

# **CENTRAL NERVOUS SYSTEM**

## **The Meninges of the Brain and Dural Venous Sinuses**

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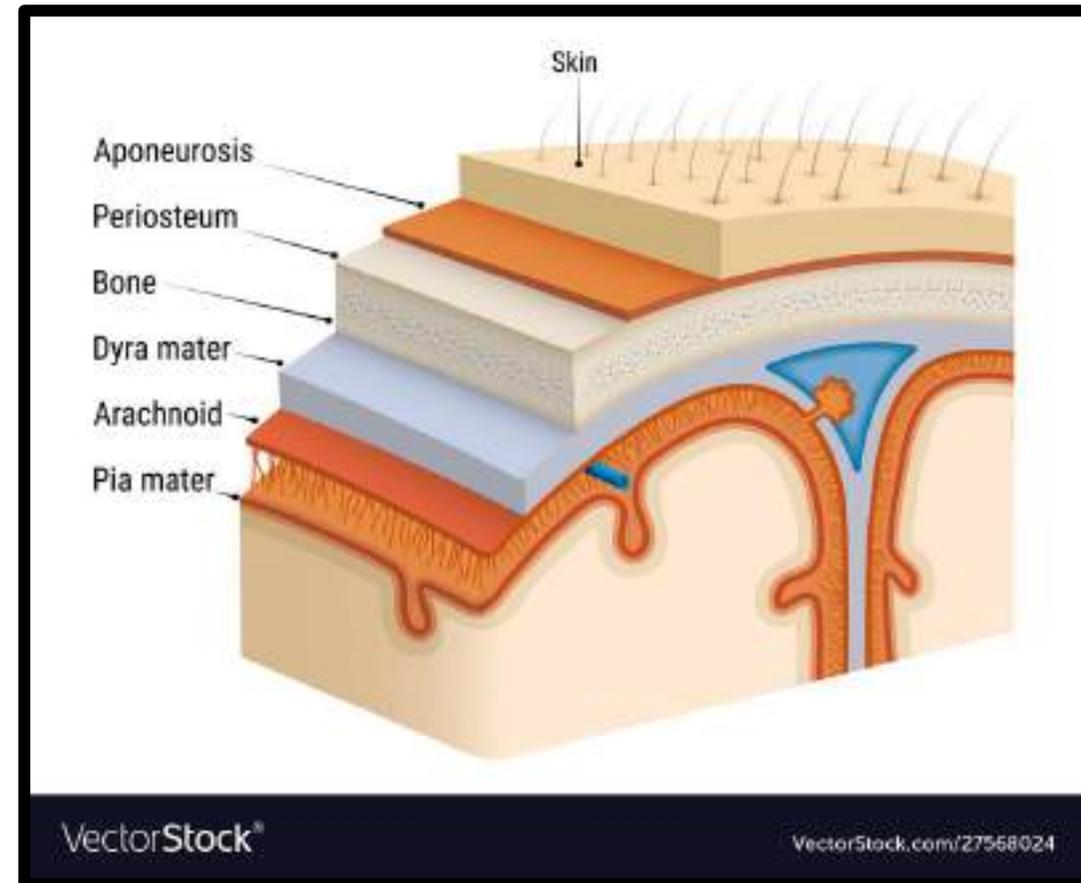
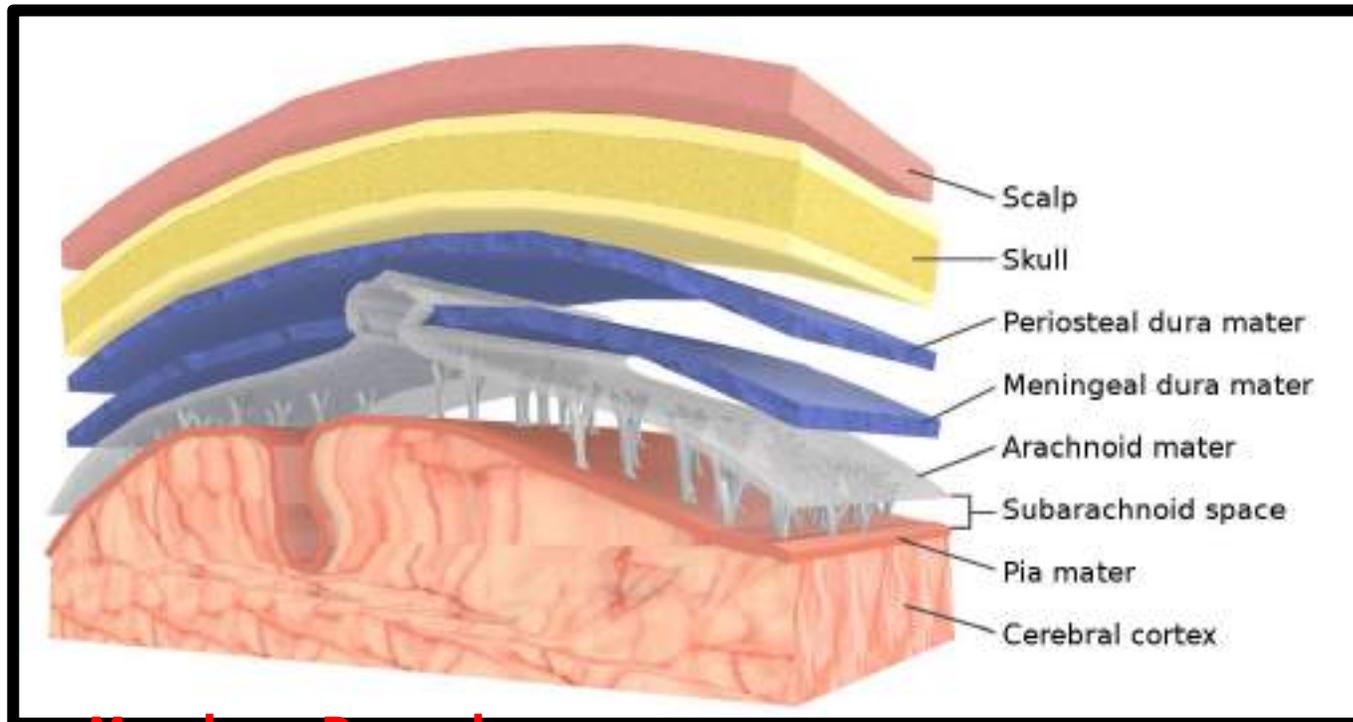
**College of Medicine / University of Mutah**

**Monday 8 December 2025**

# The Meninges of the Brain

The brain in the skull and the spinal cord in the vertebral column are surrounded by three protective membranes, or meninges:

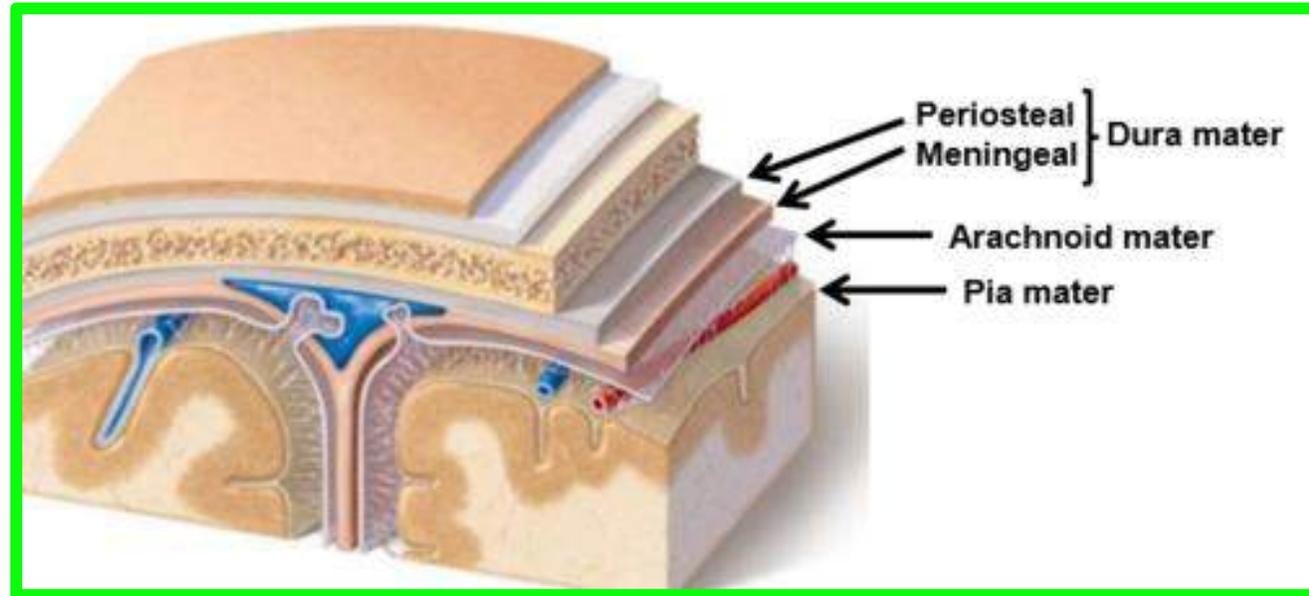
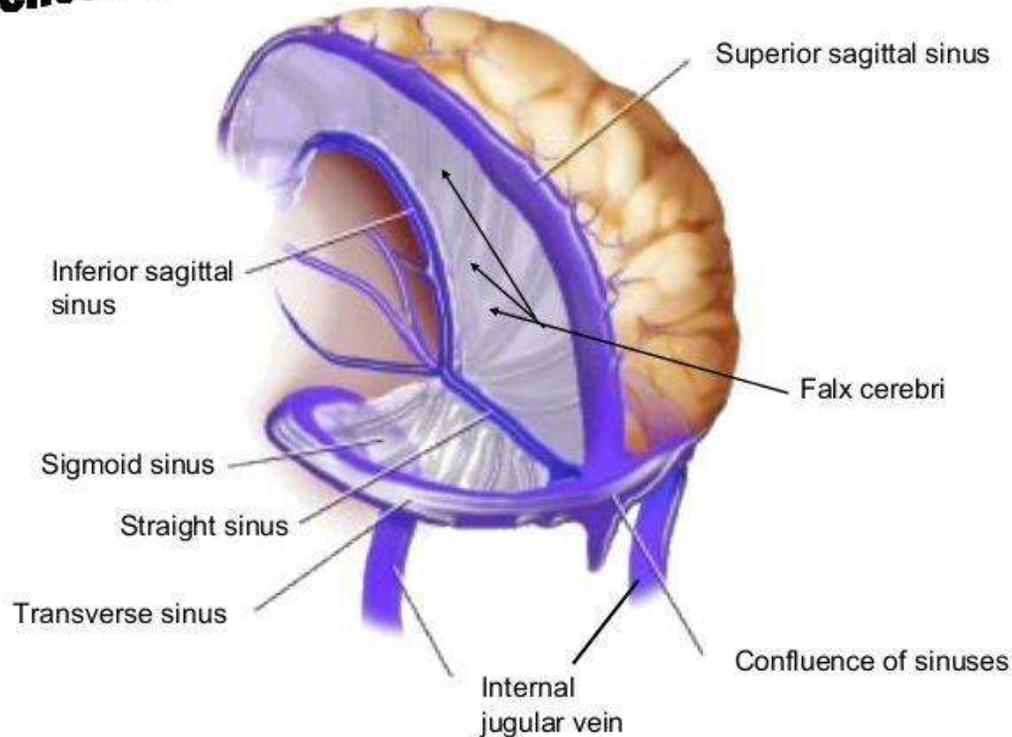
The dura mater, the arachnoid mater, and the pia mater.



# Dura Mater

- ❖ The dura mater of the brain is conventionally described as **two layers**: the **endosteal layer** and the **meningeal layer**
- ❖ These are closely united except along certain lines, where they separate to form **venous sinuses**.

## venous sinuses



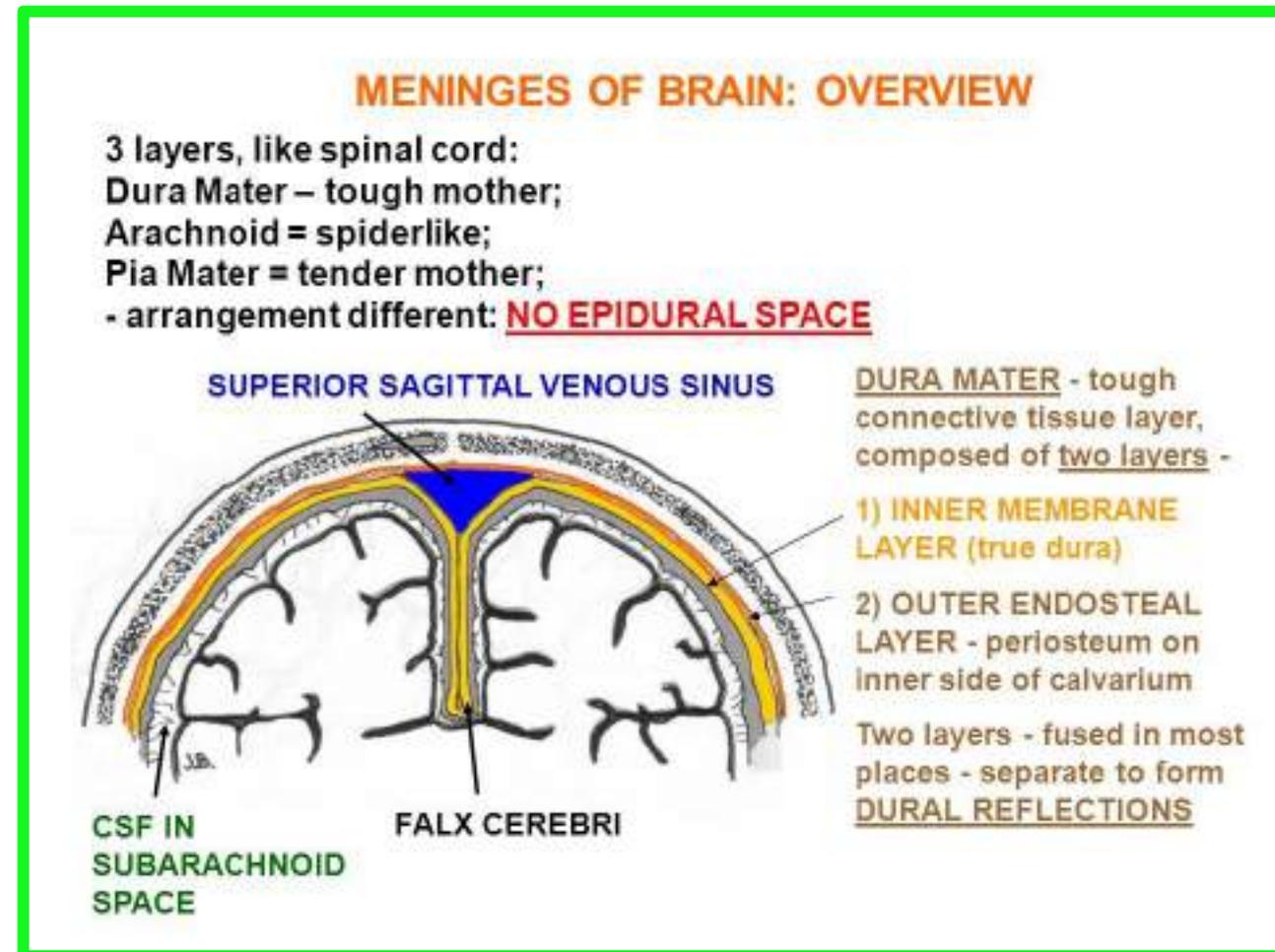
# Dura Mater

□ The **endosteal layer** is nothing more than **the periosteum** covering the inner surface of the skull bones.

❖ At **the foramen magnum**, it does not become continuous with the dura mater of the spinal cord.

❖ Around the **margins of all the foramina in the skull**, it becomes continuous with the periosteum on the outside of the skull bones.

❖ At the sutures, it is continuous with the sutural ligaments



# Dura Mater

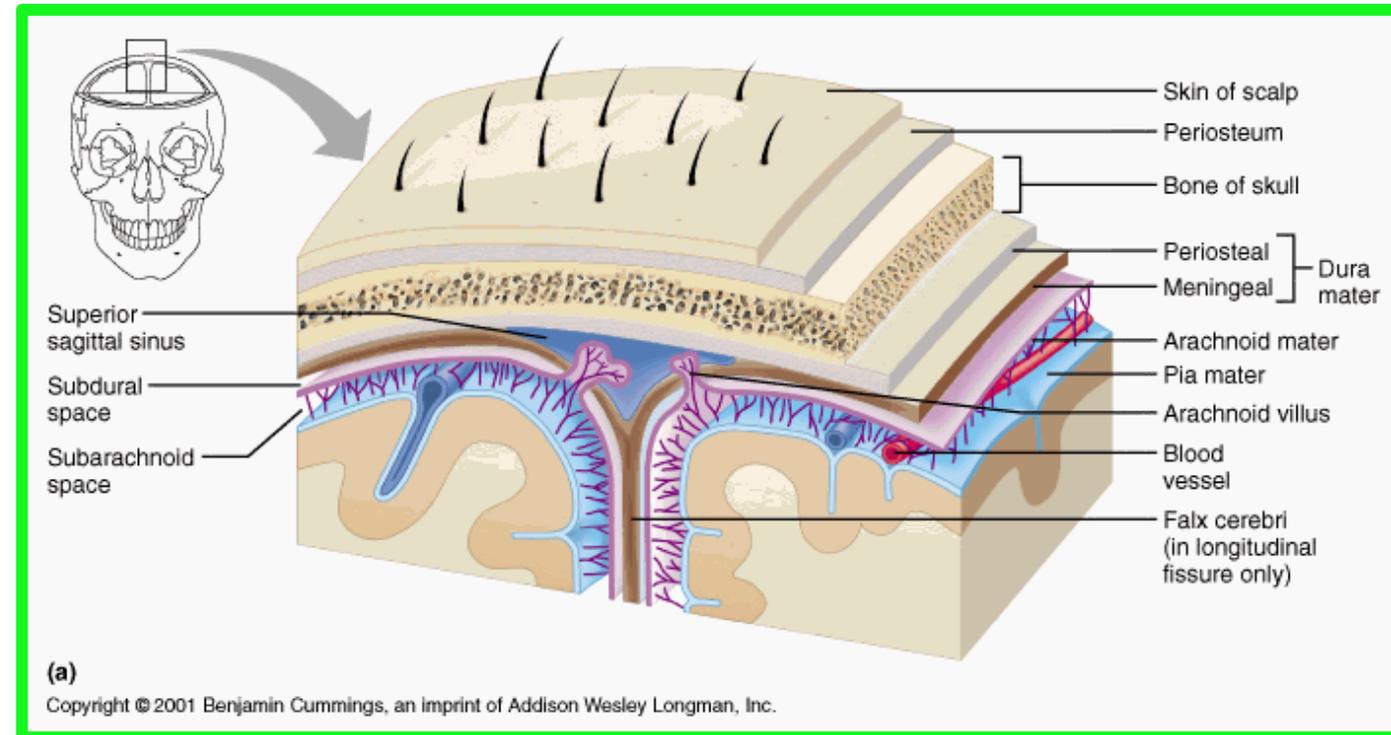
□ The meningeal layer

❖ is the **dura mater proper**. It is a **dense, strong fibrous membrane** covering the brain

❖ is continuous through the foramen magnum with the dura mater of the spinal cord.

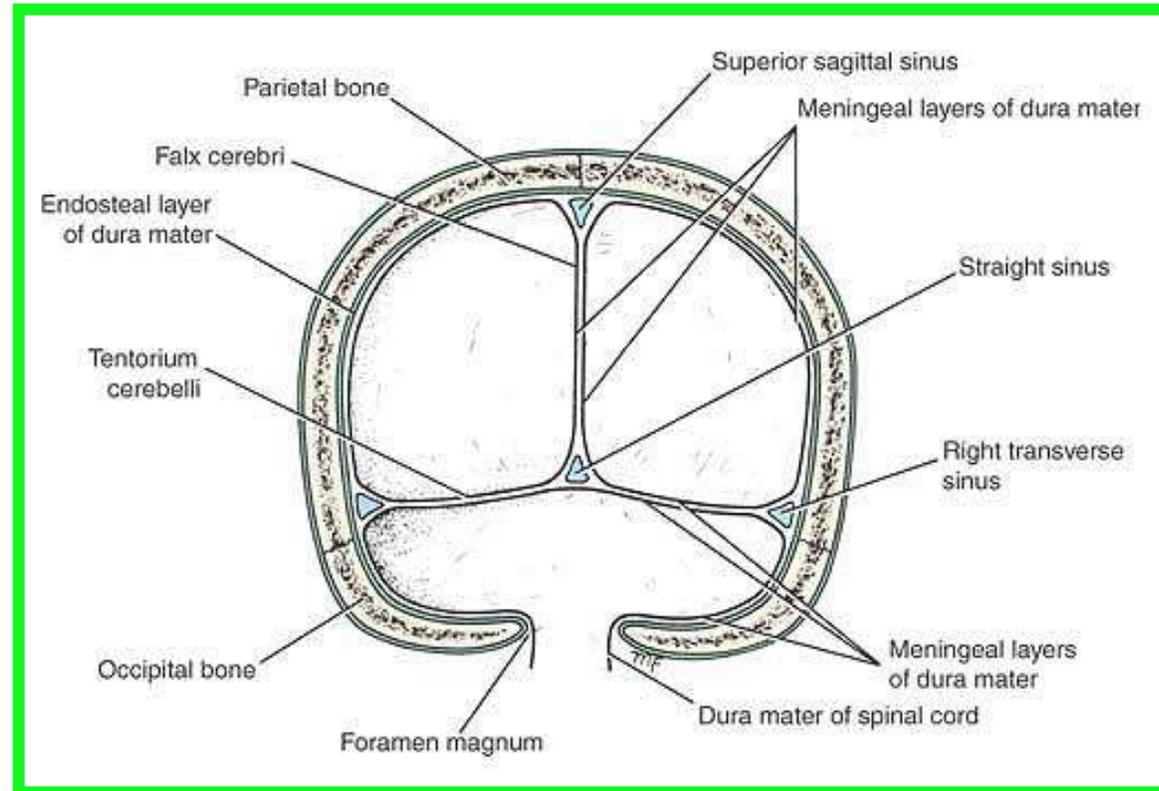
❖ It provides **tubular sheaths for the cranial nerves** as the latter pass through the foramina in the skull.

❖ Outside the skull, the sheaths fuse with the **epineurium of the nerves**



# Dura Mater

- ❖ The meningeal layer sends inward **four septa**, which divide the cranial cavity into freely communicating spaces that lodge the subdivisions of the brain.
- ❖ The function of these **septa is to restrict the displacement of the brain** associated with **acceleration** and **deceleration**, when the head is moved.

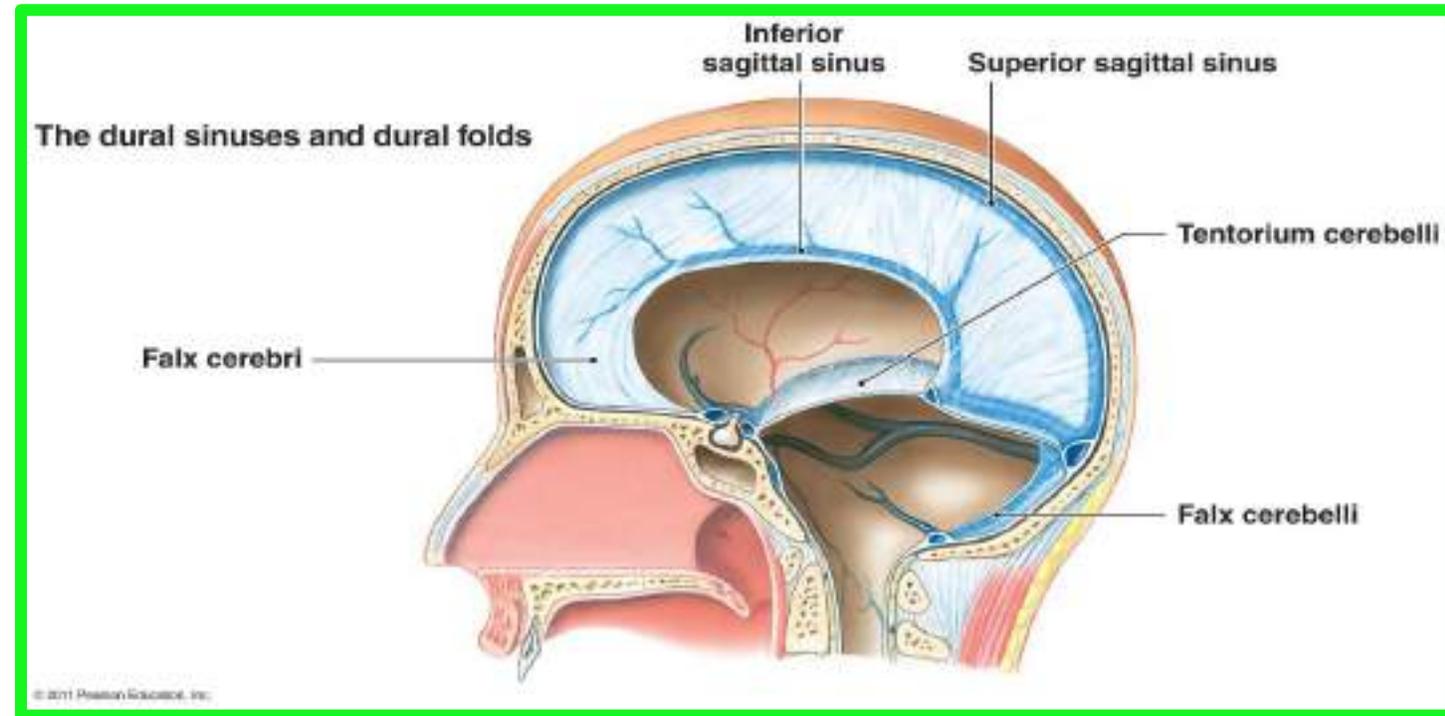


❑ 1. The falx cerebri is a **sickle-shaped fold of dura mater** that lies in the midline between the **two cerebral hemispheres**

✓ Its narrow anterior end is attached to **the internal frontal crest and the crista galli**.

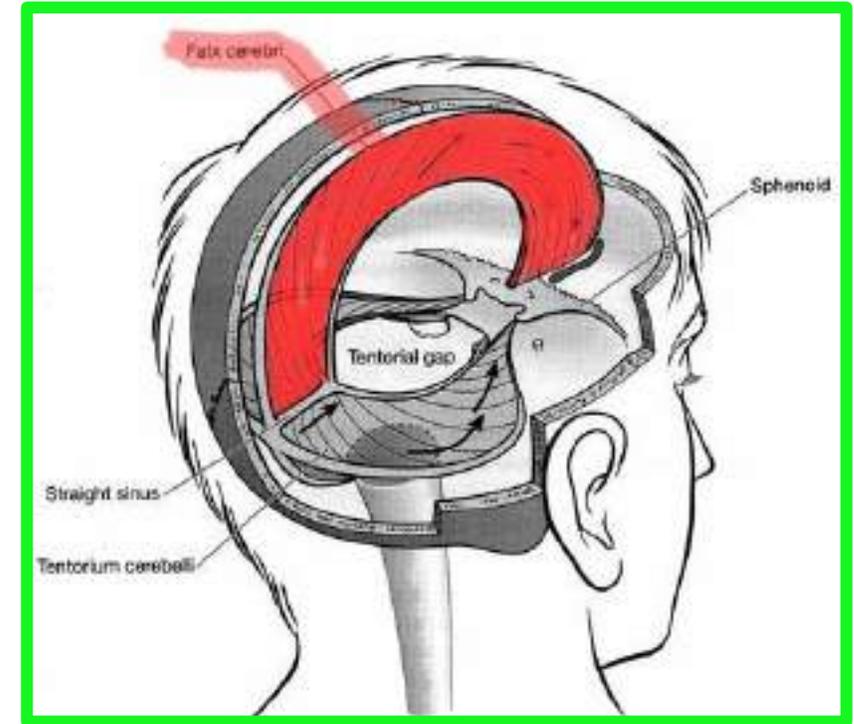
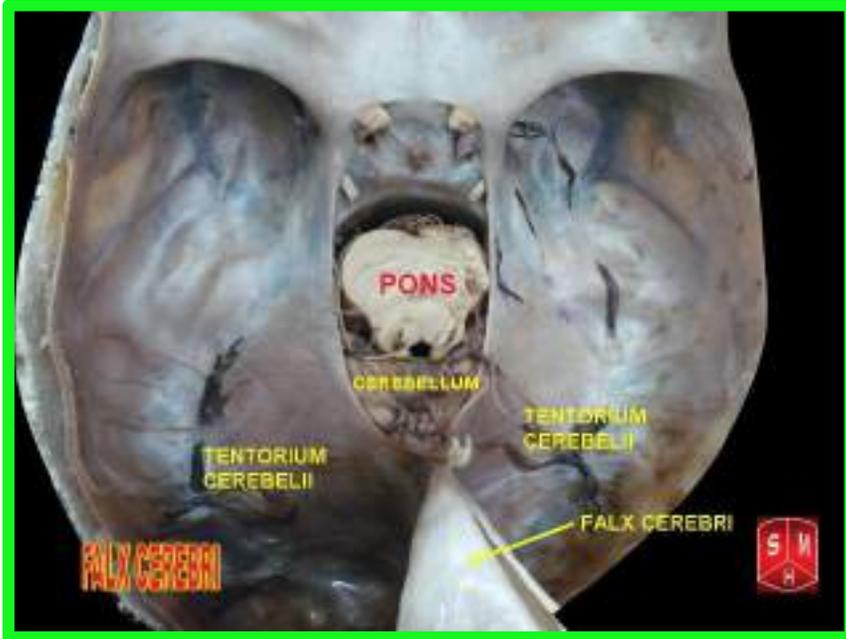
✓ Its broad posterior part blends in the midline with the **upper surface of the tentorium cerebelli**.

✓ **The superior sagittal sinus** runs in its upper fixed margin, **the inferior sagittal sinus** runs in its lower concave free margin, and **the straight sinus** runs along its attachment **to the tentorium cerebelli**



□ 2. The tentorium cerebelli is a **crescent-shaped fold of dura mater** that roofs over the posterior cranial fossa

□ It covers the **upper surface of the cerebellum** and **supports the occipital lobes of the cerebral hemispheres**.



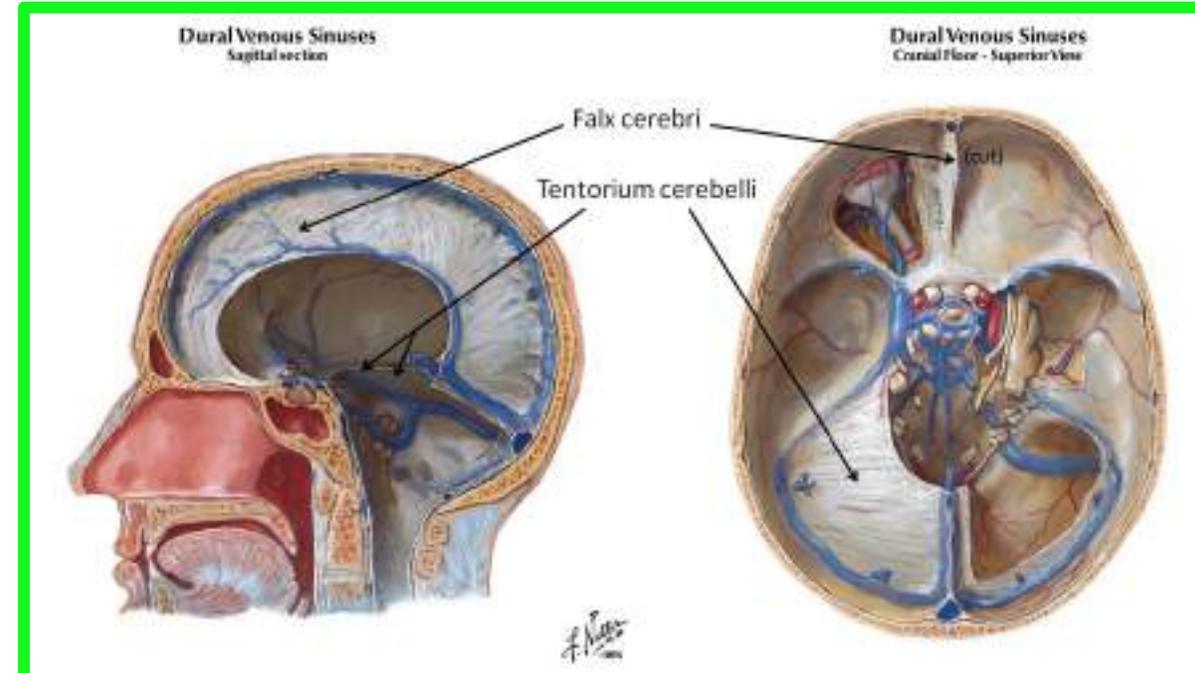
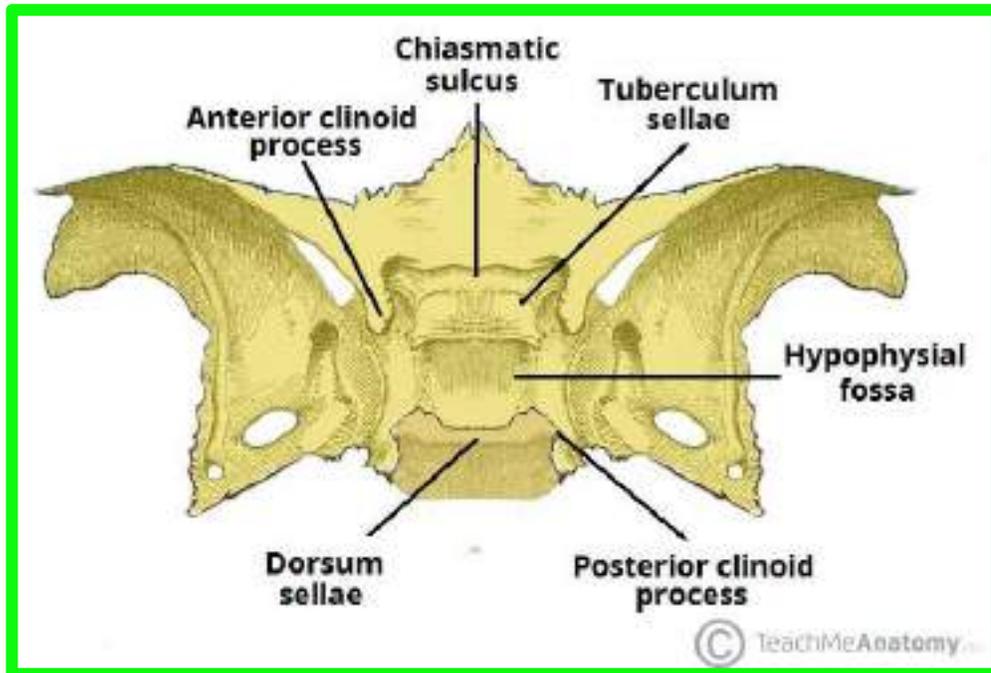
□ In the anterior edge **there is a gap, the tentorial notch**, for the passage of **the midbrain** which produces an **inner free border** and an **outer attached or fixed border**.

# Dura Mater

❑ The **fixed border** is attached to **the posterior clinoid processes**, the superior borders of the petrous bones, and **the margins of the grooves for the transverse sinuses on the occipital bone**.

❑ The **free border** runs forward at its two ends, crosses the attached border, and is affixed to **the anterior clinoid process** on each side.

✓ At the point where the two borders cross, the **third and fourth cranial nerves** pass forward to enter the lateral wall of **the cavernous sinus**



# Dura Mater

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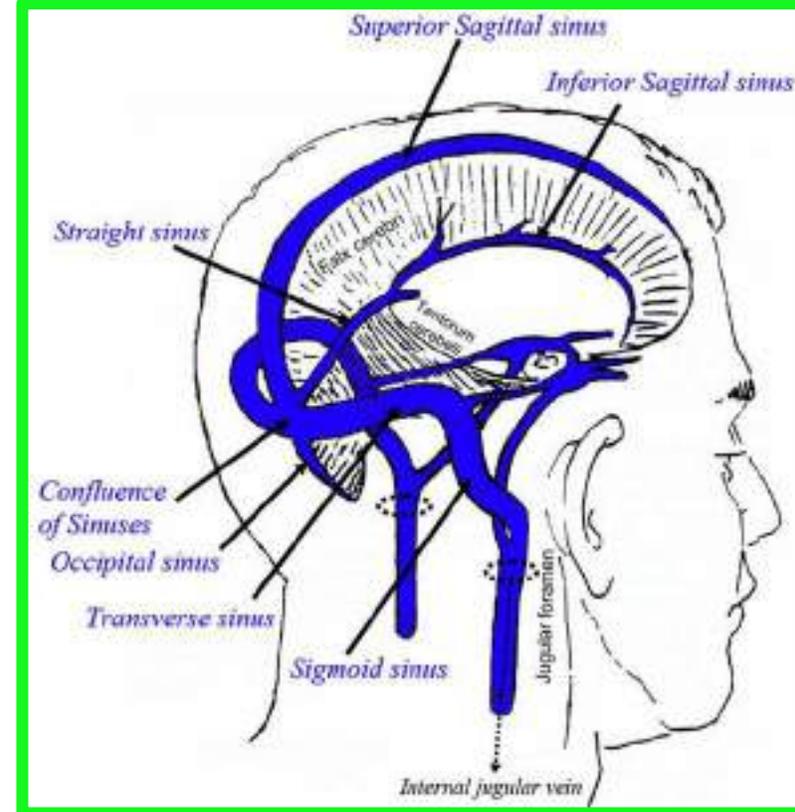
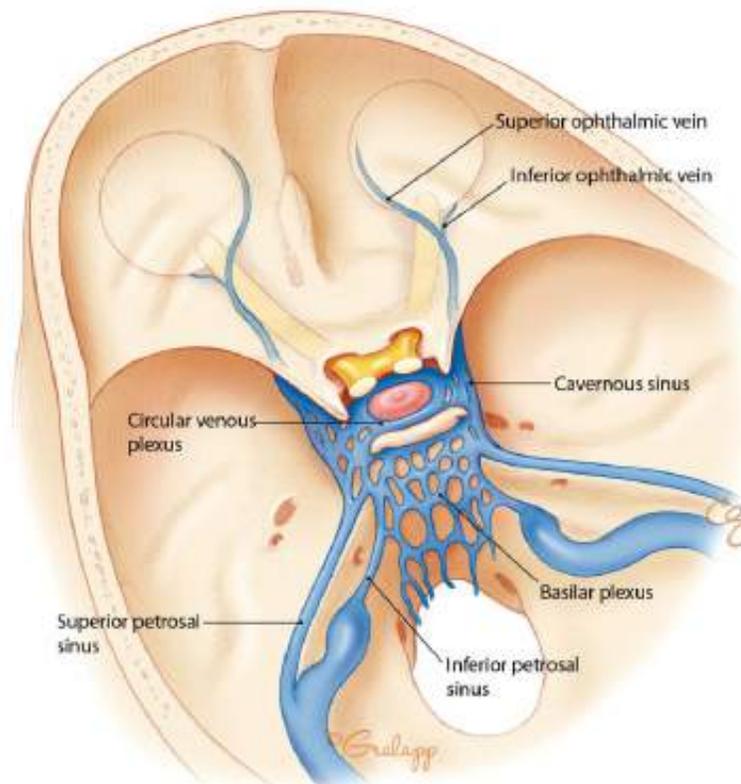
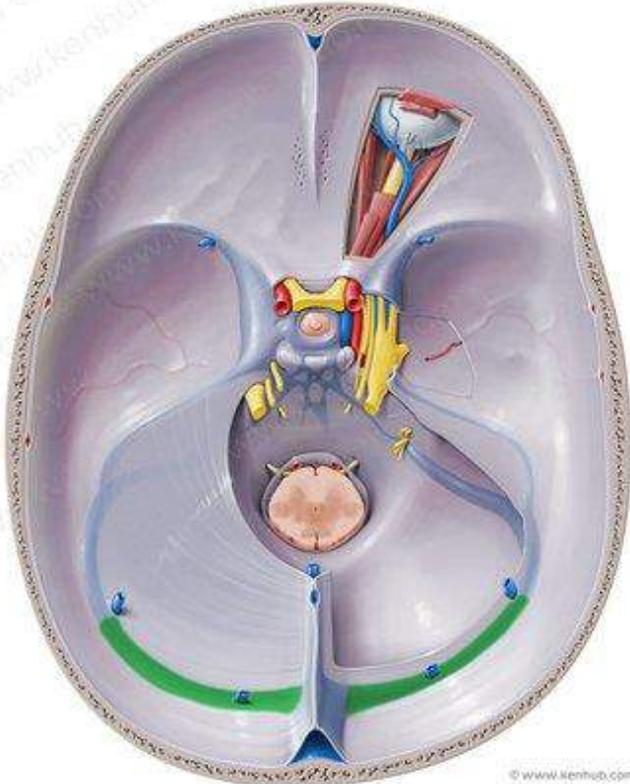
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The **falx cerebri** and the **falx cerebelli** are attached to the upper and lower surfaces of the **tentorium**, respectively.

The **straight sinus** runs along its attachment to the **falx cerebri**,

The **superior petrosal sinus** runs along its attachment to the **petrous bone**, and

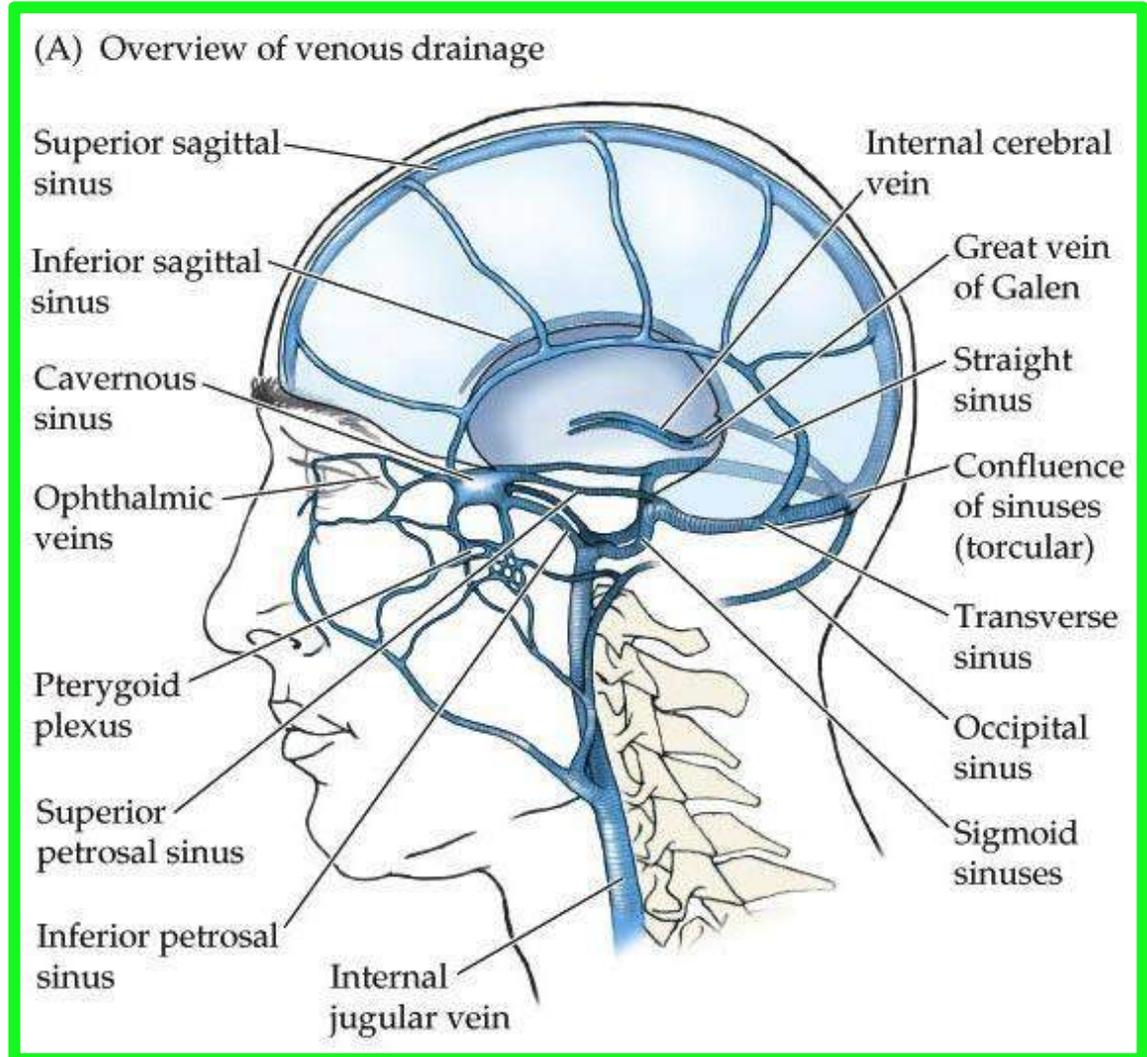
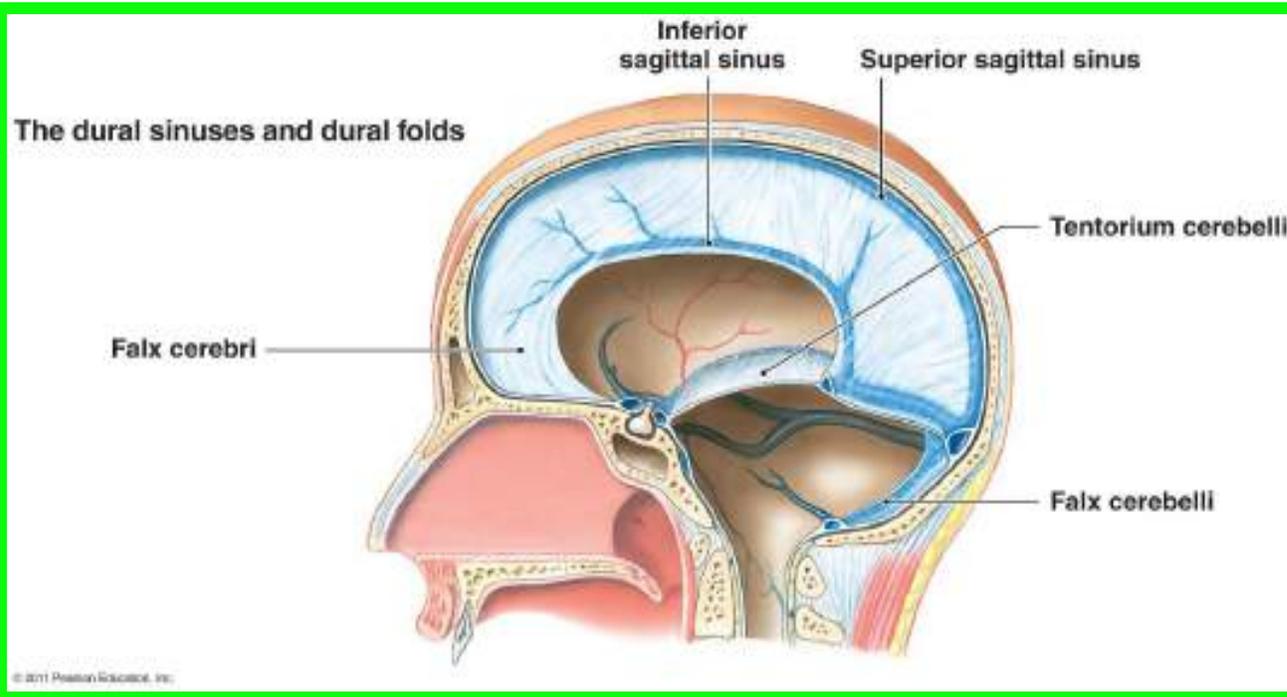
The **transverse sinus** runs along its attachment to the **occipital bone**



# Dura Mater

❑ 3. The falx cerebelli, a **small, sickle-shaped fold of dura mater** attached to the internal occipital crest, projects forward between **the two cerebellar hemispheres**

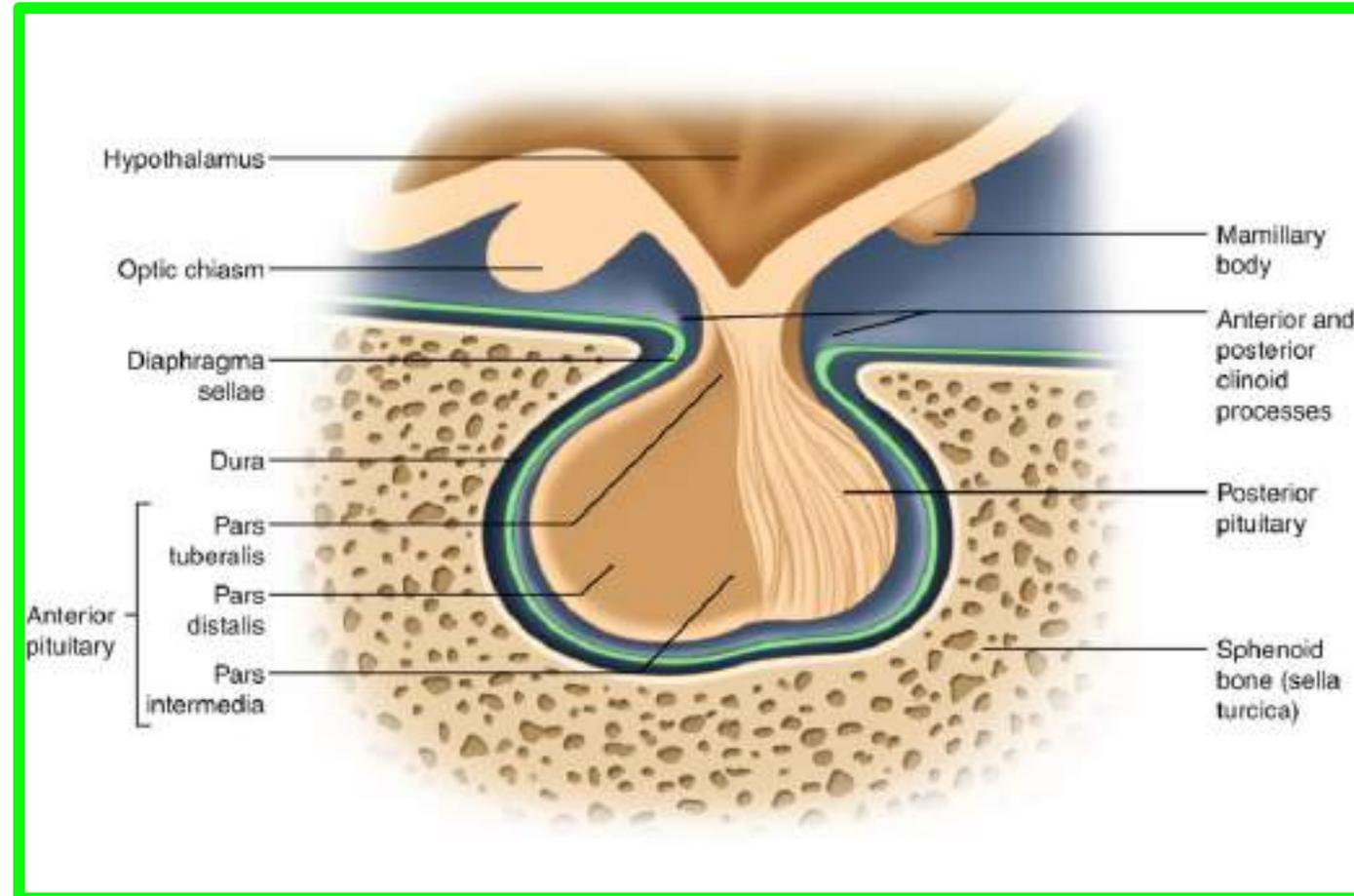
❖ Its posterior fixed margin contains **the occipital sinus.**



# Dura Mater

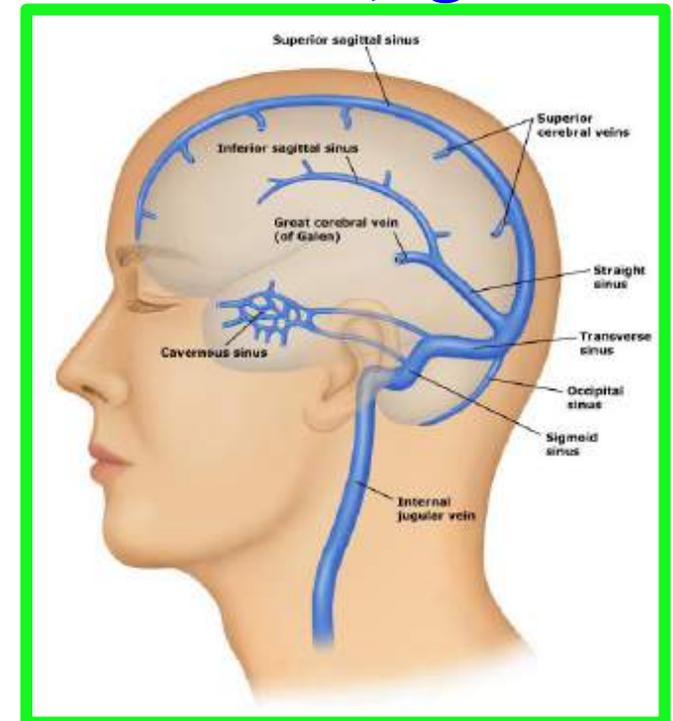
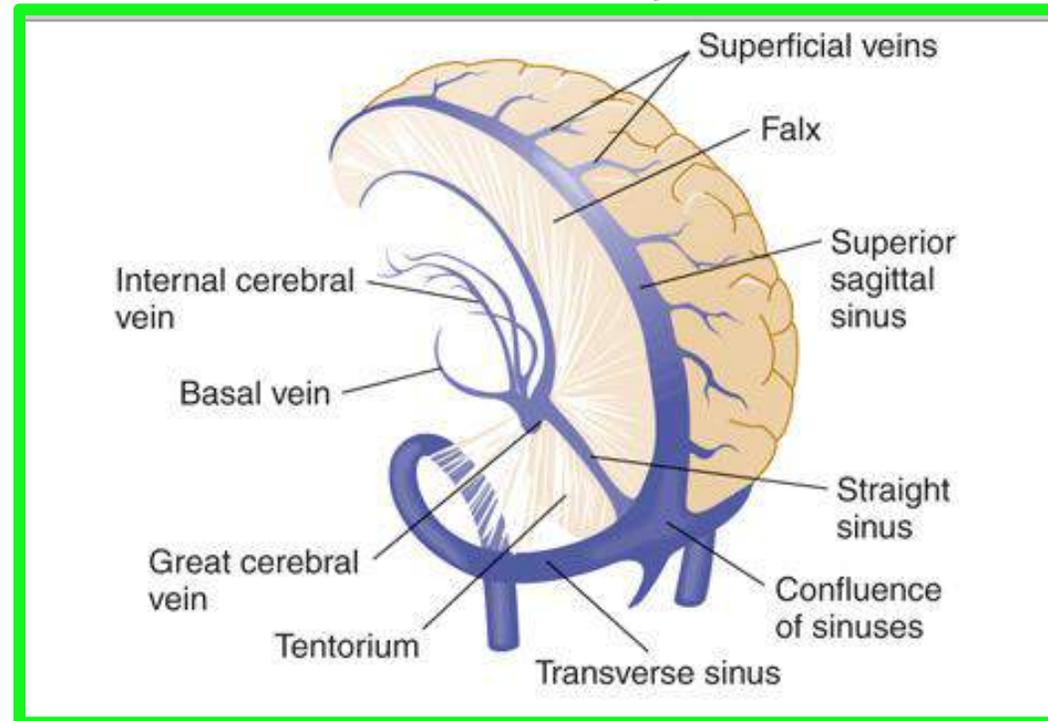
□4. The diaphragma sellae is a **small, circular fold of dura mater** that forms the roof for the sella turcica

A small opening in its center allows passage of the stalk of **the hypophysis cerebri**



# Dural Venous Sinuses

- ✓ The venous sinuses of the cranial cavity are situated **between the layers of the dura mater**
- ✓ Their main function is to receive blood from the brain through **the cerebral veins** and **the cerebrospinal fluid** from **the subarachnoid space** through the **arachnoid villi**
- ✓ The blood in the dural sinuses ultimately drains into **the internal jugular veins** in the neck.

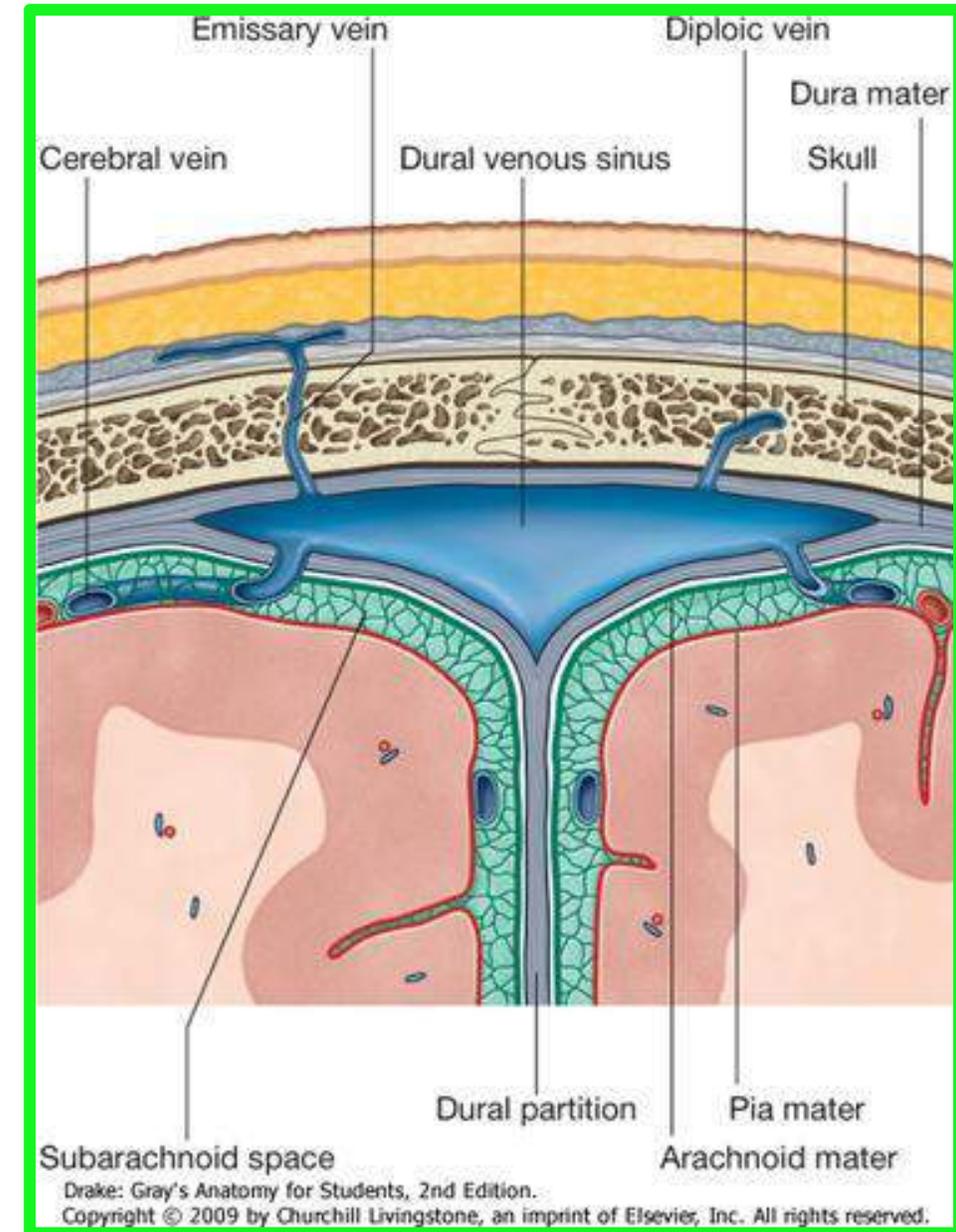
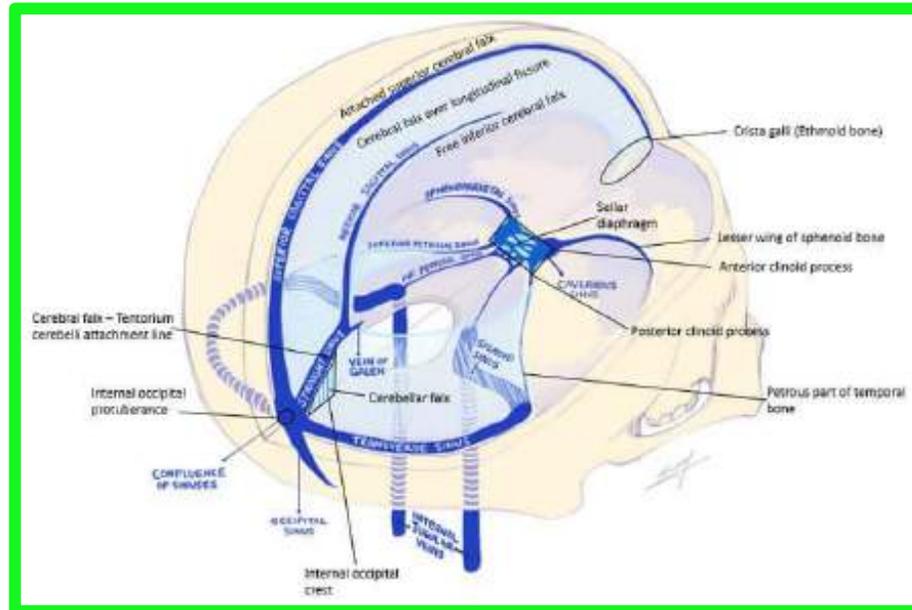


# Dural Venous Sinuses

✓ The **dural sinuses** are lined by **endothelium**, and their walls are thick but **devoid of muscular tissue**.

✓ They have **no valves**.

✓ **Emissary veins**, which are also valveless, connect the dural venous sinuses with **the diploic veins** of the skull and with **the veins of the scalp**

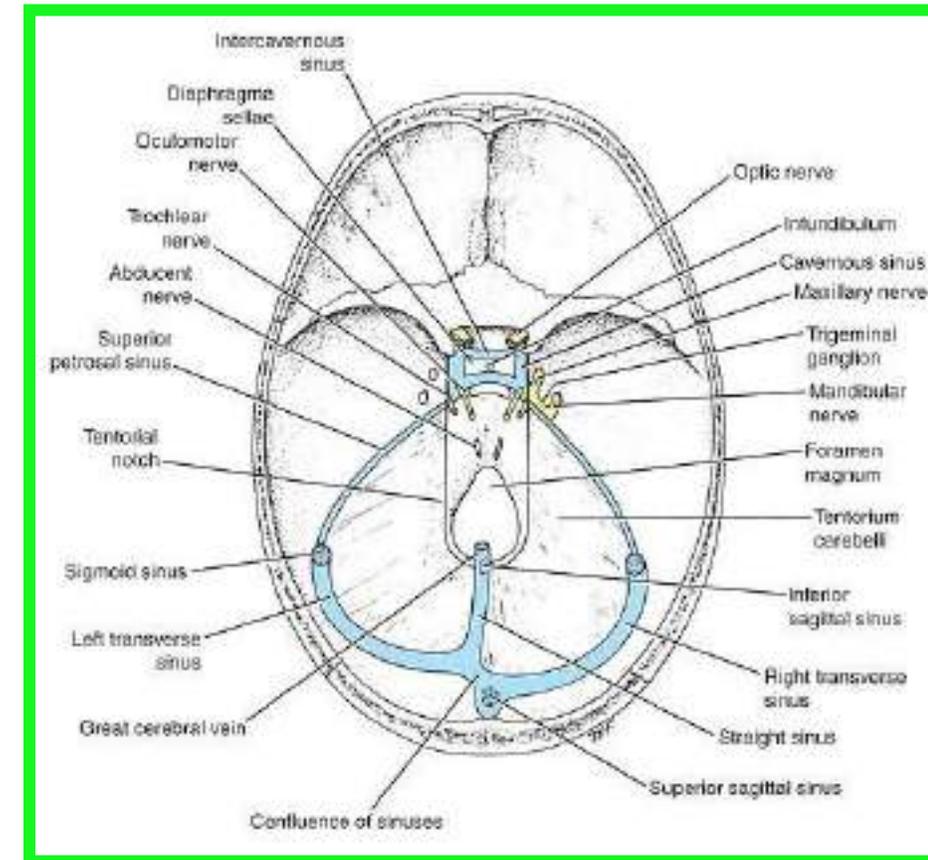


# Dural Venous Sinuses

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- ❑ The superior sagittal sinus occupies the upper fixed border of the falx cerebri (It begins anteriorly at the foramen cecum, where it occasionally receives a vein from the nasal cavity). It runs posteriorly, grooving the vault of the skull;
- ✓ Its course receives the superior cerebral veins
- At the internal occipital protuberance, it is dilated to form the confluence of the sinuses



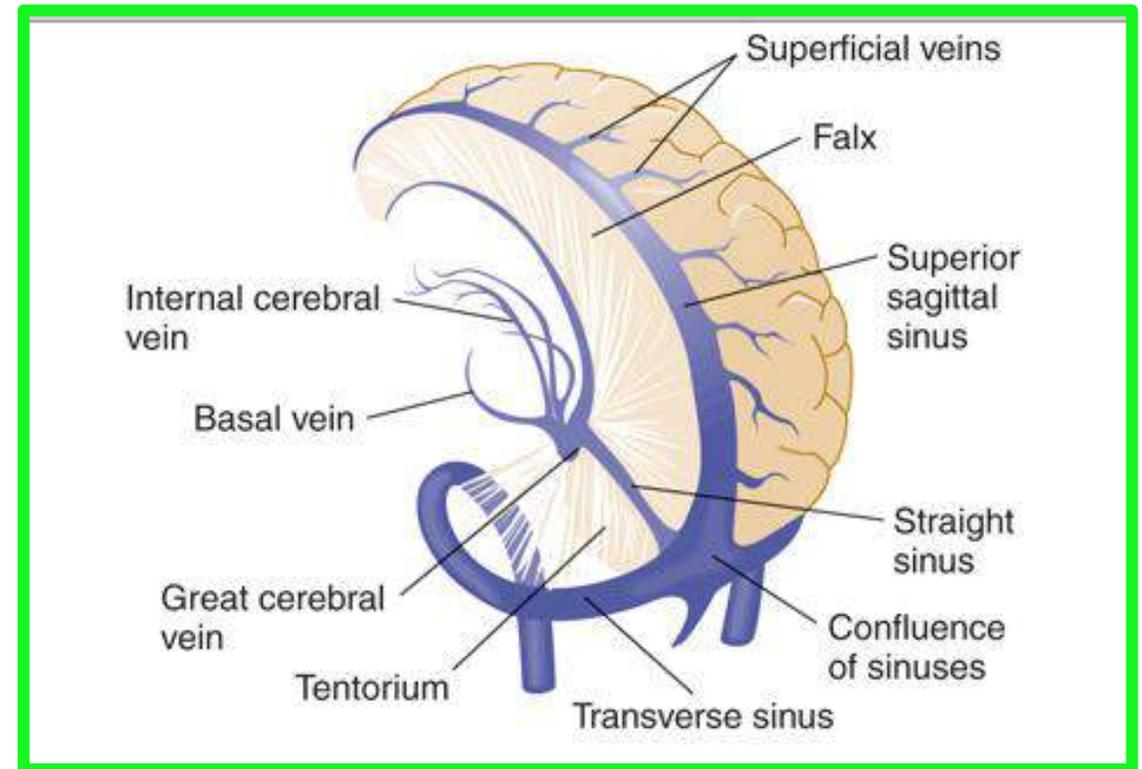
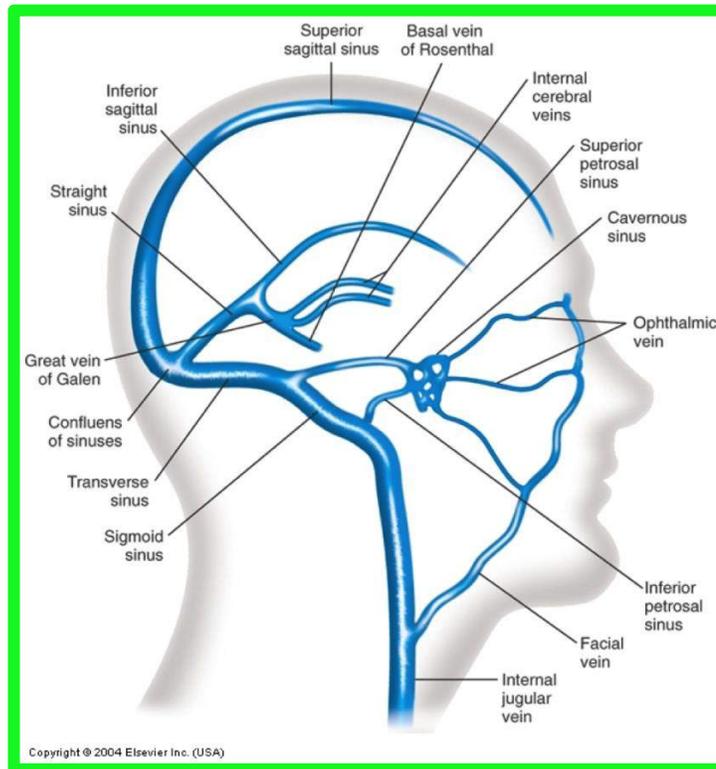
Here, the superior sagittal sinus usually becomes continuous with the right transverse sinus; it is connected to the opposite transverse sinus and receives the occipital sinus.

# Dural Venous Sinuses

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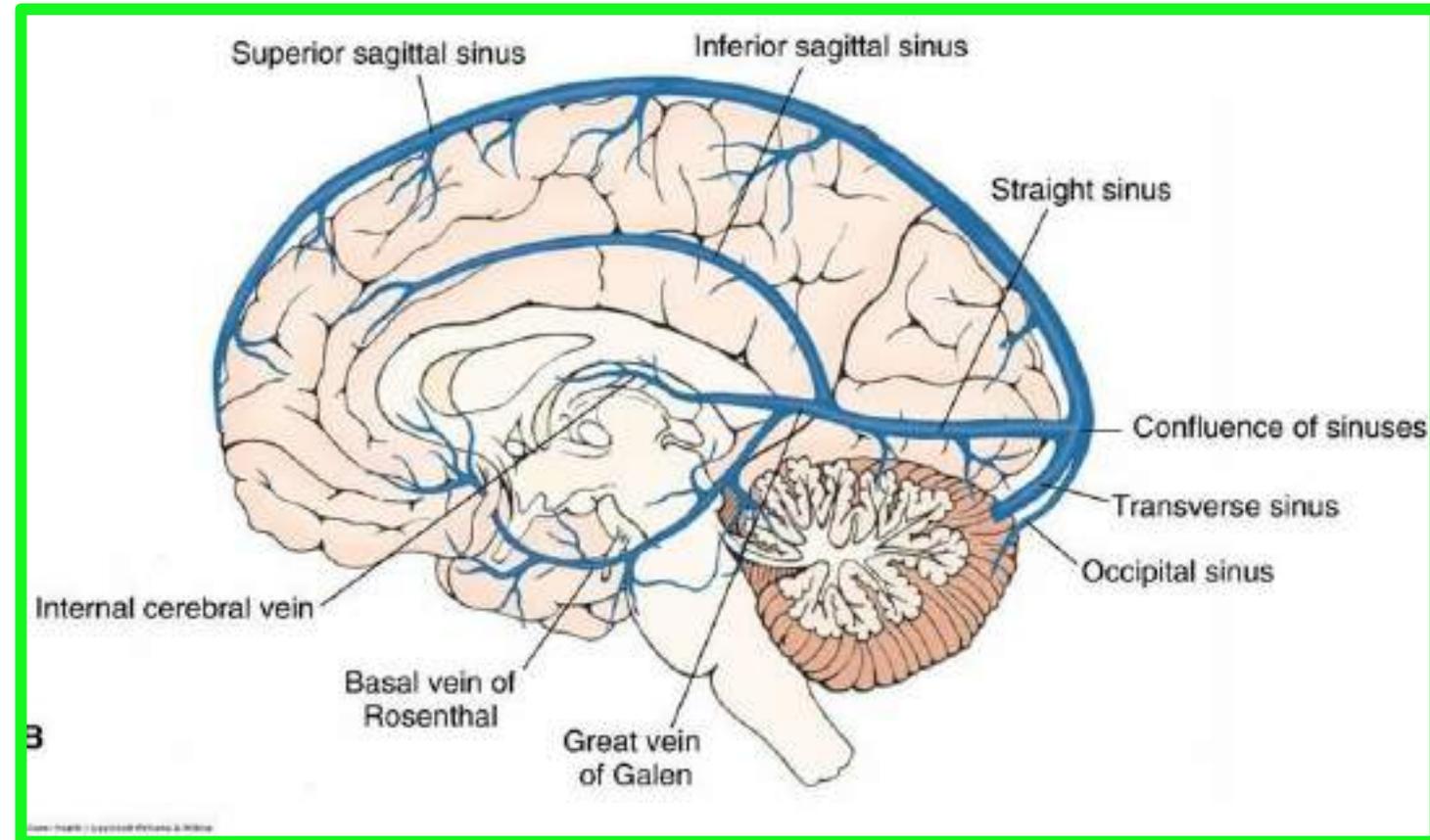
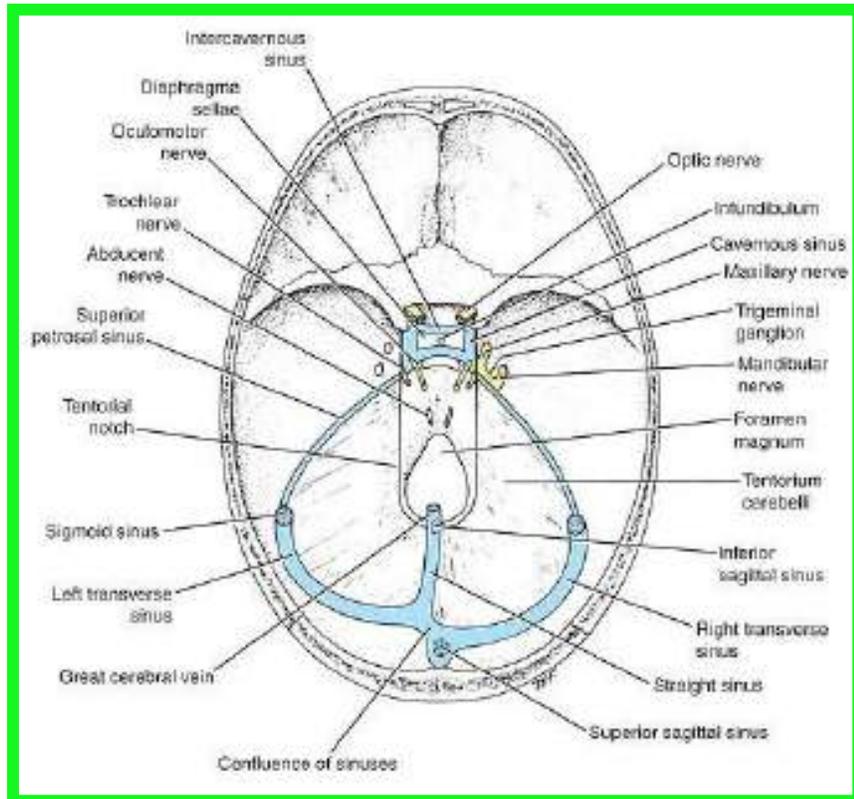
- ❑ The inferior sagittal sinus occupies the free lower margin of the falx cerebri
- ❑ It runs backward and joins the great cerebral vein at the free margin of the tentorium cerebelli to form the straight sinus
- ❑ It receives a few cerebral veins from the medial surface of the cerebral hemispheres.



# Dural Venous Sinuses

□ The straight sinus occupies the line of junction of the falx cerebri with the tentorium cerebelli

□ It is formed by the union of the inferior sagittal sinus with the great cerebral vein. It ends by turning to the left (sometimes to the right) to form the transverse sinus.



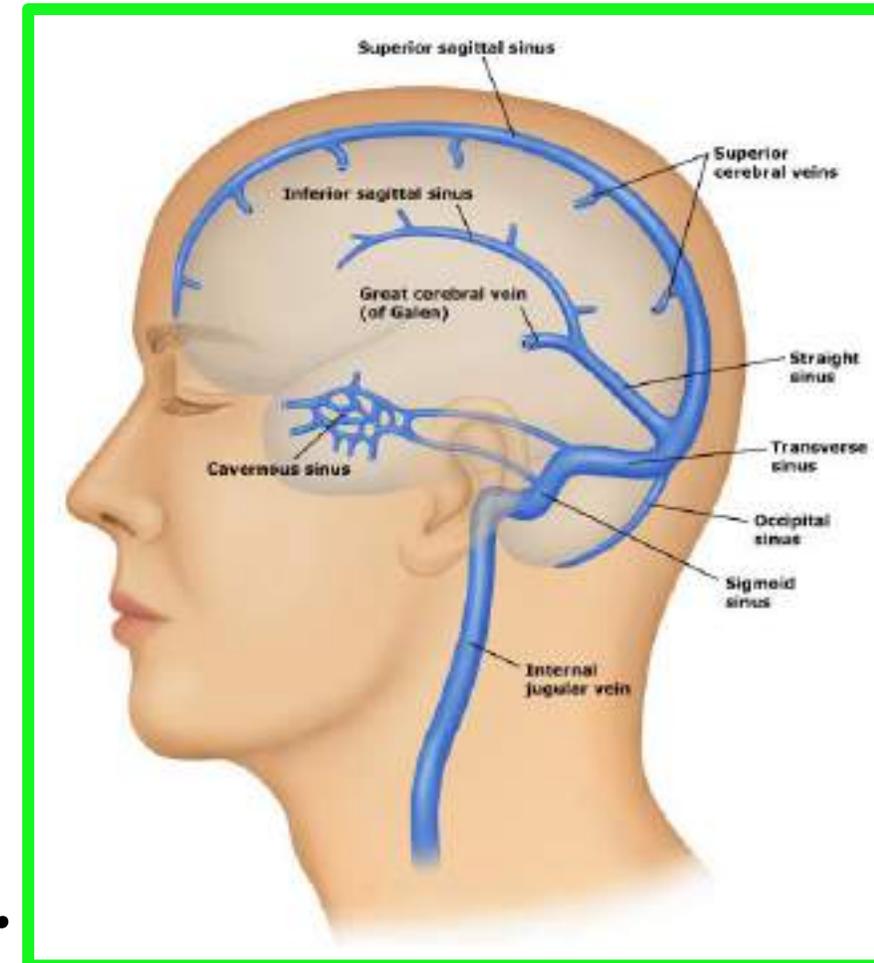
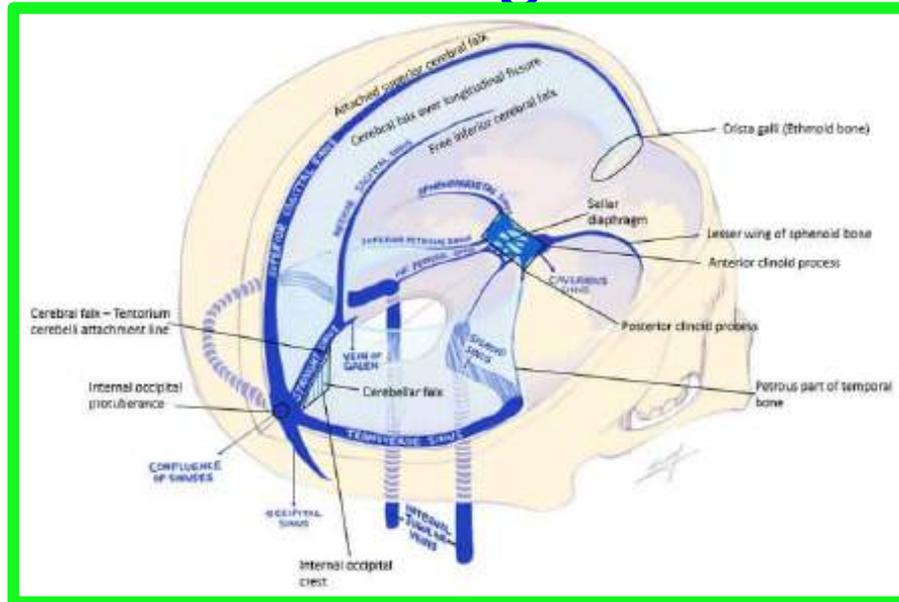
# Dural Venous Sinuses

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□ The **transverse sinuses** are paired structures that begin at **the internal occipital protuberance**

□ The **right sinus** is usually continuous with **the superior sagittal sinus**, and the **left** is continuous with **the straight sinus**.

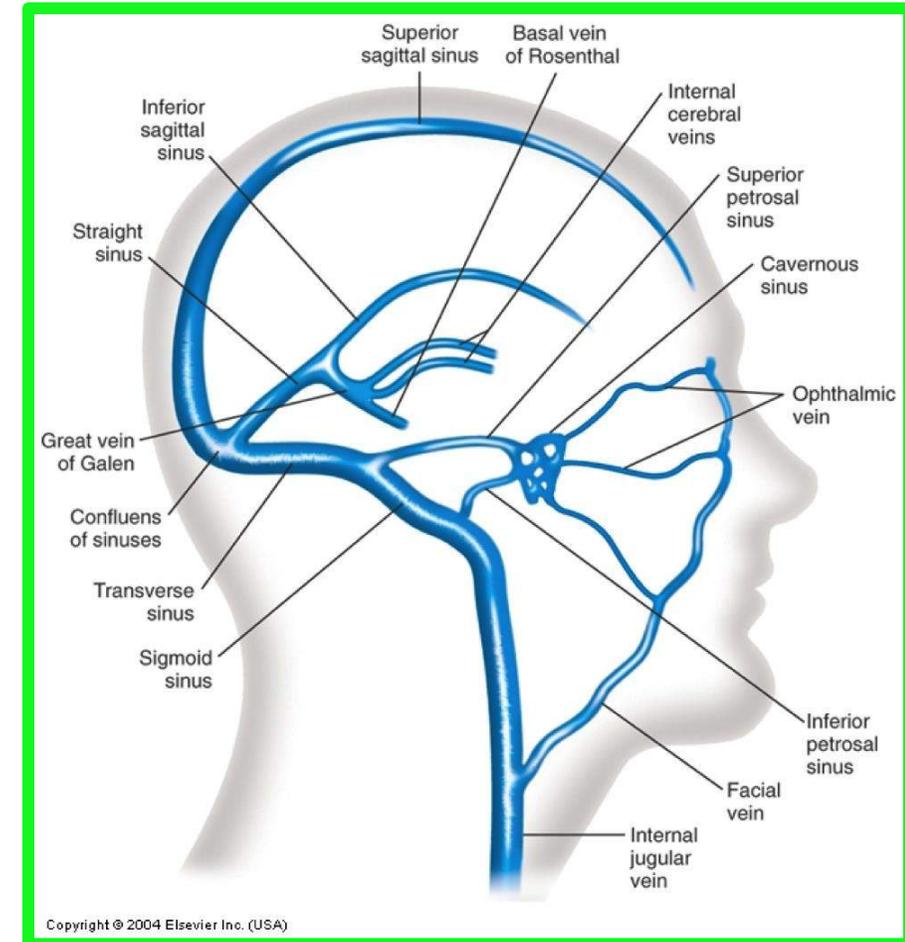
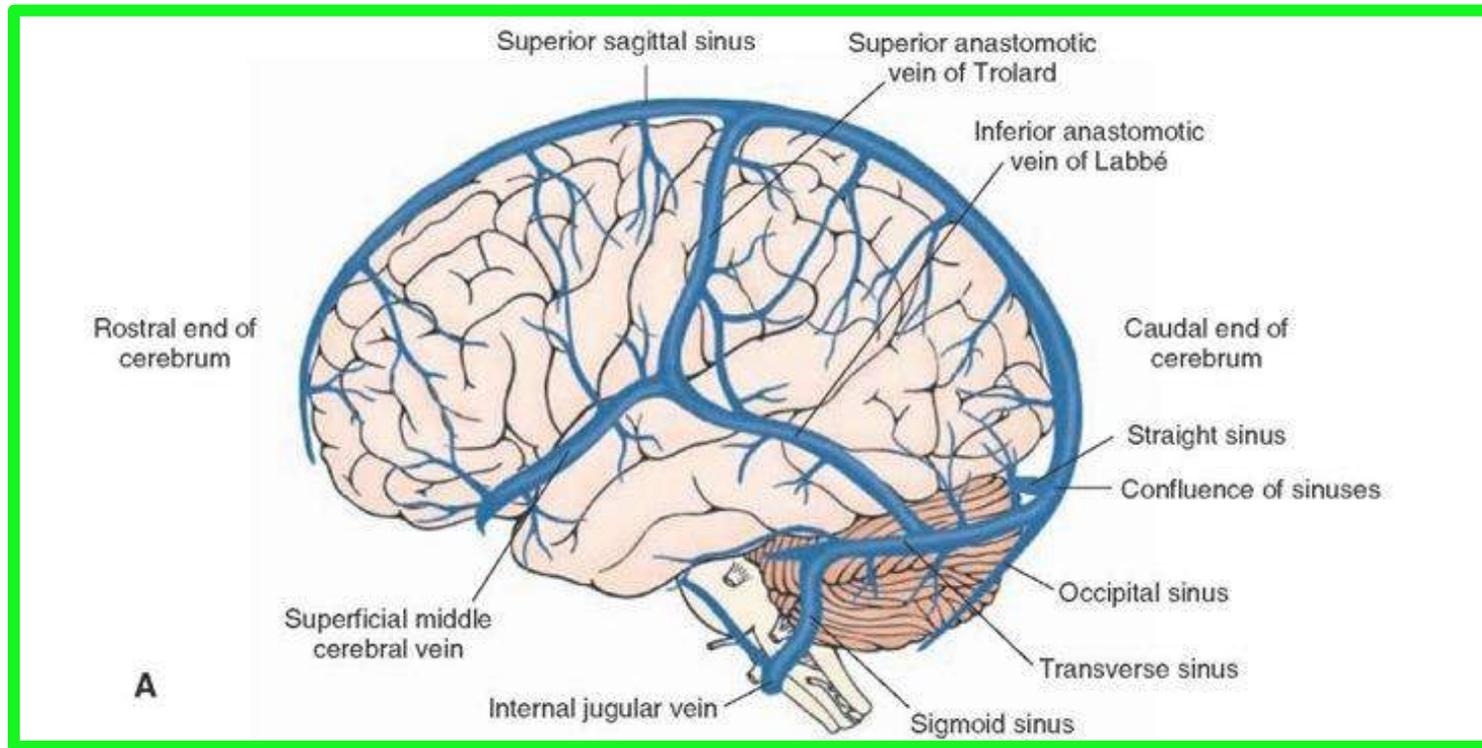


□ Each sinus occupies the attached margin of **the tentorium cerebelli**, grooving **the occipital bone** and the posteroinferior angle of the parietal bone.

# Dural Venous Sinuses

The transverse sinuses receive the superior petrosal sinuses, the inferior cerebral and cerebellar veins, and the diploic veins.

They end by turning downward as the sigmoid sinuses

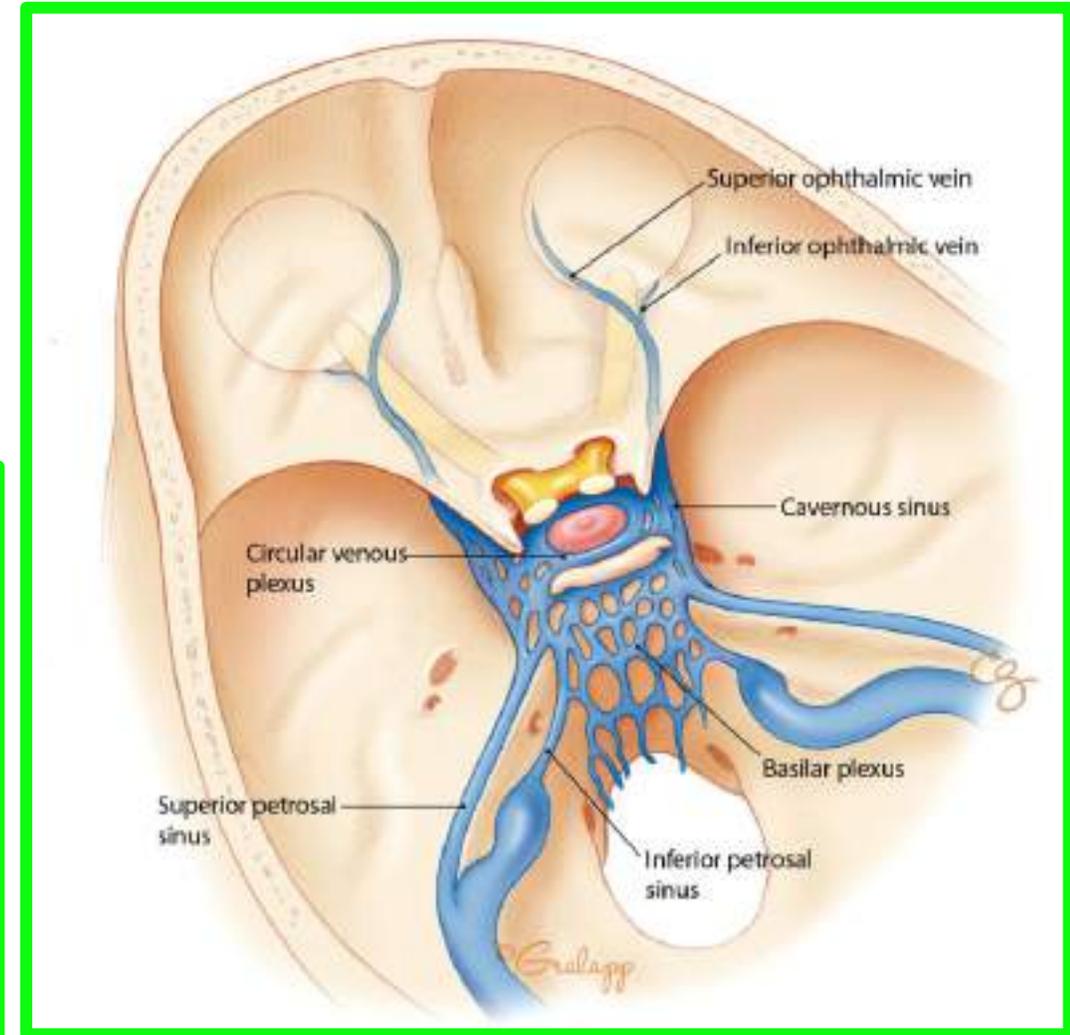
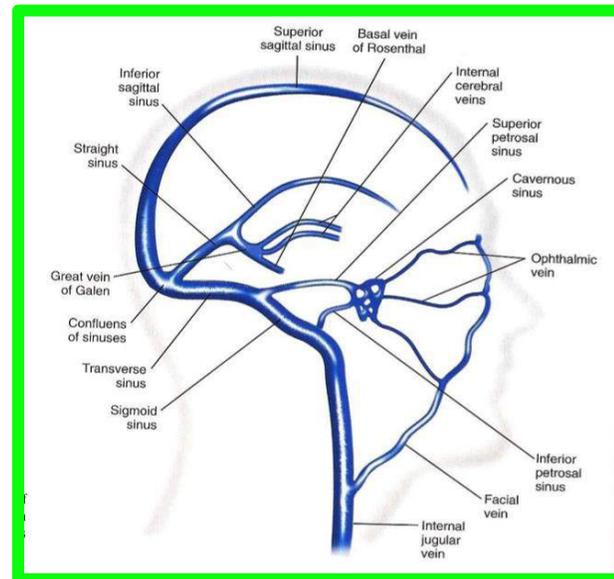


# Dural Venous Sinuses

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The superior and inferior petrosal sinuses are small sinuses situated on the superior and inferior borders of **the petrous part of the temporal bone** on each side of the skull

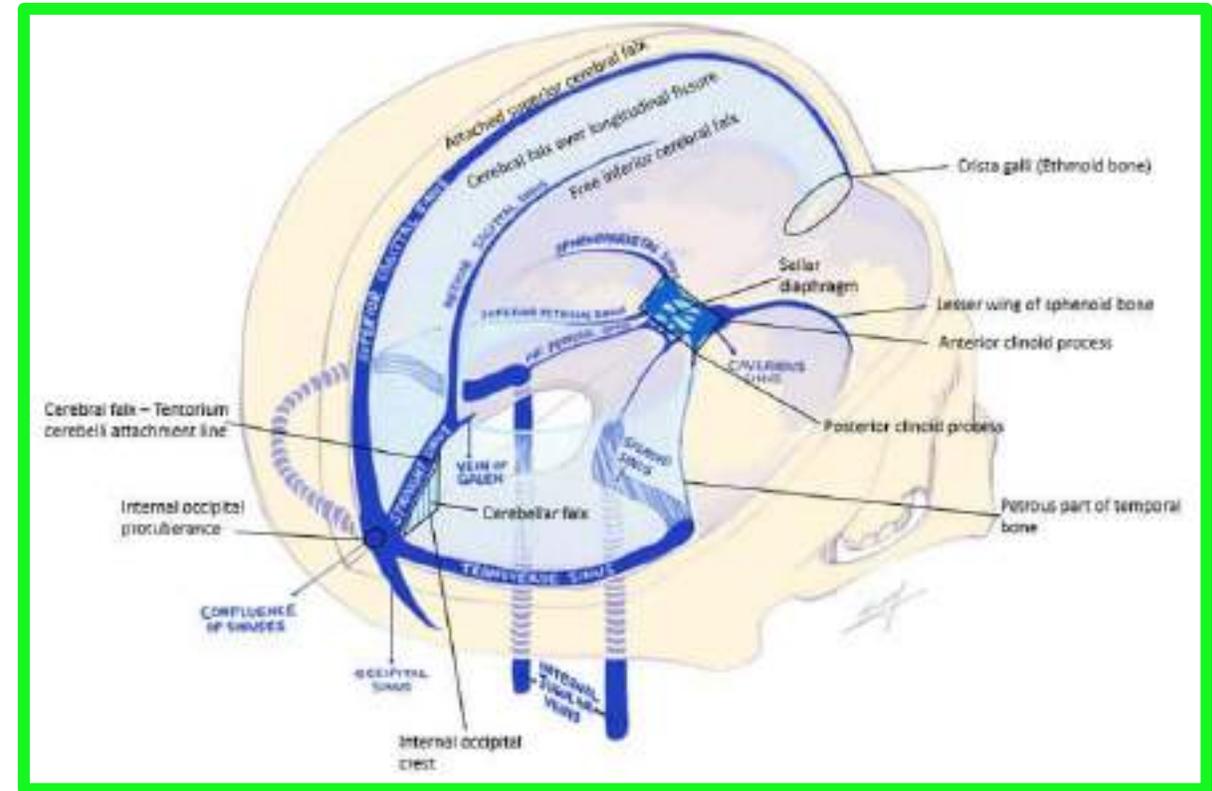
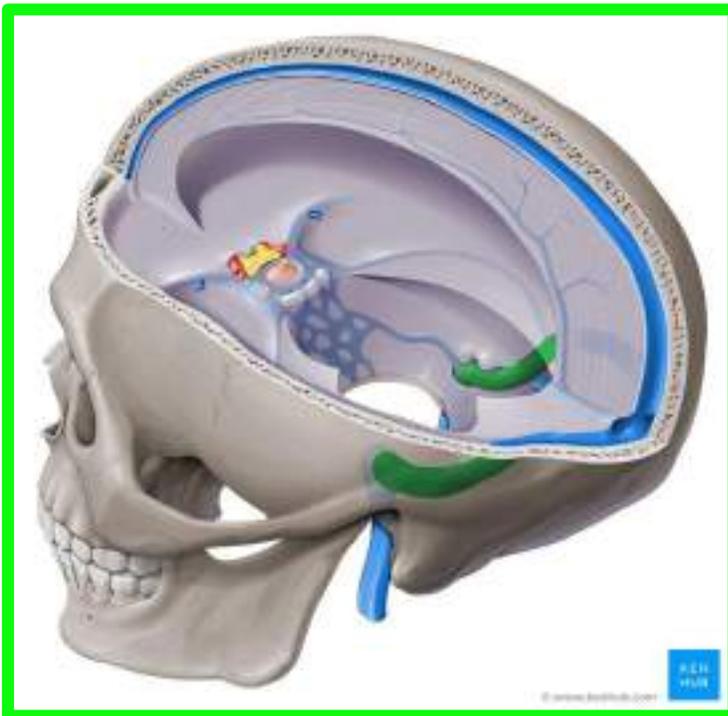
Each superior sinus drains the cavernous sinus into the transverse sinus, and each inferior sinus drains the cavernous sinus into the internal jugular vein



# Dural Venous Sinuses

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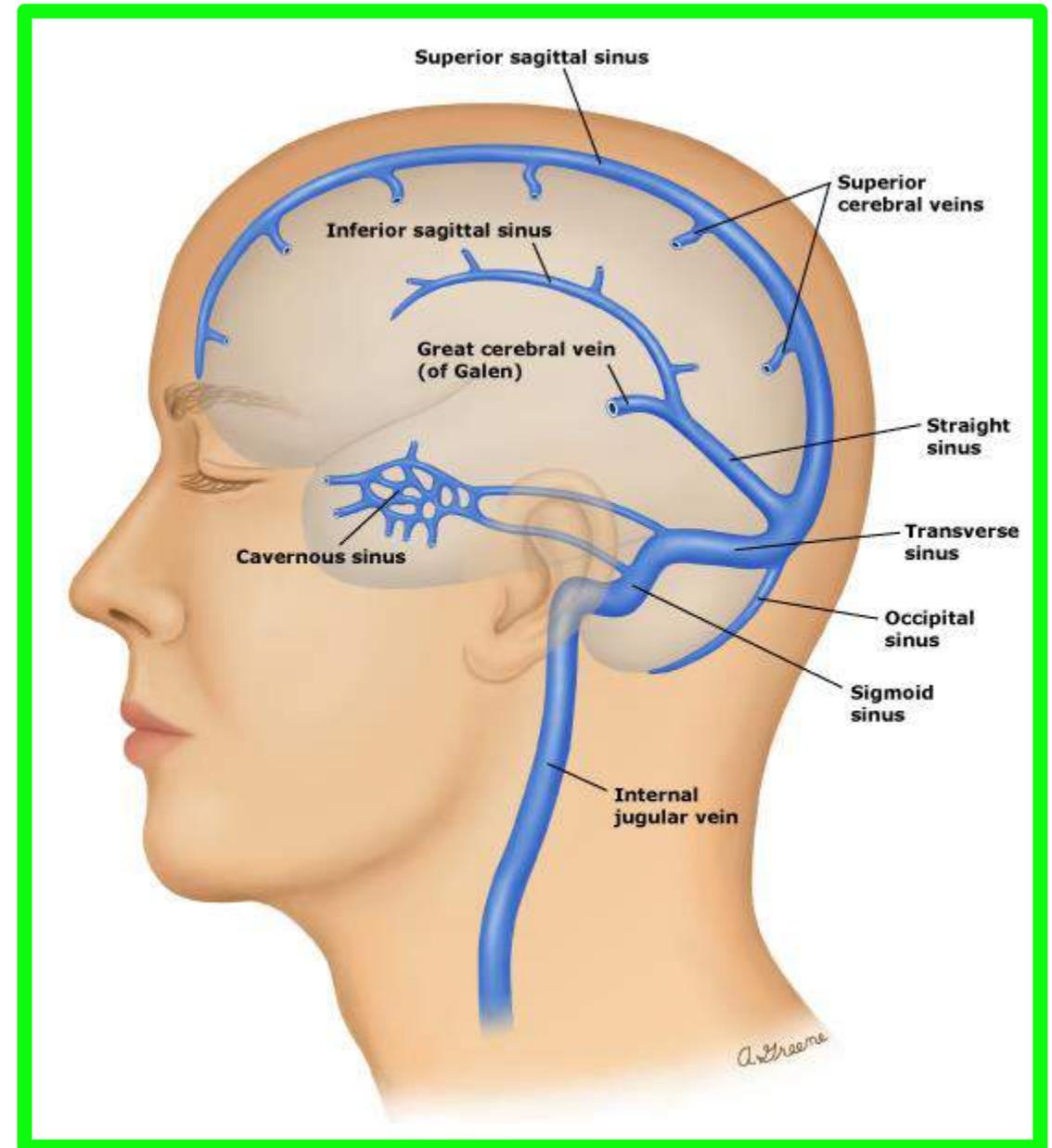
- ❑ The sigmoid sinuses are a direct continuation of the transverse sinuses.
- ✓ Each sinus turns **downward and medially** and grooves **the mastoid part of the temporal bone**
- ✓ The sinus then turns **forward** and then **inferiorly** through the posterior part of the **jugular foramen** to become continuous with the **superior bulb of the internal jugular vein**.



# Dural Venous Sinuses

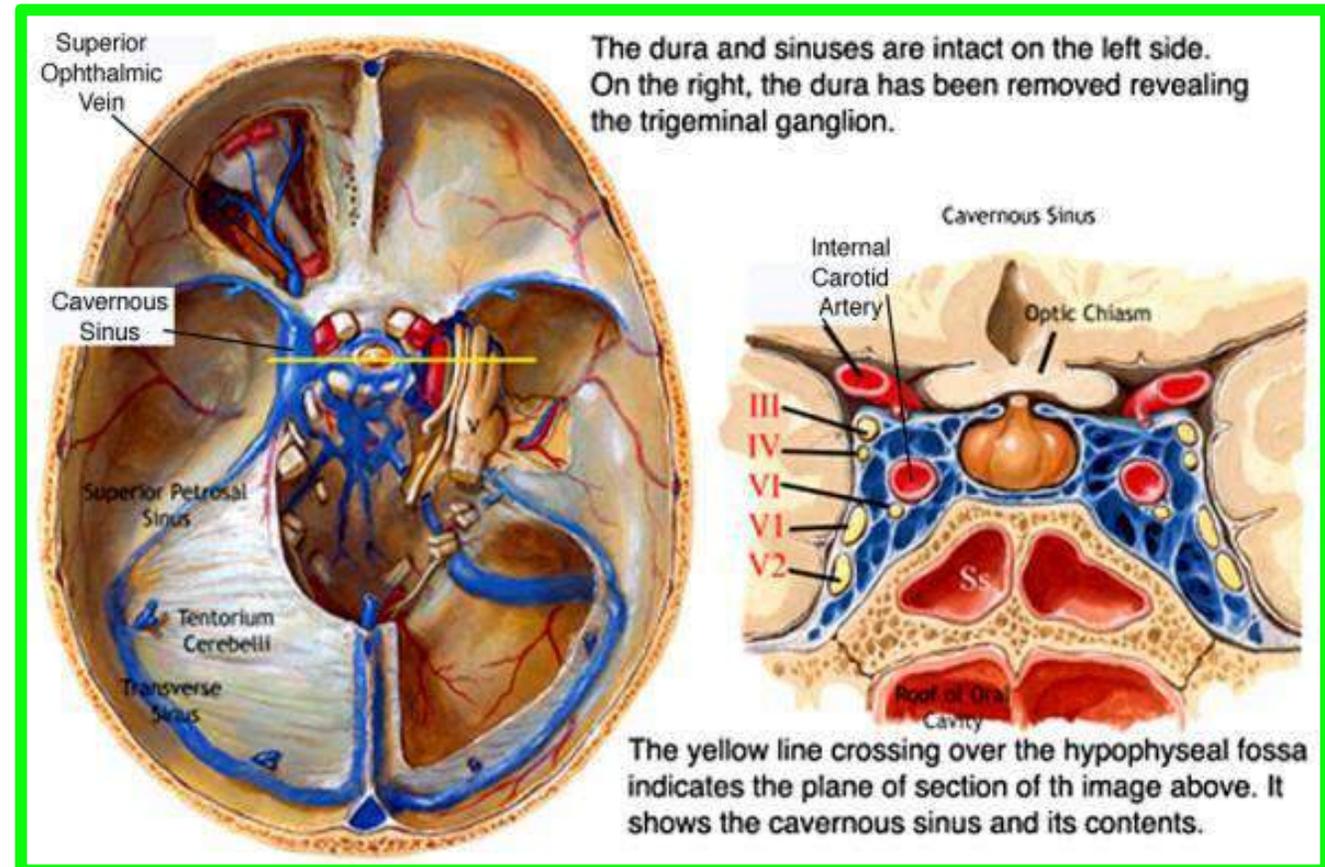
The occipital sinus is a small sinus occupying the **attached margin of the falx cerebelli**.

It commences near **the foramen magnum**, where it communicates with the vertebral veins and drains **into the confluence of sinuses**



# Dural Venous Sinuses

- The cavernous sinuses are situated **in the middle cranial fossa** on each side of the body of the sphenoid bone
- ❖ Numerous trabeculae cross their interior, giving them a spongy appearance, hence the name.
- ❖ Each sinus extends from **the superior orbital fissure** in front to **the apex of the petrous part of the temporal bone** behind.

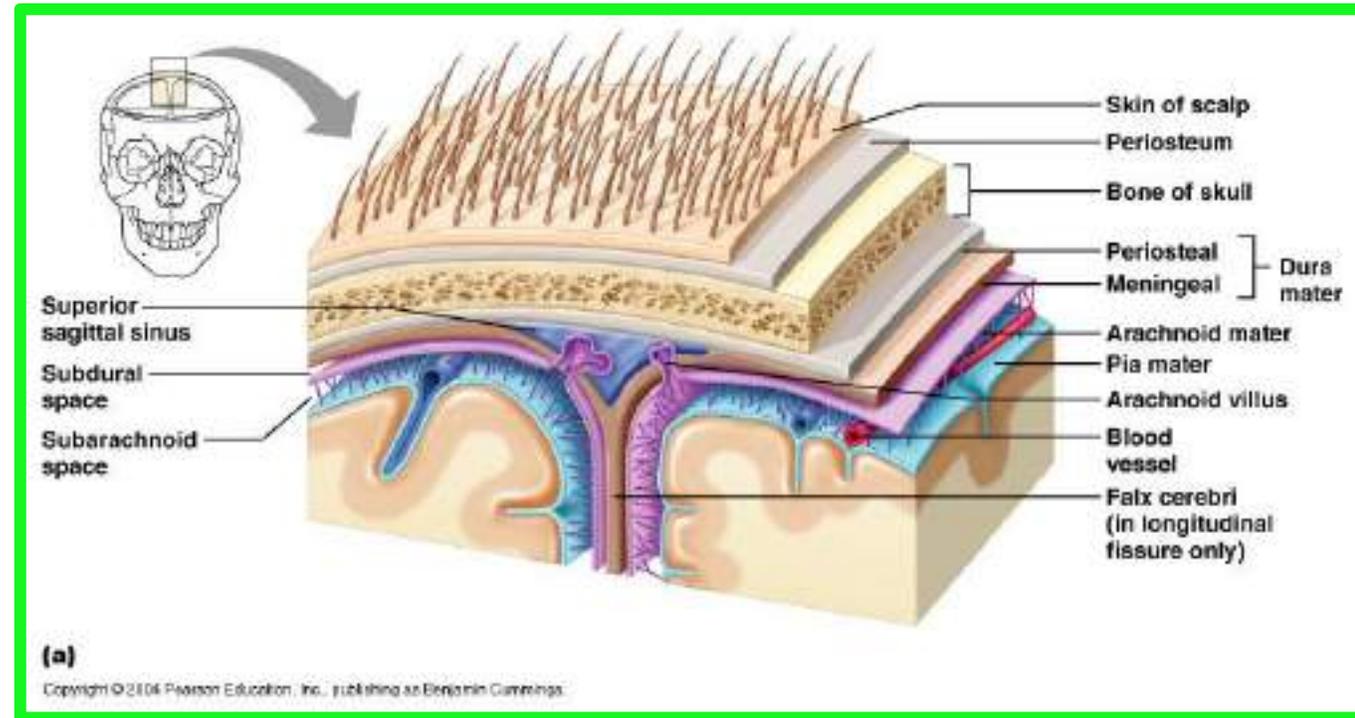


# Arachnoid Mater

✓ The **arachnoid mater** is a delicate, impermeable membrane covering the brain and lying between the **pia mater internally** and the **dura mater externally**

✓ It is separated from the **dura** by a potential space, the **subdural space**, filled by a **film of fluid**;

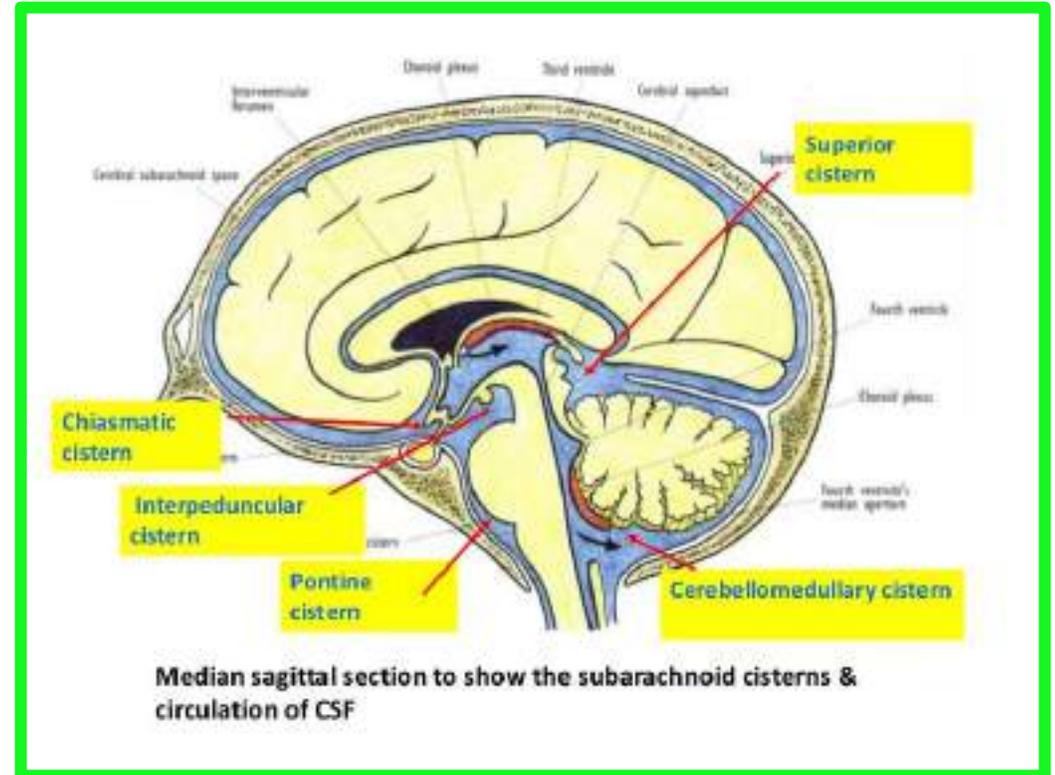
✓ it is separated from the **pia** by the **subarachnoid space**, which is filled with **cerebrospinal fluid**.



✓ The outer and inner surfaces of the arachnoid are covered with flattened mesothelial cells

❖ The arachnoid bridges over the sulci on the surface of the brain, and in certain situations, **the arachnoid** and **pia** are widely separated to form **the subarachnoid cisternae**.

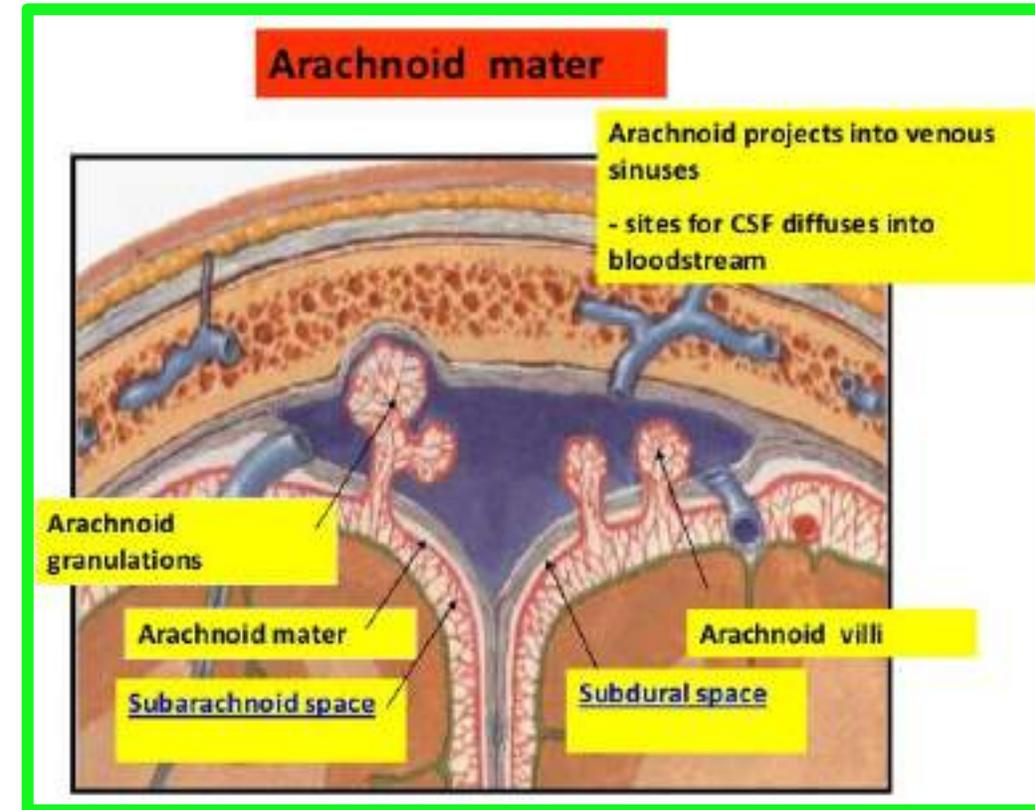
❖ **The cisterna cerebellomedullaris** lies between the inferior surface of the cerebellum and the roof of the fourth ventricle. (**cisterna magna**)



❖ **The cisterna interpeduncularis** lies between the two cerebral peduncles.

❖ All the cisternae are in free communication with one another and with the remainder of the subarachnoid space

- ❖ In certain areas, the arachnoid projects into **the venous sinuses** to form **arachnoid villi**.
- ❖ **The arachnoid villi** are most numerous along **the superior sagittal sinus**.
- ❖ Aggregations of arachnoid villi are referred to as **arachnoid granulations**
- ❖ **Arachnoid villi** serve as sites where the cerebrospinal fluid diffuses into the bloodstream.
- ❖ **The arachnoid** is connected to **the pia mater** across the fluid-filled **subarachnoid space** by **delicate strands of fibrous tissue**.

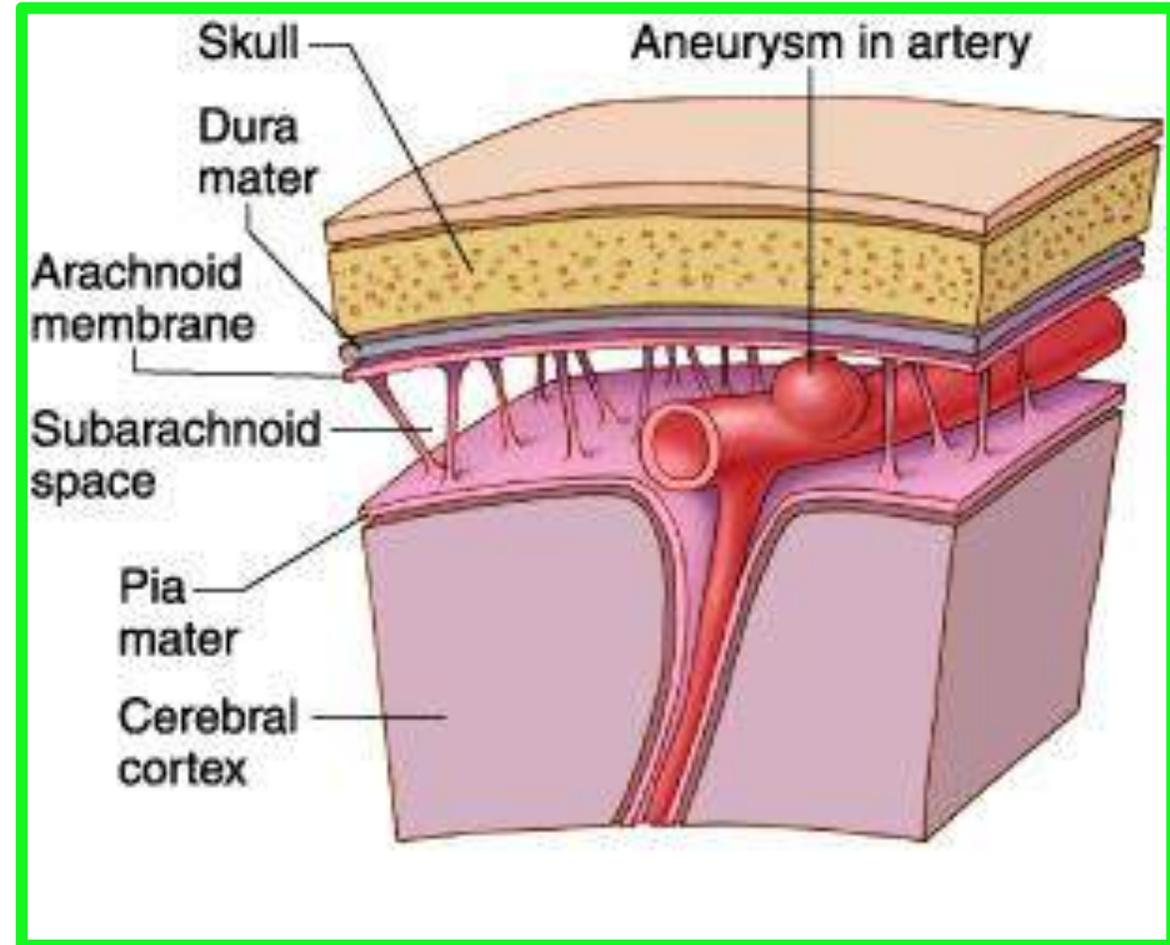


# Arachnoid Mater

✓ Structures passing to and from the brain to the skull or its foramina must pass through **the subarachnoid space**.

✓ All the **cerebral arteries** and **veins** lie in the space, as do the **cranial nerves**

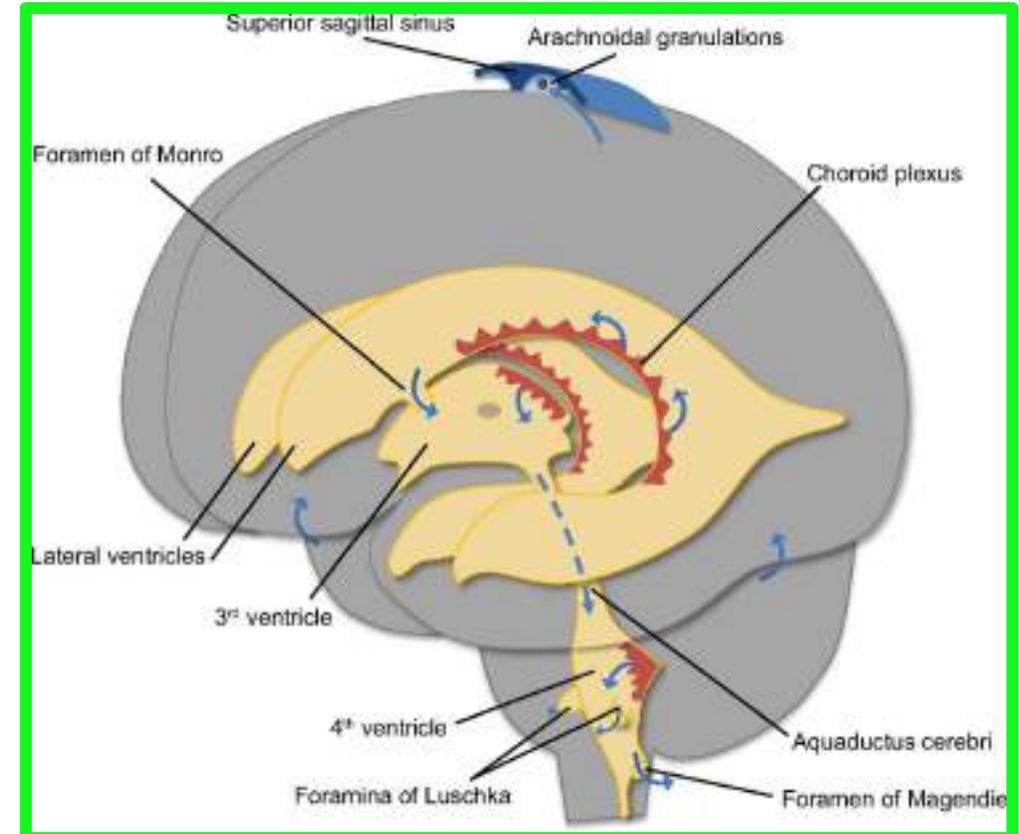
✓ The arachnoid fuses with the epineurium of the nerves at their point of exit from the skull



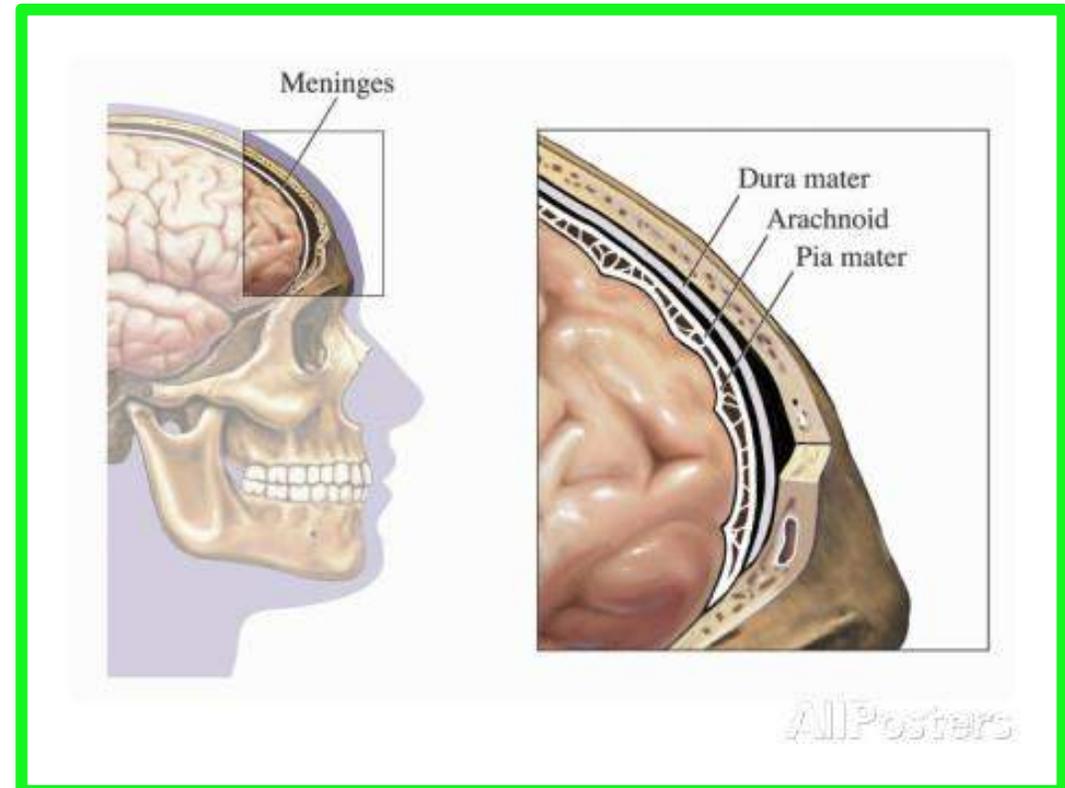
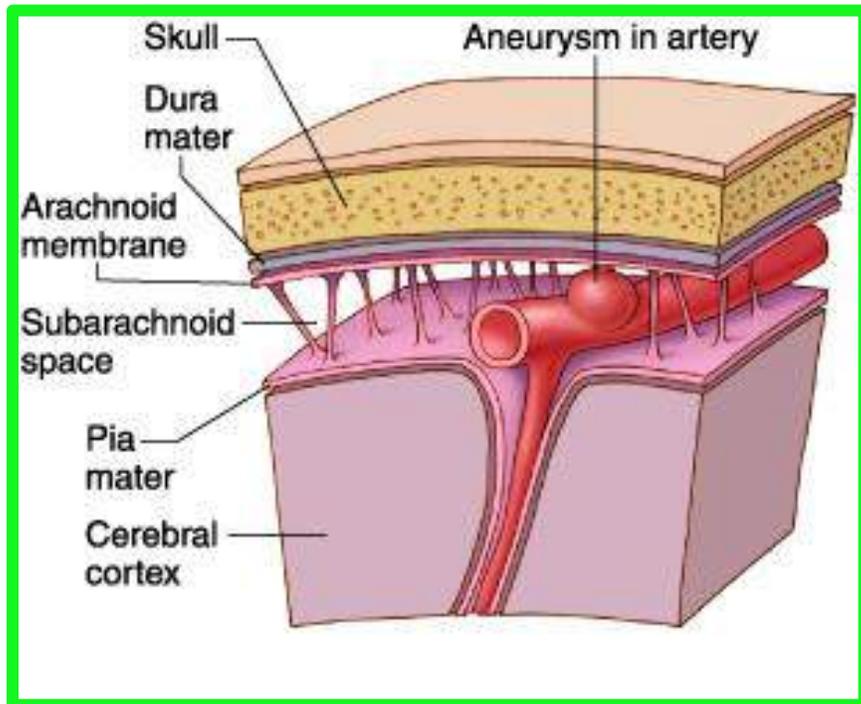
✓ **The subarachnoid space** extends around **the optic nerve** as far as the eyeball.

# Arachnoid Mater

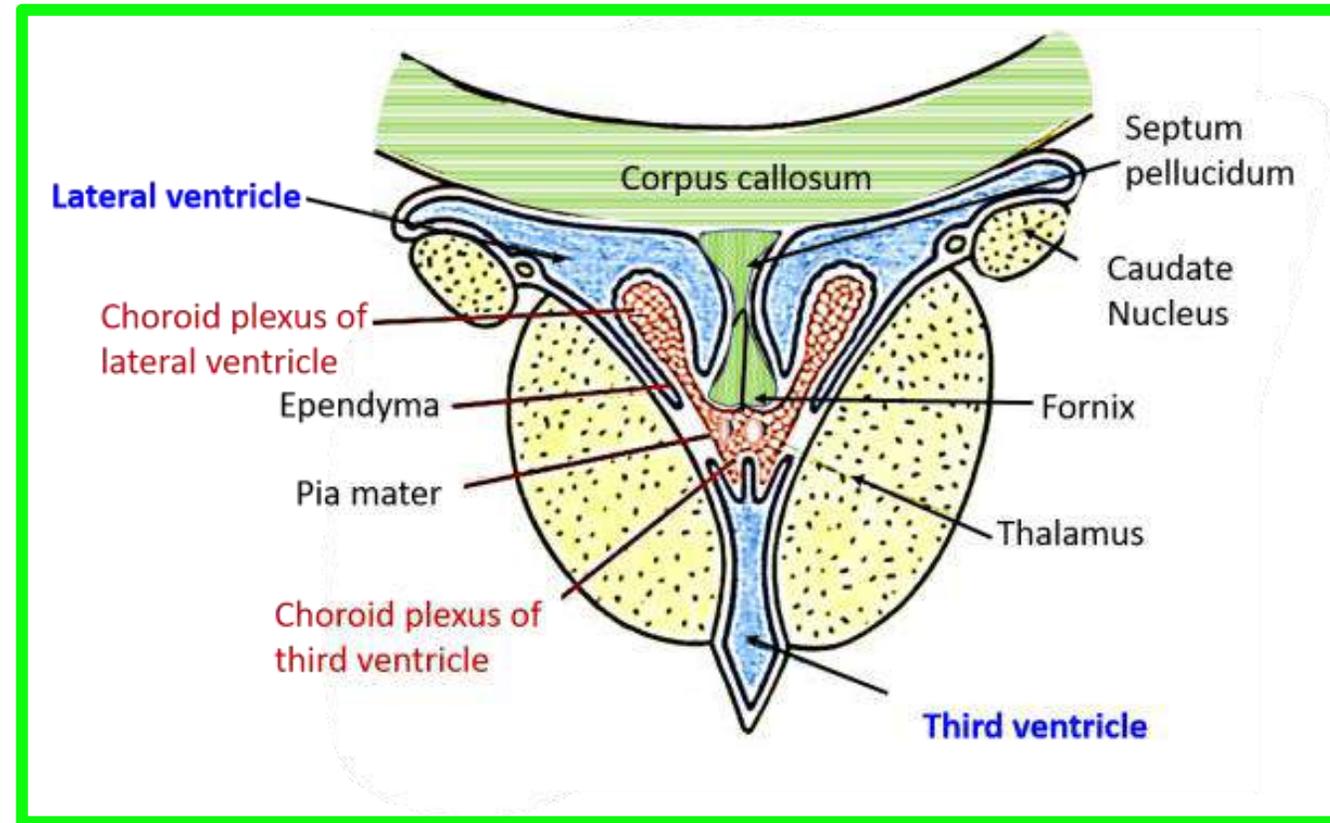
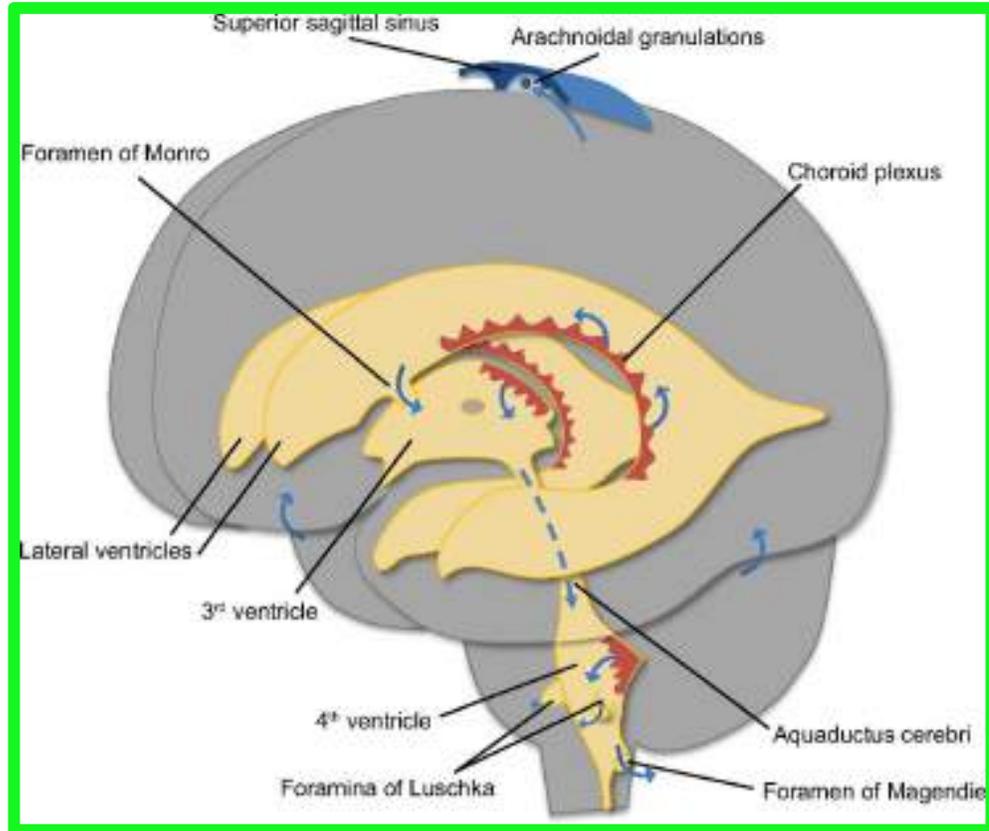
- ❖ The cerebrospinal fluid is produced by the choroid plexuses within the lateral, third, and fourth ventricles of the brain.
- ❖ It escapes from the ventricular system of the brain through the three foramina in the roof of the fourth ventricle and so enters the subarachnoid space.
- ❖ It now circulates both upward over the surfaces of the cerebral hemispheres and downward around the spinal cord.
- ❖ The spinal subarachnoid space extends down as far as the second sacral vertebra
- ❖ Eventually, the fluid enters the bloodstream by passing into the arachnoid villi and diffusing through their walls.



- ❖ The pia mater **is a vascular membrane** covered by flattened mesothelial cells. It closely invests the brain, covering the gyri and descending into the deepest sulci
- ❖ It extends out over the cranial nerves and fuses with their epineurium.
- ❖ **The cerebral arteries entering the substance of the brain carry a sheath of pia with them.**



- ❖ The pia mater forms **the tela choroidea** of the roof of the third and fourth ventricles of the brain,
- ❖ and it fuses with the ependyma to form **the choroid plexuses** in the **lateral, third, and fourth ventricles** of the brain.



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