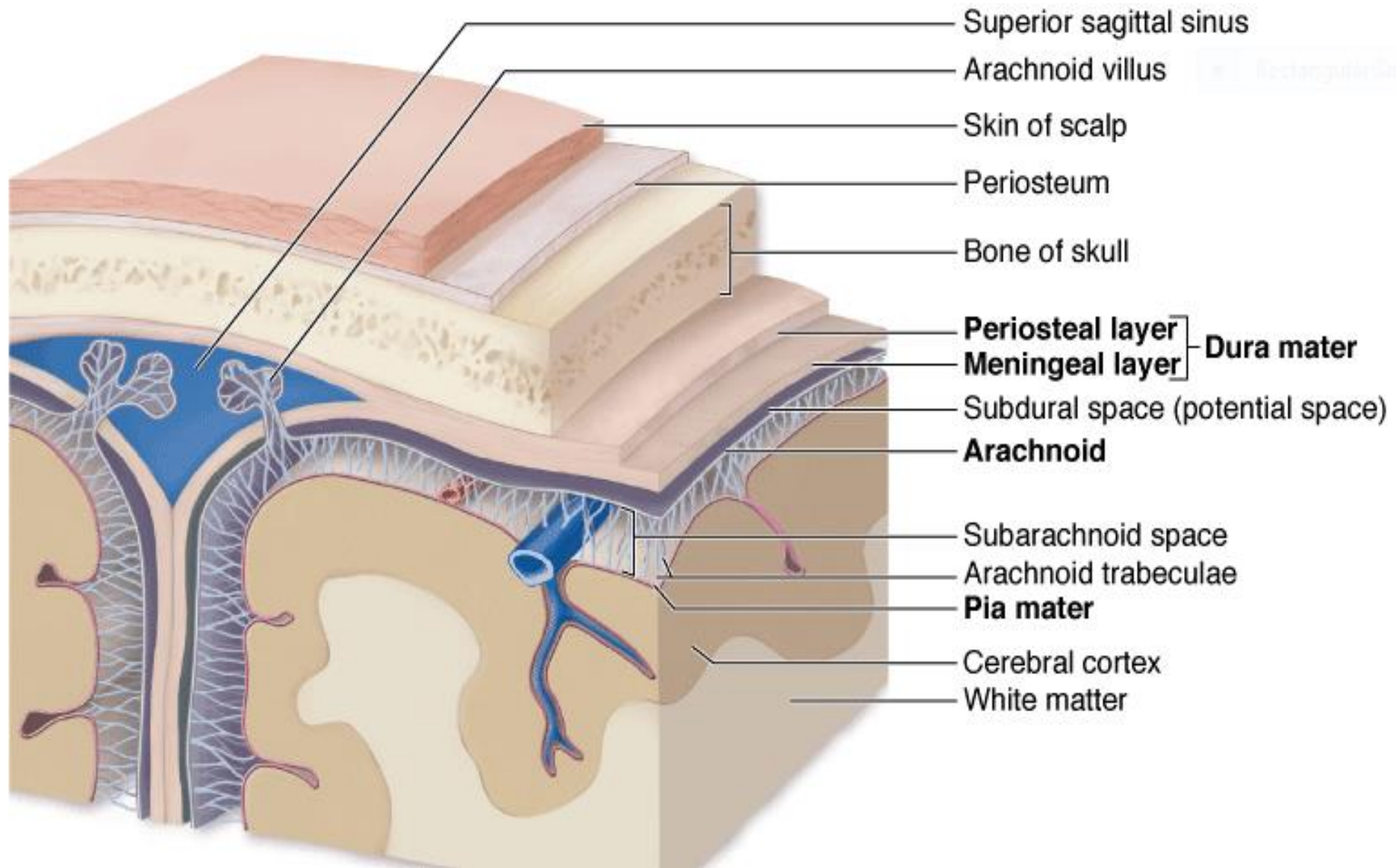


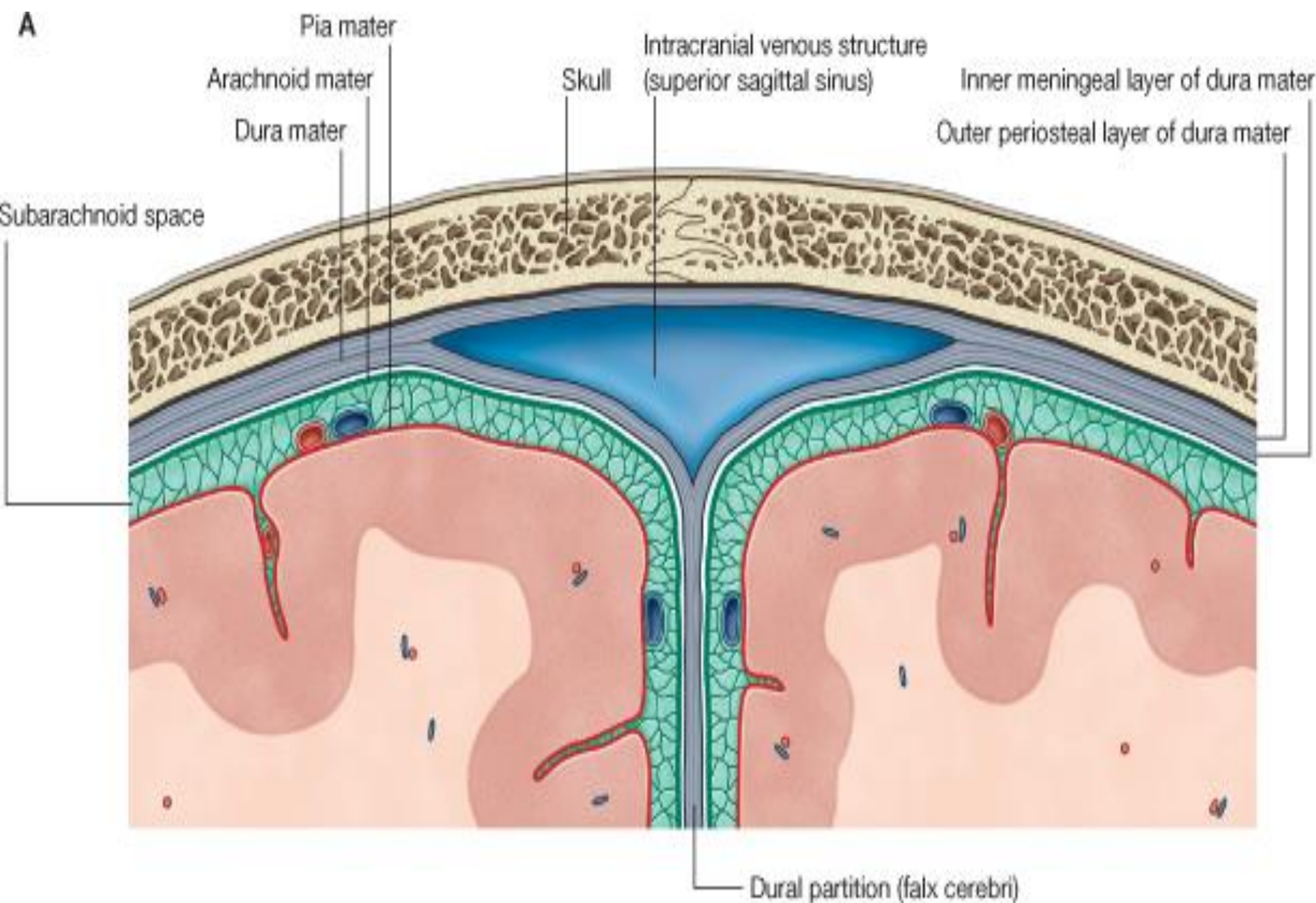
MENINGES

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Meninges

- The meninges is the envelop the brain and spinal cord.
- Support and protection.
- **Three layers:**
 - **Dura mater** (pachymeninx)-outermost.
 - **Arachnoid mater**-middle.
 - **Pia mater**-innermost.





Dura mater

- Opaque, tough and fibrous layer.
- Predominantly acellular with mainly of densely packed collagen fibres.
- Incompletely divides the cranial cavity into compartments and accommodates the dural venous sinuses.
- **Two potential spaces**
 - Epidural and subdural space.

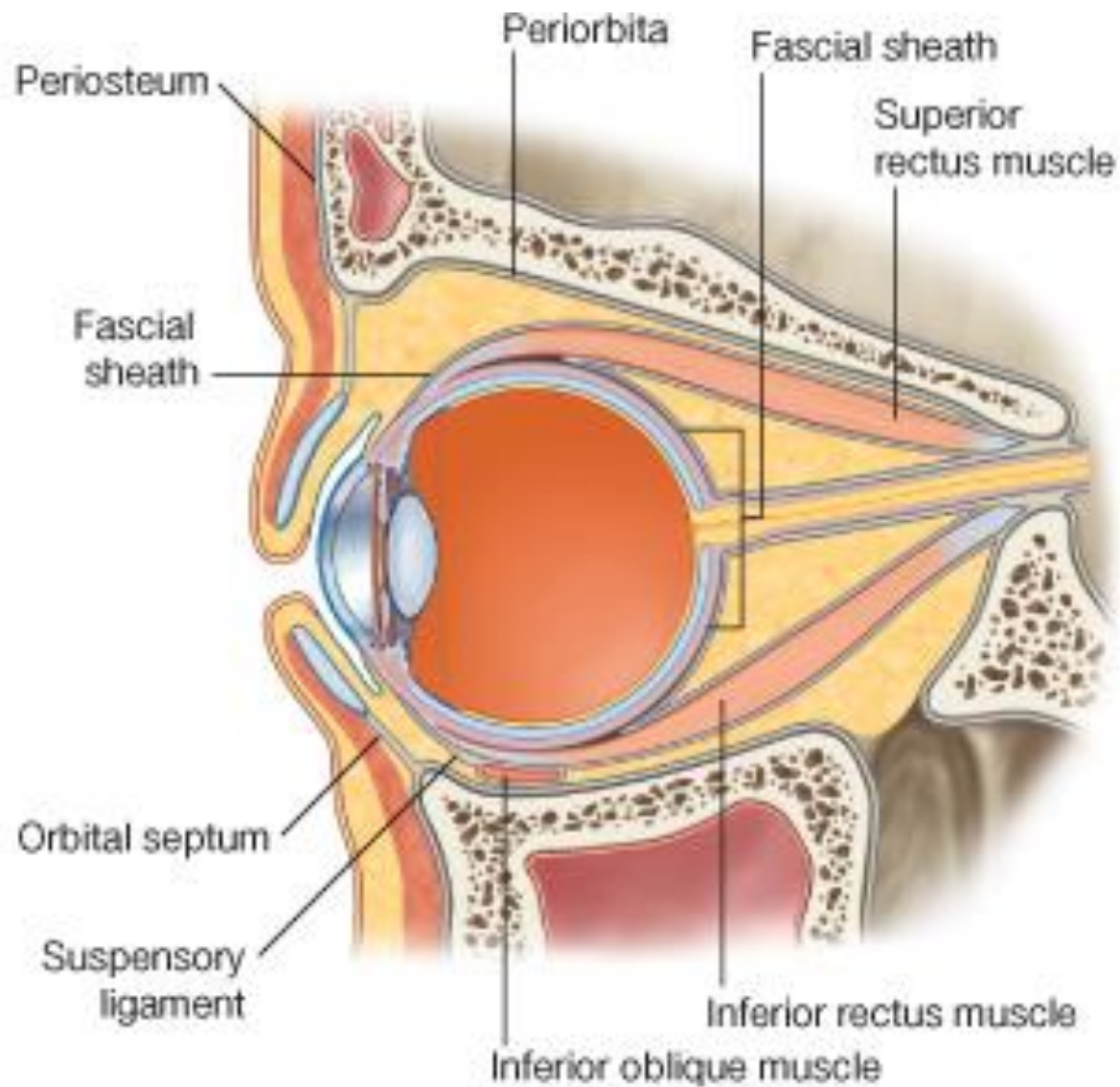
- **Epidural space:**
 - Epidural hematoma—due to meningeal arteries damage.
- **Subdural space:**
 - Bleeding due to the cerebral veins as they traverse this space to drain into the superior sagittal sinus.

- **Has two layers**
 - Inner meningeal layer.
 - Outer endosteal layer.
- United except at the dural venous sinuses.
- Both layers contain **the fibroblasts**; endosteal also contains **the osteoblast cells.**

- Adherent to the inner surface of the skull bones, particularly at the sutures, cranial base and foramen magnum.
- **Endosteal layer:**
 - Continuous with the pericranium through the sutures, and foramen, and orbital periosteum through the superior orbital fissure.

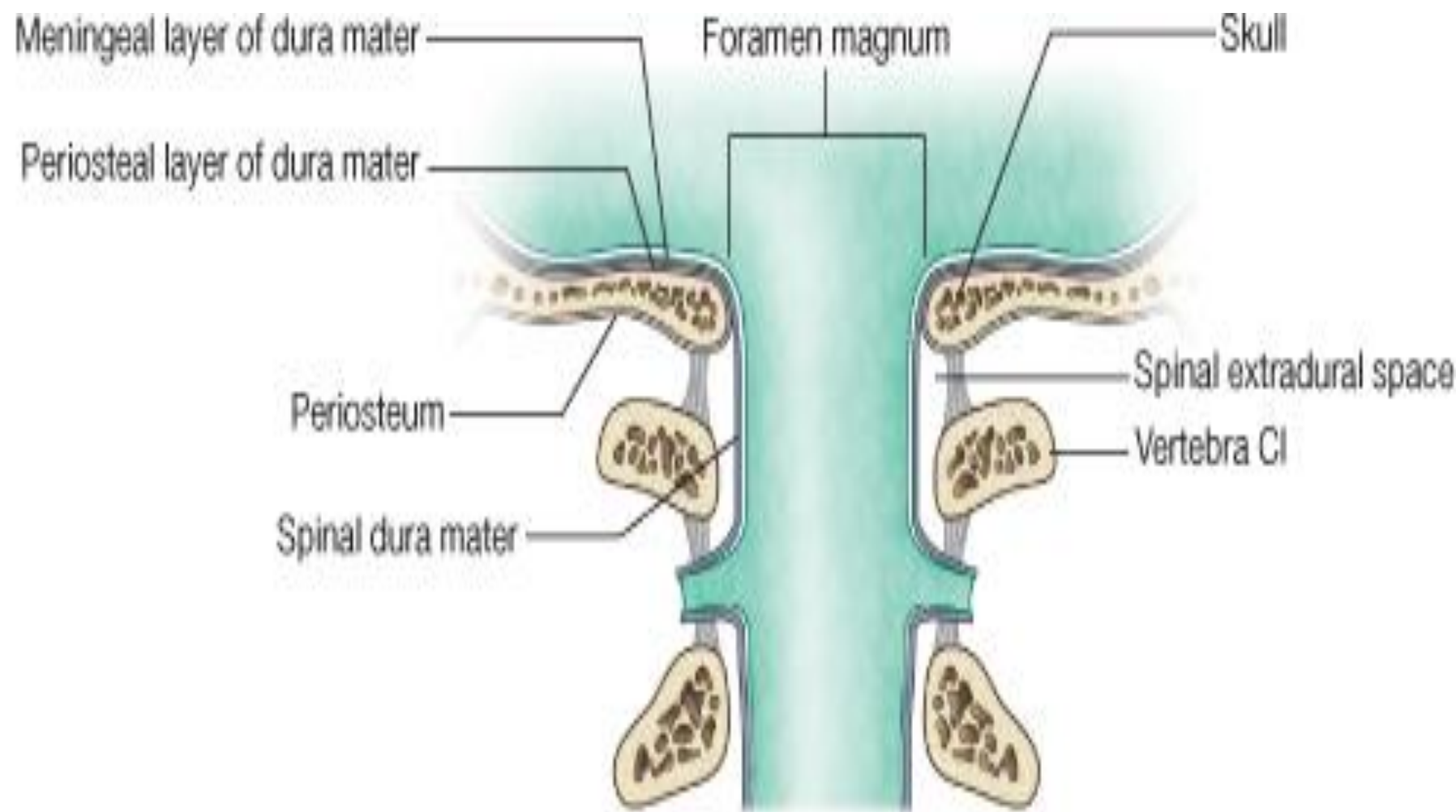
- **Meningeal layer:**

- Fuses with the epineurium of the cranial nerves as they pass out from the cranial foramina.
- Closely applied to the arachnoid mater.
- Dura mater surrounding the optic nerve is continuous with the sclera of the eye ball.
- Dura mater fuses with the adventitia of major vessels as they pierce the dura mater to enter into the cranial cavity.



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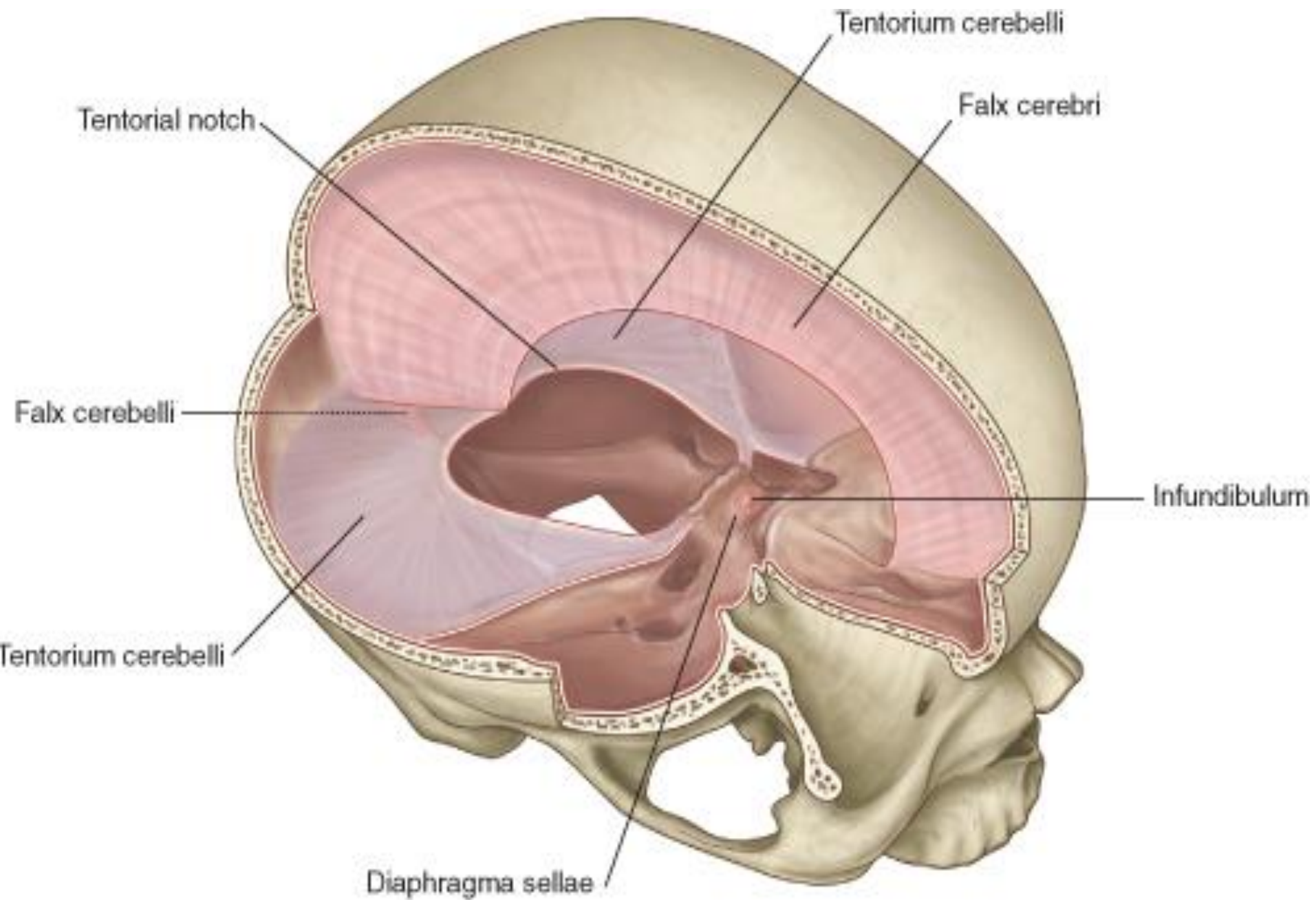
B



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Dural partitions

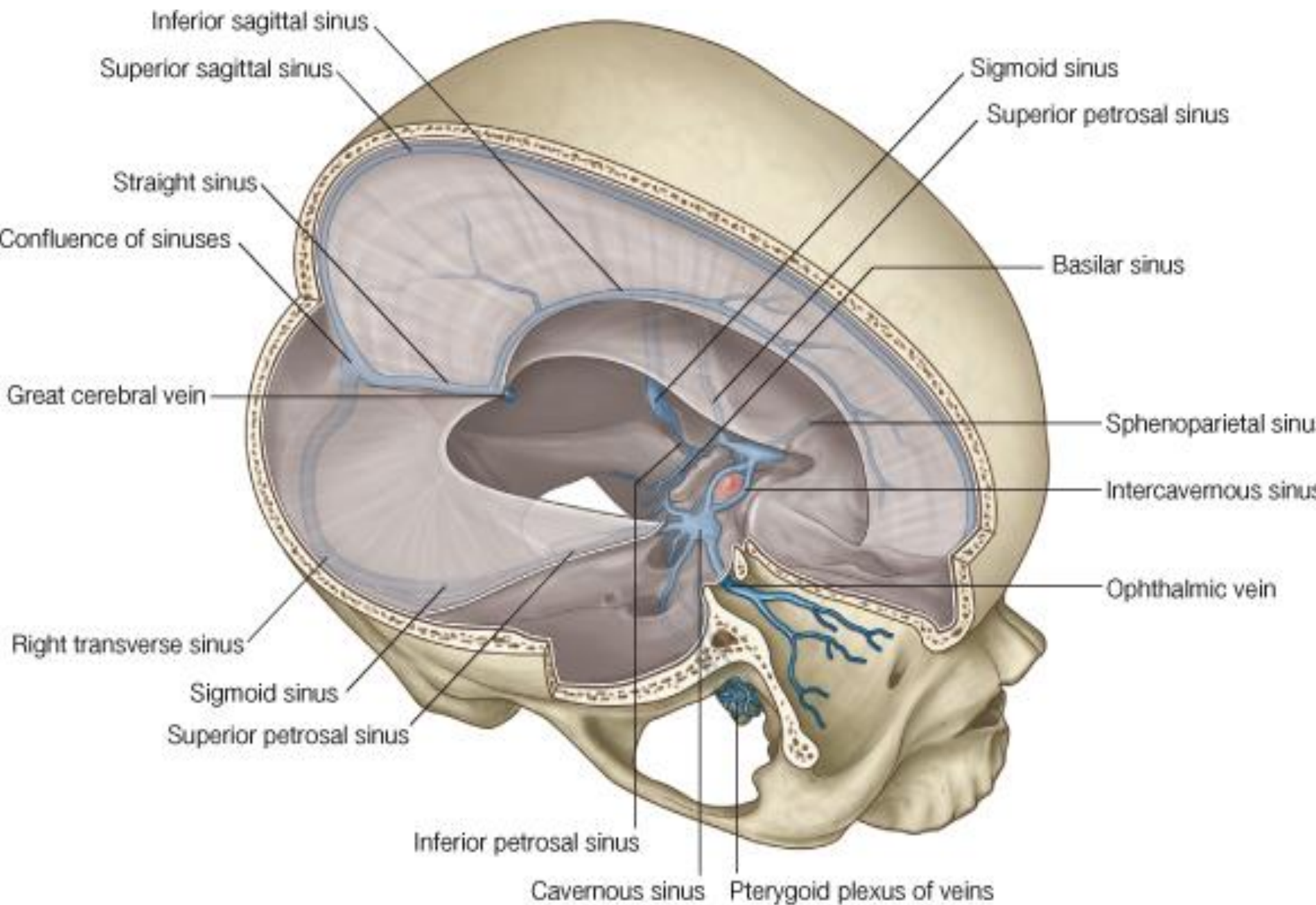
- Inner layer reflected inwards to form four septa.
 - **Falx cerebri**
 - **Falx cerebelli**
 - **Tentorium cerebelli**
 - **Diaphragm sellae.**



Falx cerebri

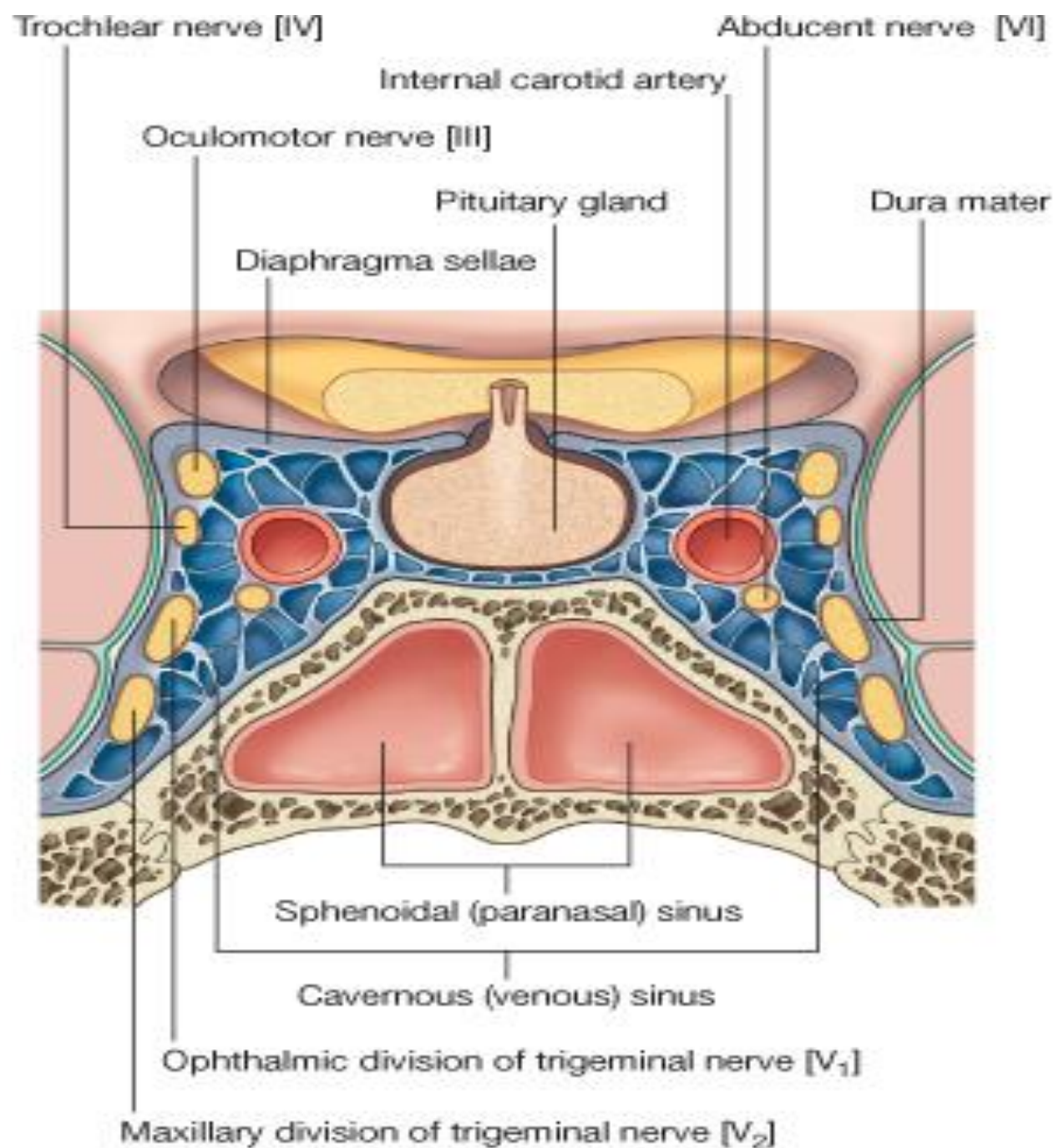
- Strong, crescent-shaped, lies in sagittal plane and occupies the longitudinal fissure.
- **Narrow anterior**-attached to the crista galli of ethmoid bone.
- **Broader Posterior**-blends with the tentorium cerebelli.
- Straight sinus along the attachment.

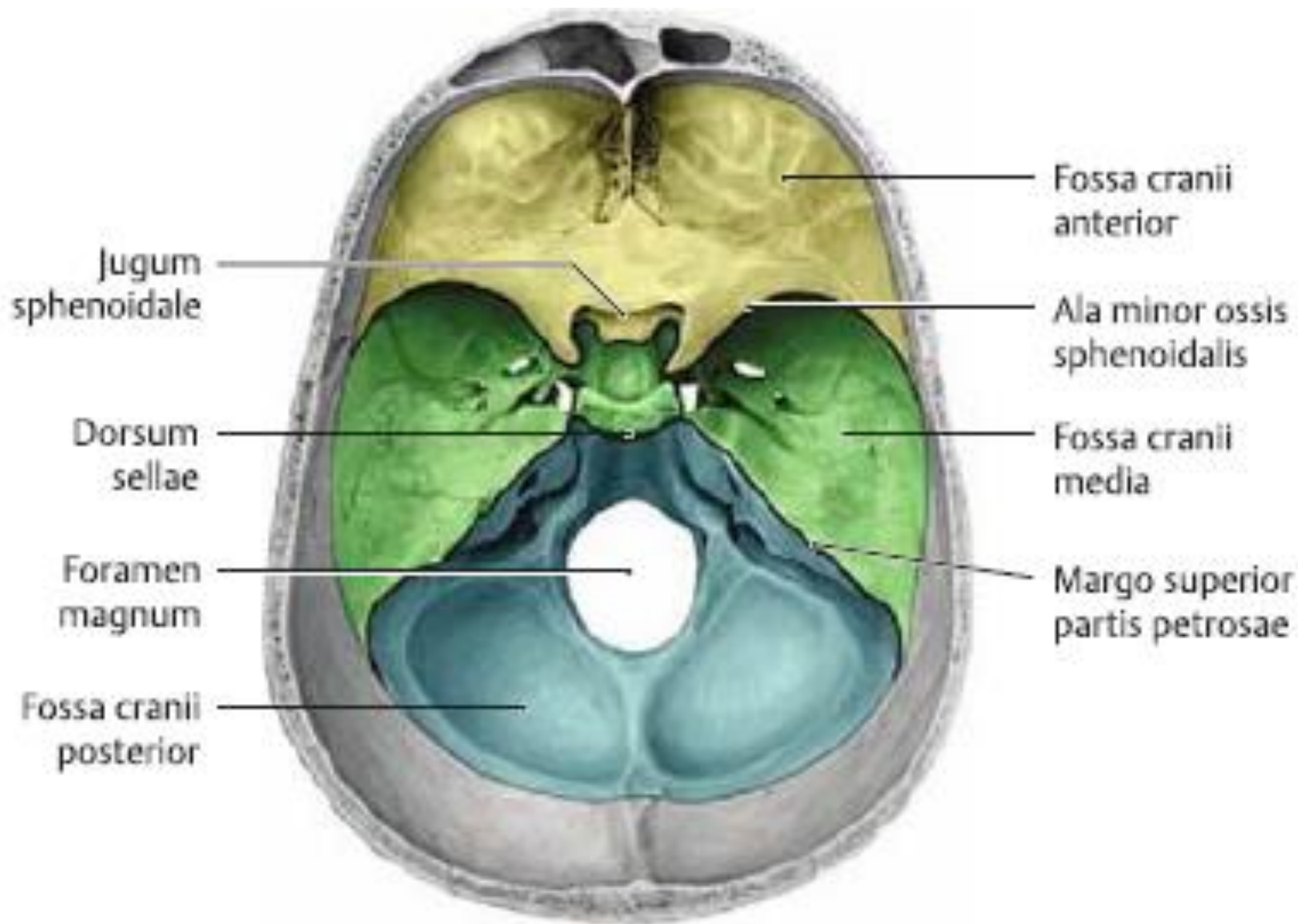
- **Superior sagittal sinus:**
 - Along the attachment of the superior convex margin as far as the internal occipital protuberance.
- **Inferior sagittal sinus:**
 - Inferior concave free margin.



Diaphragma sellae

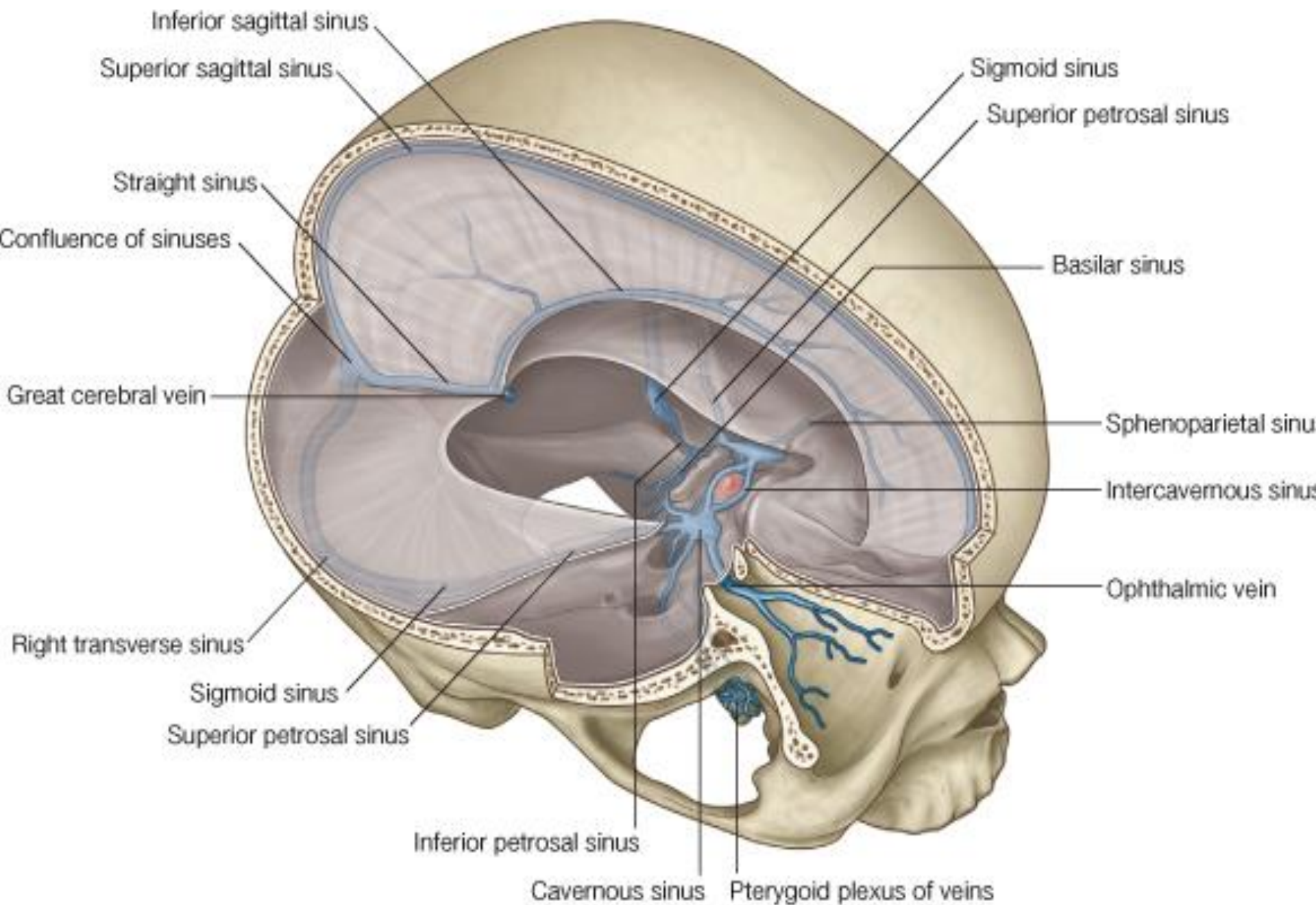
- Small, circular, horizontal sheet of dura mater attached laterally to the clinoid processes.
- Forms the roof of the sella turcica
- Almost completely covers the pituitary gland except at the center for the passage of the infundibulum and pituitary stalk.





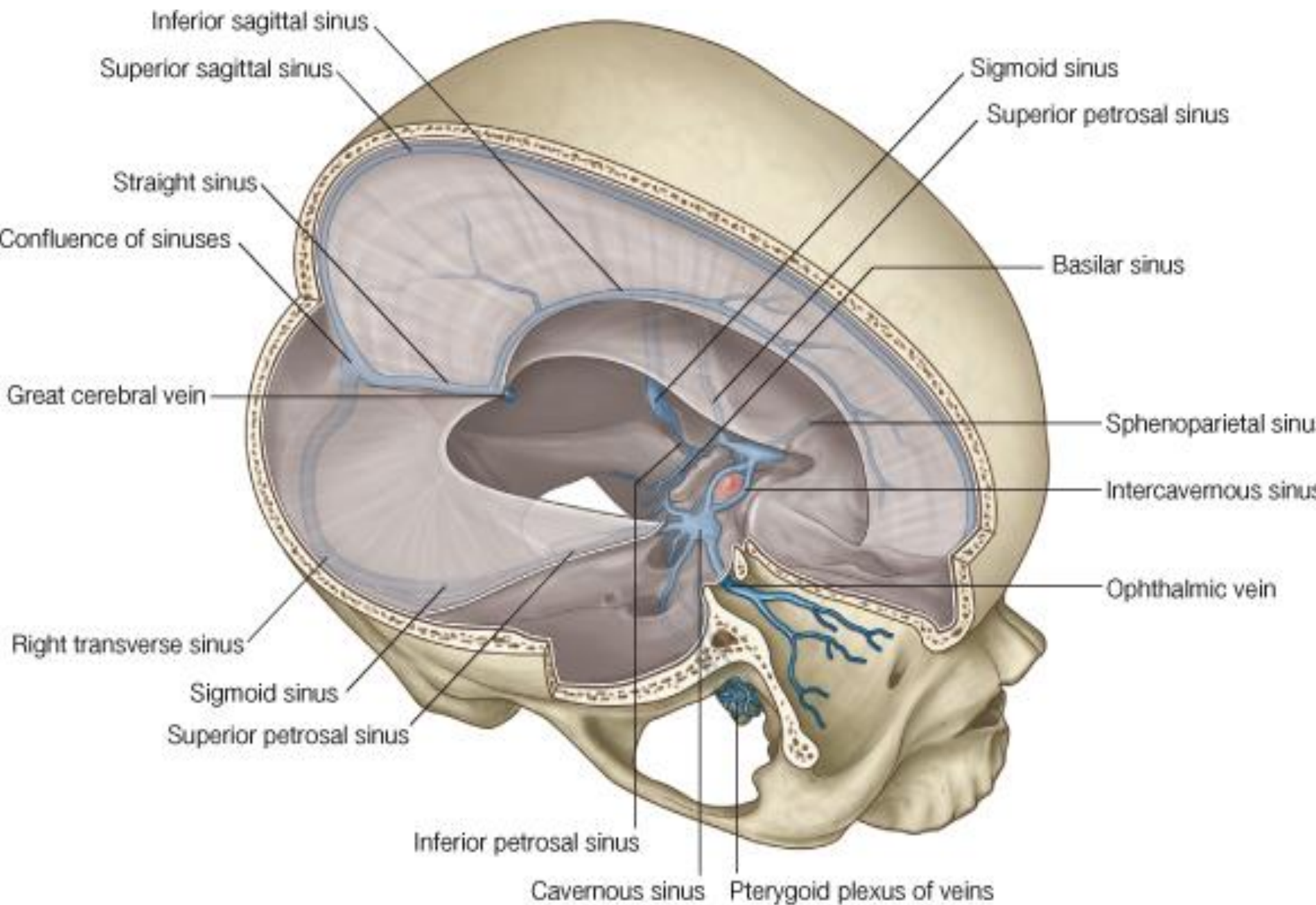
Falx cerebelli

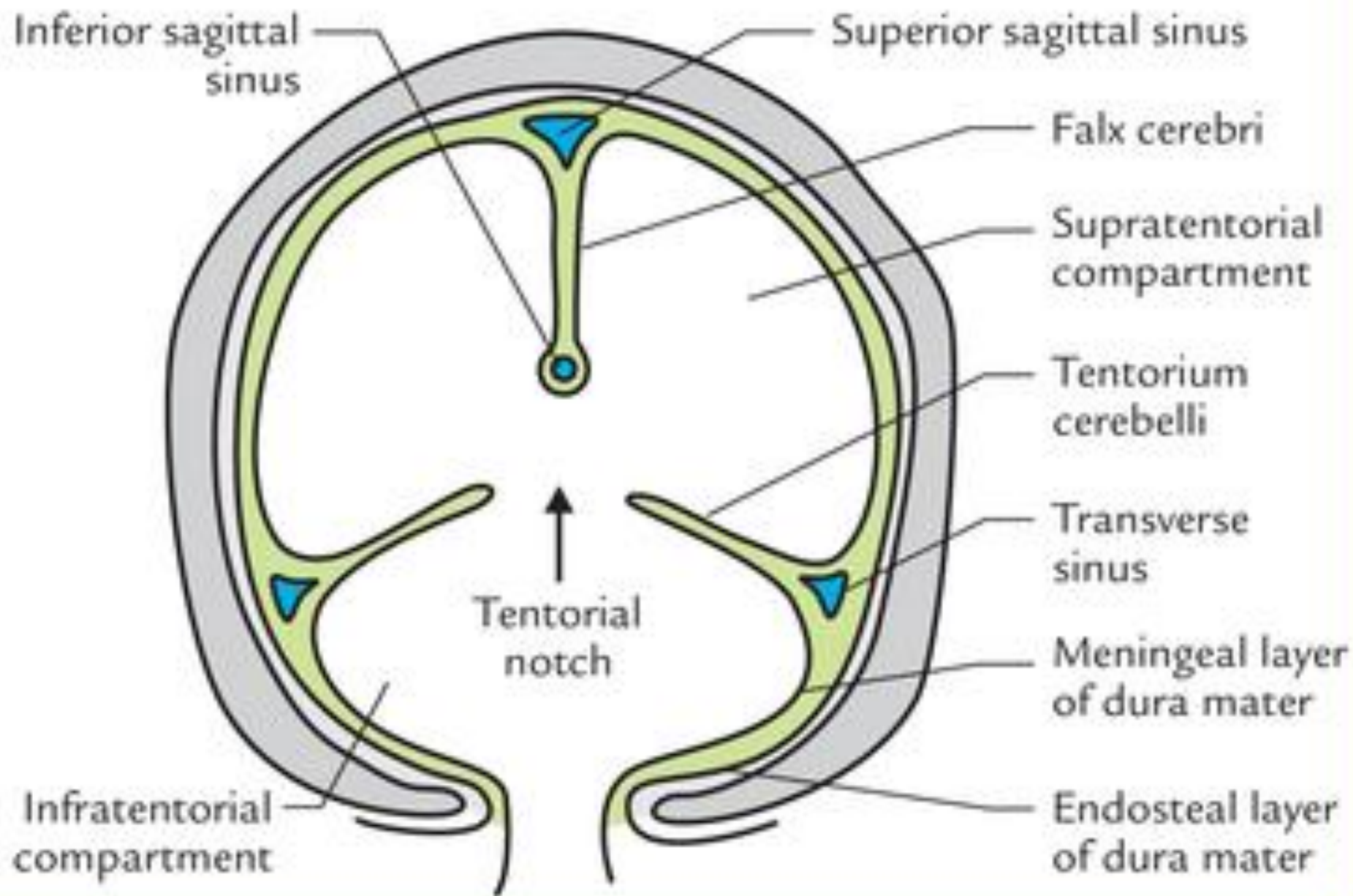
- Small midline fold lying below the tentorium cerebelli
- Projects anteriorly into the posterior cerebellar notch between two cerebellar hemispheres.
- Occipital sinus in the posterior attached border to the occipital bone.

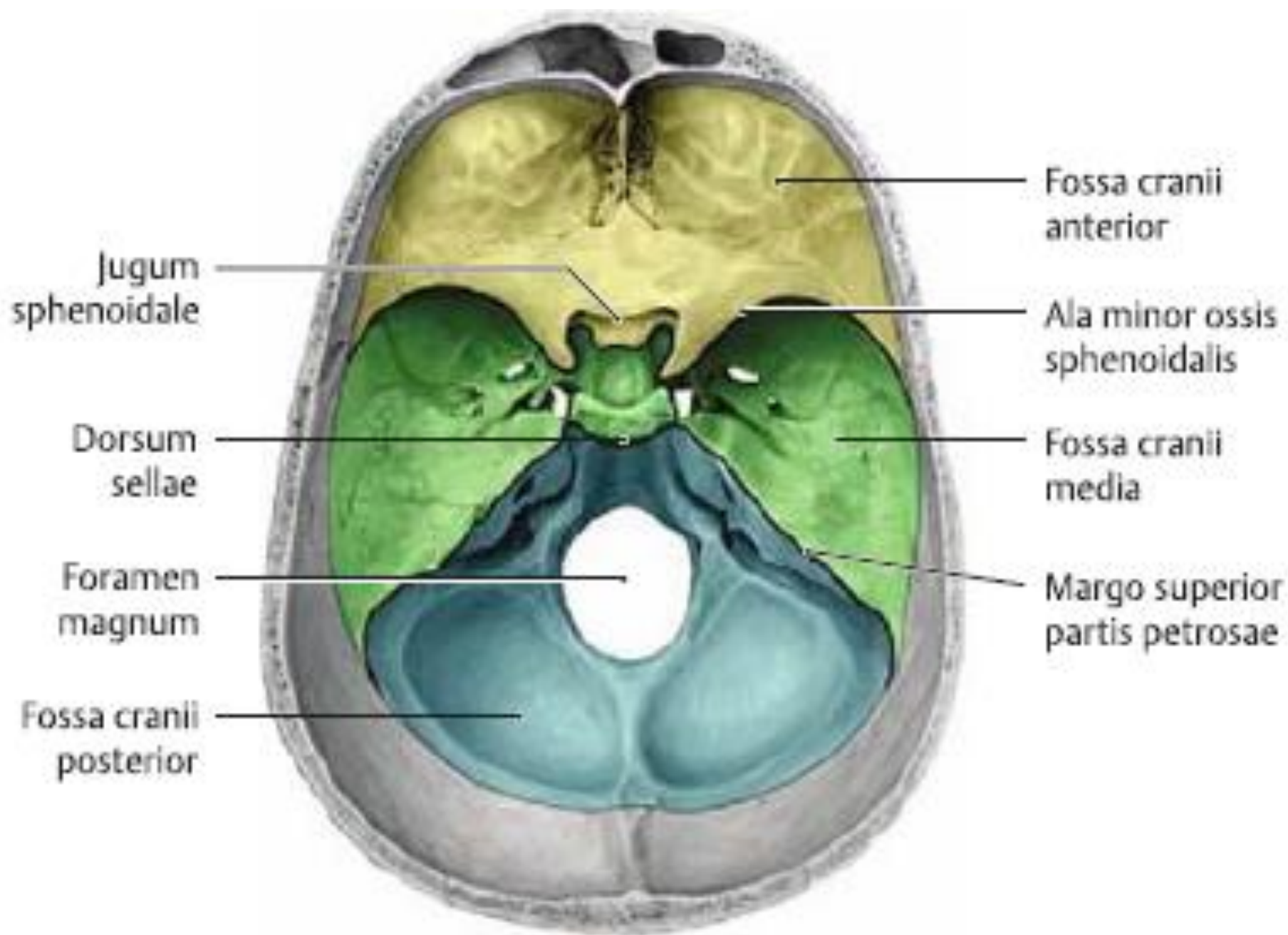


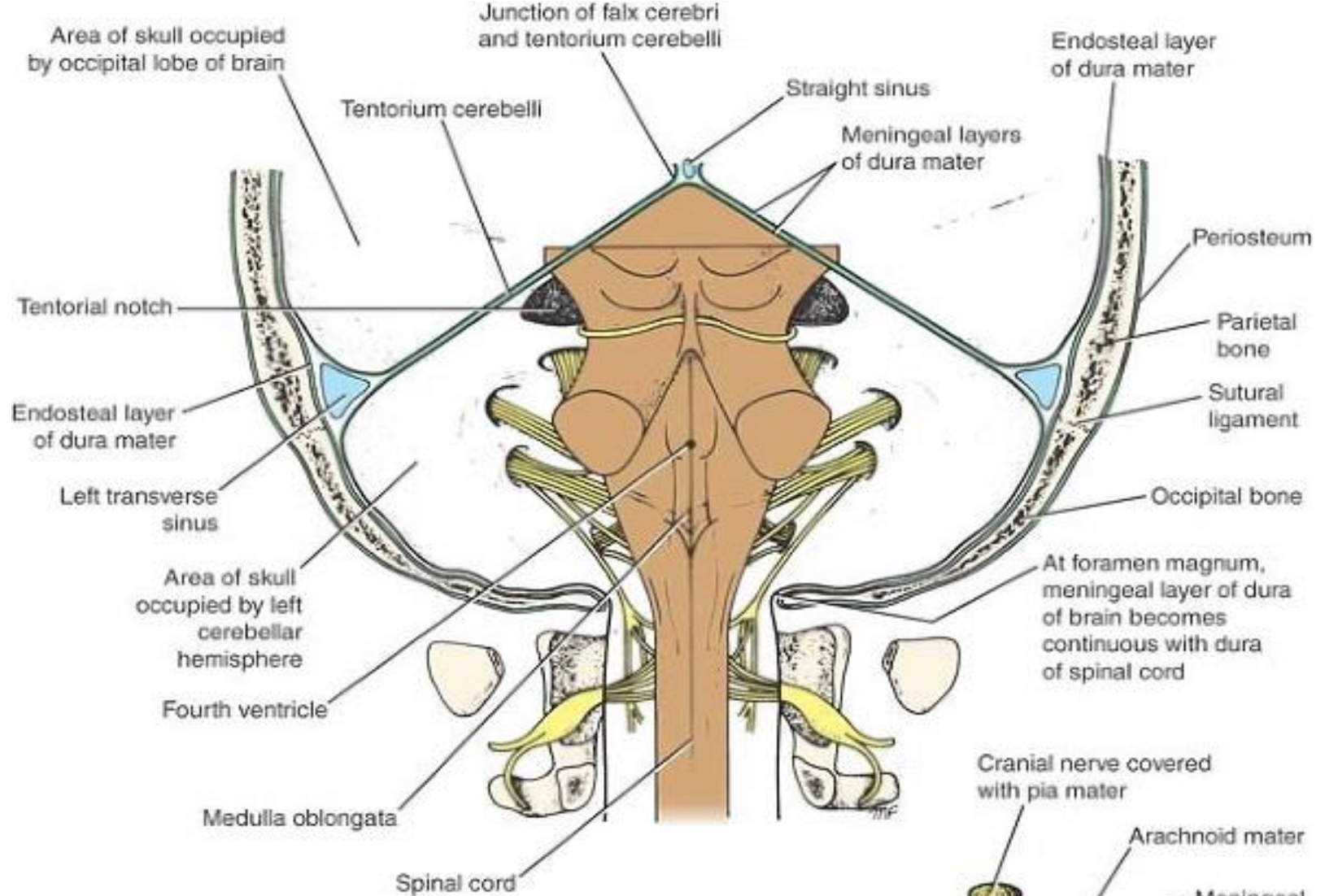
Tentorium cerebelli

- Single-poled tent shaped.
- Lies between the cerebellum and the occipital lobes of the cerebrum.
- Divides the cranial cavity into the
 - **Supratentorial** compartment containing forebrain and **infratentorial** compartment containing the hind brain.
- Attached medially to the base of the falx cerebri.
- Peripheral attachments :
 - Internal occipital protuberance-groove for the transverse sinus -superior border(crest) of petrous part of temporal bone to reach the posterior clinoid process.

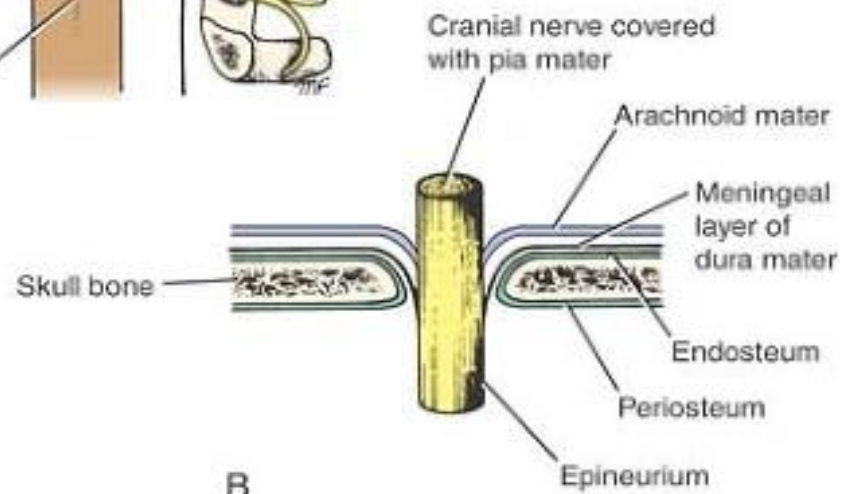






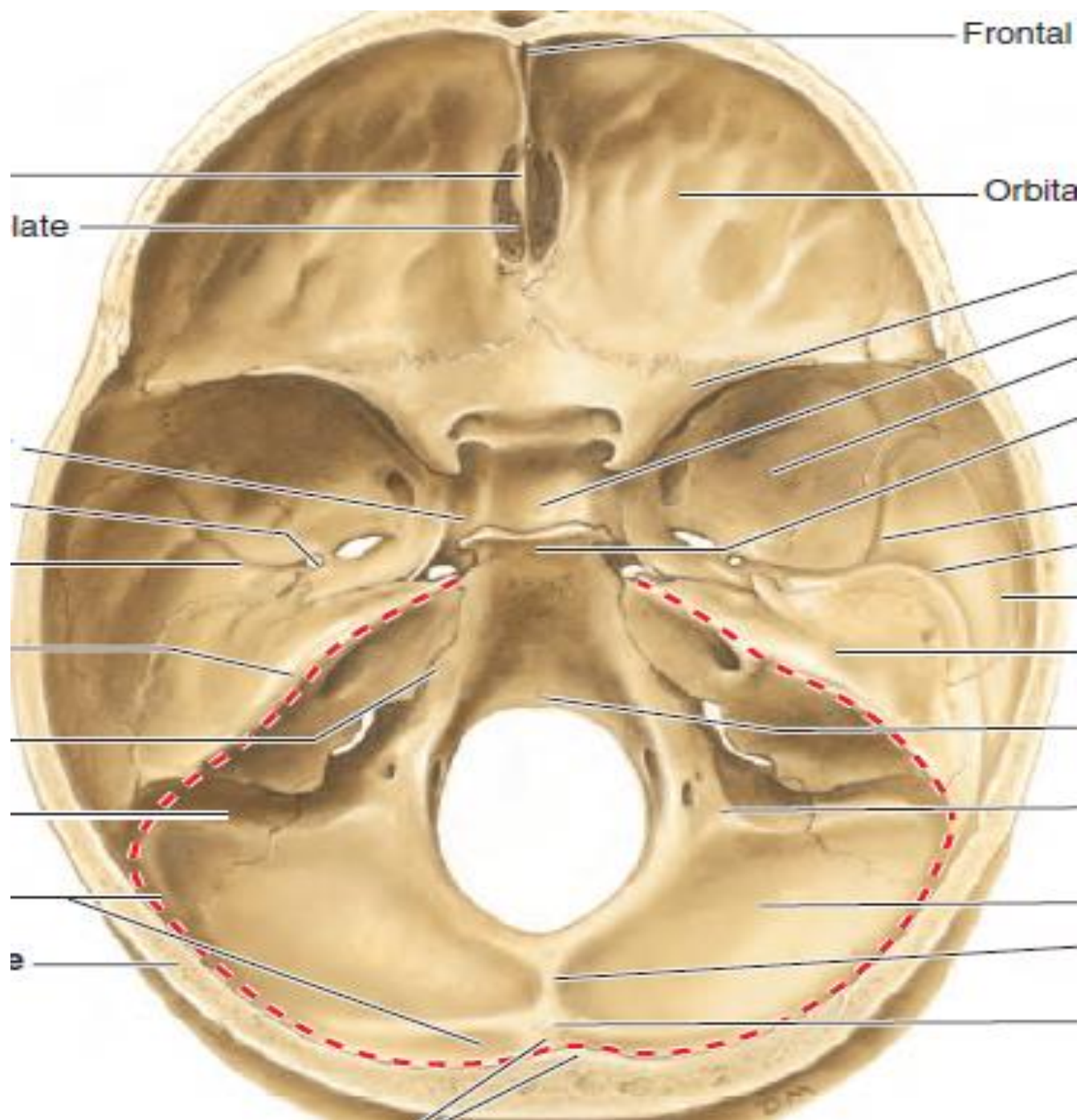


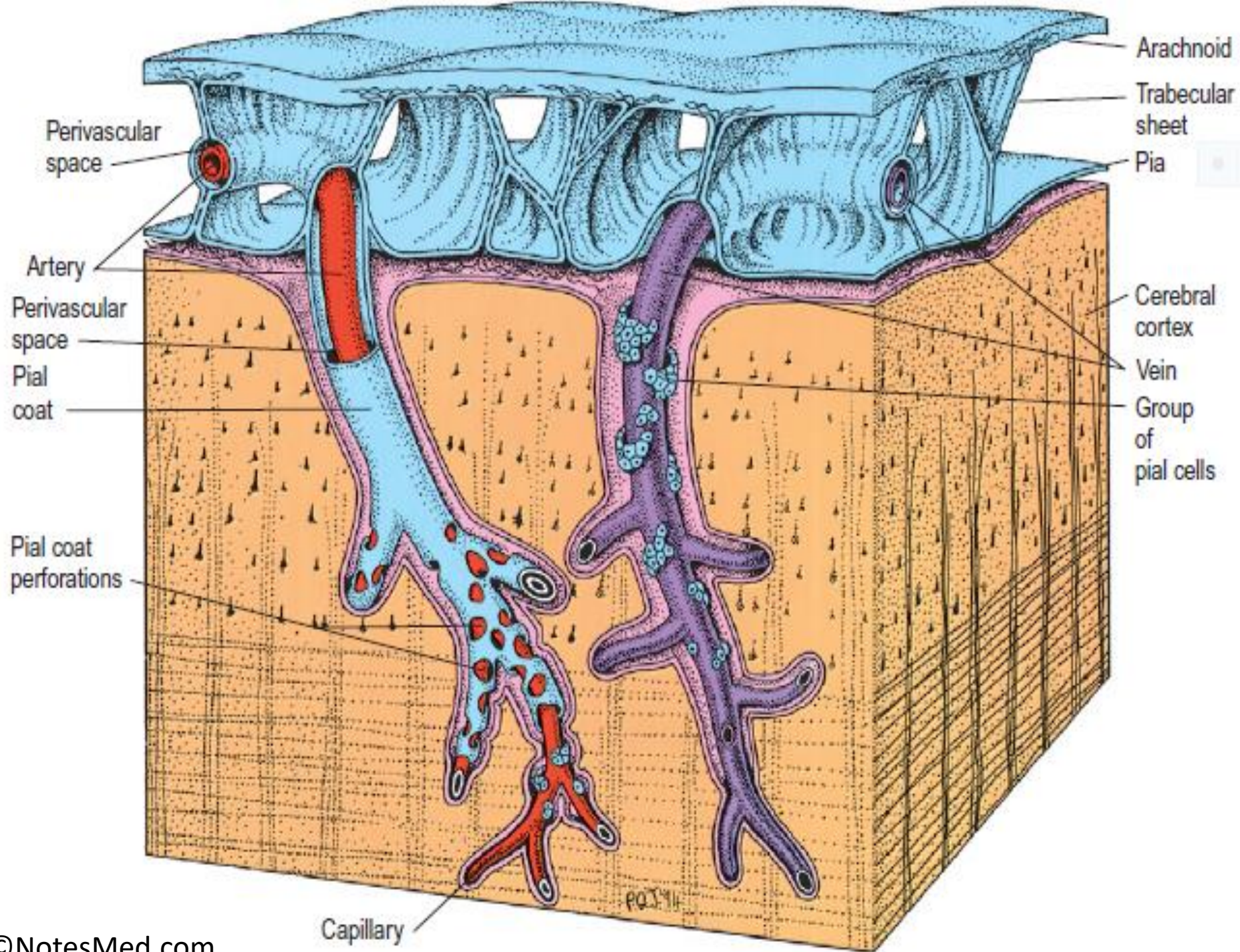
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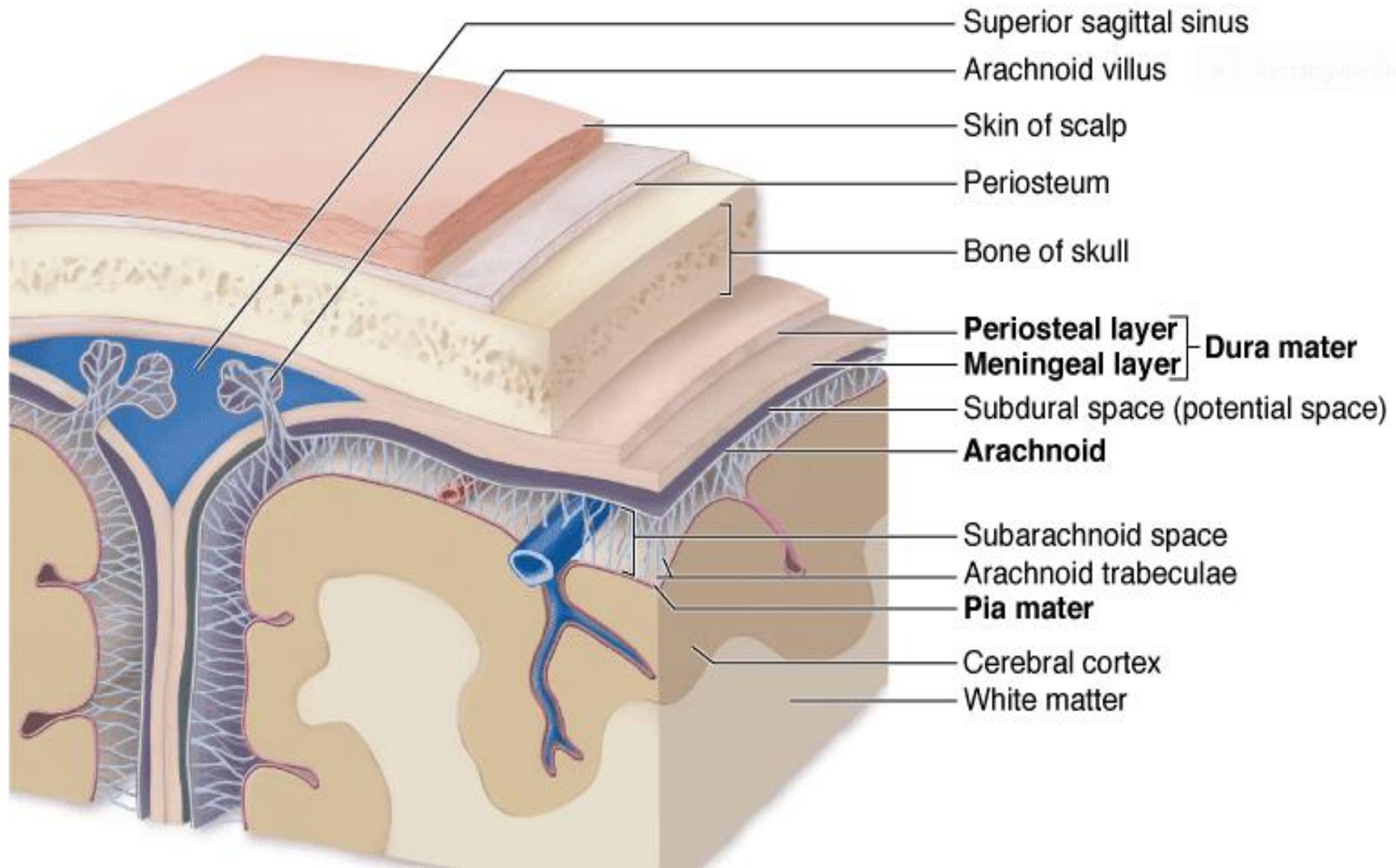


B

- Free border forms the tentorial notch.
- Passes anteriorly over the peripheral attachment of the tentorium cerebelli and attaches to the anterior clinoid process of the sphenoid bone.
- Notch embraces the midbrain.
 - herniation through the notch from supratentorial compartment.

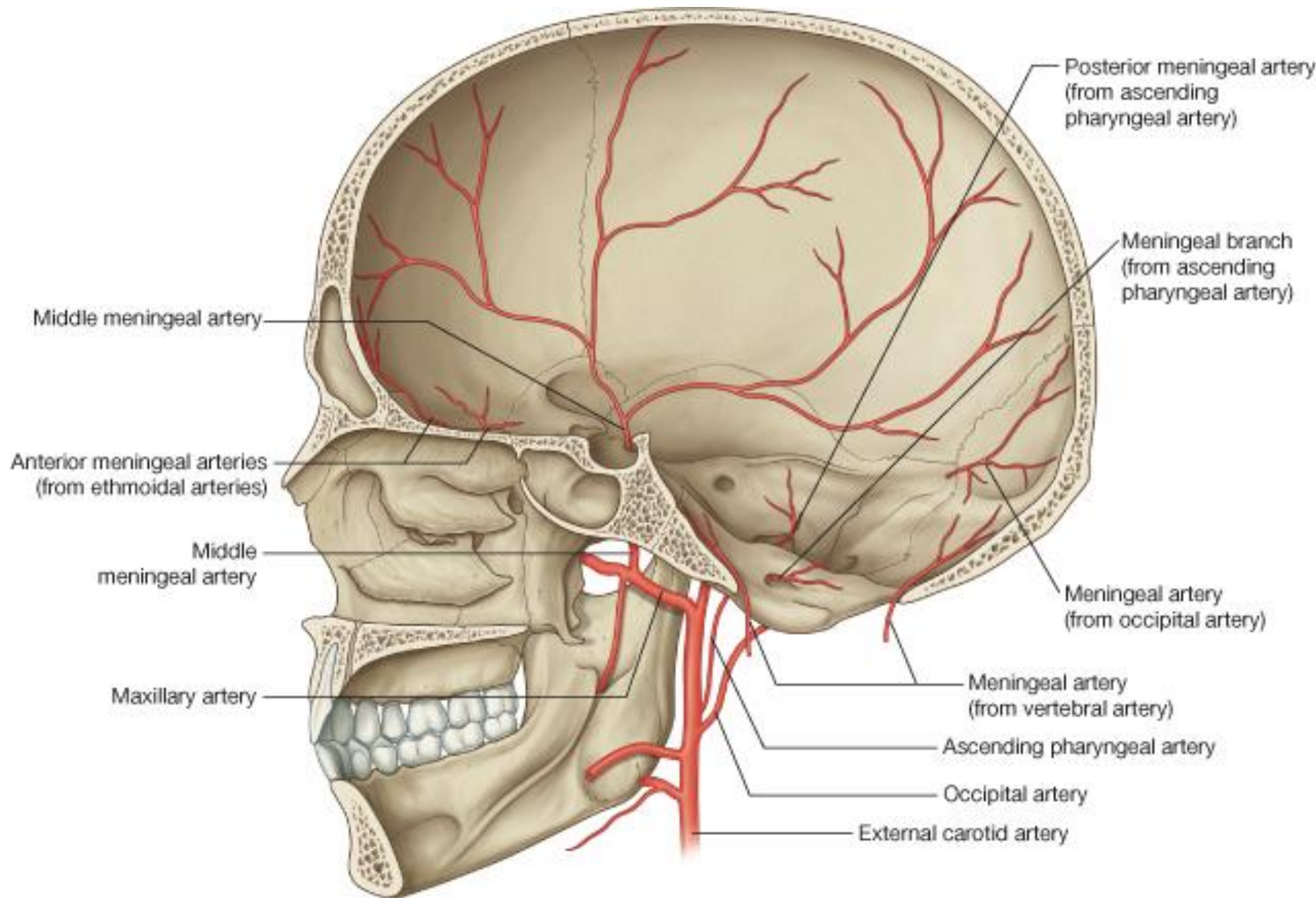


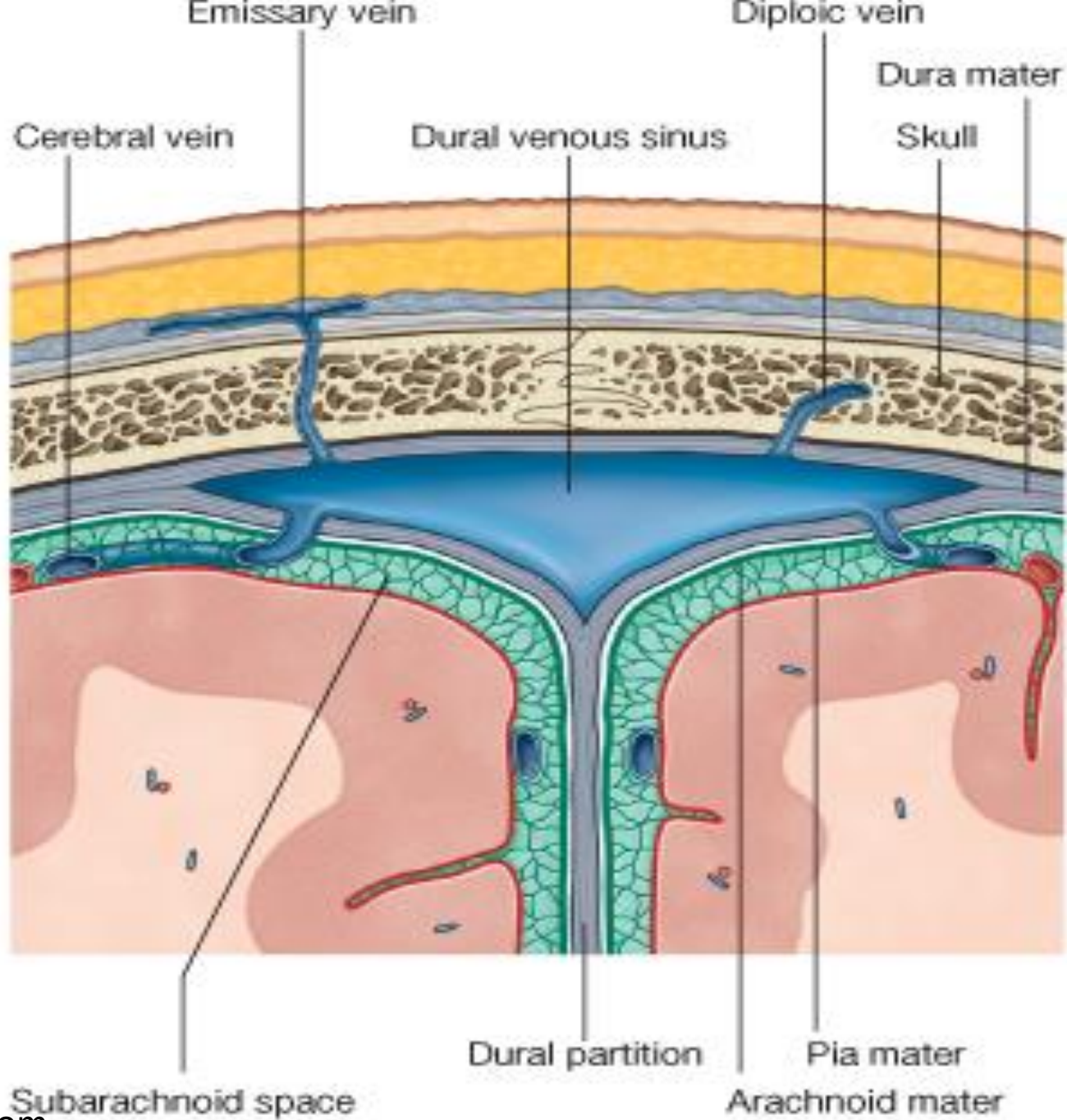




Blood supply

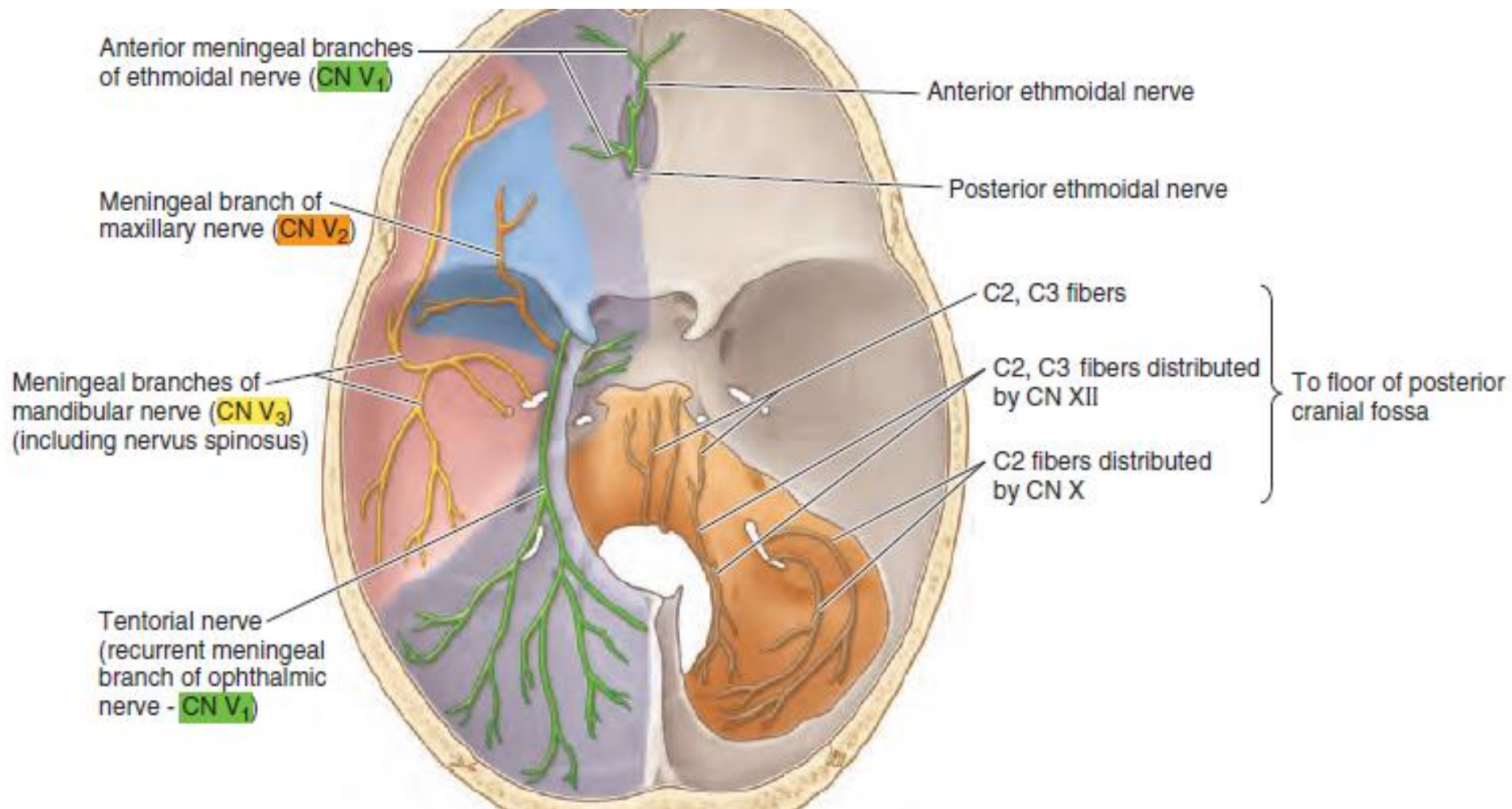
- **Arterial supply:**
 - **Meningeal arteries:**
 - Periosteal arteries lie embedded in the outer layer of dura mater.
 - **Supply**
 - Dura mater, inner table of the skull, bone marrow of diploe.
- **Venous drainage:**
 - **Meningeal veins**
 - Accompany the arteries and communicate with the venous sinuses and diploic veins.

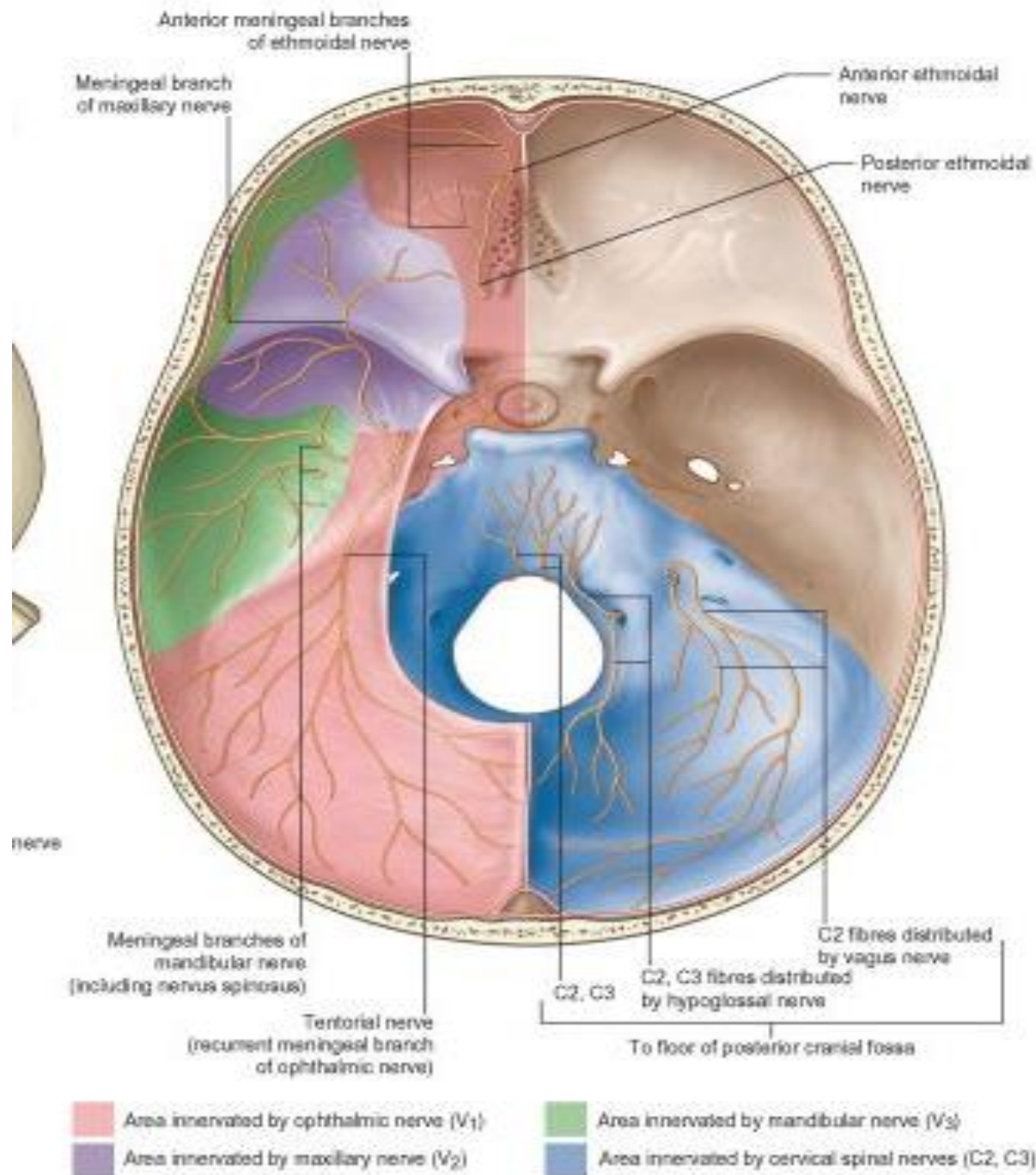




Innervation of cranial dura mater

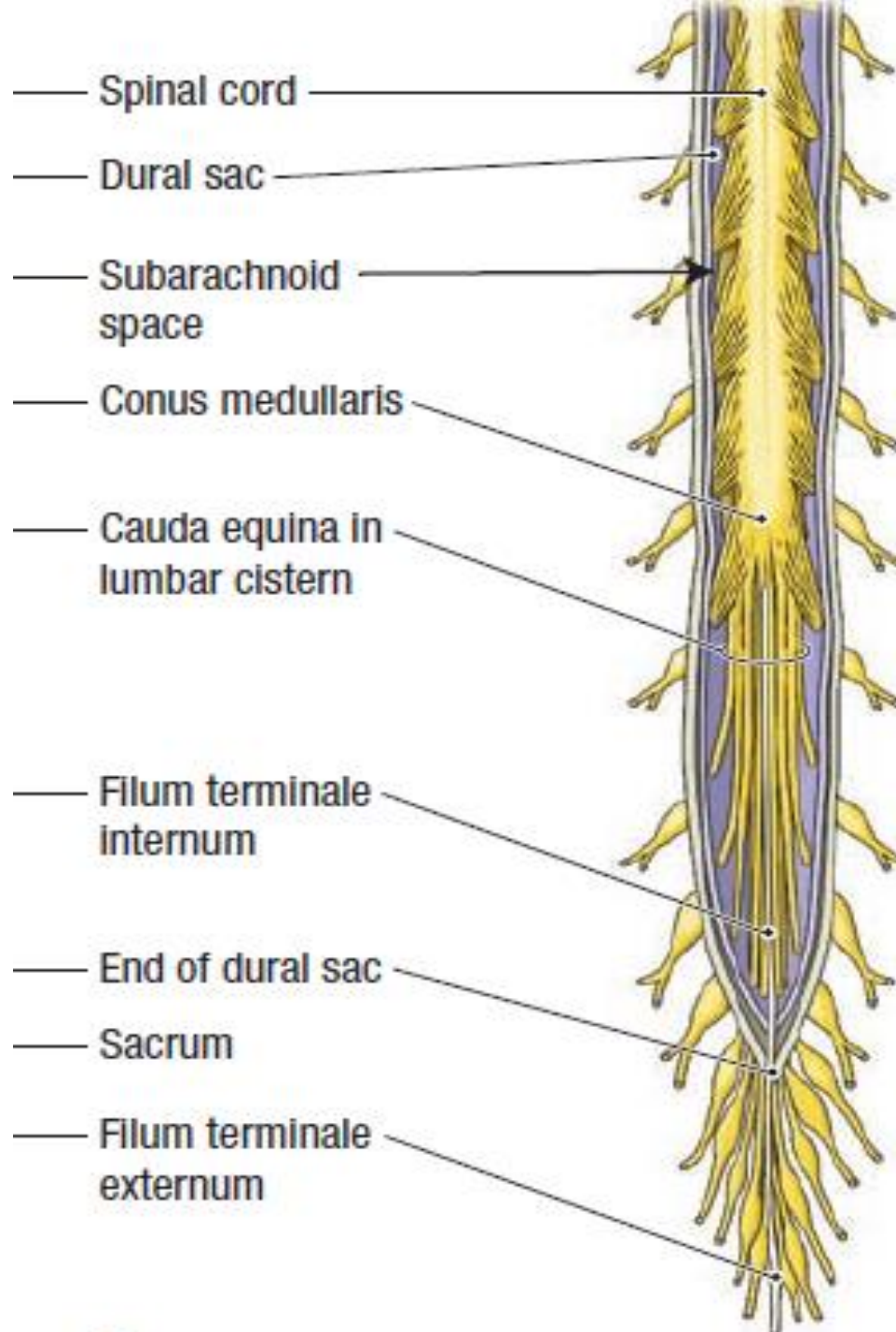
- Mainly from the three divisions of the trigeminal nerve, second and third cervical spinal nerves, and cervical sympathetic trunk
- Meningeal branches from vagus and hypoglossal nerves.

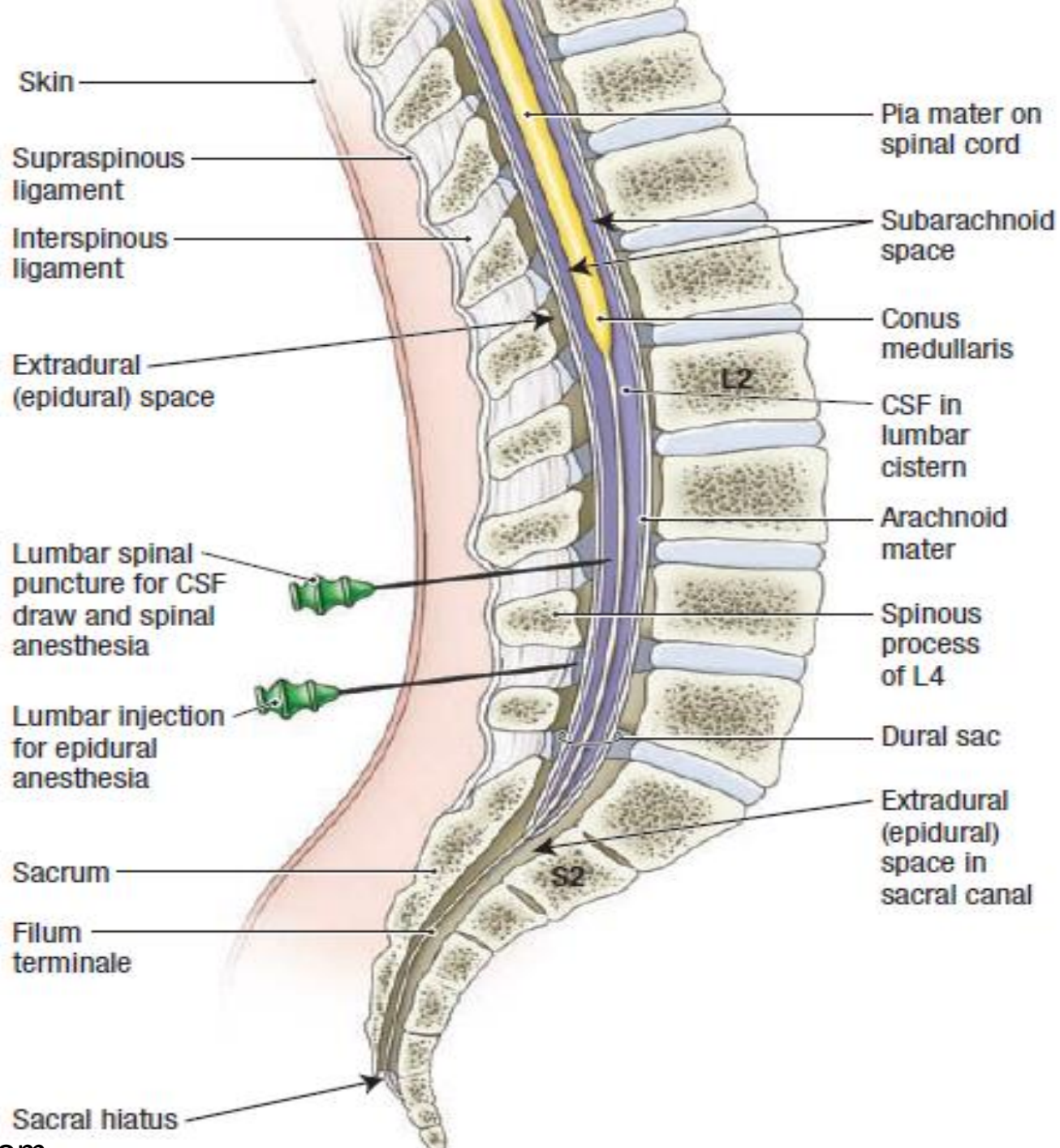


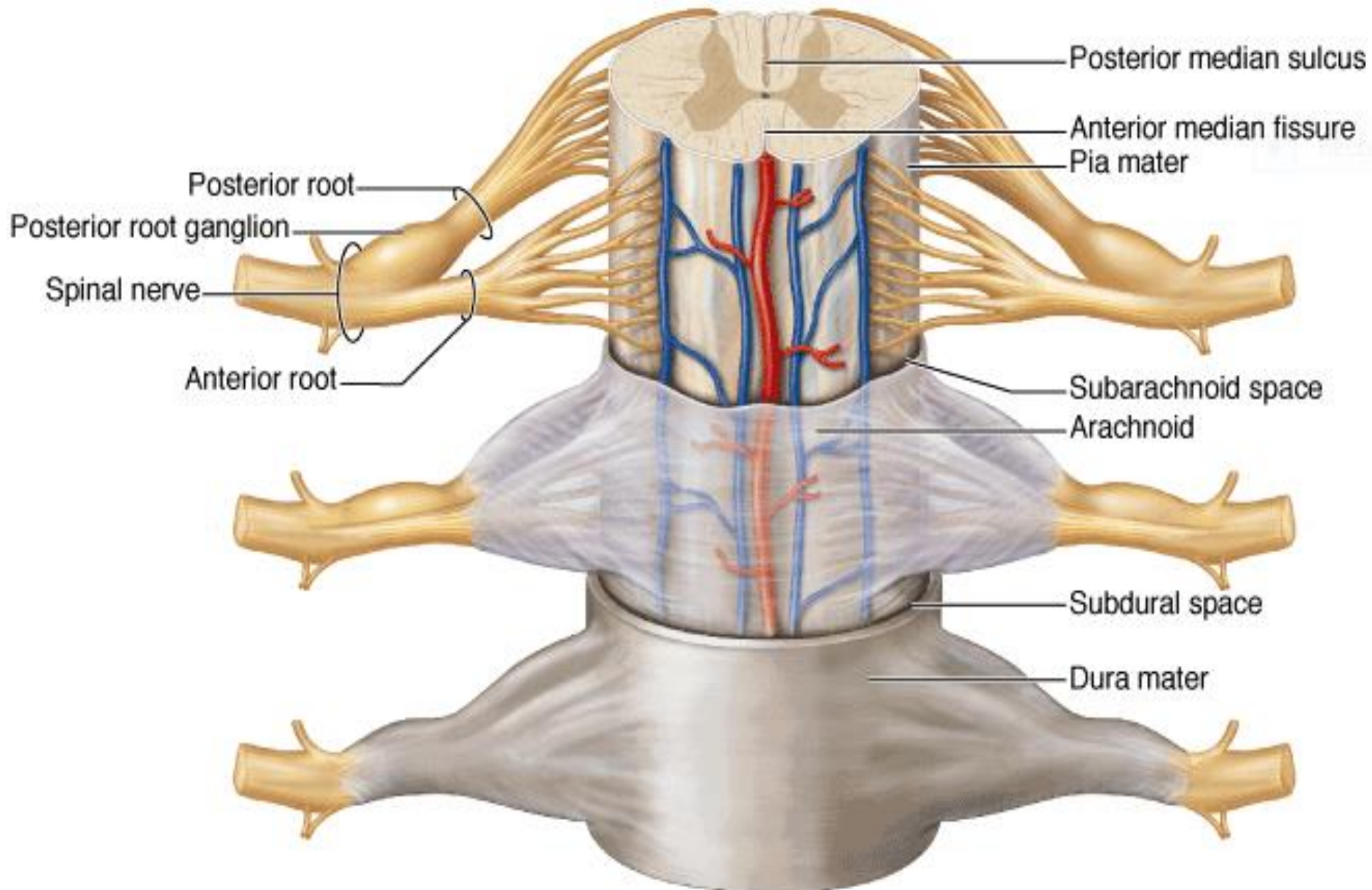


Spinal dura mater

- Downward continuation of meningeal layer of the cerebral dura mater.
- Tubular, non elastic dense envelop for the spinal cord and cauda equine.
- **Above**
 - Fixed to the margin of the foramen magnum.
- **Below**
 - Extends up to the second sacral vertebra, tapers to fuse with the arachnoid mater to invest the filum terminale only.

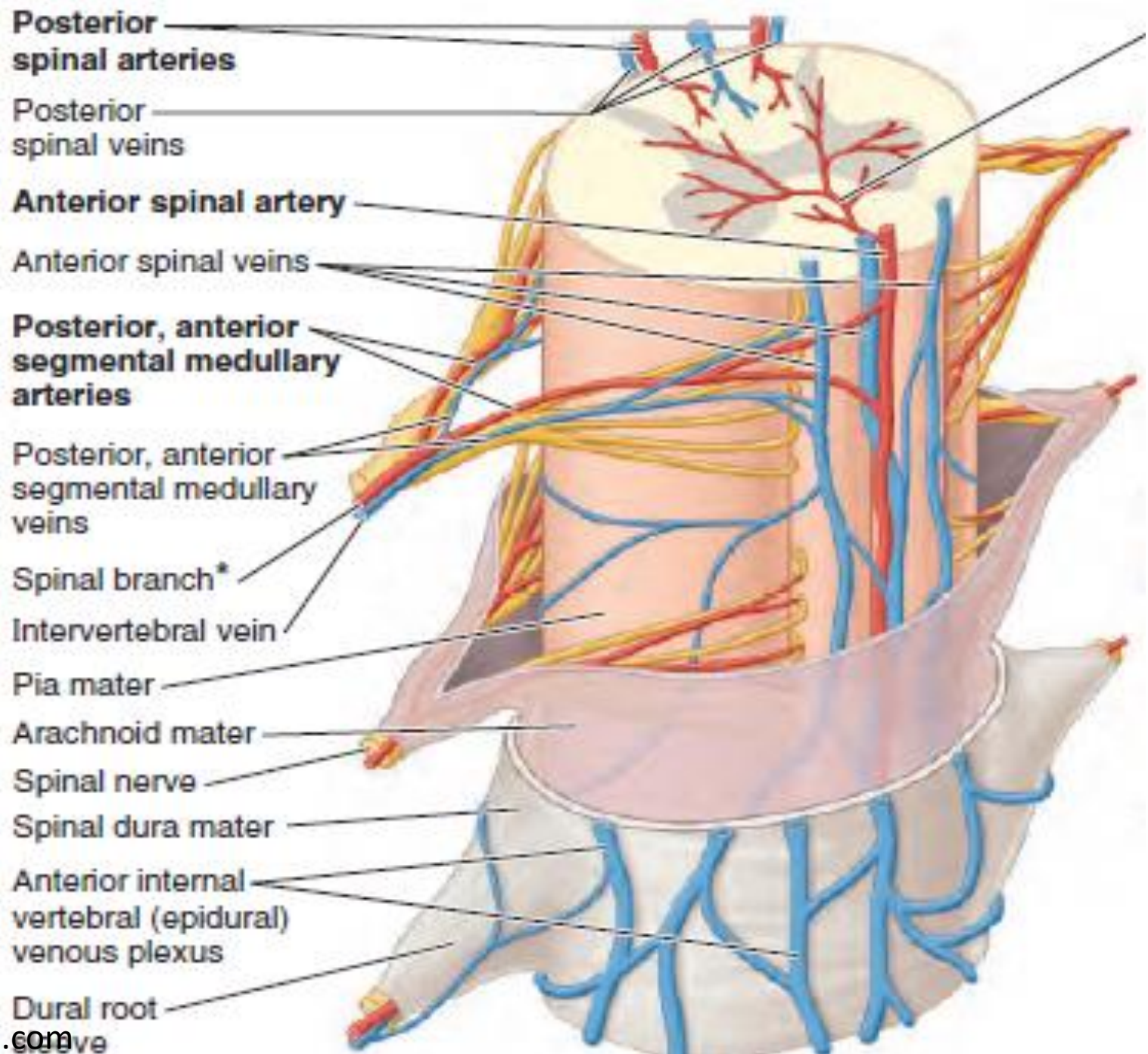


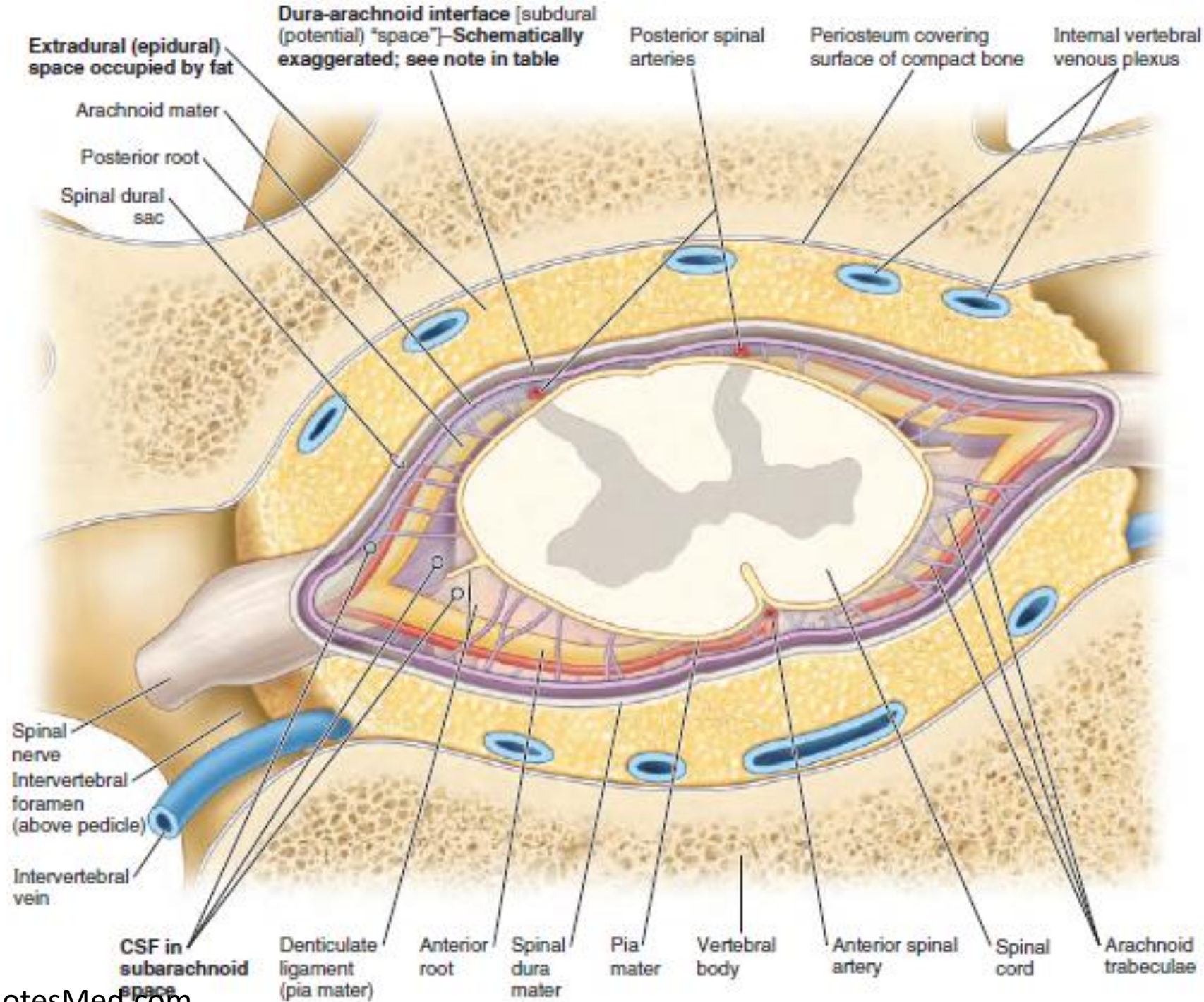




Anterior view

- Ultimately attached to the first coccygeal vertebra.
- Sends tubular sheaths around the spinal nerves and fuses with epinureum.
- Inner surface gives attachment to the ligamentum denticulatum on each side to anchor the spinal cord.
- **Epidural space**
 - Between spinal dura and periosteum.





- Extends from foramen magnum to the sacral hiatus.
- **Contents:**
 - Internal vertebral venous plexus and loose areolar tissue with fat.
- Injection of local anaesthetics into this space through the sacral hiatus which can spread upto the base of the skull.

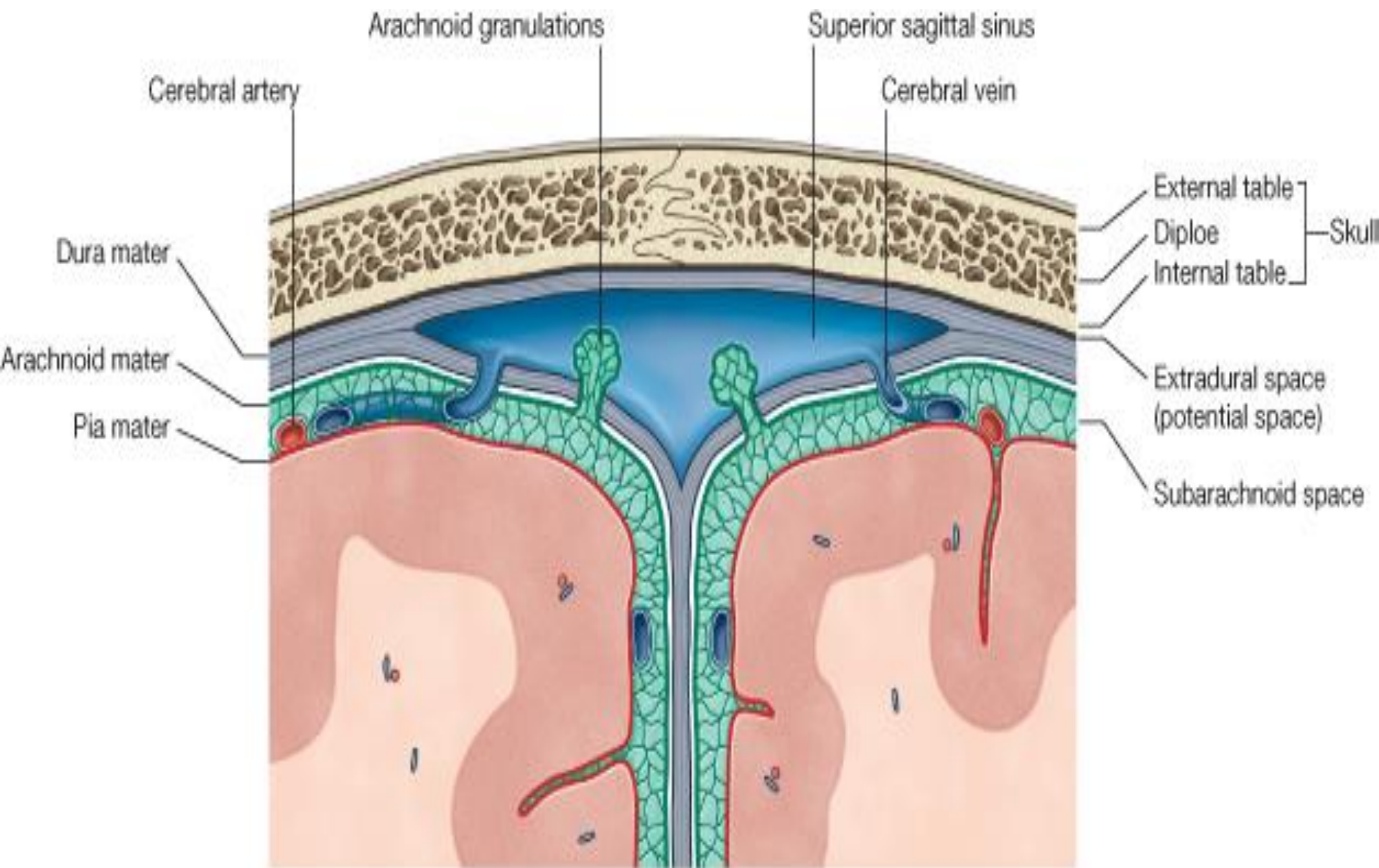
- **Nerve supply of the spinal dura mater**
 - Recurrent meningeal branches of spinal nerves.

CRANIAL LEPTOMENINGES

- **Arachnoid mater:**
 - Delicate, non vascular, impermeable membrane between the dura and pia maters.
- Arachnoid trabeculae
- **Two essential features, they are:**
 - 1. Subarachnoid space:**
 - Contains CSF surrounding the entire brain.
 - Virtually floats the brain in the cranial cavity.
 - Also contains major cerebral arteries and veins.
 - Subarachnoid hemorrhage.

2. Arachnoid villi or granulations

- Small, visible with naked eyes, mushroom-shaped evaginations of arachnoid mater into the superior sagittal sinus mainly for the CSF drainage into the venous system.
- Aggregation of villi
- **Subarachnoid cisterns:**
 - Enlarged spaces in subarachnoid space at certain places.



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Lumen of
venous sinus

Endothelium of
venous sinus

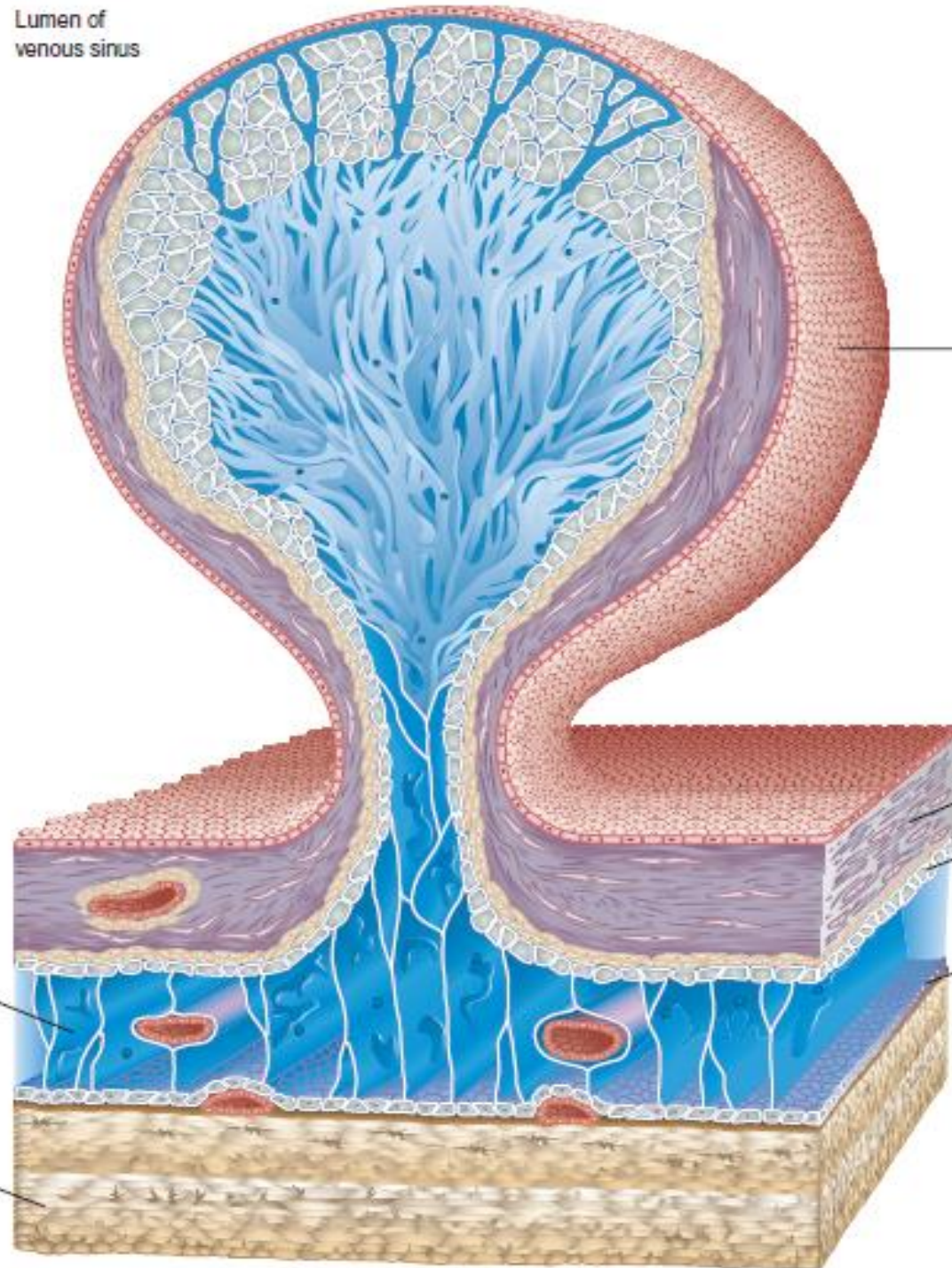
Dura mater

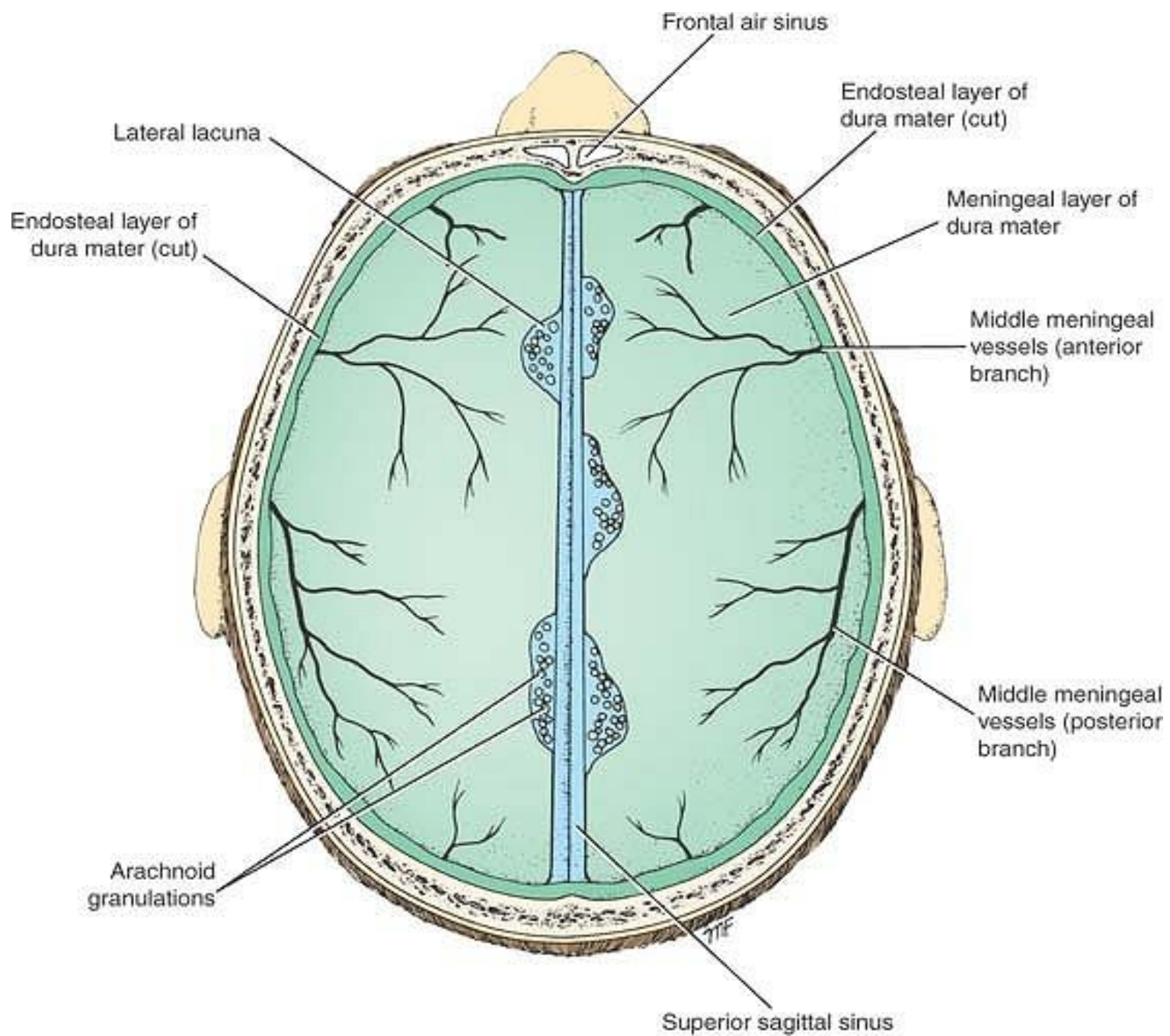
Arachnoid mater

Pia mater

Subarachnoid space

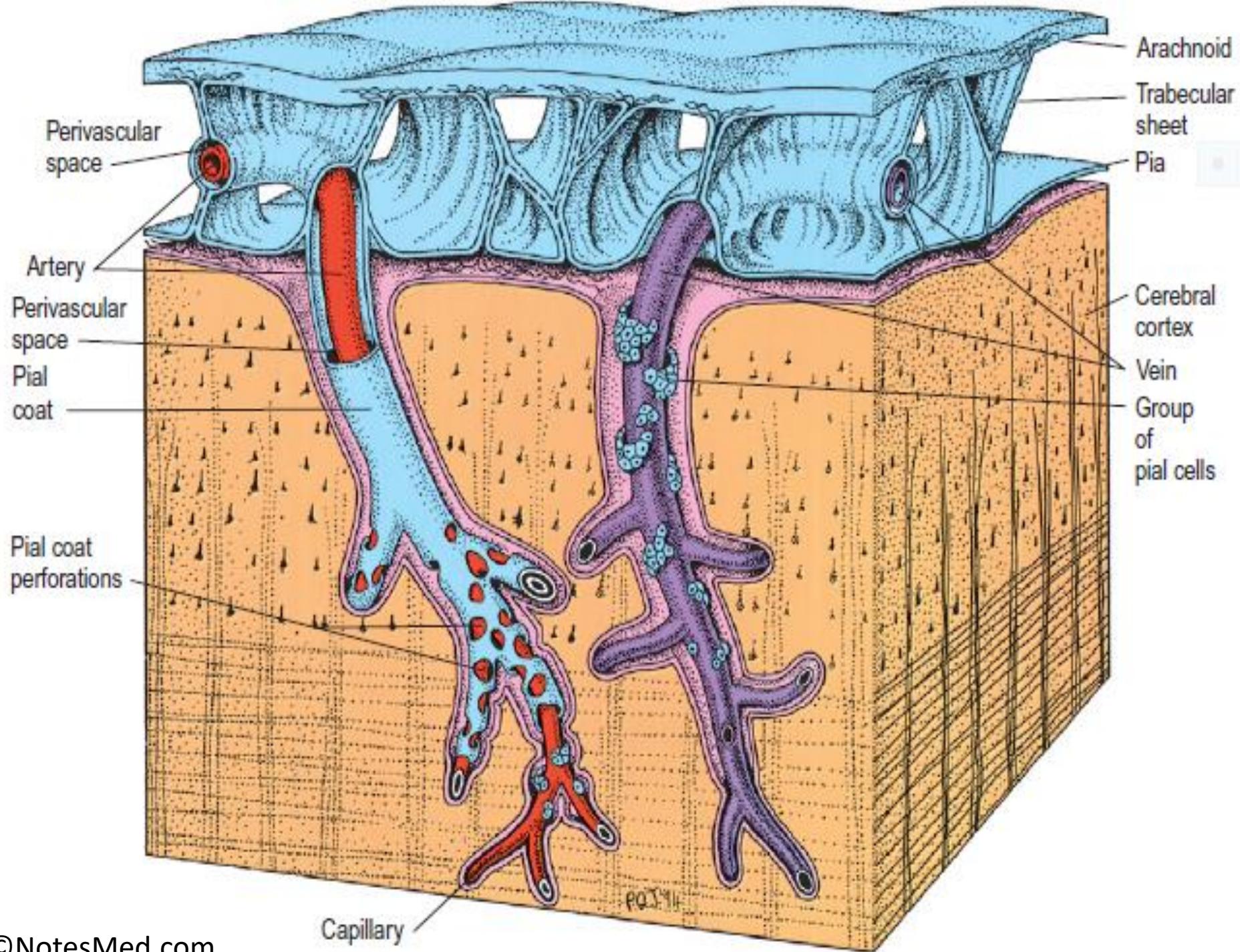
Cerebral cortex



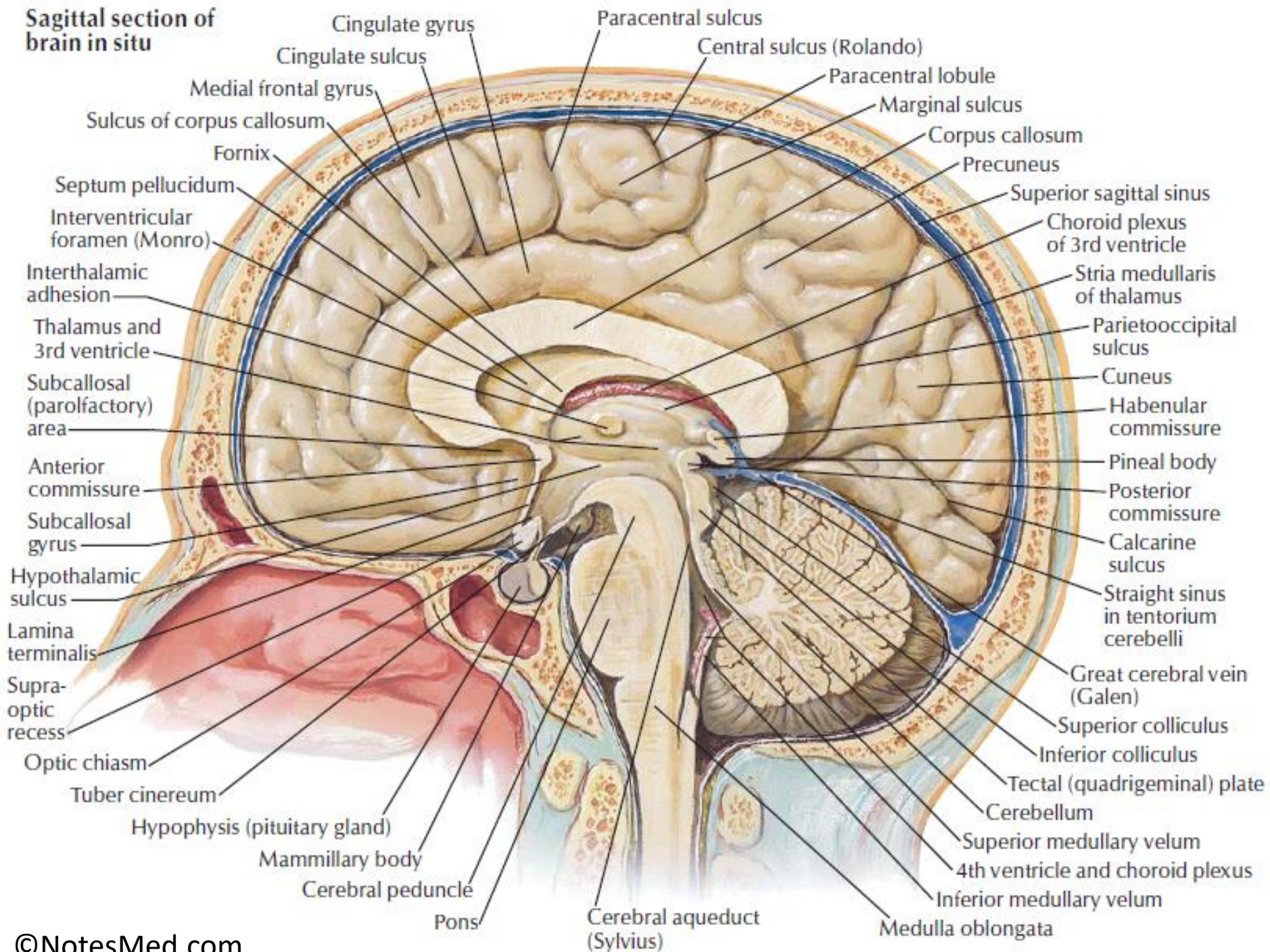


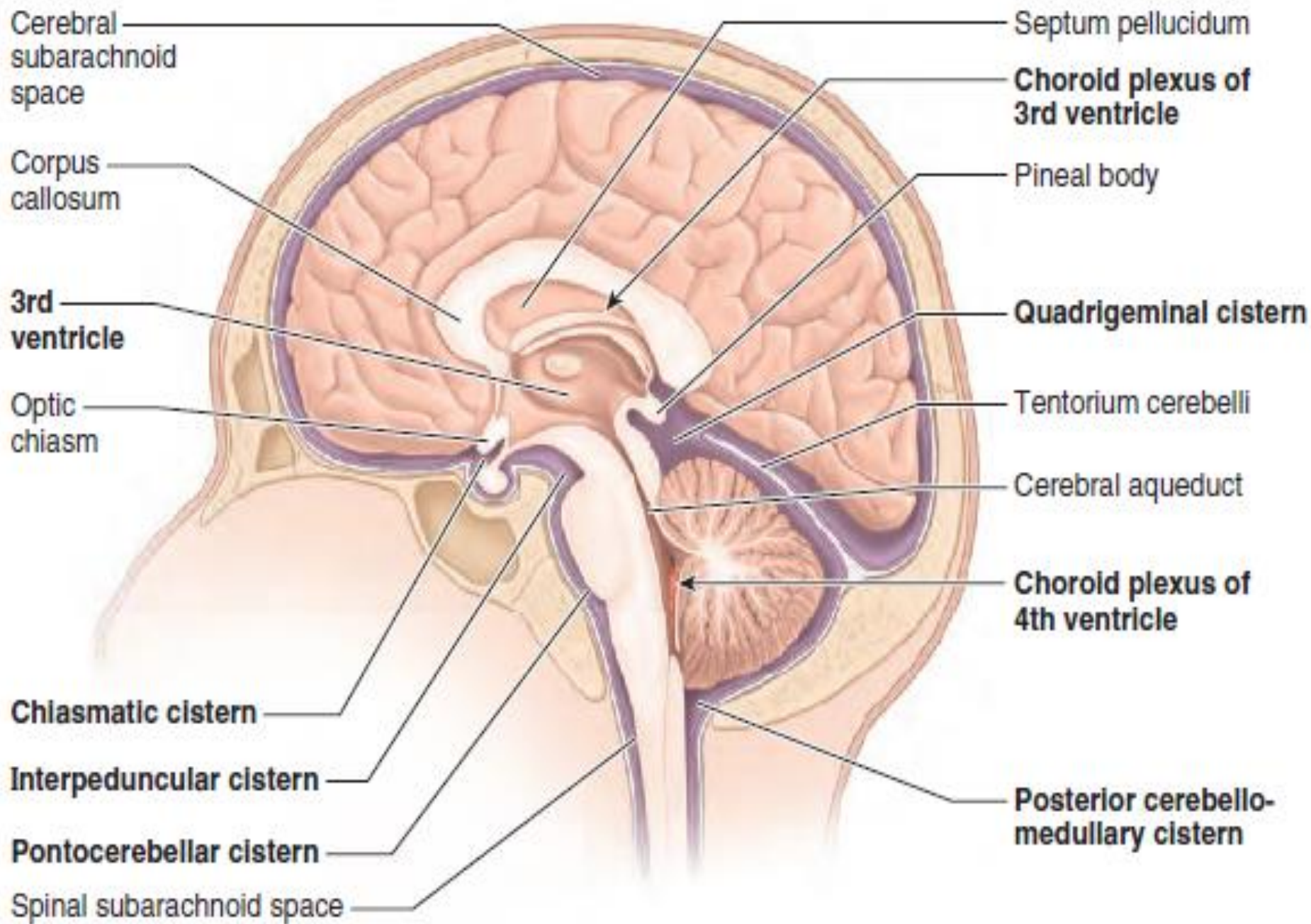
Pia mater

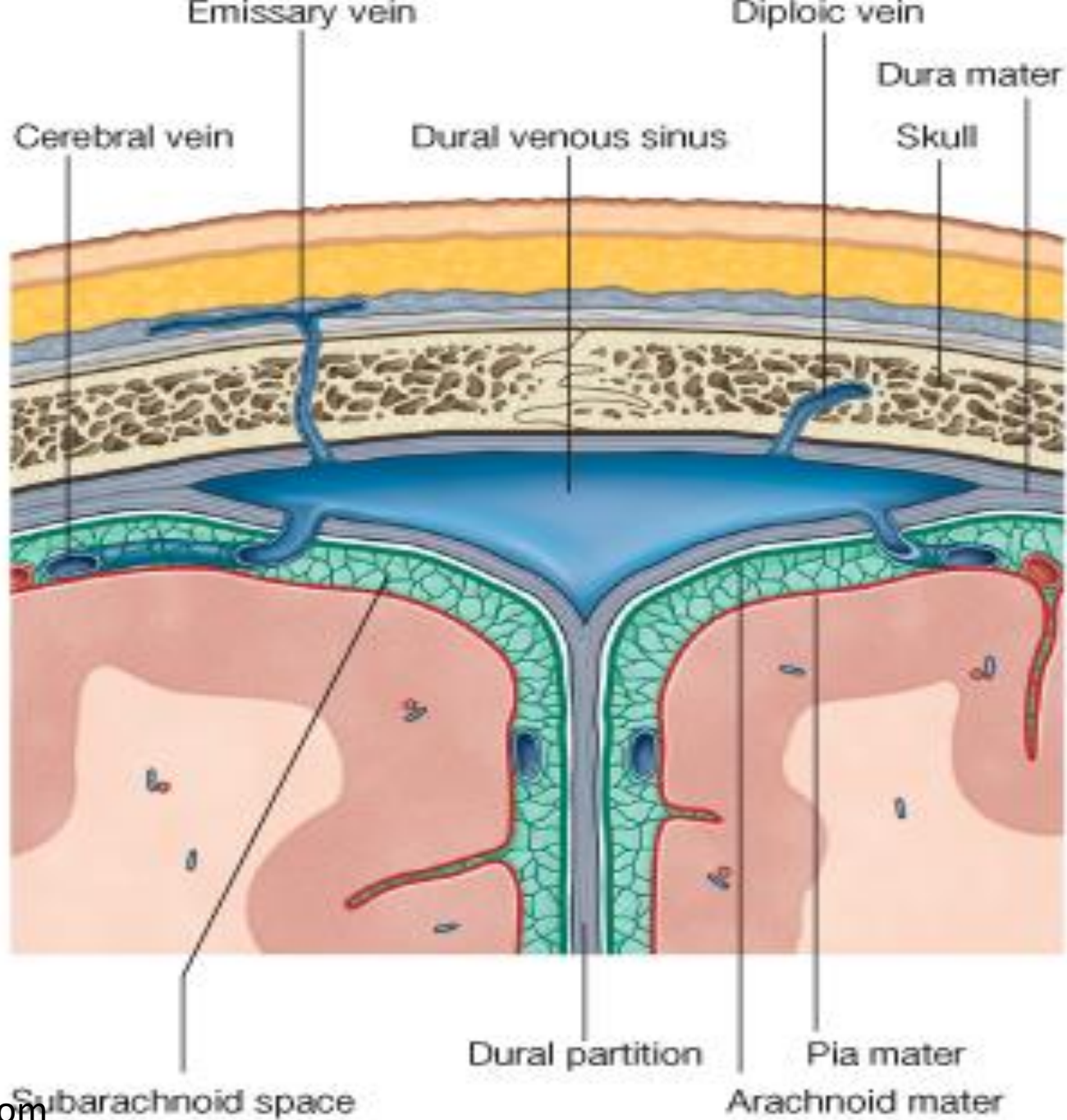
- Vascular tissue and transparent membrane.
- Closely adherent to the brain
 - Follows all the contours of the brain
 - Usually composed of single layer of fibroblasts
- **Telachoroidea**
 - Invaginations to form double layer
- **Choroid plexus**
 - Telachoroidea covered with secretory ependymal cells.



Sagittal section of brain in situ

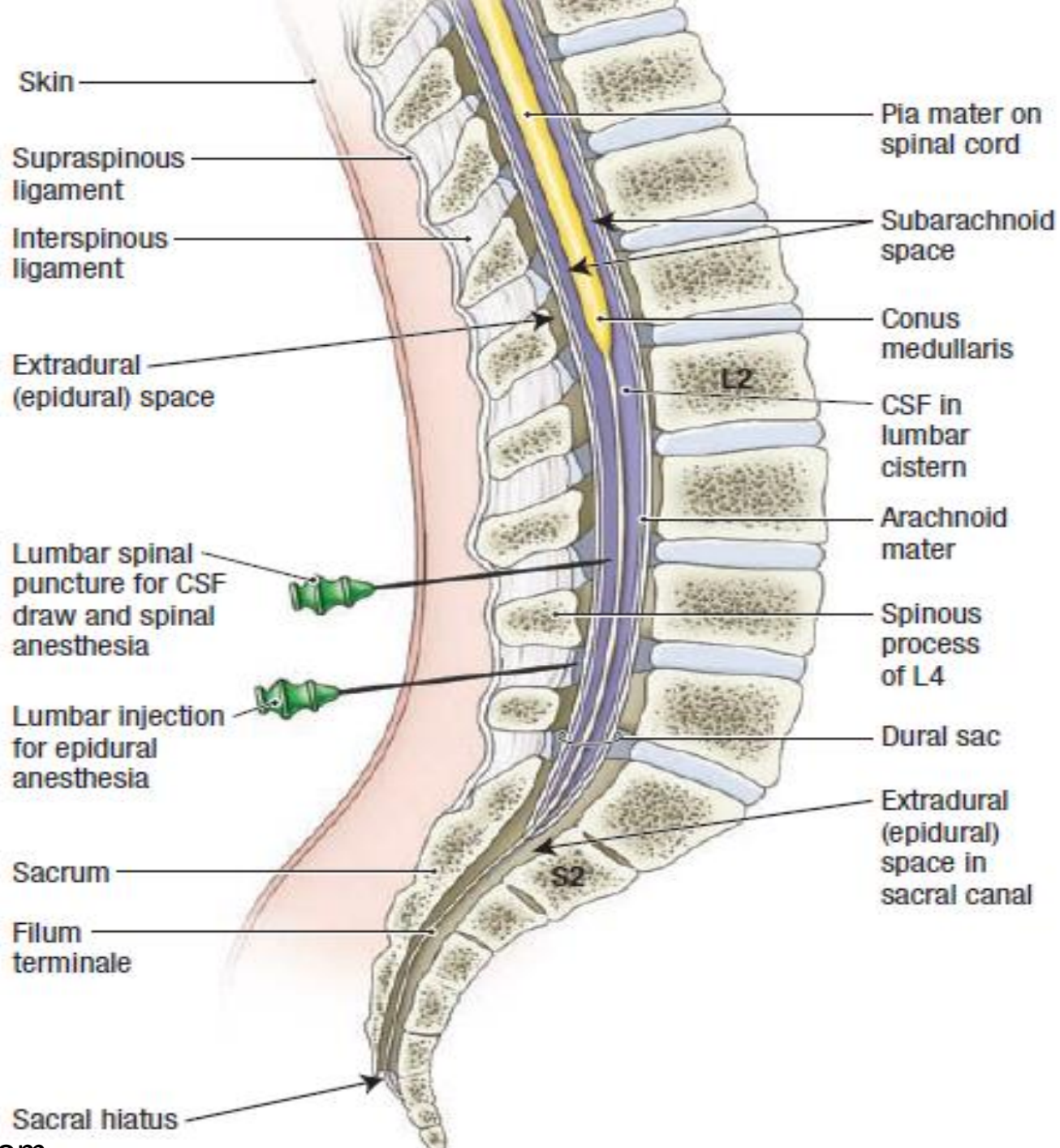


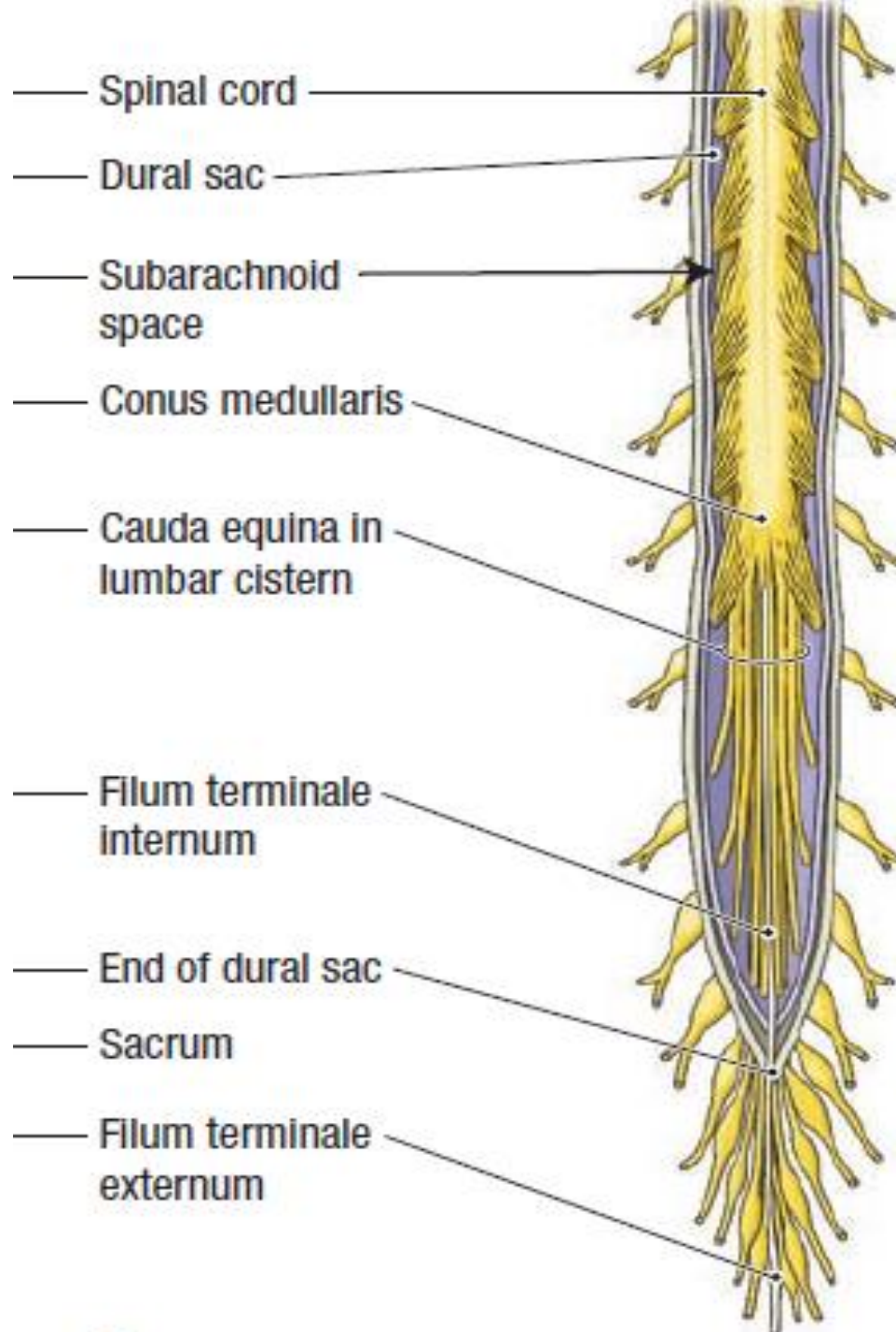




Spinal leptomeninges

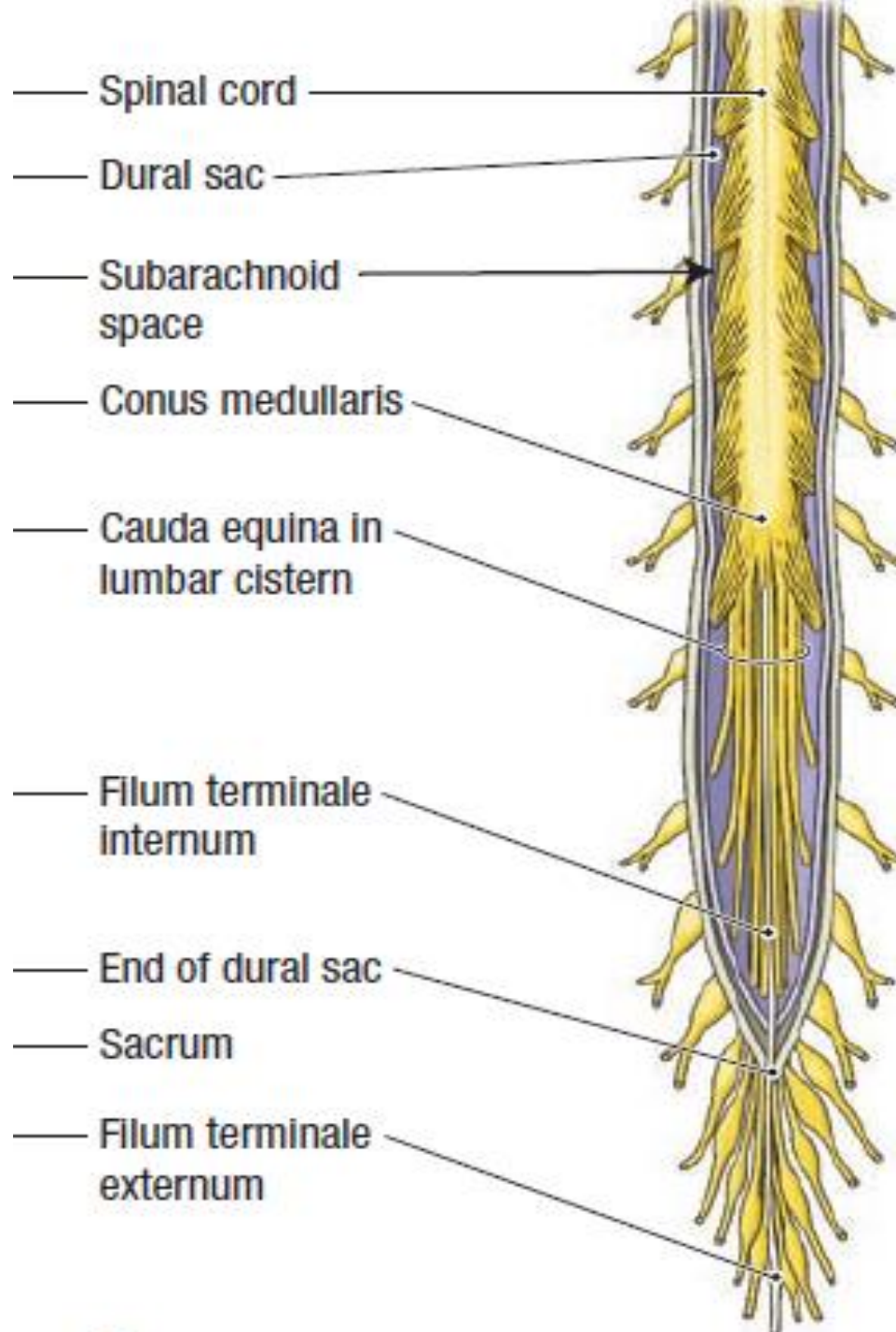
- Continuation of the cranial leptomeninges
- **Arachnoid mater:**
 - Thin, delicate and loosely investing the spinal cord.
 - Extends caudally around the cauda equine upto the level of the lower border of the second sacral vertebra.





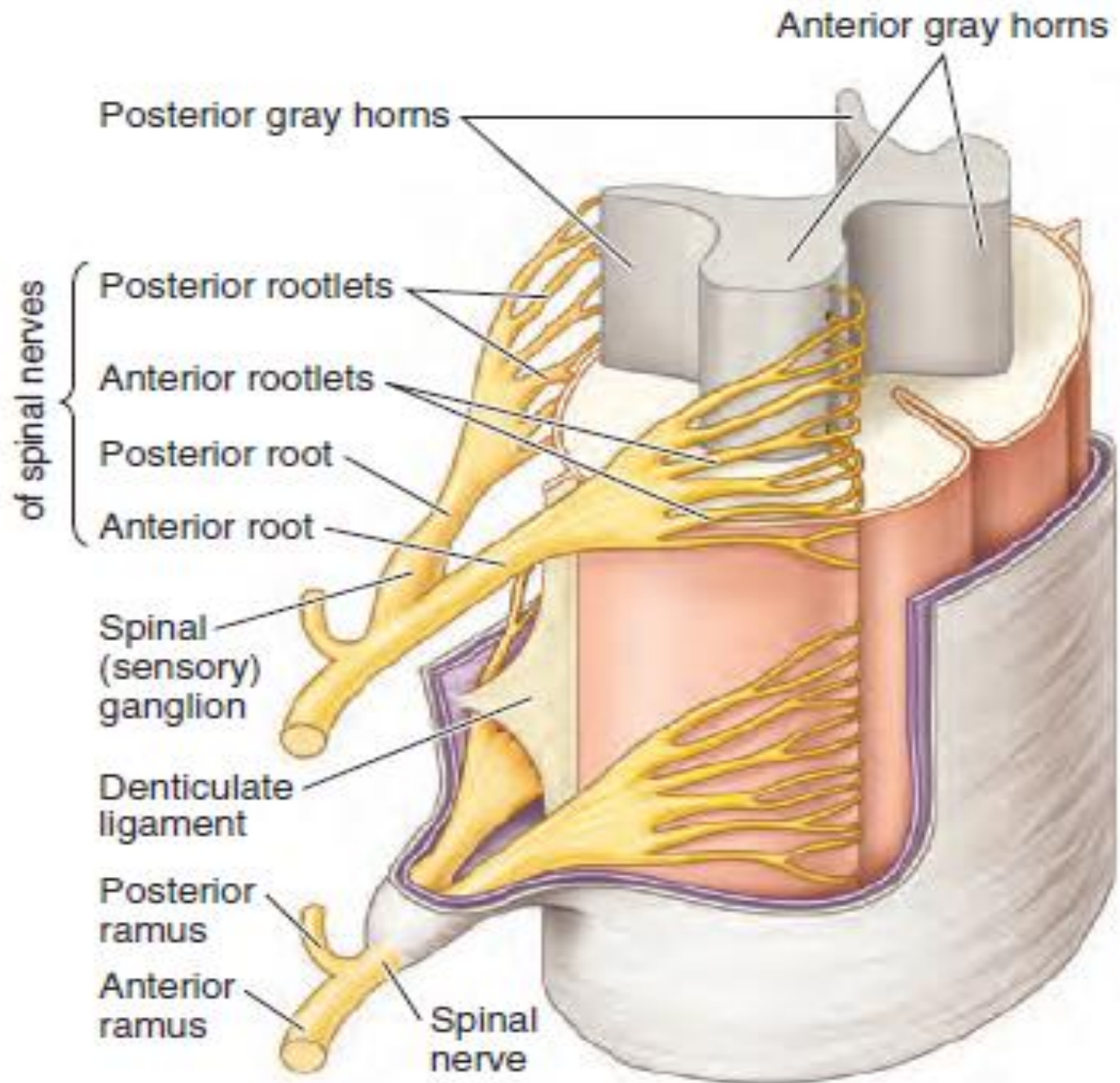
- **Subarachnoid space**

- Continuous with the cranial subarachnoid space
- Caudal to the spinal cord
- More roomy and called the lumbar or the spinal cistern.
- Extends from L1 to the S2 vertebrae
- Contains-CSF and rootlets of the cauda equine (L2 to Co spinal rootlets.)
- Site for the lumbar puncture.

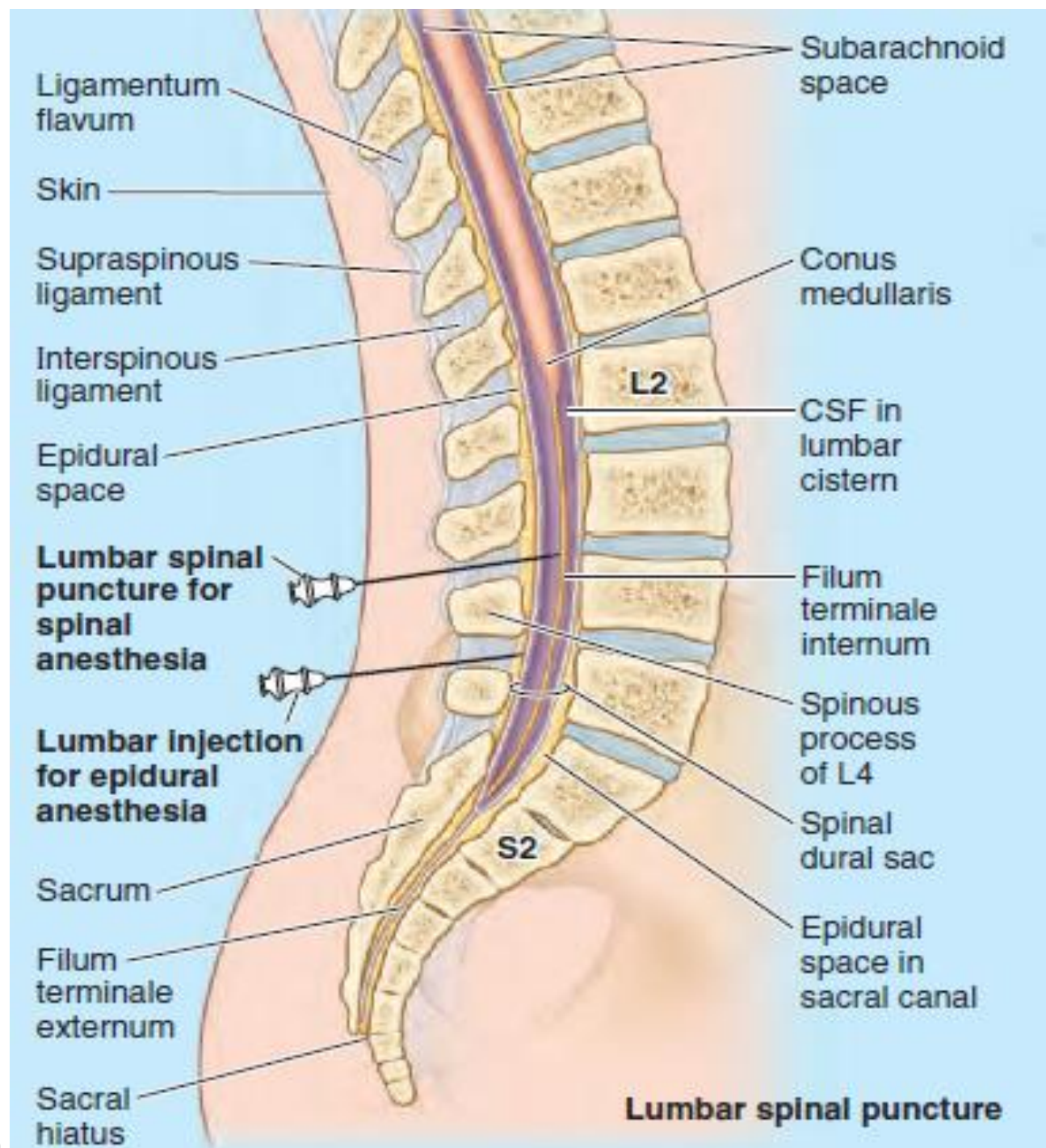


Spinal pia mater

- Intimately covers the spinal cord and initial portion of spinal nerves.
- Thicker, more firm and less vascular than the cranial pia.
- **Linea splendens**- shiny fibrous band in the lower part of the anterior median fissure.

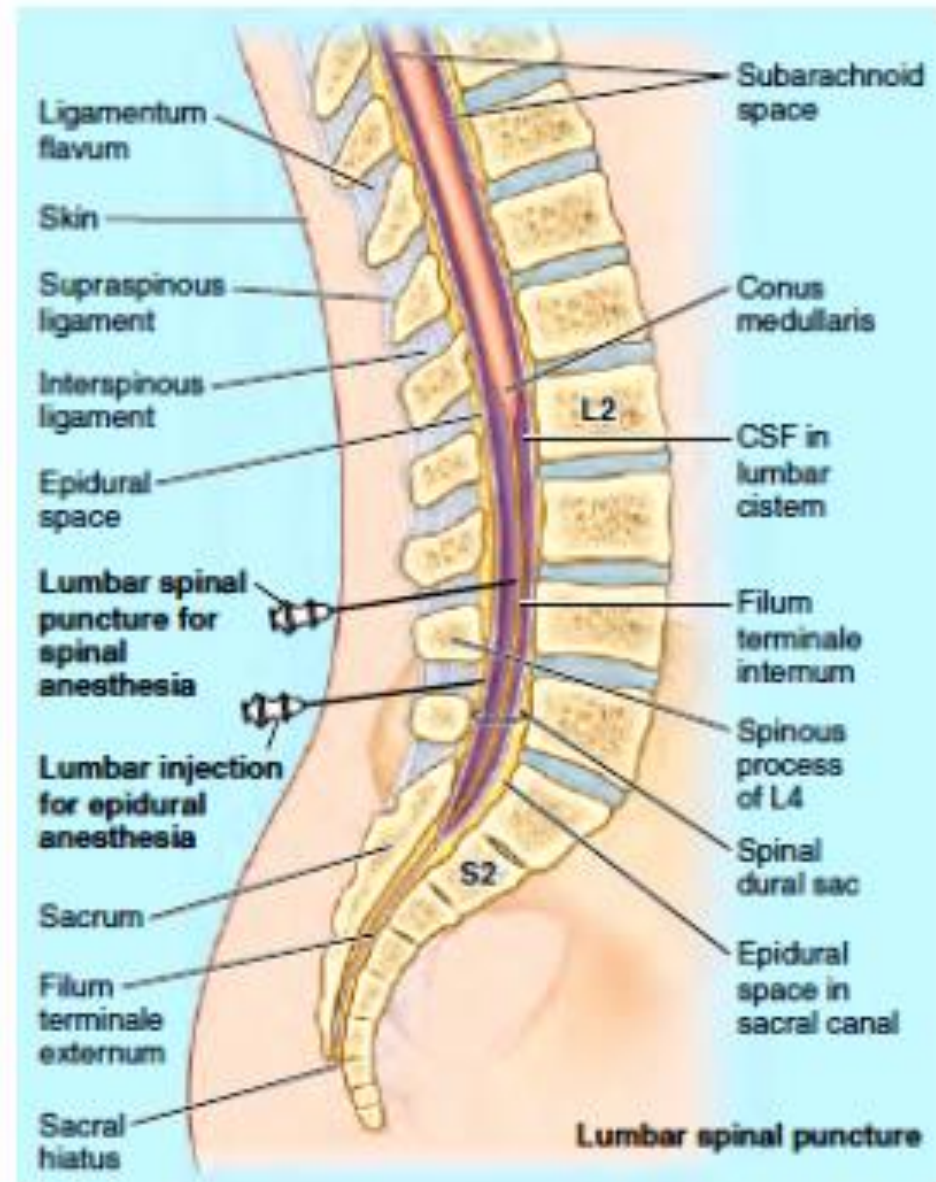


- **Filum terminale**
 - Non nervous, filamentous pial tissue caudal to the conus medullaris.
 - 15-20 cm in length
 - Fixes the lower end of spinal cord to the dorsal aspect of the first coccygeal vertebra.
- **Two parts**
- **Filum terminale internum**
 - Proximal 3/4rd within the lumbar cistern
- **Filum terminale externum**
 - Beyond the lumbar cistern after piercing through the dura and arachnoid.

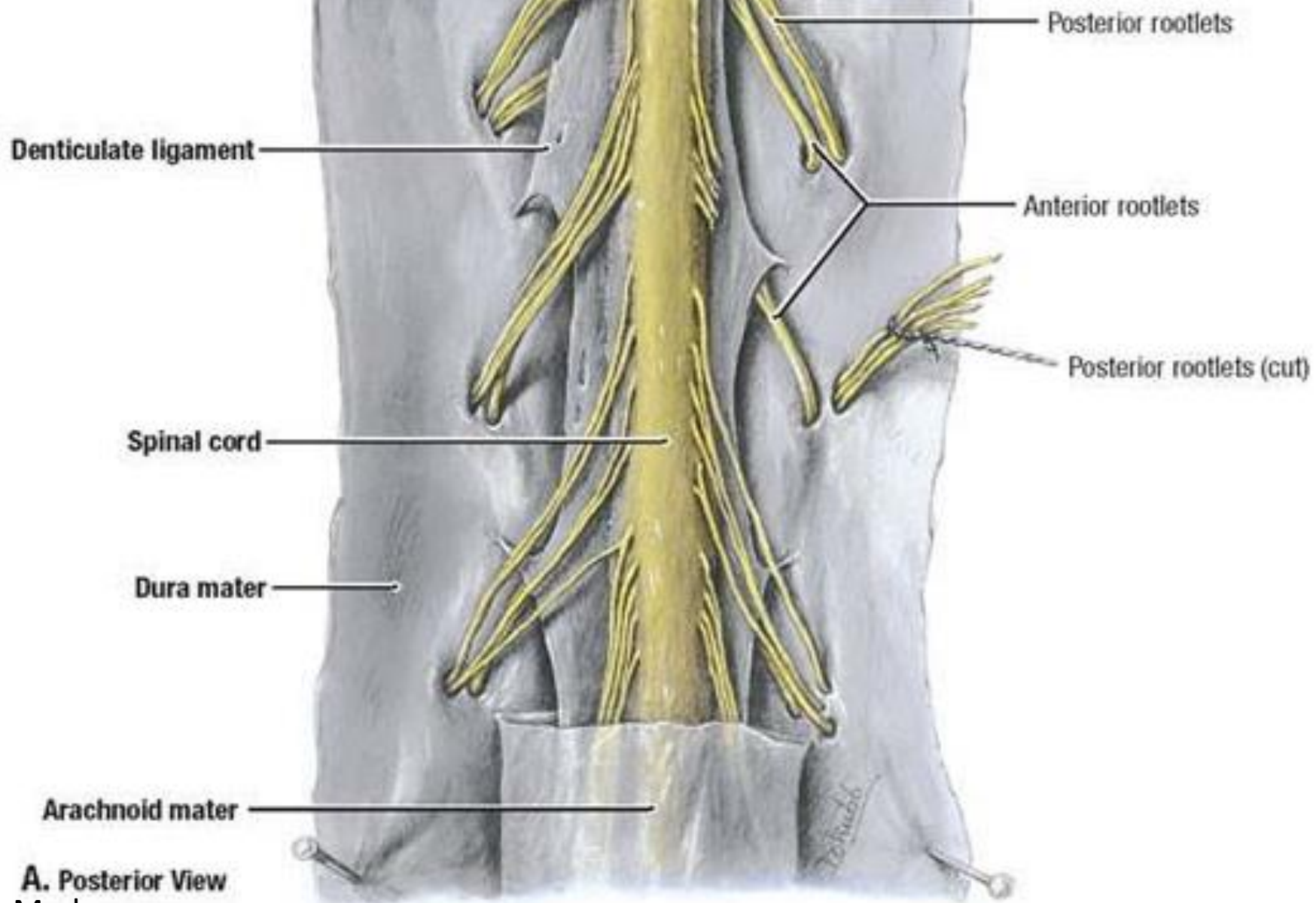


Structures pierced during lumbar puncture

- Skin
- Superficial fascia
- Supraspinous ligament
- Interspinous ligament
- Ligamentum flavum
- Epidural space
- Dura mater
- Arachnoid mater

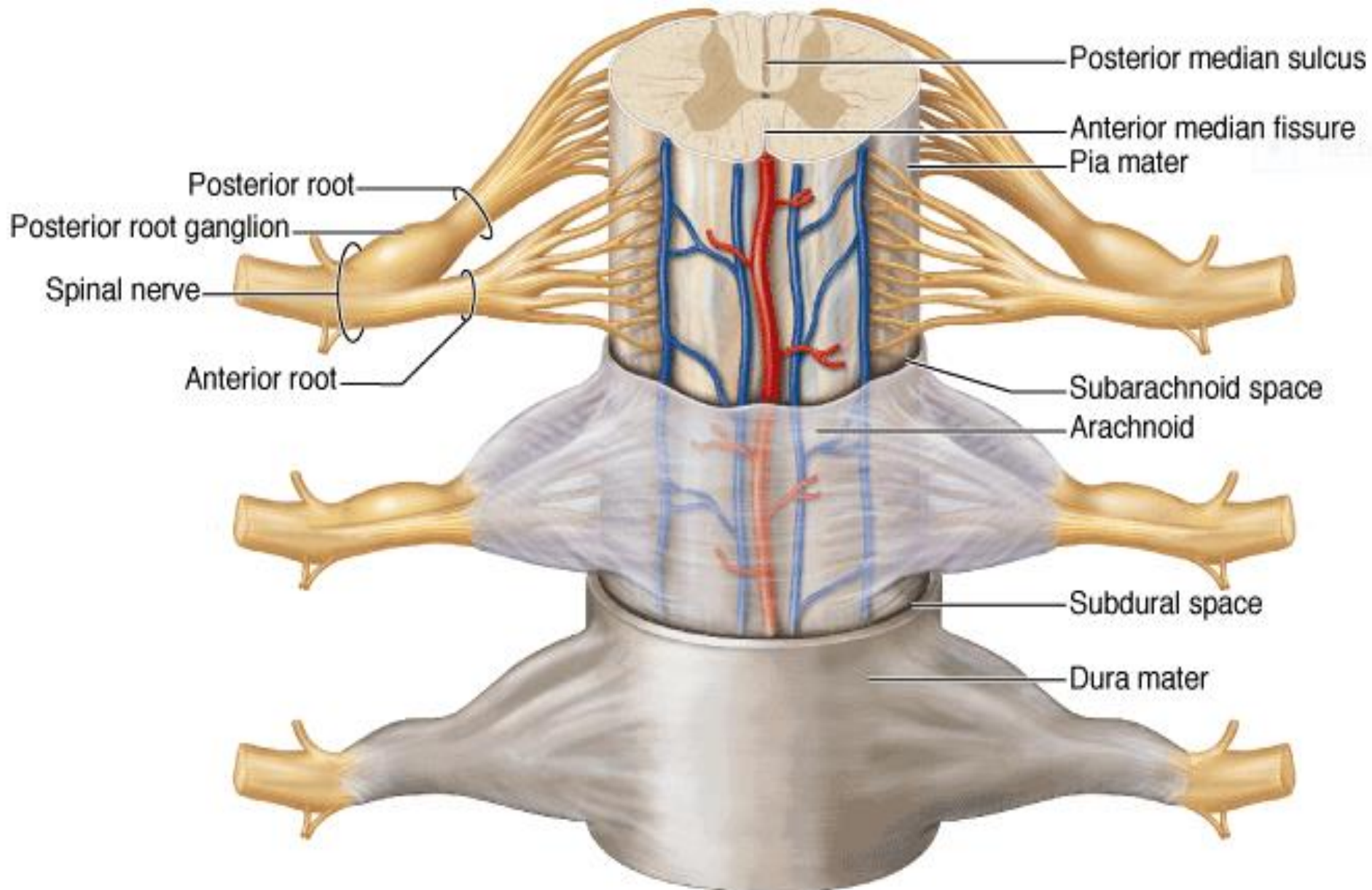


- **Ligamentum denticulatum**
 - Coronally oriented flat and narrow pial sheath
 - Extends laterally midway between the dorsal and ventral roots of spinal nerves
 - Attached to the inner surface of the dura mater.
 - Lateral margin is serrated, 21 in number.



Applied anatomy

- Meningitis
- Meningiomas



Anterior view