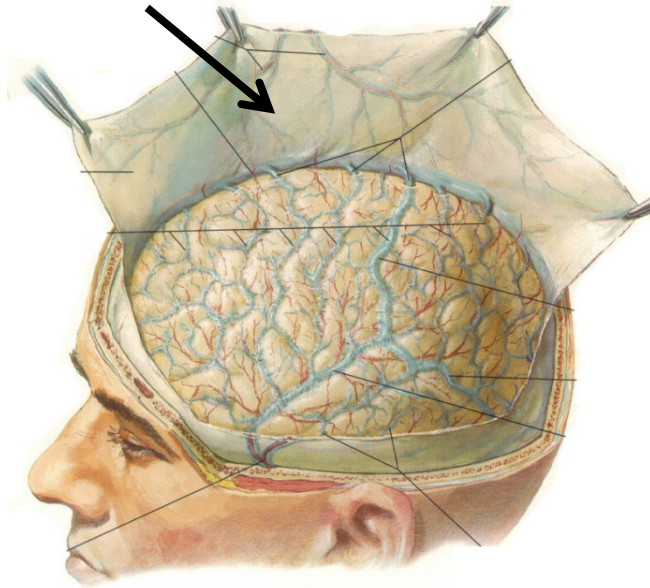


MENINGES AND VENOUS SINUSES OF BRAIN

DURA MATER



OUTLINE

- I. ARTERIAL SUPPLY
- II. MENINGES
- III. VENOUS SINUSES
- IV. CEREBROSPINAL FLUID
- V. HEMATOMAS

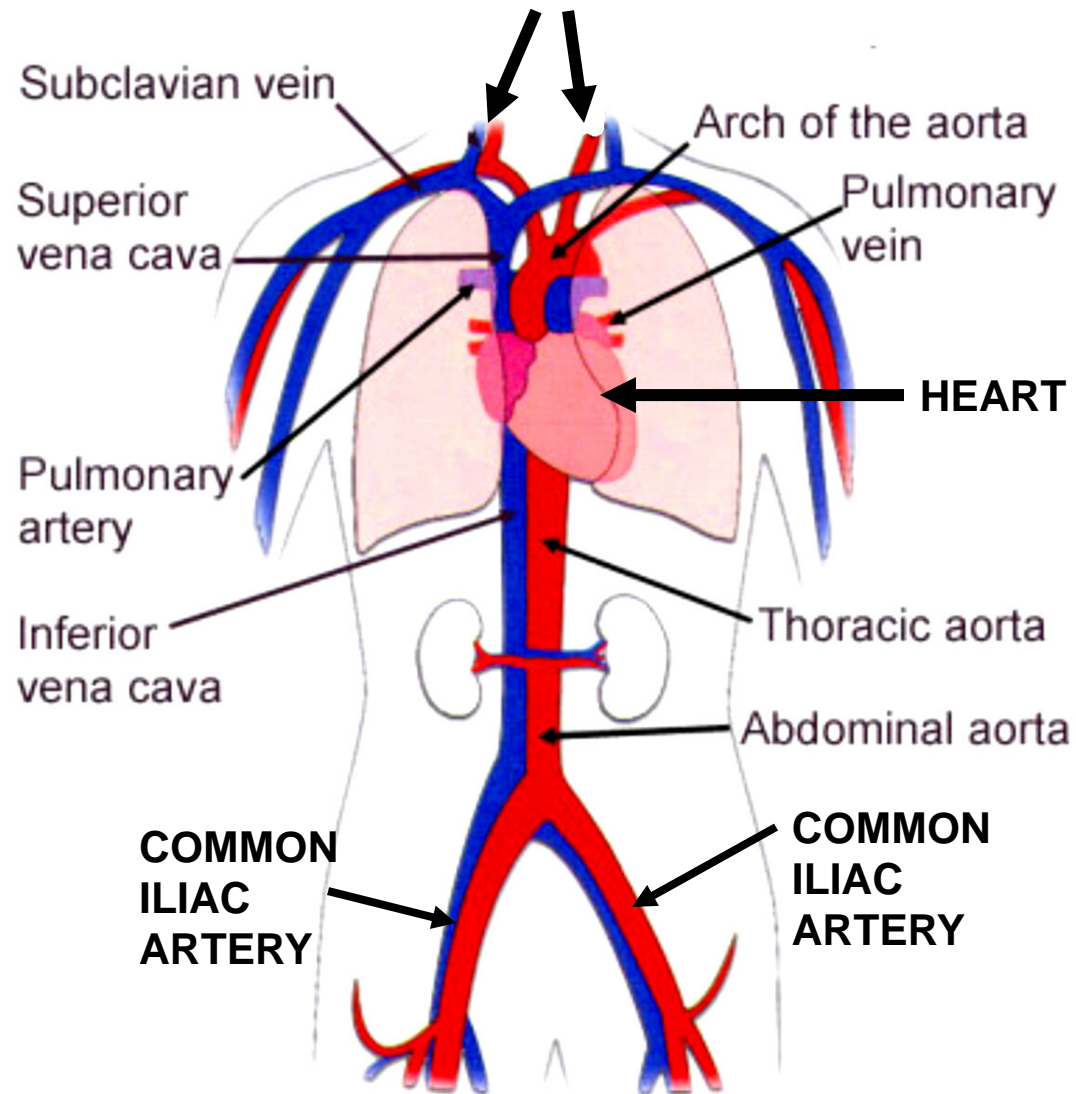
FACT: CRANIAL CAVITY IS ENCLOSED BY BONE; THERE IS NO ROOM FOR EXPANSION INSIDE SKULL

WORD OF THE DAY: HEMATOMA = abnormal mass of blood outside blood vessel

ARTERIAL SUPPLY TO HEAD

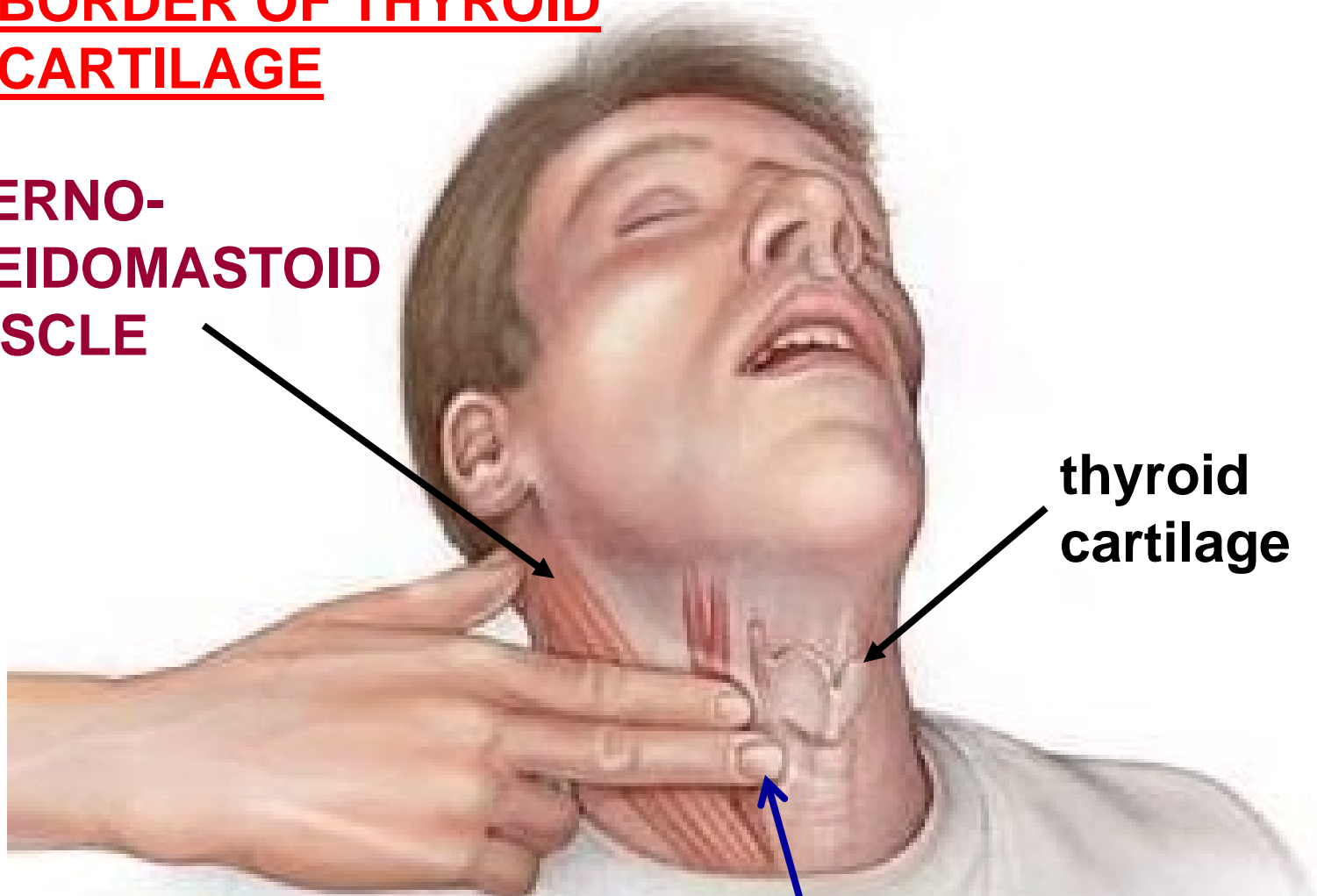
BLOOD FLOW
TO HEAD:
WHERE
DOES IT
COME
FROM?

COMMON CAROTID ARTERIES



**PALPATE CAROTID BIFURCATION AT UPPER
BORDER OF THYROID
CARTILAGE**

**STERNO-
CLEIDOMASTOID
MUSCLE**



**thyroid
cartilage**

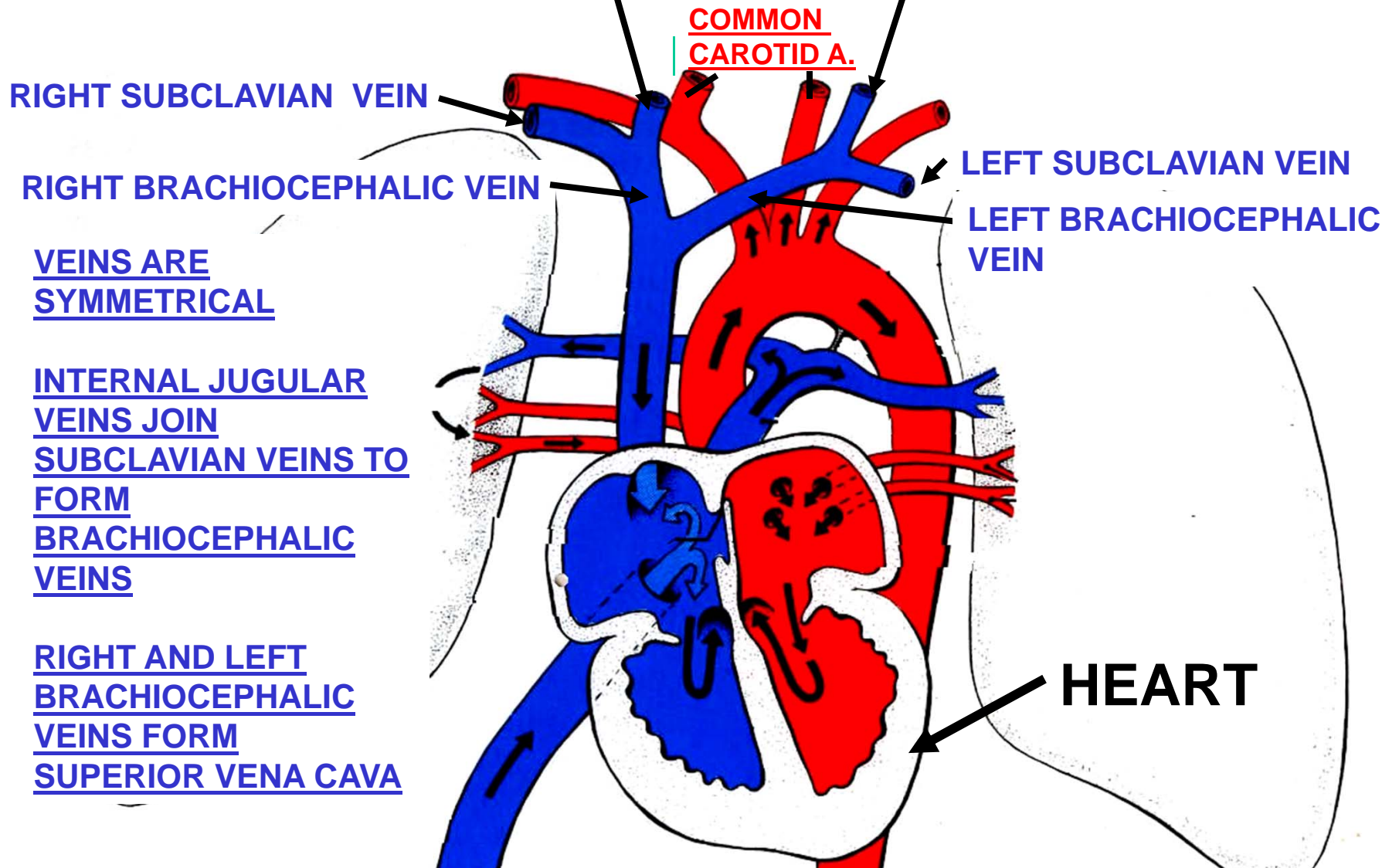
CAROTID PULSE

VERTEBRAL LEVEL C4

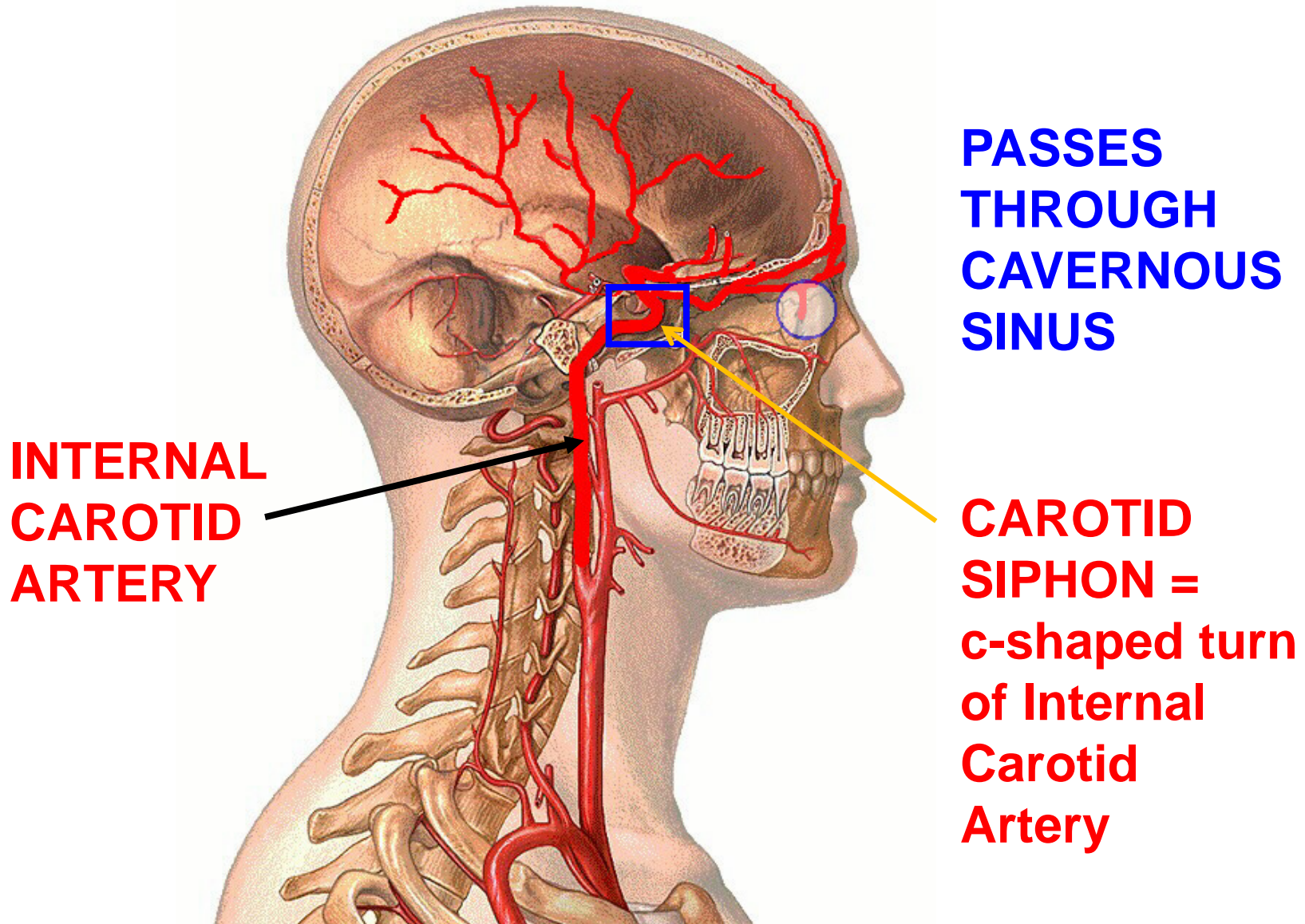
VENOUS DRAINAGE FROM HEAD

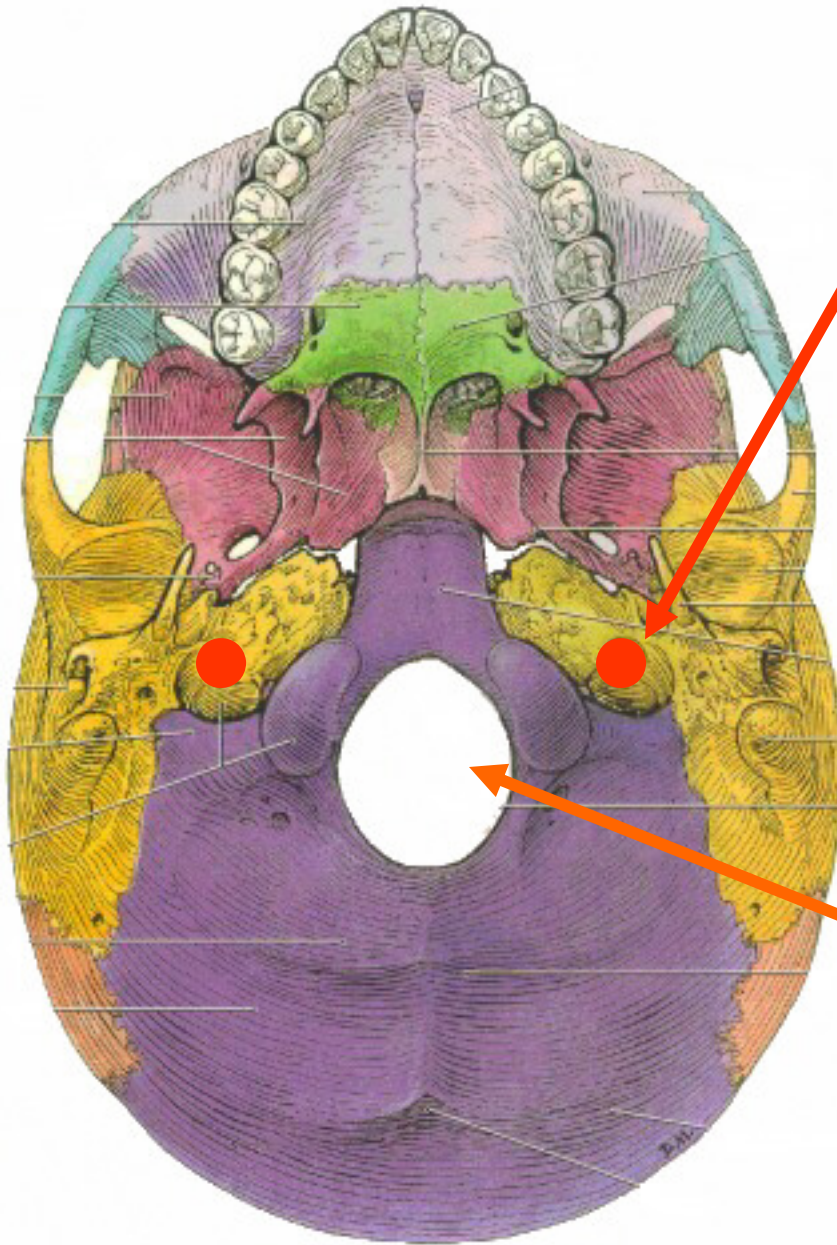
RIGHT INTERNAL JUGULAR VEIN

LEFT INTERNAL JUGULAR VEIN



INTERNAL CAROTID ARTERY: ENTERS SKULL



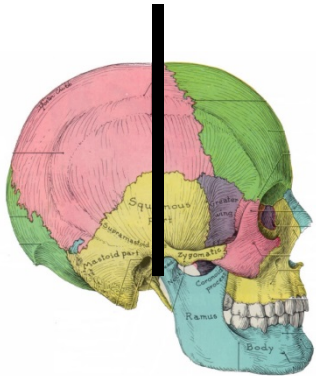


Internal Carotid Artery-
enters skull
via Carotid Canal
And Foramen
Lacerum

Vertebral Artery-
enters skull
via Foramen
Magnum

VIEW FORAMINA IN SKULL SESSION

CORONAL PLANE



ORIENT



II. MENINGES OF BRAIN

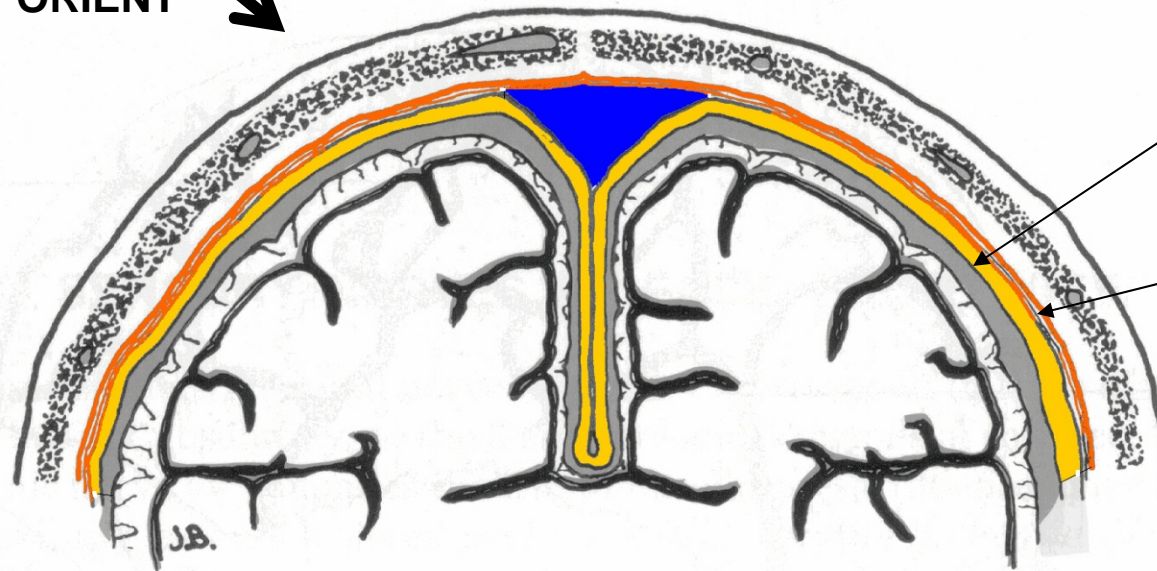
3 layers, like spinal cord; Dura Mater – tough mother; Arachnoid = spiderlike; Pia Mater = tender mother; arrangement different

A. DURA MATER -
tough connective tissue layer, composed of two layers -

1) INNER MEMBRANE LAYER (true dura)

2) OUTER ENDOSTEAL LAYER - periosteum on inner side of calvarium

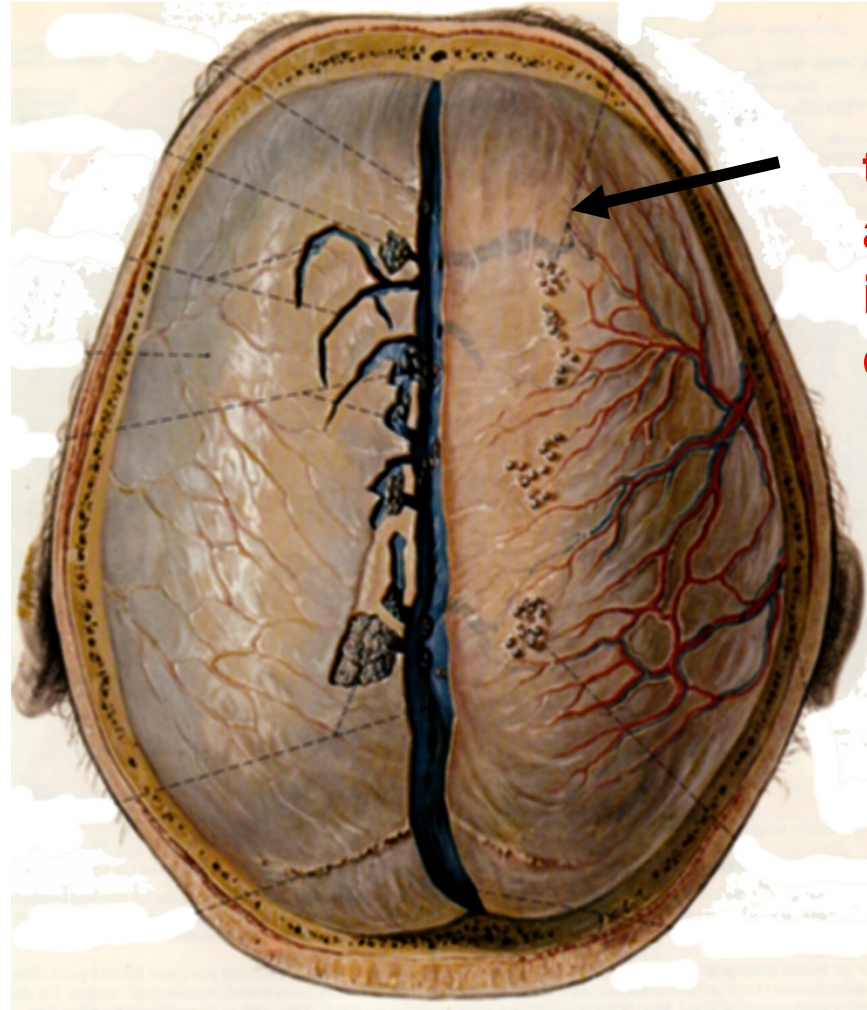
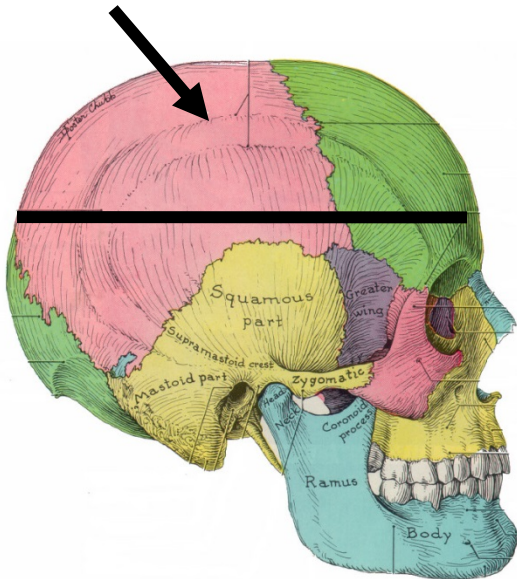
Two layers - fused in most places - separate to form DURAL REFLECTIONS



Note: There is normally NO EPIDURAL SPACE IN SKULL as dura is fused to bone

DURA - 2 LAYERS ARE FUSED IN MOST PLACES

Orient - remove
**CALVARIUM =
SKULL
CAP**

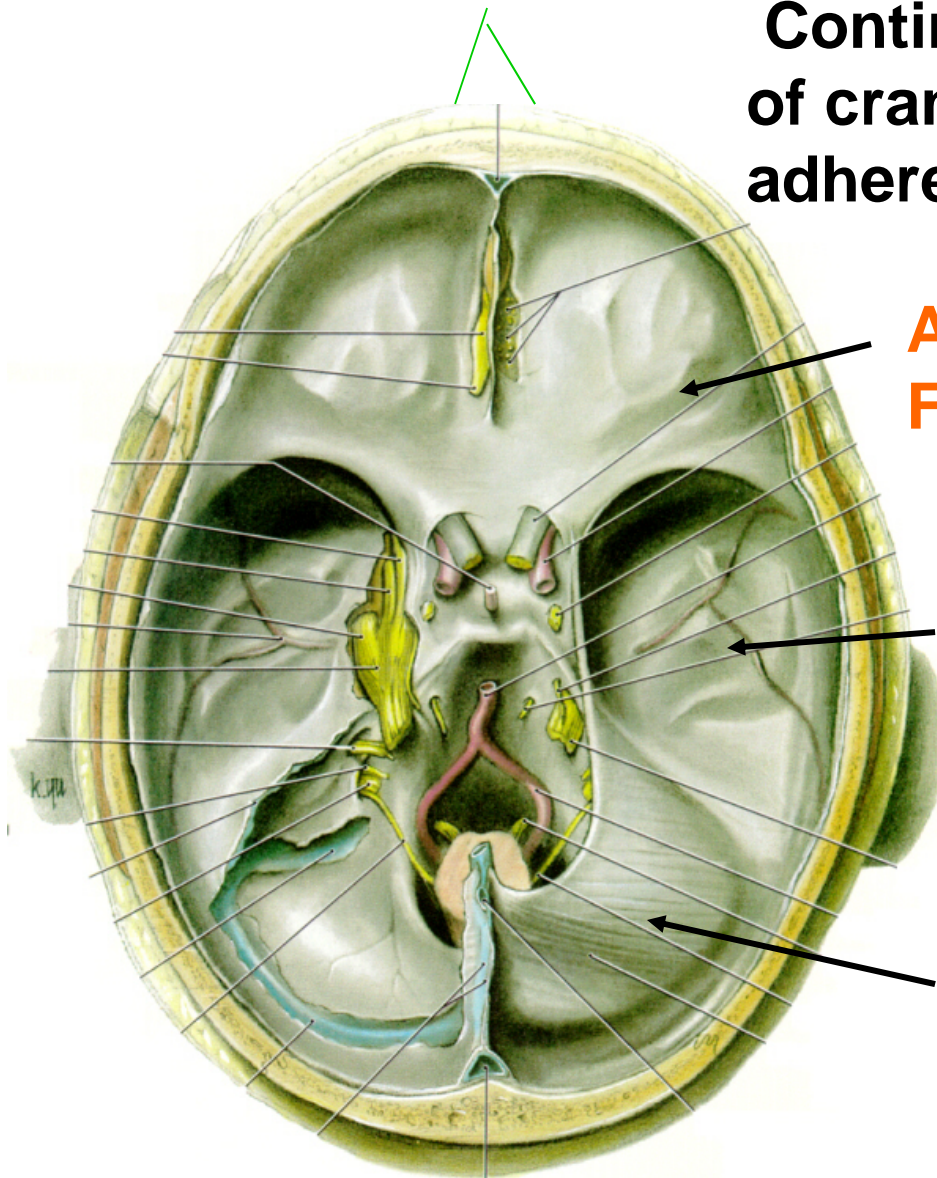


DURA is
tightly
attached to
inner side of
calvarium

**Normally No there is no Epidural Space
(unlike spinal cord); calvarium removed
by pulling away bone from dura**

DURA MATER INSIDE SKULL

Continuous lining of interior of cranial cavity, closely adherent to bone.



Anterior Cranial Fossa

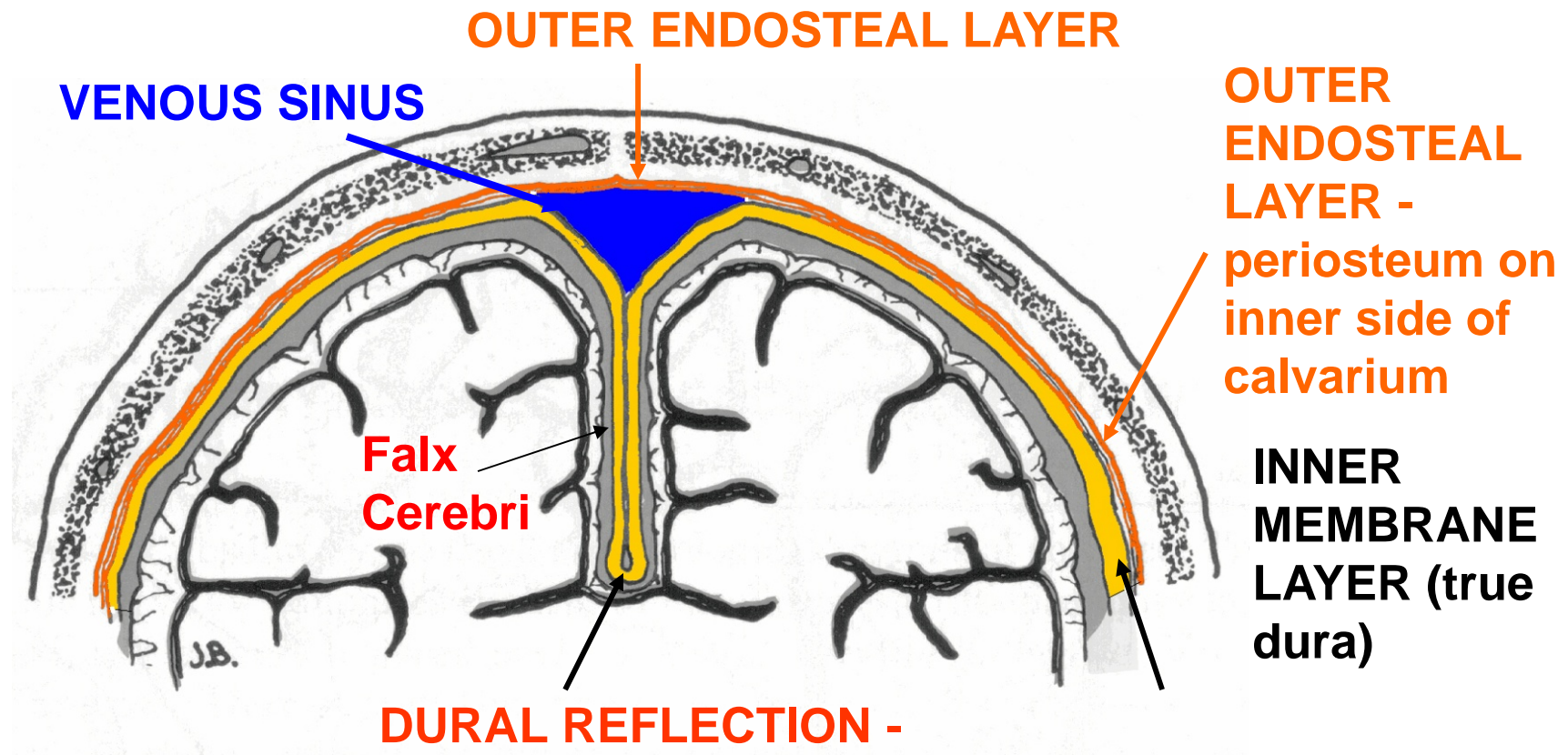
Middle Cranial Fossa

Posterior Cranial Fossa

(fossa = depression)

DURAL REFLECTIONS

2 Layers of Dura separate form Inward Folds (Reflections)-
Function to stabilize brain and contain **venous sinuses**

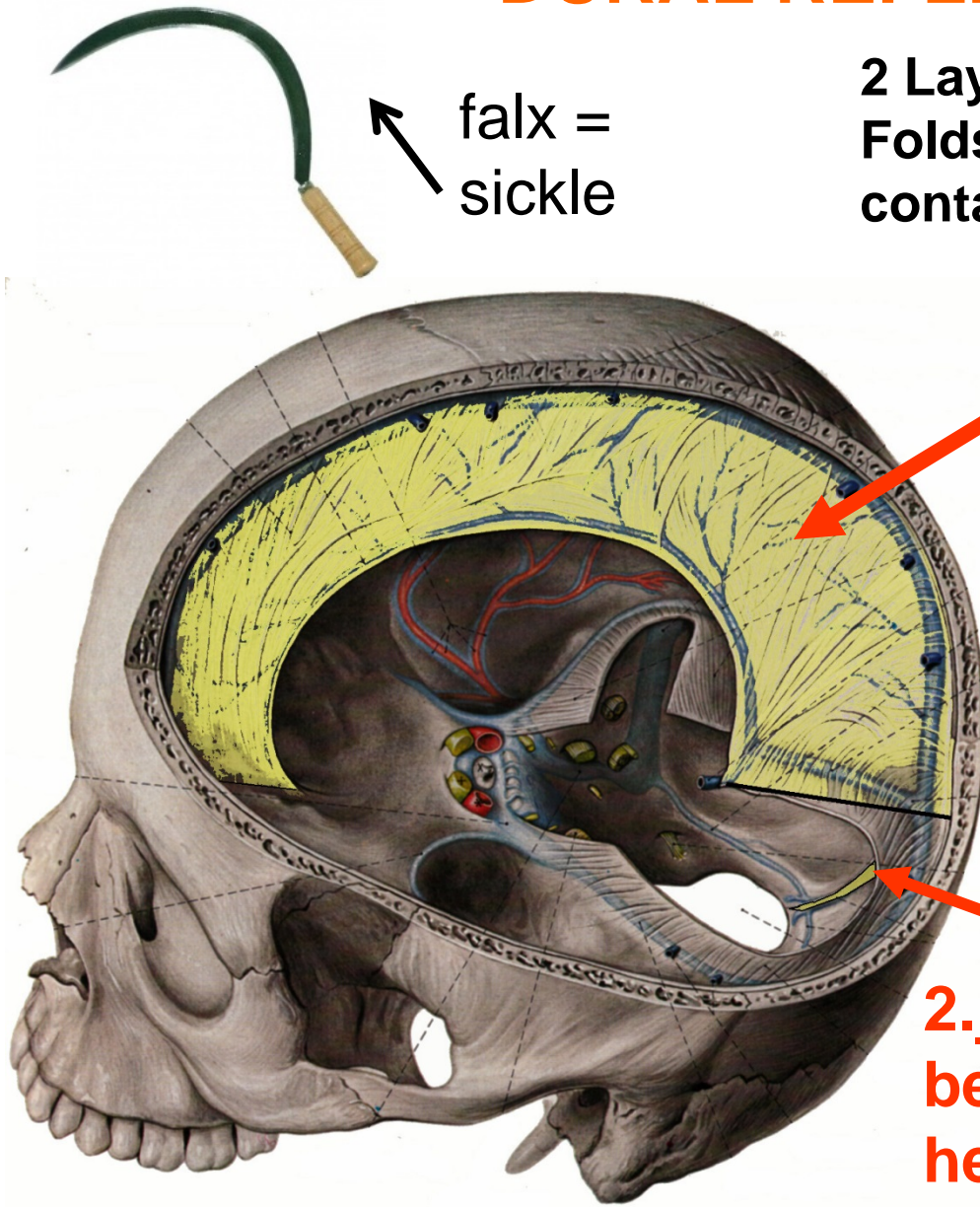


Reflection = dura projects out and turns back

DURAL REFLECTIONS

2 Layers of Dura separate form Inward Folds (Septa)- Stabilize brain and contain venous sinuses

falx = sickle

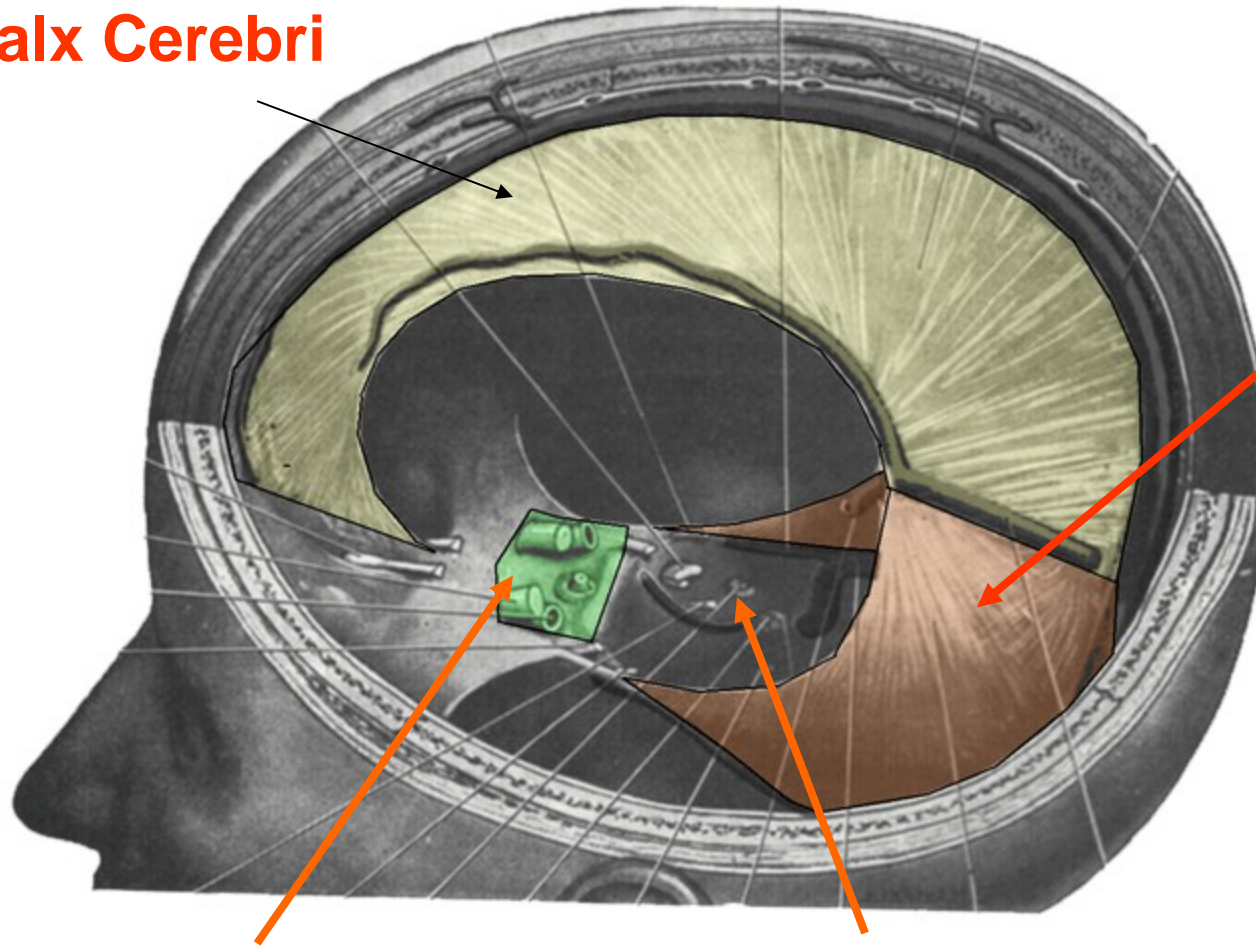


1. Falx Cerebri - sickle shaped - between cerebral hemispheres; attached ant. to crista galli of ethmoid; post. blends into tentorium cerebelli

2. Falx Cerebelli - smaller between cerebellar hemispheres along post. wall of Post. Cran. Fossa

DURAL REFLECTIONS

Falx Cerebri



3. Tentorium Cerebelli – forms **roof of post. cran. fossa**

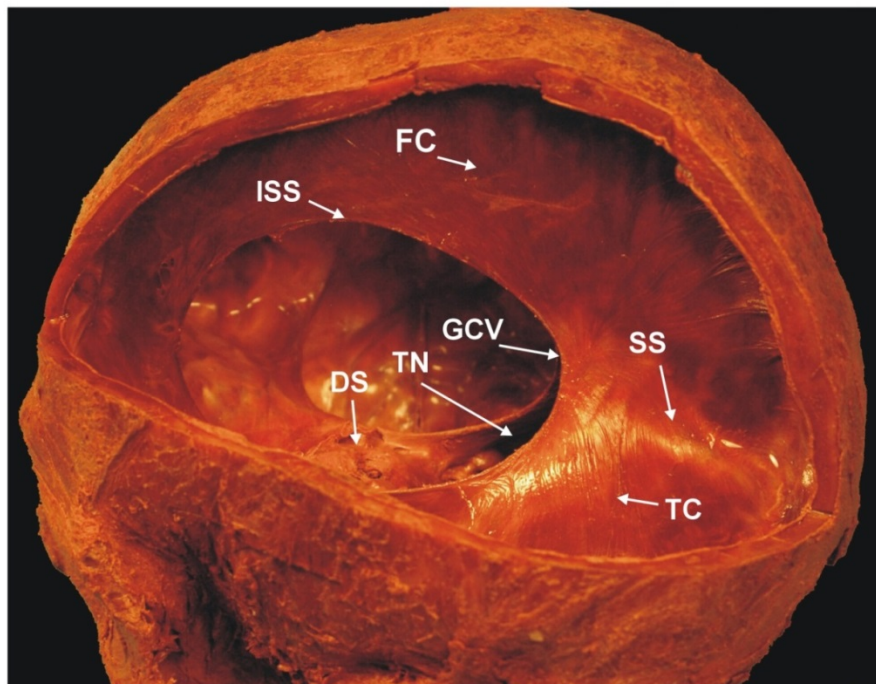
4. Diaphragma Sella – fold over sella turcica

Tentorial Notch – opening for brainstem

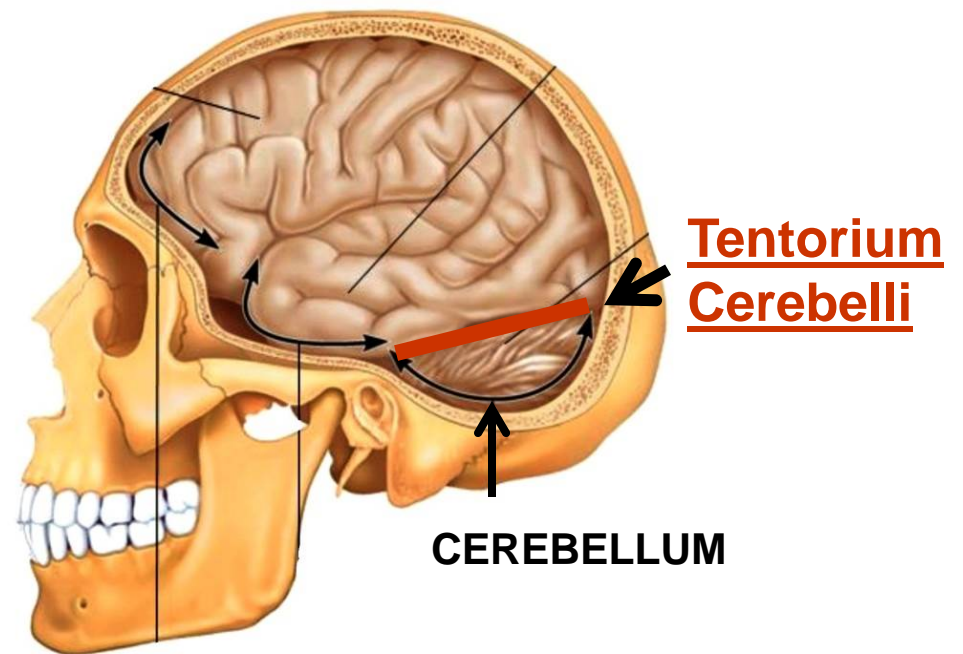
LOOK AT PROSECTION 279 – 'RED HEAD'

279

DURAL REFLECTIONS AND VENOUS SINUS



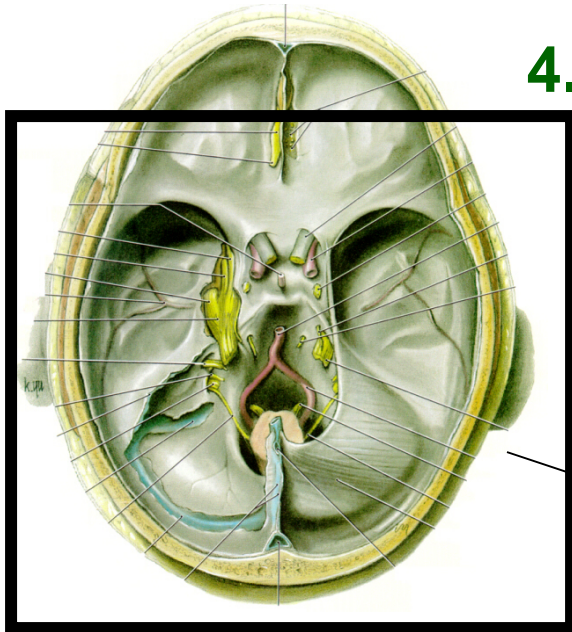
FC - FALX CEREBRI
TC - TENTORIUM CEREBELLI
ISS - LOCATION OF INFERIOR SAGITTAL SINUS
SS - LOCATION OF STRAIGHT SINUS
GCV - OPENING OF GREAT CEREBRAL VEIN OF GALEN
DS - DIAPHRAGMA SELLA
TN - TENTORIAL NOTCH



Tentorium Cerebelli =
roof over Cerebellum

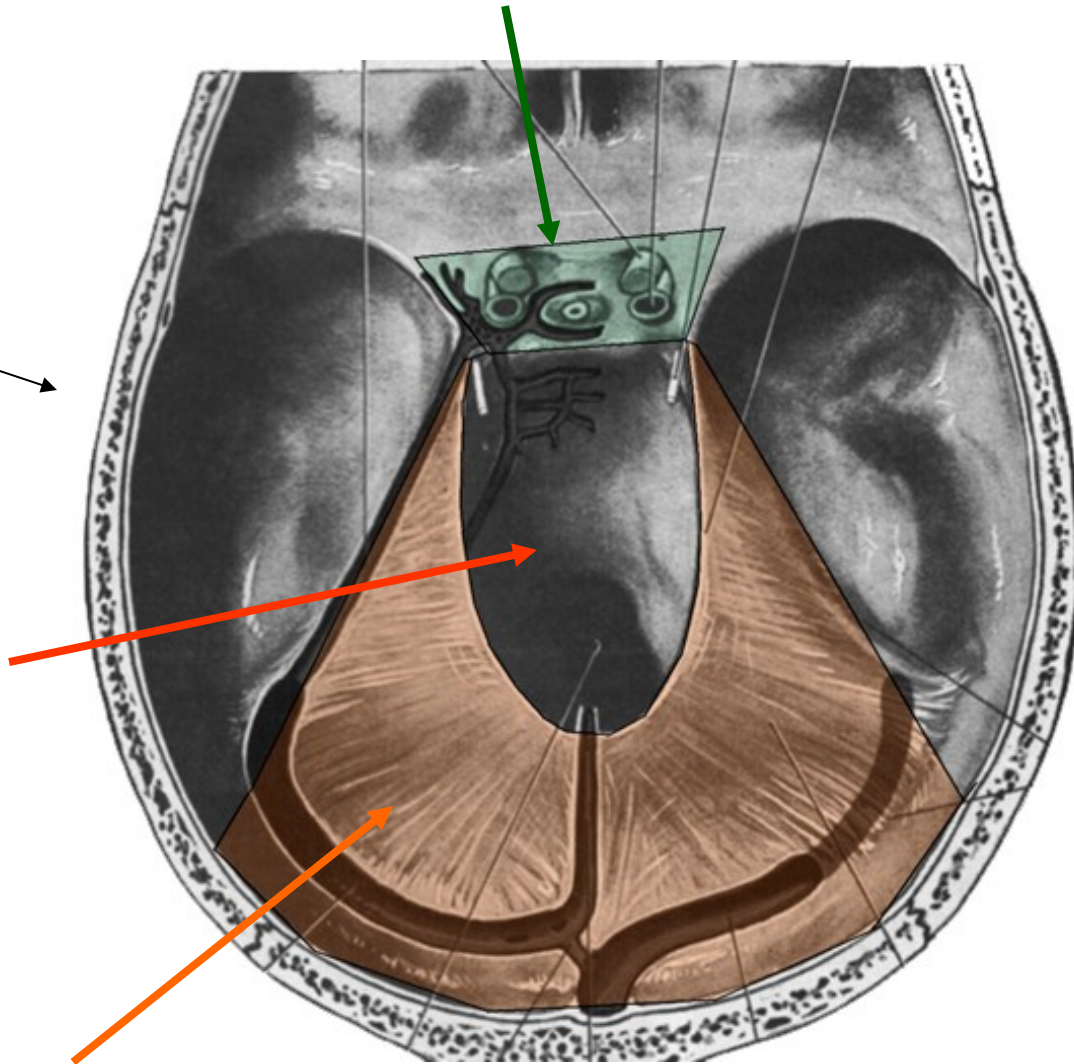
DURAL REFLECTIONS

4. Diaphragma Sella – over sella turcica



view inside cranial cavity

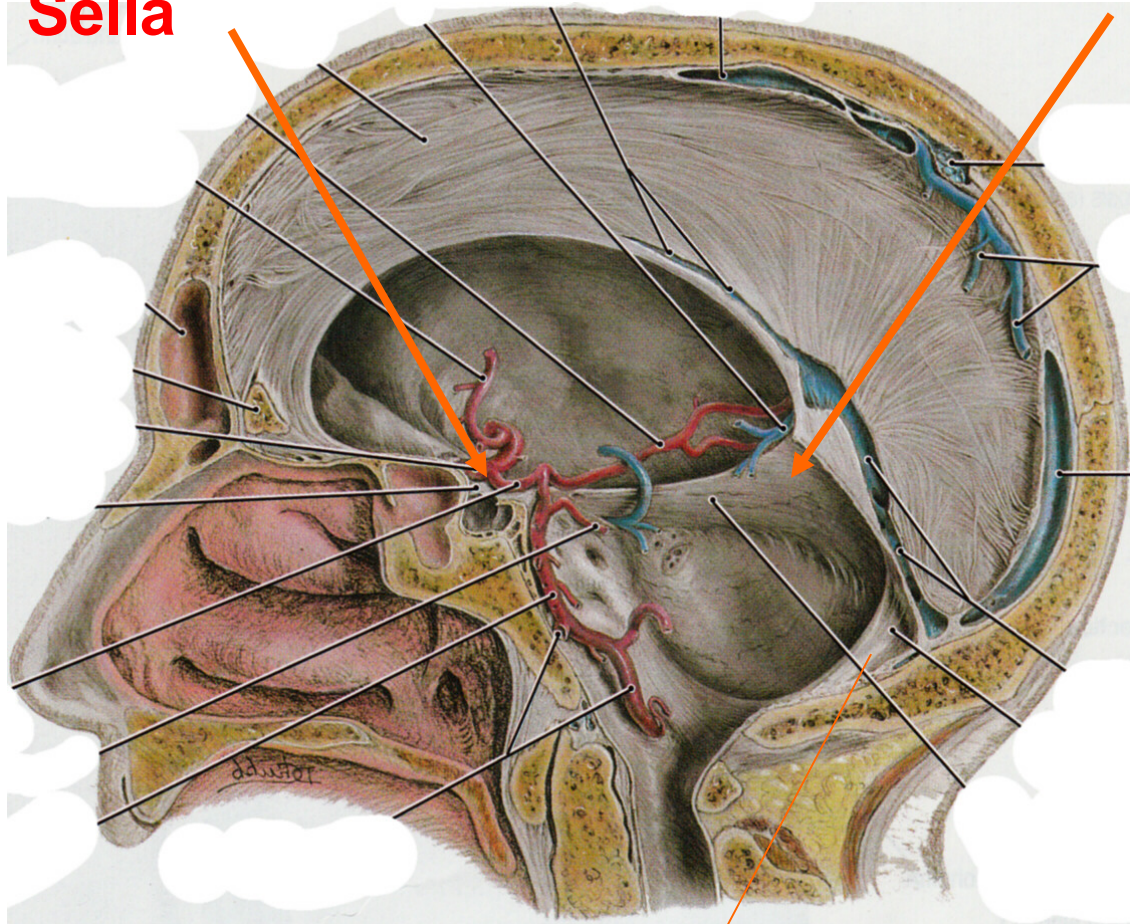
**Tentorial Notch –
opening for
brainstem**



3. Tentorium Cerebelli – forms roof of post. cran. fossa

DURAL REFLECTIONS

**Diaphragma
Sella**



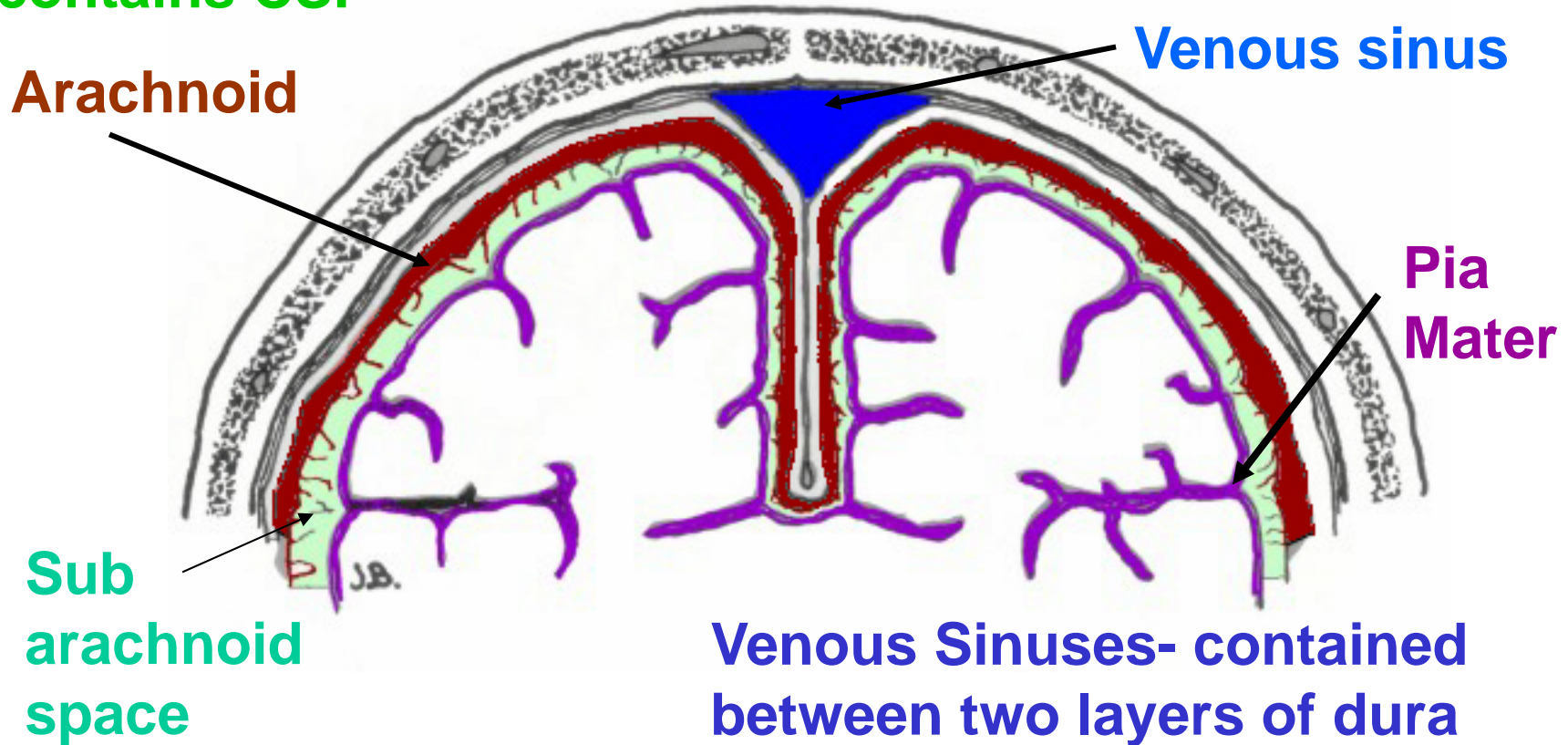
Falx Cerebelli

**3. Tentorium
Cerebelli** – crescent
shaped, forms roof of
post. cranial fossa,
has gap- tentorial
notch for pass of
brainstem

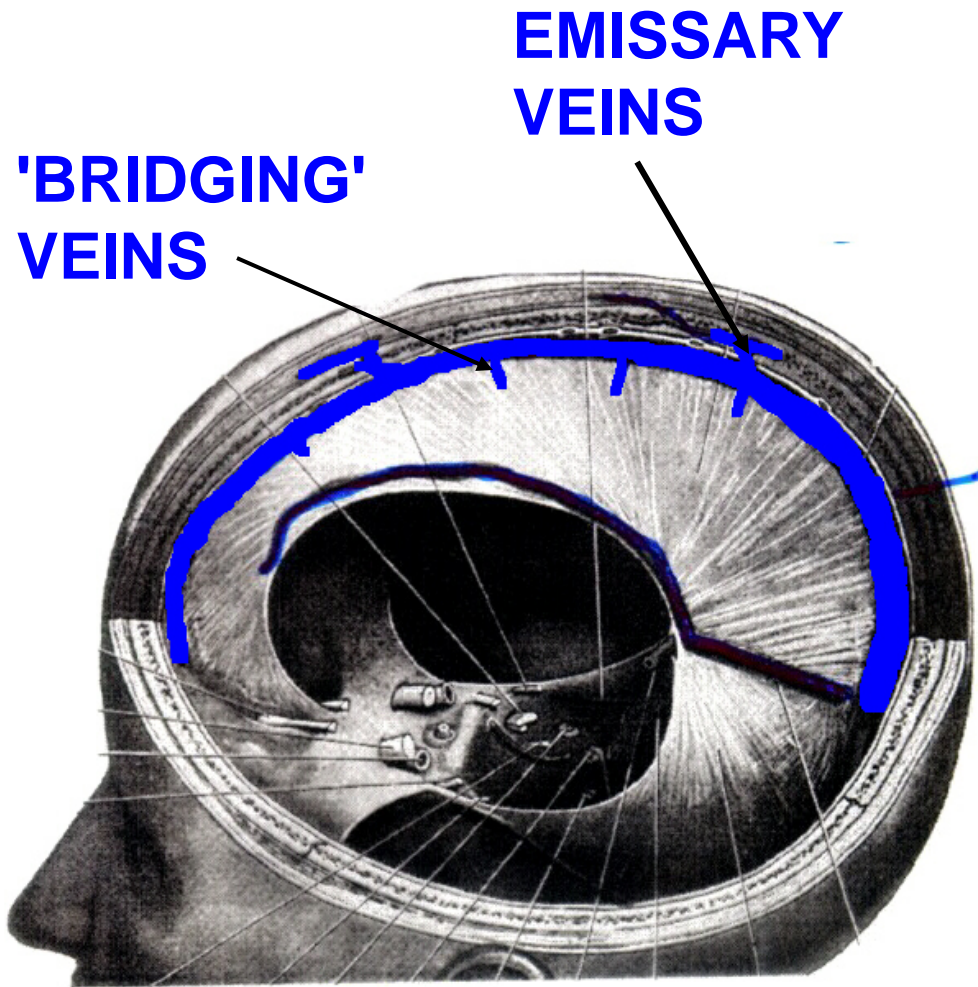
**4. Diaphragma
Sella** – circular
fold over sella
turcica, has
opening for stalk
of pituitary

MENINGES OF BRAIN

Other layers like spinal cord: B. **Arachnoid** - attached to inner side dura (potential space= Subdural Space); C. **Pia Mater** - adheres to brain; **Subarachnoid Space**- real space contains CSF



III. VENOUS SINUSES – BETWEEN 2 LAYERS OF DURA



Brain removed

Receive blood from brain, orbit, emissary veins

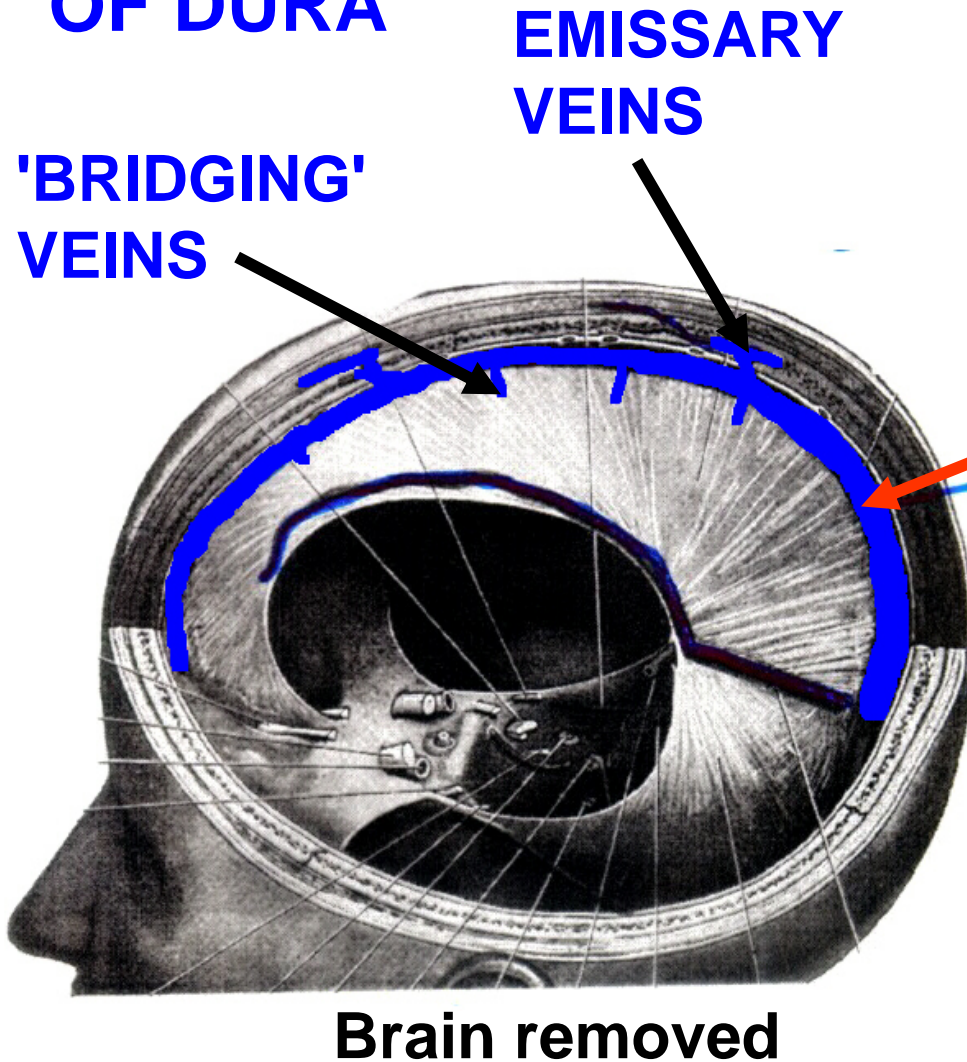
1. VEINS from brain (inside) -
a. 'BRIDGING' VEINS - inside cranial cavity - drain blood from surface of brain

b. named veins - ex. GREAT CEREBRAL VEIN OF GALEN

2. VEINS from outside (ex. scalp)
a. EMISSARY VEINS - drain blood from scalp, to venous sinuses

b. named veins - OPHTHALMIC VEINS from eye (orbit)

III. VENOUS SINUSES – BETWEEN 2 LAYERS OF DURA



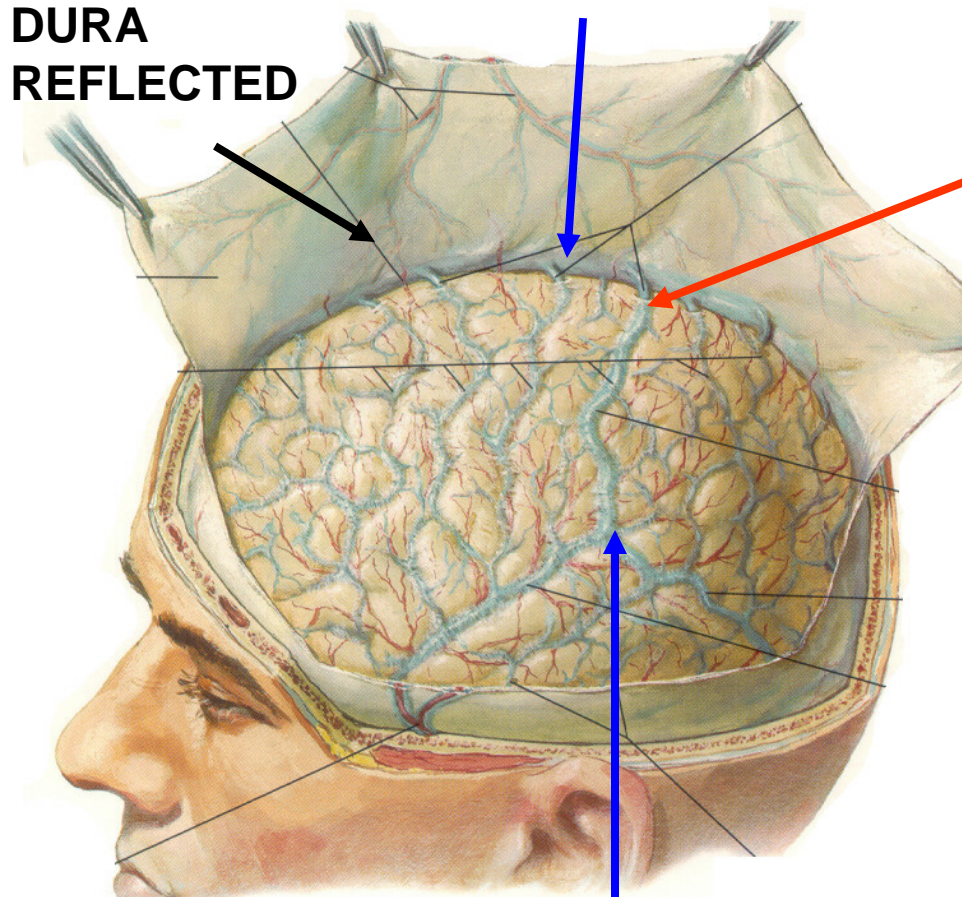
Receive blood from brain, orbit, emissary veins

1. Superior Sagittal Sinus – in upper border of falx cerebri; ant. - foramen cecum; post- transverse sinus; - communicates laterally with venous lacunae; blood from Superior Cerebral veins through 'bridging veins'; blood also from emissary veins

NOTE: Venous sinuses are like large veins – only have endothelial lining

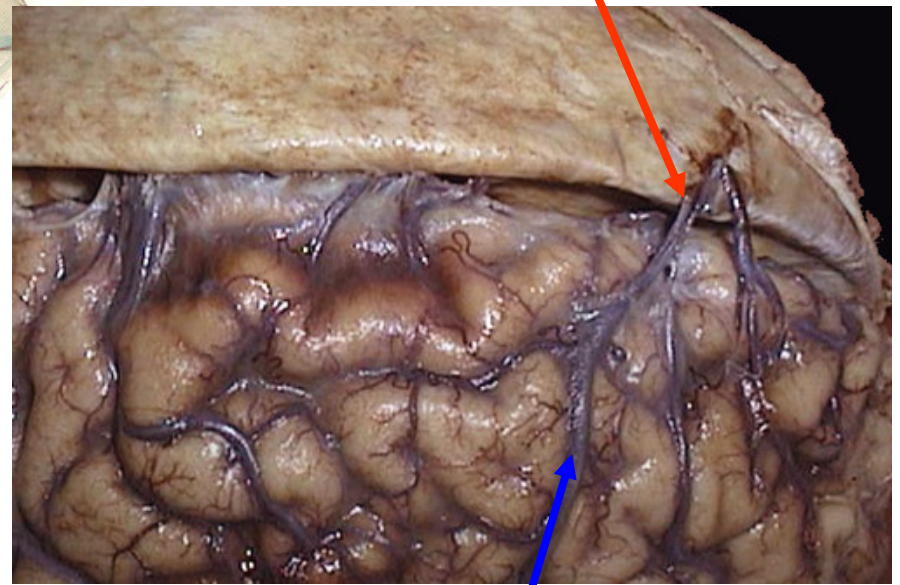
SUPERIOR SAGITTAL SINUS receives blood from Superior Cerebral veins through 'BRIDGING' VEINS

Superior Sagittal Sinus



Superior Cerebral veins

'BRIDGING' VEINS

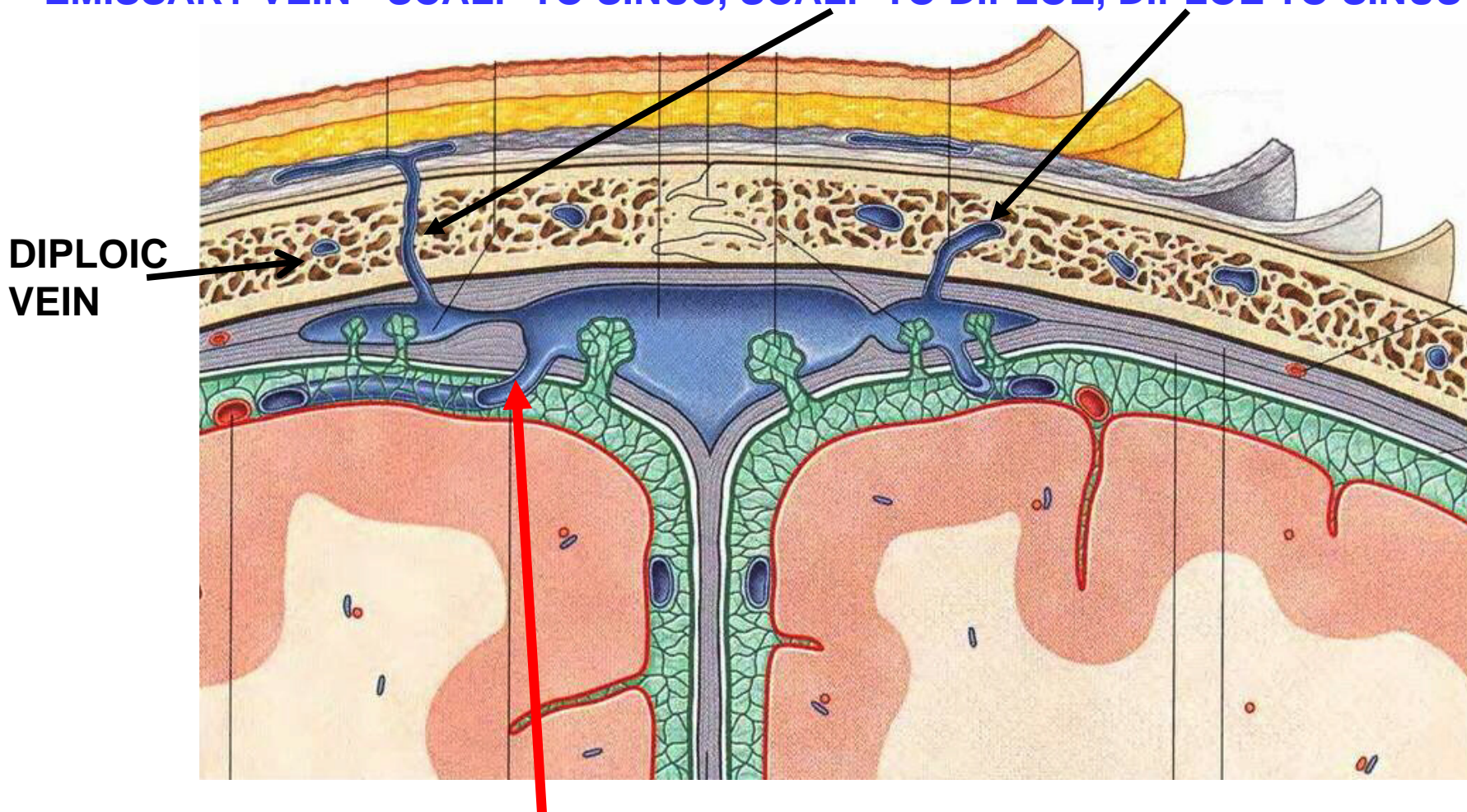


Superior Cerebral veins

Photo from lecture of Dr. Nancy Norton

EMISSARY VEINS VS BRIDGING VEINS

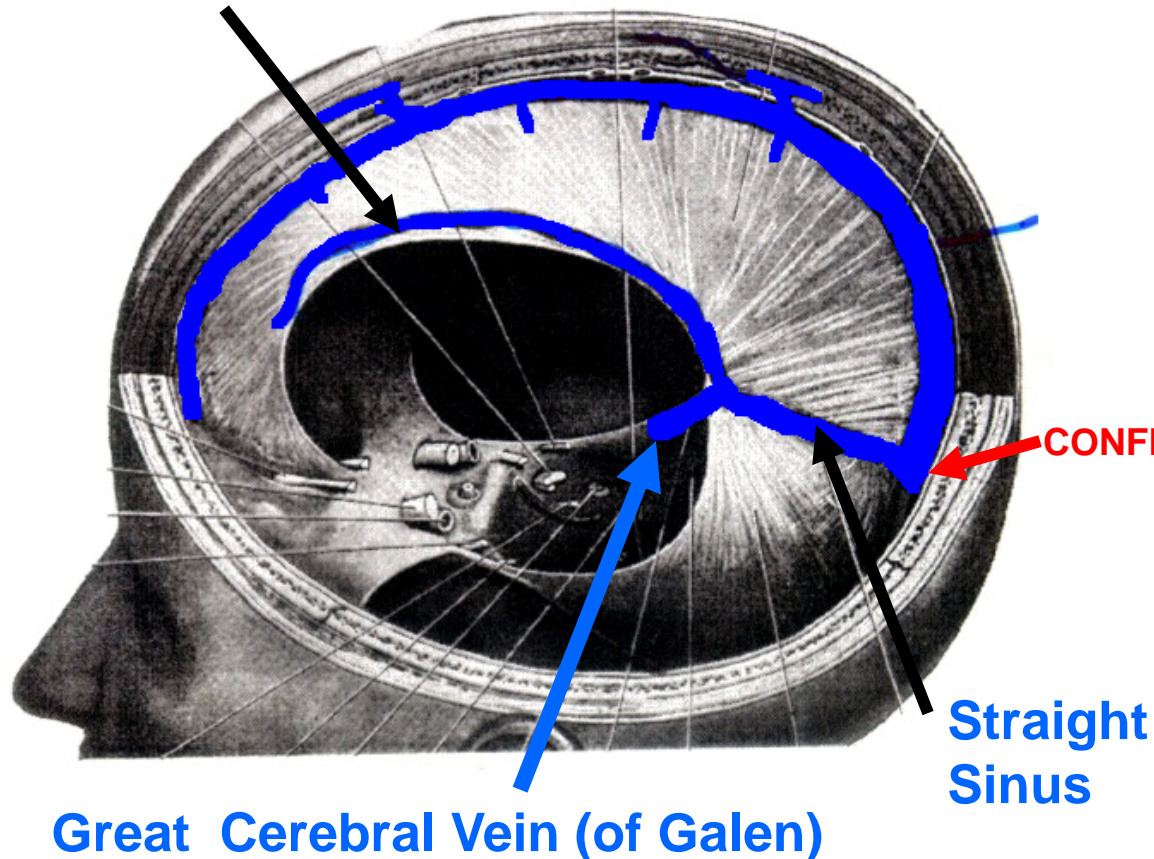
EMISSARY VEIN - SCALP TO SINUS, SCALP TO DIPLOE, DIPLOE TO SINUS



BRIDGING VEIN - CEREBRAL VEIN (BRAIN) TO SINUS

VENOUS SINUSES

Inferior Sagittal Sinus



2. Inferior Sagittal Sinus - in lower (free) border of falx cerebri; - joins Great Cerebral V. form Straight Sinus

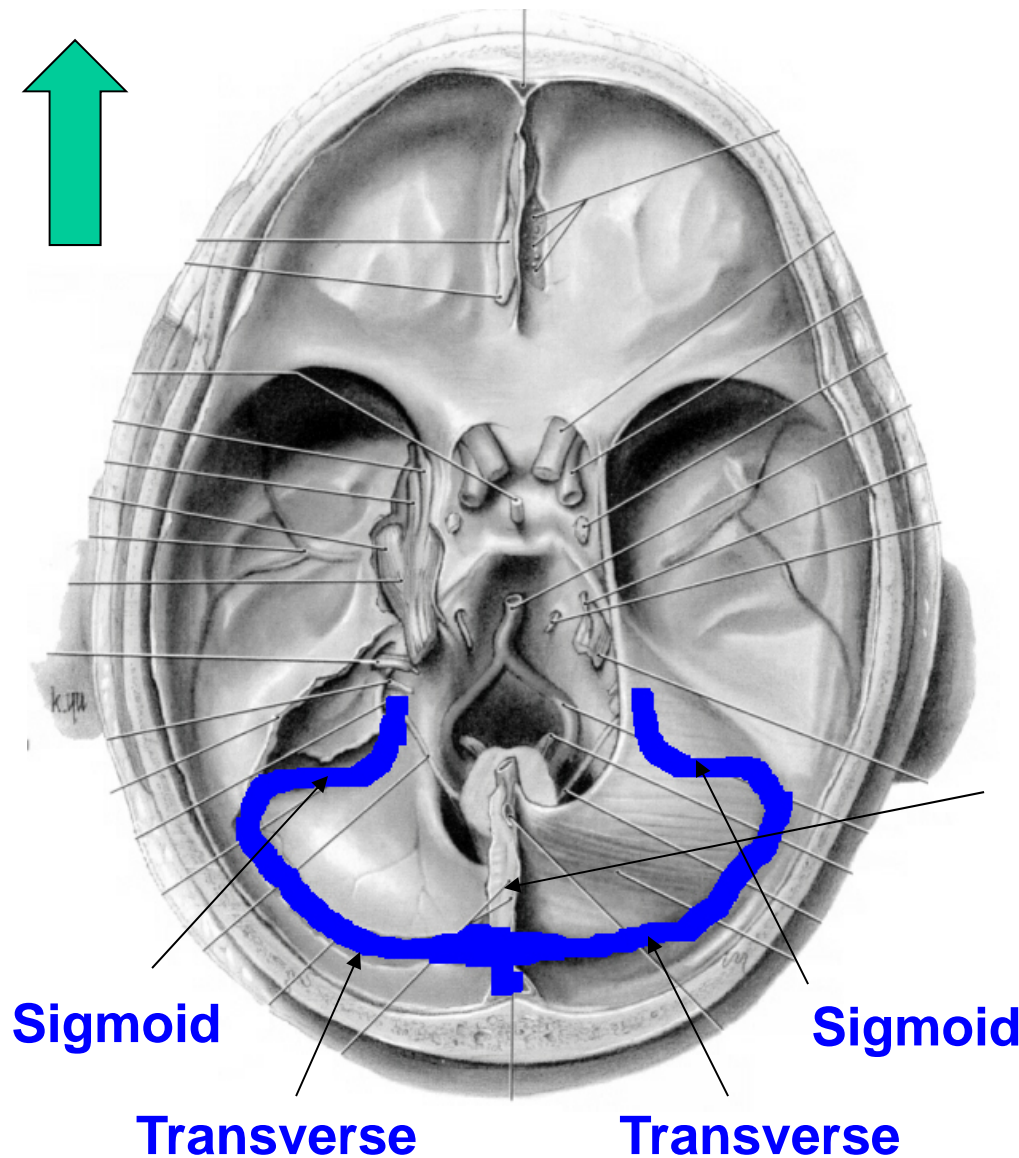
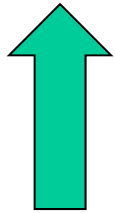
3. Straight sinus - at junction of falx cerebri and tentorium

NOTE: INFERIOR SAGITTAL SINUS DOES NOT DIRECTLY JOIN SUPERIOR SAGITTAL SINUS **

Straight Sinus can join Superior Sagittal Sinus at Confluens of Sinuses or turn left

VENOUS SINUSES

NOSE

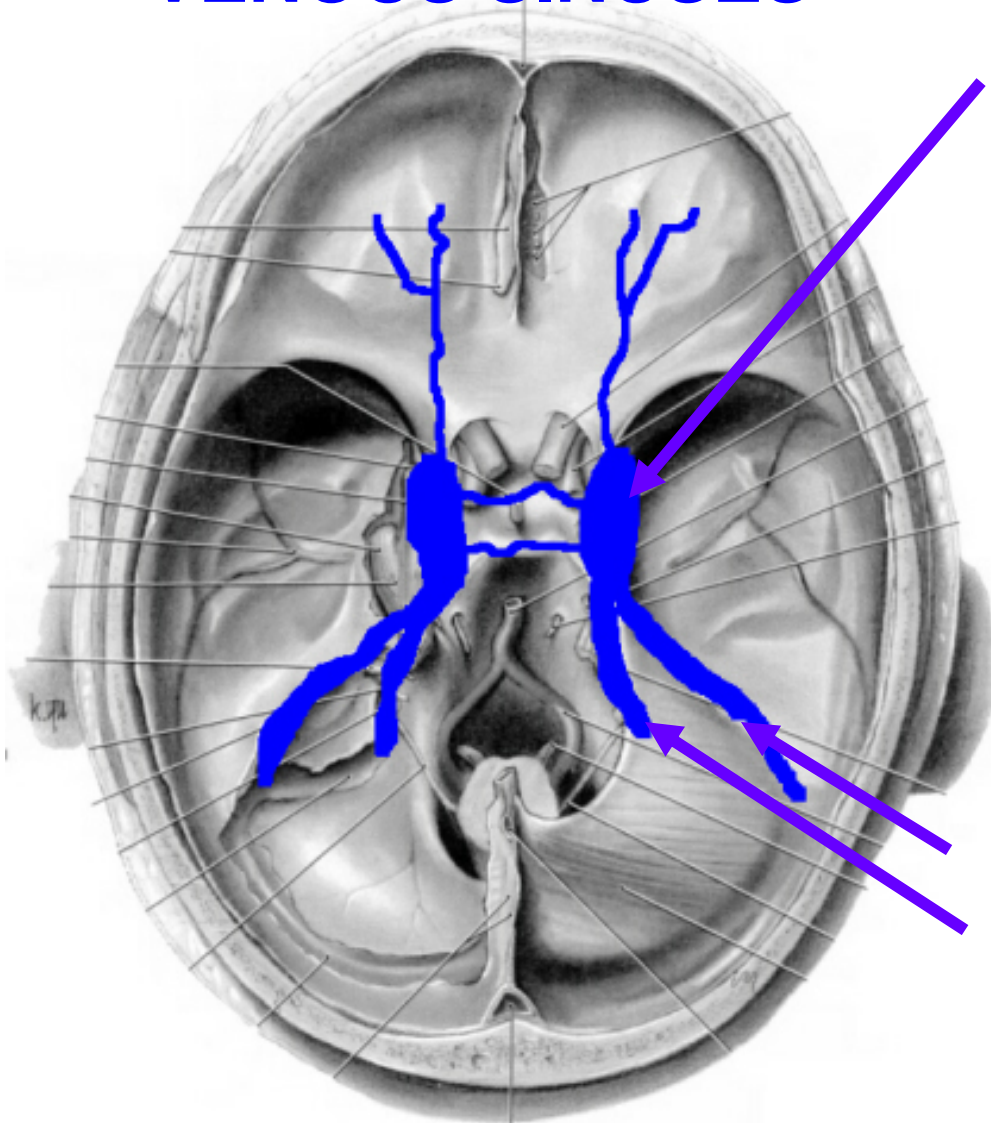


4. Transverse sinuses - in lateral fixed part of tentorium; receive blood from Sup. Sagittal or Confluens

5. Sigmoid sinuses - S-shaped continuation of Transverse; end in Jugular Foramen; form Internal Jugular Vein

6. Occipital Sinus - in Falx cerebelli; drain to Confluens

VENOUS SINUSES

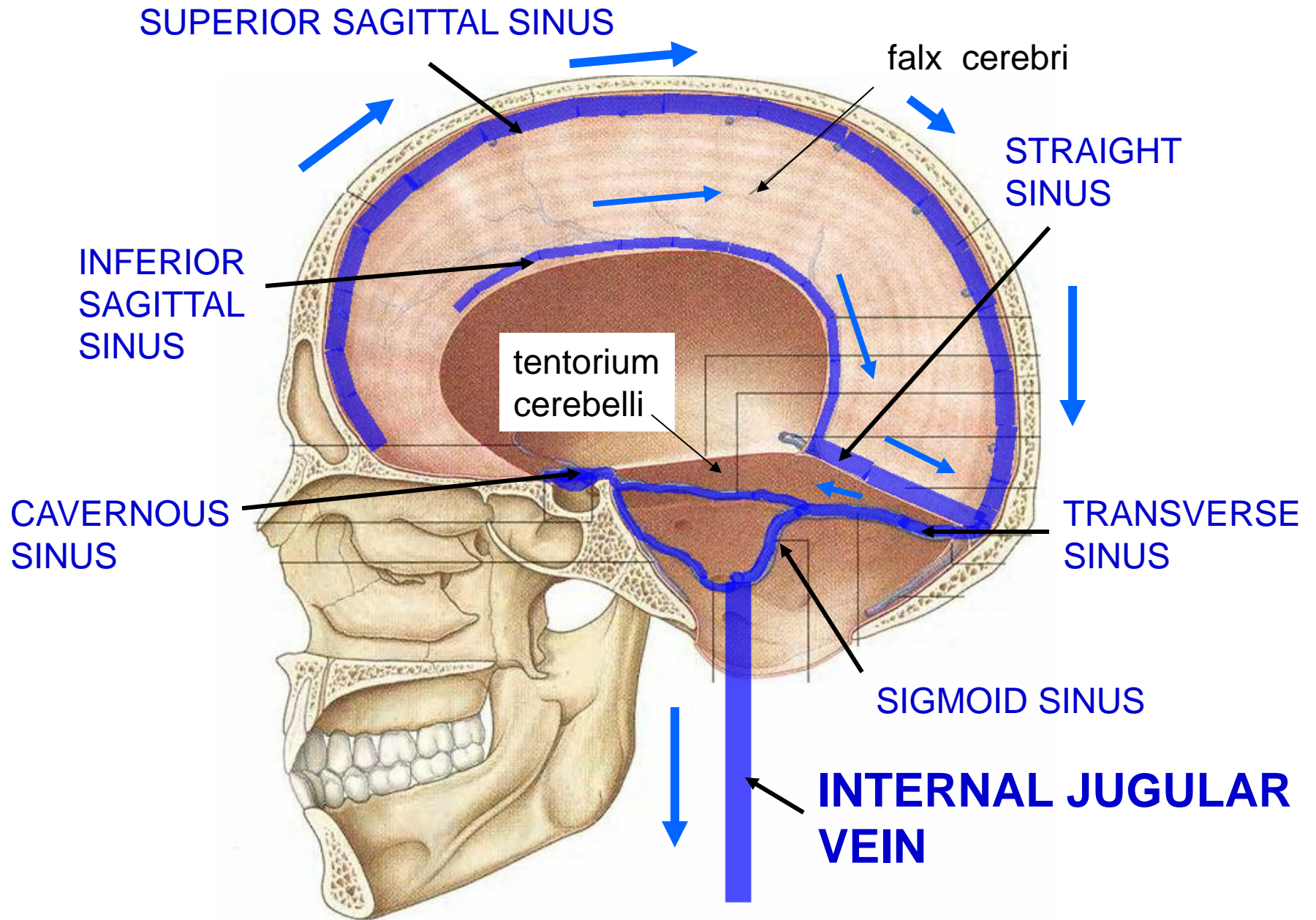


7. Cavernous sinuses - in middle cranial fossa; on side of the body of the sphenoid bone; connected by Intercavernous sinus; receive blood from Sup. and Inf. Ophthalmic veins, Cerebral veins; drain to Sup. and Inf. Petrosal sinuses

8. Sup. and Inf. Petrosal sinuses - on petrous part of temporal bone
Sup. drains to Transverse
Inf. Drains to Internal Jugular

Infection can spread from Face to Cavernous sinus via anastomoses of Ophthalmic veins and Facial veins

VENOUS SINUSES OF BRAIN



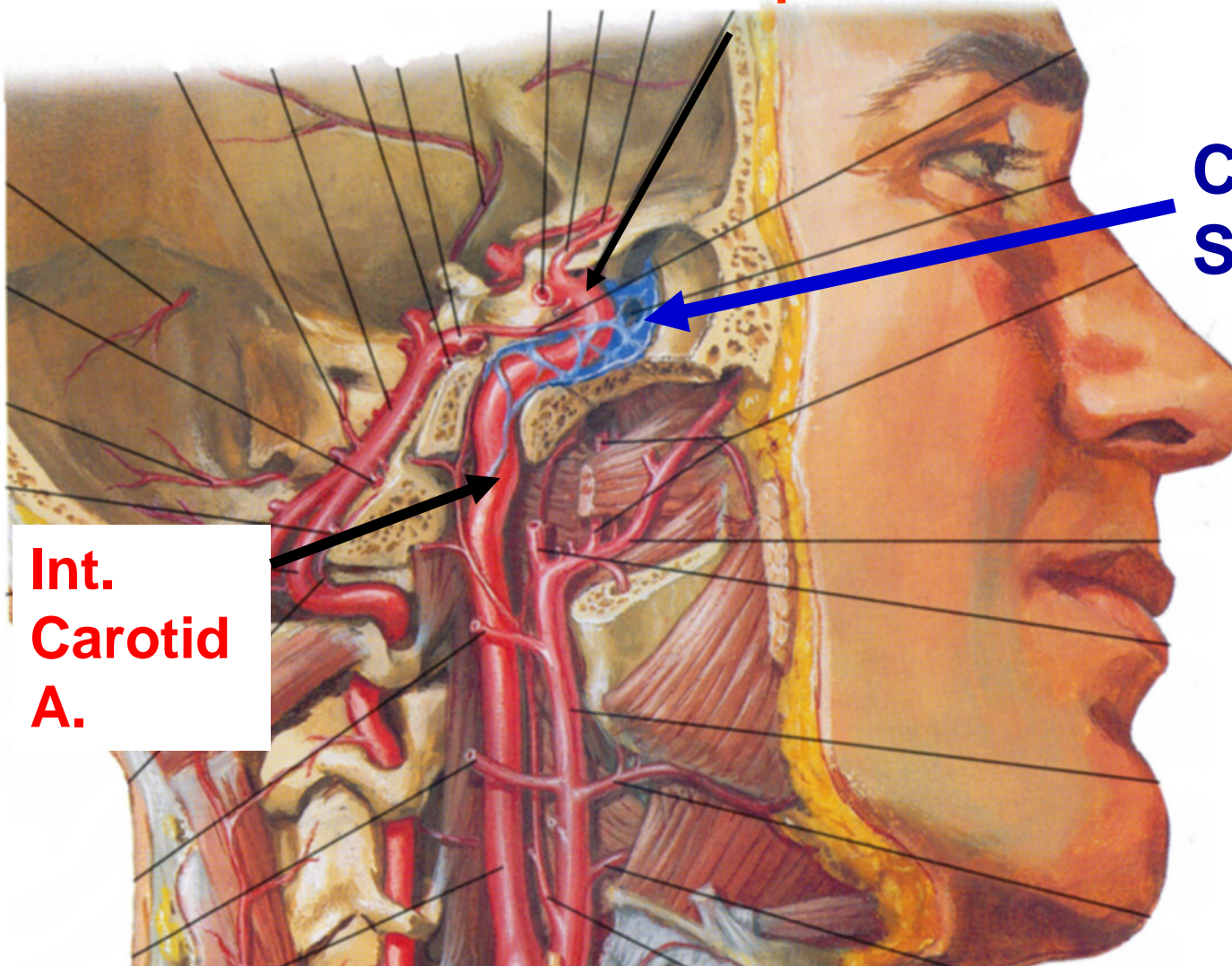
Internal Carotid Artery – Passes Through Wall of Cavernous Sinus **

Carotid Siphon

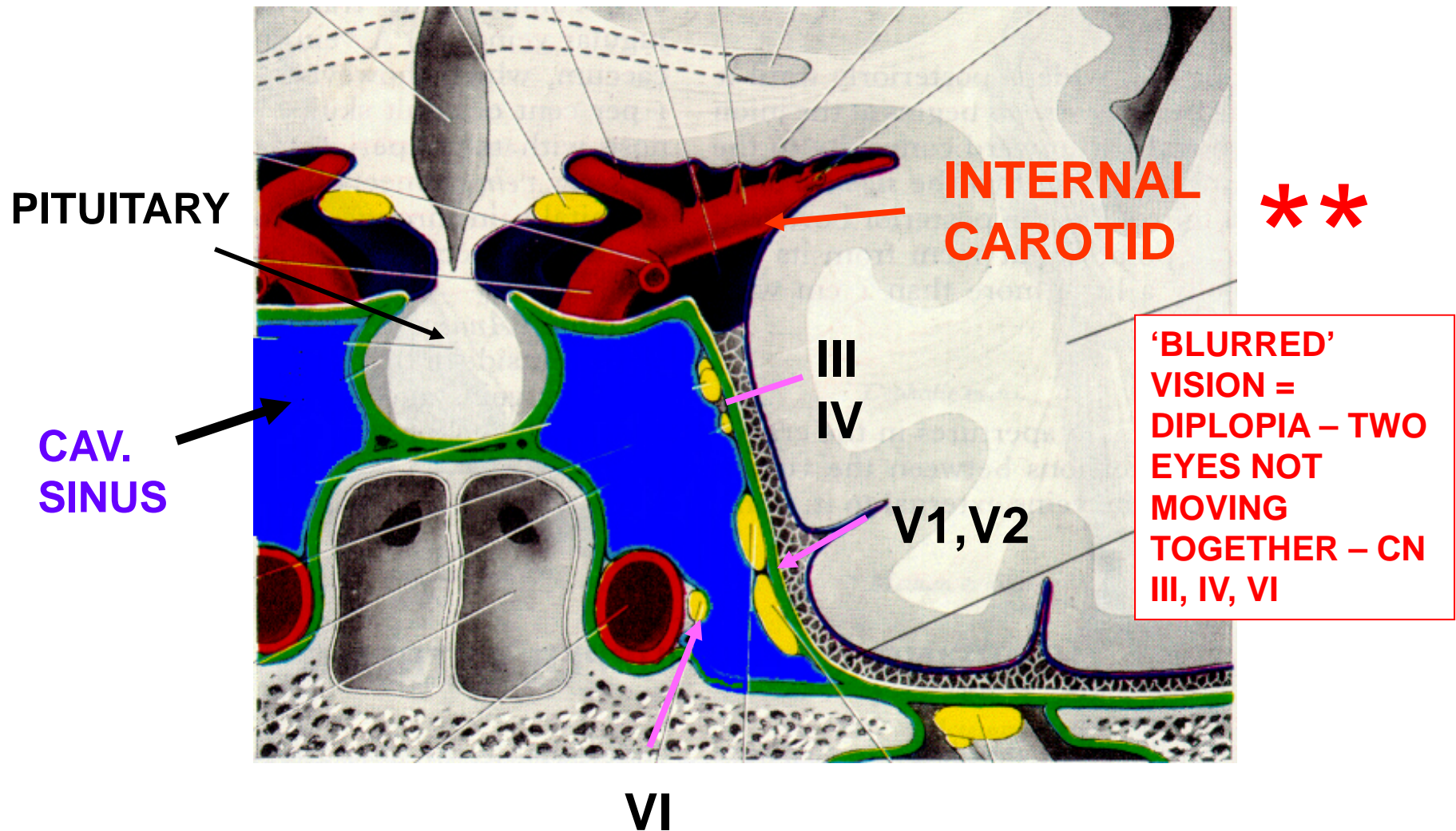
Cavernous Sinus **

Int. Carotid A.

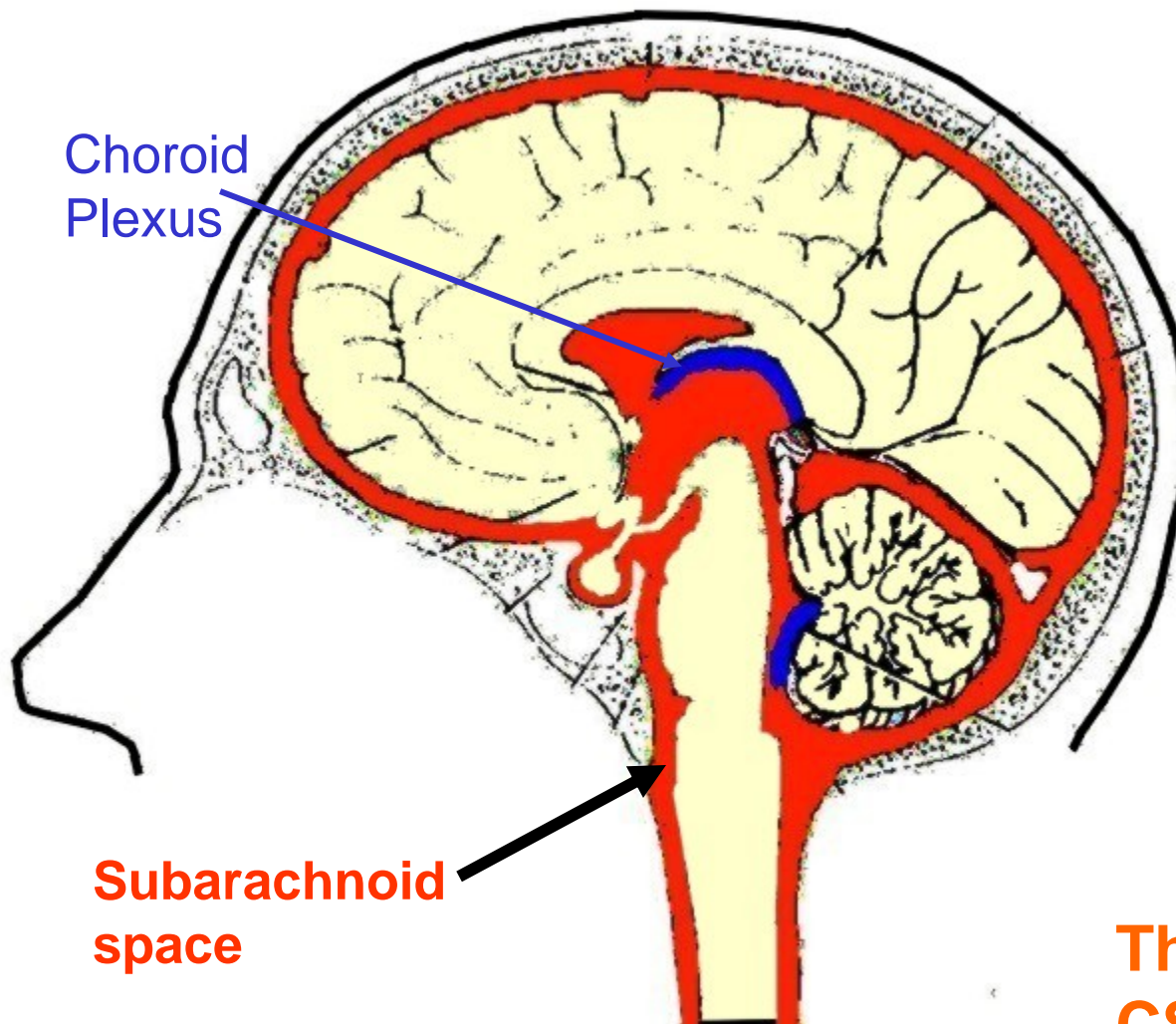
Carotid-Cavernous
Fistula -
Bleed of
Internal
Carotid
Artery inside
Cavernous
Sinus



**STRUCTURES PASSING THROUGH WALL OF CAVERNOUS SINUS - Int. Carotid A., Cranial N.'s III, IV, V1, V2, VI;
Clinical sign of Infection in Sinus – ‘BLURRED’ VISION**



IV. CEREBRO-SPINAL FLUID (CSF)



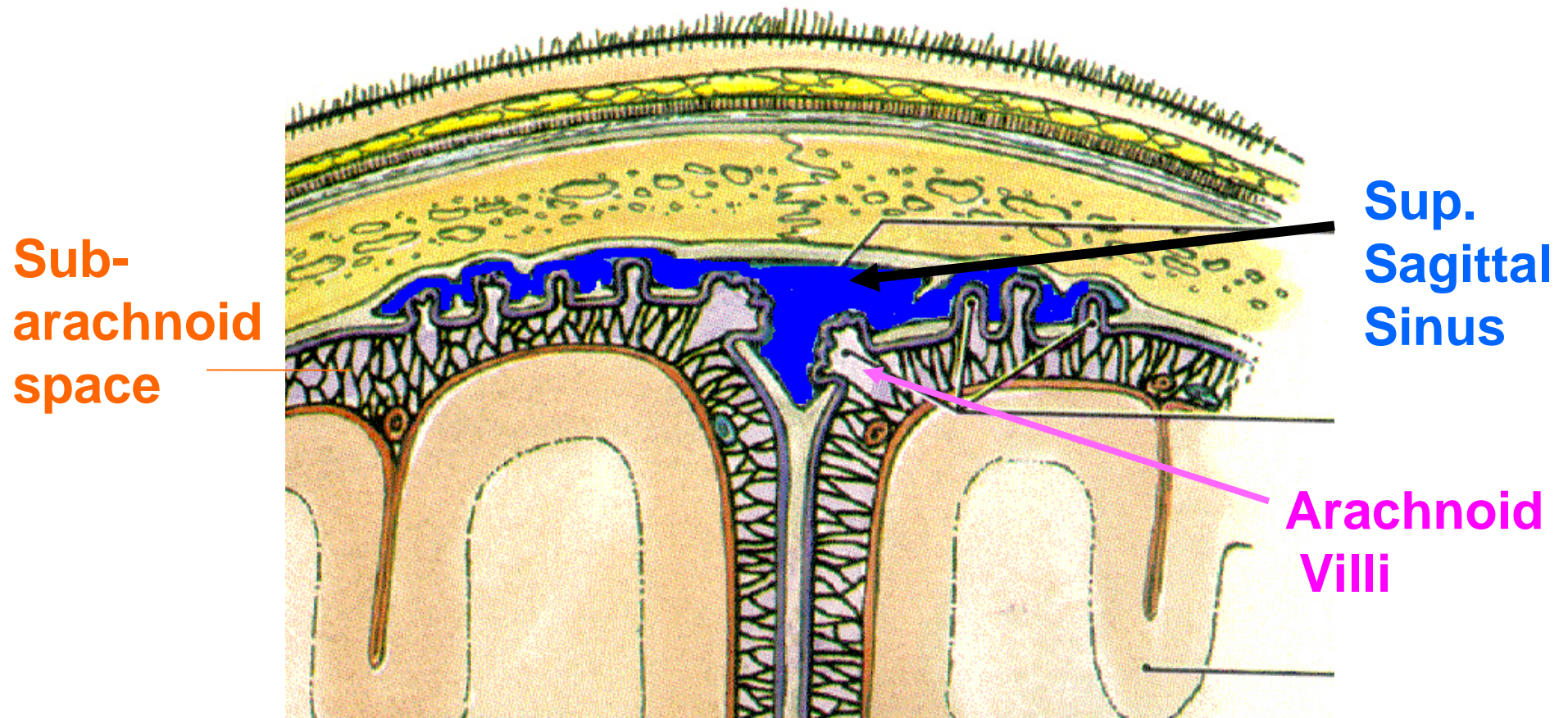
Choroid
Plexus

Subarachnoid
space

made inside
brain in Choroid
Plexus; flows
out of brain to
Subarachnoid
Space

The brain floats in
CSF - Shock
Absorber

CSF REABSORBED INTO VENOUS SINUSES



CSF reabsorbs into venous sinuses at Arachnoid Villi; - In elderly arachnoid villi can become calcified- Arachnoid Granulations; Reduced Re-Absorption can produce Communicating Hydrocephalus **

CSF REABSORBED INTO VENOUS SINUSES

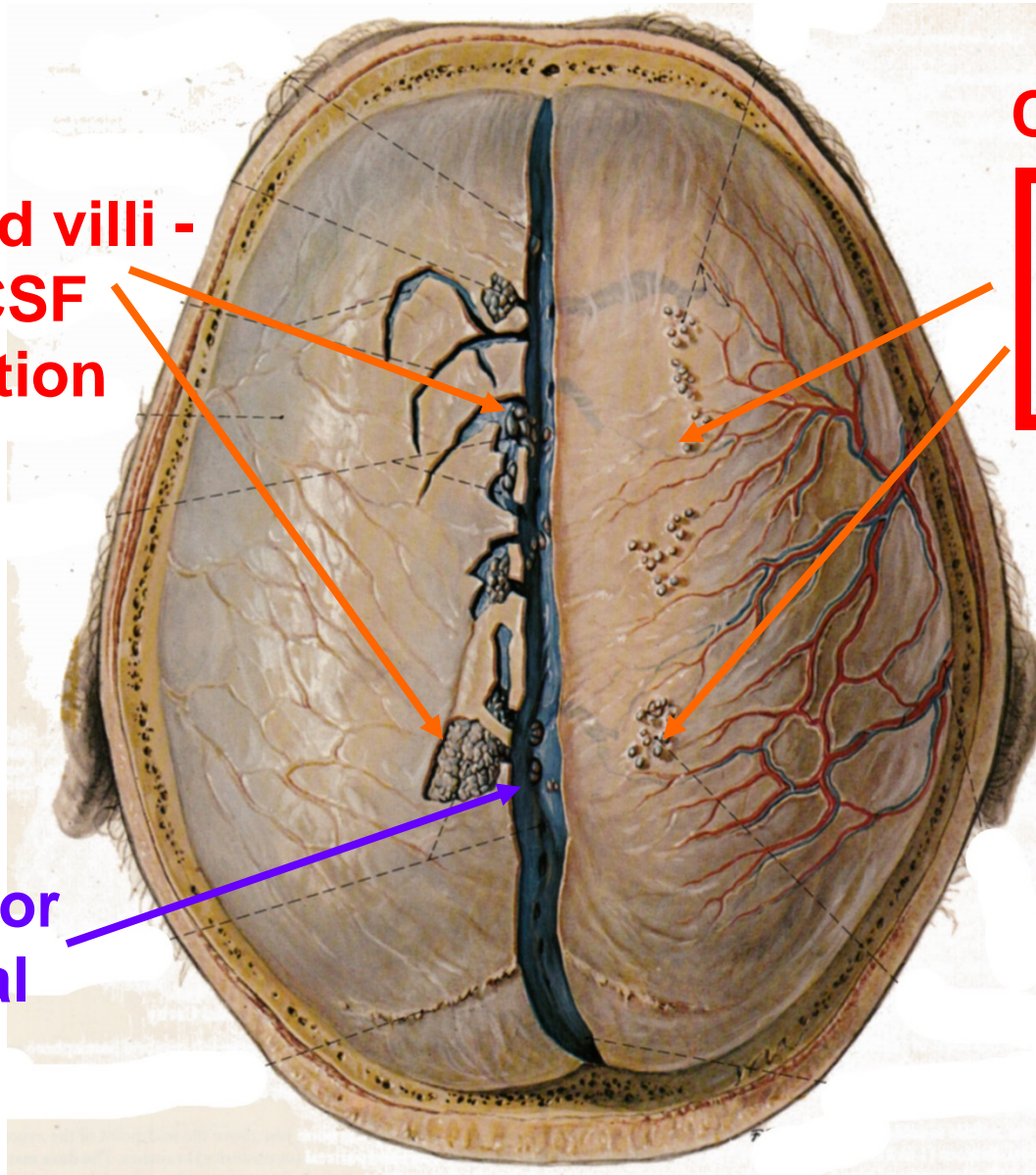
Arachnoid villi -
sites of CSF
reabsorption

CLINICAL **

Arachnoid villi -
sites of CSF
reabsorption

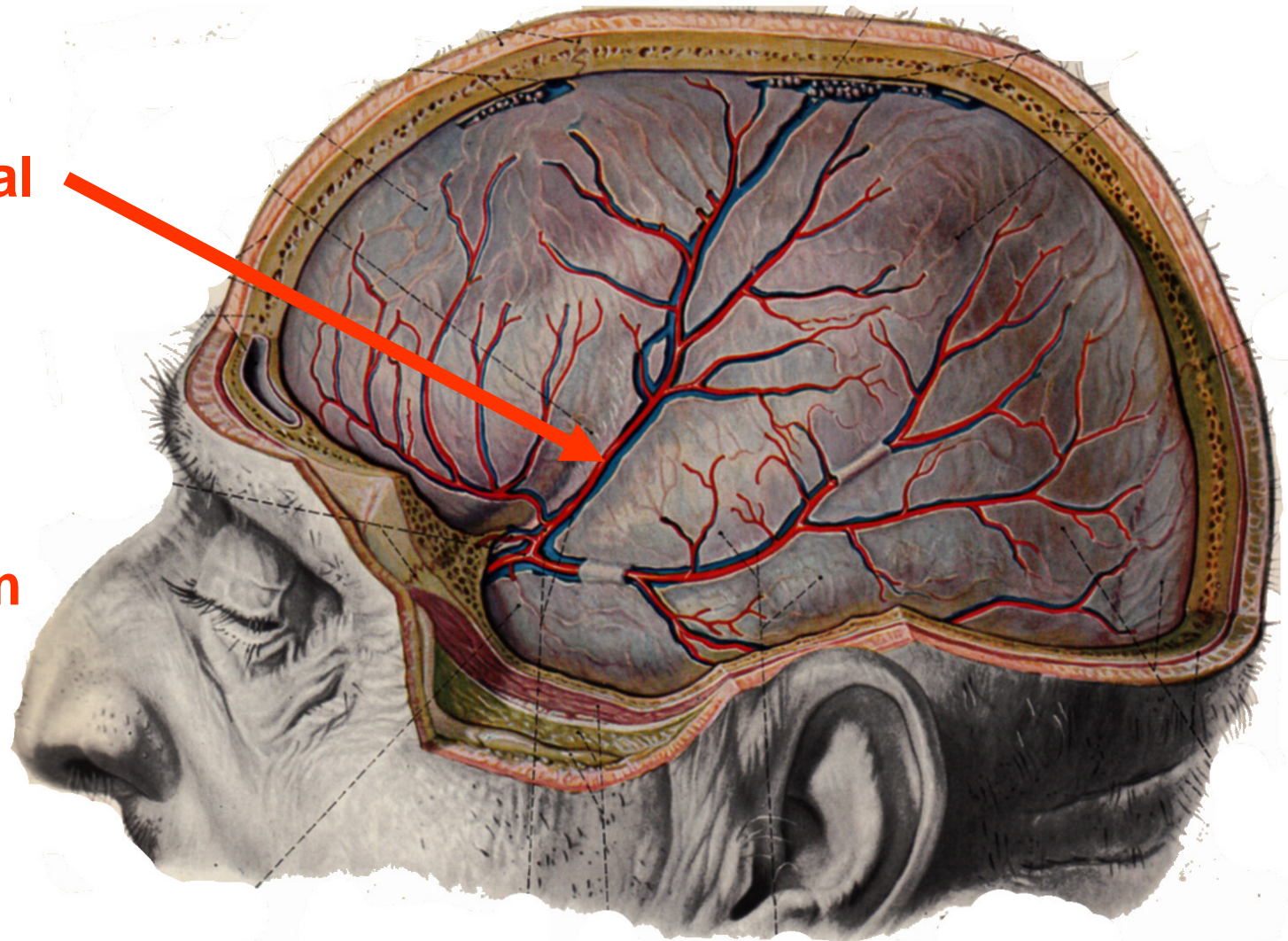
Superior
Sagittal
Sinus

Calcification of
Arachnoid Villi is
common in
elderly; can cause
hydrocephalus
due to decreased
reabsorption of
CSF

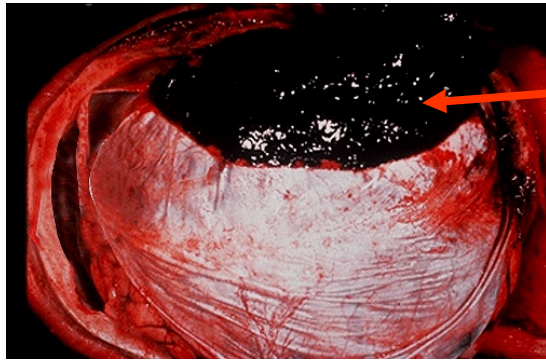


V. HEMATOMAS - INTERNAL BLEEDS

**Middle
Meningeal
Artery –
courses
outside
dura –
supplies
calvarium**



A. EPIDURAL HEMATOMA - bleeding between dura and bone



EPIDURAL HEMATOMA

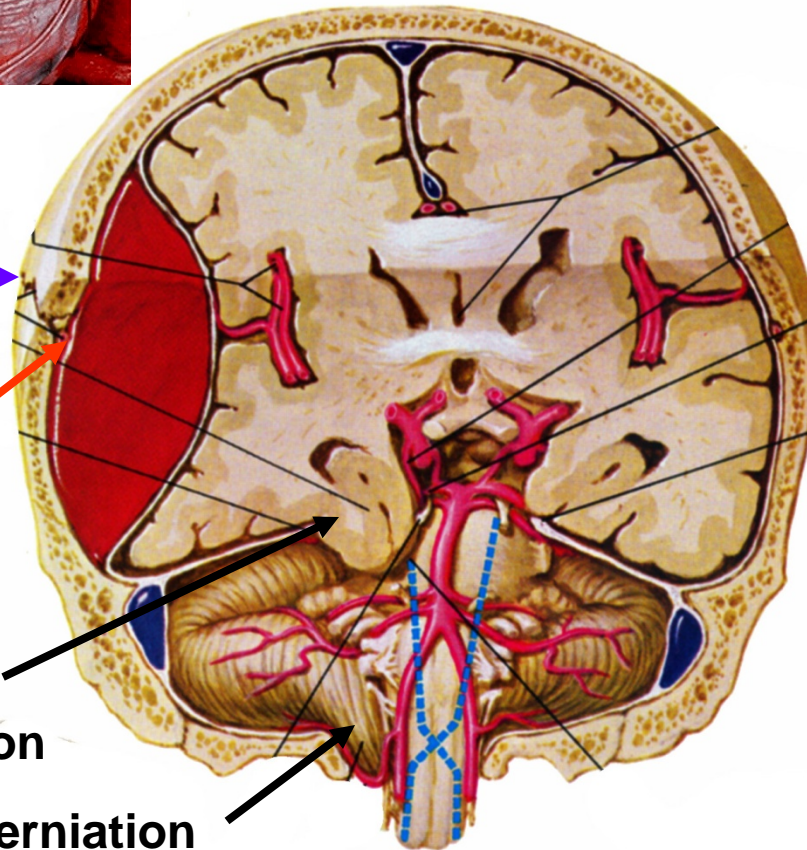
- 1) Skull fracture near Pterion
- 2) Tear Middle Meningeal Artery
- 3) Blood 'peels' dura from bone
- 4) Lens shaped (biconvex) mass on CT

Skull Fracture Near Pterion

Tear Middle Meningeal Artery

Uncal herniation

Tonsillar herniation

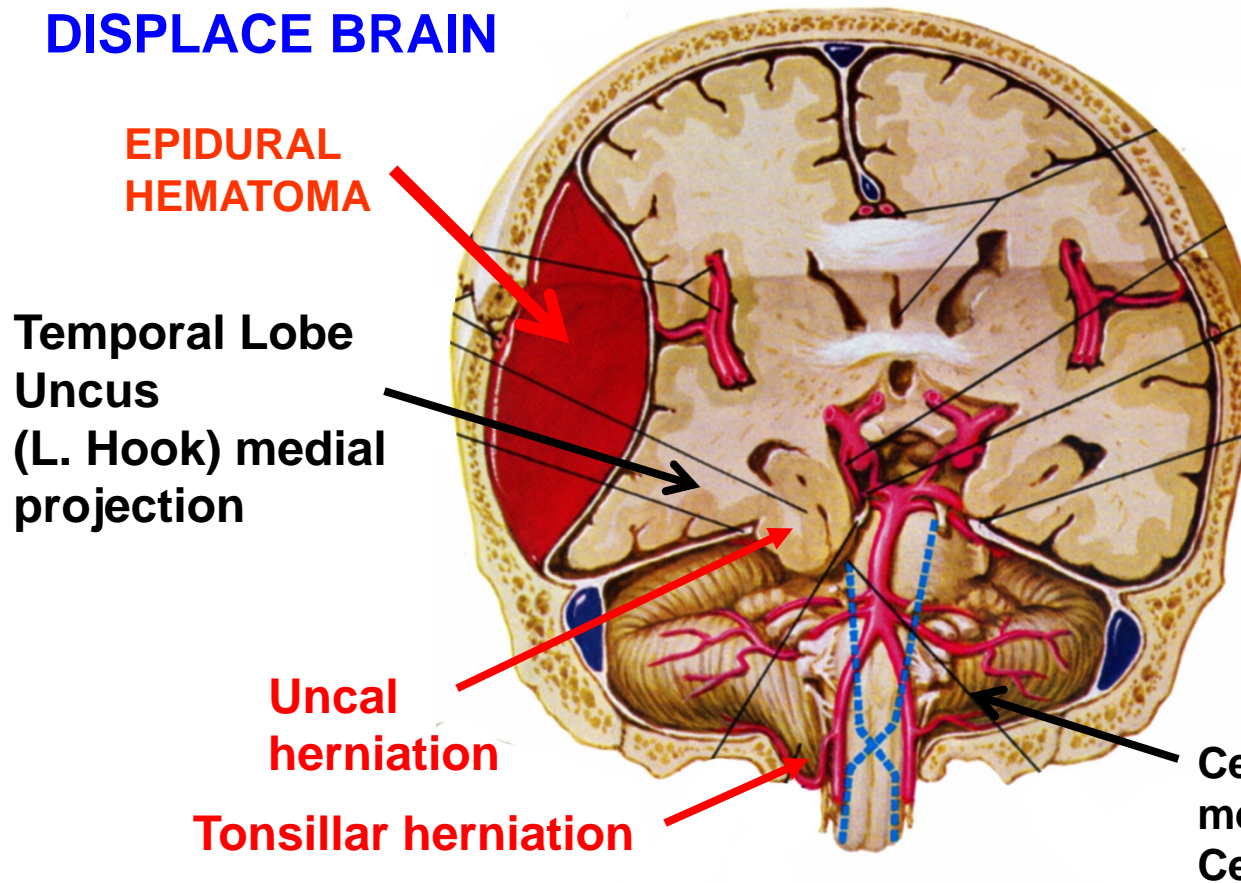


Clinical - bleeding is arterial; can be profuse and rapid (ex, car accident); patient lucid at first; can be fatal within hours if herniation occurs

EPIDURAL HEMATOMA – **
1) **ARTERIAL – often MIDDLE MENINGEAL ARTERY**
2) **'LENS' SHAPED MASS**
3) **RAPID**

EPIDURAL HEMATOMA

MASS OF BLOOD CAN
DISPLACE BRAIN



6) Herniation -

i. Uncal herniation -
push Temporal lobe
(uncus) through
Tentorial Notch

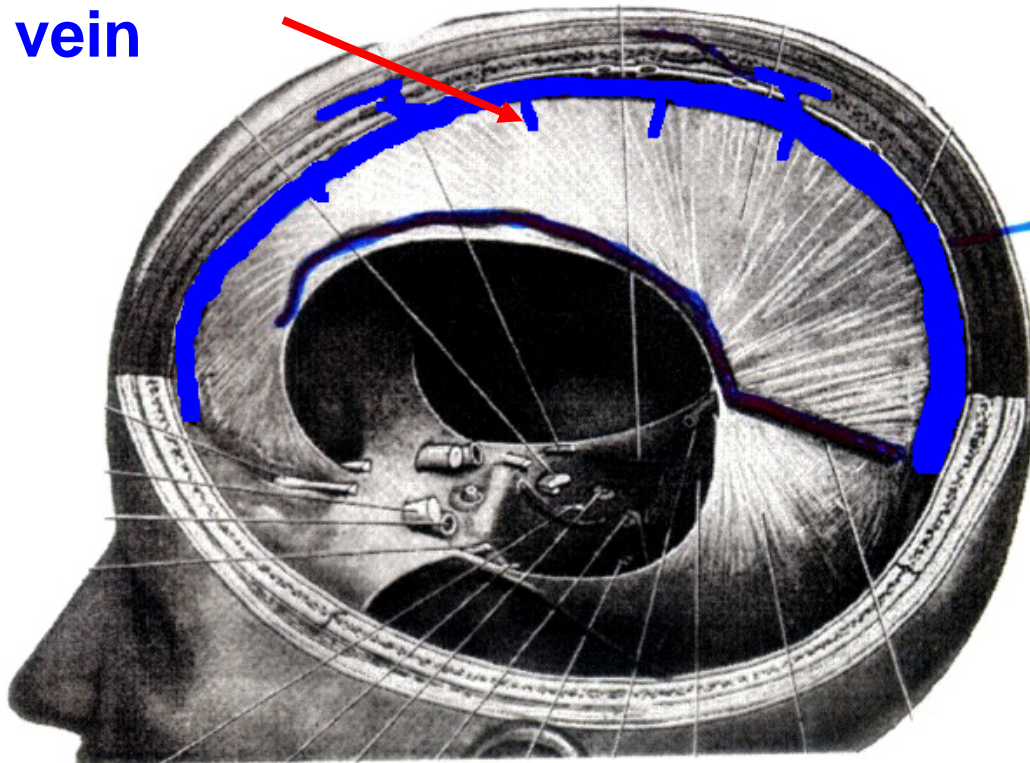
ii. Tonsillar
herniation -
push Cerebellum
(tonsil) through
Foramen Magnum

Cerebellar Tonsil -
medial projection of
Cerebellum

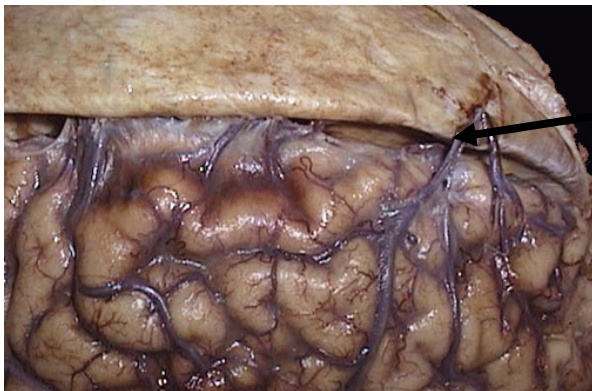
Clinical - bleeding is arterial; can be profuse and rapid (ex, car accident);
patient lucid at first; can be fatal within hours if herniation occurs - actress
Natasha Richardson 2009 **

B. SUBDURAL HEMATOMA

'Bridging'
vein



- bleed into potential space between Dura and Arachnoid
- from **tear 'Bridging' vein or sinus ****
- bleeding often **slow**
- chronic subdural hematomas can remain undetected



'Bridging'
vein

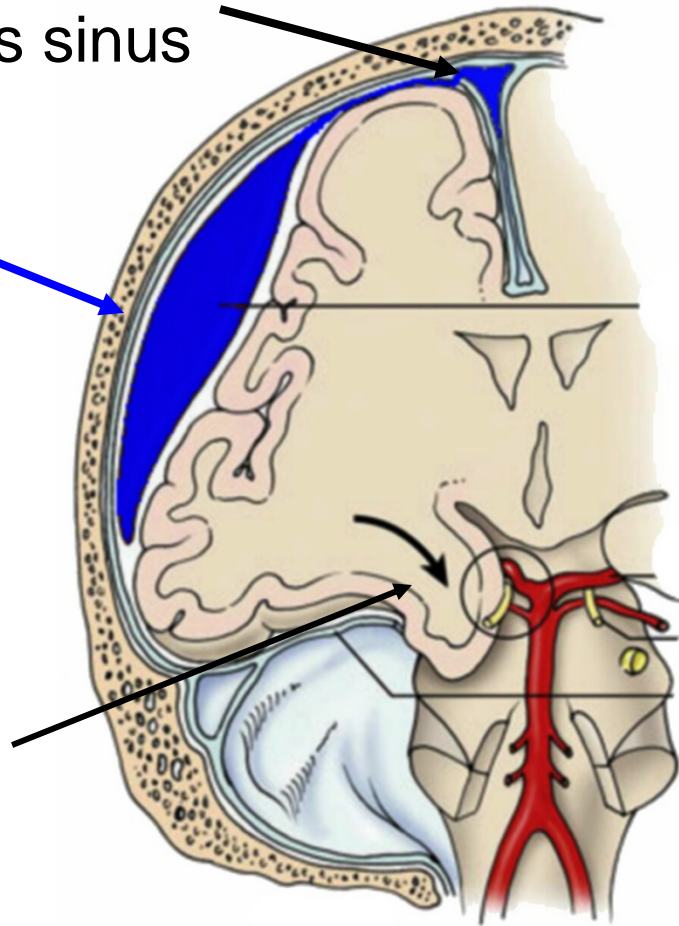
Photo from lecture of Dr. Nancy Norton

SUBDURAL HEMATOMA

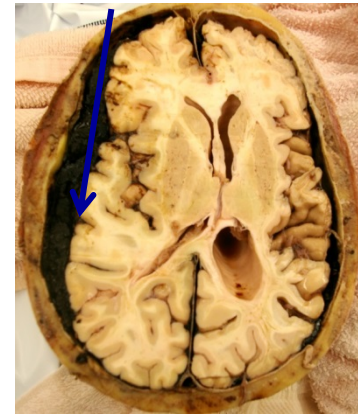
Tear 'bridging' vein
or venous sinus

Crescent
shaped
hematoma
on CT/MRI

Herniation
of uncus (L.
hook) of
temporal
lobe
through
Tentorial
notch



SUBDURAL HEMATOMA
BLOOD

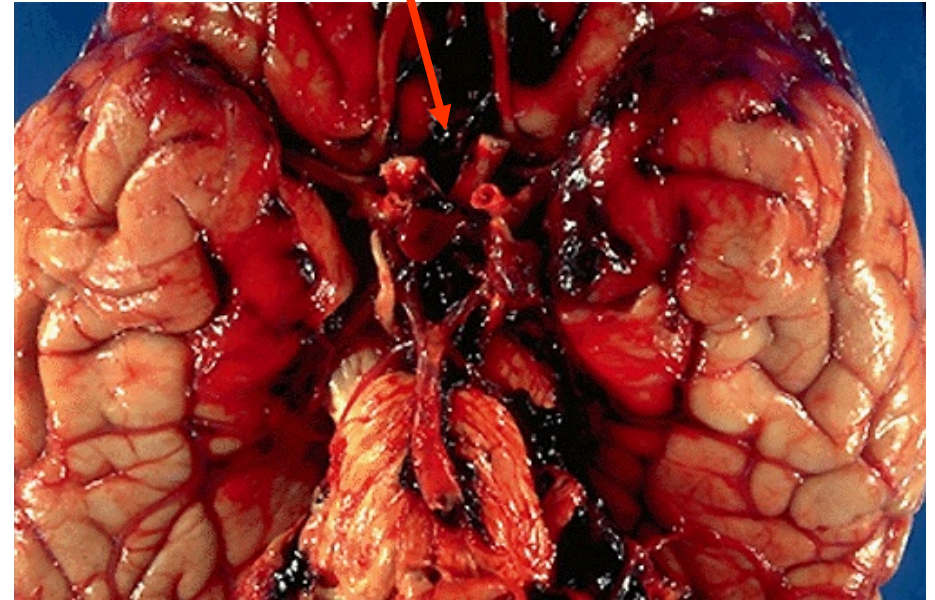
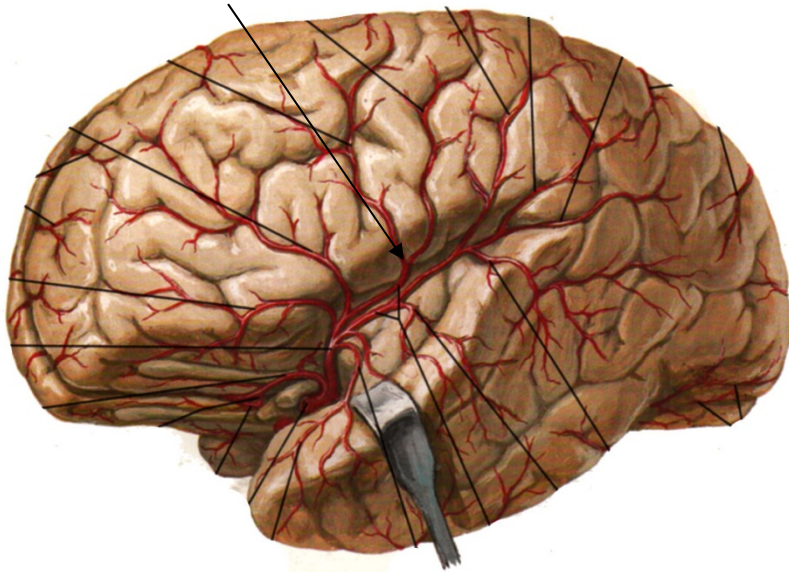


**SUBDURAL **
HEMATOMA –
1) VENOUS – often
BRIDGING VEIN
2) CRESCENT
SHAPED MASS
3) SLOW**

**Clinical: bleeding slow (venous); Chronic Subdural Hematomas
can remain undetected; can result in herniation if untreated**

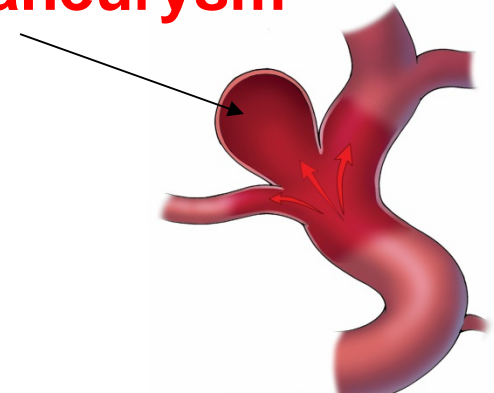
C. SUBARACHNOID HEMATOMA

Cerebral artery

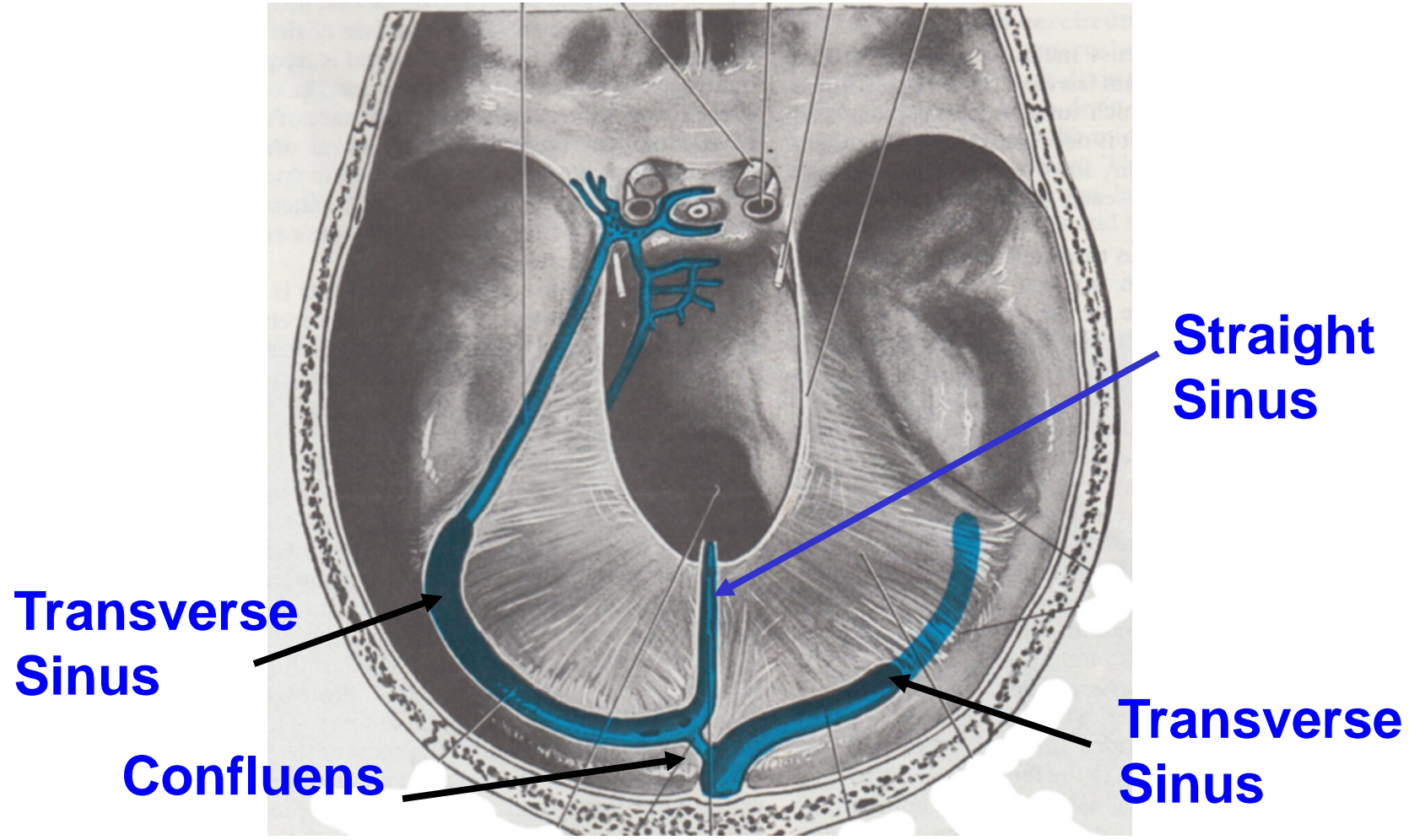


Tearing cerebral artery or aneurysm (ex, berry aneurysma = swelling of vessel wall) or cerebral vein; If arterial can be rapid and fatal

Berry aneurysm



VARIANT: INCOMPLETE FORMATION OF CONFLUENS OF SINUSES



Straight Sinus can join Superior Sagittal Sinus at Confluens of Sinuses or **turn left**