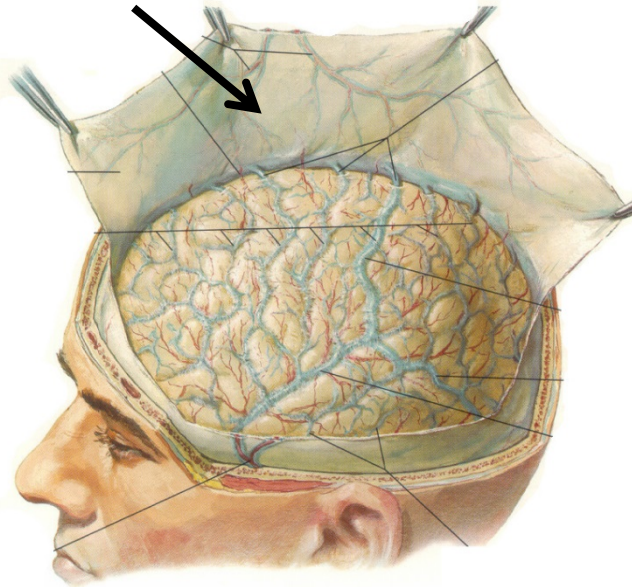


MENINGES AND VENOUS SINUSES OF BRAIN: 2022

EPIDURAL HEMATOMA



DURA MATER



OUTLINE

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

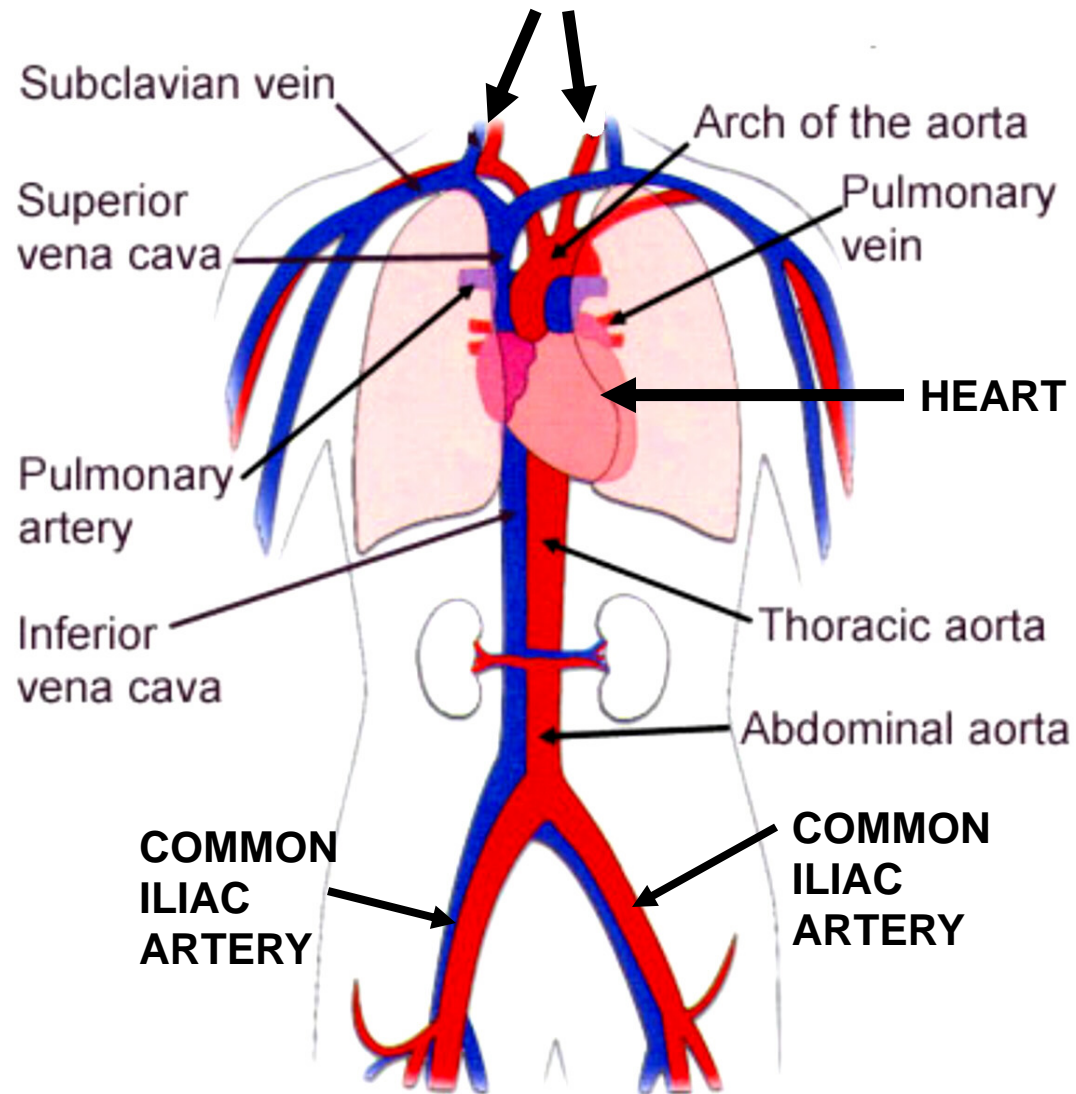
FACT: CRANIAL CAVITY IS ENCLOSED BY BONE; THERE IS NO ROOM FOR EXPANSION INSIDE SKULL

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



OVERVIEW OF BLOOD SUPPLY TO HEAD

1) COMMON CAROTID ARTERY DIVIDES TO EXTERNAL AND INTERNAL CAROTID ARTERIES

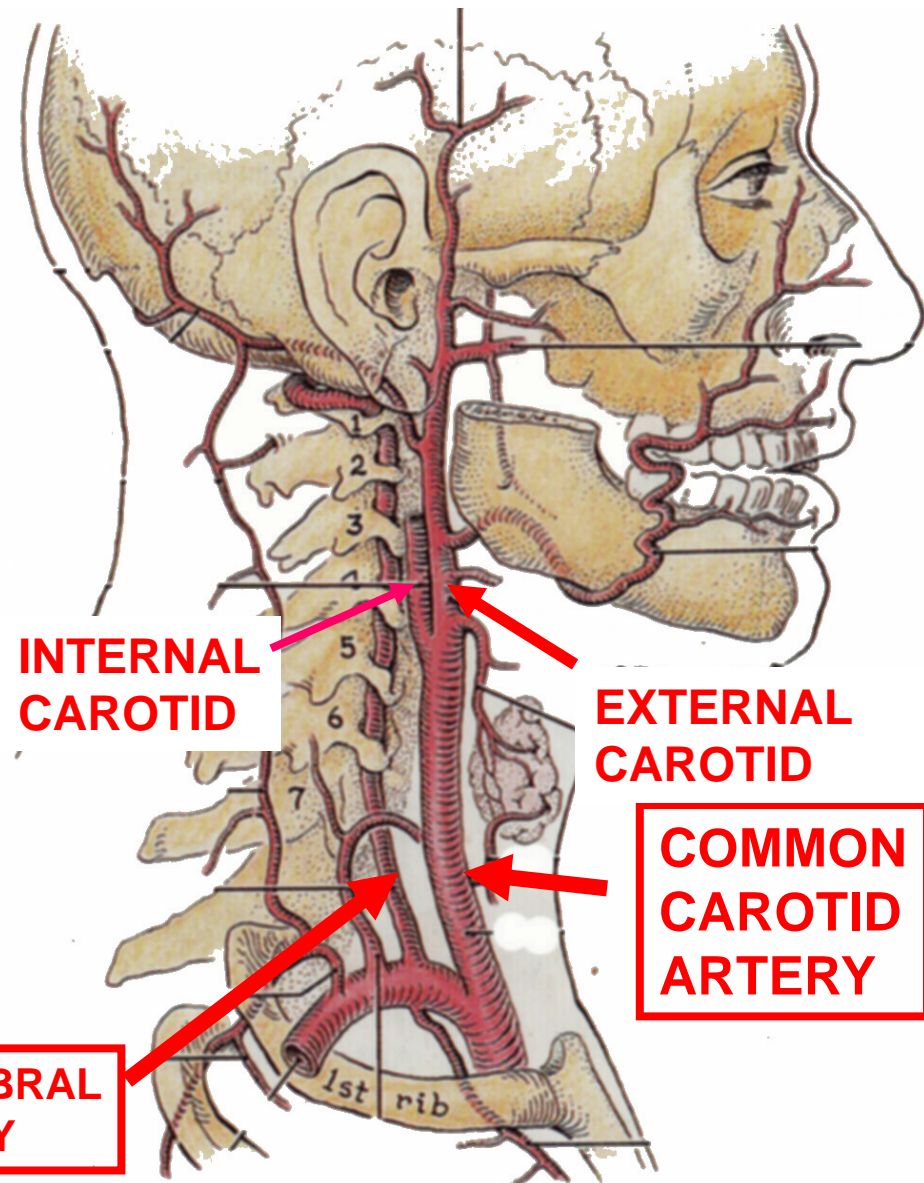
2) INTERNAL CAROTID ARTERY AND VERTEBRAL ARTERY SUPPLY BRAIN

3) EXTERNAL CAROTID ARTERY SUPPLIES FACE AND HEAD

Branches:

1. SUPERIOR THYROID
2. ASCENDING PHARYNGEAL
3. LINGUAL
4. FACIAL
5. OCCIPITAL
6. POSTERIOR AURICULAR
7. SUPERFICIAL TEMPORAL
8. MAXILLARY

Mnemonic - 'Some Anatomists Like Freaking Out Poor Medical Students'



VENOUS DRAINAGE FROM HEAD - most blood to Internal Jugular Veins

RIGHT INTERNAL JUGULAR VEIN

LEFT INTERNAL JUGULAR VEIN

COMMON CAROTID A.

RIGHT SUBCLAVIAN VEIN

RIGHT BRACHIOCEPHALIC VEIN

VEINS ARE SYMMETRICAL

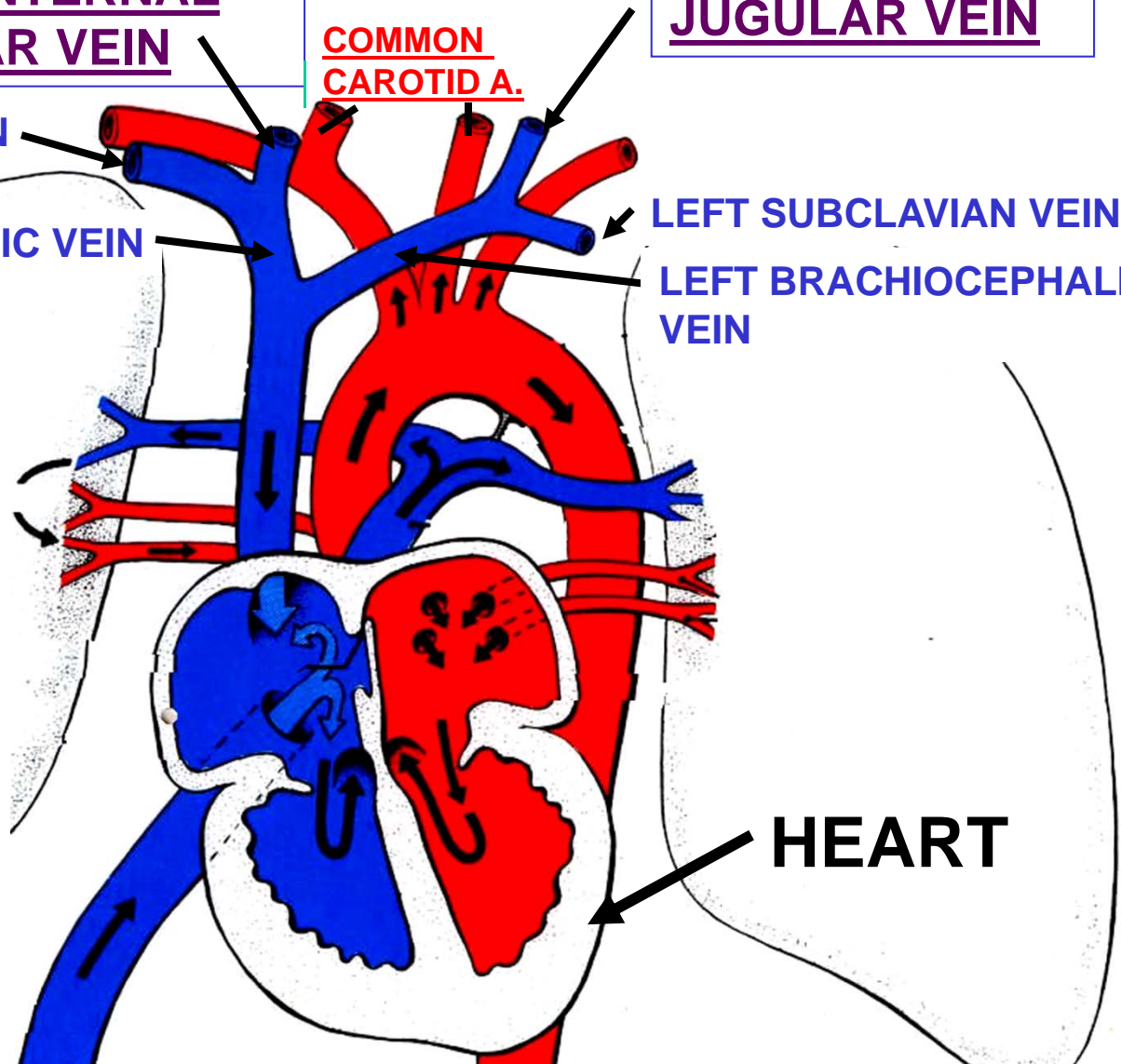
INTERNAL JUGULAR VEINS JOIN SUBCLAVIAN VEINS TO FORM BRACHIOCEPHALIC VEINS

RIGHT AND LEFT BRACHIOCEPHALIC VEINS FORM SUPERIOR VENA CAVA

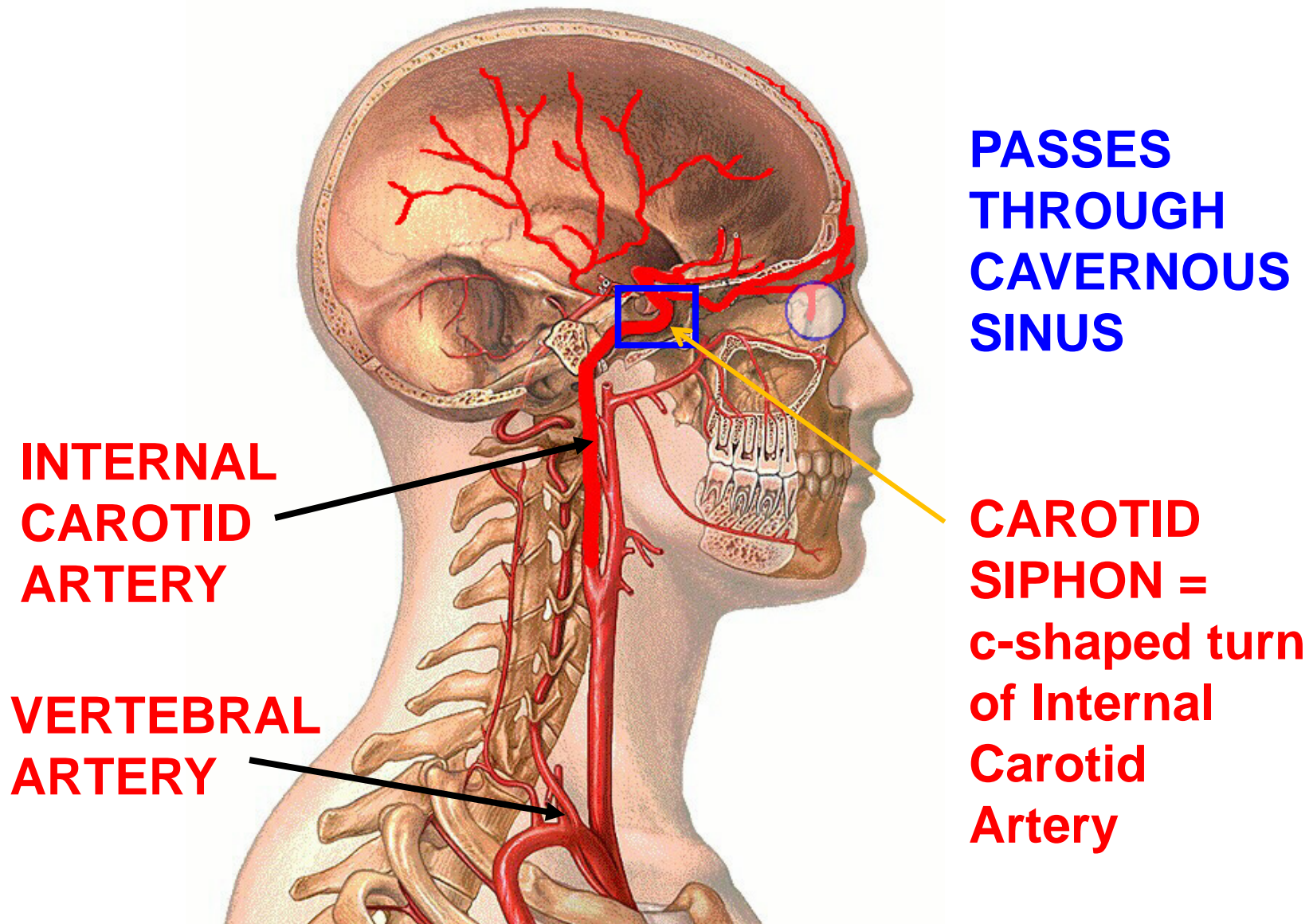
LEFT SUBCLAVIAN VEIN

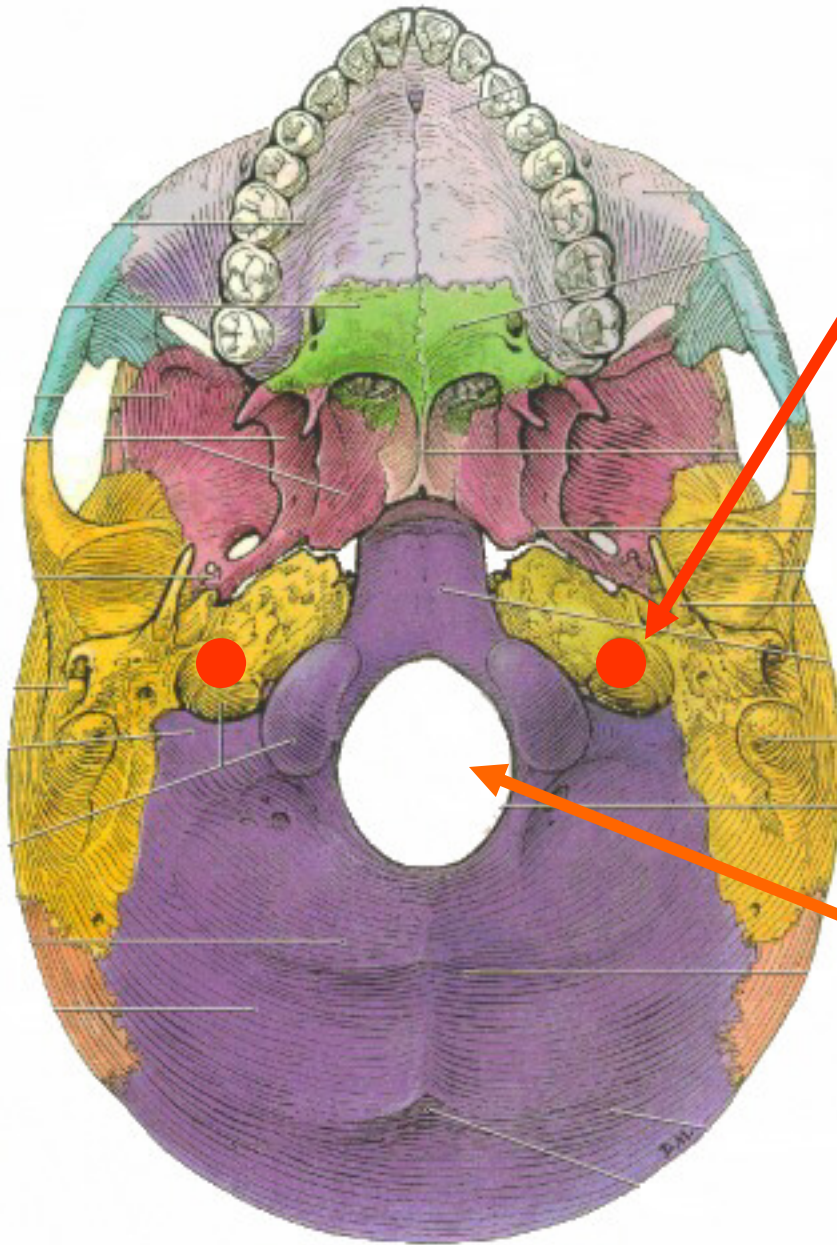
LEFT BRACHIOCEPHALIC VEIN

HEART



INTERNAL CAROTID ARTERY: ENTERS SKULL



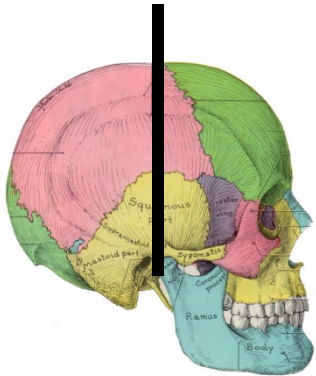


Internal Carotid Artery-
enters skull
via Carotid Canal
And Foramen
Lacerum

Vertebral Artery-
enters skull
via Foramen
Magnum

VIEW FORAMINA IN SKULL SESSION

CORONAL PLANE



ORIENT



II. MENINGES OF BRAIN

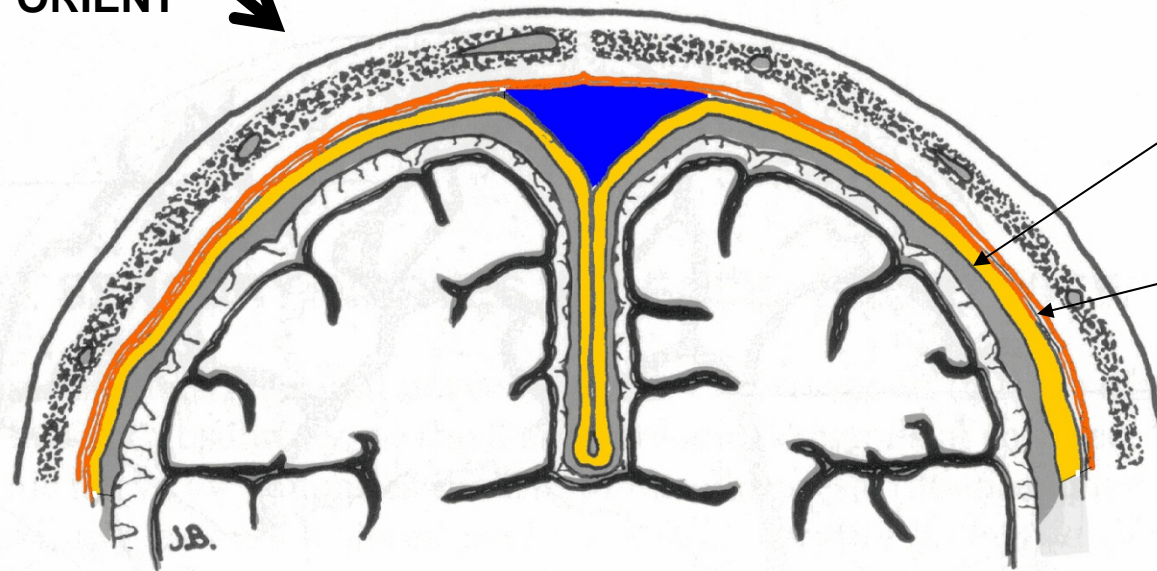
3 layers, like spinal cord; Dura Mater – tough mother; Arachnoid = spiderlike; Pia Mater = tender mother; arrangement different

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

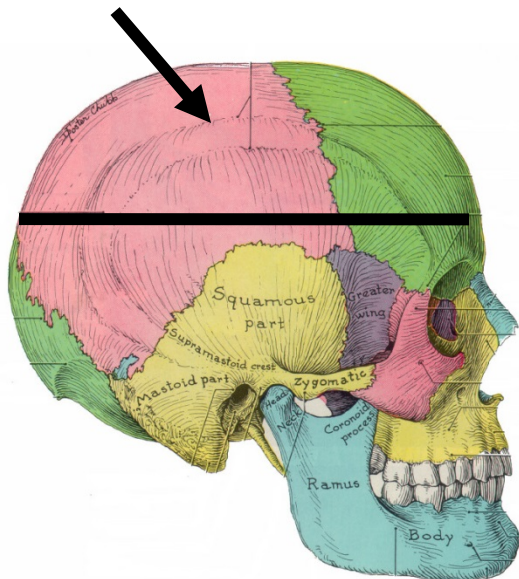
Two layers - fused in most places - separate to form DURAL REFLECTIONS



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**



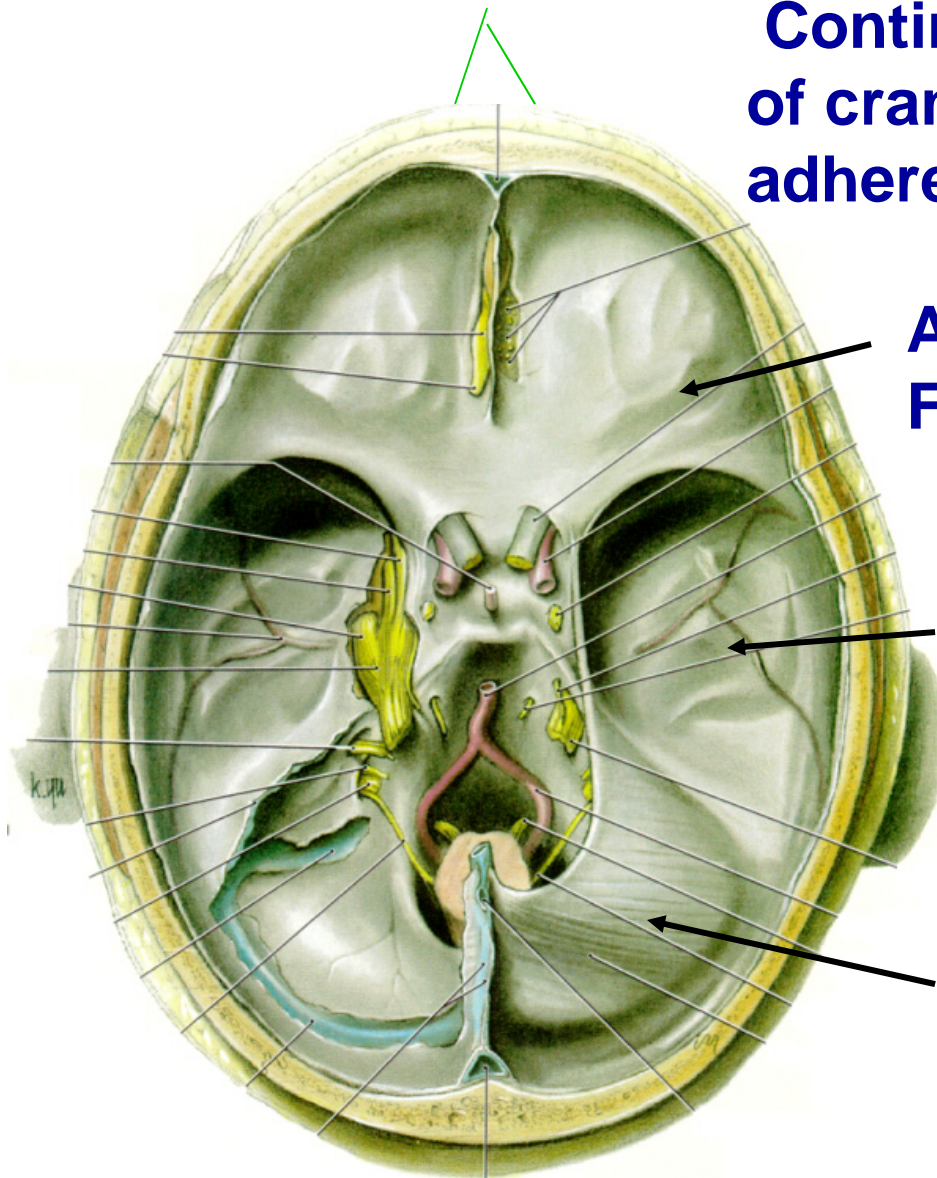
DURA is
tightly
attached to
inner side of
calvarium



**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

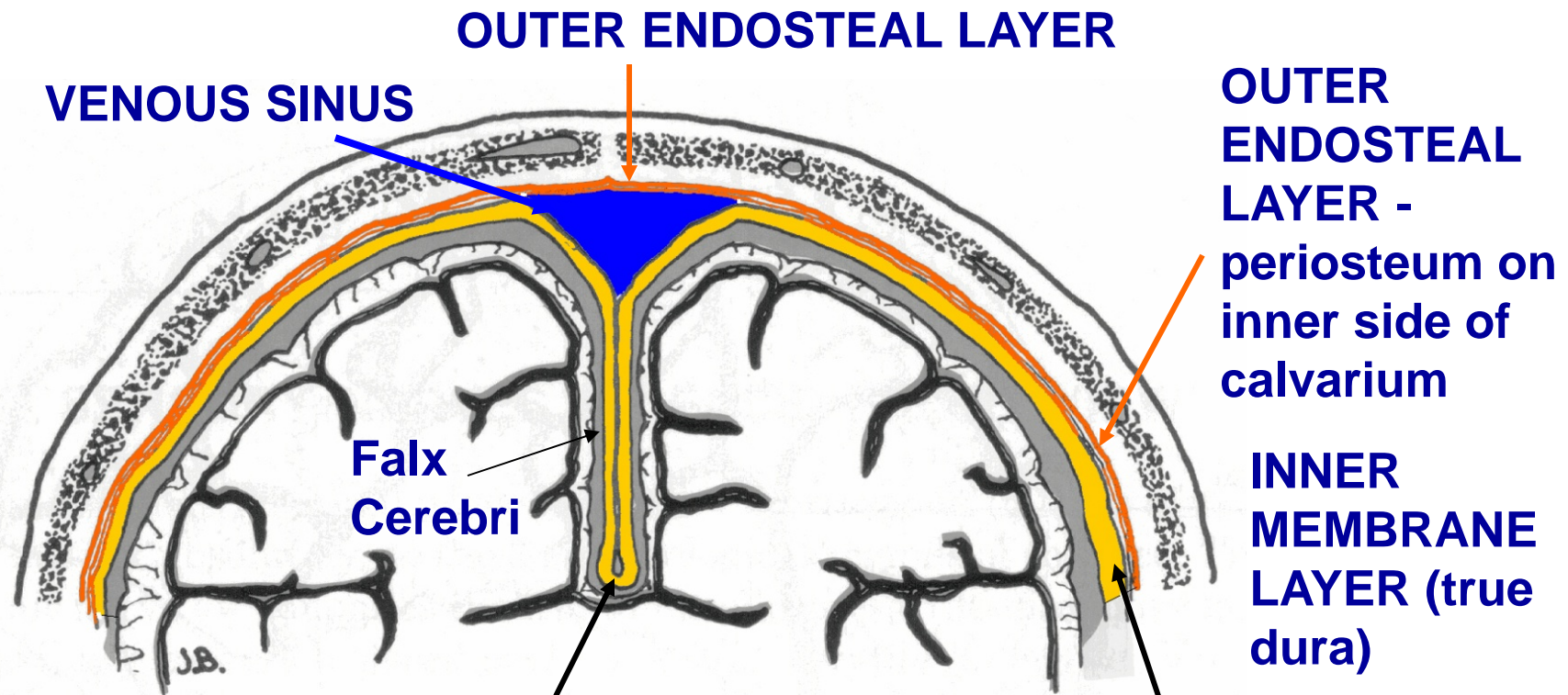
Middle Cranial Fossa

Posterior Cranial Fossa

(fossa = depression)

DURAL REFLECTIONS

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



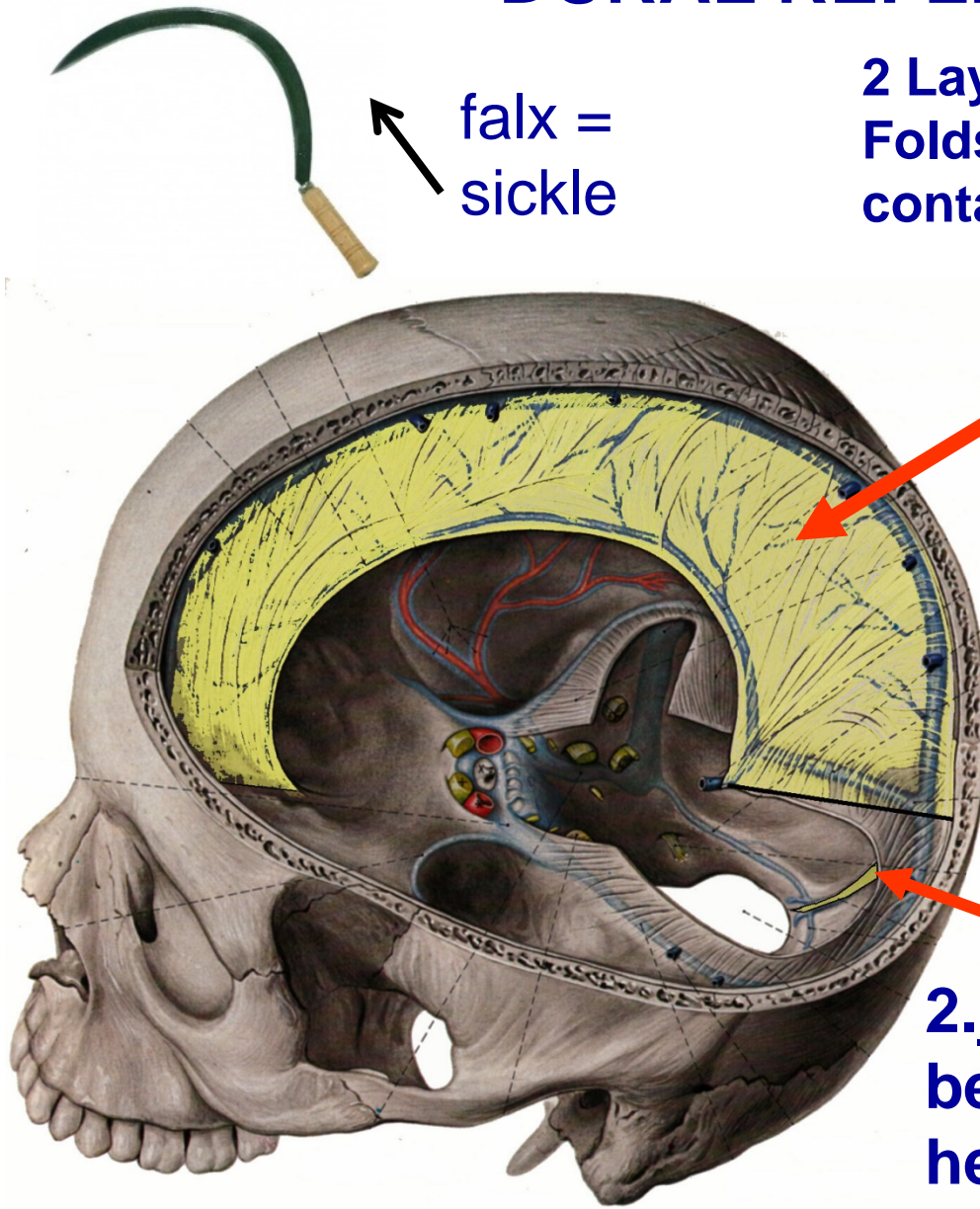
DURAL REFLECTION - TWO LAYERS OF INNER MEMBRANE LAYER (true dura)

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

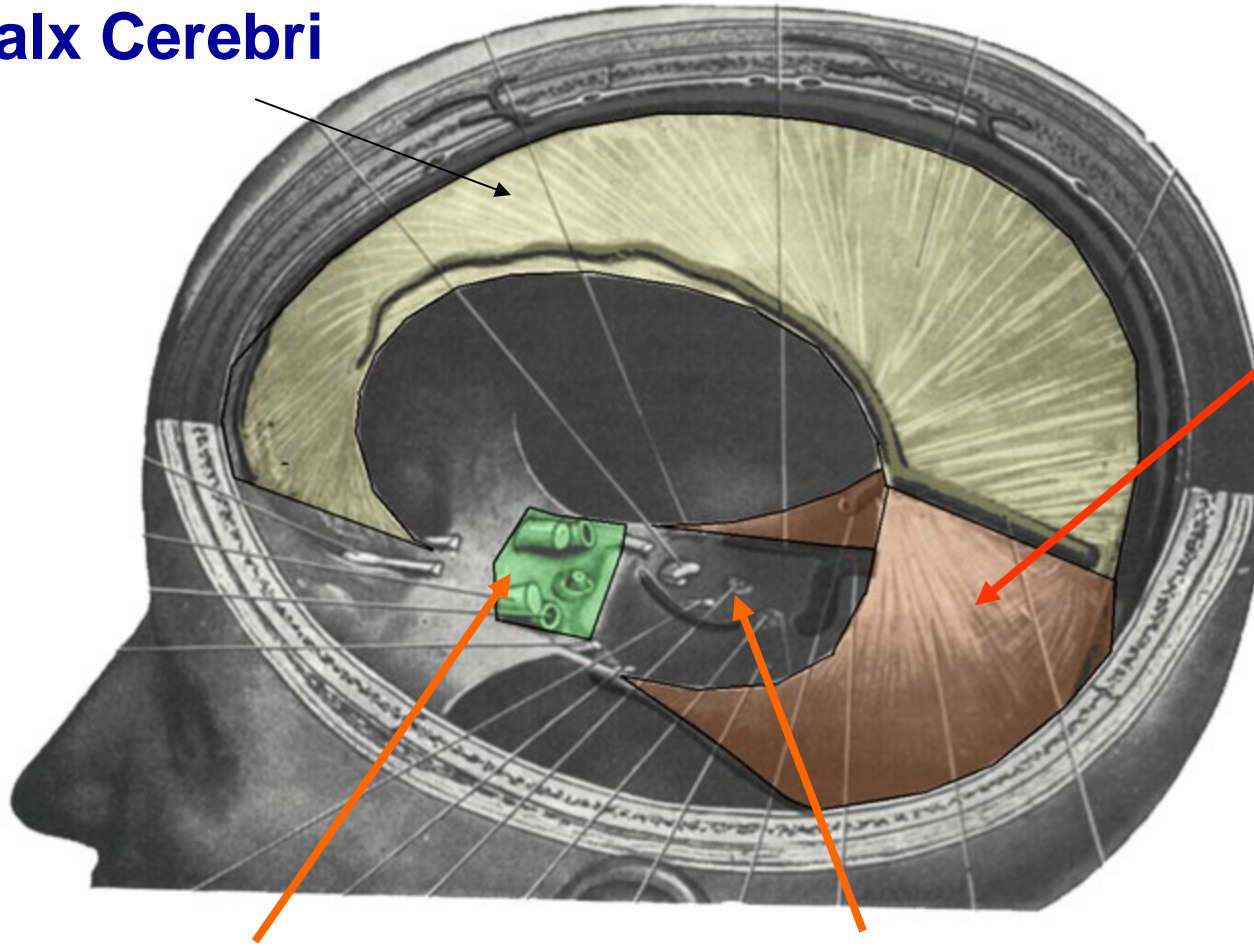


1. Falx Cerebri - sickle shaped - between cerebral hemispheres; attached ant. to crista galli of ethmoid; post. blends into tentorium cerebelli

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

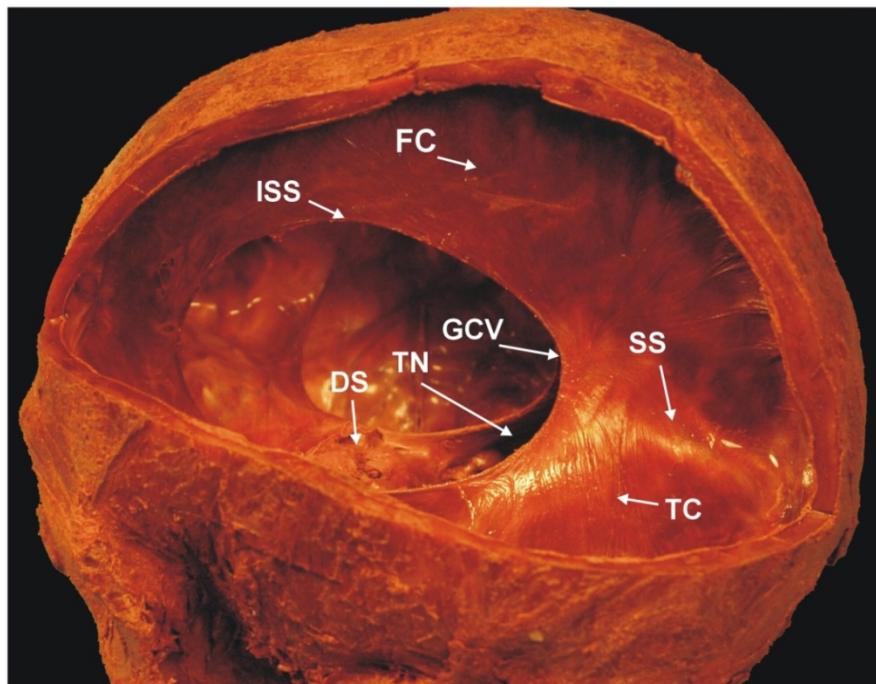
4. Diaphragma Sella – fold over sella turcica

Tentorial Notch – opening for brainstem

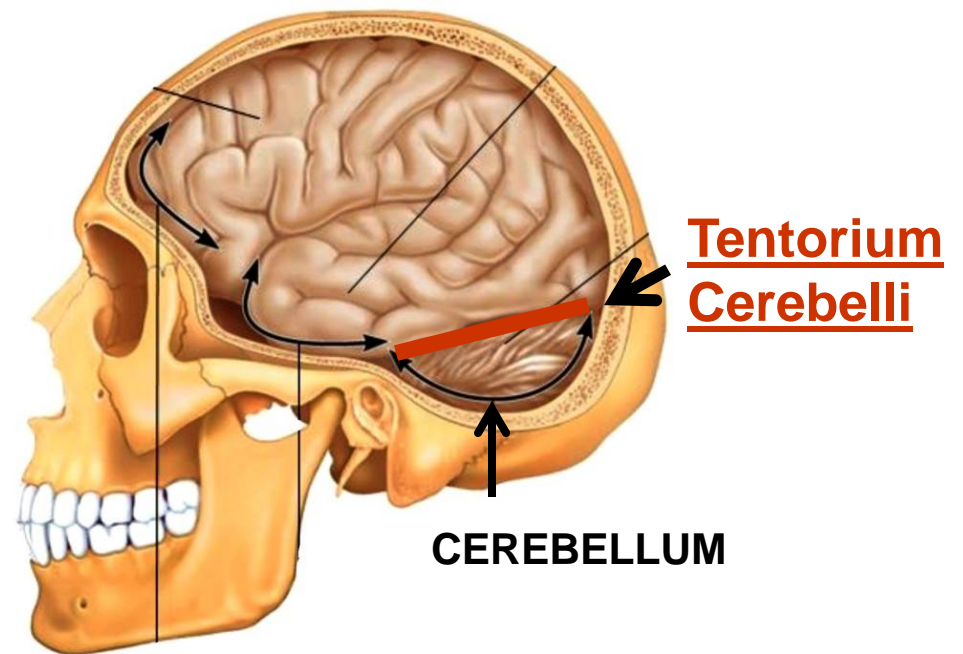
LOOK AT PROSECTION 279 – 'RED HEAD'

279

DURAL REFLECTIONS AND VENOUS SINUS



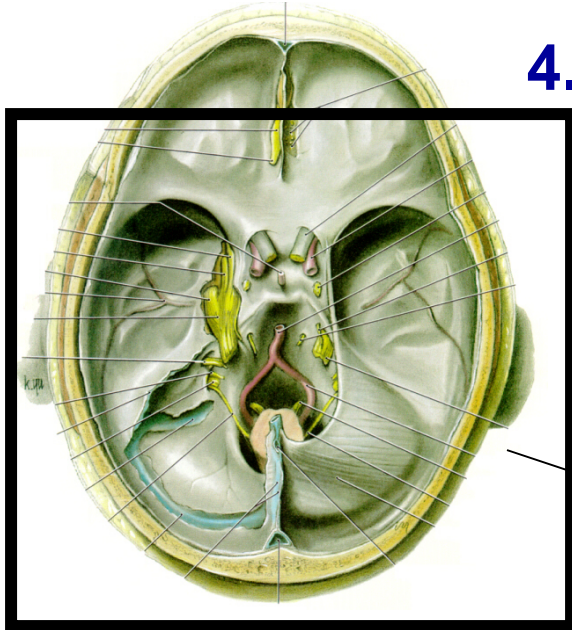
FC - FALX CEREBRI
TC - TENTORIUM CEREBELLI
ISS - LOCATION OF INFERIOR SAGITTAL SINUS
SS - LOCATION OF STRAIGHT SINUS
GCV - OPENING OF GREAT CEREBRAL VEIN OF GALEN
DS - DIAPHRAGMA SELLA
TN - TENTORIAL NOTCH



Tentorium Cerebelli =
roof over Cerebellum

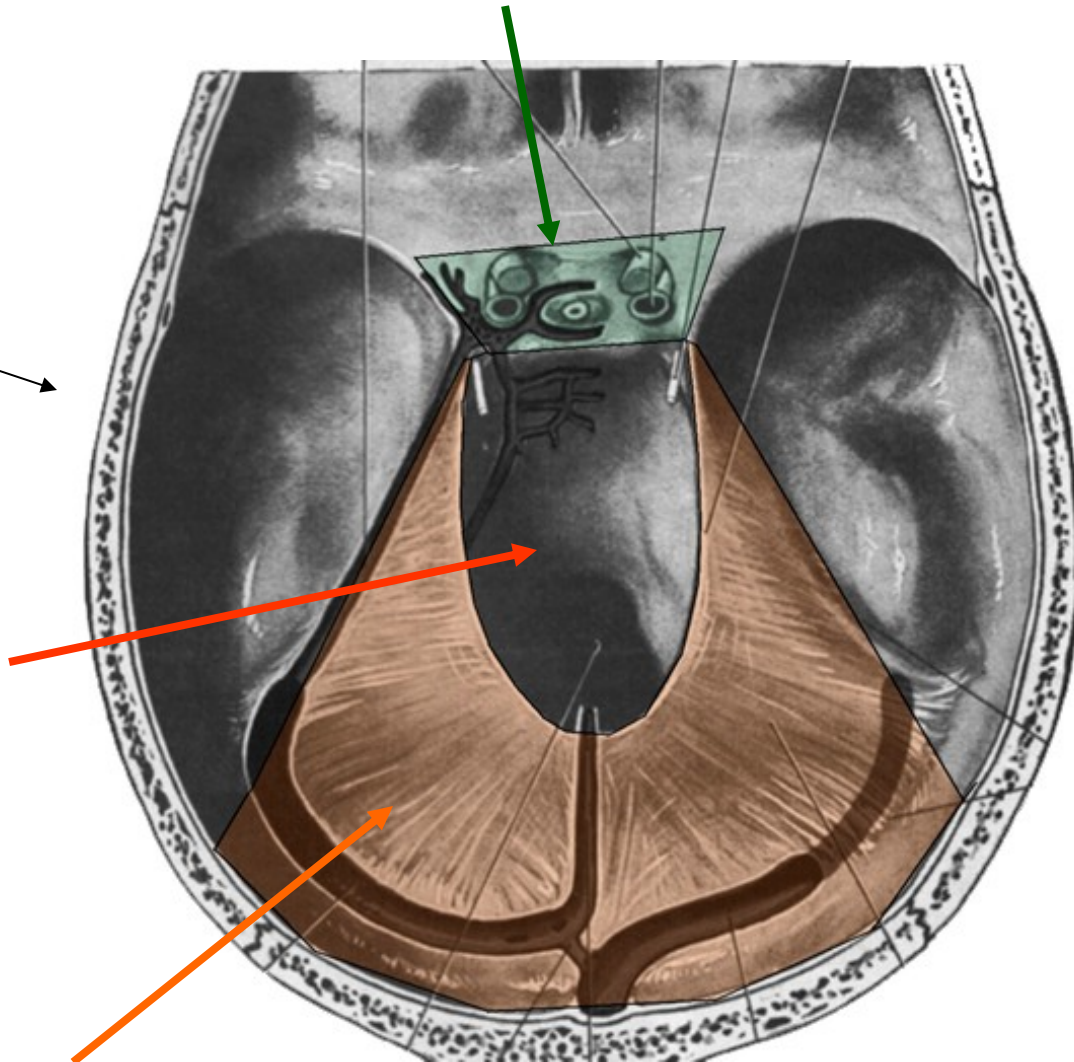
DURAL REFLECTIONS

4. Diaphragma Sella – over sella turcica



view inside cranial cavity

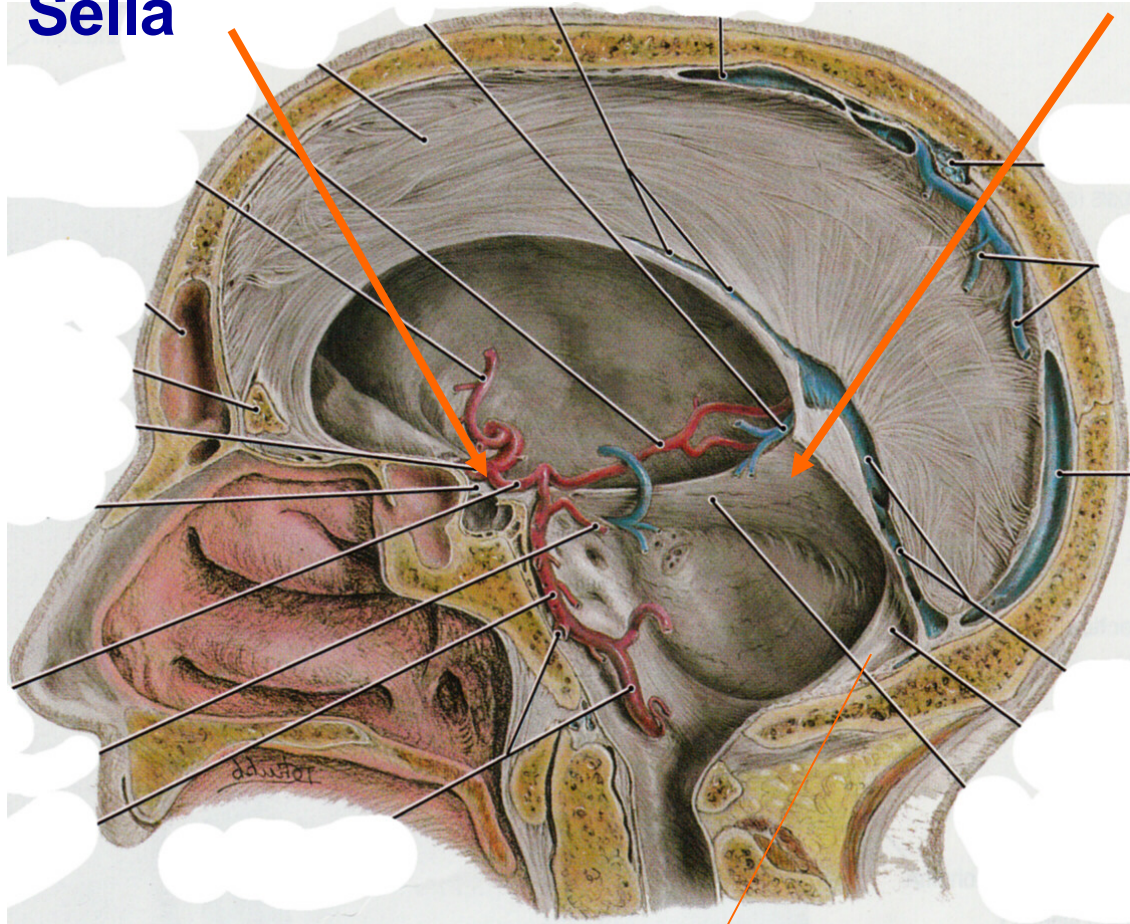
**Tentorial Notch –
opening for
brainstem**



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

DURAL REFLECTIONS

**Diaphragma
Sella**



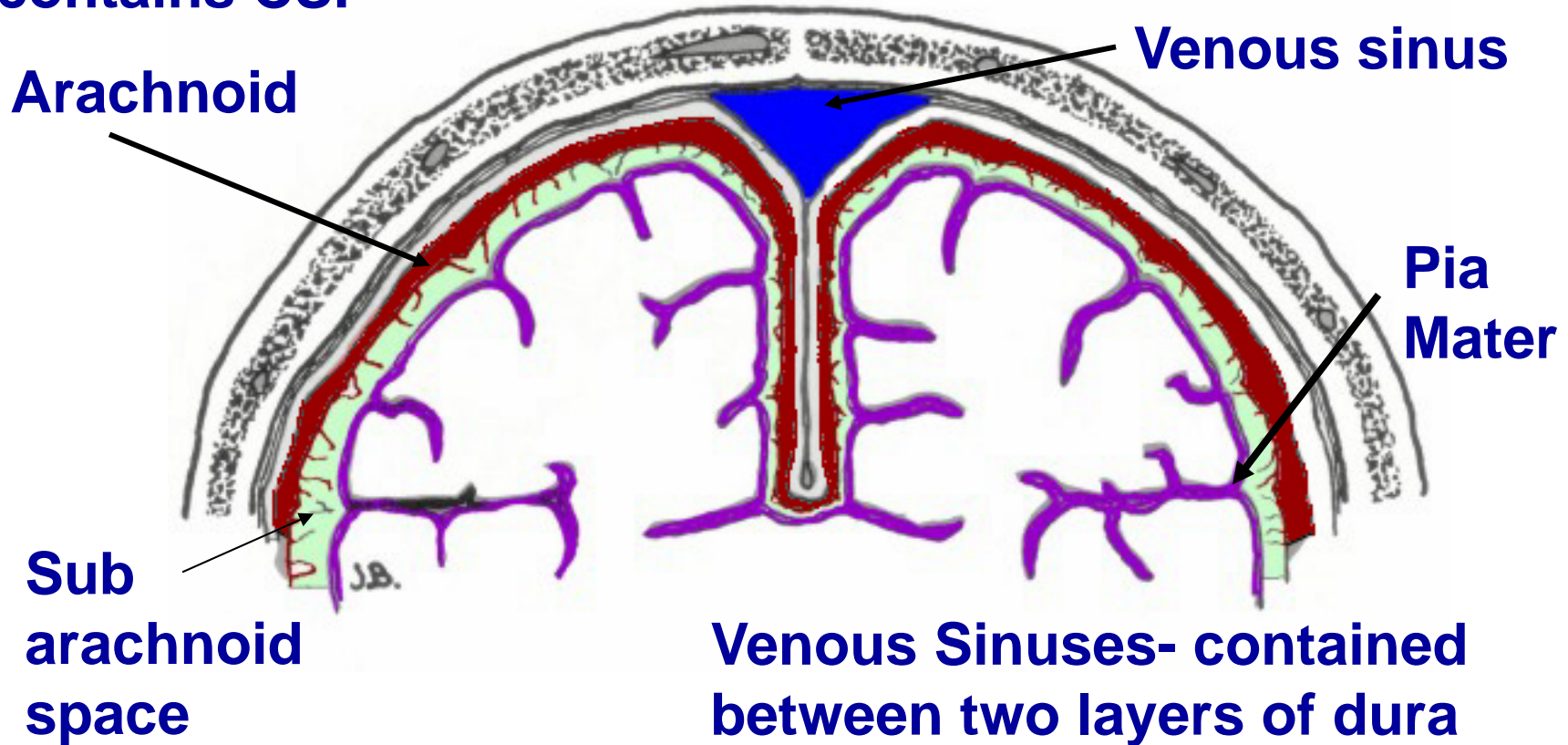
Falx Cerebelli

**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

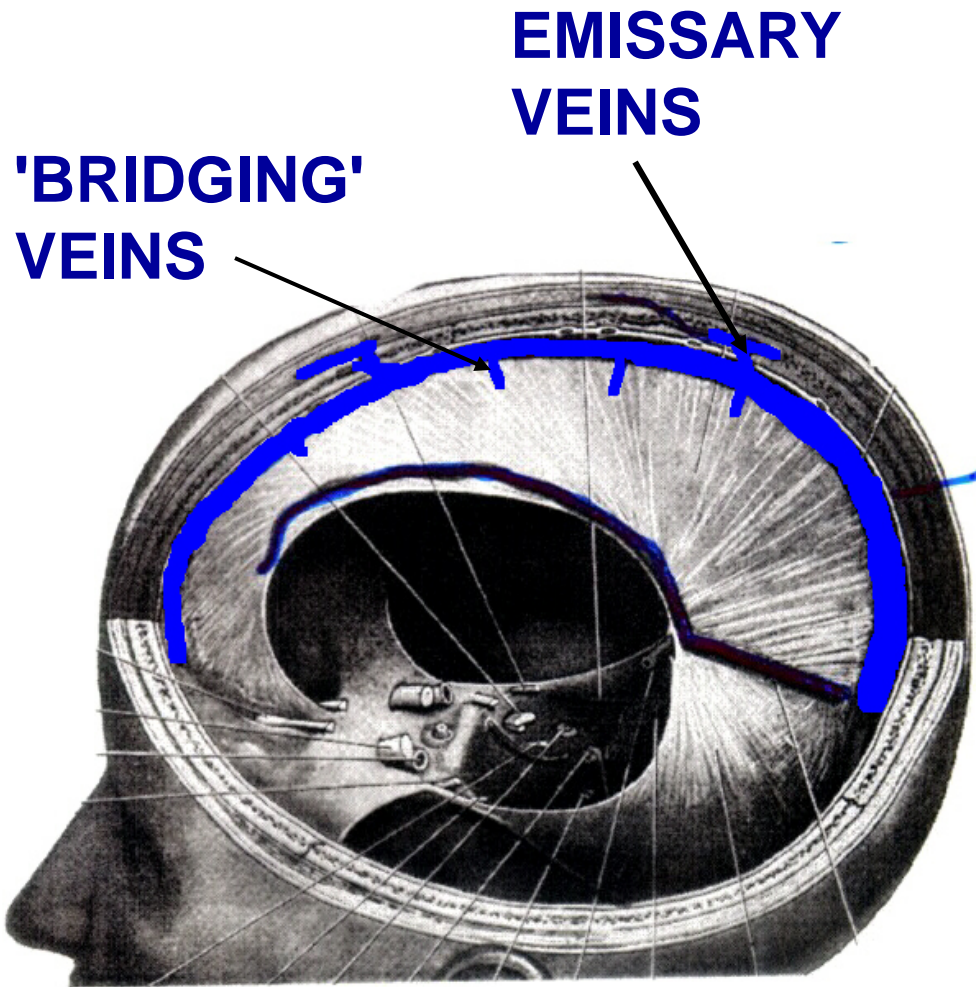
MENINGES OF BRAIN

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

Receive blood from brain, orbit, emissary veins



Brain removed

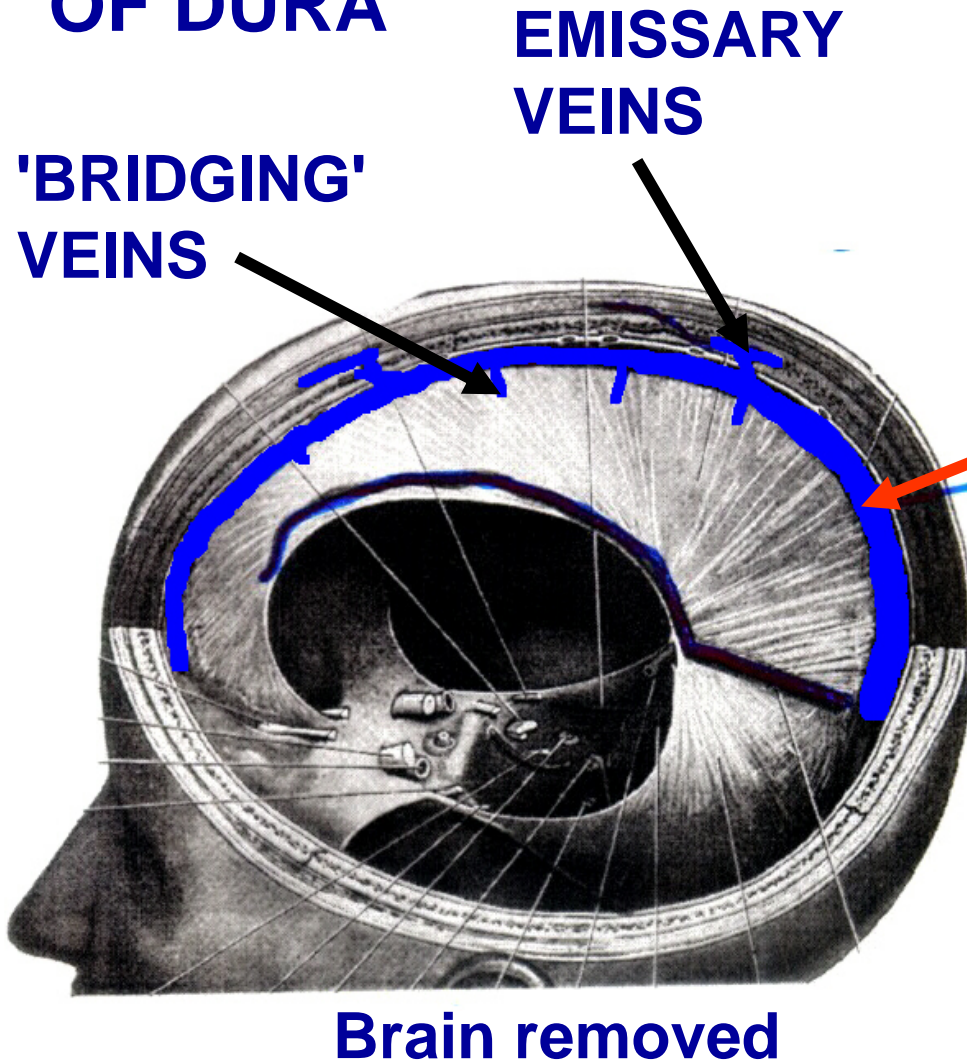
1. VEINS from brain (inside) -
a. 'BRIDGING' VEINS - inside cranial cavity - drain blood from surface of brain

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



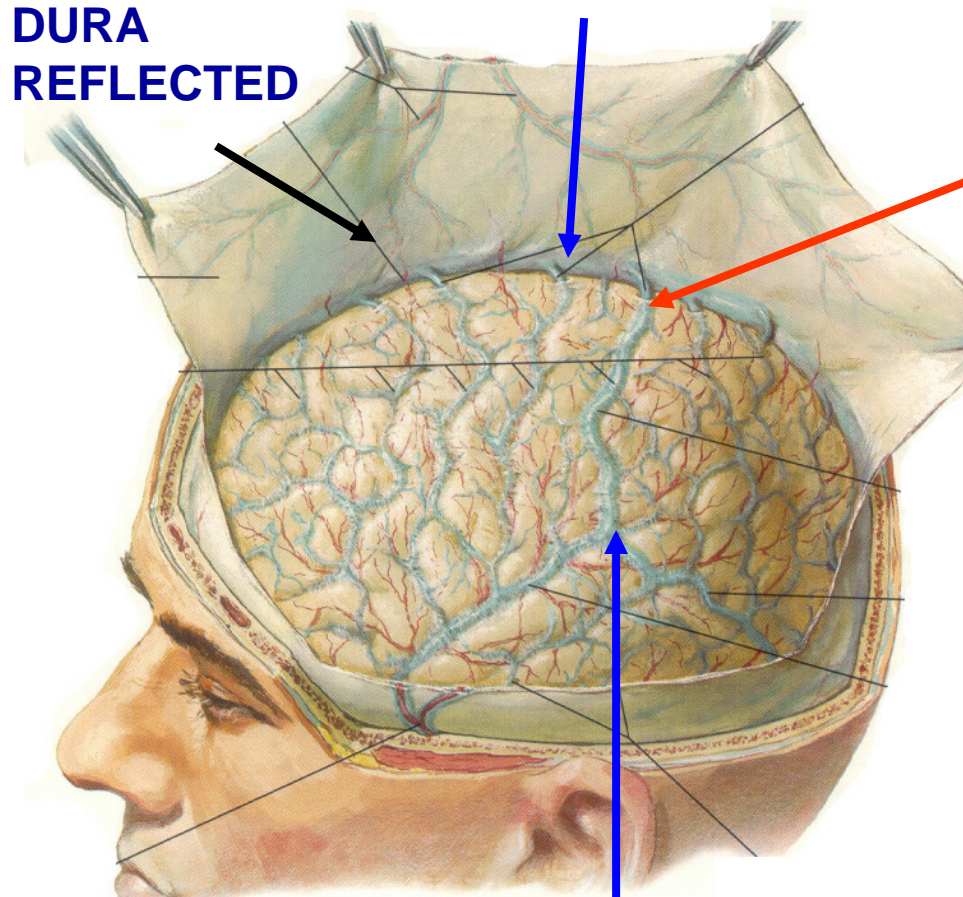
Receive blood from brain, orbit, emissary veins

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

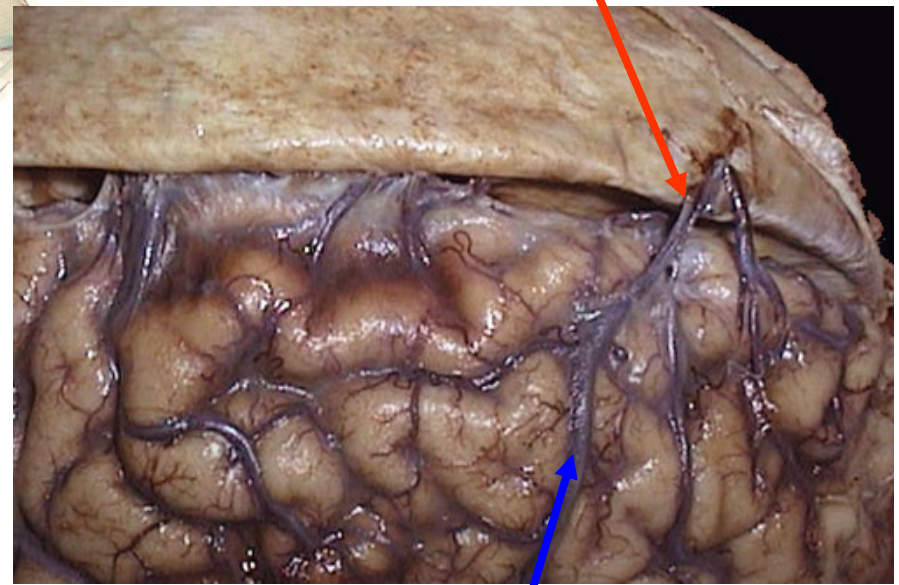
SUPERIOR SAGITTAL SINUS receives blood from Superior Cerebral veins through 'BRIDGING' VEINS

Superior Sagittal Sinus



Superior Cerebral veins

'BRIDGING' VEINS



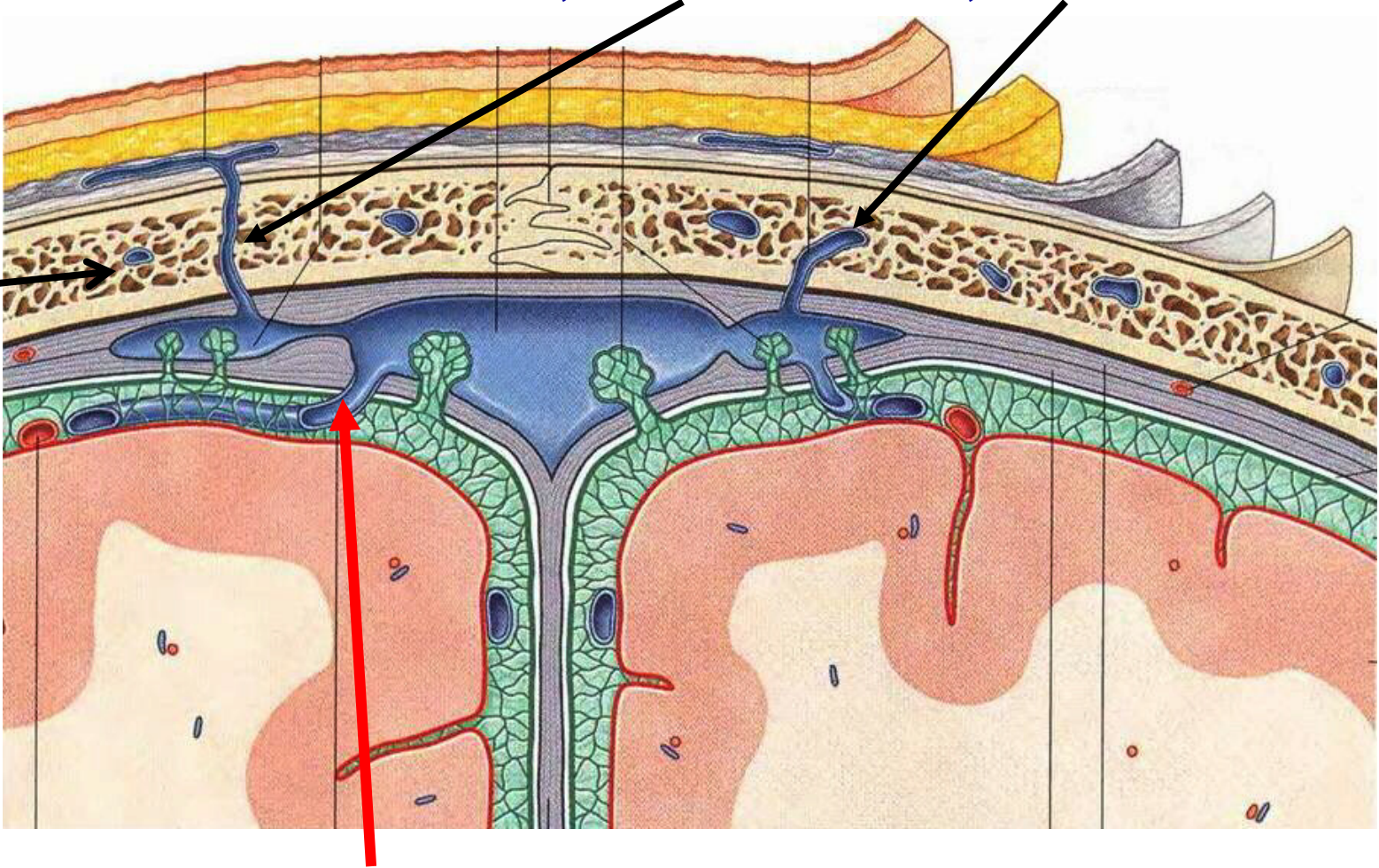
Superior Cerebral veins

Photo from lecture of Dr. Nancy Norton

EMISSARY VEINS VS BRIDGING VEINS

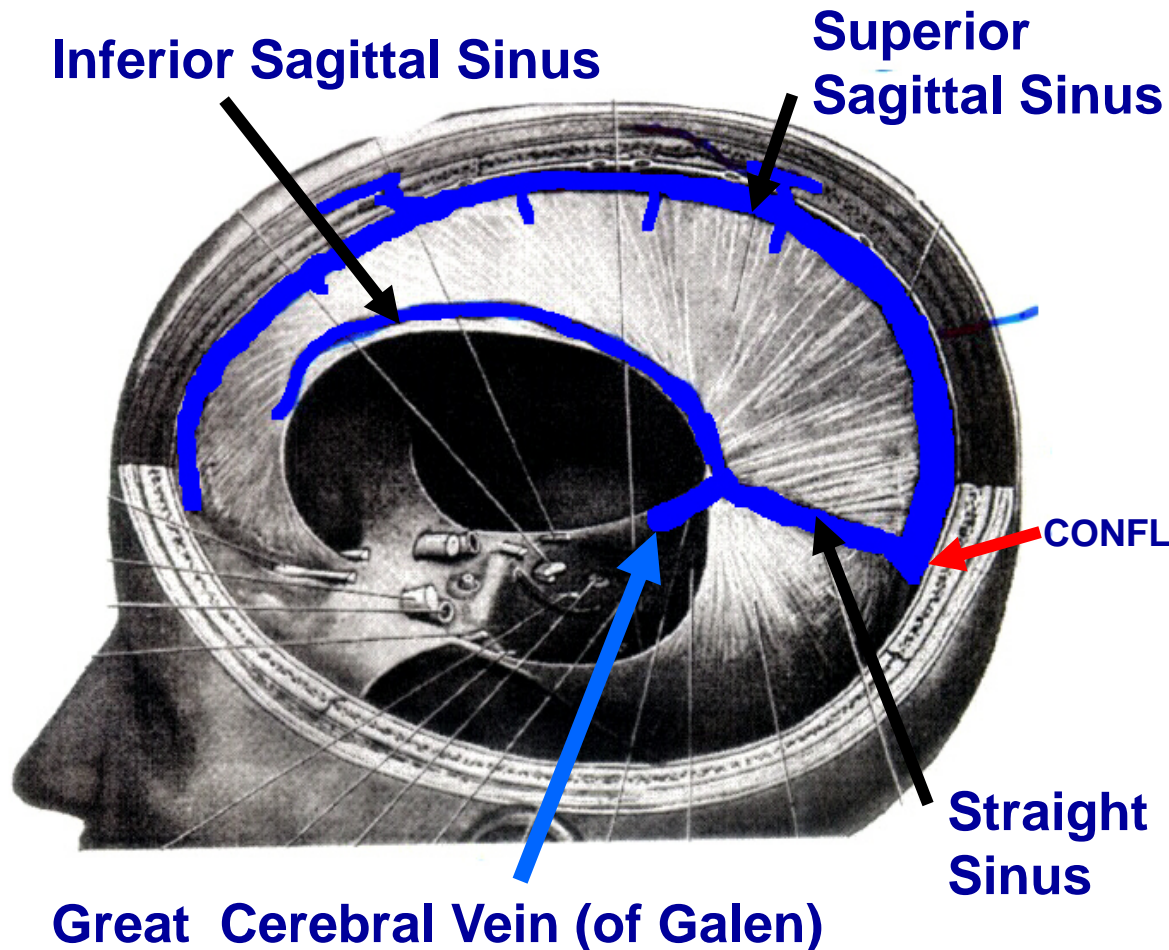
EMISSARY VEIN - SCALP TO SINUS, SCALP TO DIPLOE, DIPLOE TO SINUS

DIPLOIC VEIN



BRIDGING VEIN - CEREBRAL VEIN (BRAIN) TO SINUS

VENOUS SINUSES



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

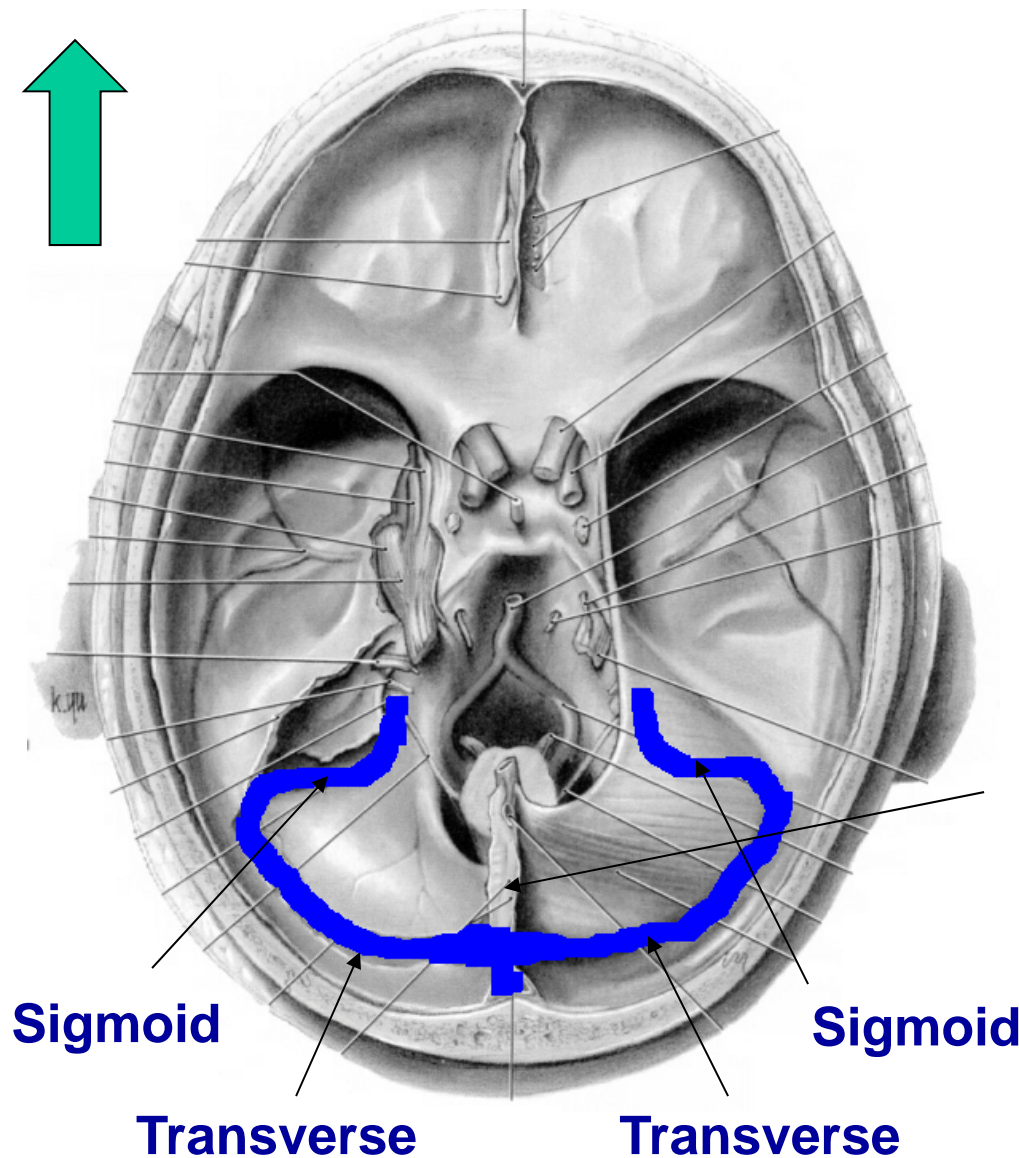
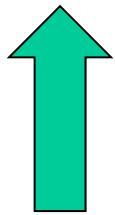
3. Straight sinus - at junction of falx cerebri and tentorium

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

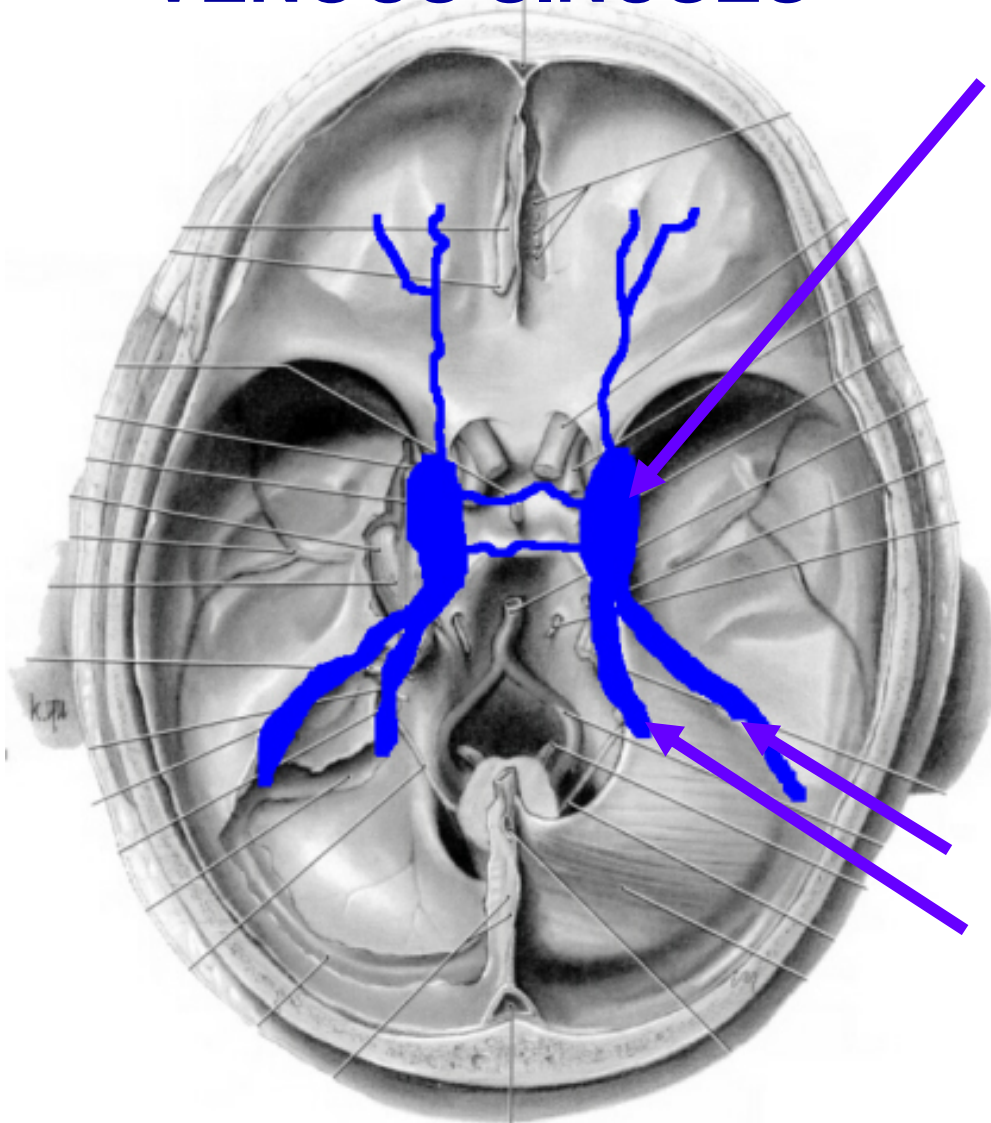


4. Transverse sinuses - in lateral fixed part of tentorium; receives blood from Sup. Sagittal or Confluens

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

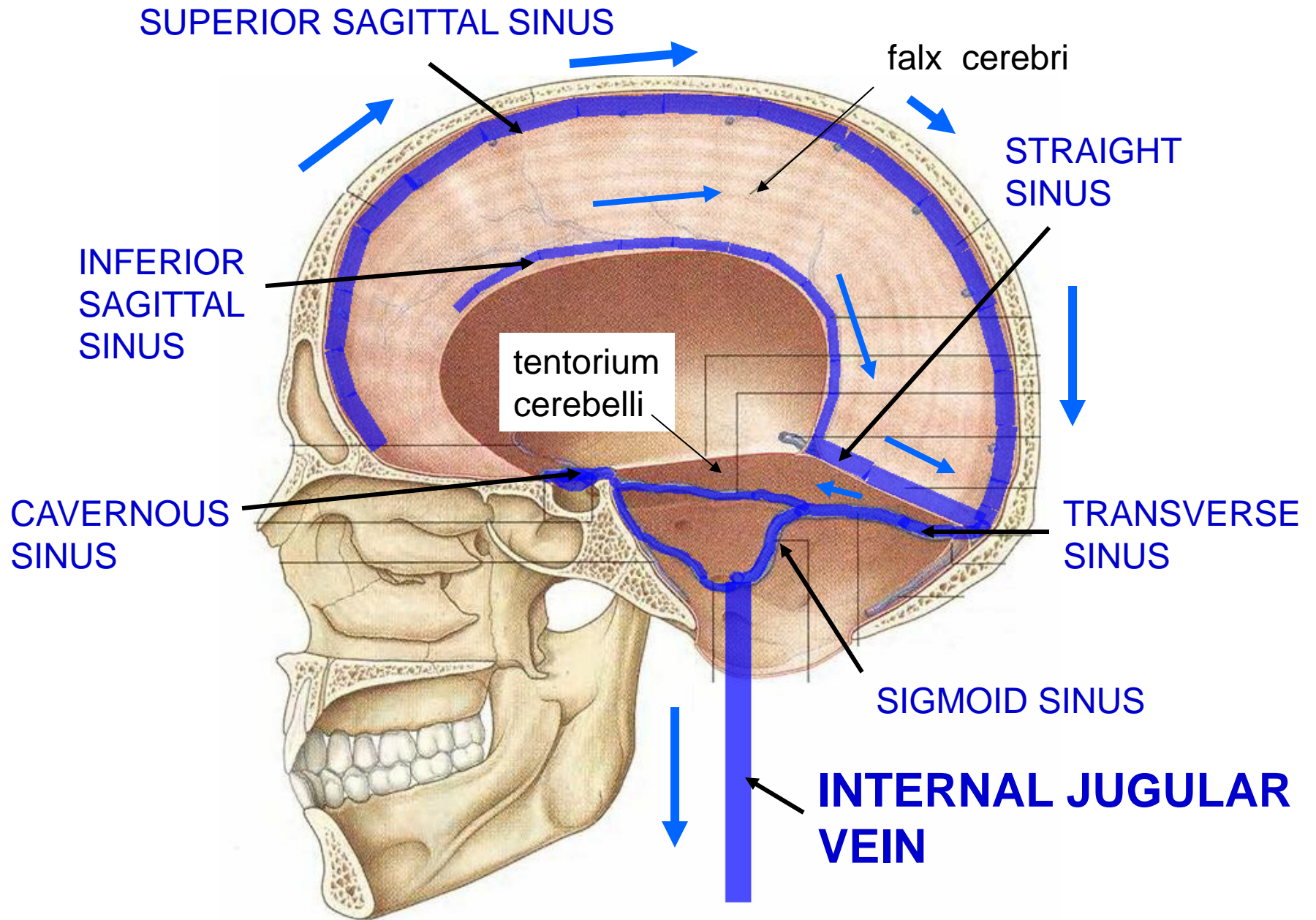


7. Cavernous sinuses - in middle cranial fossa; on side of the body of the sphenoid bone; connected by Intercavernous sinus; receive blood from Sup. and Inf. Ophthalmic veins, Cerebral veins; drain to Sup. and Inf. Petrosal sinuses

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



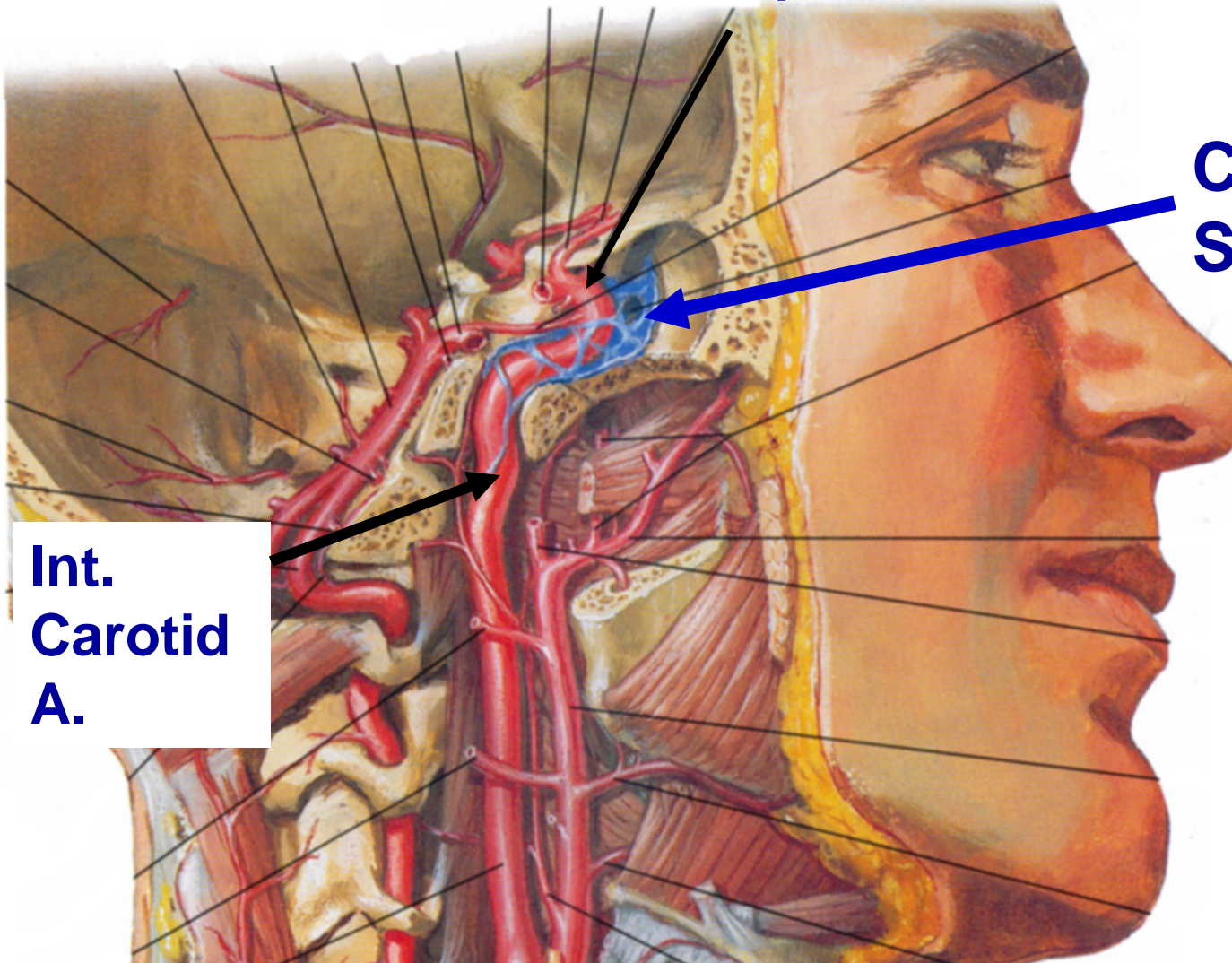
Internal Carotid Artery – Passes Through Wall of Cavernous Sinus **

Carotid Siphon

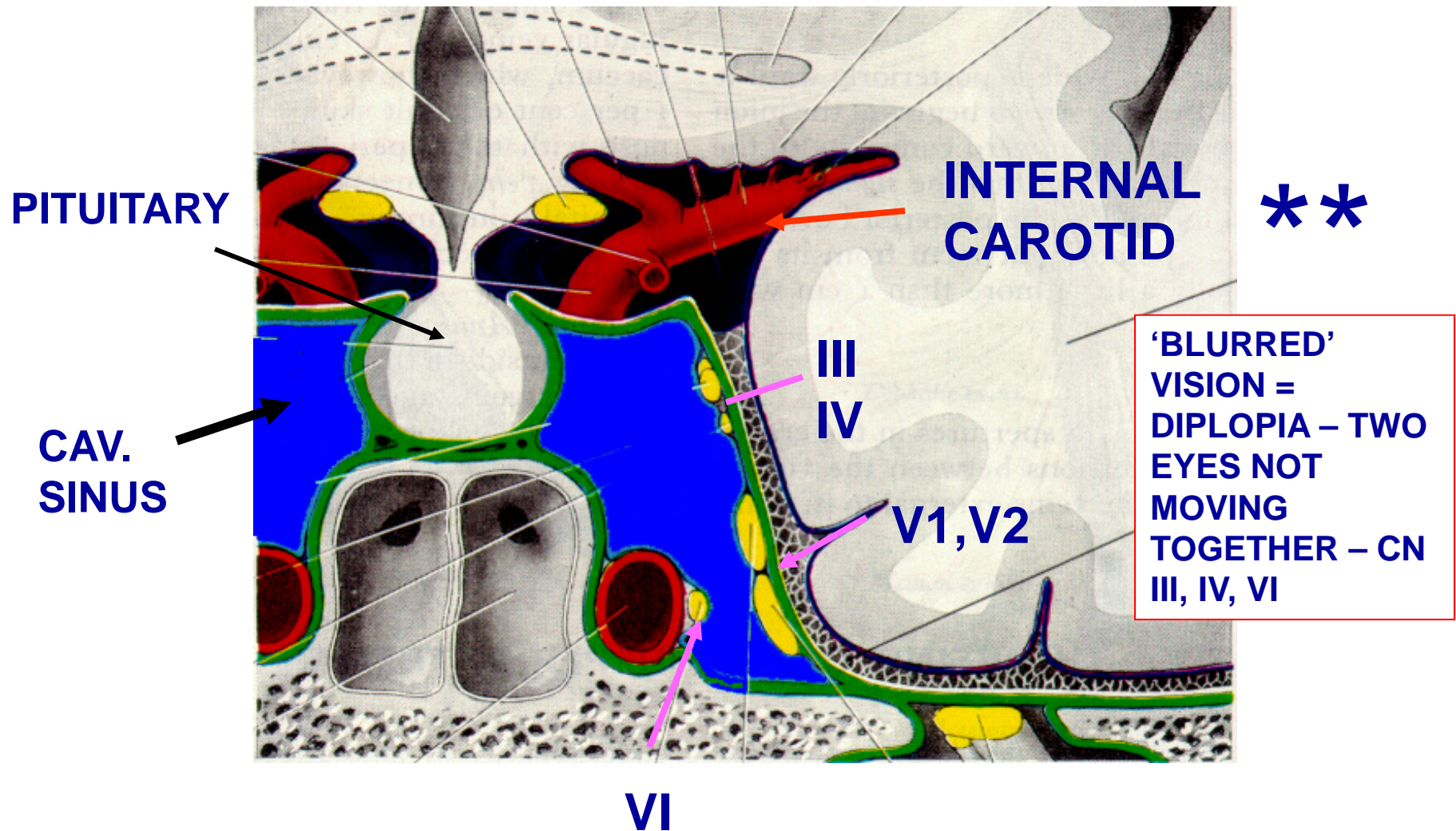
Cavernous Sinus **

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

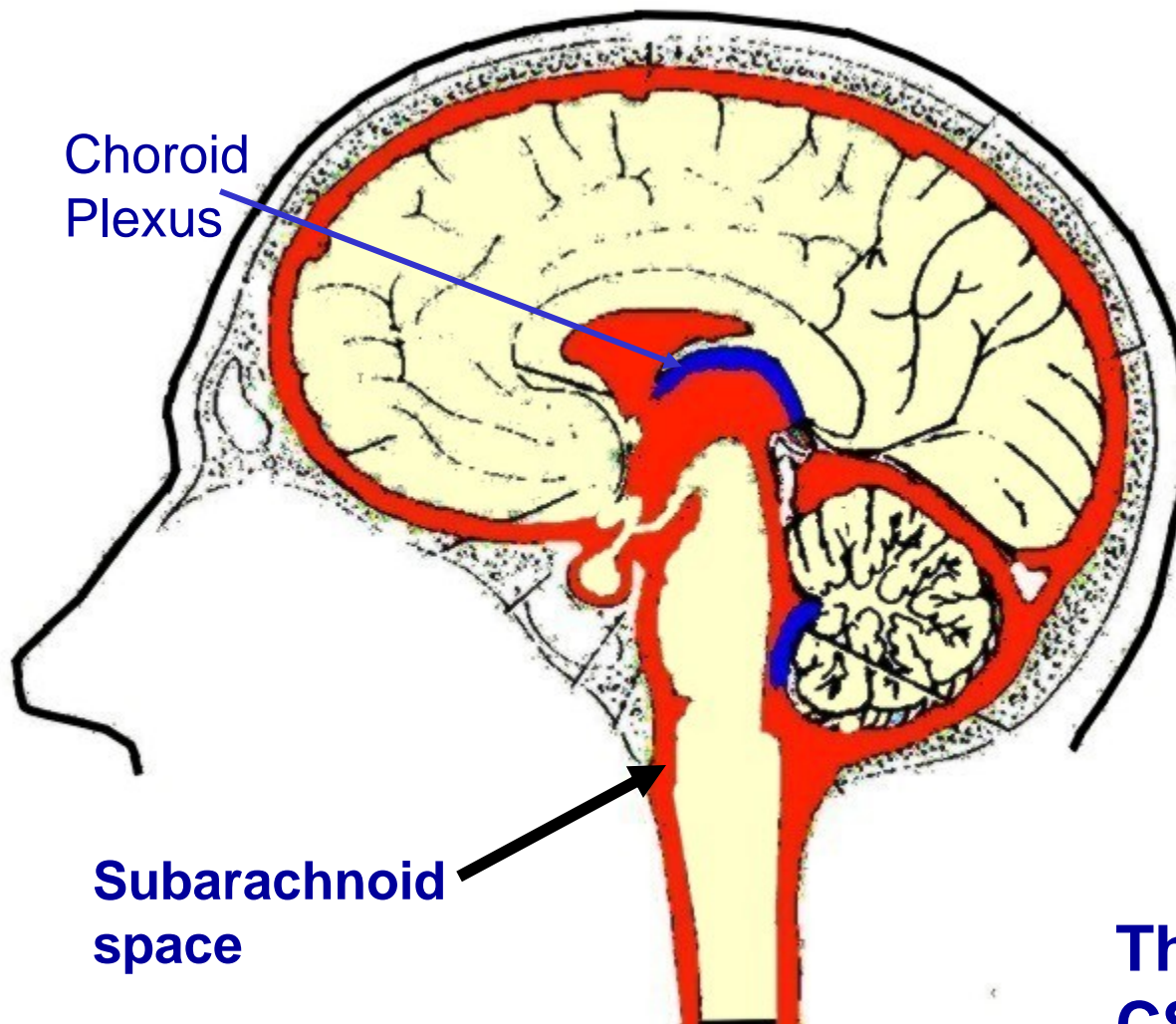
Int.
Carotid
A.



**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**



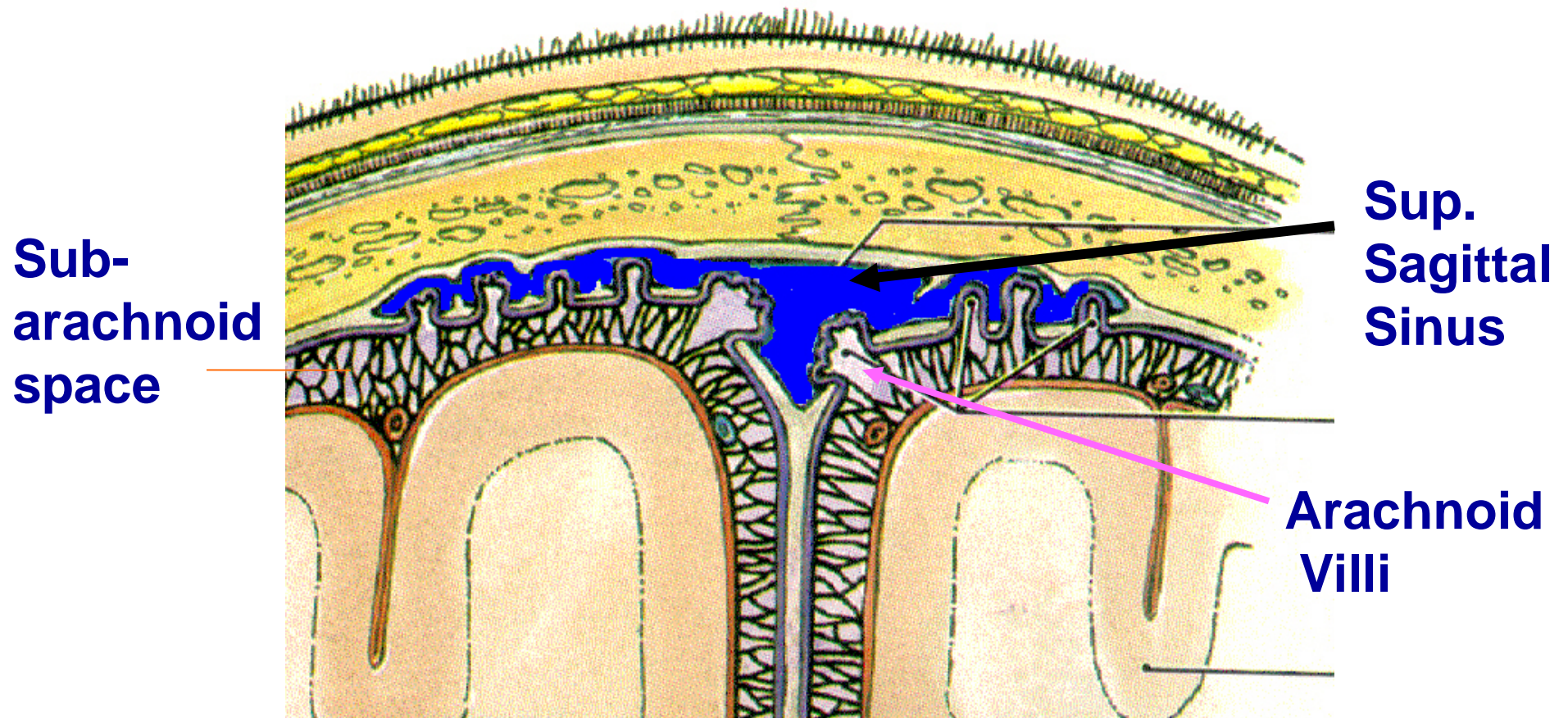
IV. CEREBRO-SPINAL FLUID (CSF)



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

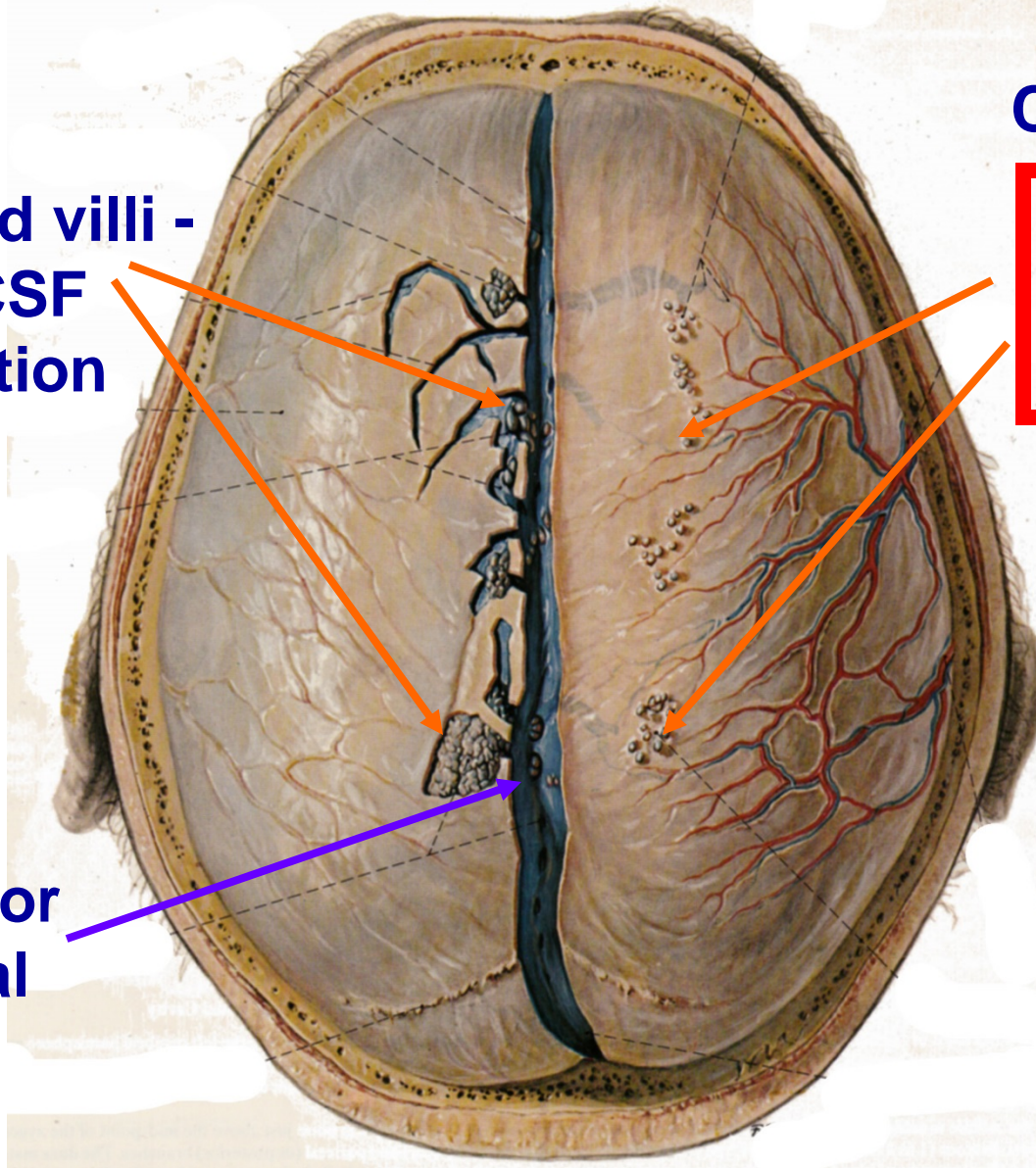


**CSF reabsorbs into venous sinuses at Arachnoid Villi; -
In elderly arachnoid villi can become calcified- Arachnoid
Granulations; Reduced Re-Absorption can produce
Communicating Hydrocephalus ****

CSF REABSORBED INTO VENOUS SINUSES

Arachnoid villi -
sites of CSF
reabsorption

Superior
Sagittal
Sinus



CLINICAL **

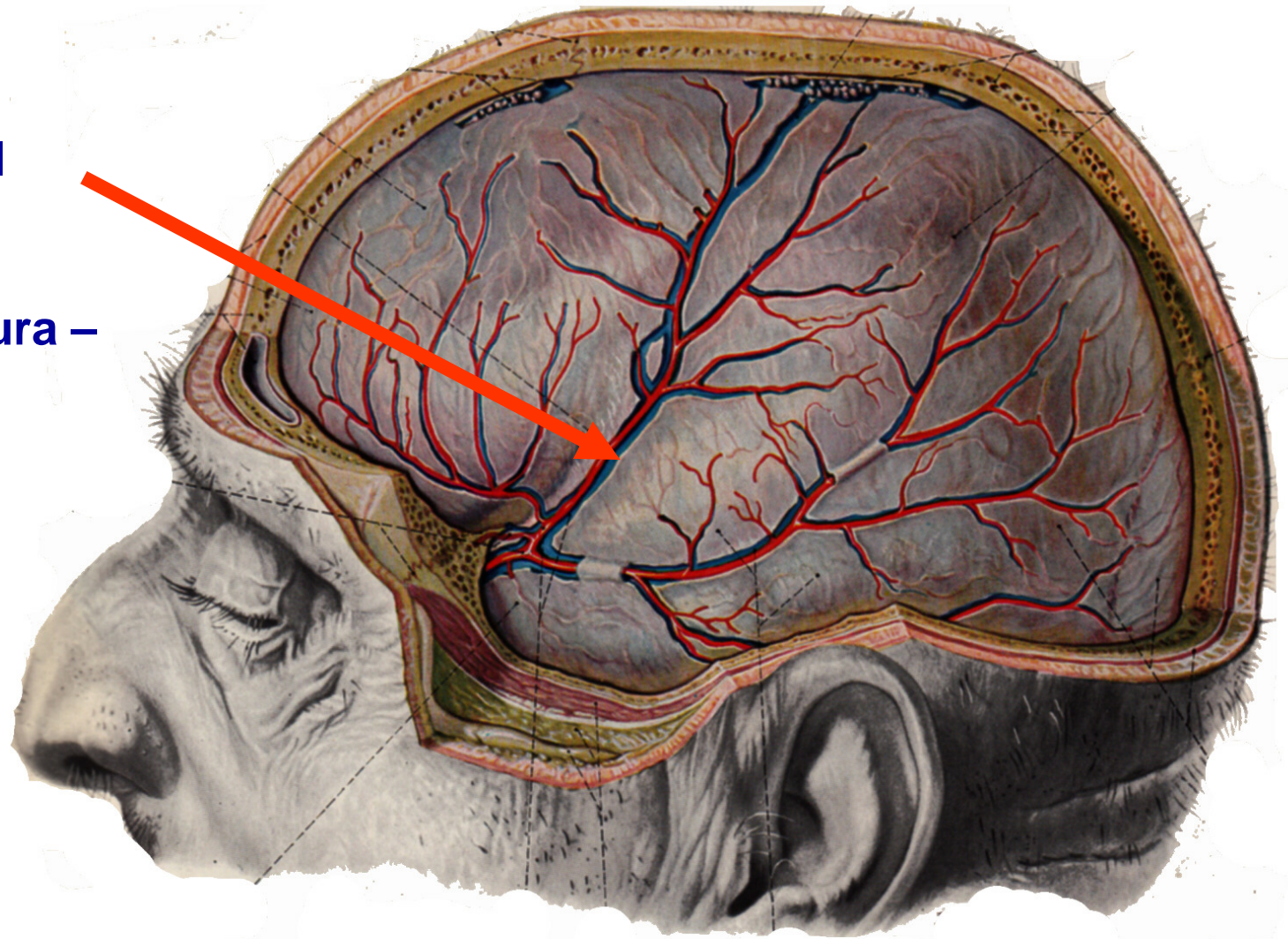
Arachnoid villi -
sites of CSF
reabsorption

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

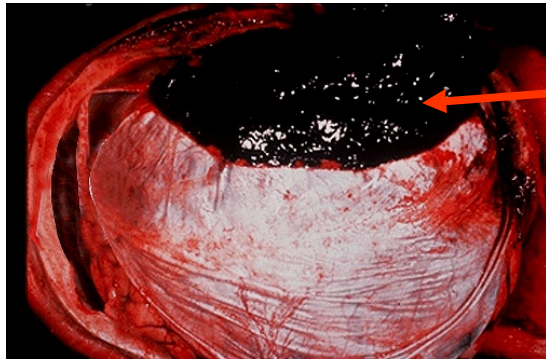
V. HEMATOMAS - INTERNAL BLEEDS

Middle
Meningeal
Artery –
courses
outside dura –
supplies
calvarium

HEMATOMA
= abnormal
mass of
blood outside
blood vessel



A. EPIDURAL HEMATOMA - bleeding between dura
and bone



EPIDURAL HEMATOMA

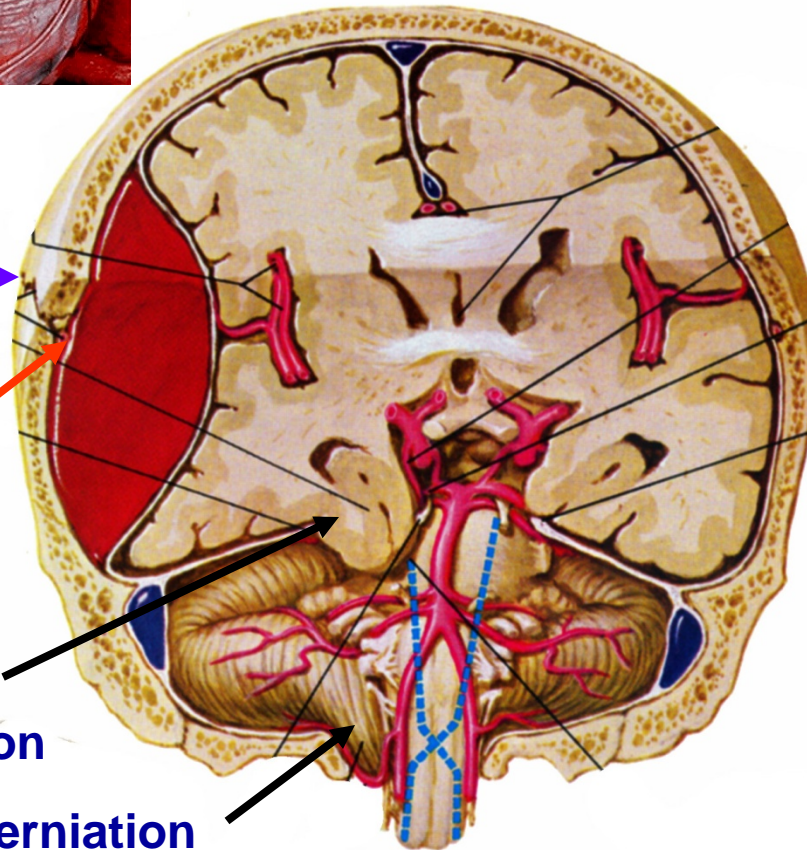
- 1) Skull fracture near Pterion
- 2) Tear Middle Meningeal Artery
- 3) Blood 'peels' dura from bone
- 4) Lens shaped (biconvex) mass on CT

Skull Fracture Near Pterion

Tear Middle Meningeal Artery

Uncal herniation

Tonsillar herniation



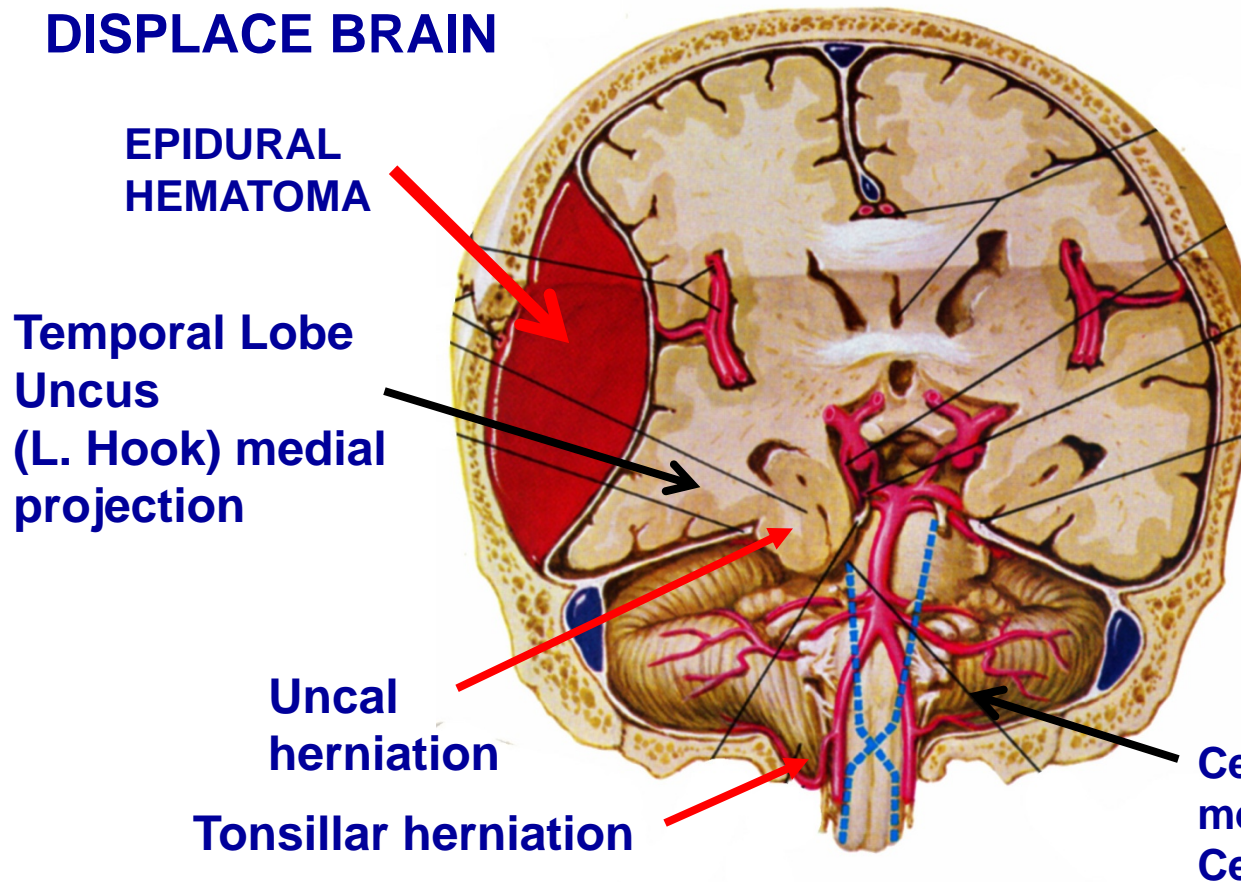
EPIDURAL HEMATOMA – **

- 1) ARTERIAL – often MIDDLE MENINGEAL ARTERY
- 2) 'LENS' SHAPED MASS
- 3) RAPID

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

**MASS OF BLOOD CAN
DISPLACE BRAIN**



6) Herniation -

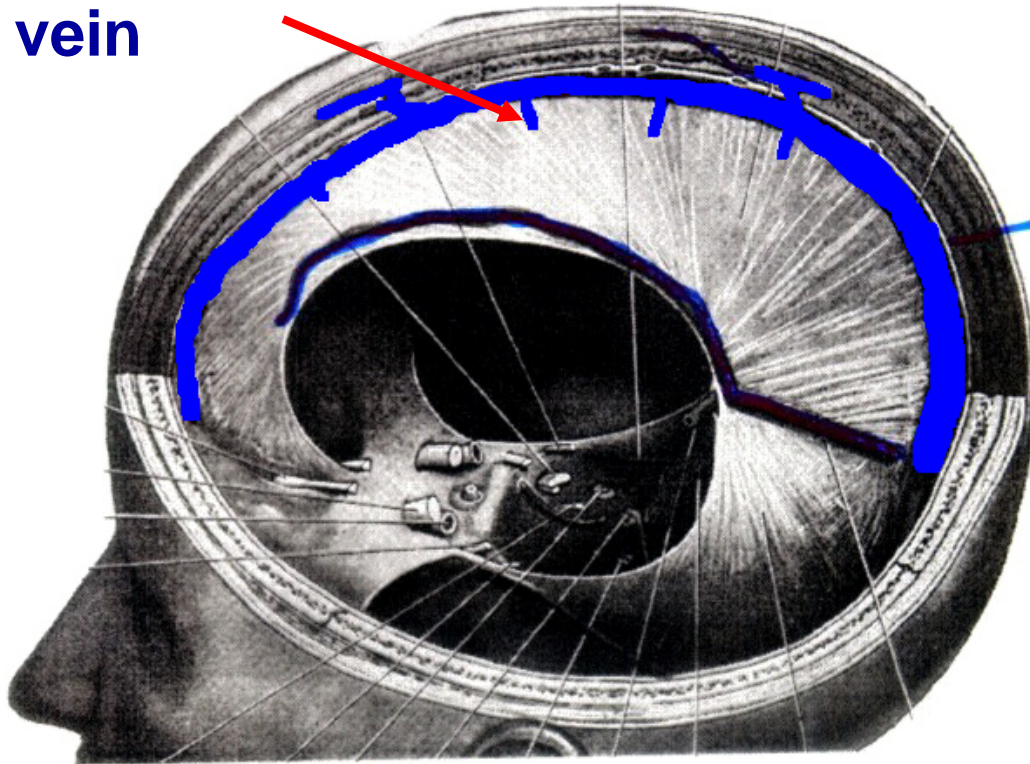
i. Uncal herniation -
push Temporal lobe
(uncus) through
Tentorial Notch

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

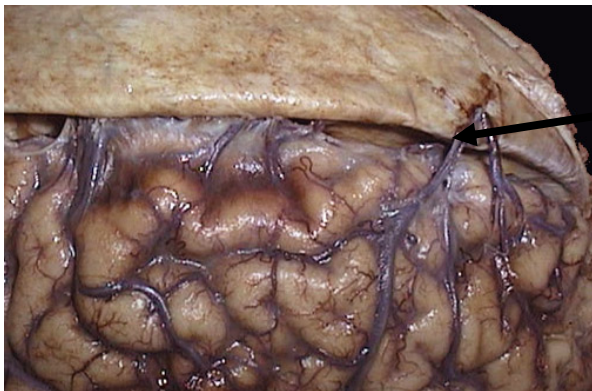
**Clinical - bleeding is arterial; can be profuse and rapid (ex, car accident);
patient lucid at first; can be fatal within hours if herniation occurs – actress
Natasha Richardson 2009 * ***

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

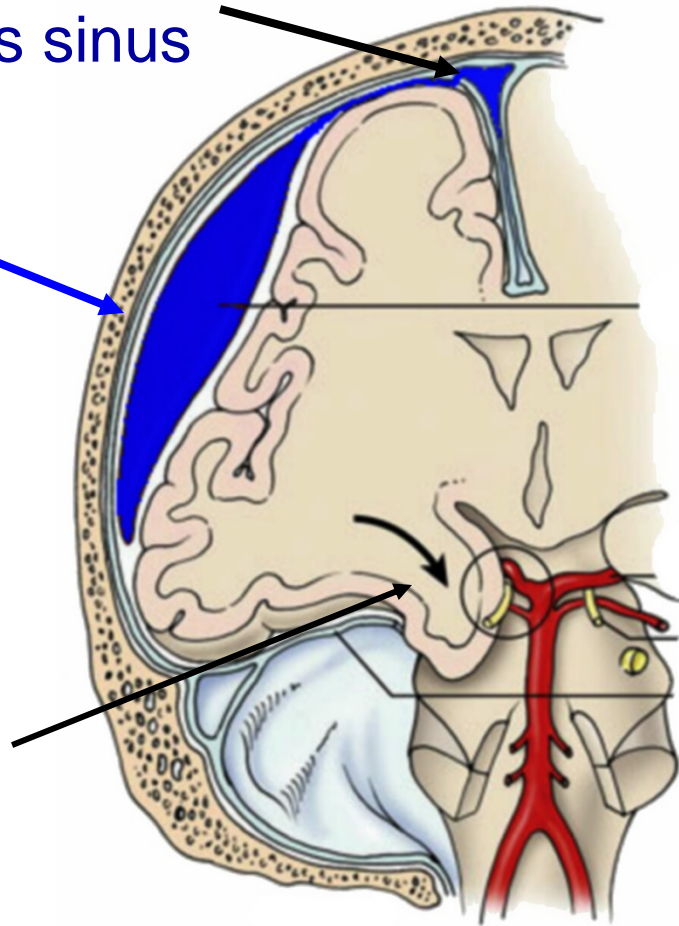
Photo from lecture of Dr. Nancy Norton

SUBDURAL HEMATOMA

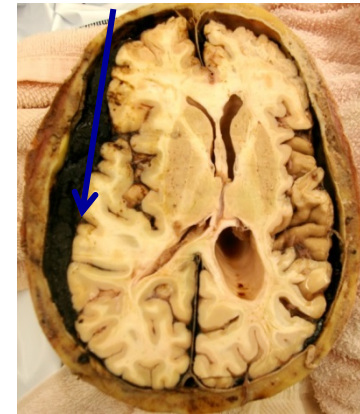
Tear 'bridging' vein
or venous sinus

Crescent
shaped
hematoma
on CT/MRI

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



SUBDURAL HEMATOMA
BLOOD

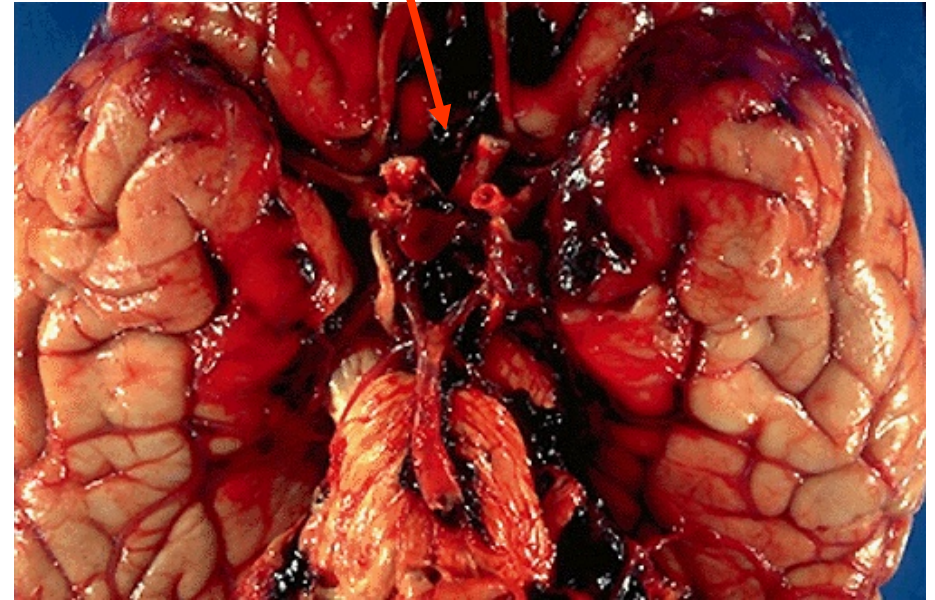
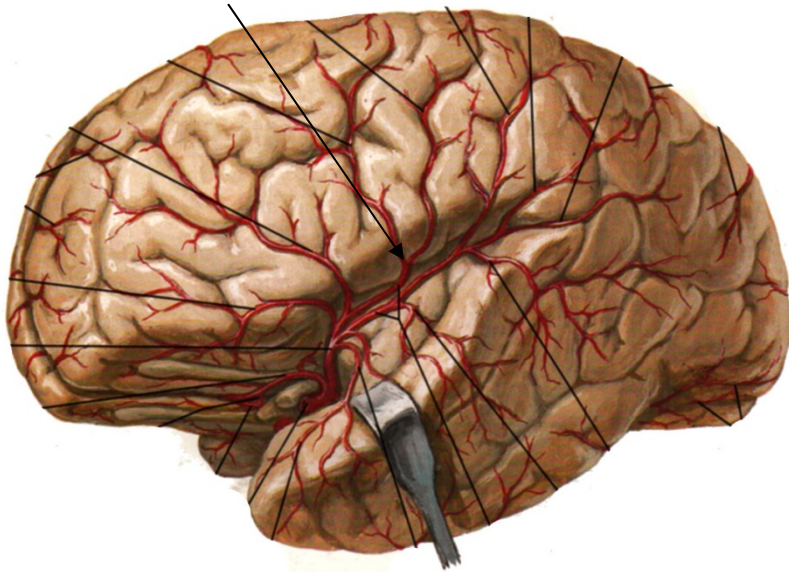


**SUBDURAL **
HEMATOMA –
1) VENOUS – often
BRIDGING VEIN
2) CRESCENT
SHAPED MASS
3) SLOW**

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

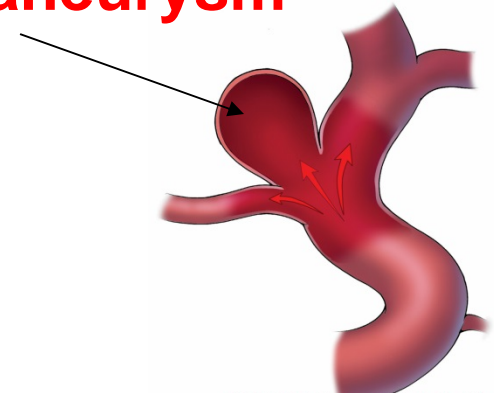
C. SUBARACHNOID HEMATOMA

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



SUMMARY CHART HEMATOMAS

SUMMARY: INTRACRANIAL HEMATOMAS

Clinical	Anatomy	Cause	Sign/Symptom
Epidural Hematoma	Middle Meningeal artery (90% of Epidural hematomas); branch of Maxillary artery that passes through foramen spinosum; supplies bone of calvarium;	Blow to side of head (fracture skull in region of pterion)	Patient conscious after accident; loses consciousness within hours; coma, death (Note: hematoma is lens-shaped on CT)
Subdural Hematoma	Bridging veins link Superficial cerebral veins on surface of brain and Superior Sagittal sinus (also other venous sinuses)	Blow to head; in elderly can occur without distinct event	Slow onset of neurological symptoms, headache (often hours to days) (Note: hematoma is crescent-shaped on CT)
Subarachnoid hematoma	Rupture of artery (ex. 'berry aneurism') or vein into subarachnoid space	Many, Hypertension, Trauma, etc.	Berry Aneurysm: Headache (sudden onset); rapid loss of consciousness, 25-50 % die

EPIDURAL - Arterial (Middle Meningeal A.), Lens shaped, Fast
SUBDURAL - Venous (Bridging vein), Crescent shaped, Slow