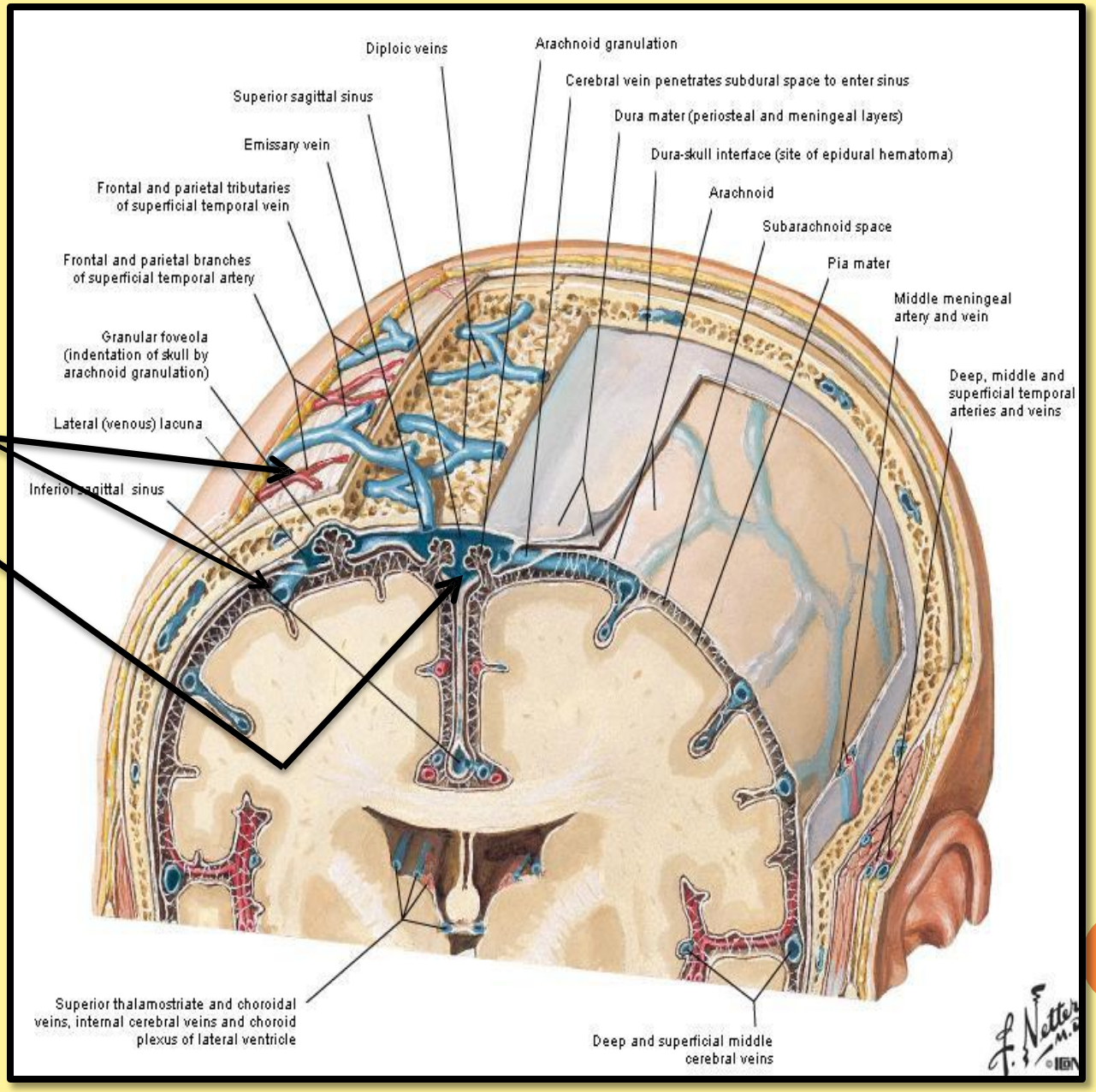
The Cranial Cavity

CONTENTS

-1The brain and its surrounding Meninges

2 Arteries
3 Veins



-4Venous sinuses

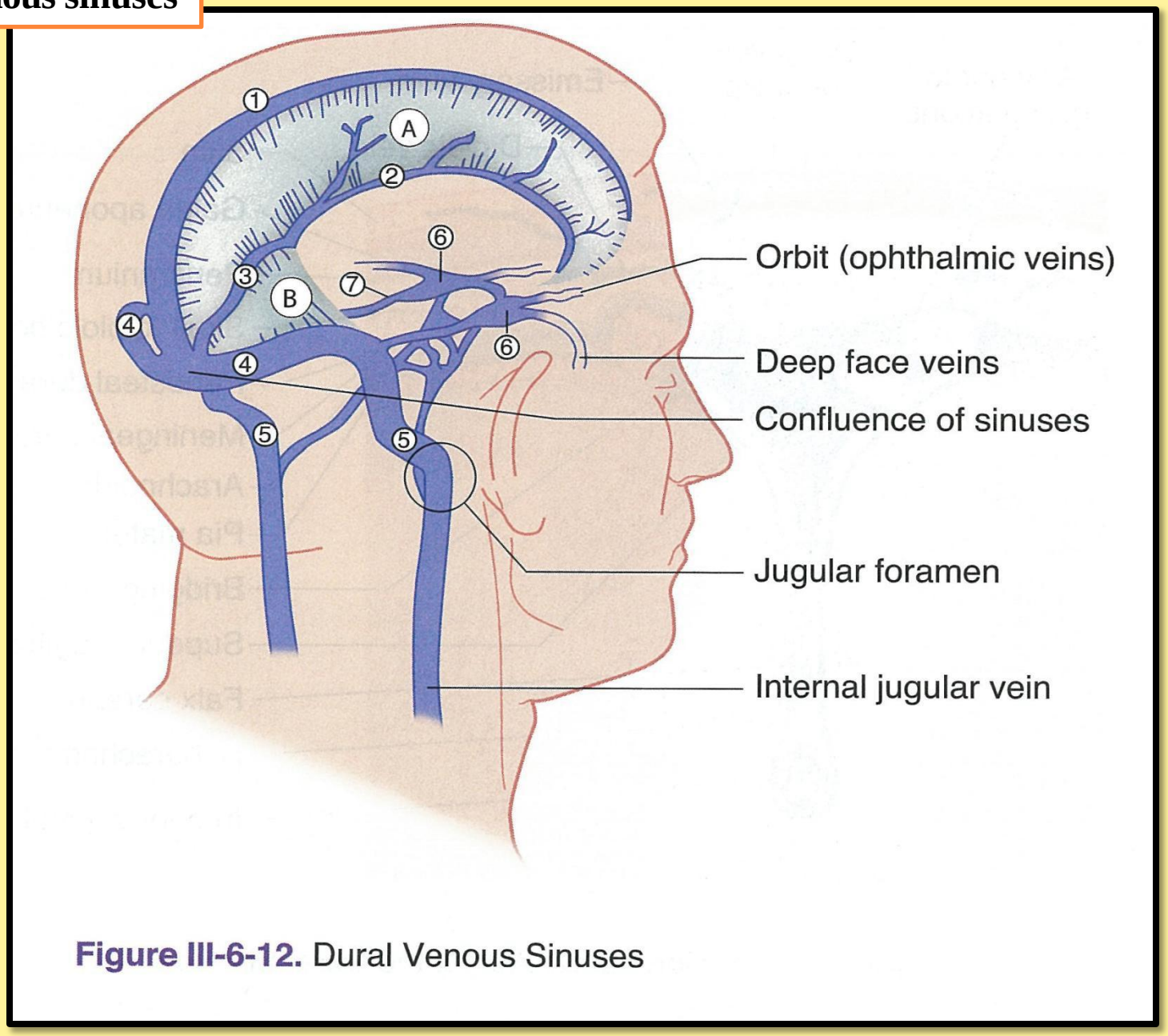
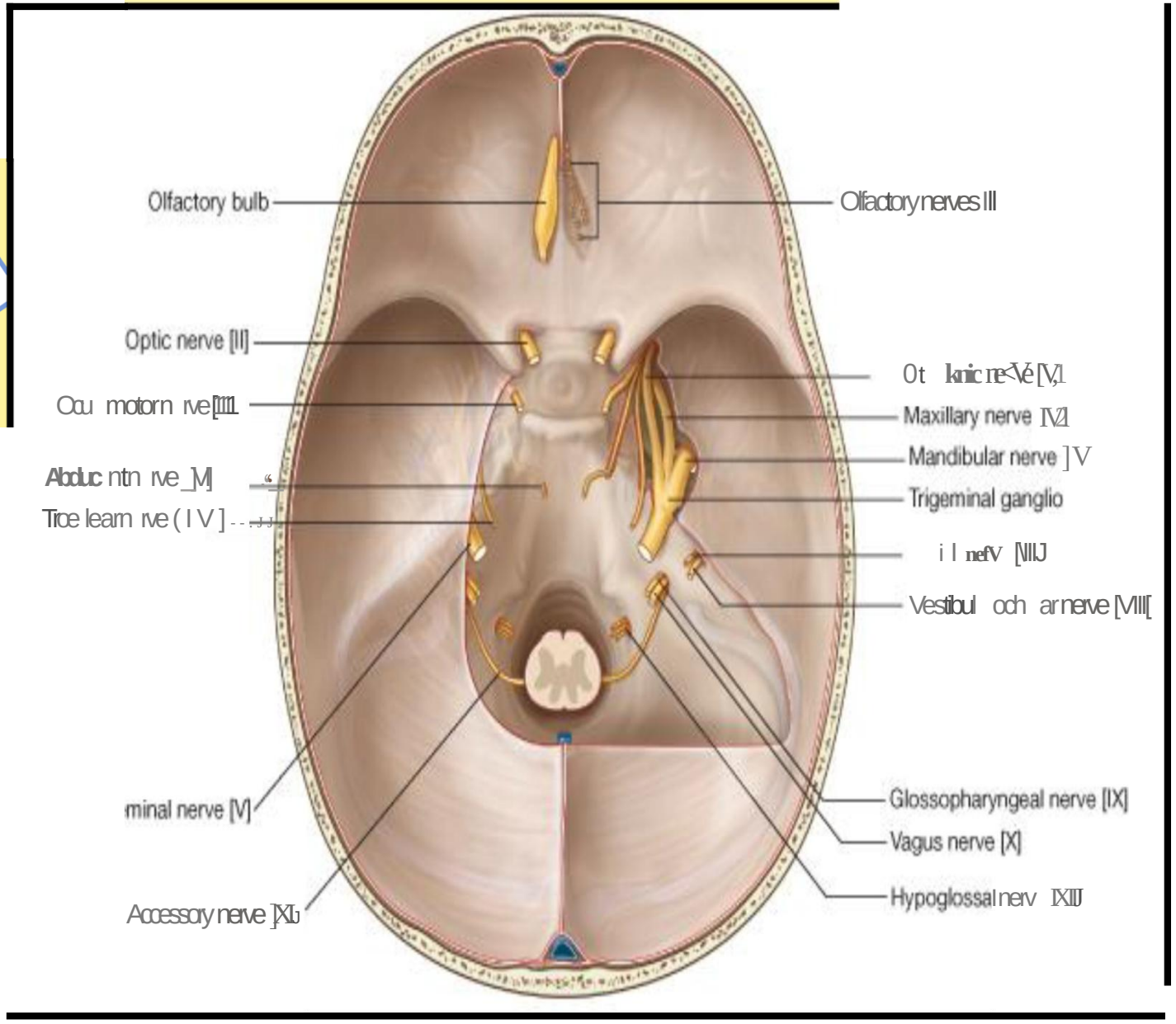


Figure III-6-12. Dural Venous Sinuses

5-Parts of the cranial nerves



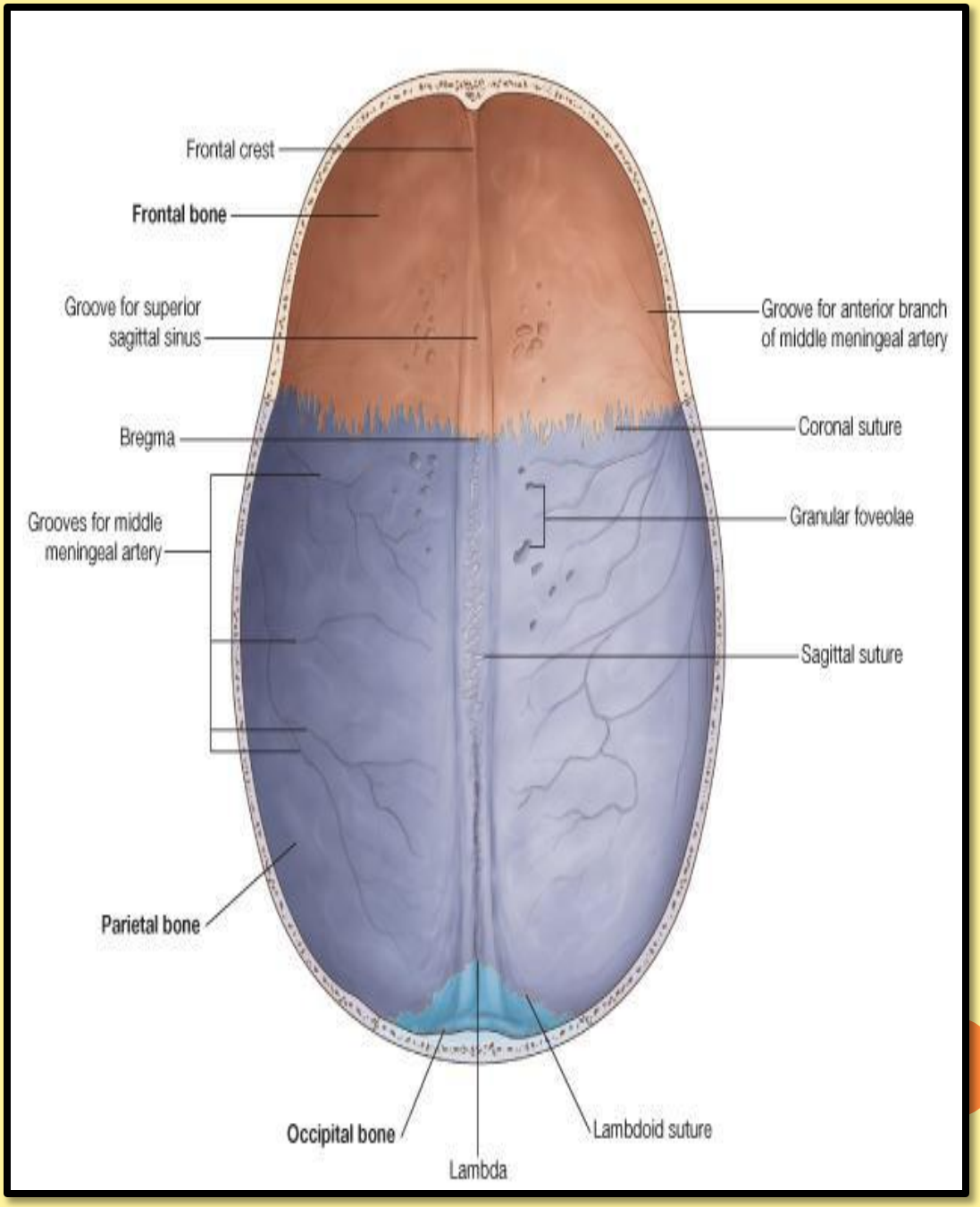
VAULT OF THE SKULL

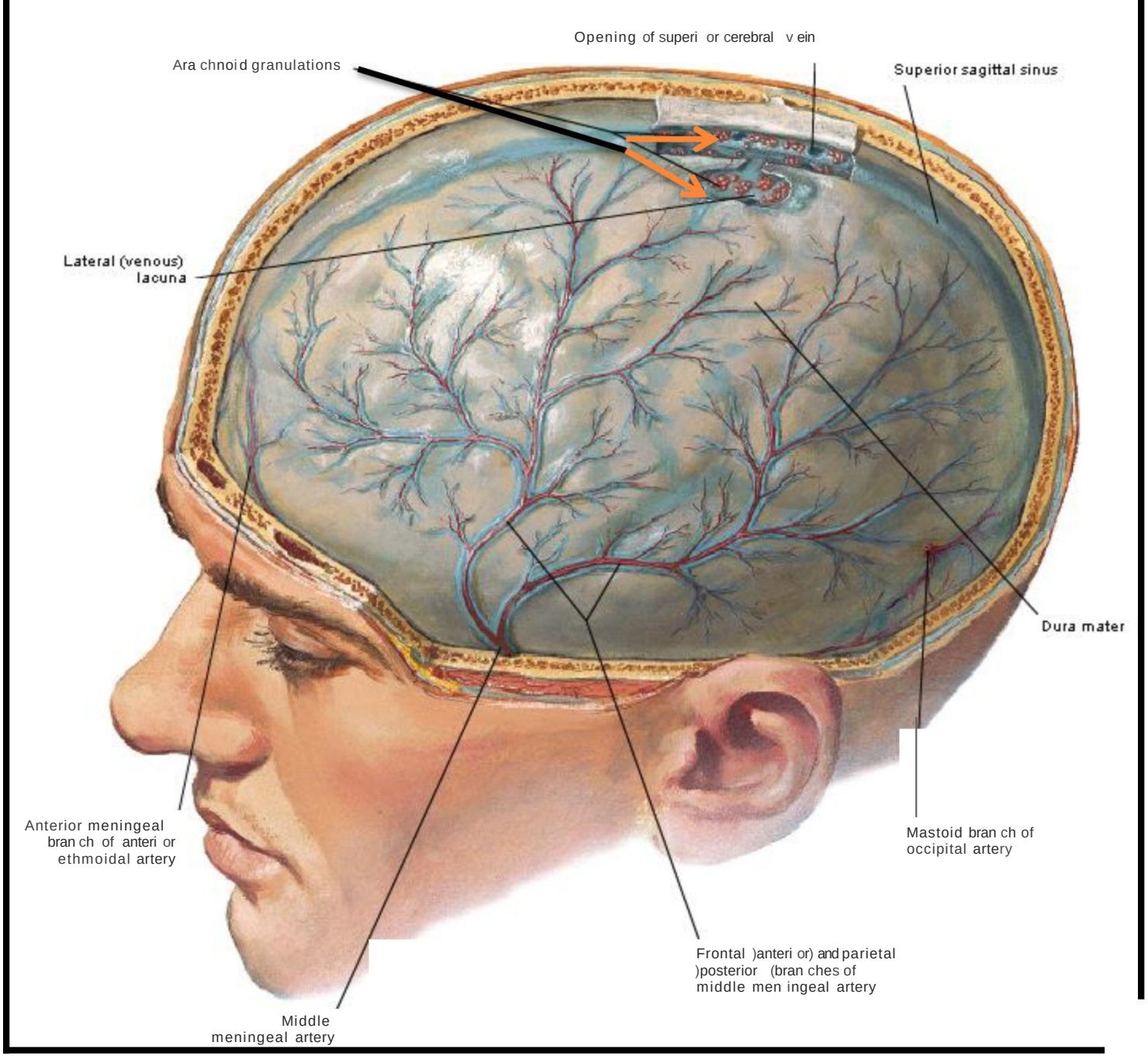
The internal surface of the vault presents:
-1The coronal
-2Sagittal
-3Lambdoid sutures

4In the midline is a shallow **sagittal groove** containing the **SUPERIOR SAGITTAL SINUS**

5On each side of the groove are several small pits, called **GRANULAR PITS? What for)see next slide(**

6 Grooves for the middle meningeal artery




Opening of superi or cerebral v ein
Ara chnoid granulations
Superior sagittal sinus
Lateral (venous) lacuna
Dura mater
Anterior meningeal bran ch of anteri or ethmoidal artery
Mastoid bran ch of occipital artery
Frontal)anteri or) and parietal)posterior (bran ches of middle men ingeal artery
Middle meningeal artery

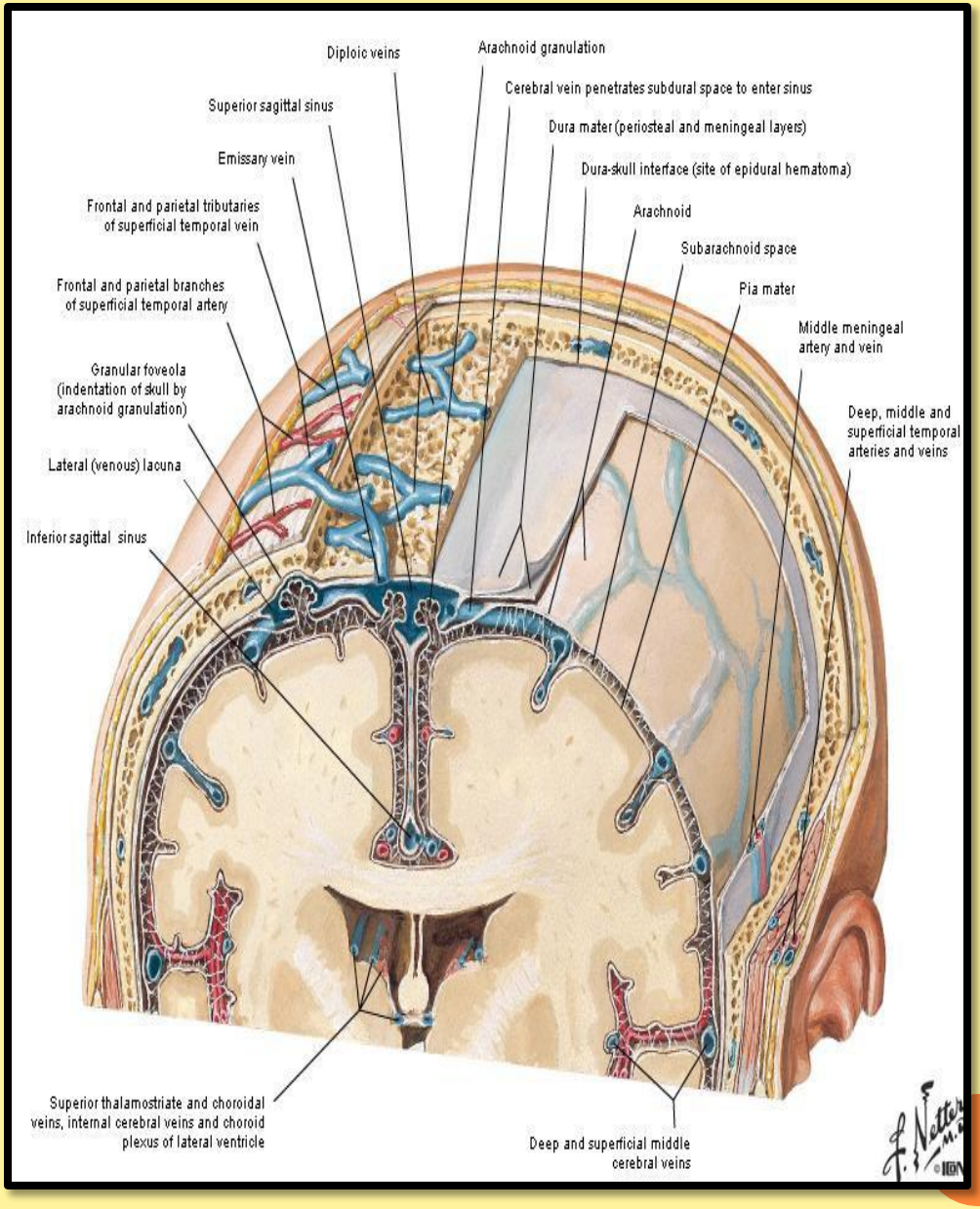
The Meninges

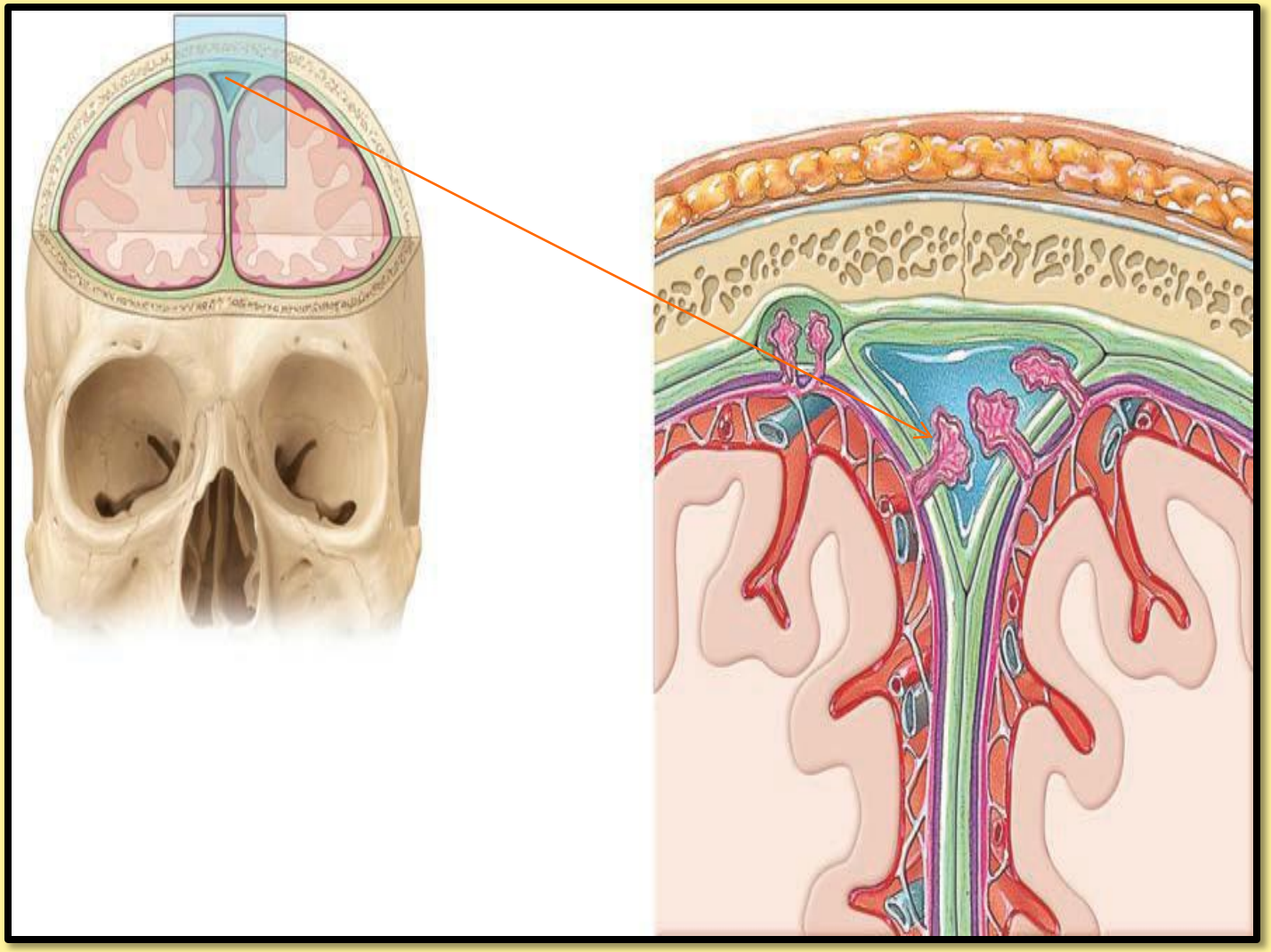
The brain in the skull is surrounded
by three membranes or meninges:

1-THE DURA MATER

-2THE ARACHNOID MATER

-3THE PIA MATER





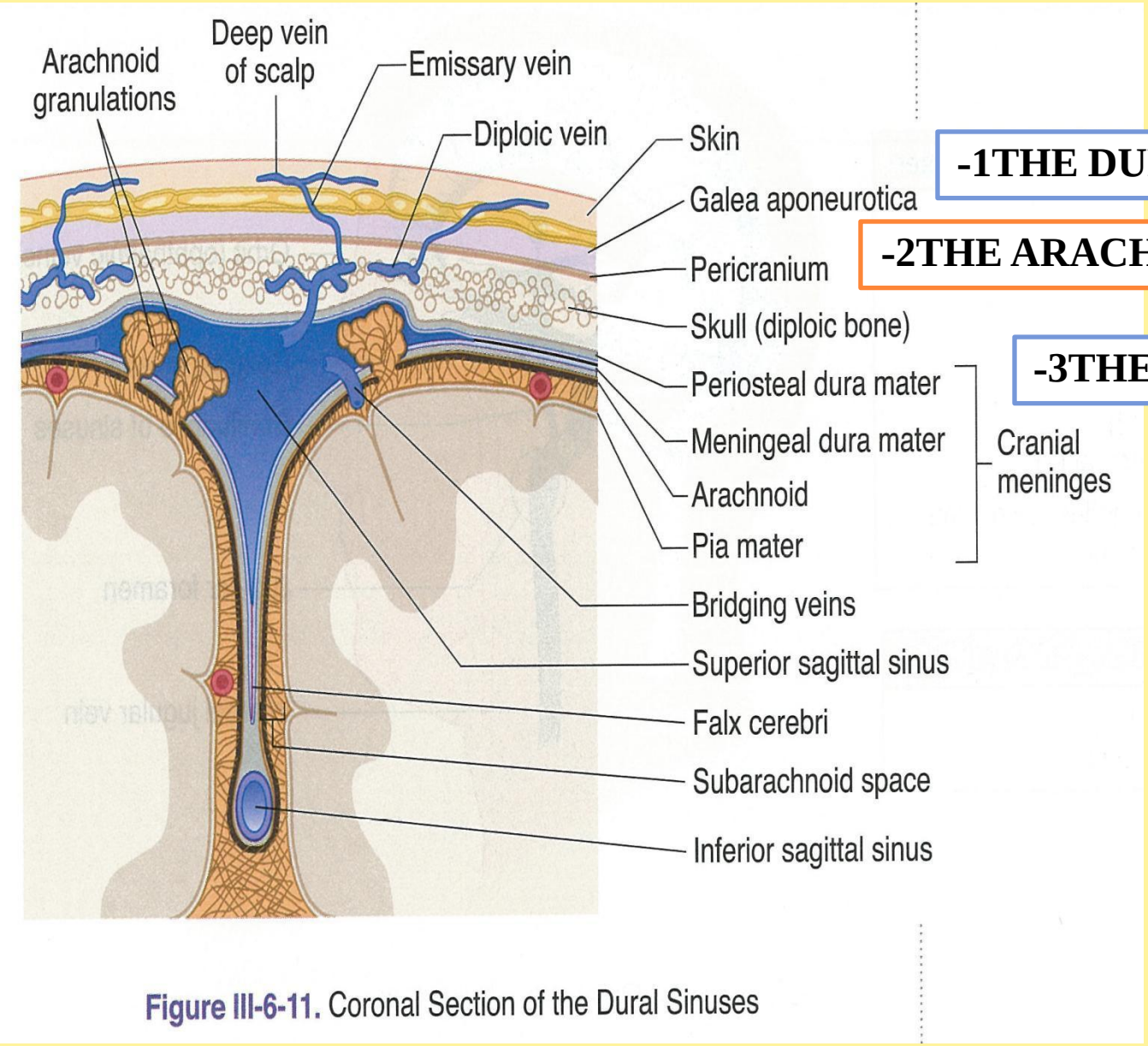


Figure III-6-11. Coronal Section of the Dural Sinuses

-1THE DURA MATER

-2THE ARACHNOID MATER

-3THE PIA MATER

-1DURA MATER OF THE BRAIN

Made of two layers:
a-The endosteal layer
b-The meningeal layer
These are closely united except along where they separate to form
VENOUS SINUSES

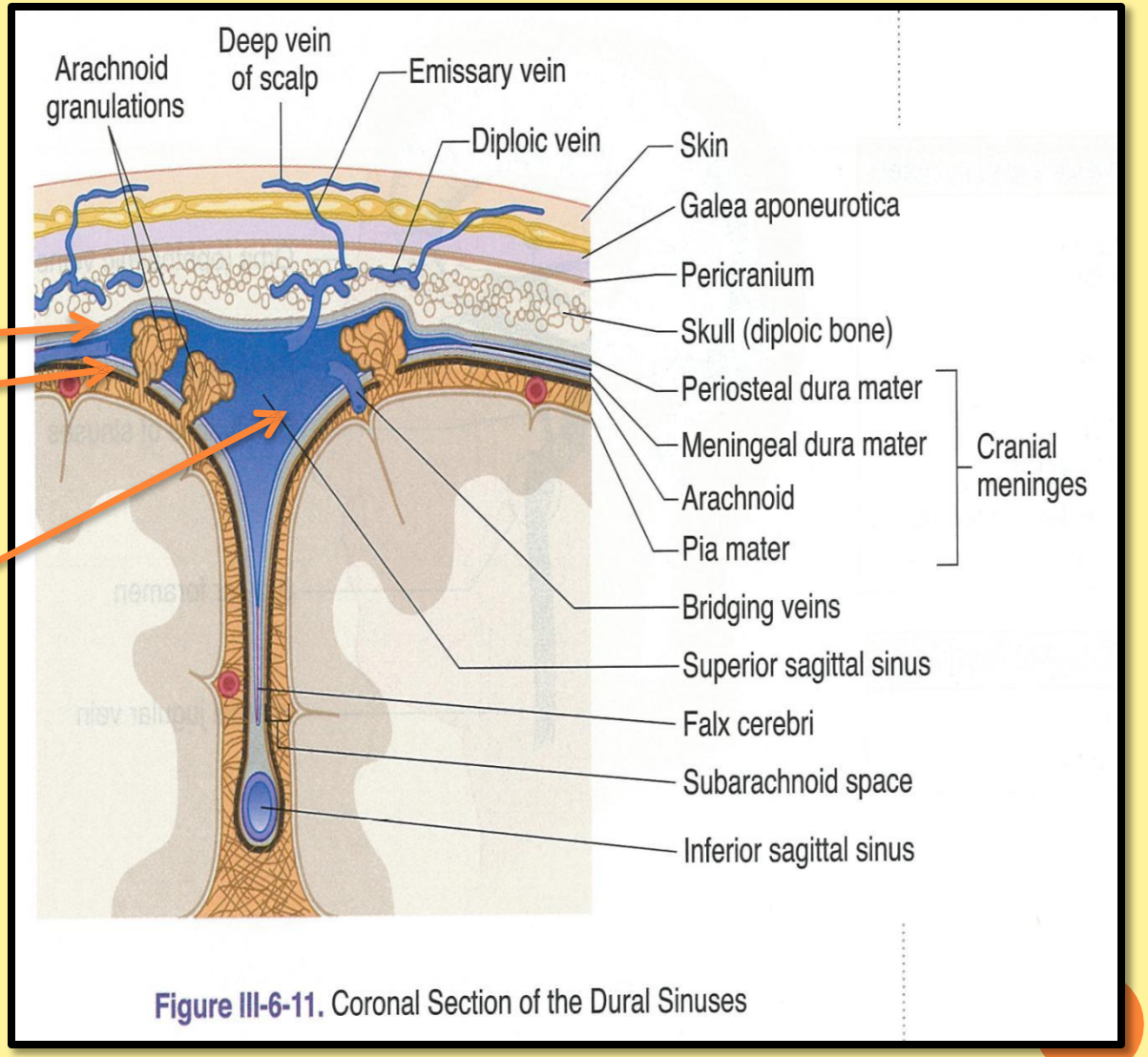


Figure III-6-11. Coronal Section of the Dural Sinuses

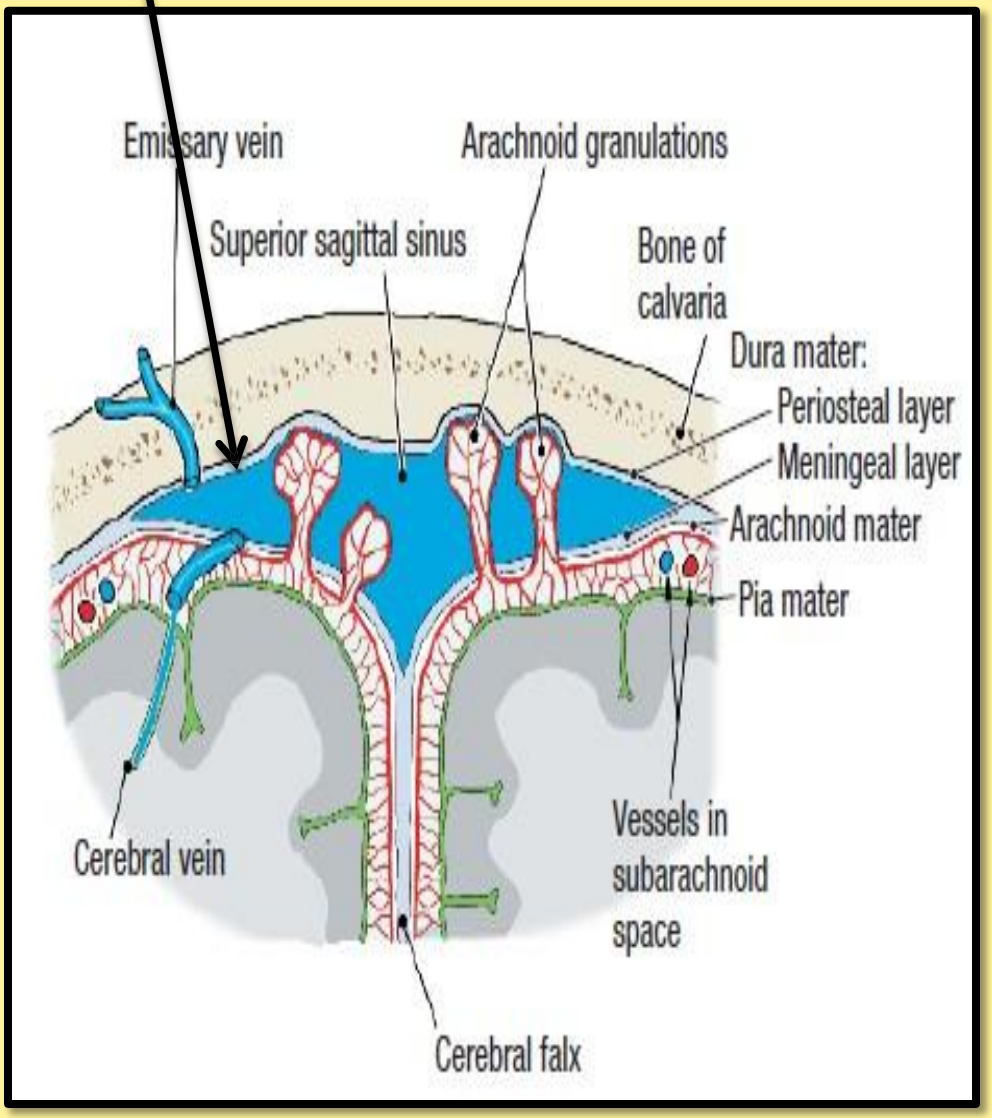
➢A-The endosteal layer

➢Is the **ordinary periosteum** covering the inner surface of the skull bones

➢It ***does not extend*** through the foramen magnum to become continuous with the dura mater of the spinal cord

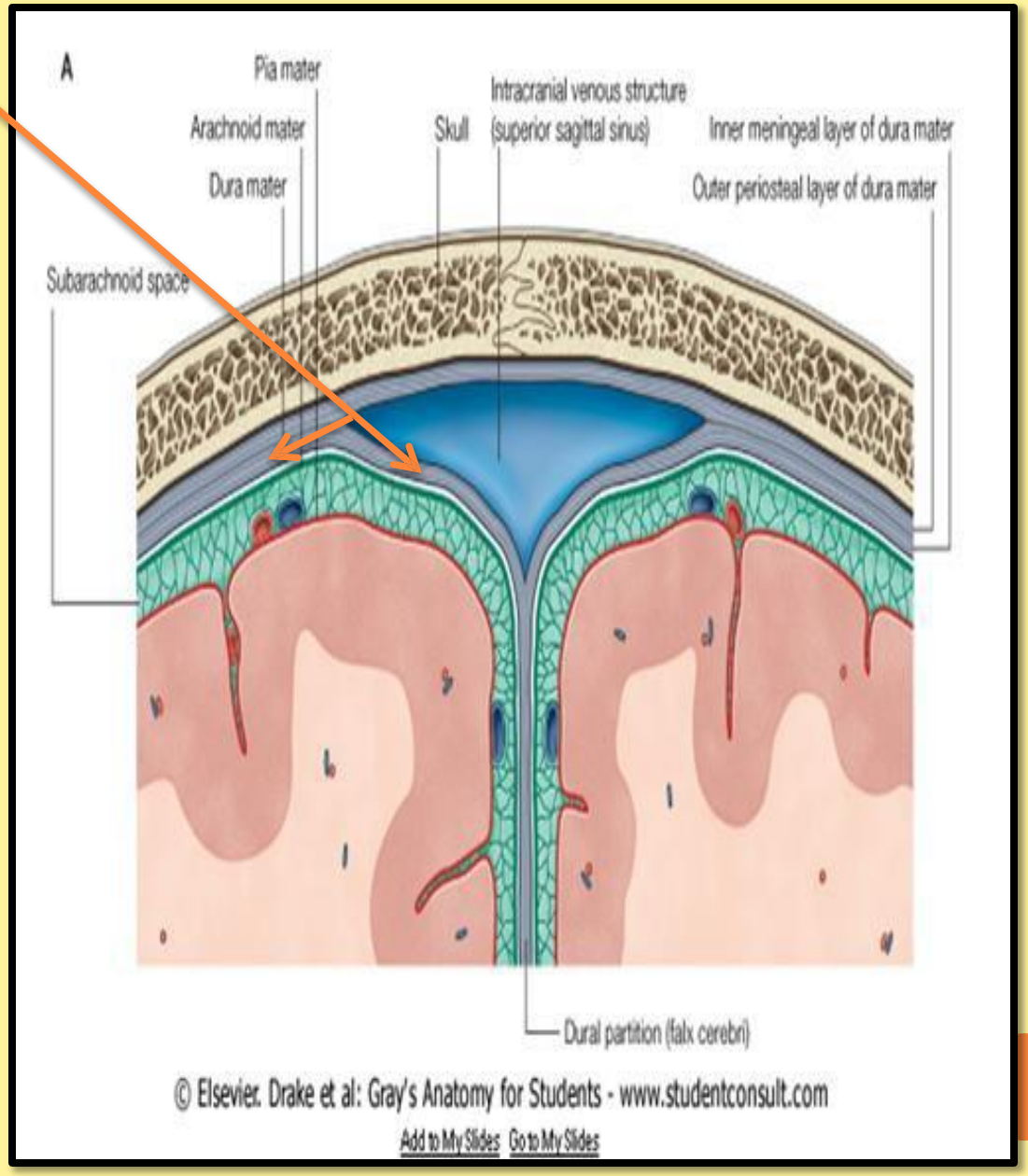
➢Around the margins of all the foramina in the skull it becomes continuous with the periosteum on the outside of the skull bones

➢At the sutures it is continuous with the sutural ligaments.



B-The meningeal layer

- Is the dura mater proper
- It is a dense, strong‹ *fibrous membrane*
- covering the brain and 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



The meningeal layer sends inward

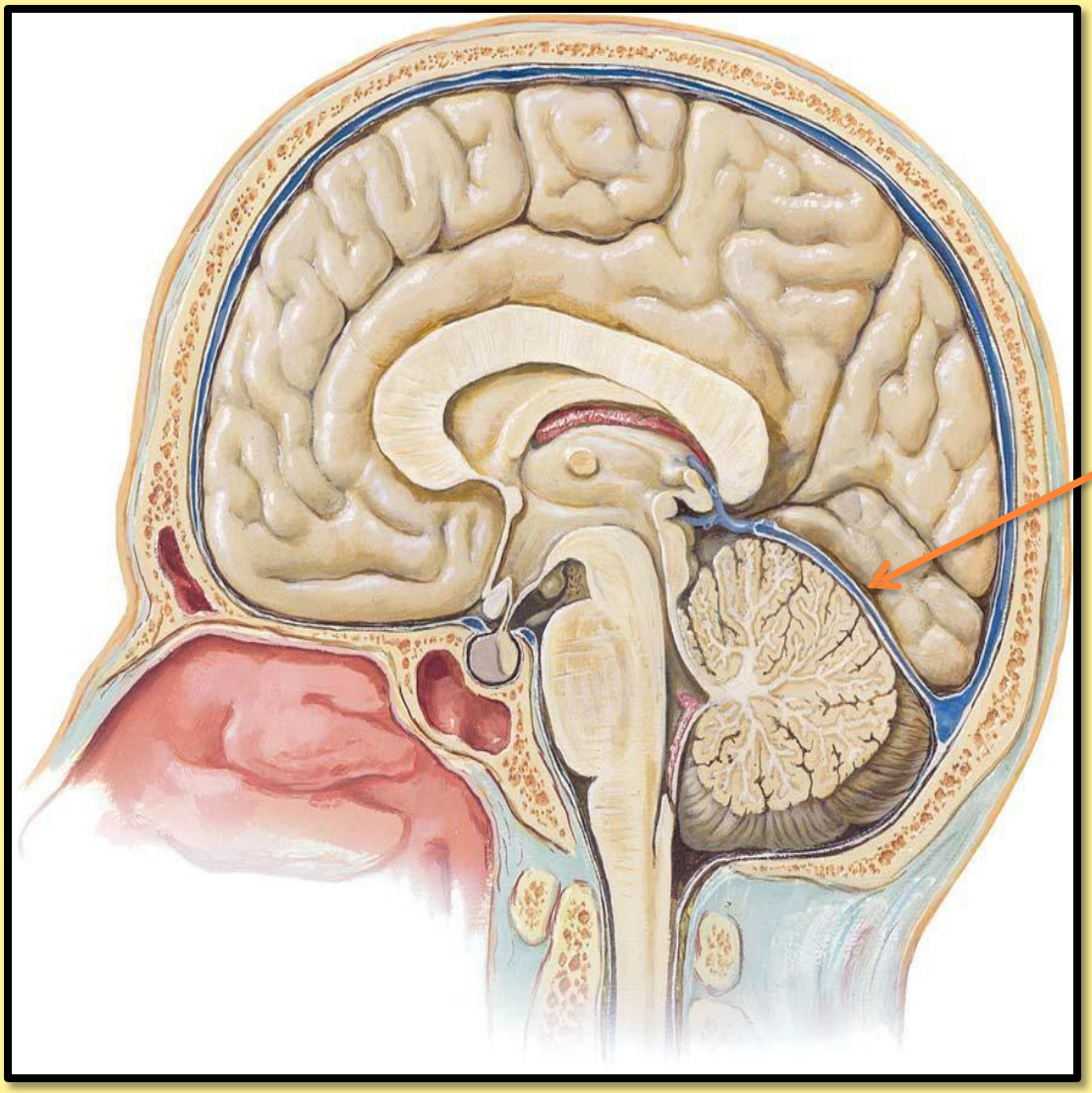
FOUR SEPTA

1-THE FALX CEREBRI

2-THE TENTORIUM CEREBELLI

-3THE FALX CEREBELLI

-4THE DIAPHRAGMA SELLAE



The meningeal layer sends

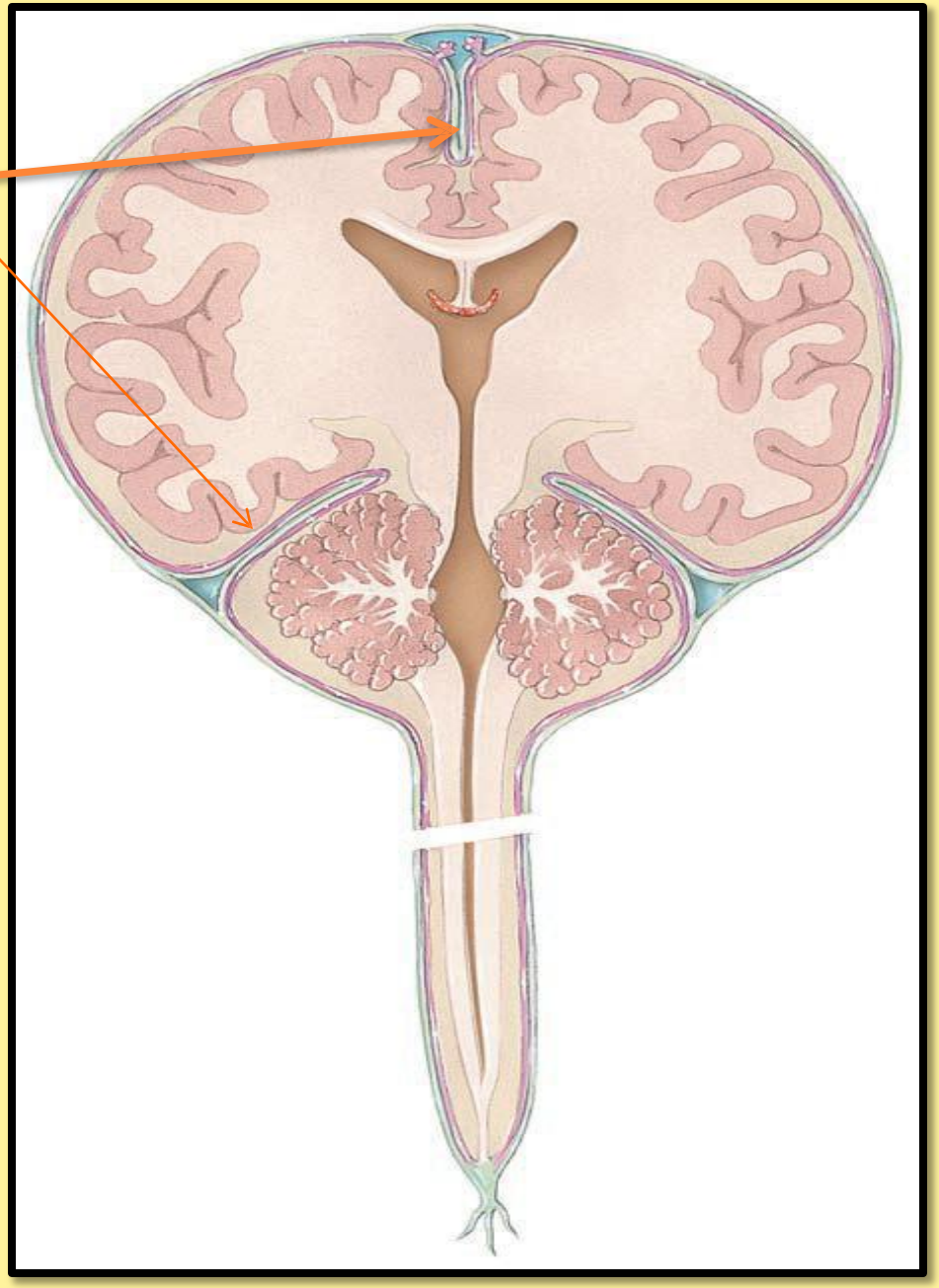
inward

SEPTA

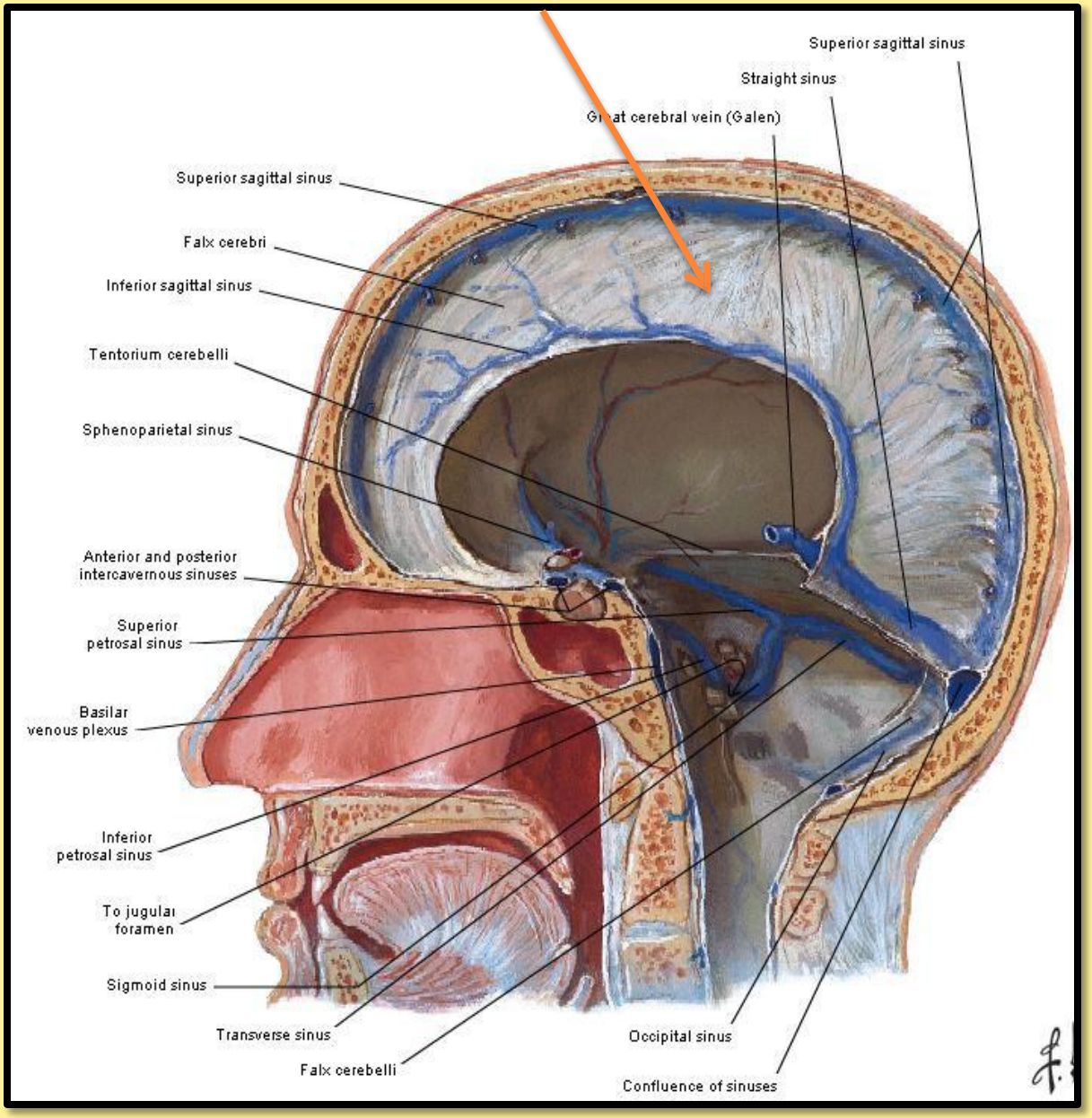
The meningeal layer sends

inward

SEPTA



1-THE FALX CEREBRI



➢Is a sickle-shaped fold of dura mater that lies ***in the midline between the two cerebral hemispheres***

➢Its narrow end **in front** is attached to the

THE CRISTA GALLI

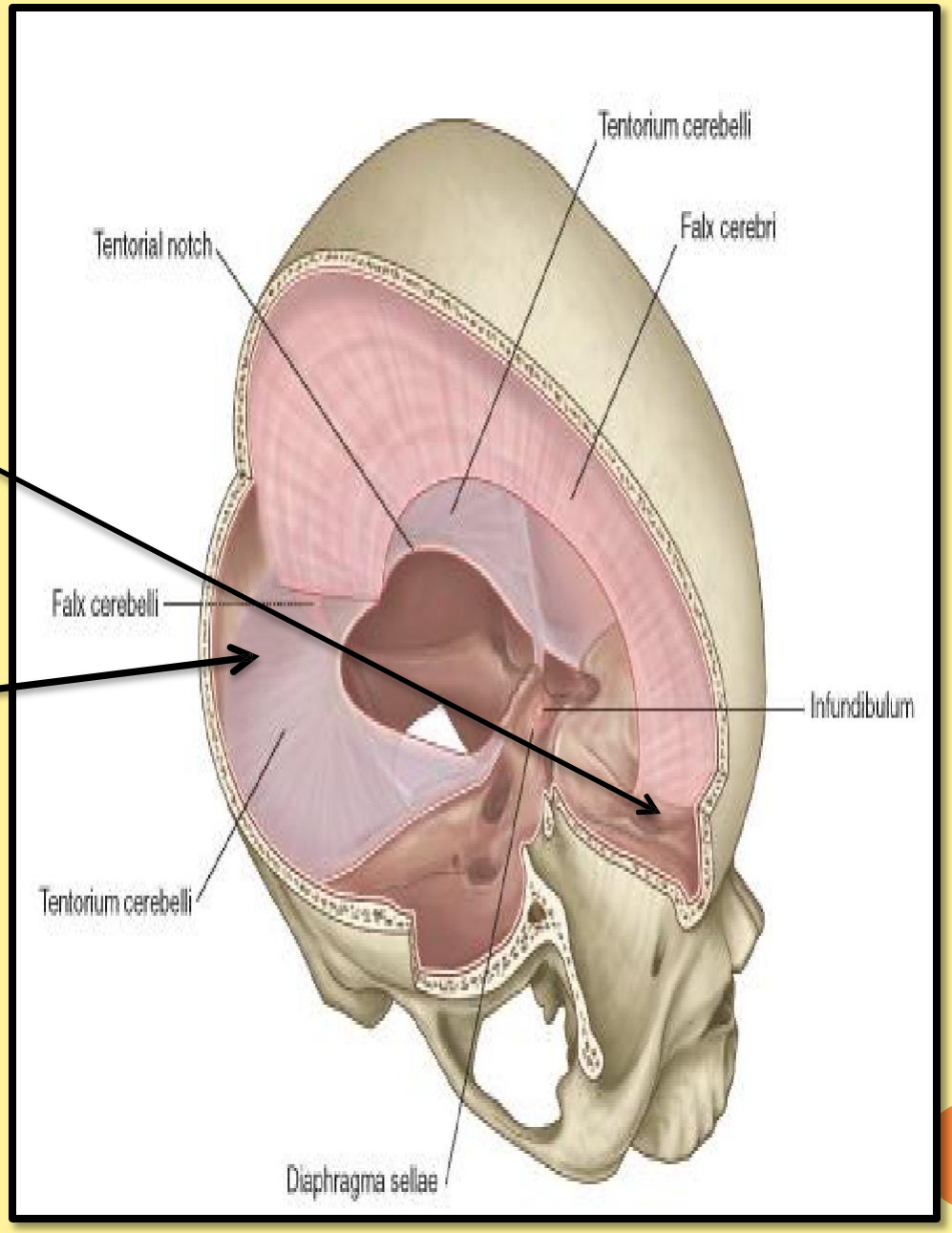
➢Its broad **posterior part** blends in the midline with the upper surface of the

Tentorium cerebelli

➢The ***superior sagittal sinus*** runs in its ***upper fixed margin***

➢the ***inferior sagittal sinus*** runs in its lower ***concave free margin***

➢The straight sinus runs along its attachment to the ***tentorium cerebelli.***



THE TENTORIUM CEREBELLI

- Is a crescent-shaped)or tent-shaped(fold of dura mater
- Roofs over the posterior cranial fossa
- It covers the upper surface of the cerebellum and supports the occipital lobes of the cerebral hemispheres.
- In front is a gap, ***the tentorial notch***, for the passage of the midbrain
- It has:

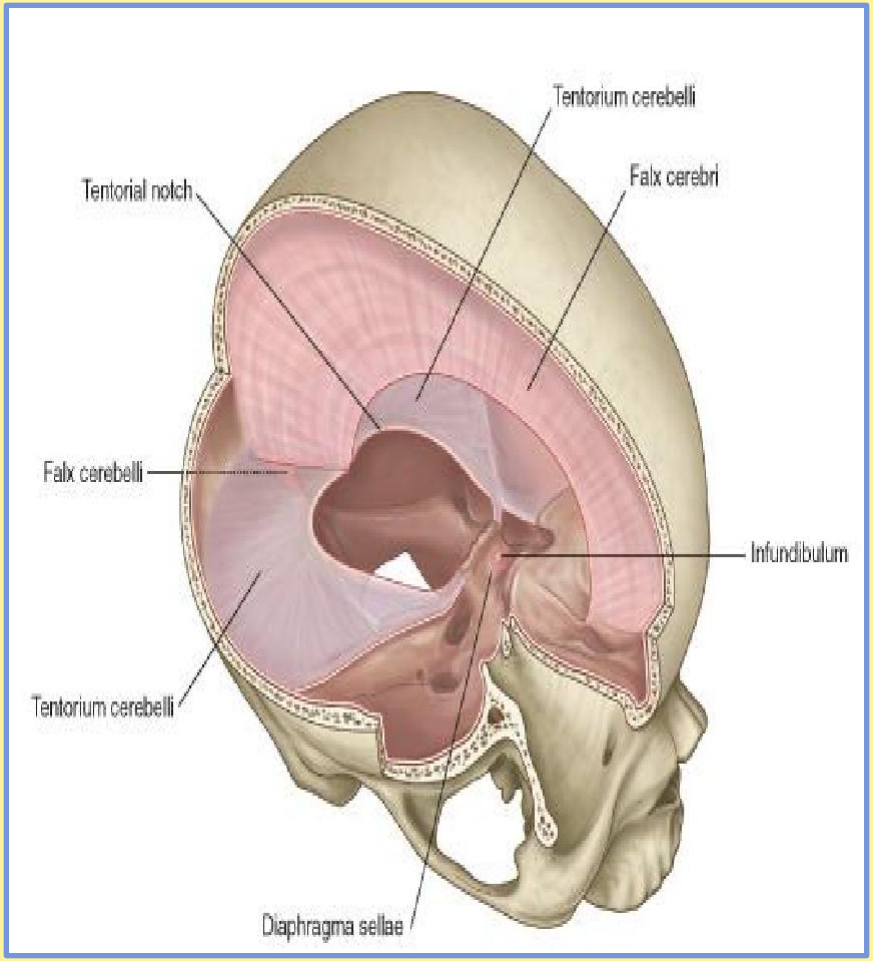
an inner free border

an outer attached or fixed border

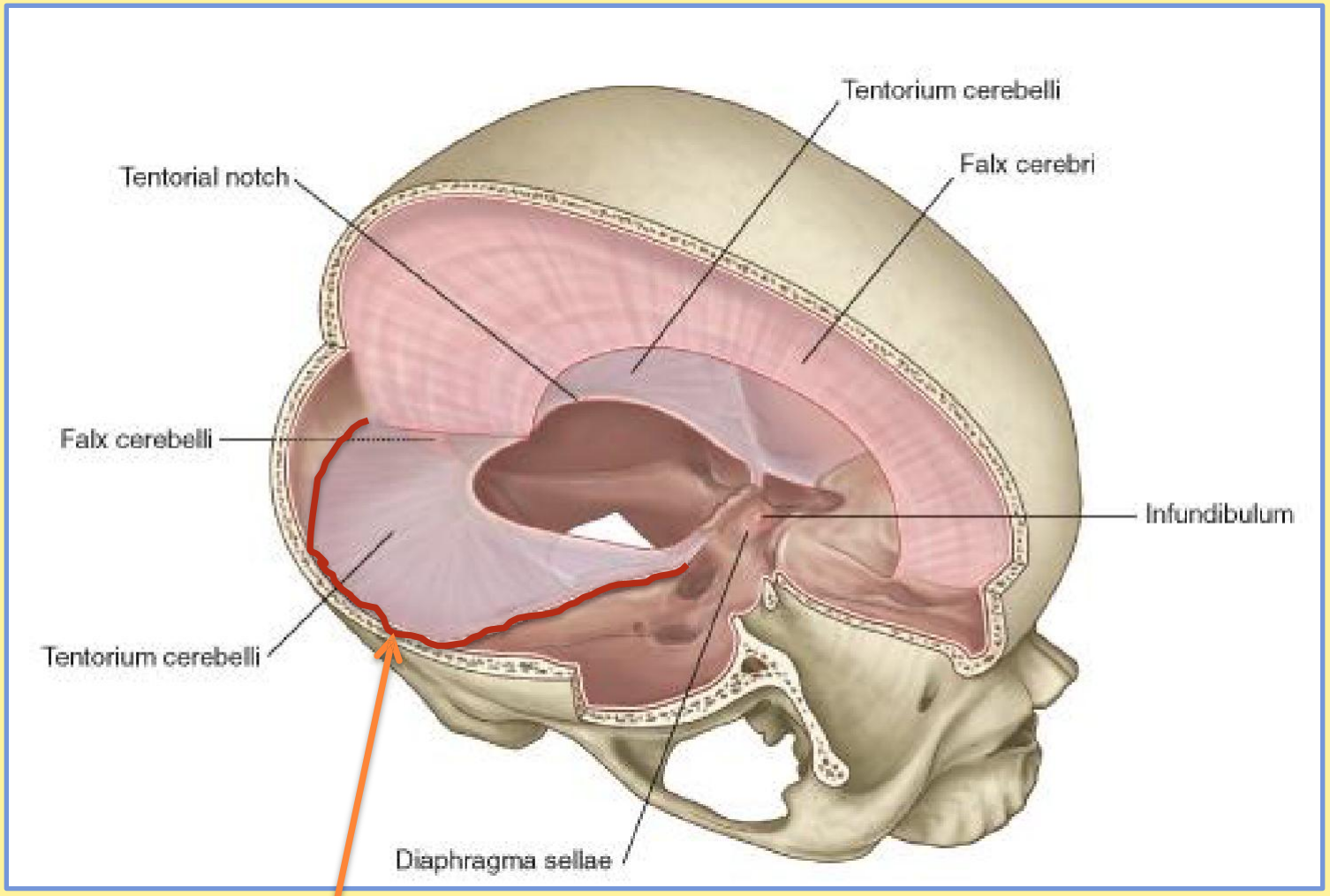
- Divides the cranial cavity into:

1 SUPRATENTORIAL

2 INFRATENTORIAL



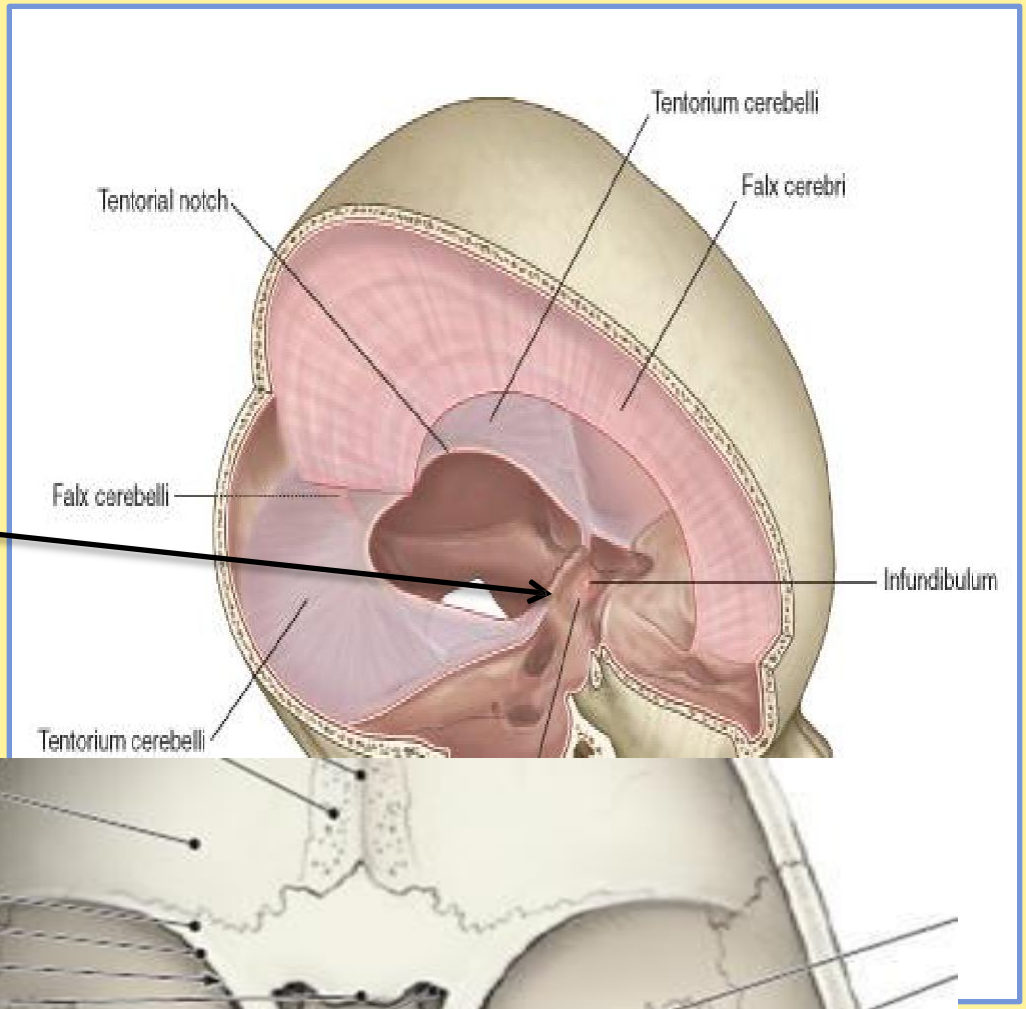
We were dividing the cranial cavity into:
anterior , middle and posterior cranial cavity . At present it is well established that we divide the cranial cavity into **supratentorial and infratentorial regions.**

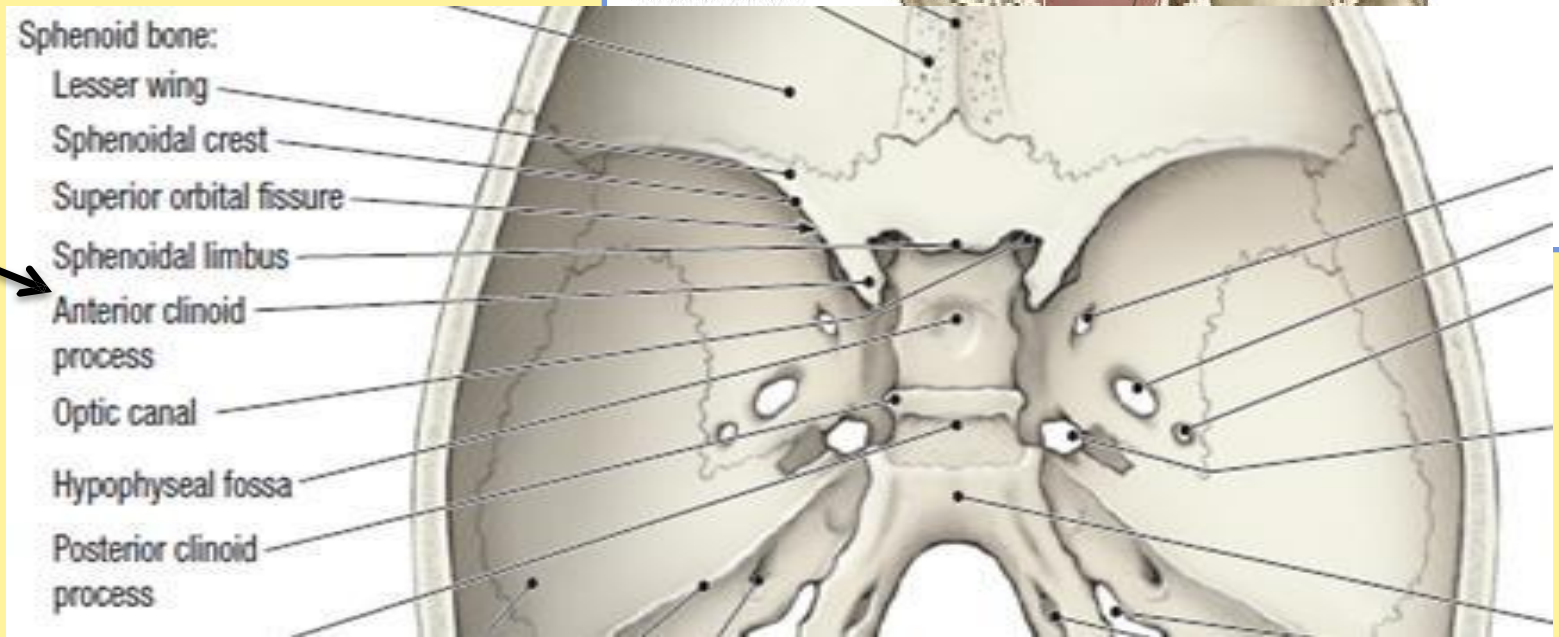


- **The fixed border is attached to:**
- the posterior **<u>clinoid processes</u>**
- The **<u>superior borders of the petrous bones</u>**
- The margins of the grooves for the transverse sinuses on the occipital bone

The free border runs forward at its two ends:

- Attached 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





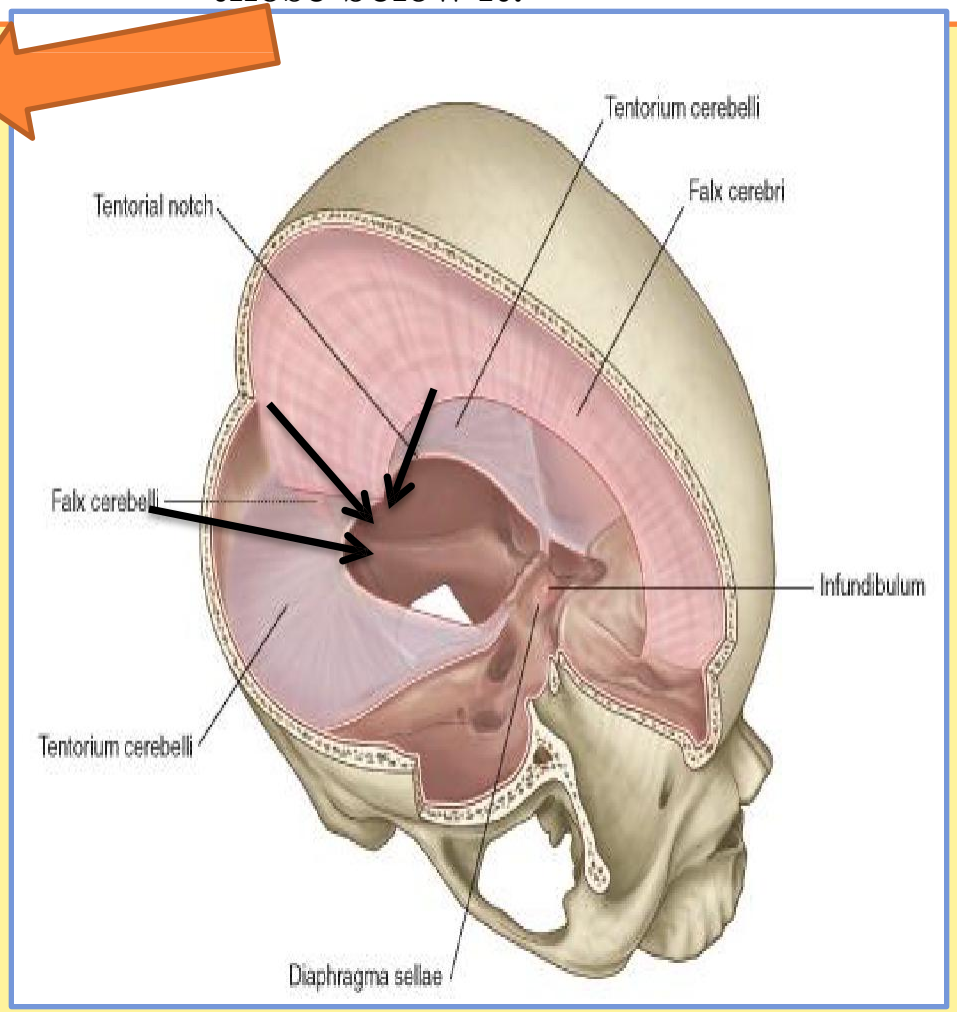
Remember that the dura is a tough structure and its tentorium as well, thus one should think about it as a real septa

Which **really** separates the structures above it from those below it.

Any intracranial mass inside the skull (tumor, bleeding…) may force its neighboring structures to herniate

?

For example



)Temporal Lobe) Herniation

Consequences

1-Compression of cranial nerve III. The ipsilateral third nerve, The first clinical sign is **ipsilateral pupil dilation**

To be explained later in the eye section

since the parasympathetic fibers that supply the constrictor pupil are located on the outside of the nerve **(III)** and are inactivated first by compression.

-2Compression of midbrain cerebral peduncles: resulting in **contralateral hemiparesis** or hemiplegia

-3Brainstem compression

The patient becomes comatose and may develop bradycardia secondary to increasing brainstem compression

It is important to understand that dura is not only a layer that covers the brain but also a though structure that divides the brain into compartments .these compartments are enclosed by the skull which means that any increased intracranial pressure may lead to herniation of some structures of the brain

شخوهف اه اعبط.......

قفـلخجاليخحا حزاه ديما (اللهخوس لا !!!!اه ننًا فزاع اًا

لخوجوج نظعسخ ..وسفخب حز سب(ززسيخشبهقلا يا هو

لهفـتوجو كاُه سشنُحوتيلاملأا ءاشغقحعفحسخ به.

اذذذذذذذذذذذذذذذذذذذذذذذر هو

قف يع هخنيق (حزوب)

لوجلا ياه لظفخح لاالله بلثيه

قبلا يلاسلا جظفد ديما...تفصلا ياه جلصو ماده

ظظظظظظظظظظظظظظظظظظظفد !!!!!لطب

❖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 along its attachment to the petrous bone

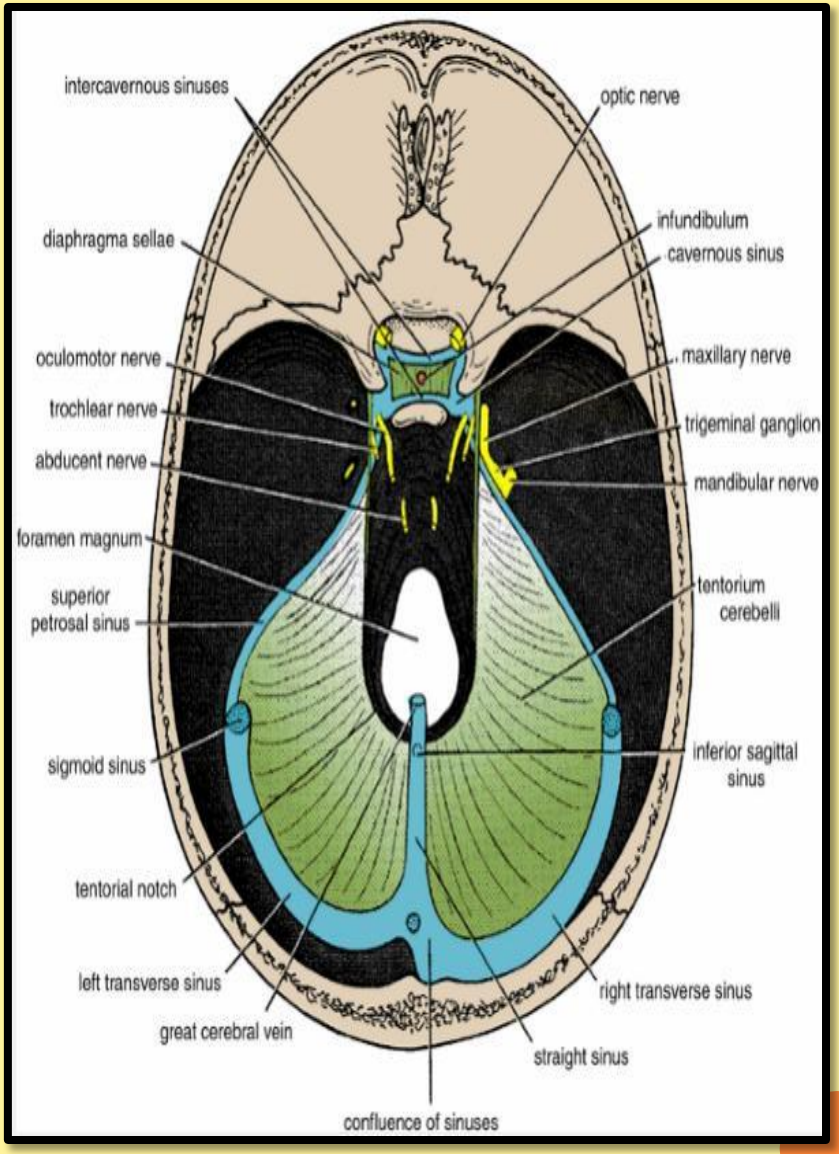
❖ the transverse sinus along its attachment to the occipital bone

-3THE FALX CEREBELLI

- is a small, sickle-shaped fold of dura mater that is attached to the internal occipital crest and projects forward between the two cerebellar hemispheres.
- Its posterior fixed margin contains the occipital sinus.

4-THE DIAPHRAGMA SELLAE

- Is a small circular fold of dura mater that forms the roof for ***the sella turcica***
- Attached to the ***tuberculm sellae*** anteriorly
- Attached to the ***dorsum sellae*** posteriorly
- A small opening in its center allows passage of the ***stalk of the pituitary gland***



The Venous Blood Sinuses

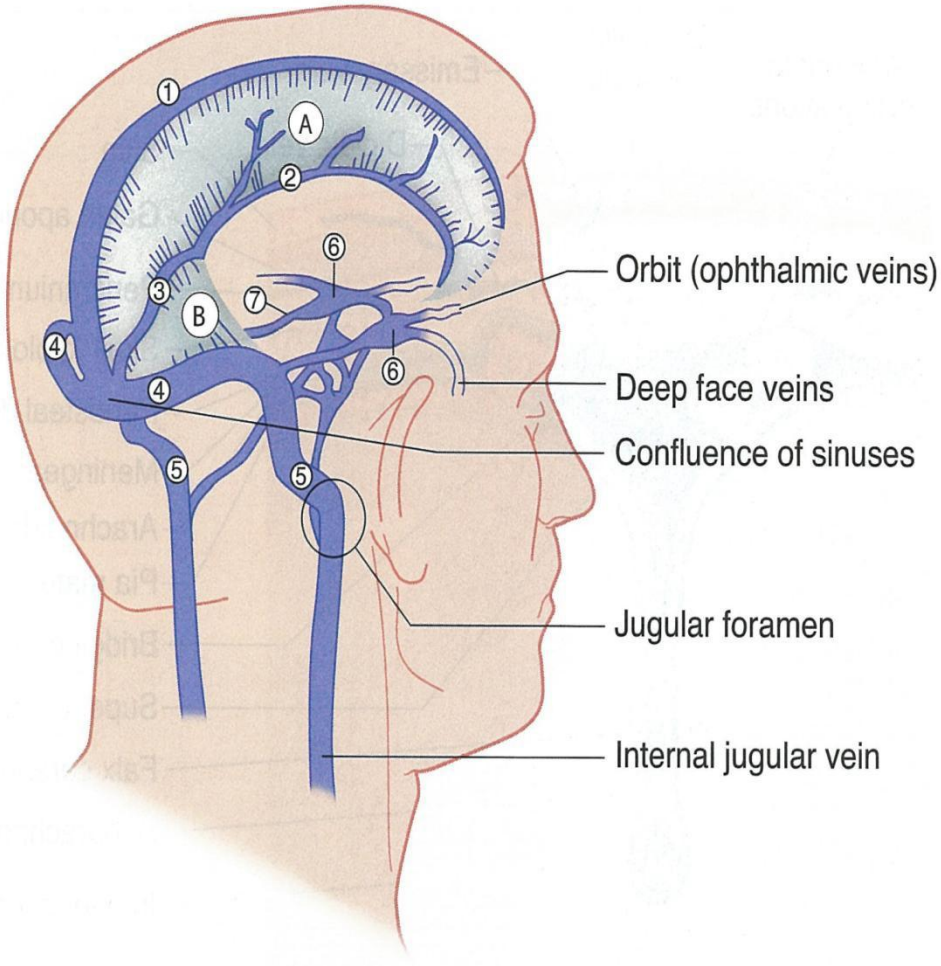
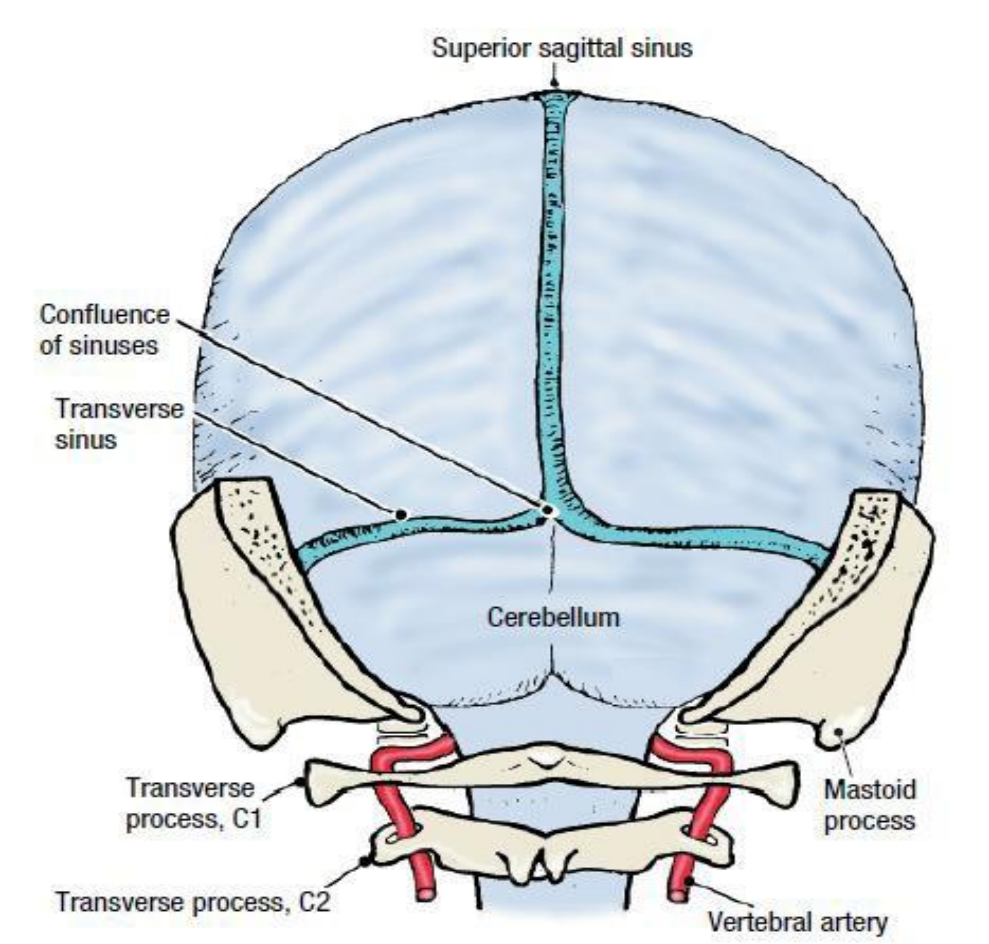


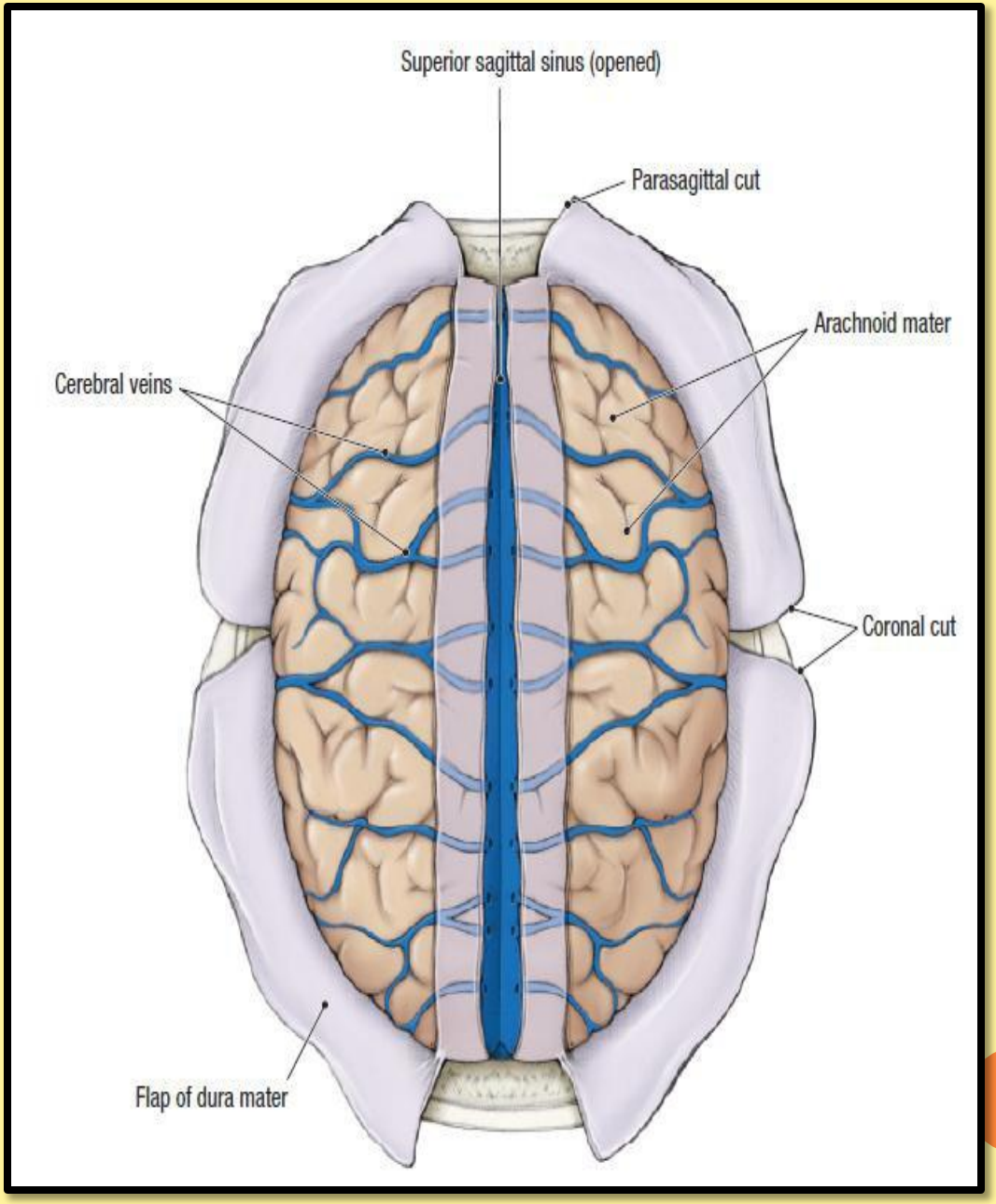
Figure III-6-12. Dural Venous Sinuses

- are blood-filled spaces situated between the layers of the dura mater
- They are lined by endothelium
- Their walls are thick and composed of fibrous tissue
- They have no muscular tissue
- The sinuses have no valves
- They receive tributaries from the brain, the diploë of the skull, the orbit, and the internal ear

The superior sagittal sinus



lies in the upper fixed border of the falx cerebri
It becomes continuous with ***the right transverse*** sinus.
The sinus communicates on each side with the **VENOUS LACUNAE**
Numerous arachnoid villi and granulations project into the lacunae
The superior sagittal sinus receives **THE SUPERIOR CEREBRAL VEINS**

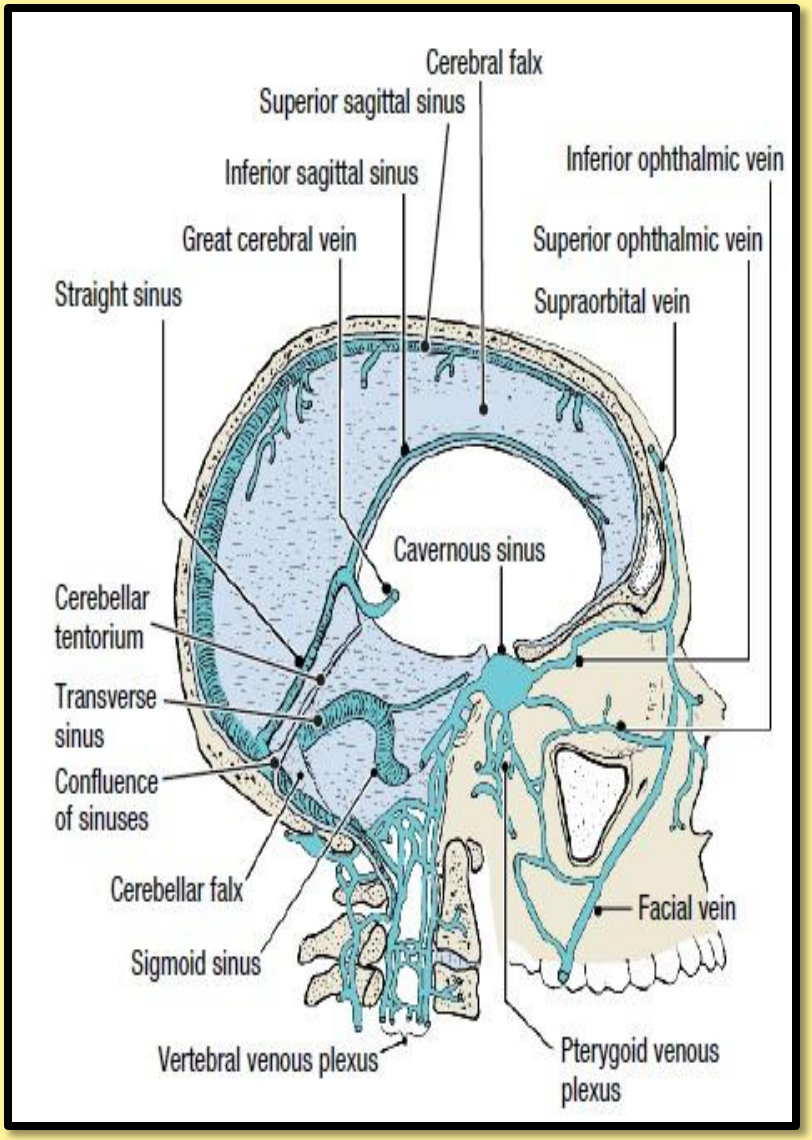


THE INFERIOR SAGITTAL SINUS

•lies in the free lower margin of the falx cerebri
➢It runs backward and joins the great cerebral vein to form the straight sinus
➢It receives cerebral veins from the medial surface of the cerebral hemisphere.

THE STRAIGHT SINUS

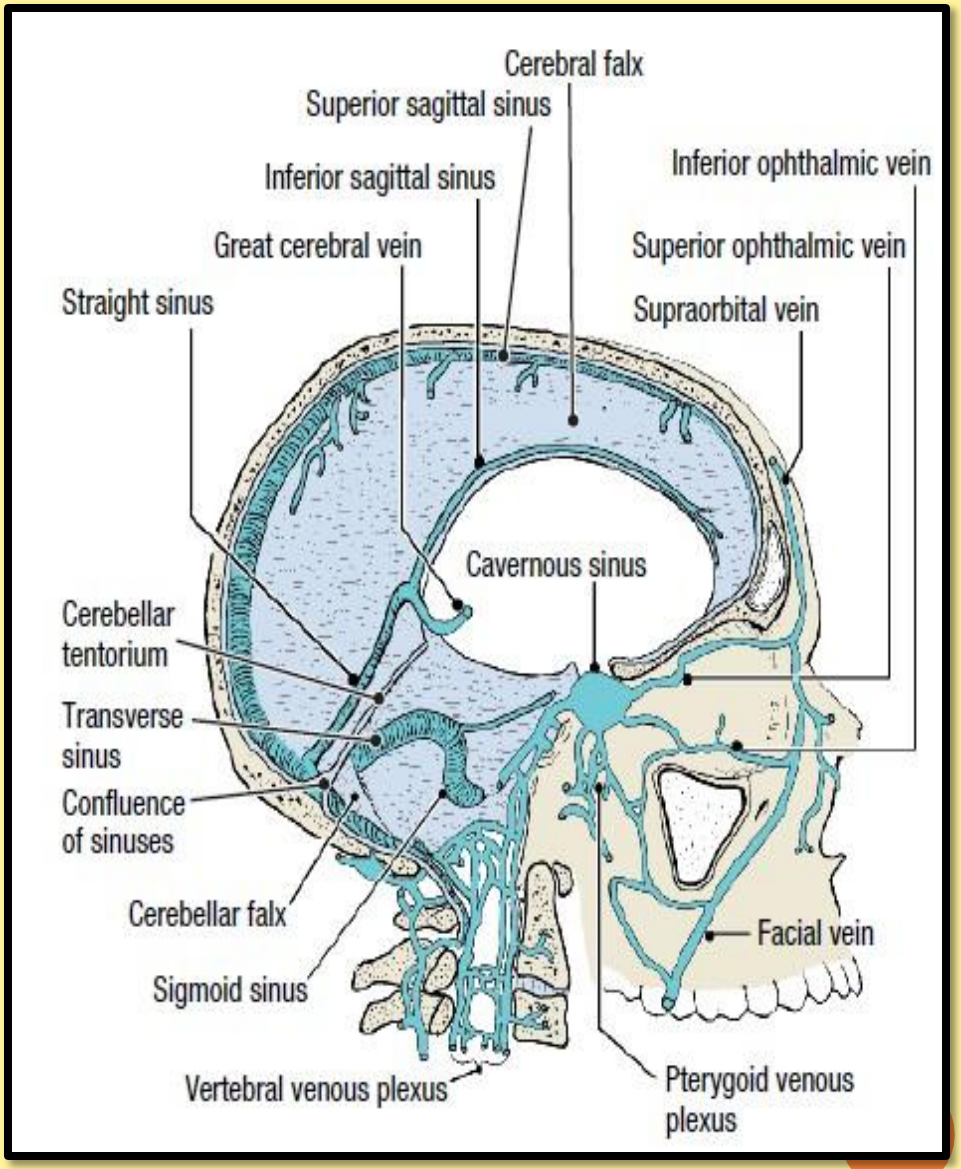
➢lies at the junction of the falx cerebri with the tentorium cerebelli
➢Formed by the union of the inferior sagittal sinus with the great cerebral vein
❖ it drains into ***the left transverse sinus***



THE RIGHT TRANSVERSE SINUS

begins as a continuation of ***the superior sagittal sinus; (***the left transverse sinus is usually a continuation of the straight sinus(

❖Each sinus lies in the lateral attached margin of the tentorium cerebelli, and they end on each side by becoming the sigmoid sinus

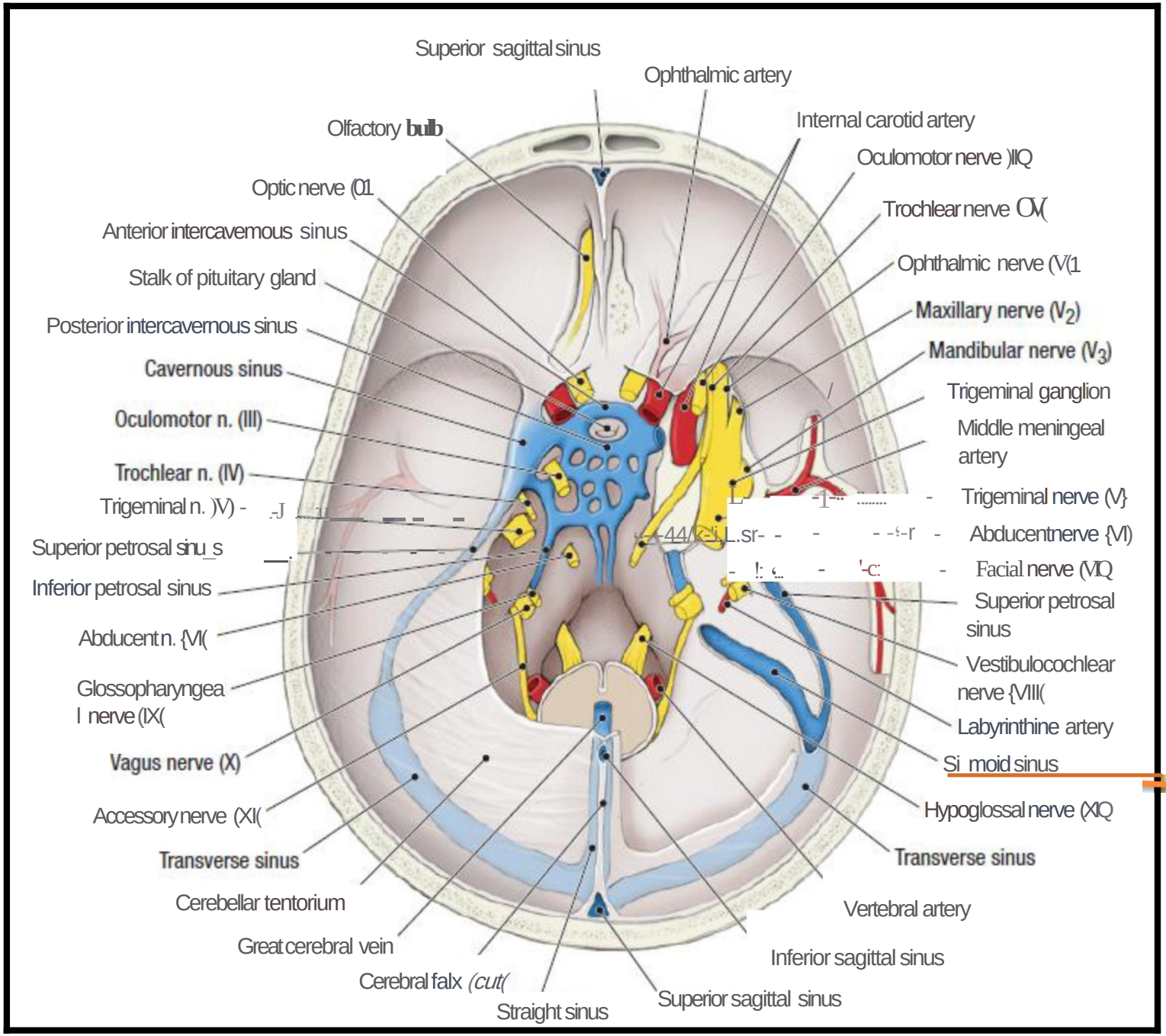


The sigmoid sinuses

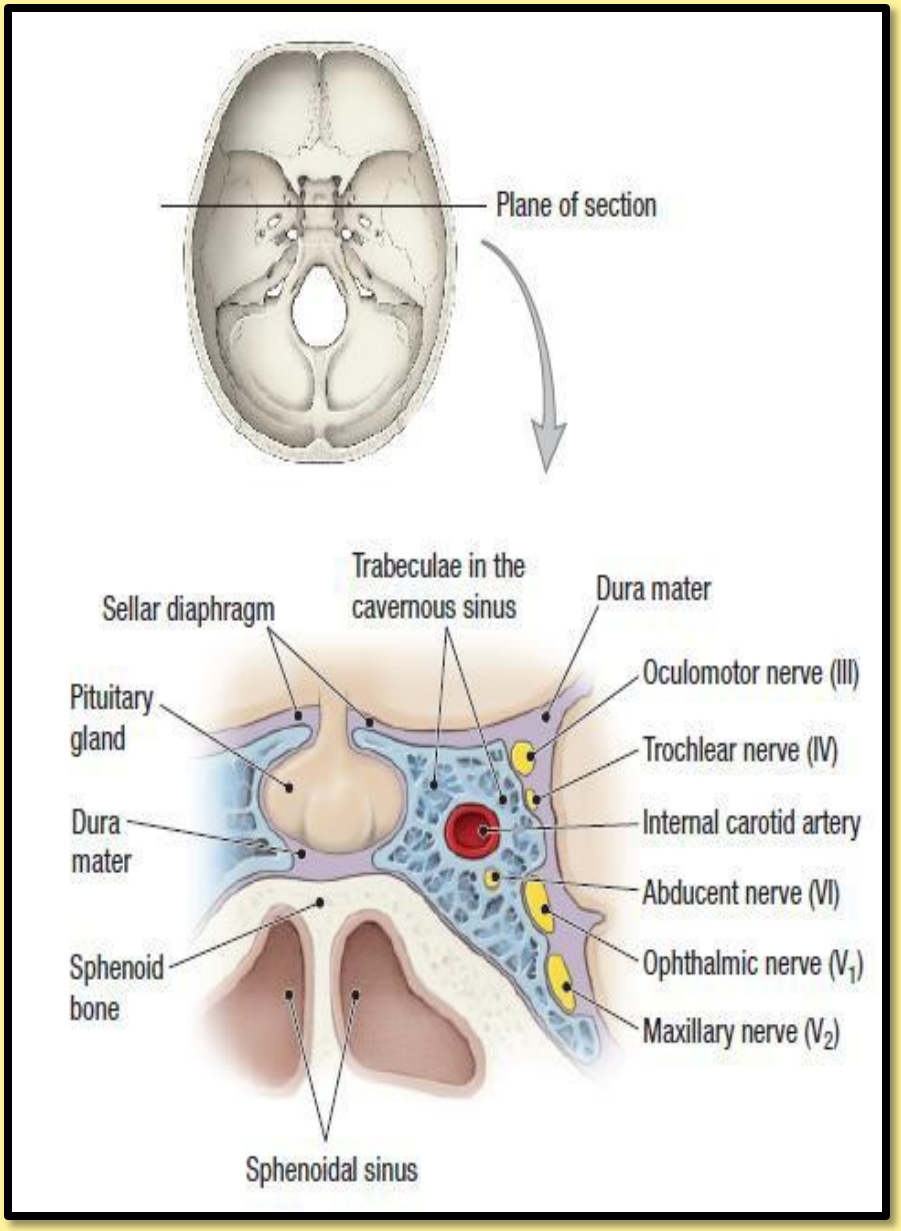
- Are a direct continuation of the transverse sinuses
- Each sinus turns downward behind the mastoid antrum of the temporal bone and then leaves the skull through the jugular foramen
- Become the internal jugular vein

The occipital sinus

- lies in the attached margin of the falx cerebelli
- It communicates with the vertebral veins through the foramen magnum and the transverse sinuses


Superior sagittal sinus
Ophthalmic artery
Olfactory bulb
Internal carotid artery
Oculomotor nerve)IIQ
Optic nerve (01
Trochlear nerve CV(
Anterior intercavernous sinus
Ophthalmic nerve (V(1
Stalk of pituitary gland
Maxillary nerve (V2)
Posterior intercavernous sinus
Mandibular nerve (V3)
Cavernous sinus
Trigeminal ganglion
Oculomotor n. (III)
Middle meningeal artery
Trochlear n. (IV)
Trigeminal nerve (V}
Trigeminal n.)V) -
Abducentnerve {VI)
Superior petrosal sinu_s
Facial nerve (VIQ
Inferior petrosal sinus
Superior petrosal sinus
Abducent n. {VI(
Vestibulocochlear nerve {VIII(
Glossopharyngeal nerve (IX(
Labyrinthine artery
Vagus nerve (X)
Si_moid sinus
Accessory nerve (XI(
Hypoglossal nerve (XIQ
Transverse sinus
Transverse sinus
Cerebellar tentorium
Vertebral artery
Great cerebral vein
Inferior sagittal sinus
Cerebral falx (cut(
Straight sinus
Superior sagittal sinus

CAVERNOUS SINUS

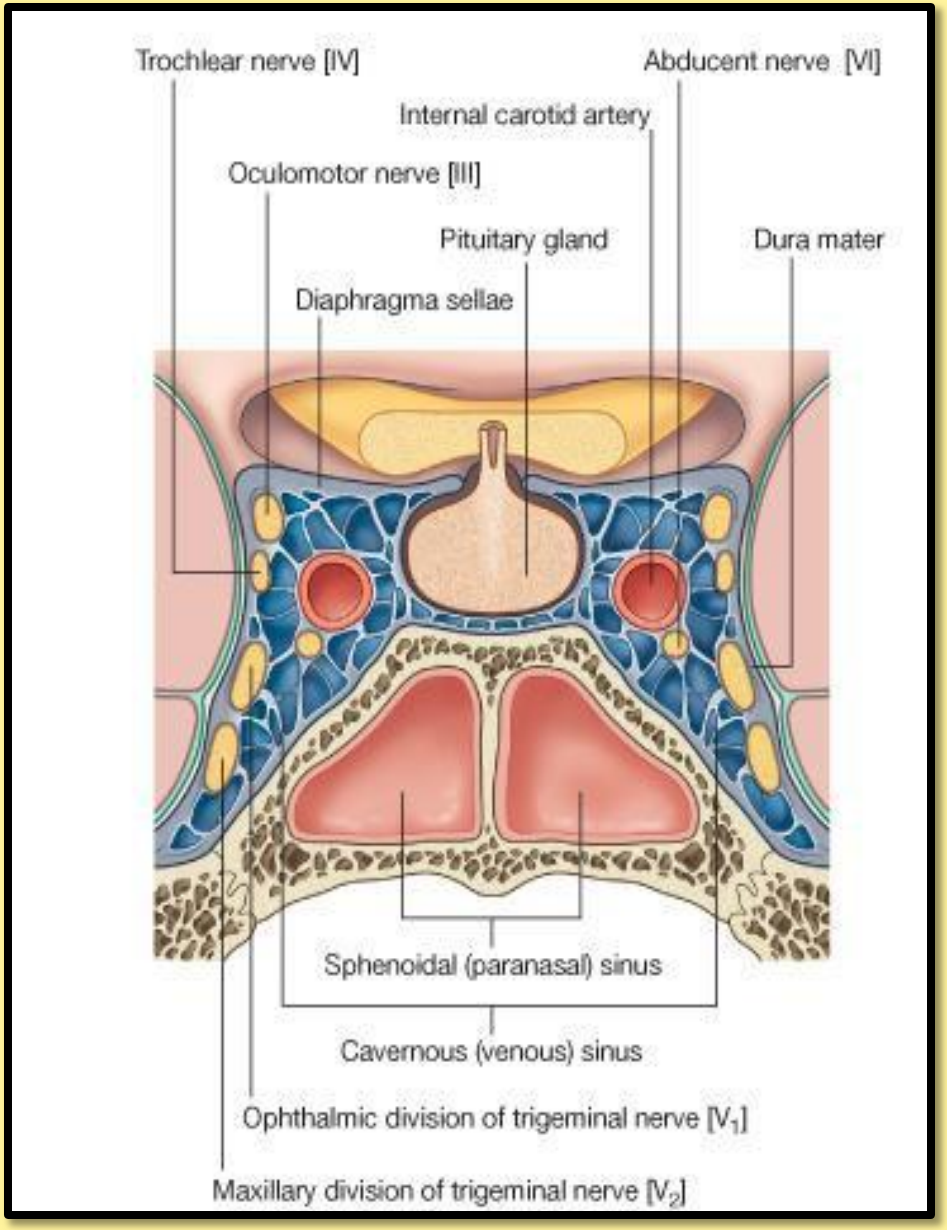


- lies on the lateral side of the body of the sphenoid bone
- Anteriorly, the sinus receives

-1The inferior ophthalmic vein

-2The central vein of the retina

The sinus drains posteriorly into: the *transverse sinus* through ***the superior petrosal sinus*** ***Intercavernous sinuses***



Important Structures Associated With the Cavernous Sinuses

1 The internal carotid artery

2 The sixth cranial nerve

on the lateral wall

1The third

2 Fourth cranial nerves

3The ophthalmic and maxillary divisions of the fifth cranial nerve

4-The pituitary gland, which lies medially in the sella turcica

-5The veins of the face, which are connected with the cavernous sinus via
a-The facial vein
b-Inferior ophthalmic vein
and are an important route for the spread of infection from the face

-6The superior and inferior petrosal sinuses, which run along the upper and lower borders of the petrous part of the temporal bone

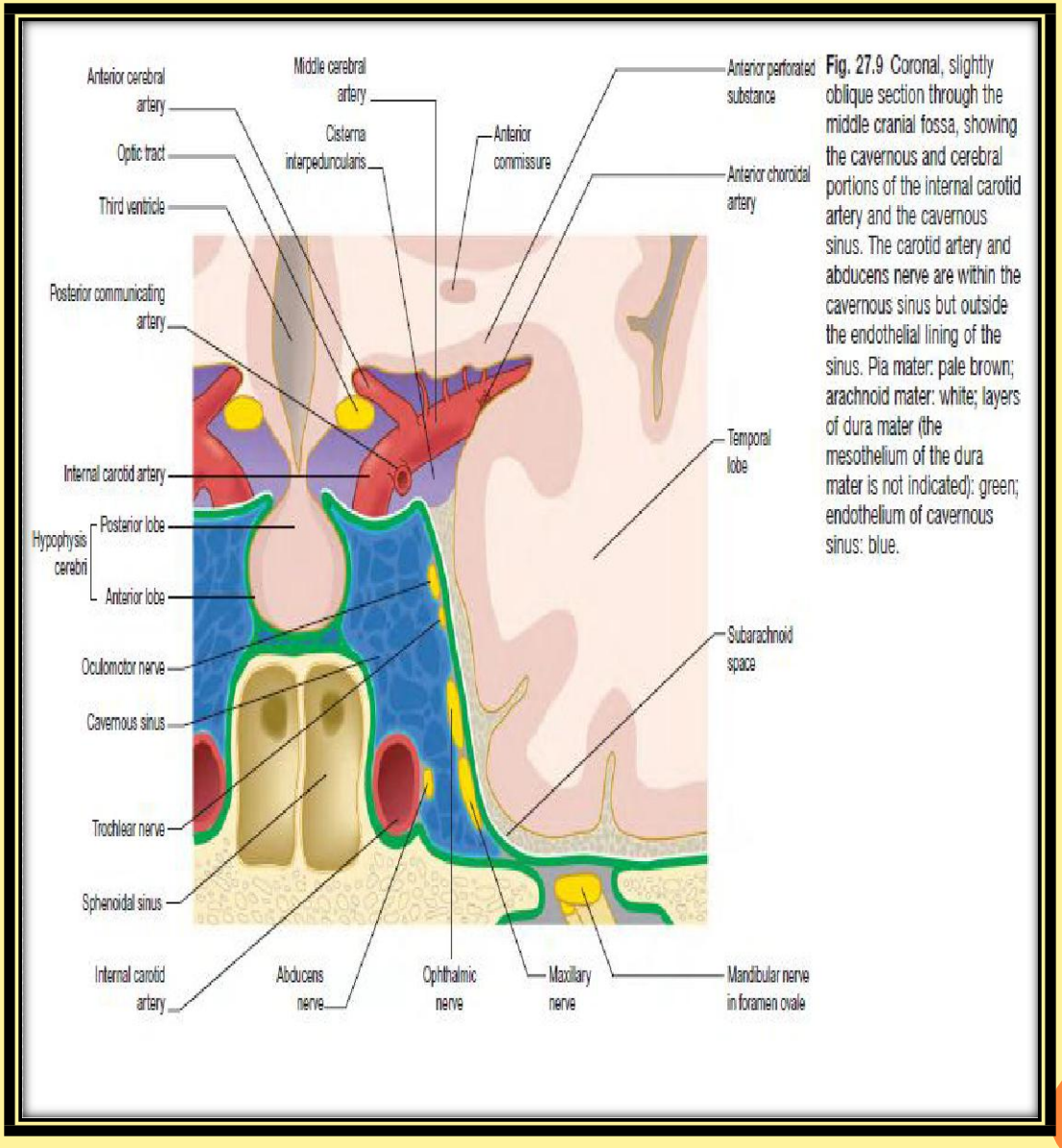


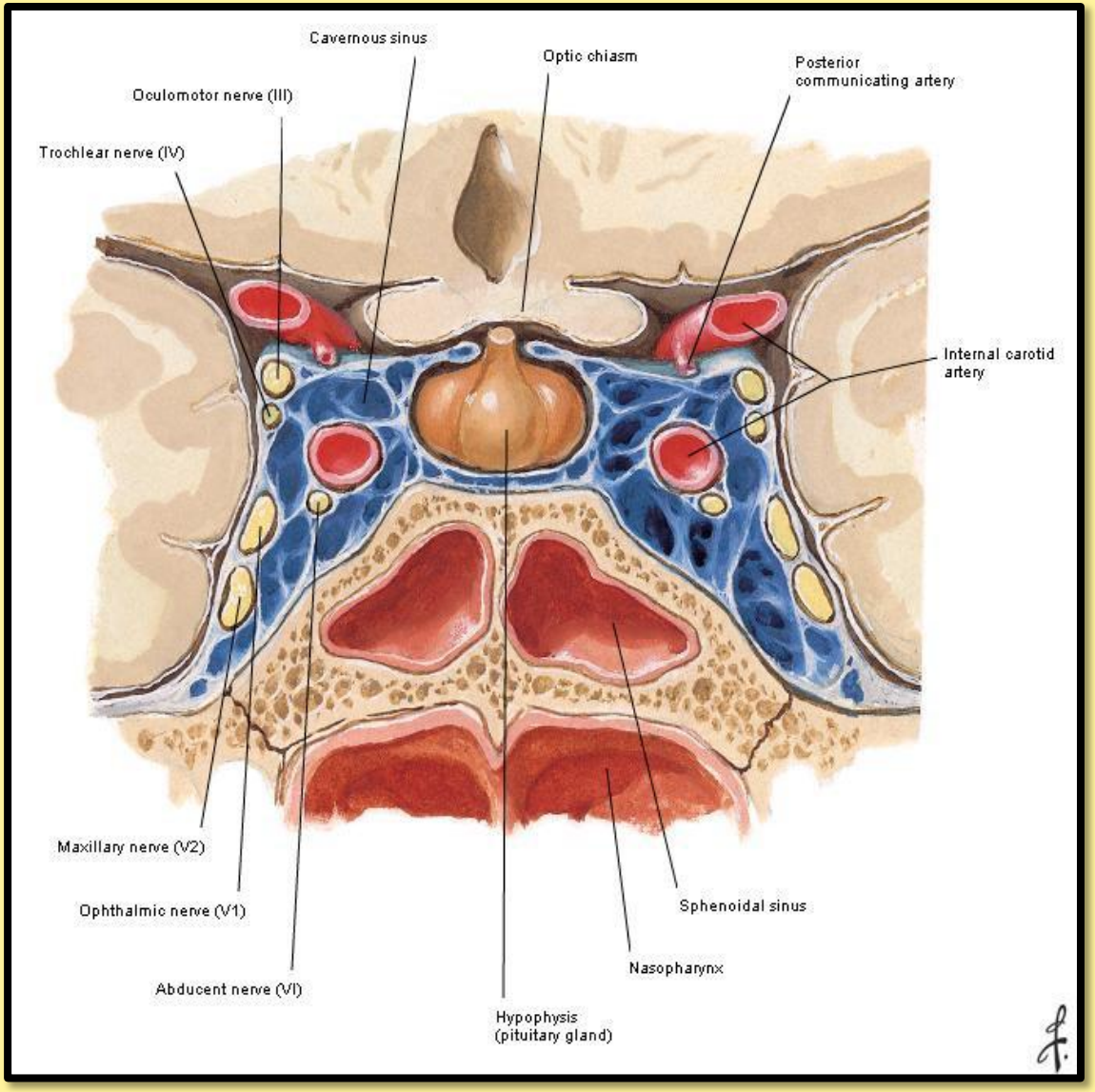
Fig. 27.9 Coronal, slightly oblique section through the middle cranial fossa, showing the cavernous and cerebral portions of the internal carotid artery and the cavernous sinus. The carotid artery and abducens nerve are within the cavernous sinus but outside the endothelial lining of the sinus. Pia mater: pale brown; arachnoid mater: white; layers of dura mater (the mesothelium of the dura mater is not indicated): green; endothelium of cavernous sinus: blue.

Pituitary Gland)Hypophysis Cerebri(

The pituitary gland is a small, oval structure attached to the undersurface of the brain by the

infundibulum

The gland is well protected in the sella turcica of the sphenoid bone



Dural Nerve Supply

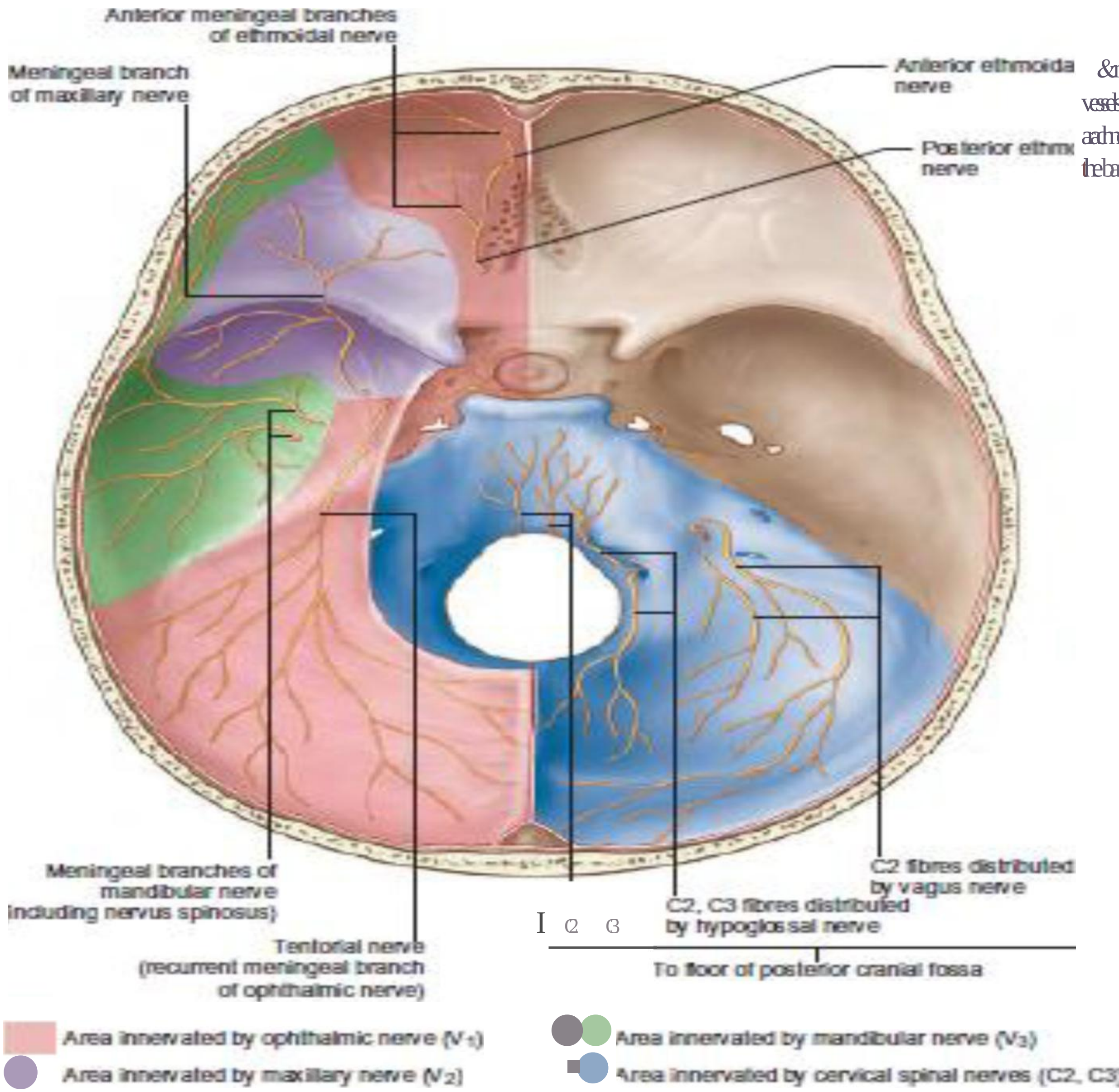
Branches of the trigeminal, vagus, and first three cervical nerves and branches from the sympathetic system pass to the dura.

Numerous sensory endings are in the dura.

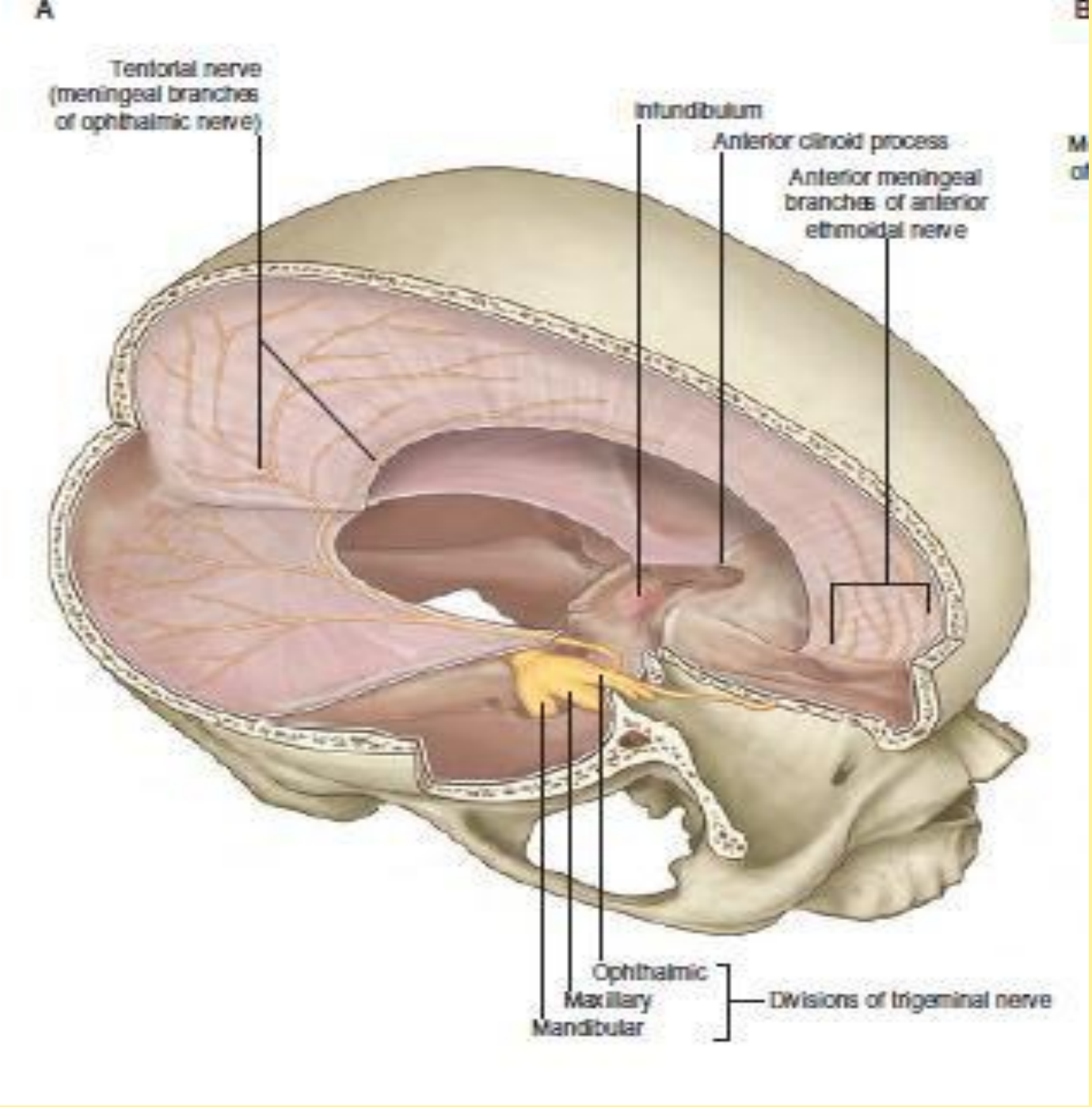
The dura is sensitive to stretching, which produces the sensation of headache.

Stimulation of the sensory endings of the trigeminal nerve above the level of the tentorium cerebelli produces referred pain to an area of skin on the same side of the head.

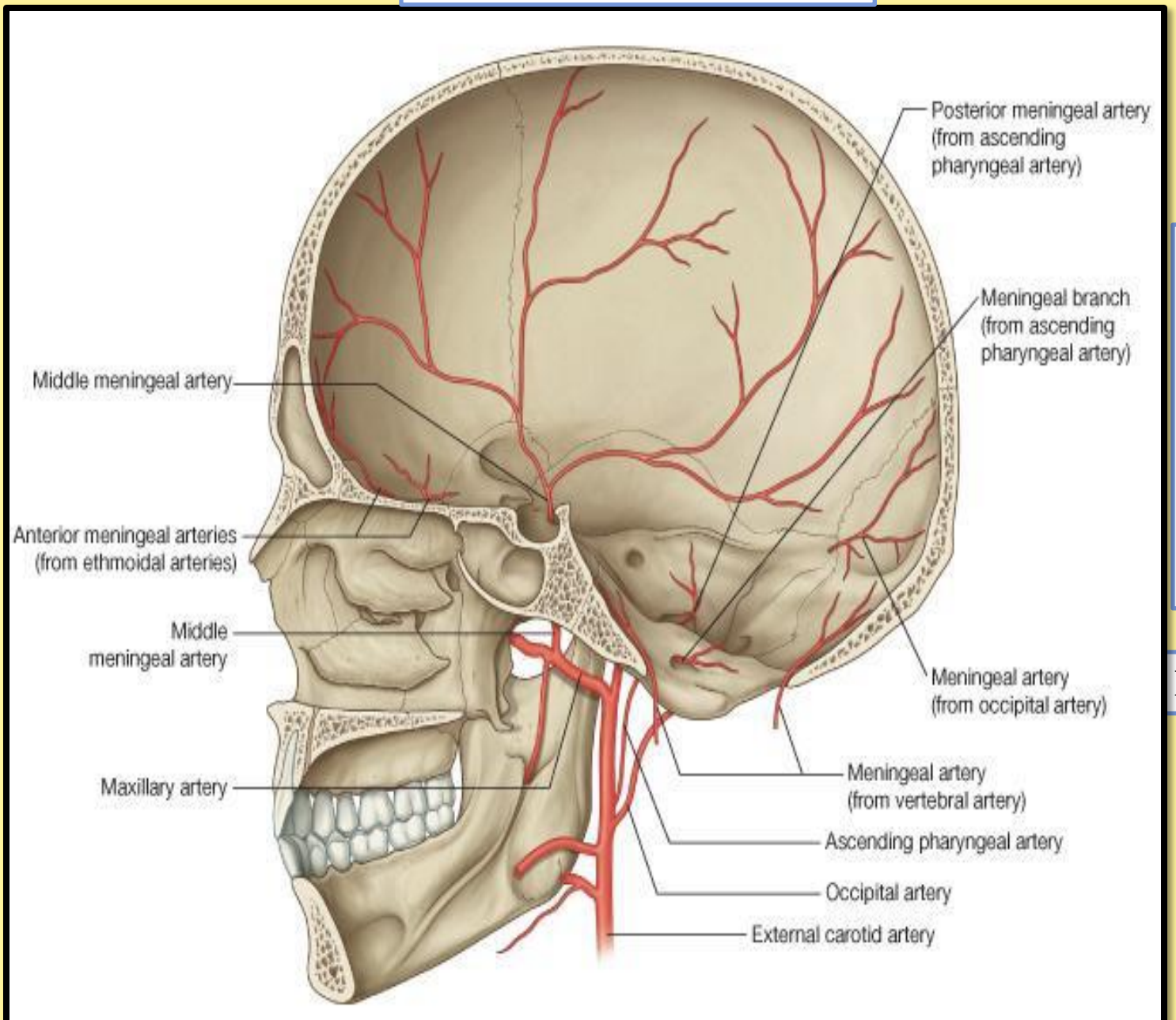
Stimulation of the dural endings below (posterior cranial fossa) the level of the tentorium produces **referred pain to the back of the neck and back of the scalp along the distribution of the greater occipital nerve**



&nsory nerve endings are restricted to ilie dura mater and cerebral blood vessels, and are not found in either the brain itself, or in ilie arachnoid or pia mater. Stimulation of these nerve endings causes pain and is the basis of certain forms of headache.


A
Tentorial nerve
(meningeal branches
of ophthalmic nerve)
Infundibulum
Anterior clinoid process
Anterior meningeal
branches of anterior
ethmoidal nerve
Ophthalmic
Maxillary
Mandibular
Divisions of trigeminal nerve

Dural Arterial Supply



Numerous arteries supply the dura mater For example, the internal carotid, Maxillary vertebral arteries.

However!!!!

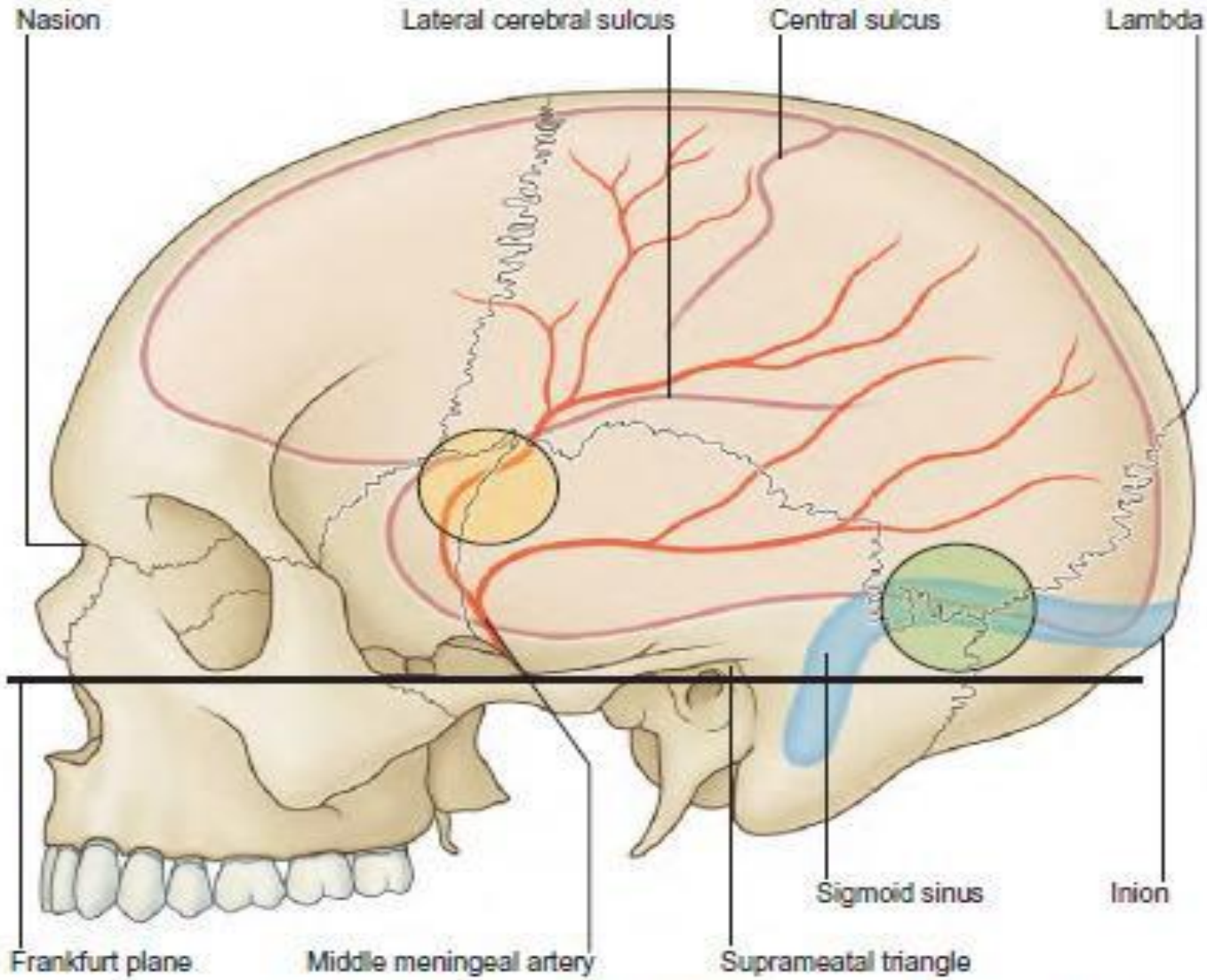


Fig. 27.7 The relations of the brain, the middle meningeal artery and the transverse and sigmoid sinuses to the surface of the skull. Area enclosed in yellow circle (including the pterion) for trephining over the frontal branch of the middle meningeal artery and lateral Sylvian fissure; area enclosed in green circle for trephining over the transverse sinus.

The middle meningeal artery is the main artery that supplies the dura mater

➢arises from the maxillary artery in the infratemporal fossa
it passes through the foramen spinosum to lie between the meningeal and endosteal layers of dura
Branches

The anterior (frontal(

branch deeply grooves or tunnels the anteroinferior angle of the parietal bone, and its course corresponds roughly to the line of the underlying precentral gyrus of the brain.

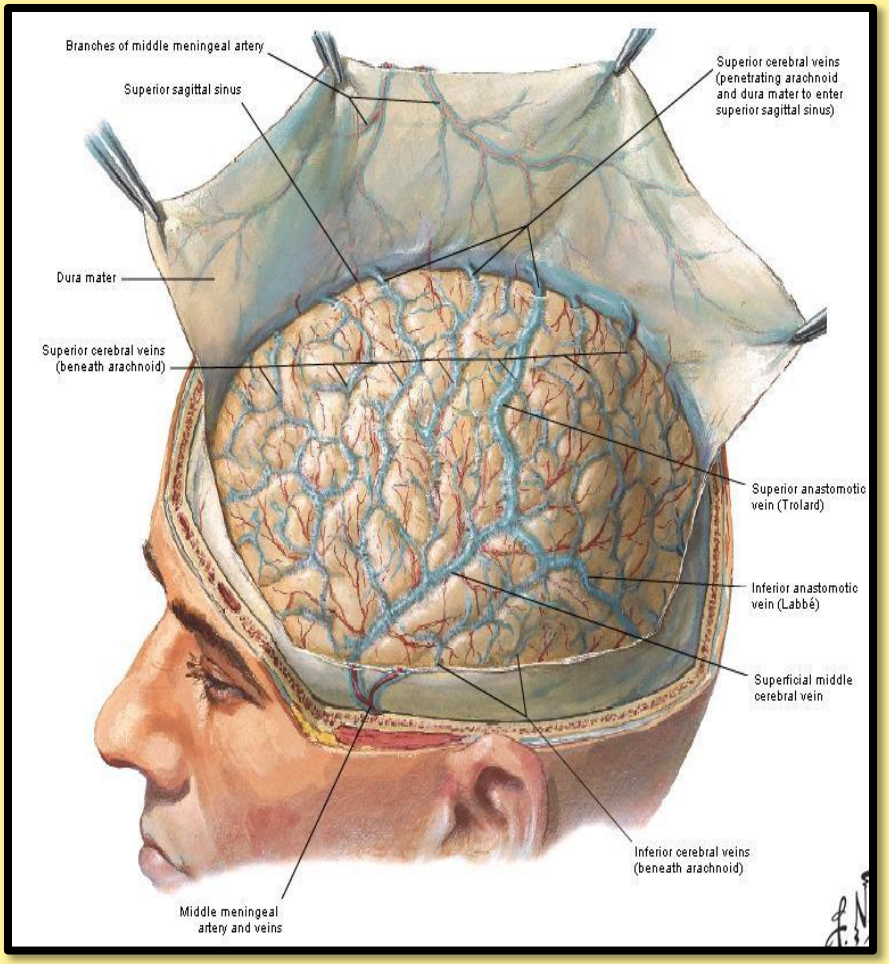
The posterior (parietal(

branch curves backward and supplies the posterior part of the dura mater

-2Arachnoid Mater of the Brain

➢The arachnoid mater is a delicate membrane covering the brain and lying between **THE PIA MATER INTERNALLY THE DURA MATER EXTERNALLY**

It is separated from the dura by a potential space THE SUBDURAL SPACE and from the pia by THE SUBARACHNOID SPACE which is filled with ***cerebrospinal fluid***



in certain situations the arachnoid and pia are widely separated to form

THE SUBARACHNOID CISTERNAE

In certain areas the arachnoid projects into the venous sinuses to form

ARACHNOID VILLI

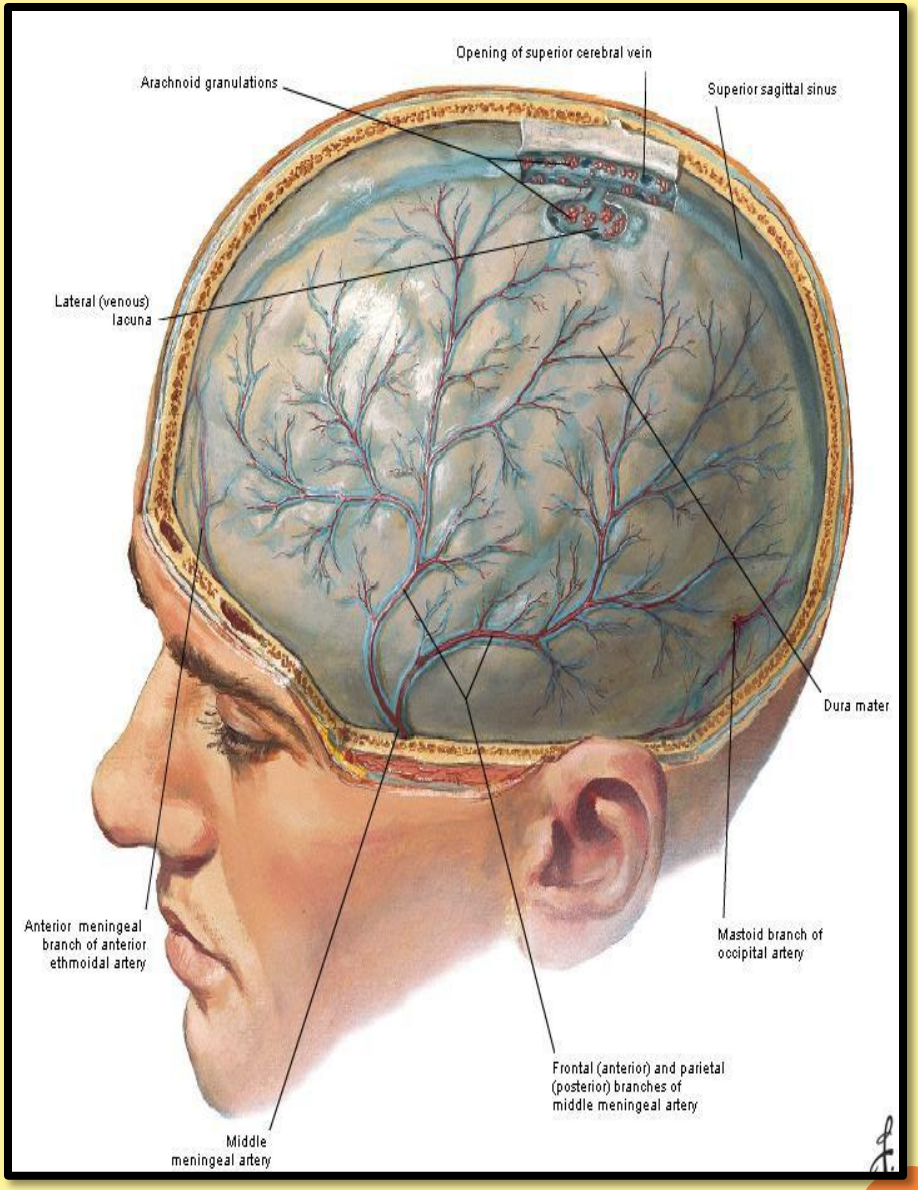
The arachnoid villi are most numerous along ***the superior sagittal sinus .***

Aggregations of arachnoid villi are referred to ***as arachnoid granulations***

Arachnoid villi serve as sites where the cerebrospinal fluid diffuses into the bloodstream.

All the cerebral arteries, the

- cranial nerves and veins lie in the space

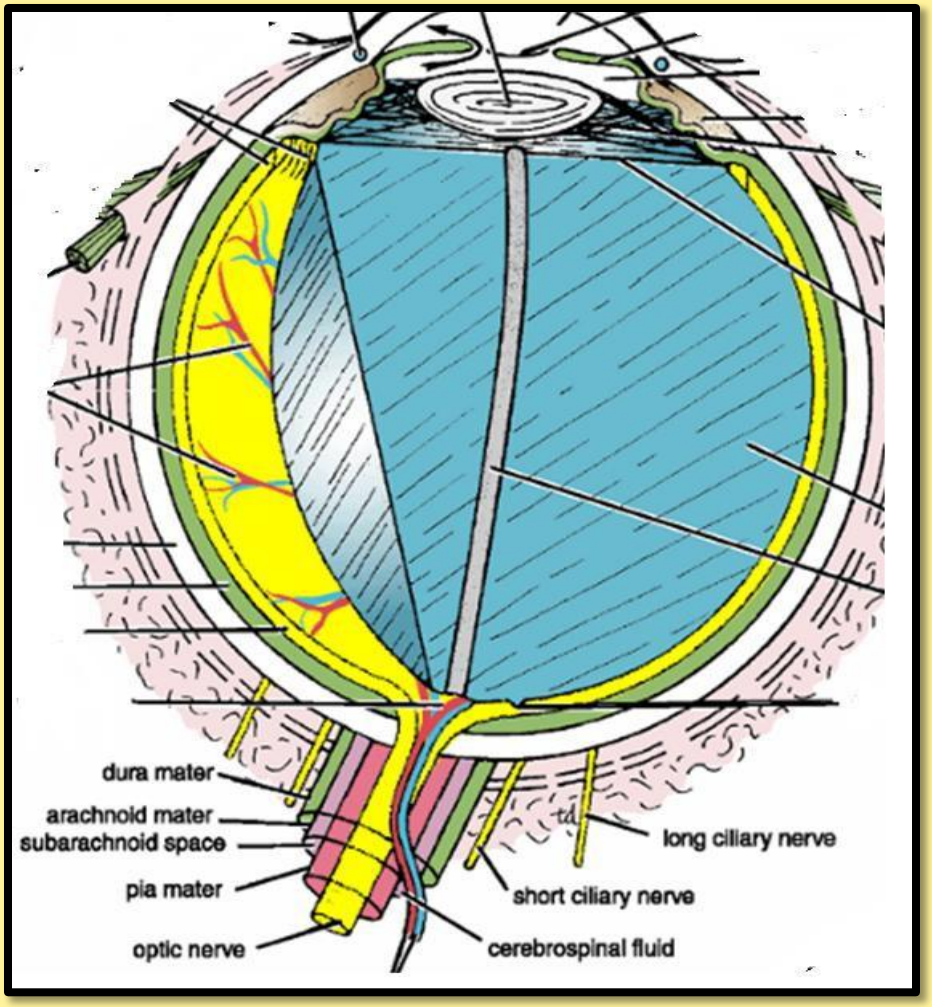


The arachnoid fuses with the epineurium of the nerves at their point of exit from the skull For example

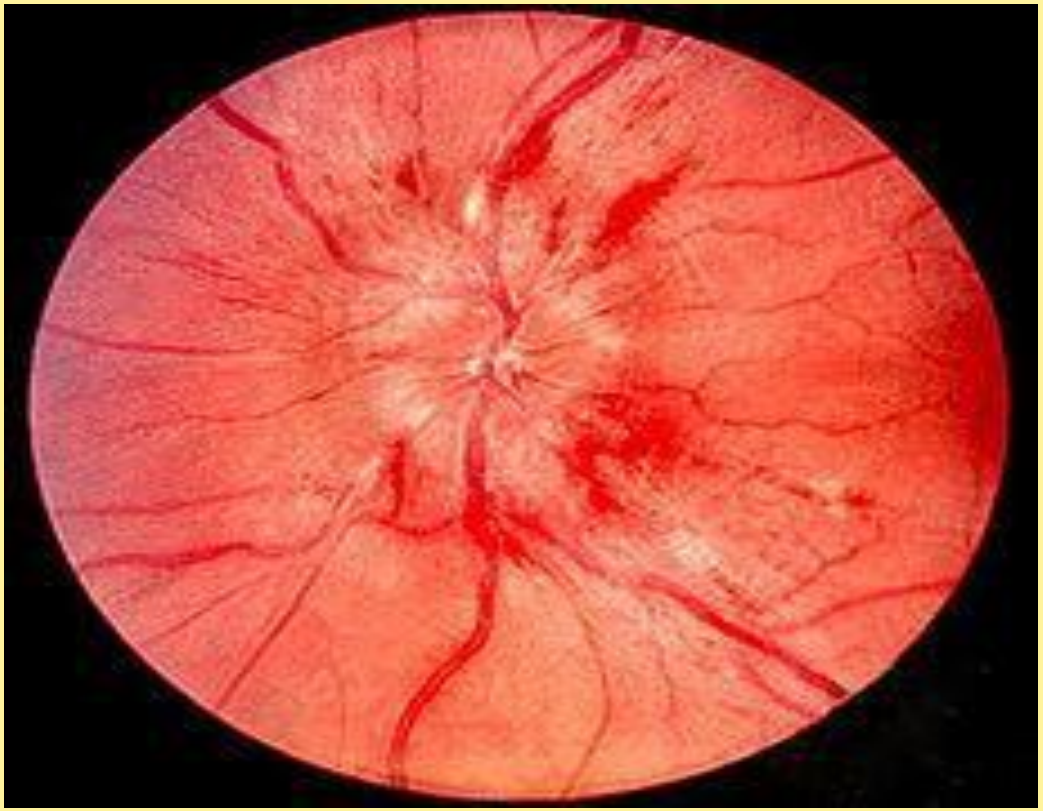
THE OPTIC NERVE

the arachnoid forms a sheath for the nerve that extends into the orbital cavity through the optic canal and fuses with the sclera of the eyeball

Thus, the subarachnoid space extends around the optic nerve as far as the eyeball

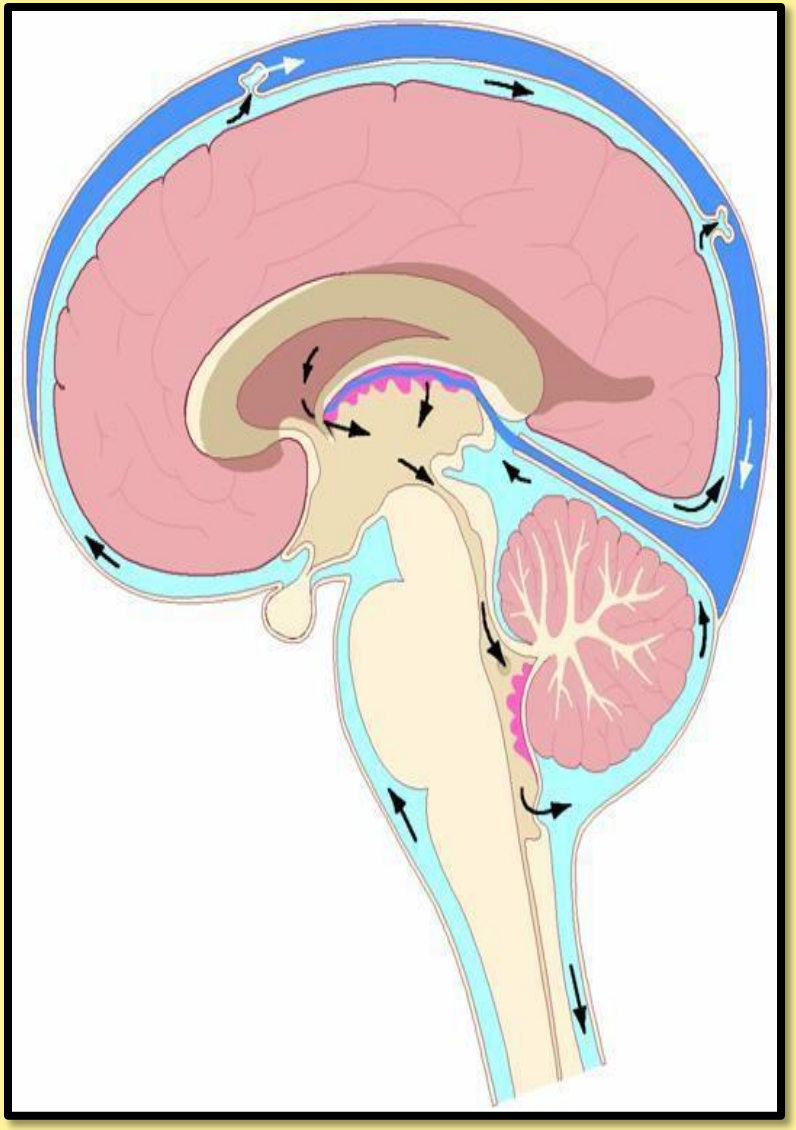


Papilledema



Because the optic nerve sheath is continuous with the subarachnoid space of the brain, increased pressure is transmitted through to the optic nerve.
the anterior end of the optic nerve stops abruptly at the eye.

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 CRANIAL NERVES IN THE CRANIAL CAVITY

THE 12PAIRS OF CRANIAL NERVES ARE NAMED AS FOLLOWS:

I. OLFACTORY (SENSORY(

II. OPTIC (SENSORY(

III. OCULOMOTOR (MOTOR(

IV. TROCHLEAR (MOTOR(

V. TRIGEMINAL (MIXED(

VI. ABDUCENT (MOTOR(

VII. FACIAL (MIXED(

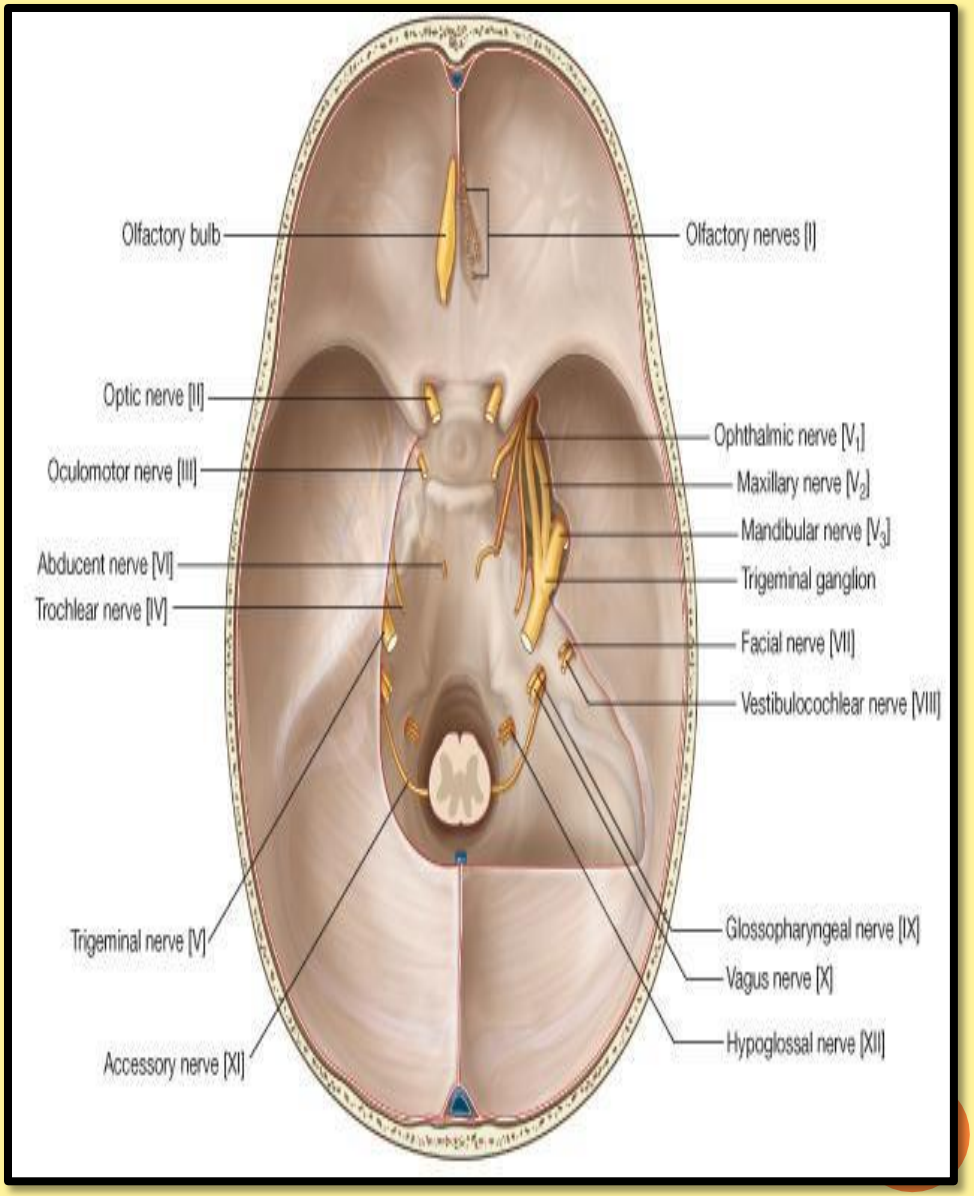
VIII. VESTIBULOCOCHLEAR (SENSORY(

IX. GLOSSOPHARYNGEAL (MIXED(

X. VAGUS (MIXED(

XI. ACCESSORY (MOTOR(

XII. HYPOGLOSSAL (MOTOR(



Origin of the 12cranial nerves

CEREBRUM

2 & 1

BRAINSTEM

MIDBRAIN

4 & 3

PONS

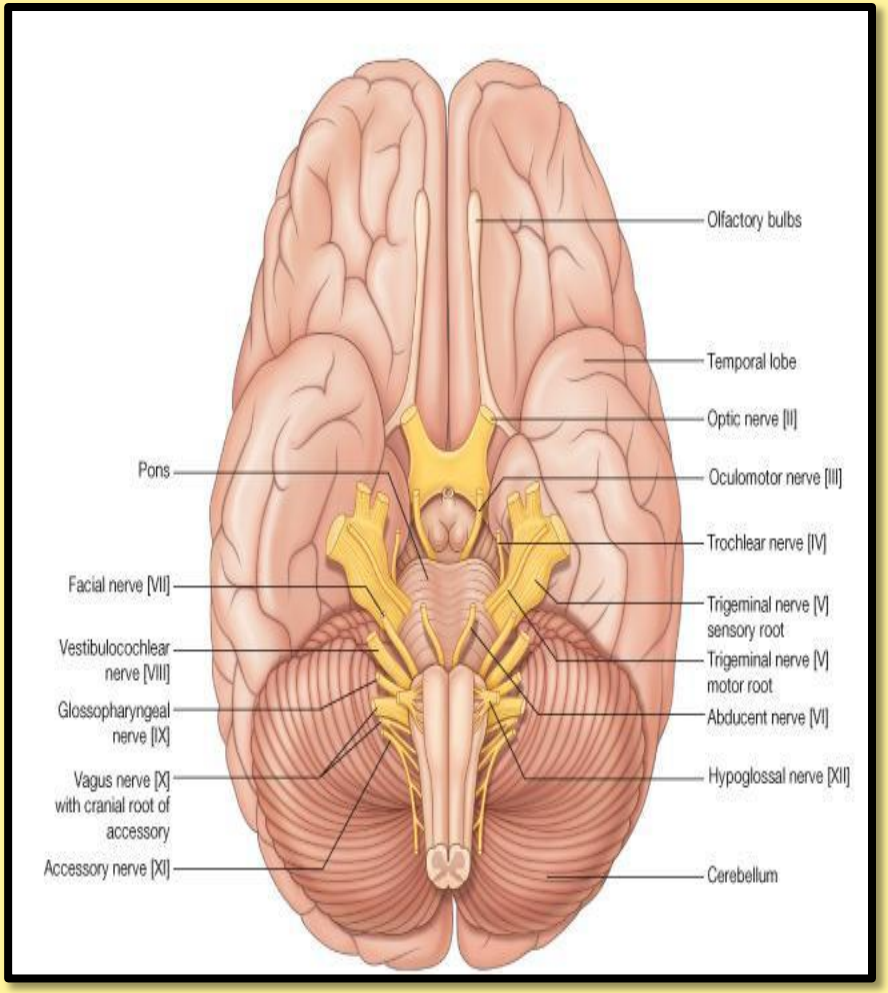
8 & ‹7 ‹6 ‹5

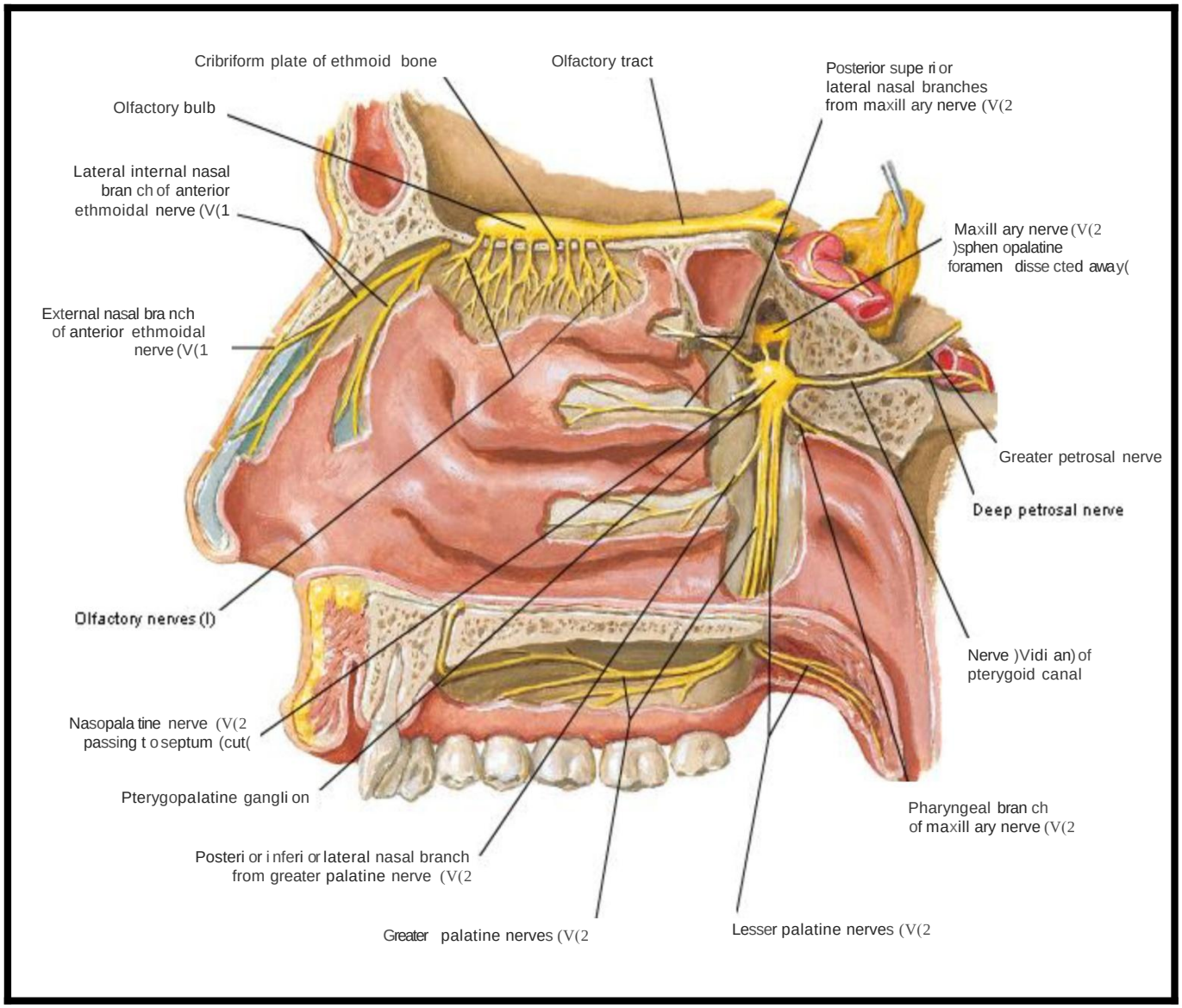
MEDULLA

12 & 11 ‹10 ‹9

Accessory nerve (11th) has dual origin – Cranial & spinal root

Only one nerve arise from dorsal aspect – Trochlear nerve (4th(




Cribriform plate of ethmoid bone
Olfactory tract
Posterior superior lateral nasal branches from maxillary nerve (V(2
Olfactory bulb
Lateral internal nasal branch of anterior ethmoidal nerve (V(1
Maxillary nerve (V(2
)sphenopalatine foramen dissected away(
External nasal branch of anterior ethmoidal nerve (V(1
Greater petrosal nerve
Deep petrosal nerve
Olfactory nerves (I)
Nerve)Vidian) of pterygoid canal
Nasopalatine nerve (V(2 passing to septum (cut(
Pterygopalatine ganglion
Pharyngeal branch of maxillary nerve (V(2
Posterior inferior lateral nasal branch from greater palatine nerve (V(2
Greater palatine nerves (V(2
Lesser palatine nerves (V(2

Clinical Features of the Neonatal Skull

FONTANELLES

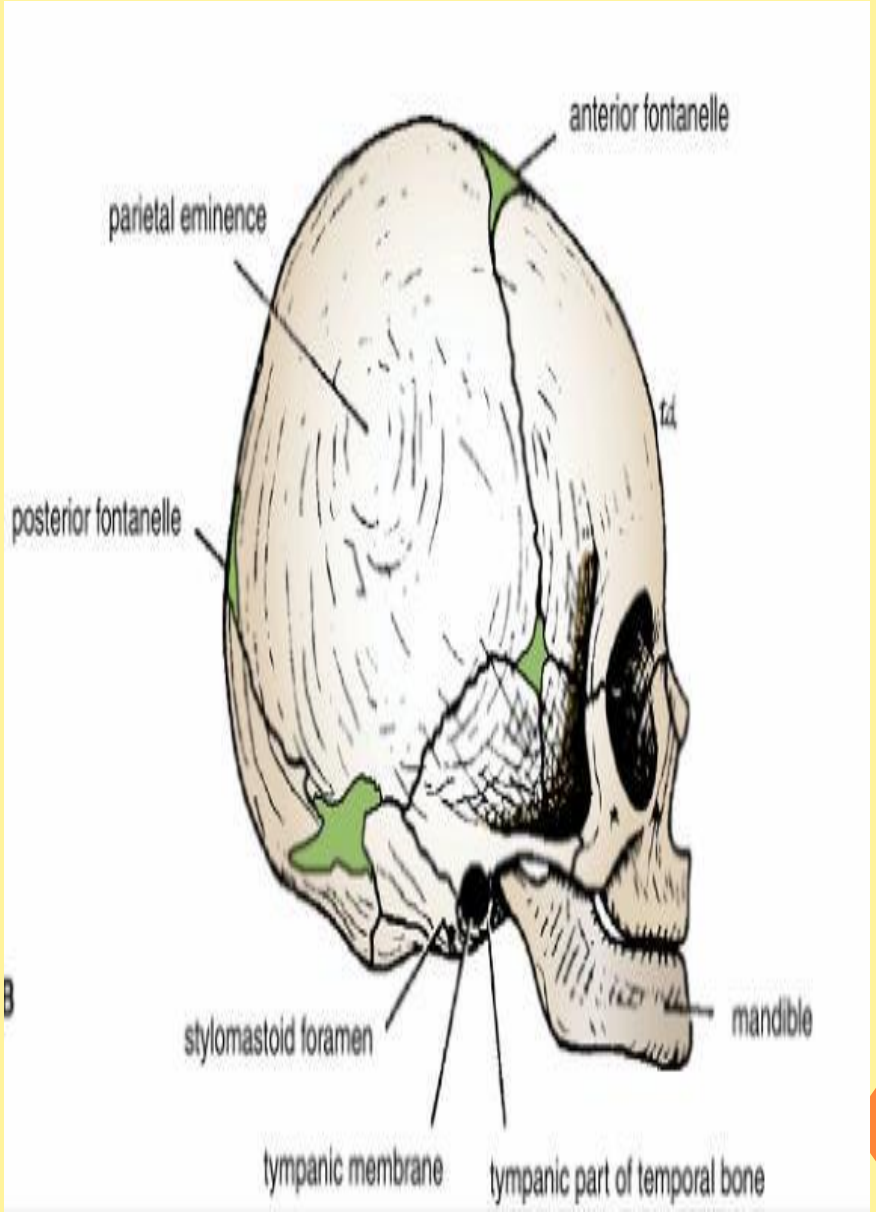
Palpation of the fontanelles enables the physician to determine

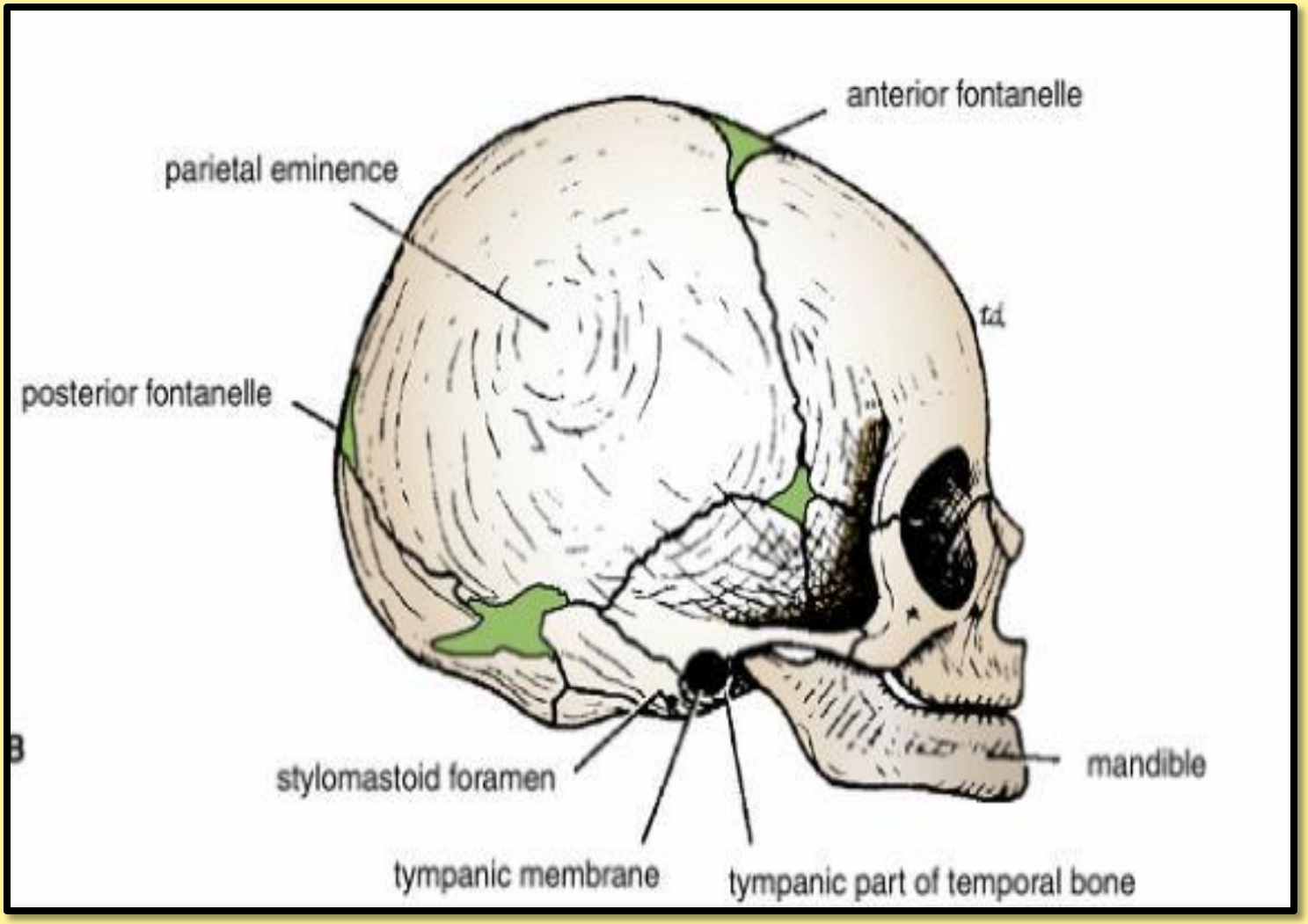
-1The progress of growth in the surrounding bones, -2the degree of hydration of the baby

if the fontanelles are depressed below the surface **THE BABY IS DEHYDRATED**

a bulging fontanelle indicates

RAISED INTRACRANIAL PRESSURE





Samples of cerebrospinal fluid can be obtained by passing a long needle obliquely through the anterior fontanelle into the subarachnoid space CLOSES anterior after 18 months, because the frontal and parietal bones have enlarged to close the gap.

Intracranial Hemorrhage

Intracranial hemorrhage may result from
trauma or
cerebral vascular lesions.
Four varieties are considered here:

EXTRADURAL

SUBDURAL

SUBARACHNOIDl

Cerebral

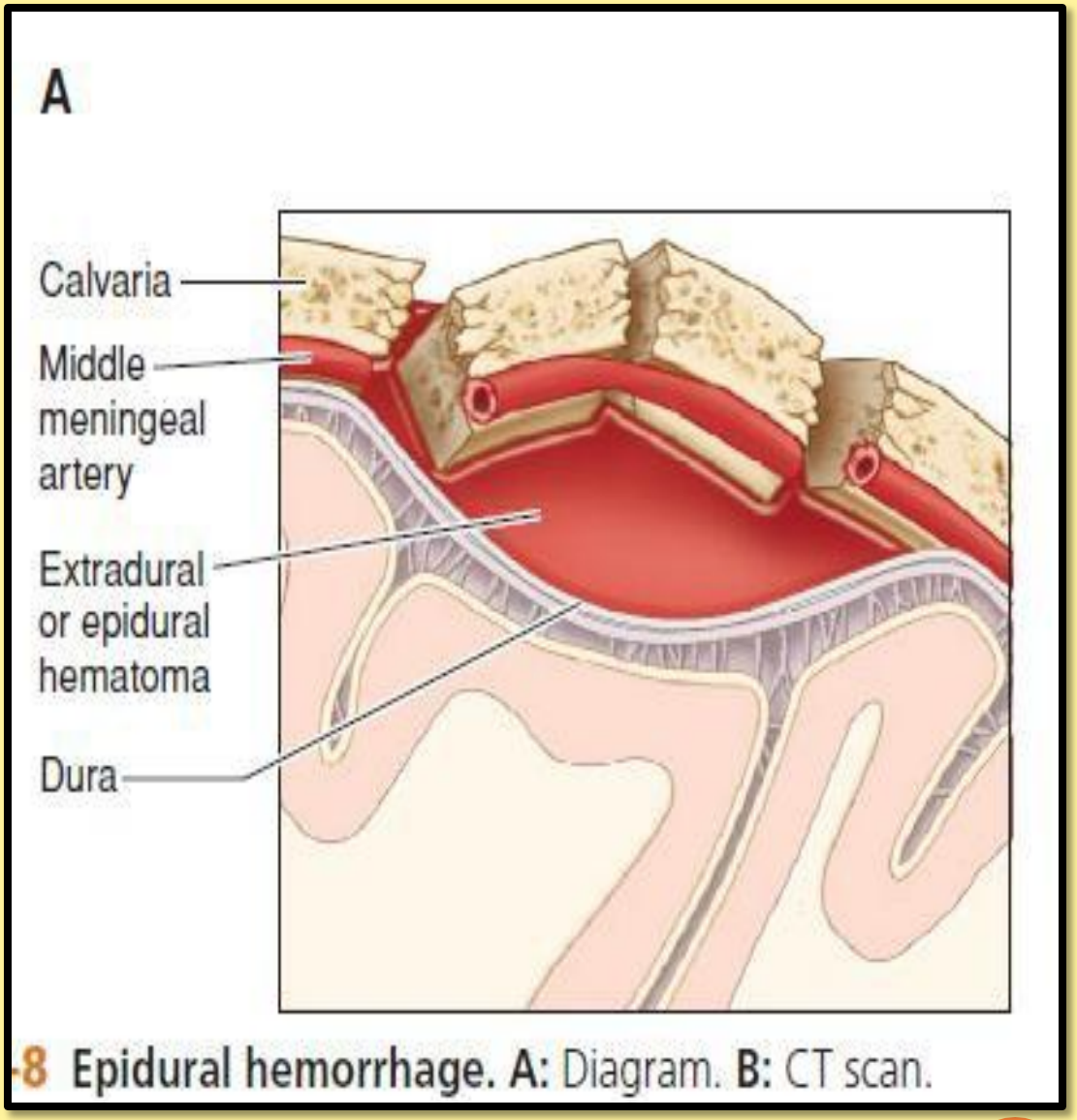
Extradural hemorrhage

results from injuries **<u>to the meningeal arteries or veins.</u>**

The most common artery to be damaged **<u>is the anterior division of the middle meningeal artery</u>**

Bleeding occurs and strips up the meningeal layer of dura from the internal surface of the skull.

The intracranial pressure rises, and the enlarging blood clot exerts local pressure on the underlying motor area in **the precentral gyrus**.



8 **Epidural hemorrhage. A:** Diagram. **B:** CT scan.

Epidural Hemorrhage

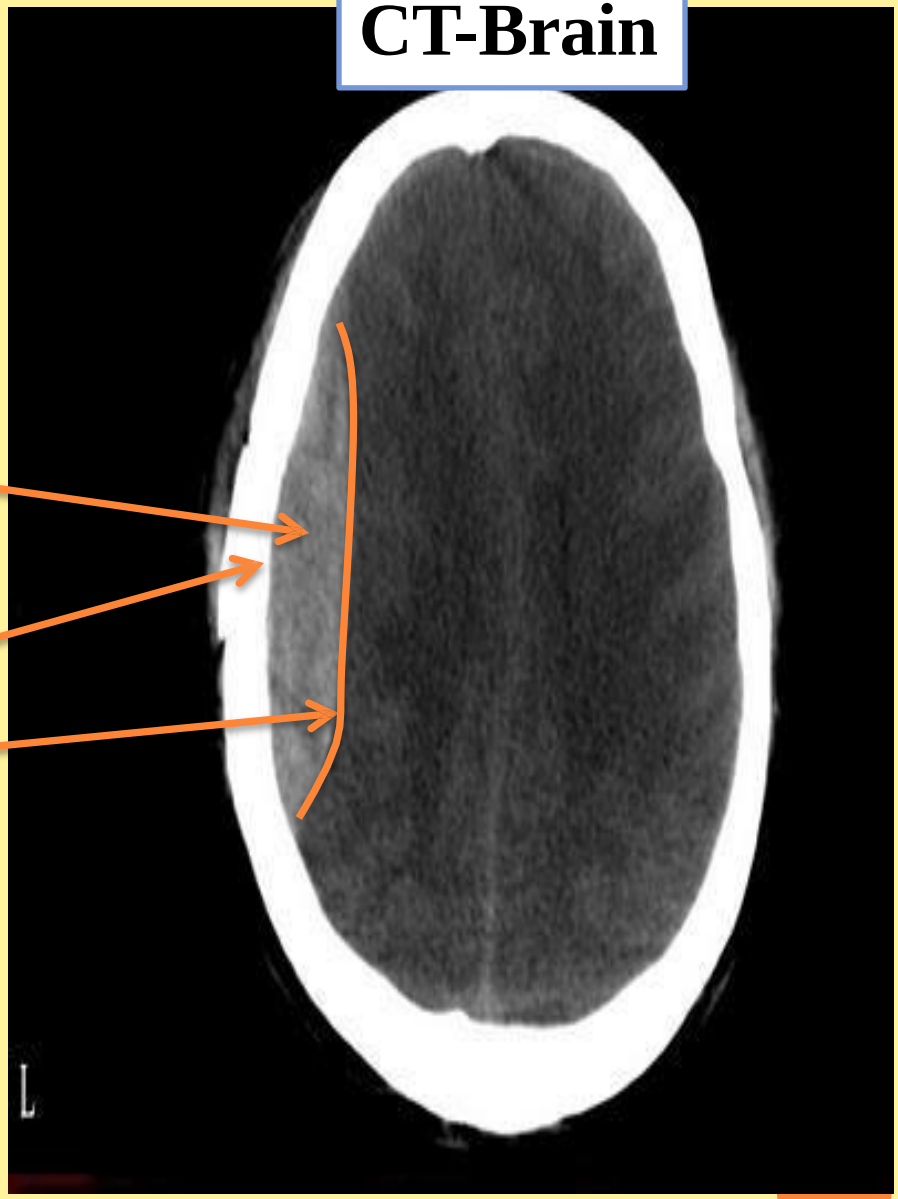
is a medical emergency.
The blood vessel involved is the **middle meningeal artery.**

Clinical features include:
A CT scan shows a lens-shaped)biconvex(hyperdensity adjacent to bone

arterial blood is located between the skull and dura

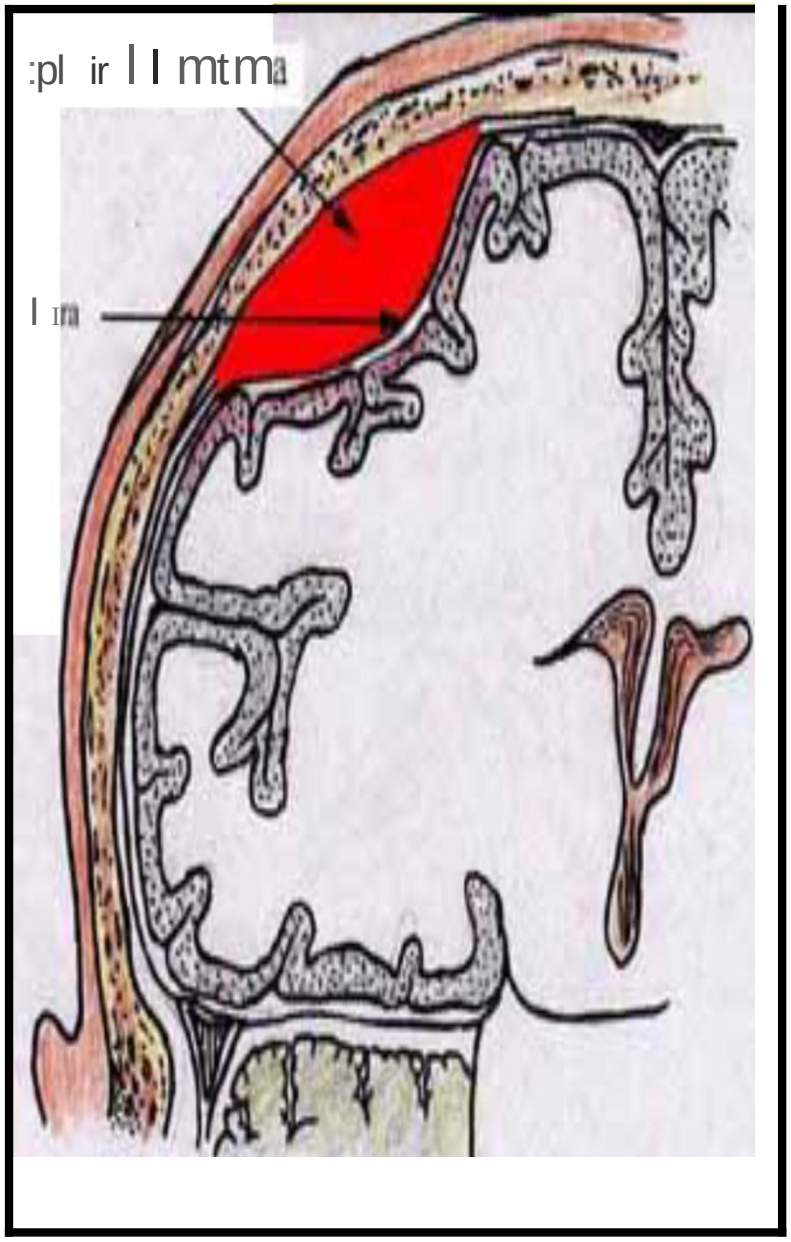
lucid interval (no symptoms) for a few hours followed by <u>death</u> ("talk and die syndrome")

CT-Brain



may cause

)Temporal Lobe) Herniation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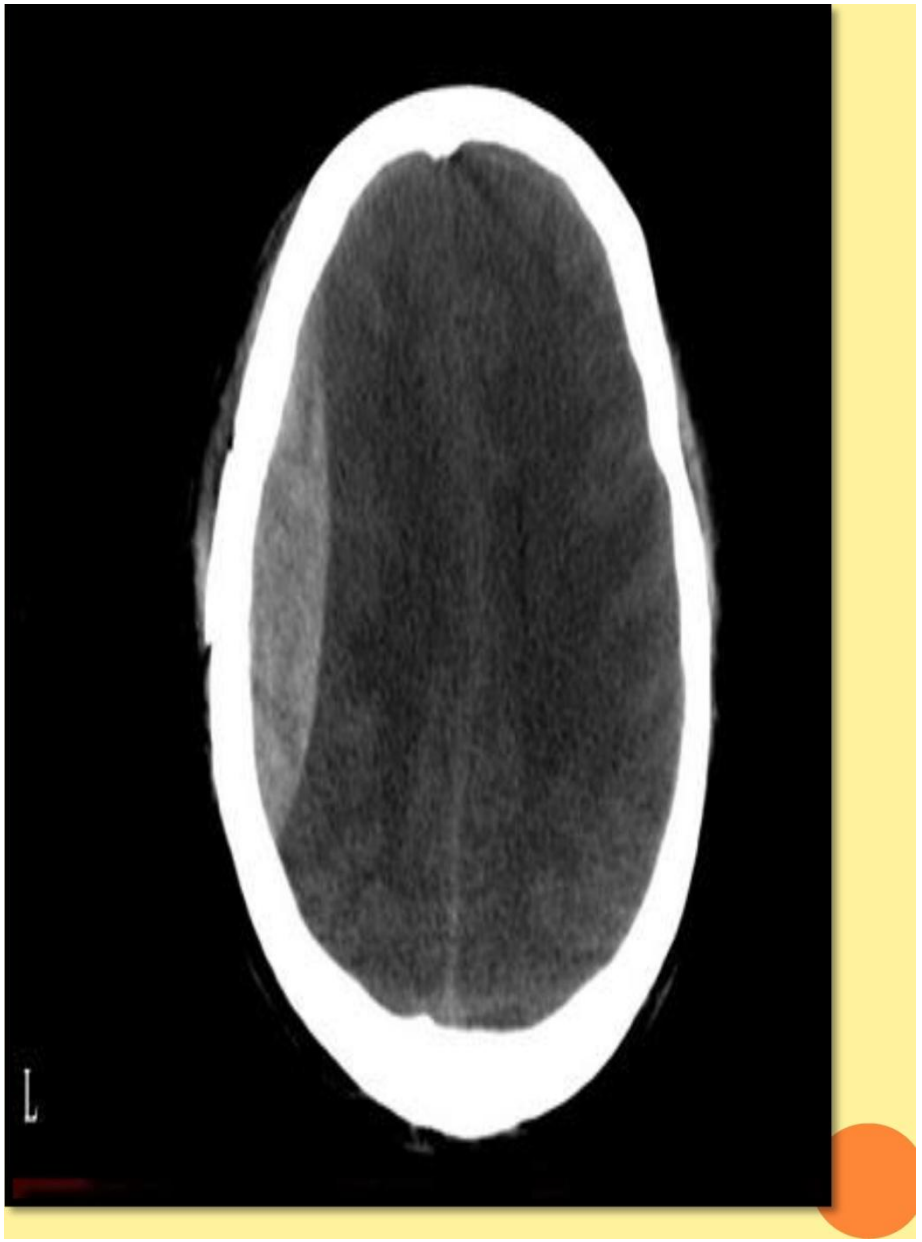

L

Lucid interval

lucid interval is a temporary improvement in a patient's condition after a traumatic brain injury, after which the condition deteriorates

It occurs after the patient is knocked out by the initial concussive force of the trauma, then lapses into unconsciousness again after recovery when bleeding causes the hematoma to expand past the point at which the body can no longer compensate

A lucid interval is especially indicative of an epidural hematoma.
An estimated 20 to 50% of patients with epidural hematoma experience such a lucid interval.
It can last minutes or hours

To stop the hemorrhage, the torn artery or vein must be ligated or plugged. The burr hole through the skull wall should be placed about 1 to 1.5 in. (2.5 to 4 cm) above the midpoint of the zygomatic arch.

Subdural Hemorrhage

A subdural hemorrhage is caused by a violent shaking of the head (e.g., child abuse or car accident) and commonly occurs in alcoholics and elderly..

The blood vessels involved are the **superior cerebral veins ("bridging veins"). Clinical features include:**

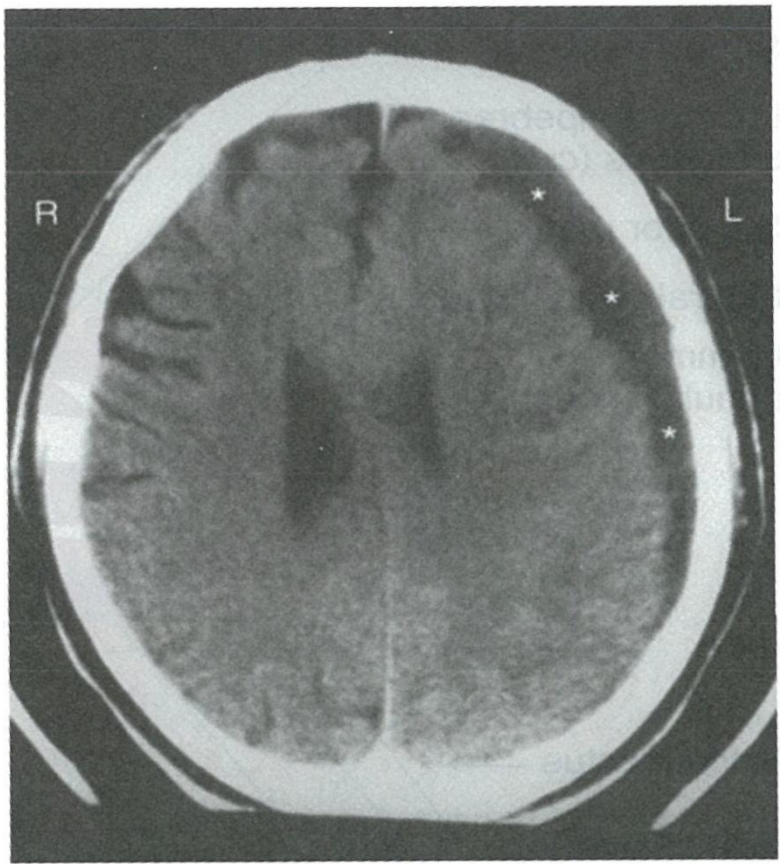
A CT scan shows a **thin, crescent-shaped hyperdensity that**

hugs **the contours of the brain;**

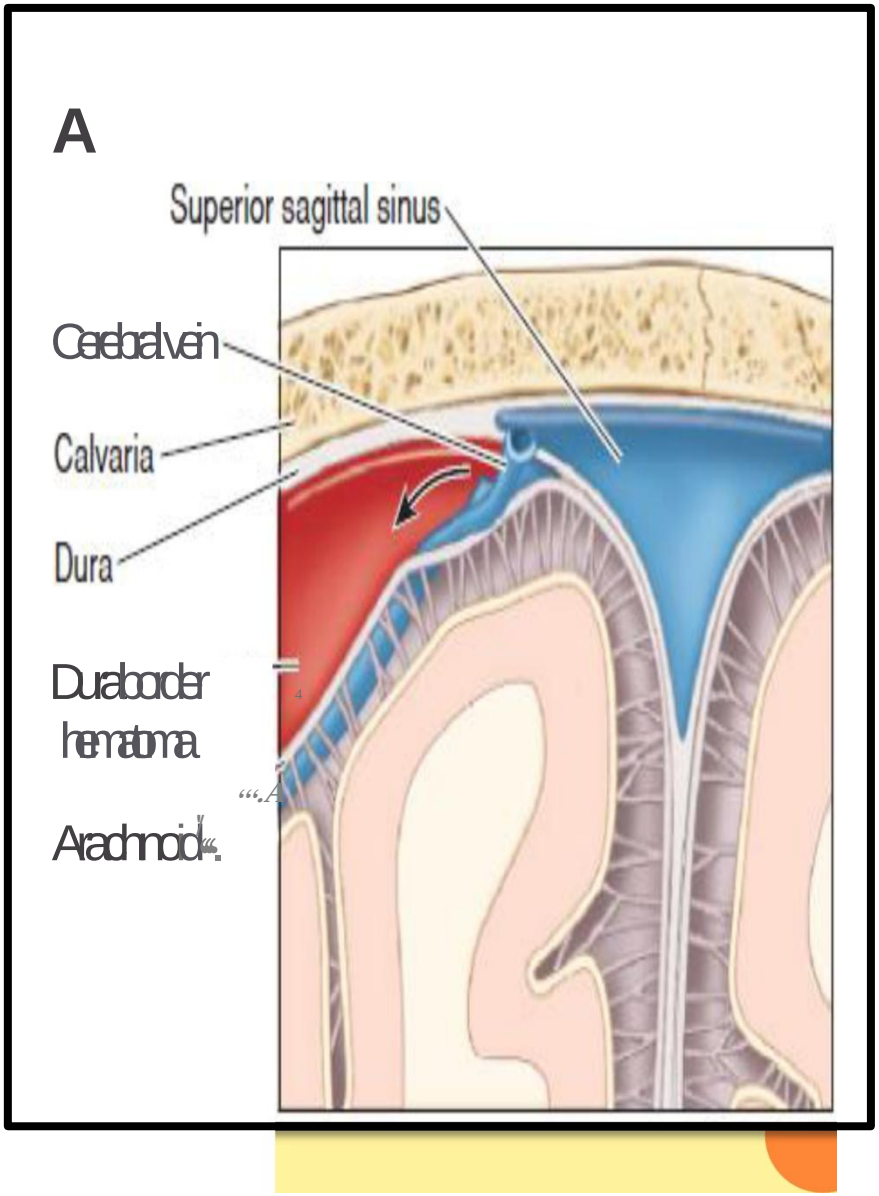
venous blood

is located between the dura and arachnoid; blood accumulates slowly (days to weeks after trauma);

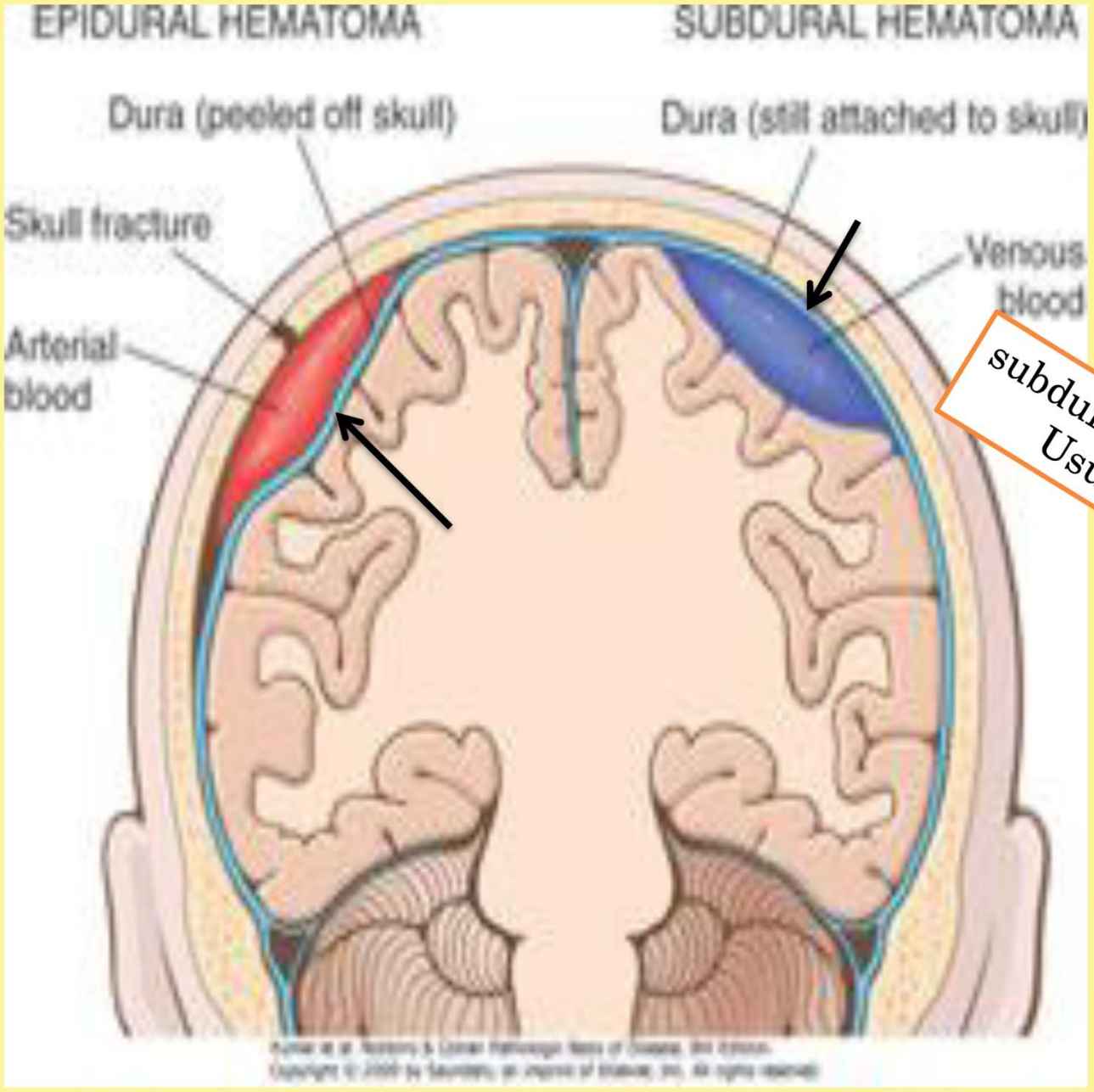
➢**no blood in the CSF after lumbar puncture.**



B. Subdural Hematoma*



Epidural above the dura
*V*sua1Jy *arterial*



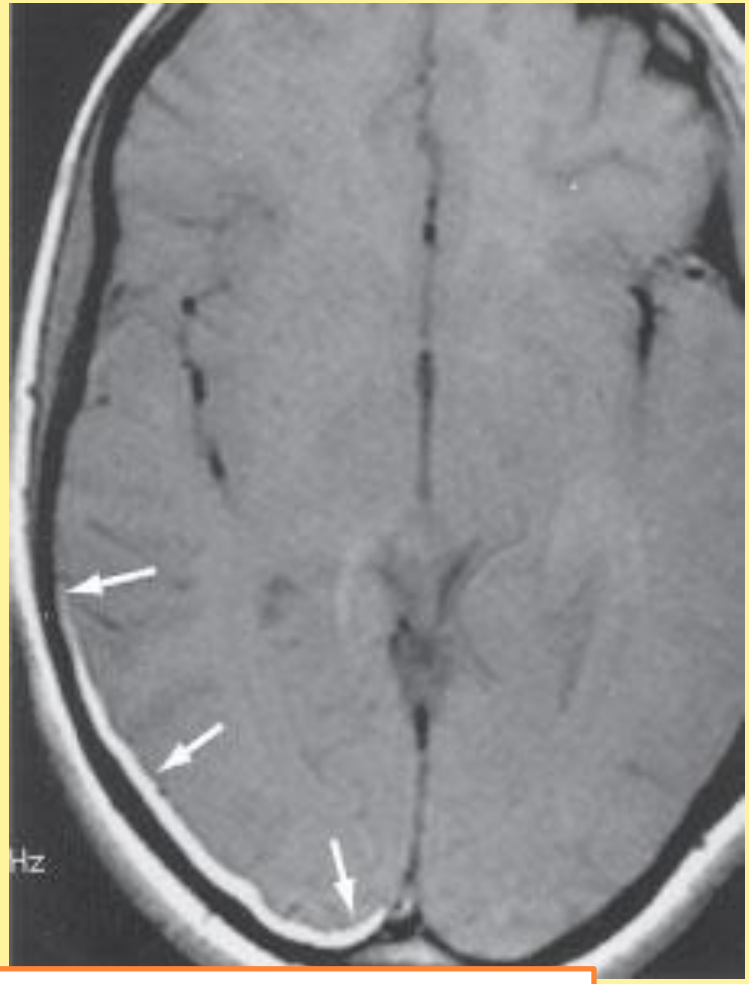
subdural under the dura
Usually venous

Subarachnoid Hemorrhage

A subarachnoid hemorrhage is caused by a contusion or laceration injury to the brain or a berry aneurysm.

The blood vessels involved are the **cerebral arteries or the anterior or posterior communicating arteries.**

Clinical features include: A CT scan shows a **hyperdensity in the cisterns, fissures, and sulci of the brain; thickening of the falx cerebri;**



arterial blood with the subarachnoid space; irritation of the meninges causes a sudden onset of the **"worst headache of my life"; stiff neck; vomiting; decreased mentation; early "herald headache"** may occur; and **blood within the CSF after lumbar puncture.**

Cerebral hemorrhage

is generally caused by rupture
of the thin-walled a branch of
the middle cerebral artery.
The hemorrhage involves the vital corticobulbar and corticospinal fibers in the internal capsule and produces hemiplegia on the opposite side of the body. The patient immediately loses consciousness, and the paralysis is evident when consciousness is regained

This is a subject of the third year thus , read it only