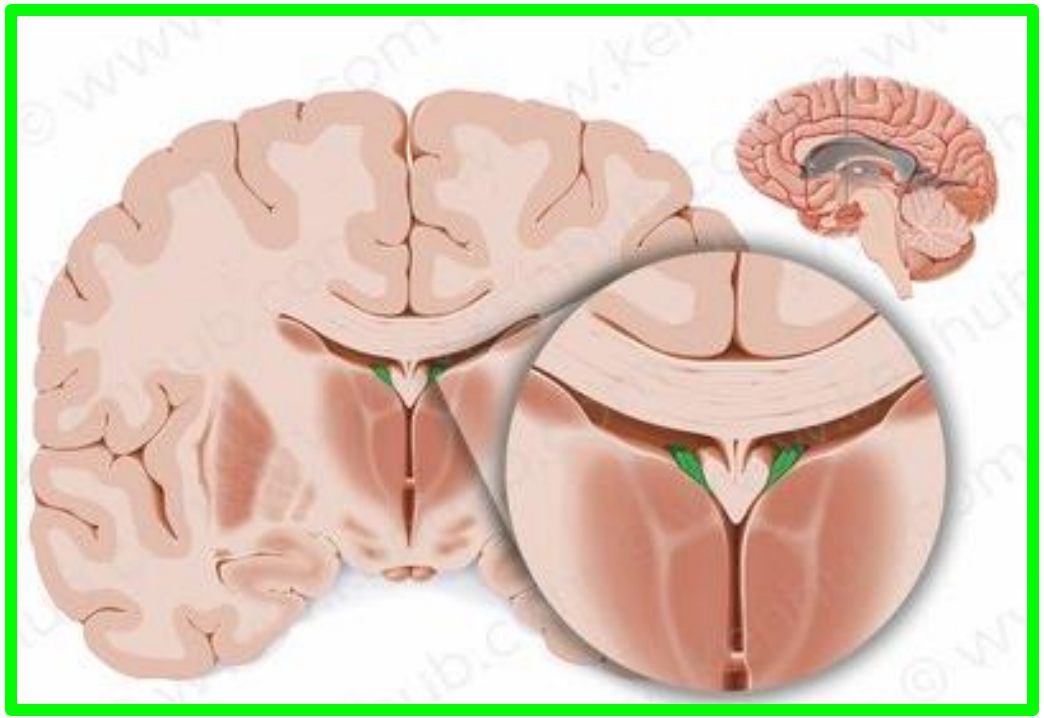
Dr. Aiman Qais Afar
Thursday 21 December 2023
7

❑*The choroid plexus of the ventricle projects into the body of the ventricle through the slitlike gap between the body of the fornix and the superior surface of the thalamus.*

❑*This slitlike gap is known as the choroidal fissure; through it, the blood vessels of the plexus invaginate the pia mater of the tela choroidea and the ependyma of the lateral ventricle.*







Lateral Ventricles

Boundaries of the lateral ventricle

❑2- Anterior Horn

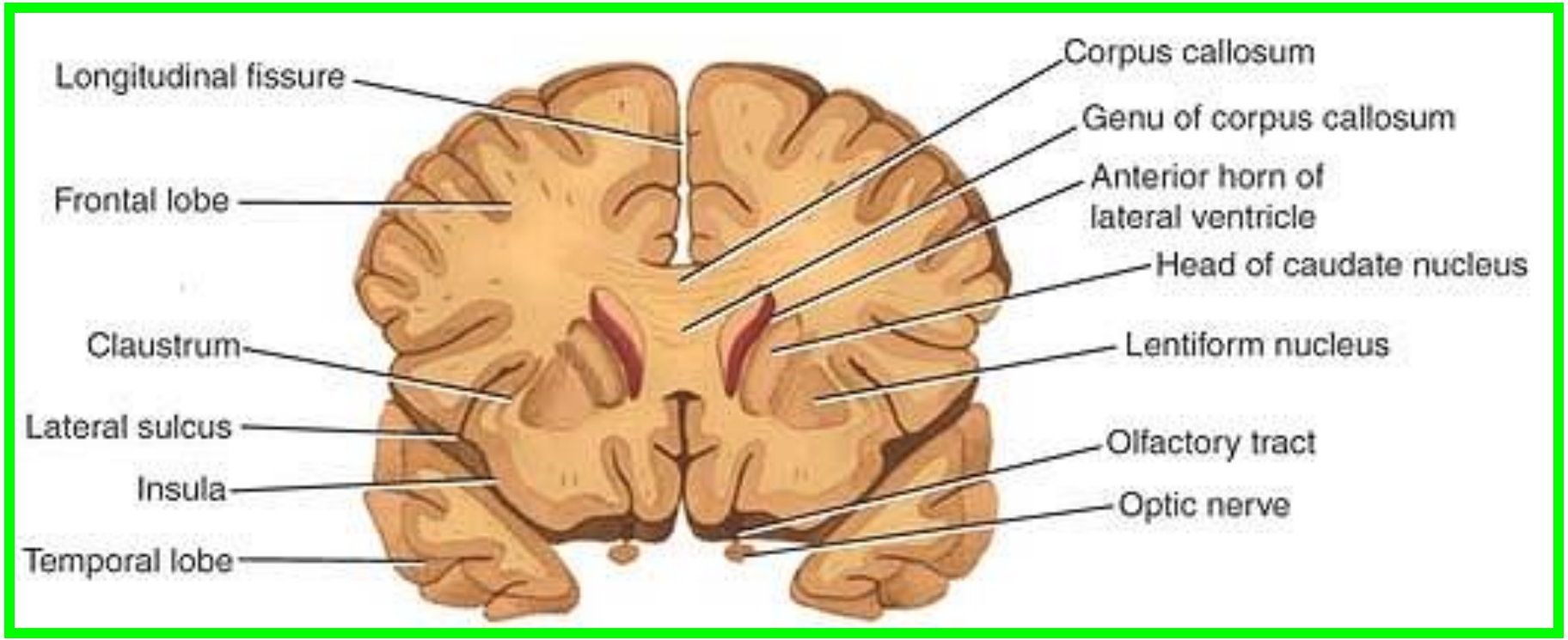
1- Anterior wall: posterior surface of the genu of corpus callosum.

2- Roof; anterior part of trunk of corpus callosum.

3- Floor; rostrum of corpus callosum.

4- Lateral wall: sloping and is formed by the head of caudate nucleus.

5- Medial wall; the septum pellucidum.



Dr. Aiman Qais Afar
Thursday 21 December 2023

Lateral Ventricles

Boundaries of the lateral ventricle

Dr. Aiman Qais Afar
Thursday 21 December 2023

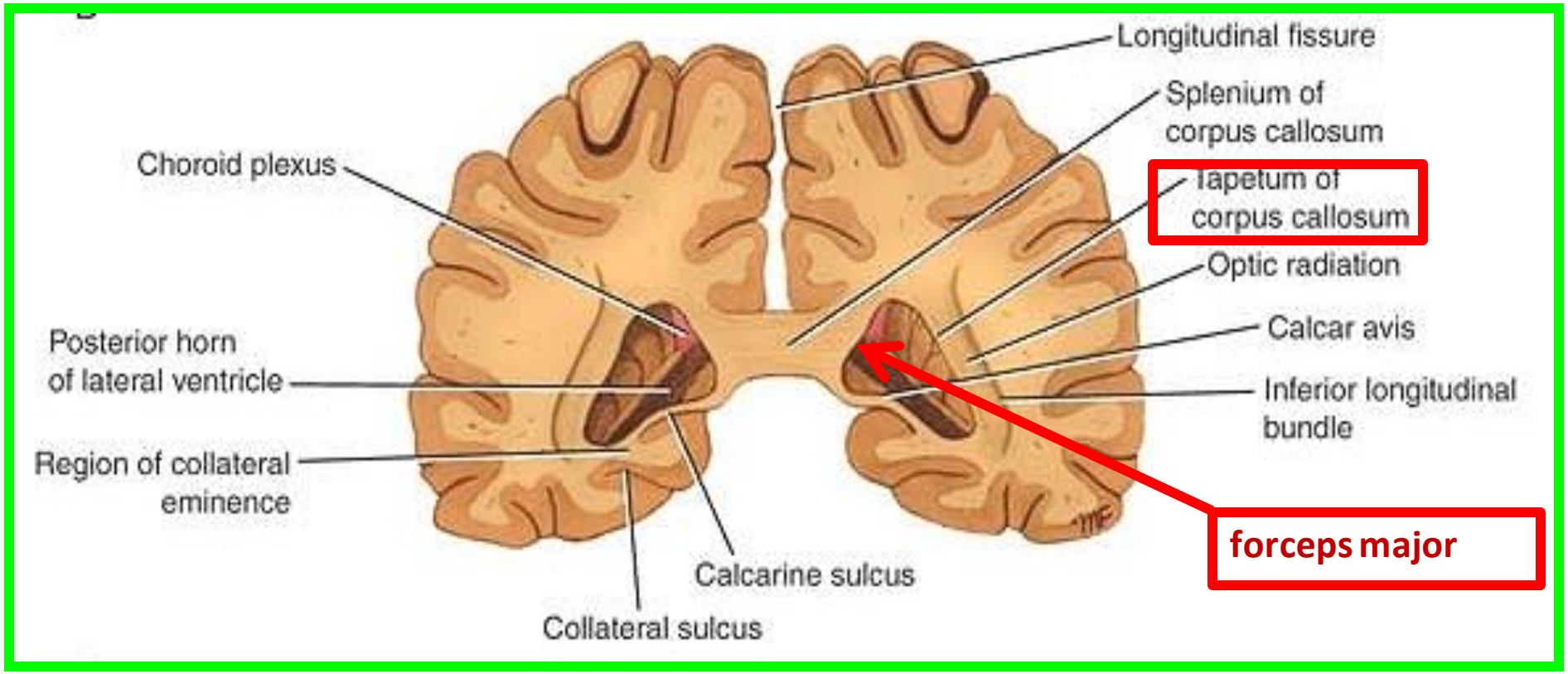
❑3- Posterior Horn

1- Roof, and lateral wall; tapetum of corpus callosum.

2- Infero-Medial wall; shows 2 elevations;

a- Upper elevation (bulb of posterior horn); is formed by the forceps major.

b- Lower elevation (calcar avis); produced by the calcarine sulcus.



Lateral Ventricles

Boundaries of the lateral ventricle

Dr. Aiman Qais Afar

❑4- Inferior Horn

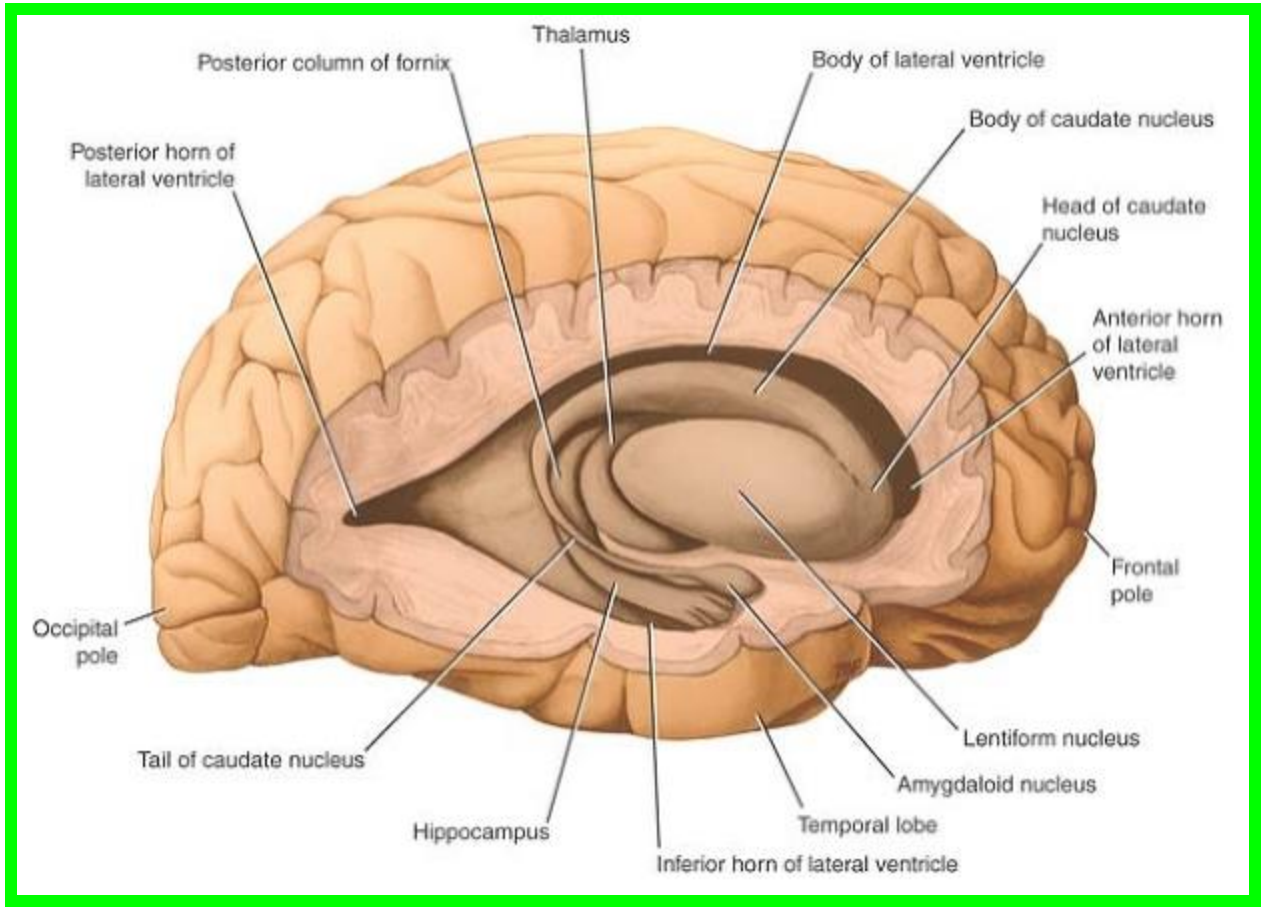
1- Roof,

1) Tail of caudate nucleus.

2) the tapetum of the corpus callosum

3) Amygdaloid body.

4) Stria terminalis.



Lateral Ventricles

Boundaries of the lateral ventricle

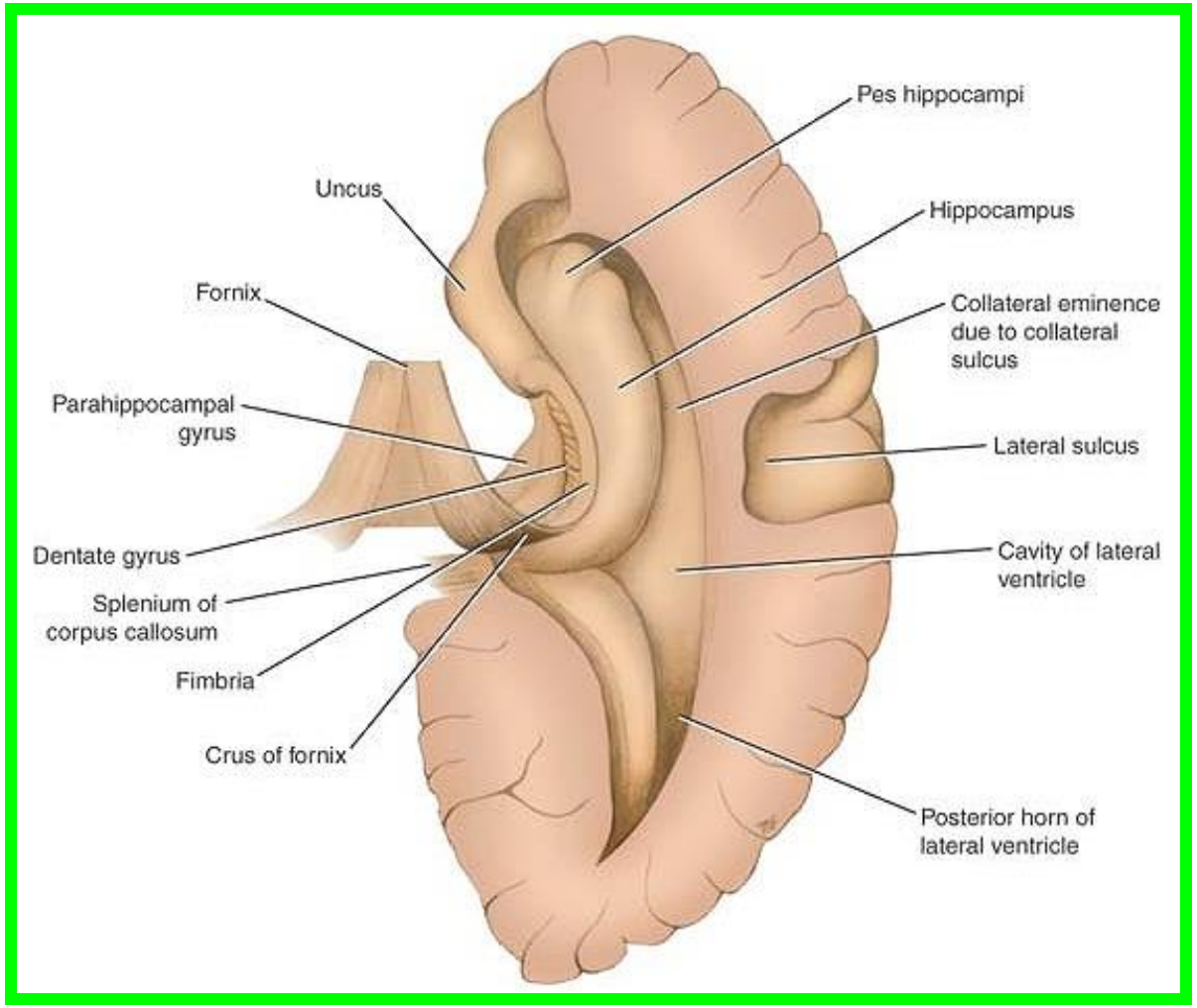
2- Floor; formed of the following structures from lateral to medial;

a- collateral eminence produced by the collateral sulcus.

b- Hippocampus

c- Fimbria of the hippocampus.

- There is a choroid fissure between the fimbria and stria terminalis through which the choroid plexus of the lateral ventricle invaginates the ependyma

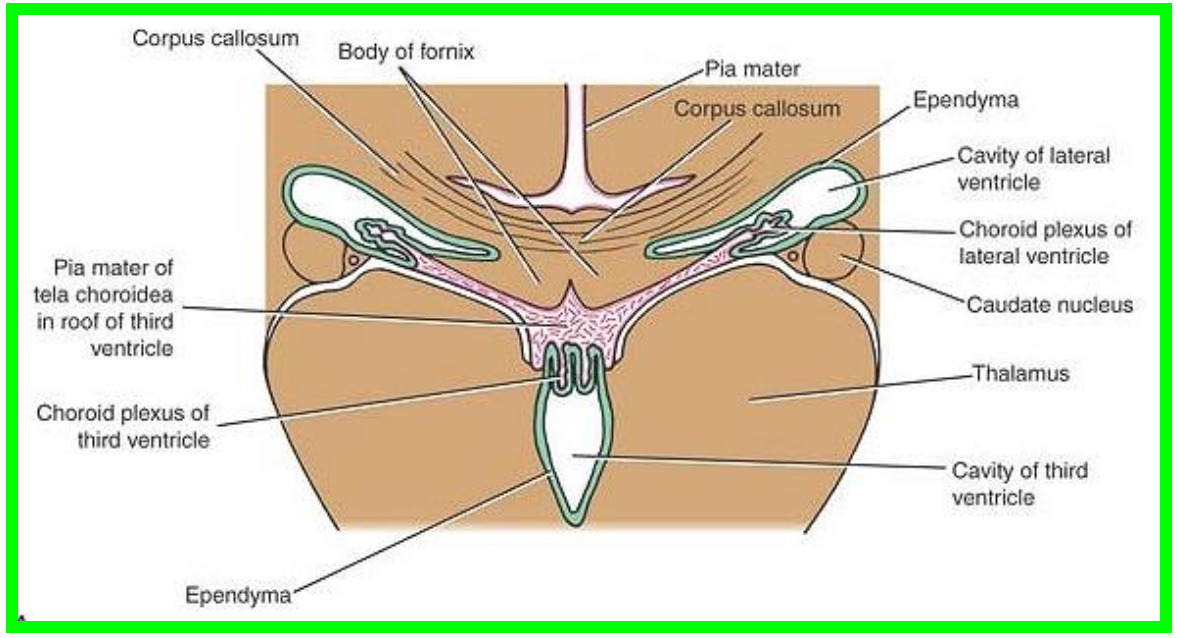


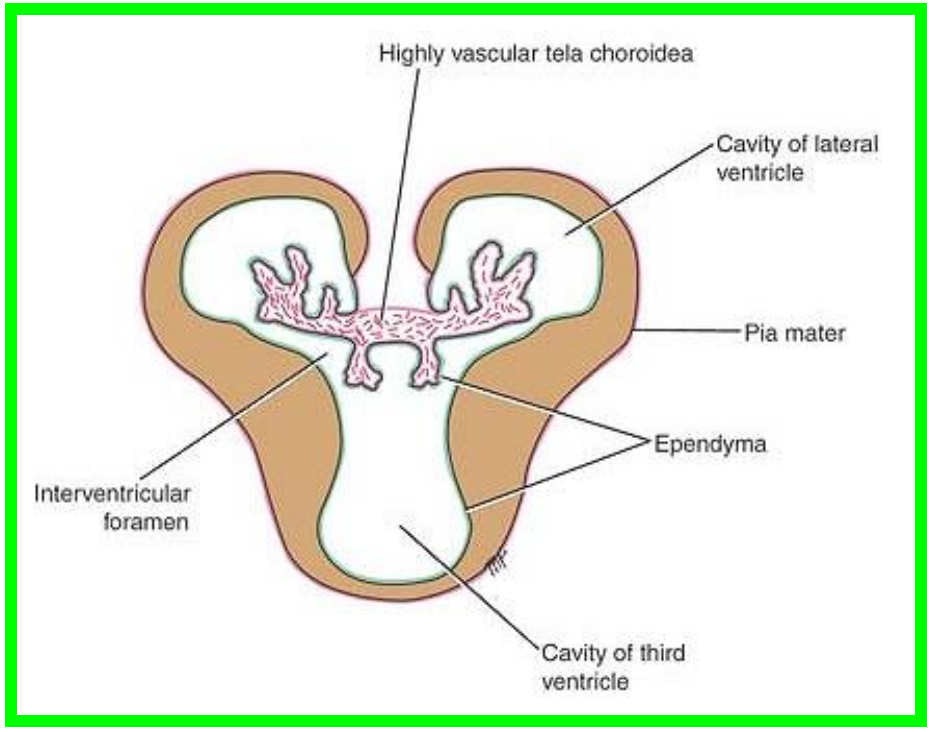
Choroid Plexus of the Lateral Ventricle

Dr. Aiman Qais Afar
Thursday 21 December 2023

❖*The choroid plexus projects into the ventricle on its medial aspect and is a vascular fringe composed of pia mater covered with the ependymal lining of the ventricular cavity*

❖*The choroid plexus is, in fact, the irregular lateral edge of the tela choroidea, which is a two-layered fold of pia mater situated between the fornix superiorly and the upper surface of the thalamus*

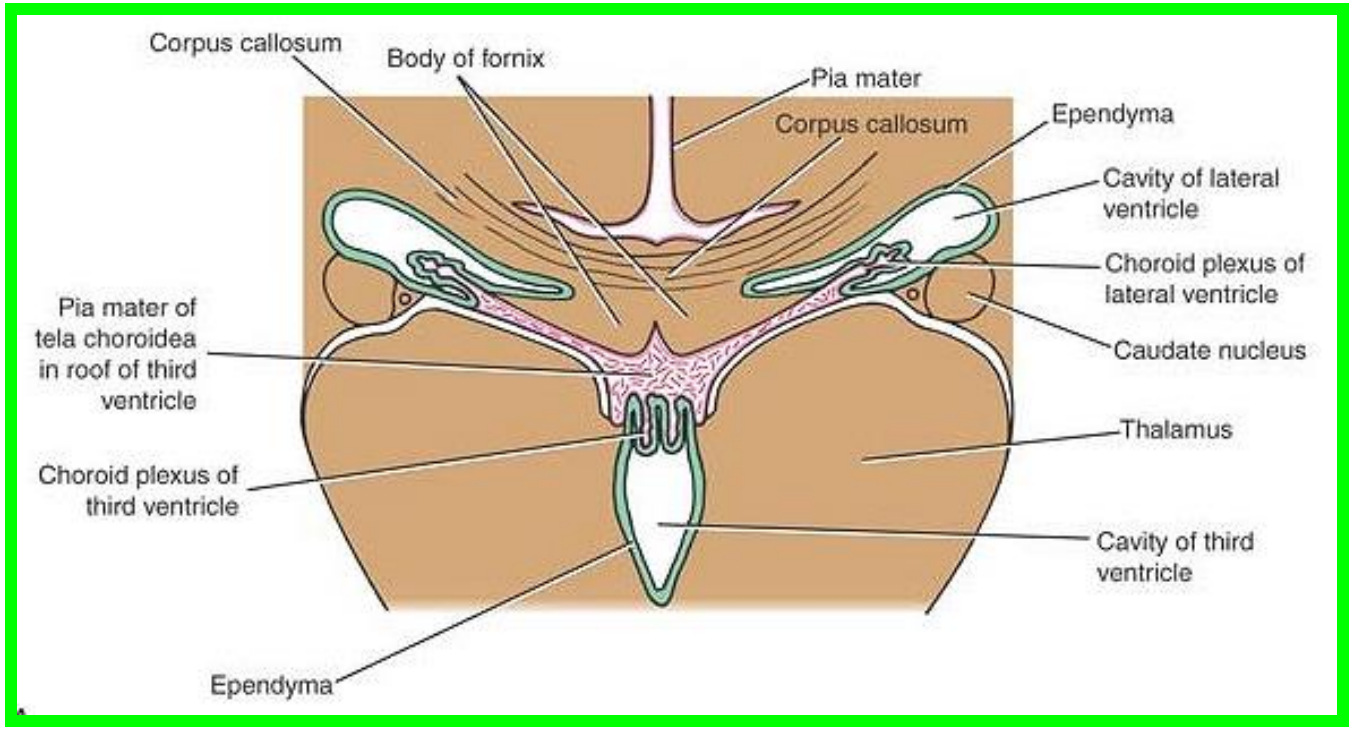


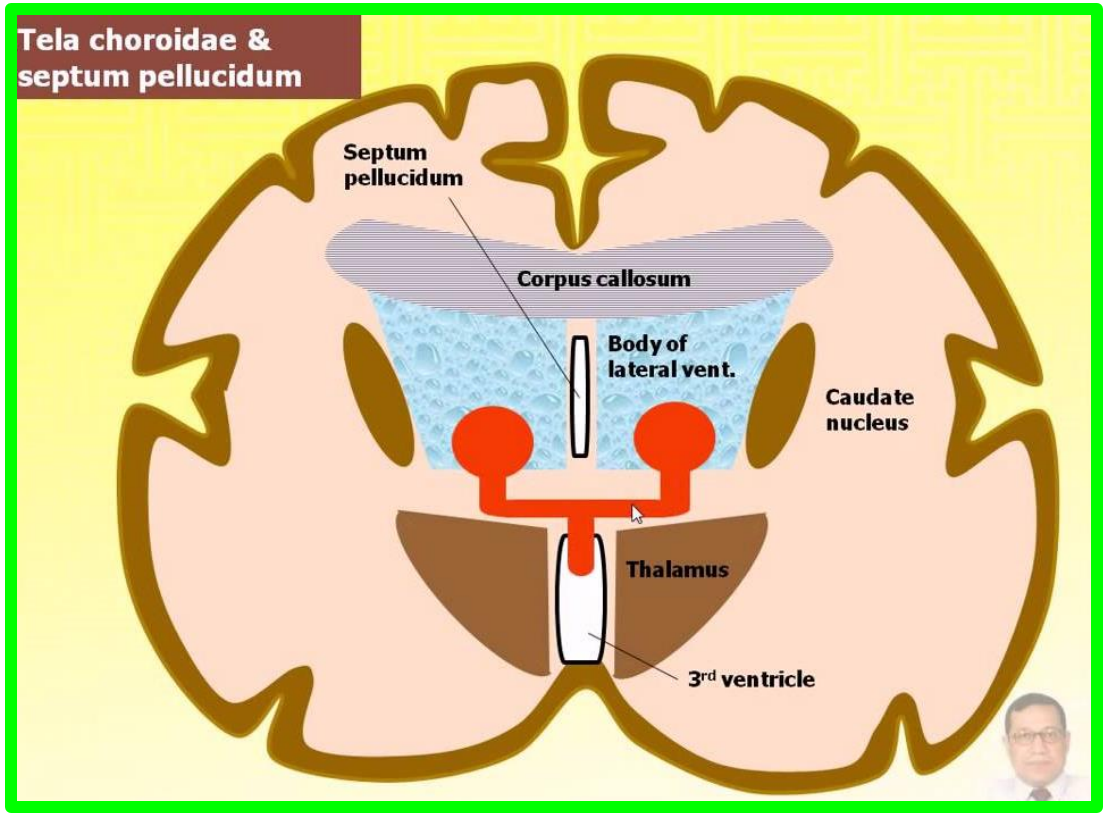


Choroid Plexus of the Lateral Ventricle

❖*At the junction of the body of the lateral ventricle and the inferior horn, the choroid plexus is continued into the inferior horn and projects through the choroidal fissure.*

❖ *The function of the choroid plexus is to produce cerebrospinal fluid.*

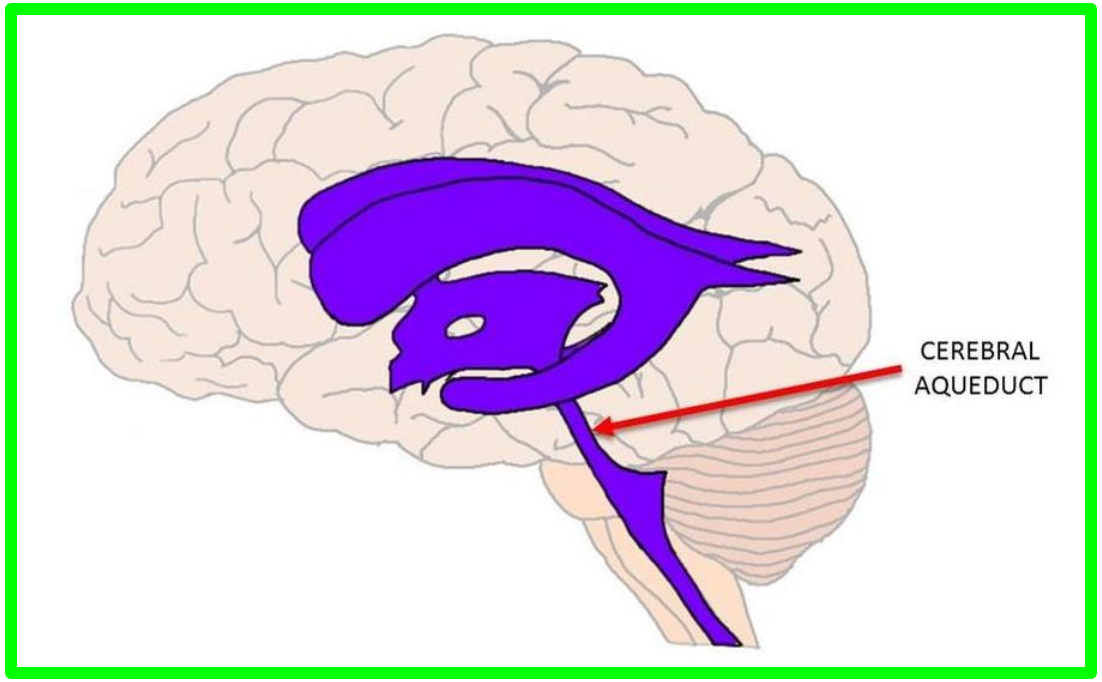


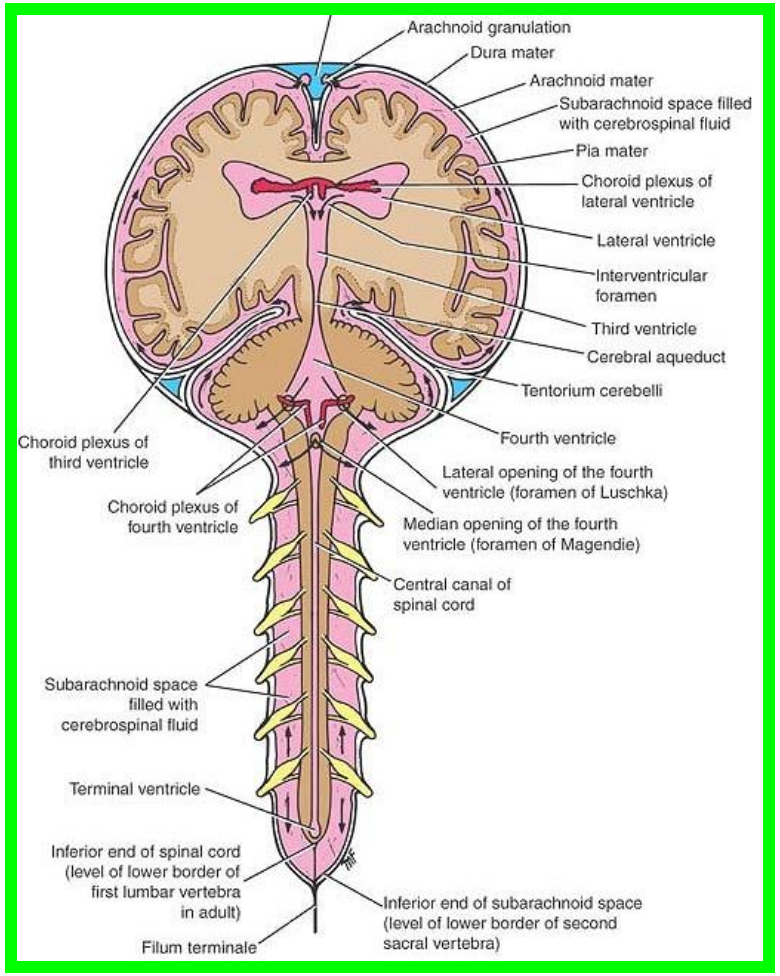


Cerebral Aqueduct

❖*The cerebral aqueduct (aqueduct of Sylvius), a narrow channel about ¾ of an inch (1.8 cm) long, connects the third ventricle with the fourth ventricle*

❖*It is lined with ependyma and is surrounded by a layer of gray matter called the central gray.*





❖*The direction of flow of cerebrospinal fluid is from the third to the fourth ventricle.*

❖*There is no choroid plexus in the cerebral aqueduct.*

Central Canal of the Spinal Cord and Medulla Oblongata

Dr. Aiman Qais Afar

❖*The central canal opens superiorly into the fourth ventricle.*

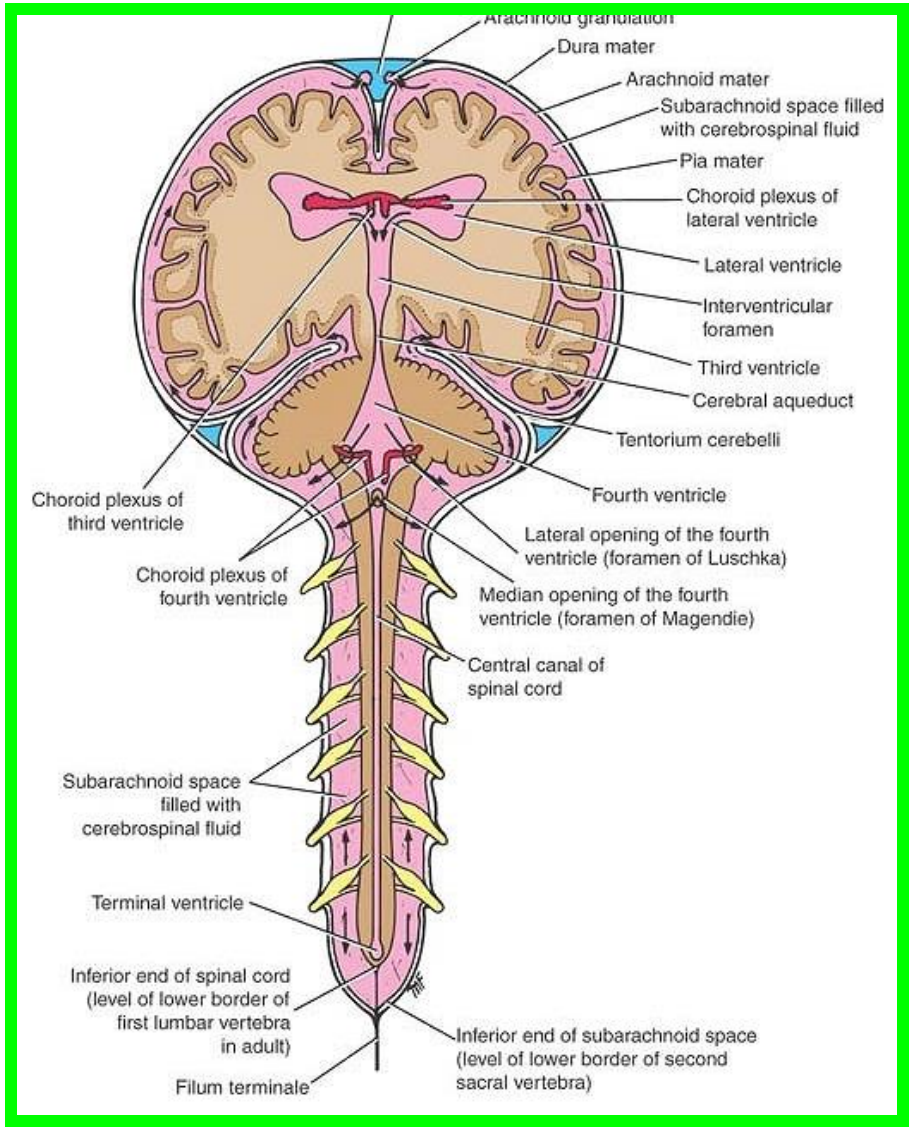
❖ *Inferiorly, it extends through the inferior half of the medulla oblongata and through the entire length of the spinal cord.*

❖*In the conus medullaris of the spinal cord, it expands to form the terminal ventricle*

❖ *The central canal is closed at its lower end, is filled with cerebrospinal fluid, and is lined with ependyma.*

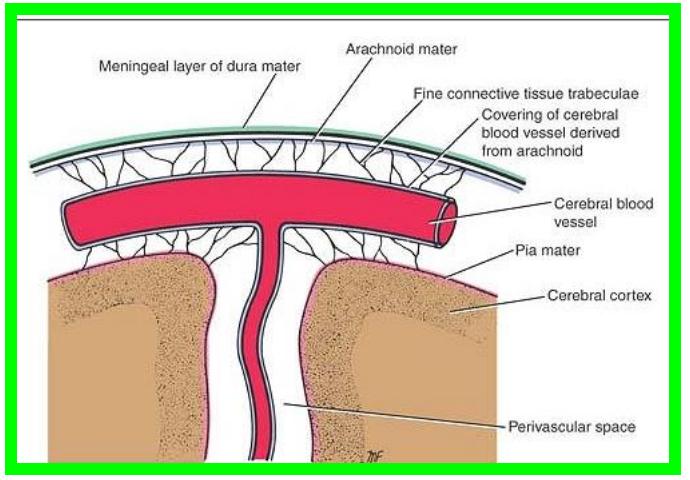
❖*The central canal is surrounded by gray matter, the gray commissure.*

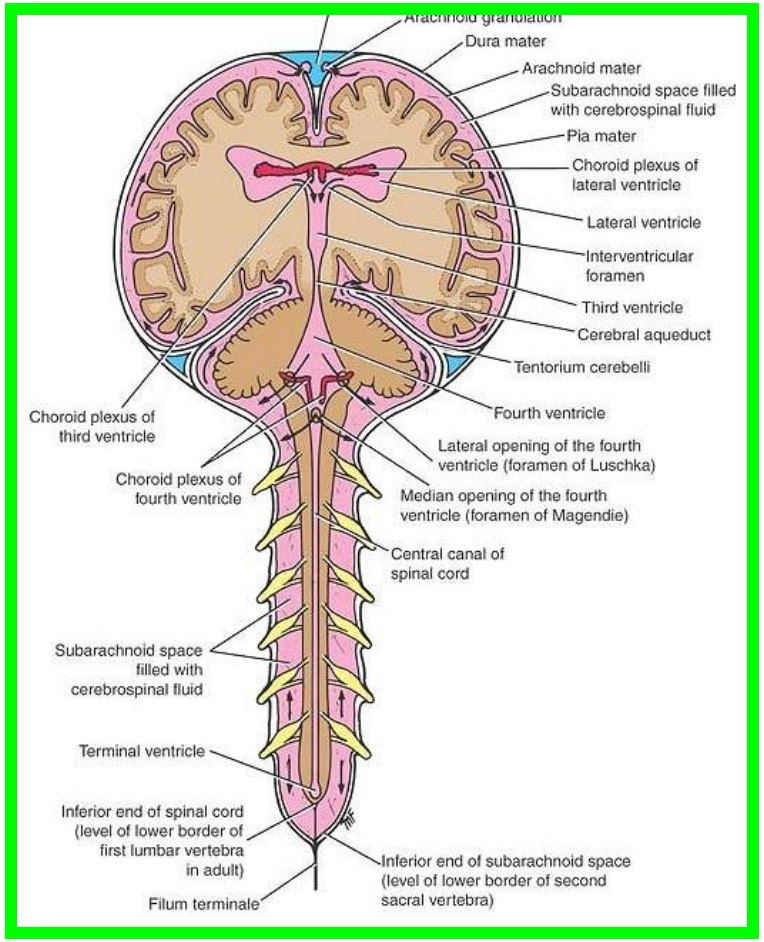
❖*There is no choroid plexus in the central canal*



Subarachnoid Space

- It is the interval between the arachnoid mater and pia mater
- The space is filled with cerebrospinal fluid and contains the large blood vessels of the brain
- The subarachnoid space also extends along the cerebral blood vessels as they enter and leave the substance of the brain and stops where the vessels become an arteriole or a venule.



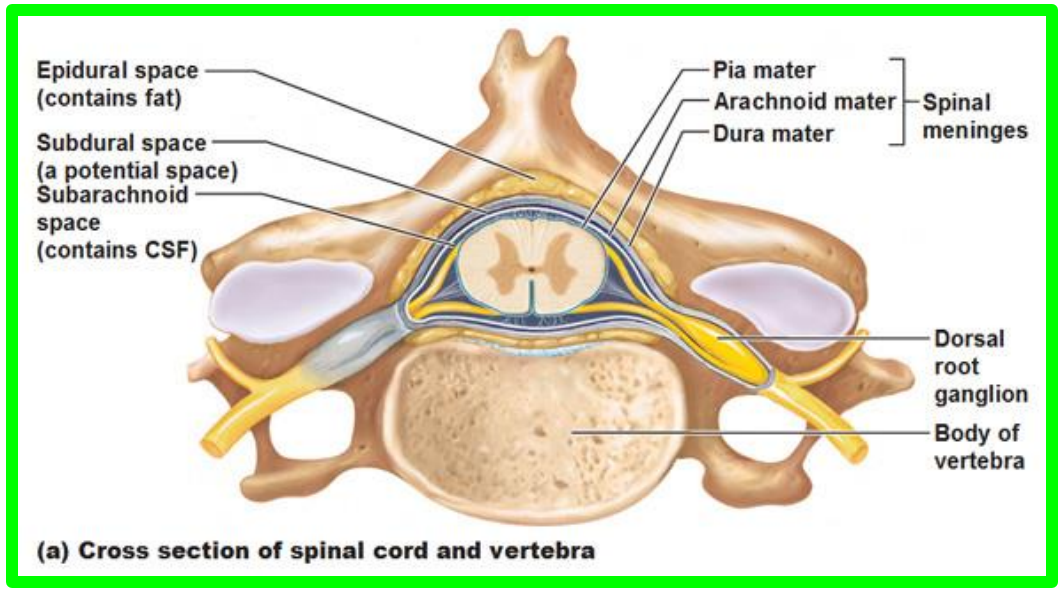


- This space is traversed by a network of fine trabeculae, formed of delicate connective tissue

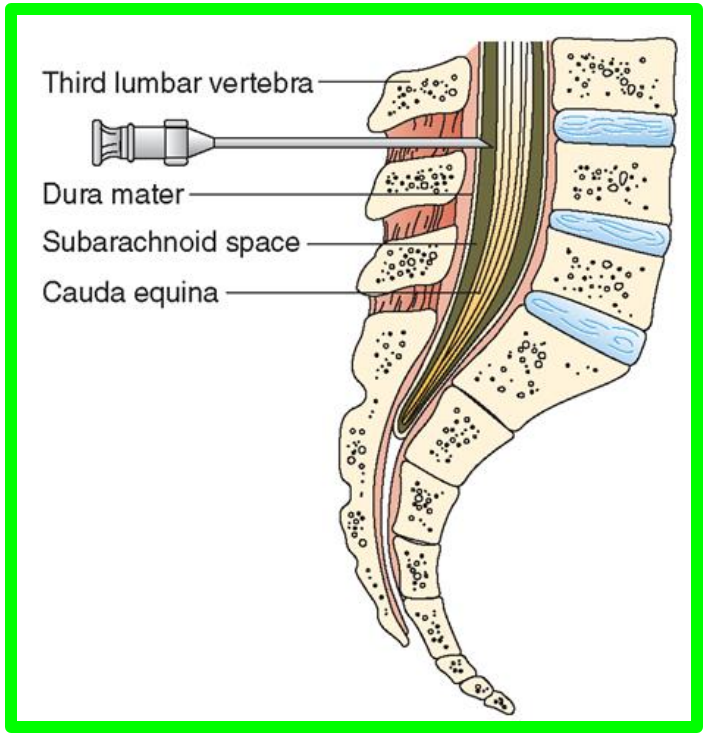
Subarachnoid Space

❖*Inferiorly, the subarachnoid space extends beyond the lower end of the spinal cord and invests the cauda equina*

❖*The subarachnoid space ends below at the level of the interval between the second and third sacral vertebrae.*



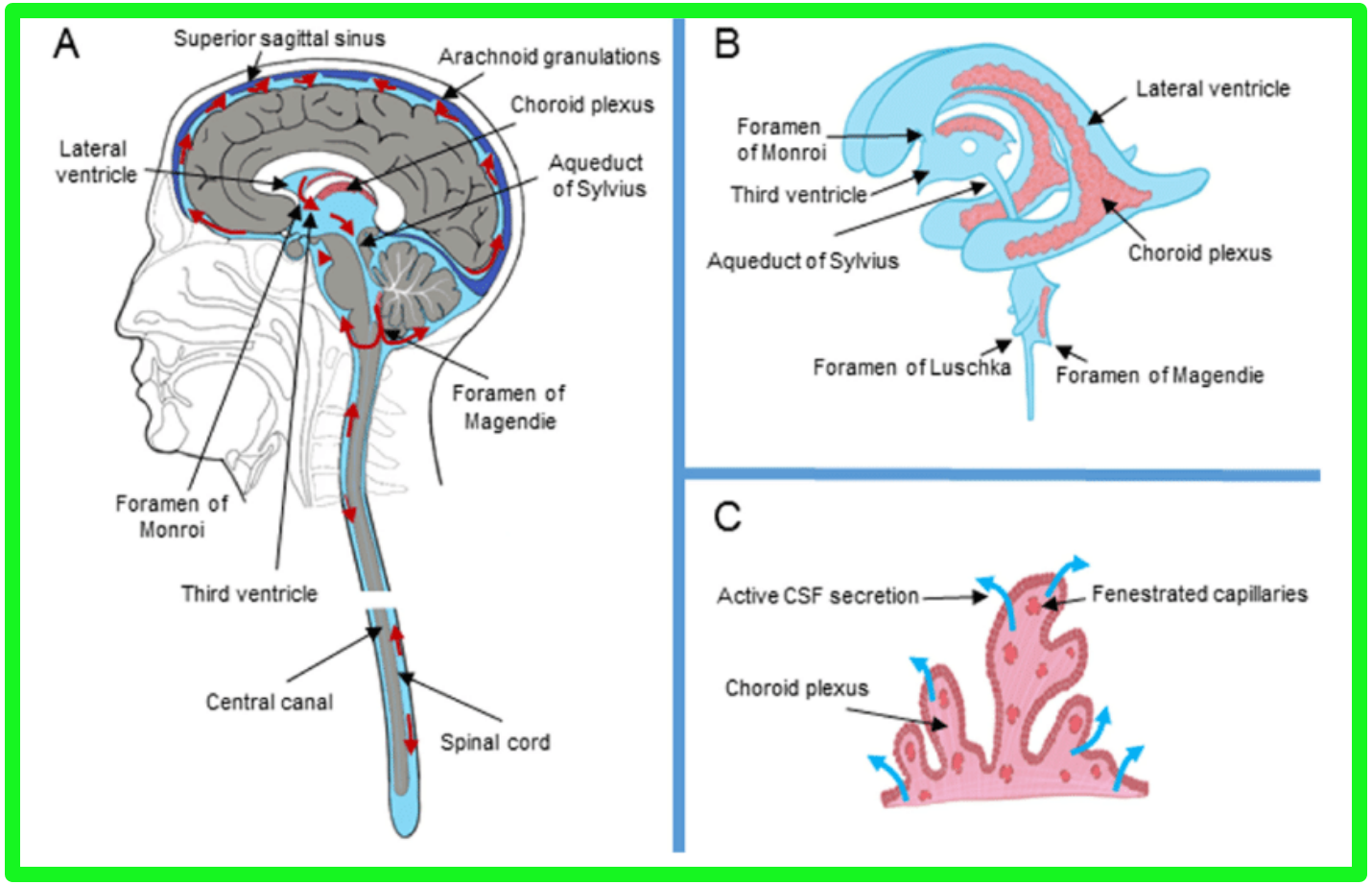
(a) Cross section of spinal cord and vertebra



❖*The subarachnoid space surrounds the cranial and spinal nerves and follows them to the point where they leave the skull and vertebral canal. Here, the arachnoid mater and pia mater fuse with the perineurium of each nerve.*

CEREBROSPINAL FLUID

- *The CSF is found in the ventricles of the brain and in the subarachnoid space around the brain and spinal cord.*
- *It has a volume of about 150 mL.*
- *It is a clear, colorless fluid and possesses, in solution, inorganic salts similar to those in the blood plasma*

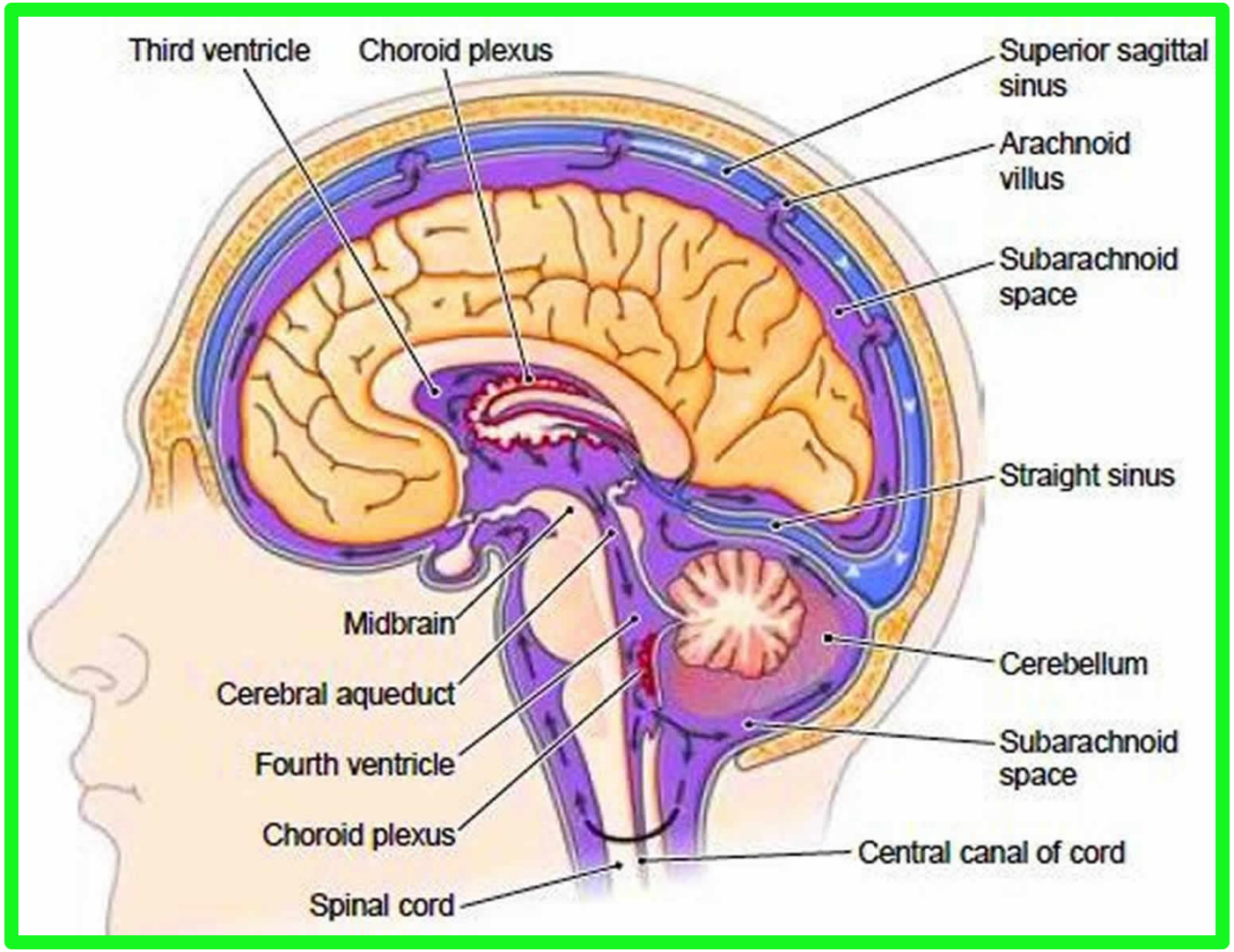


1- Formation

1- Secretion of the choroid plexuses into the ventricles (lateral, 3rd and 4th).

2- Filtration from the capillary bed of the brain.

3- Metabolic water production



1- Formation

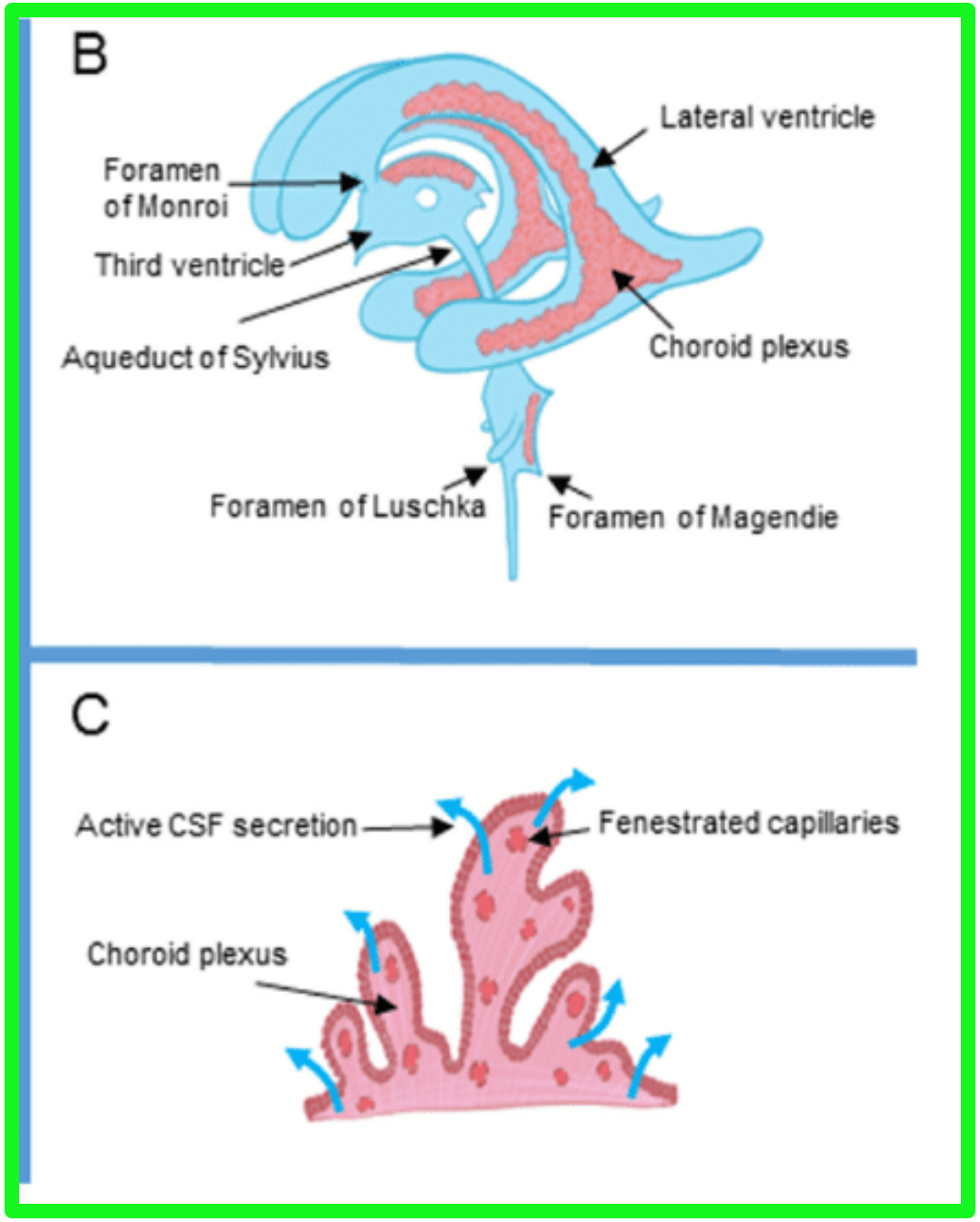
- *Choroid plexus of the lateral ventricle*

a) Inferior horn by branch from the internal carotid artery.

b) Central part by branch from posterior cerebral artery.

- *Choroid plexus of the 3rd ventricle by branch from posterior cerebral artery.*

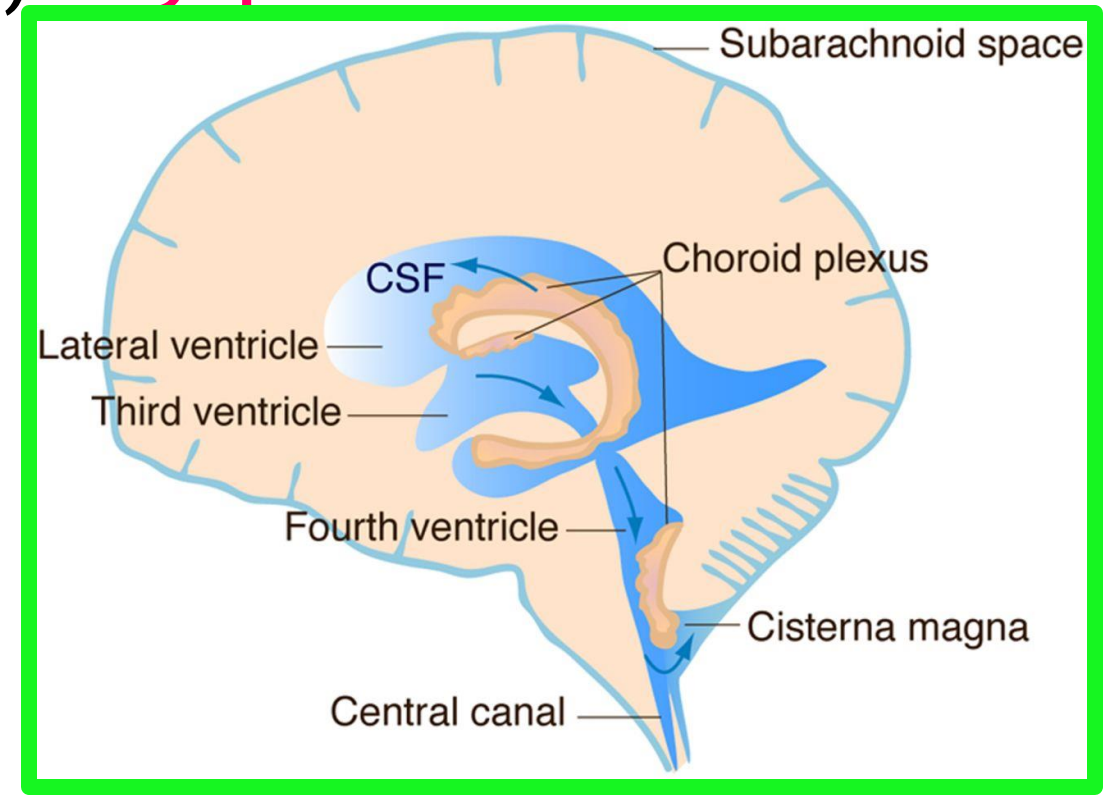
- *Choroid plexus of the 4th ventricle by branches from the posterior inferior cerebellar artery.*



2- Circulation

It circulates in the ventricles and central canals of the C.N.S;

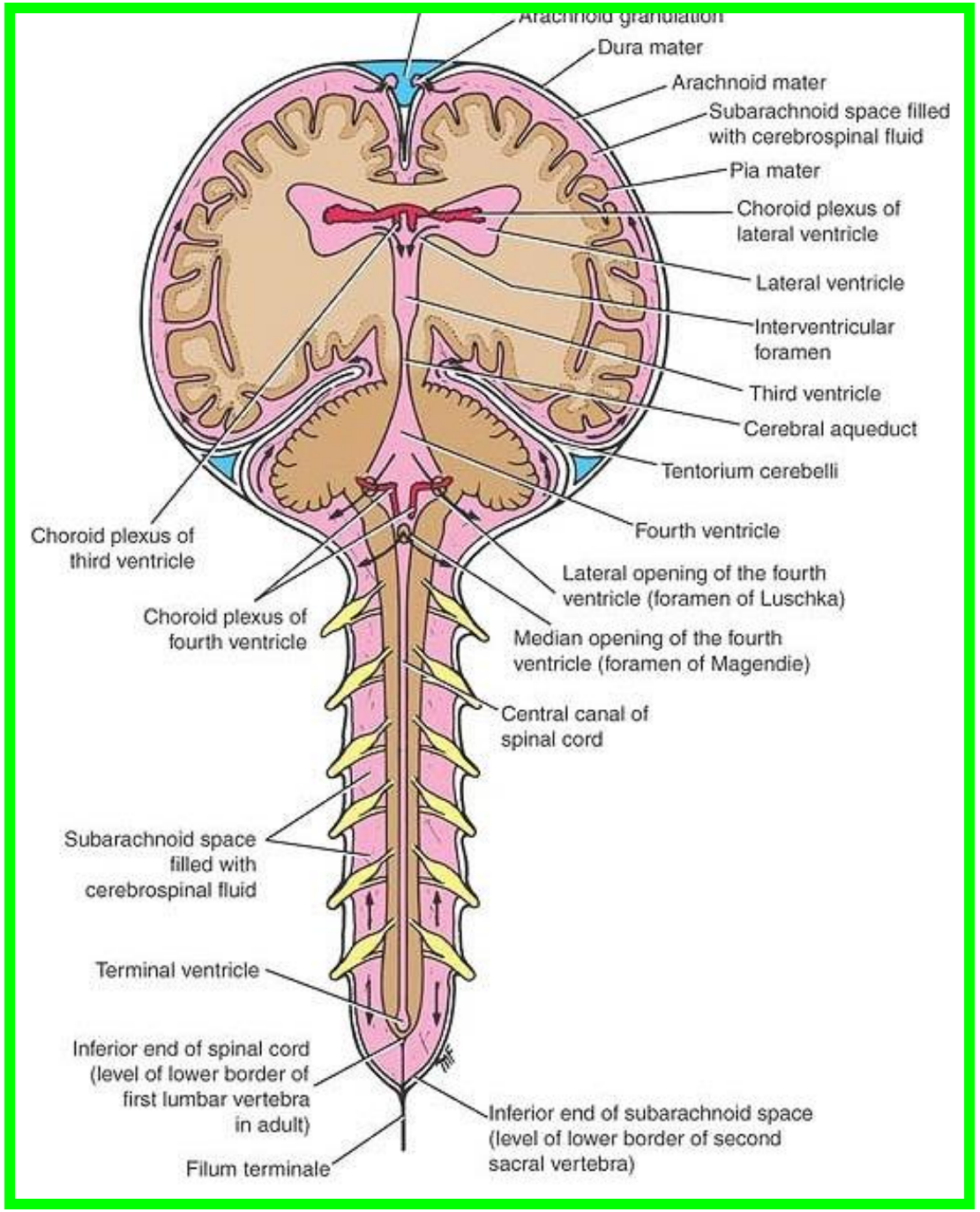
- **C.S.F. is filtrated by the choroid plexus of the lateral ventricles on each side → interventricular foramina → 3rd ventricle (more C.S.F. is added by the choroid plexuses) →cerebral aqueduct → 4th ventricle (more C.S.F. is added by the choroid plexuses) → 3 apertures in the roof of the 4th ventricle**



2- Circulation

(2 lateral foramina of Luschka and median foramen of Magendi) → suharachnoid space.

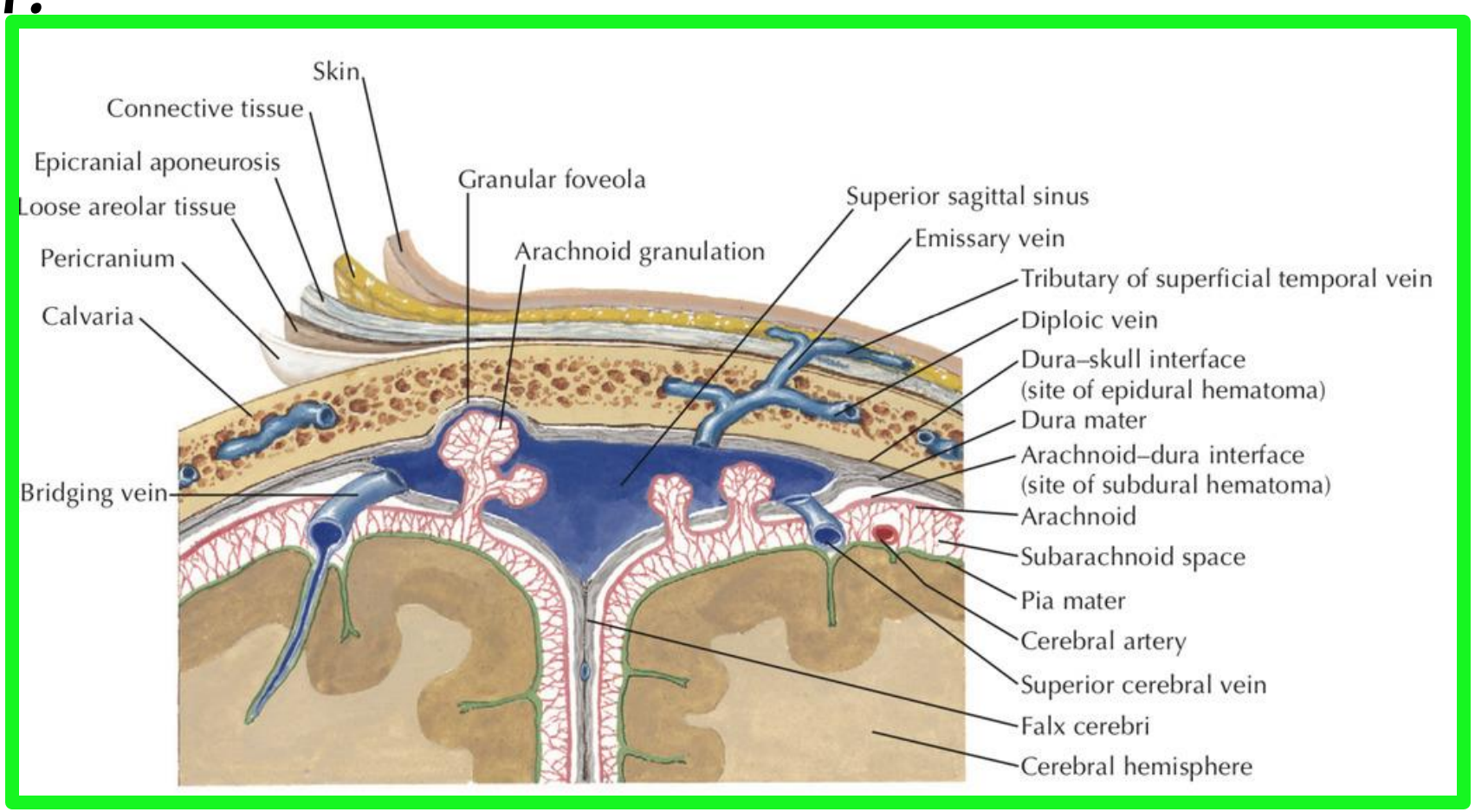
- Some of the C.S.F. passes down through the foramen magnum into the spinal subarachnoid space and central canal.



3- Absorption

- C.S.F. was filtrated by arachnoid villi and granulations into the dural venous sinues.

N.B:- Pulsation of the large arteries present in the subarachoid space, helping the circulation of the C.S.F.



Dr. Aiman Qais Afar

Thursday 21 December 2023

• Characters of the C.S.F.

1- Specific gravity: 1.003 -1.008.

2- Amount: is about 120-150 ml.

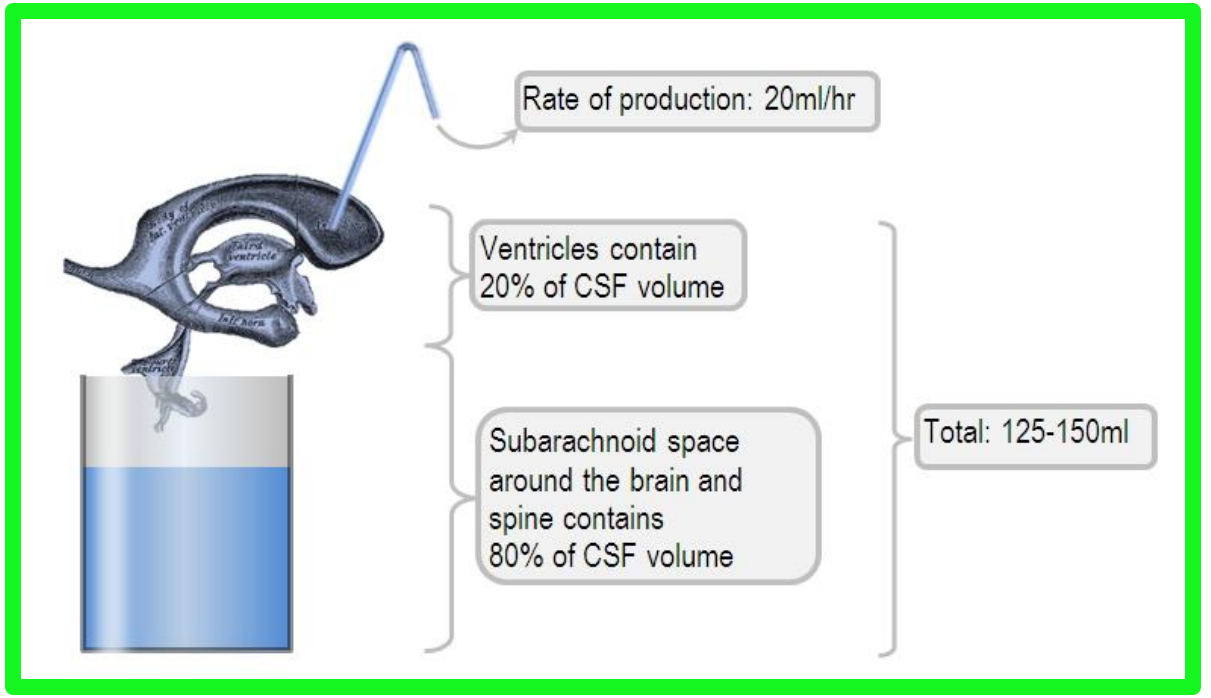
3- Replacement: it is replace 3 times per day.

4- Appearance: clear watery fluid. If it becomes turbid this indicates meningitis.

5- Glucose: its glucose level is 1/2 that of the blood.

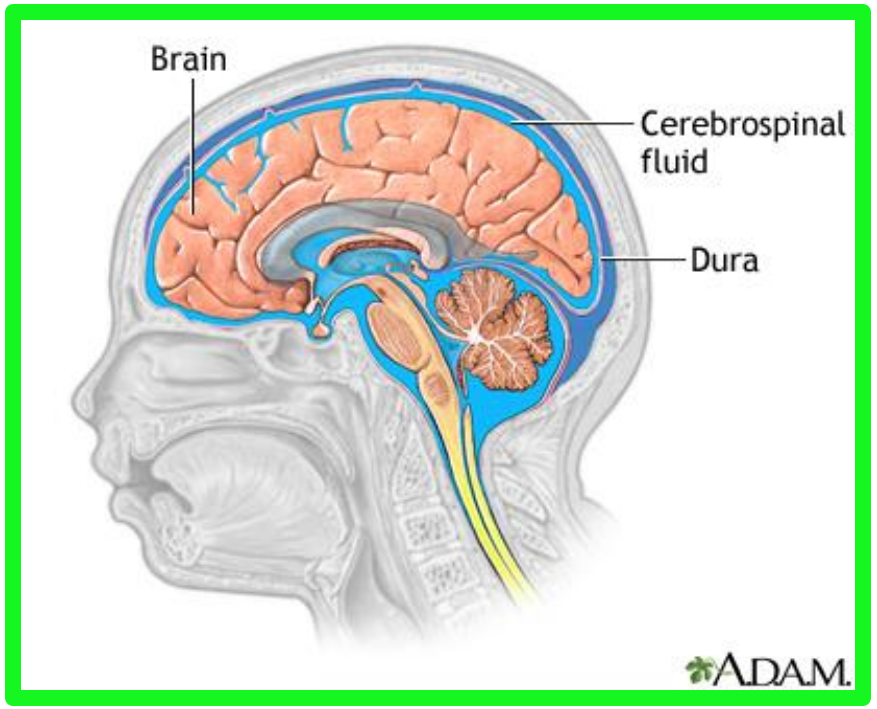
6- Protein: low protein content (20-30 mg/100ml).

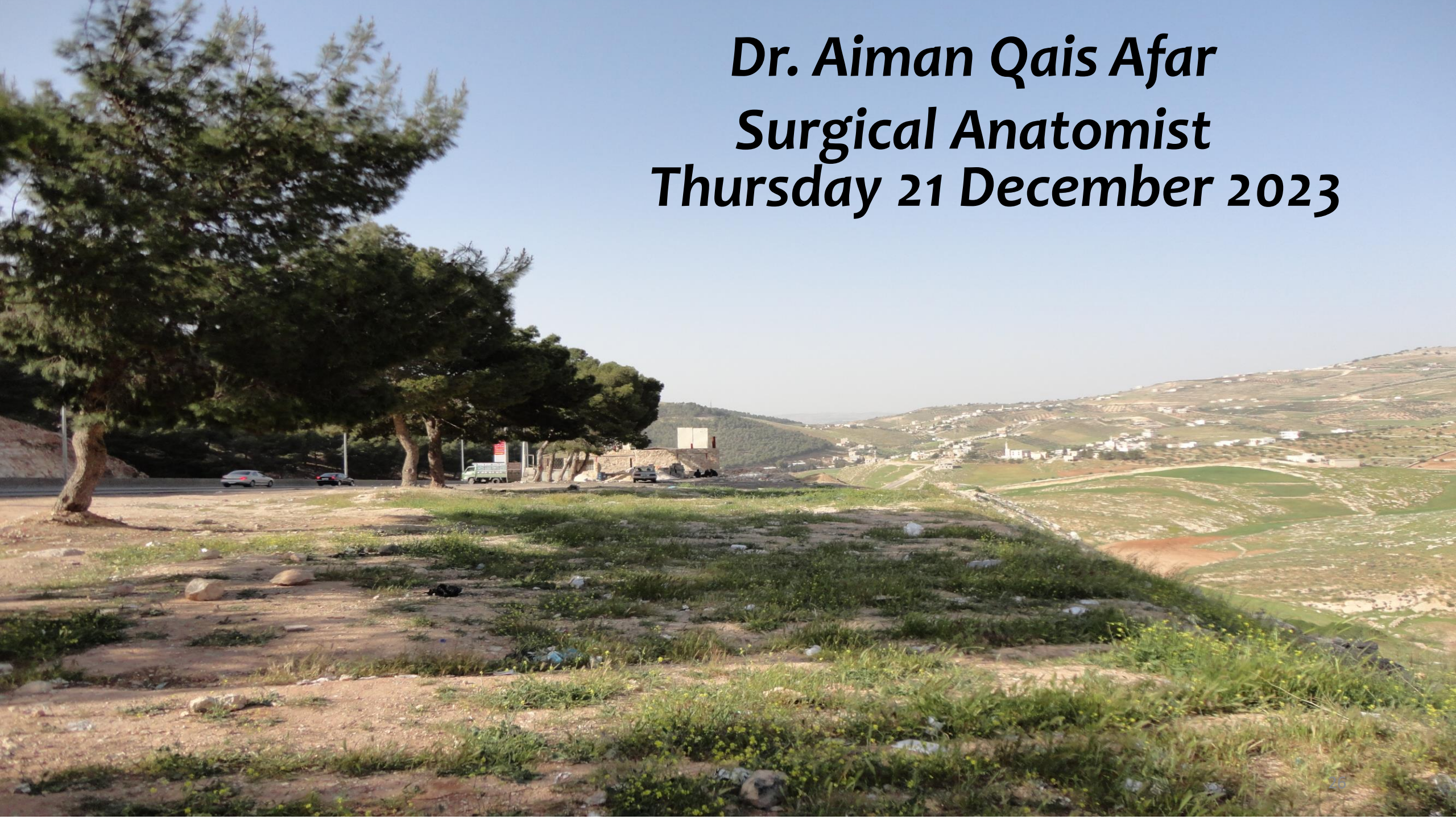
7- Chloride: more chloride content



Functions

1. Cushions and protects the central nervous system from trauma
2. Provides mechanical buoyancy and support for the brain
3. Serves as a reservoir and assists in the regulation of the contents of the skull
4. Nourishes the central nervous system
5. Removes metabolites from the central nervous system
6. Serves as a pathway for pineal secretions to reach the pituitary gland




Dr. Aiman Qais Afar
Surgical Anatomist
Thursday 21 December 2023