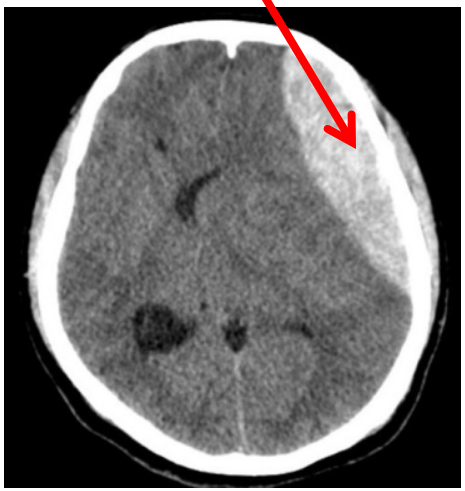
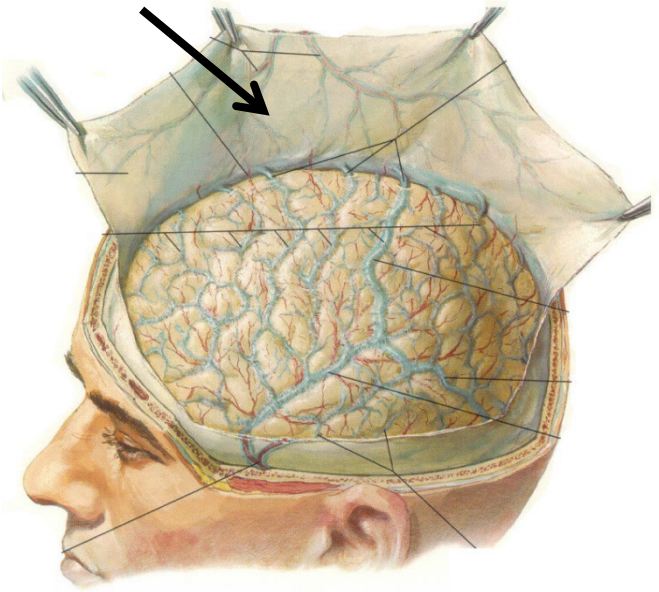
MENINGES AND VENOUS SINUSES OF BRAIN

EPIDURAL HEMATOMA



DURA MATER



OUTLINE

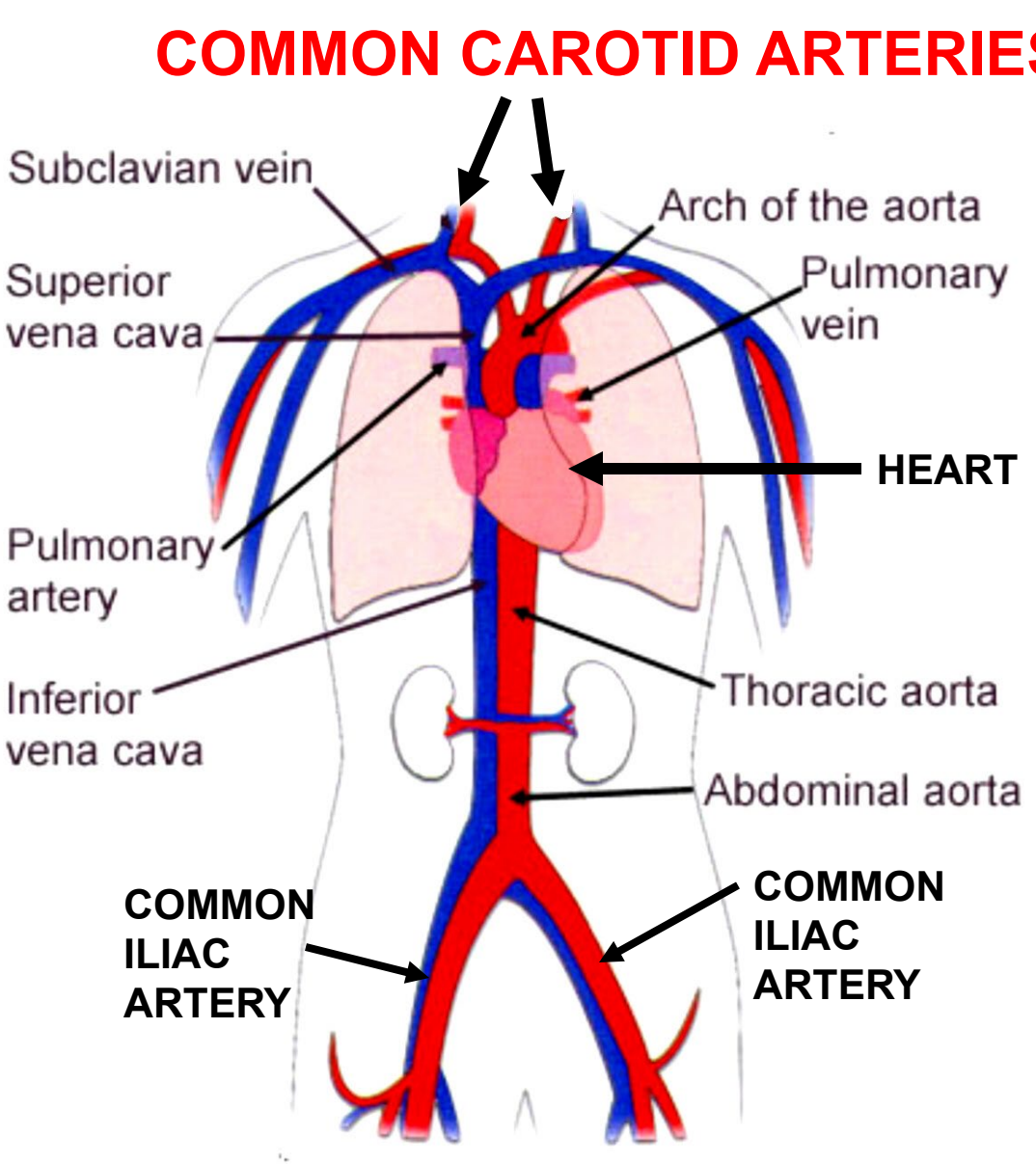
I. ARTERIAL SUPPLY
II. MENINGES
III. VENOUS SINUSES
IV. CEREBROSPINAL FLUID
V. HEMATOMAS

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?



OVERVIEW OF BLOOD SUPPLY TO HEAD

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

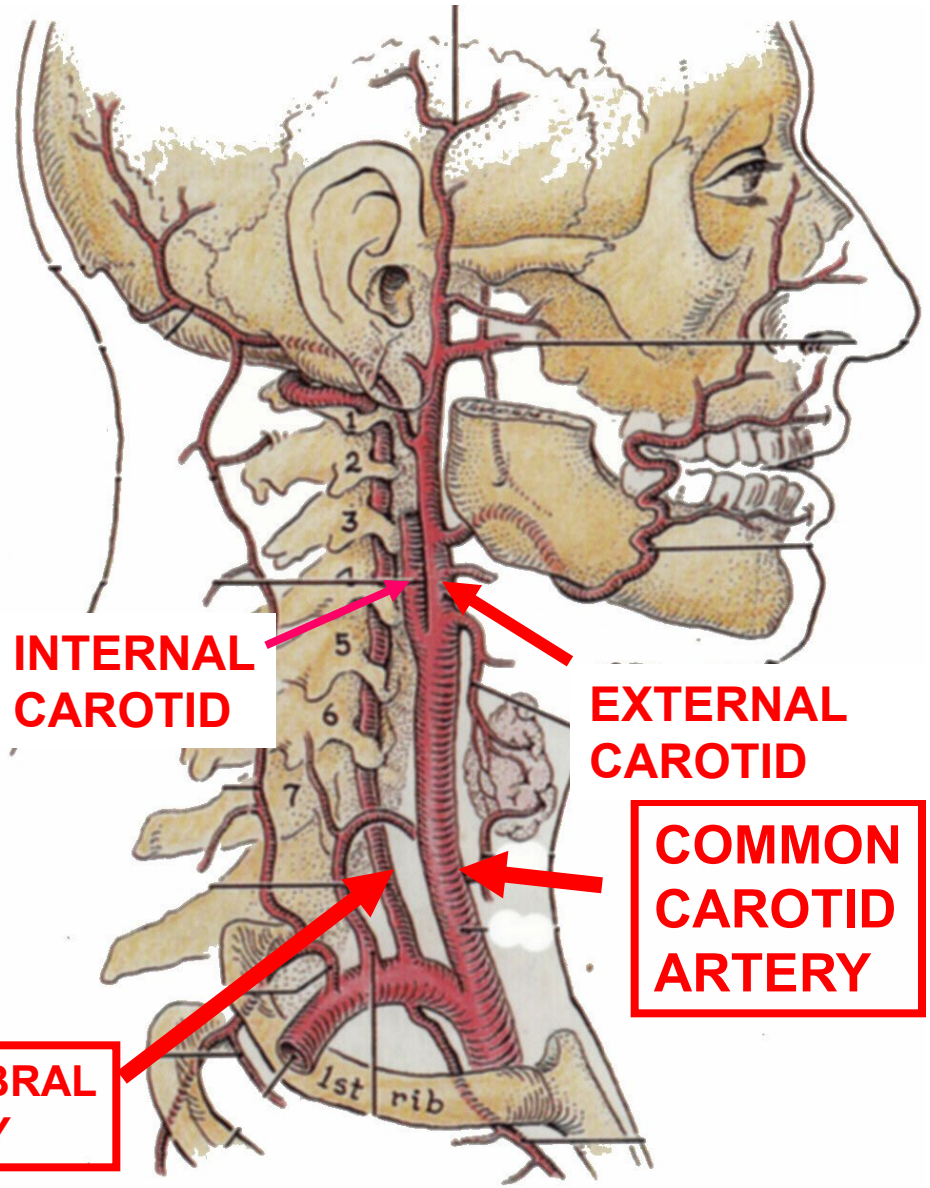
2) INTERNAL CAROTID ARTERY AND VERTEBRAL ARTERY SUPPLY BRAIN

3) EXTERNAL CAROTID ARTERY SUPPLIES FACE AND HEAD

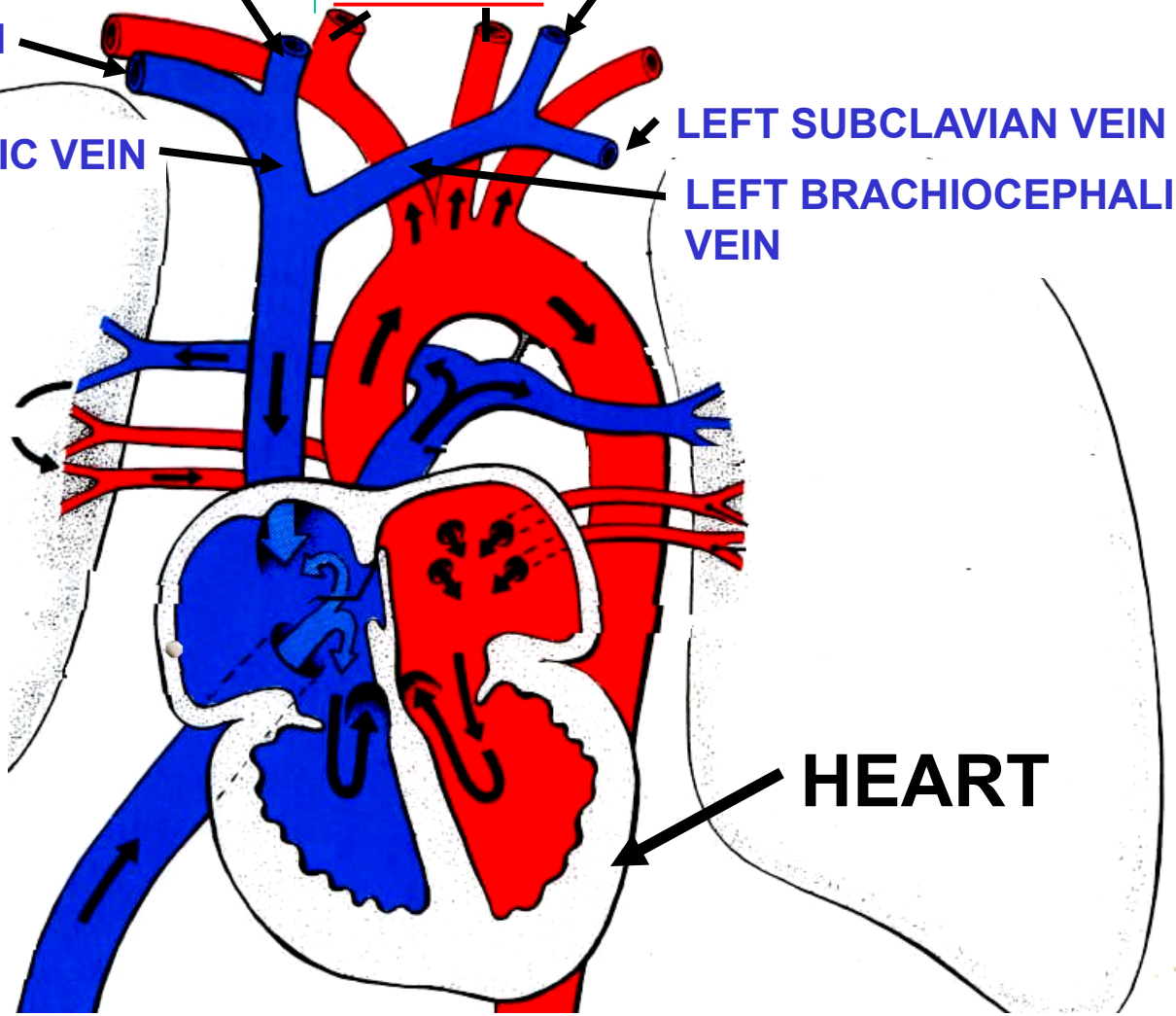
Branches:

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

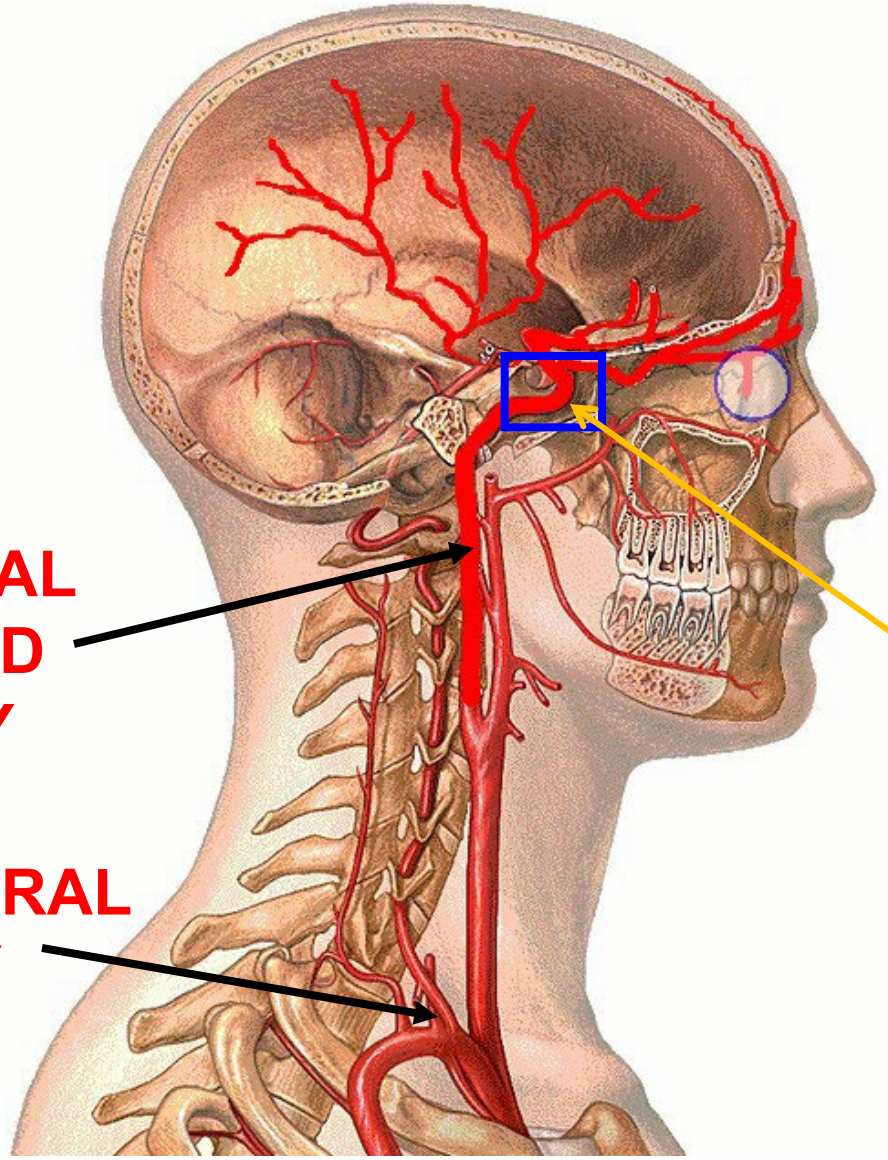


VEINS ARE SYMMETRICAL

INTERNAL JUGULAR VEINS JOIN SUBCLAVIAN VEINS TO FORM BRACHIOCEPHALIC VEINS

RIGHT AND LEFT BRACHIOCEPHALIC VEINS FORM SUPERIOR VENA CAVA

INTERNAL CAROTID ARTERY: ENTERS SKULL

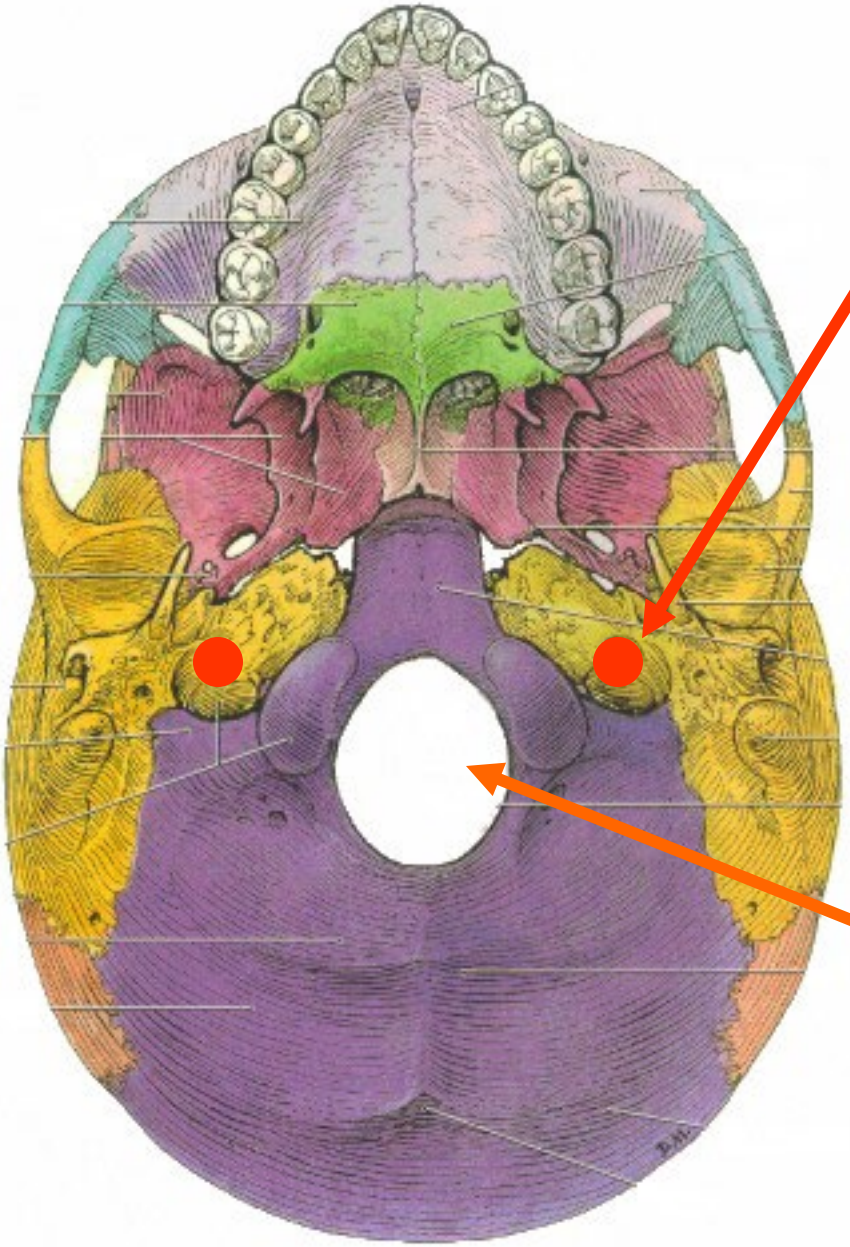


PASSES THROUGH CAVERNOUS SINUS

INTERNAL CAROTID ARTERY

CAROTID SIPHON = c-shaped turn of Internal Carotid Artery

VERTEBRAL ARTERY

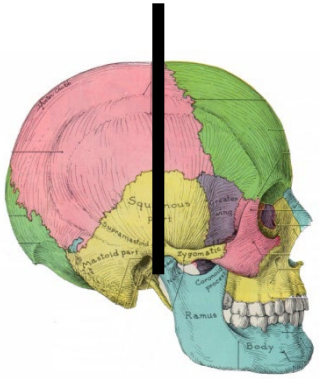


Internal Carotid Artery- enters skull via Carotid Canal And Foramen Lacerum

Vertebral Artery- enters skull via Foramen Magnum

VIEW FORAMINA IN SKULL SESSION

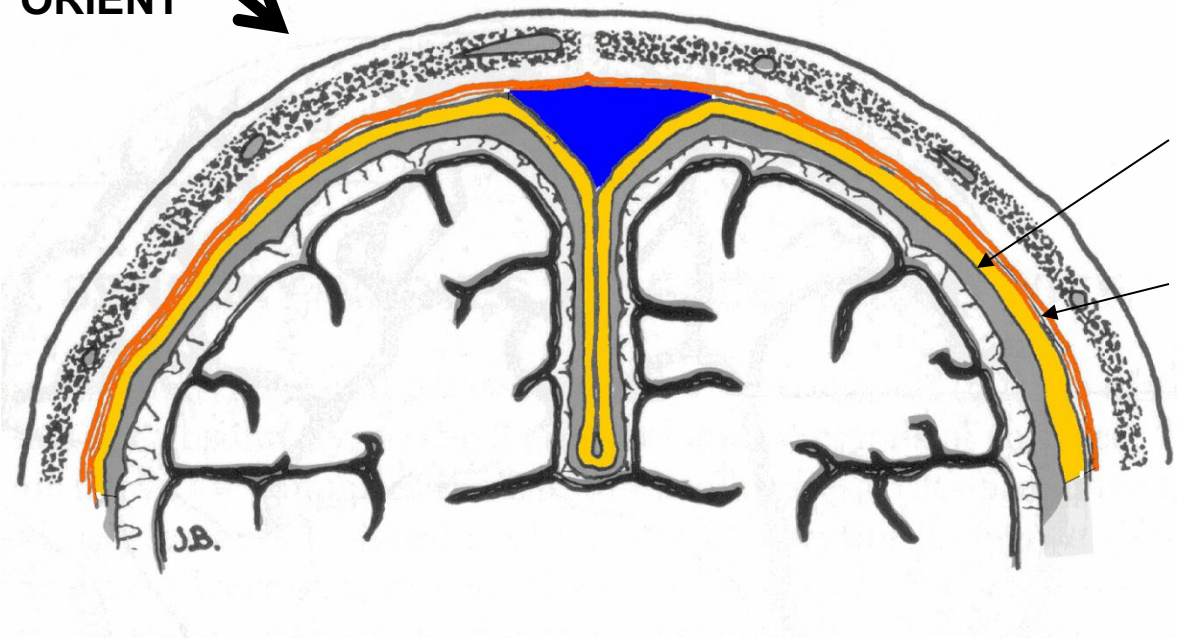
CORONAL PLANE



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)

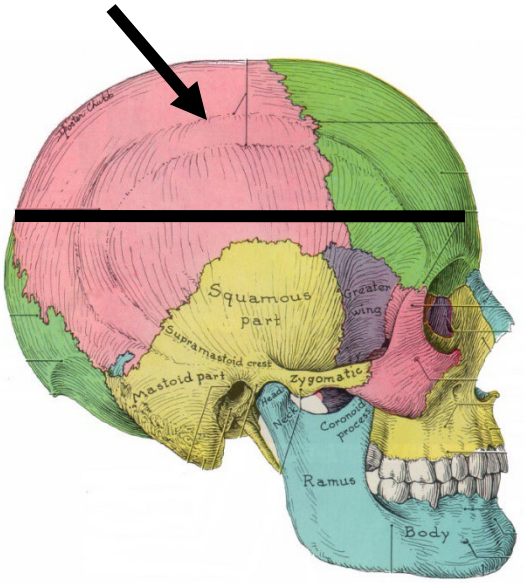
2) OUTER ENDOSTEAL LAYER - periosteum on inner side of calvarium

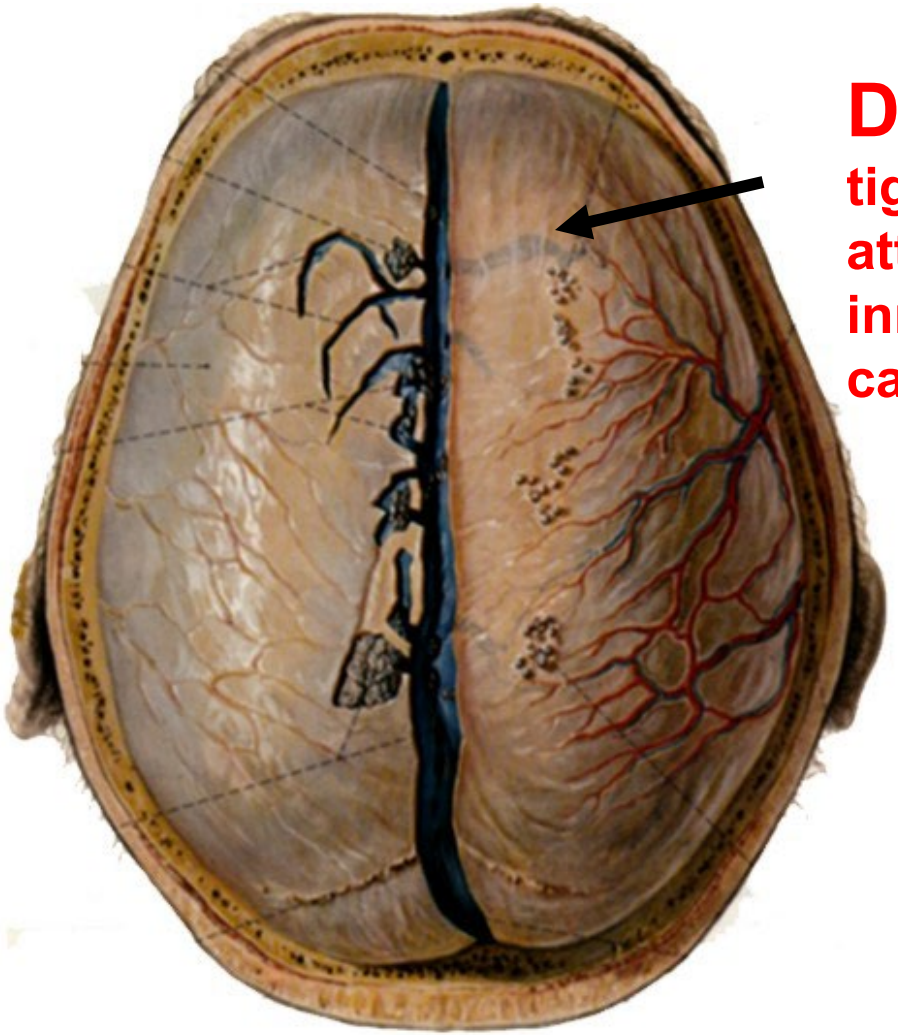
Two layers - fused in most places - separate to form DURAL REFLECTIONS

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

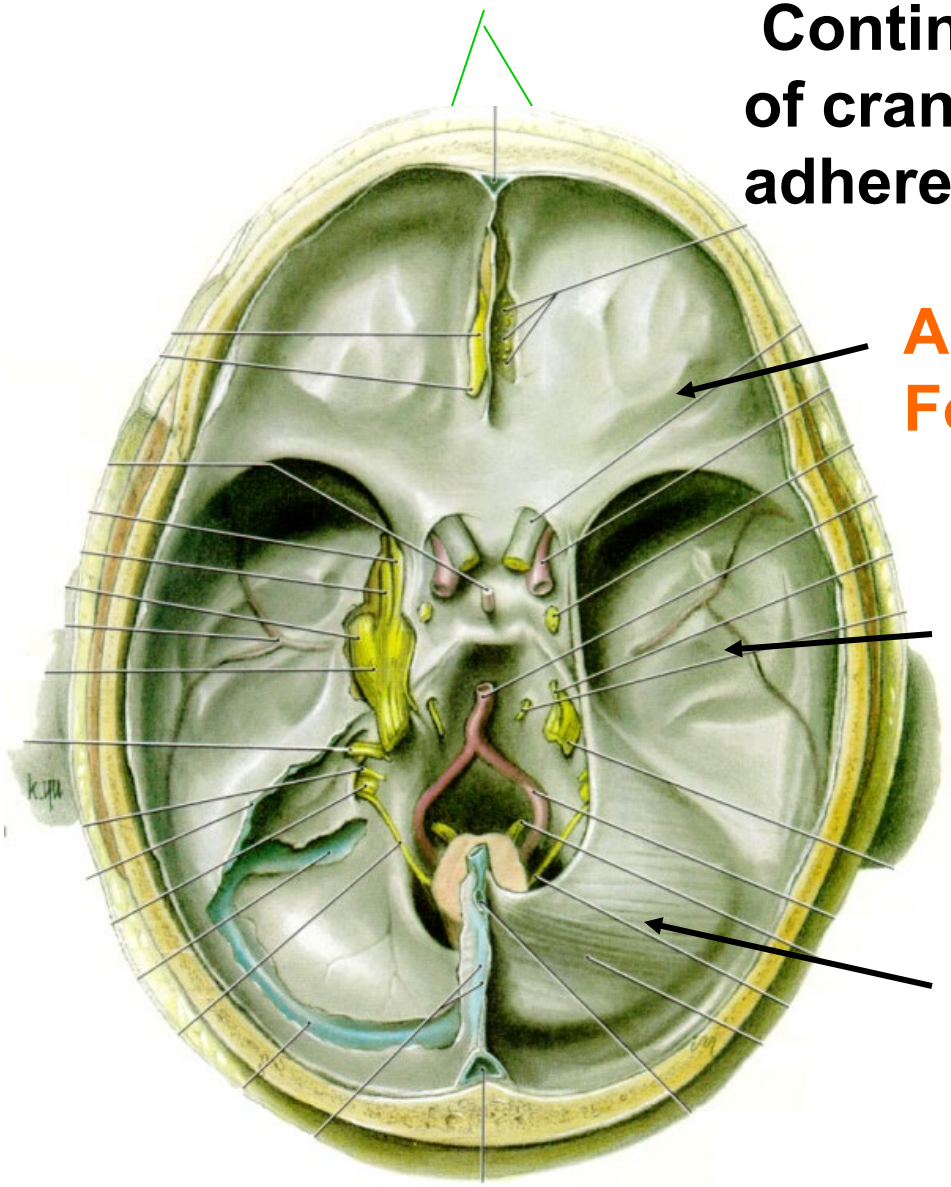




DURA is tightly attached to inner side of calvarium

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

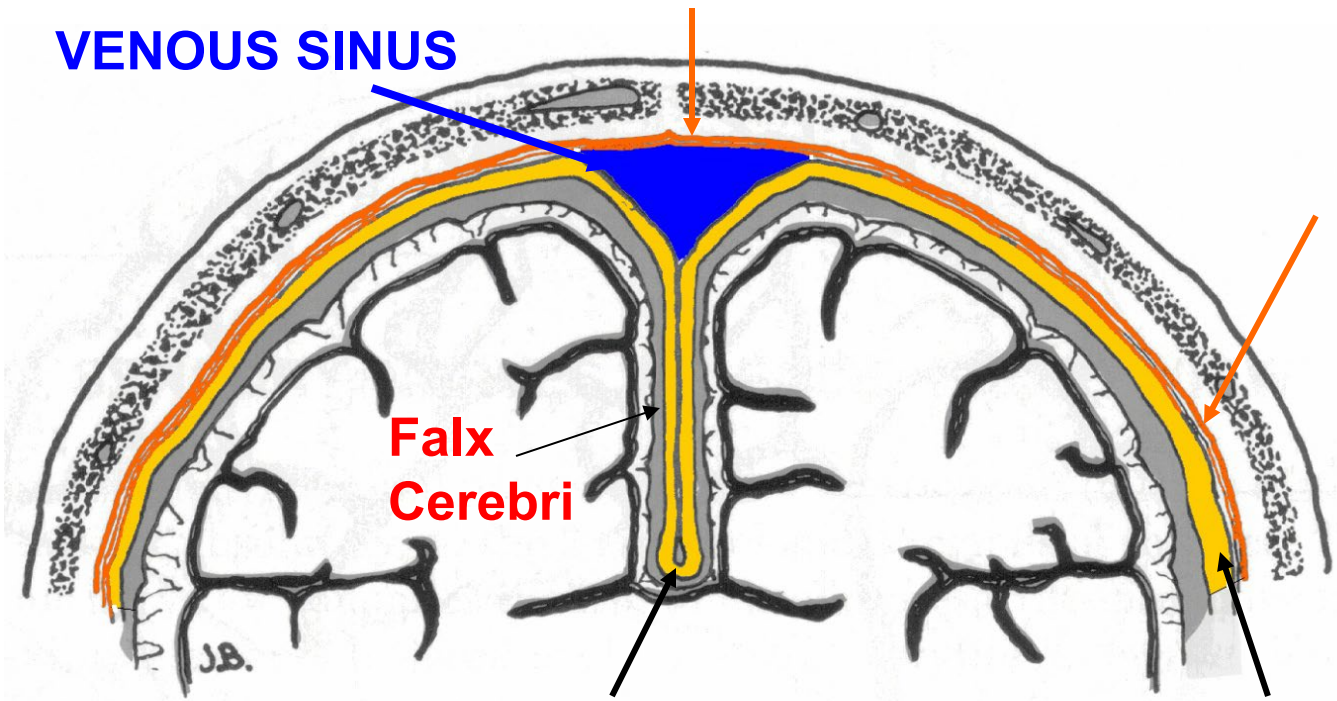
Middle Cranial Fossa

Posterior Cranial Fossa

(fossa = depression)

DURAL REFLECTIONS

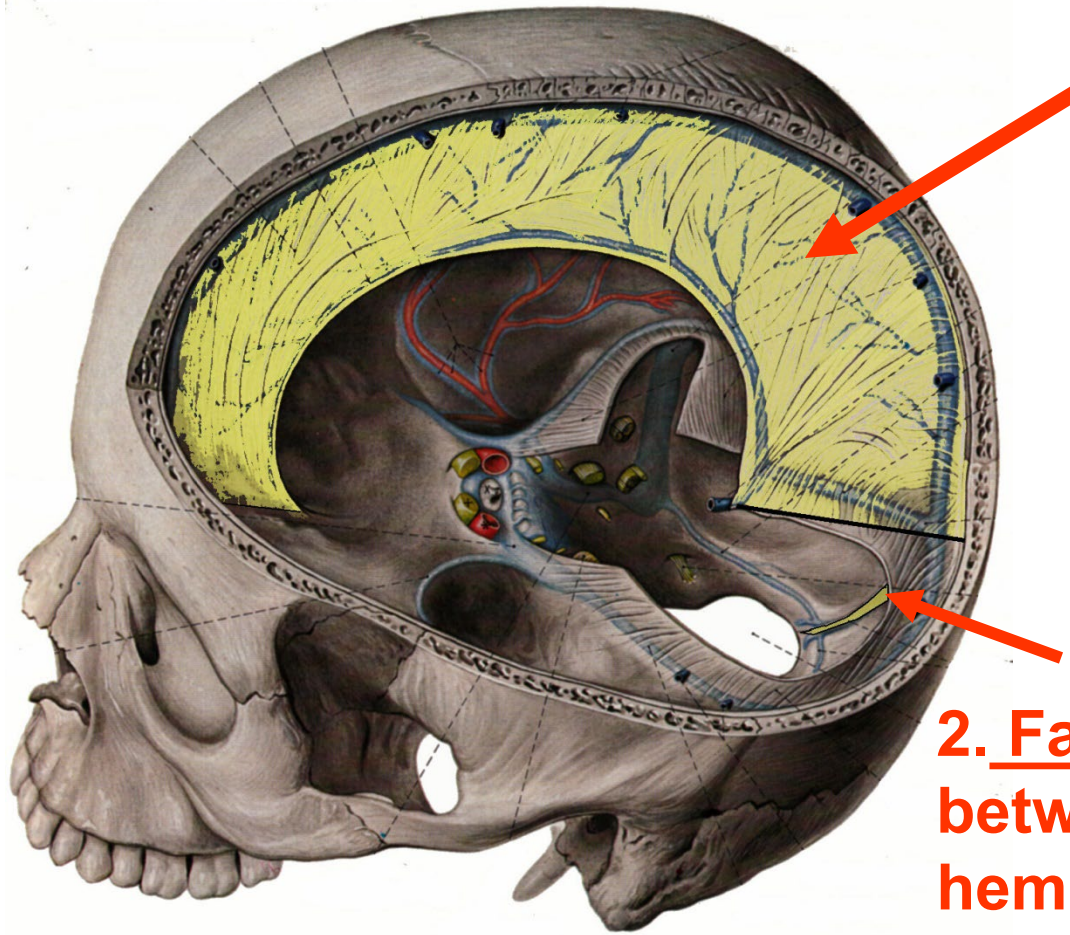
2 Layers of Dura separate form Inward Folds (Reflections)- Function to stabilize brain and contain venous sinuses



DURAL REFLECTIONS

falx = sickle

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



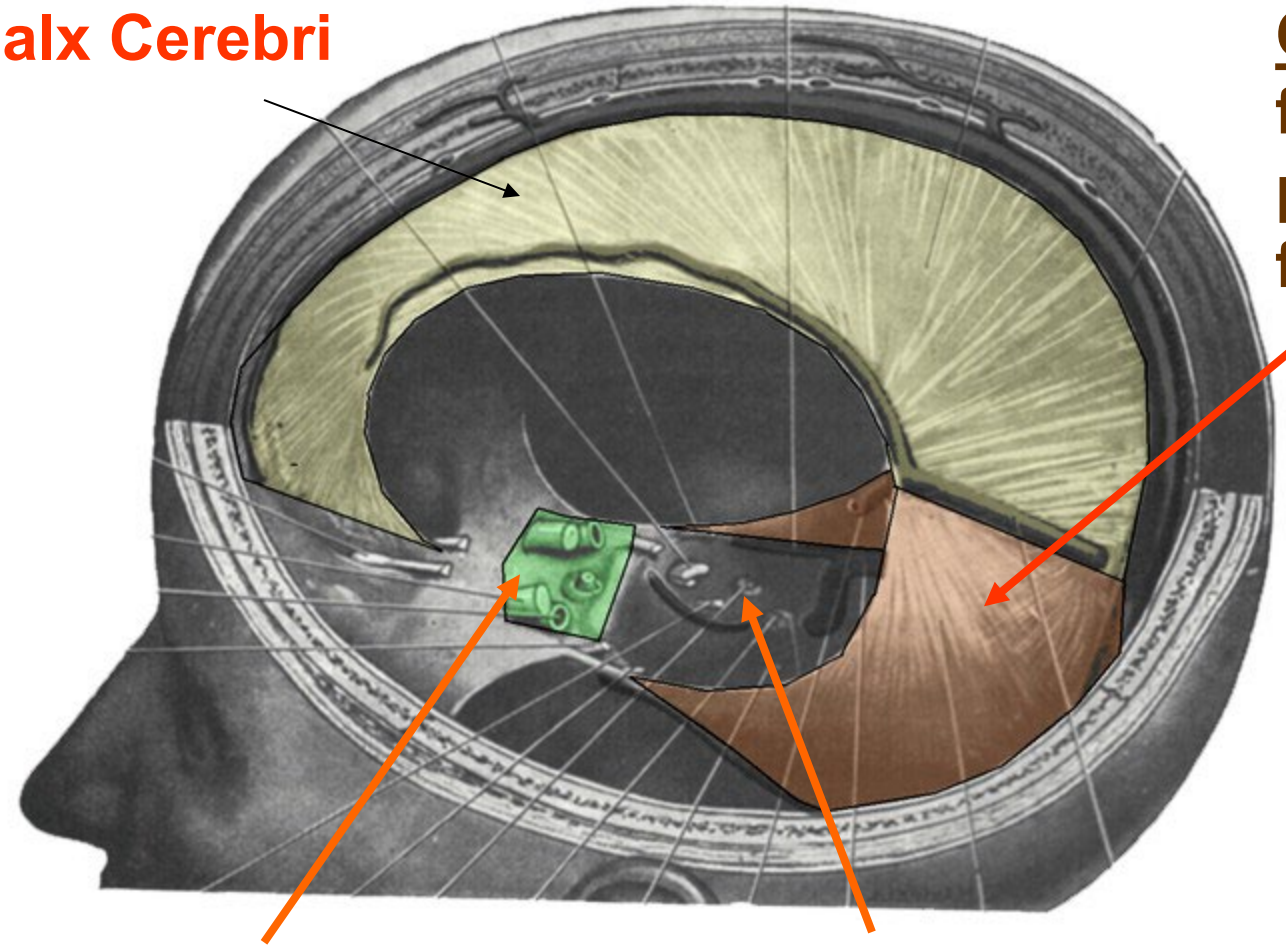
1. **Falx Cerebri - sickle shaped - between cerebral hemispheres; attached ant. to crista galli of ethmoid; post. blends into tentorium cerebelli**

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



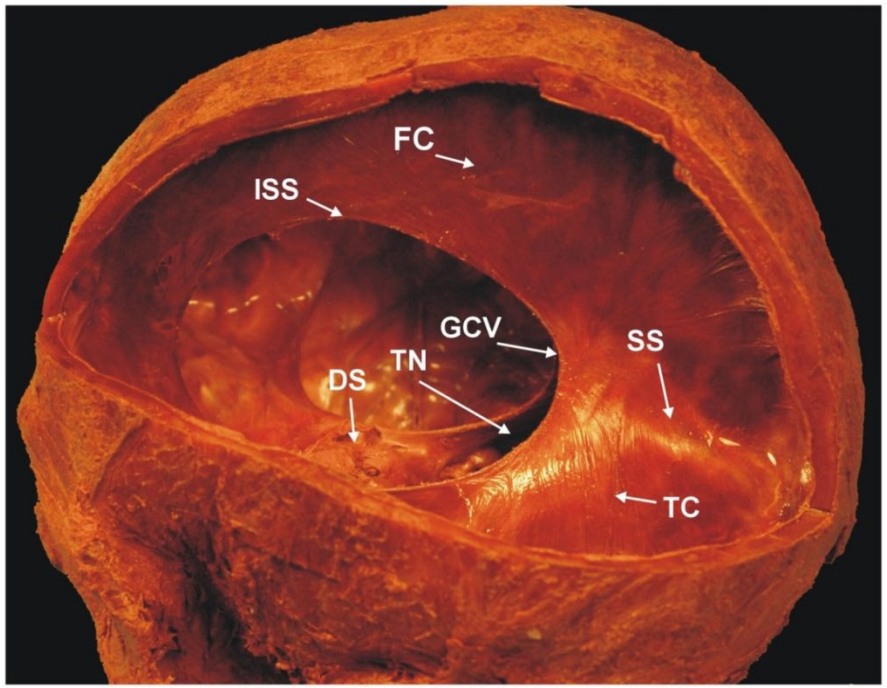
4. Diaphragma Sella – fold over sella turcica

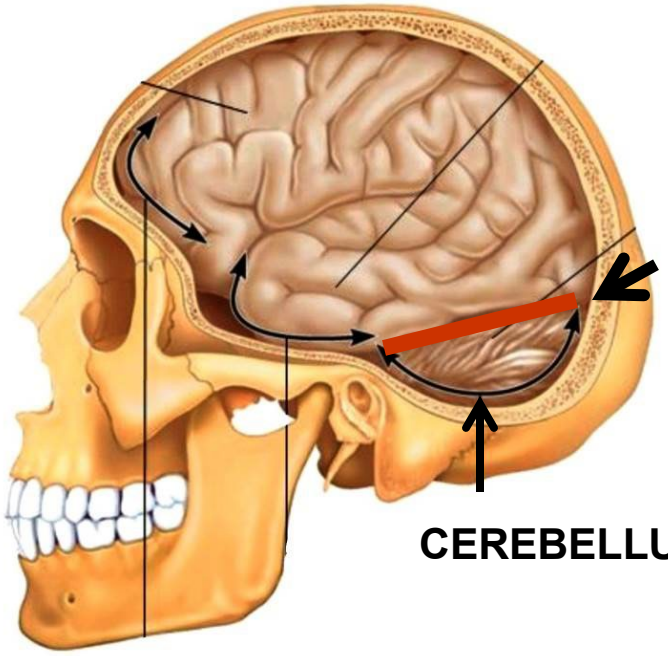
Tentorial Notch – opening for brainstem

LOOK AT PROSECTION
279 – 'RED HEAD'

279

DURAL REFLECTIONS AND VENOUS SINUS

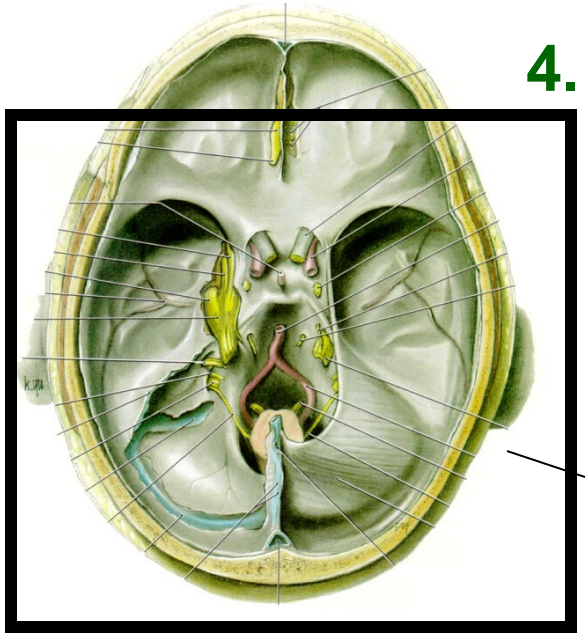




FC - FALX CEREBRI
TC - TENTORIUM CEREBELLI
ISS - LOCATION OF INFERIOR SAGITTAL SINUS
SS - LOCATION OF STRAIGHT SINUS
GCV - OPENING OF GREAT CEREBRAL VEIN OF GALEN
DS - DIAPHRAGMA SELLA
TN - TENTORIAL NOTCH

Tentorium Cerebelli =
roof over Cerebellum

DURAL REFLECTIONS



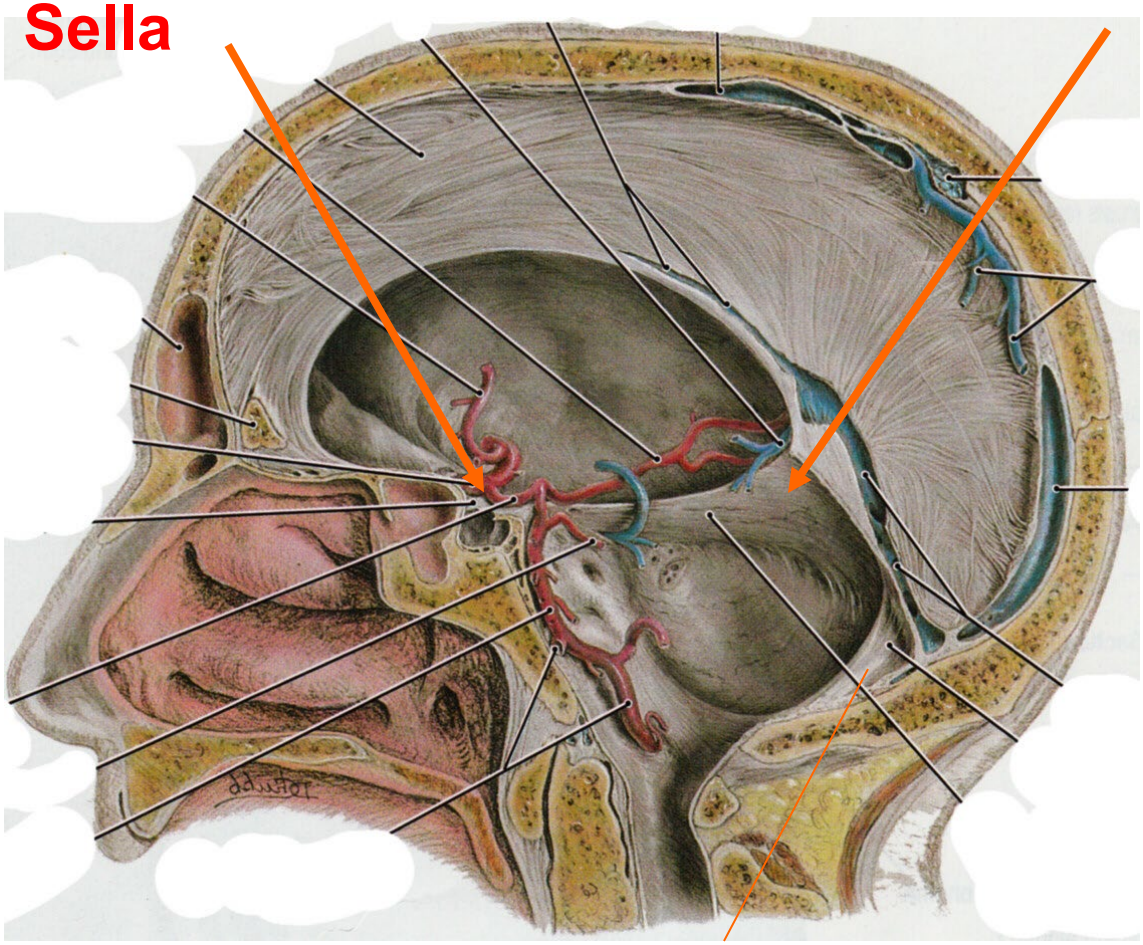
view inside cranial cavity

4. Diaphragma Sella – over sella turcica

Tentorial Notch – opening for brainstem

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

DURAL REFLECTIONS

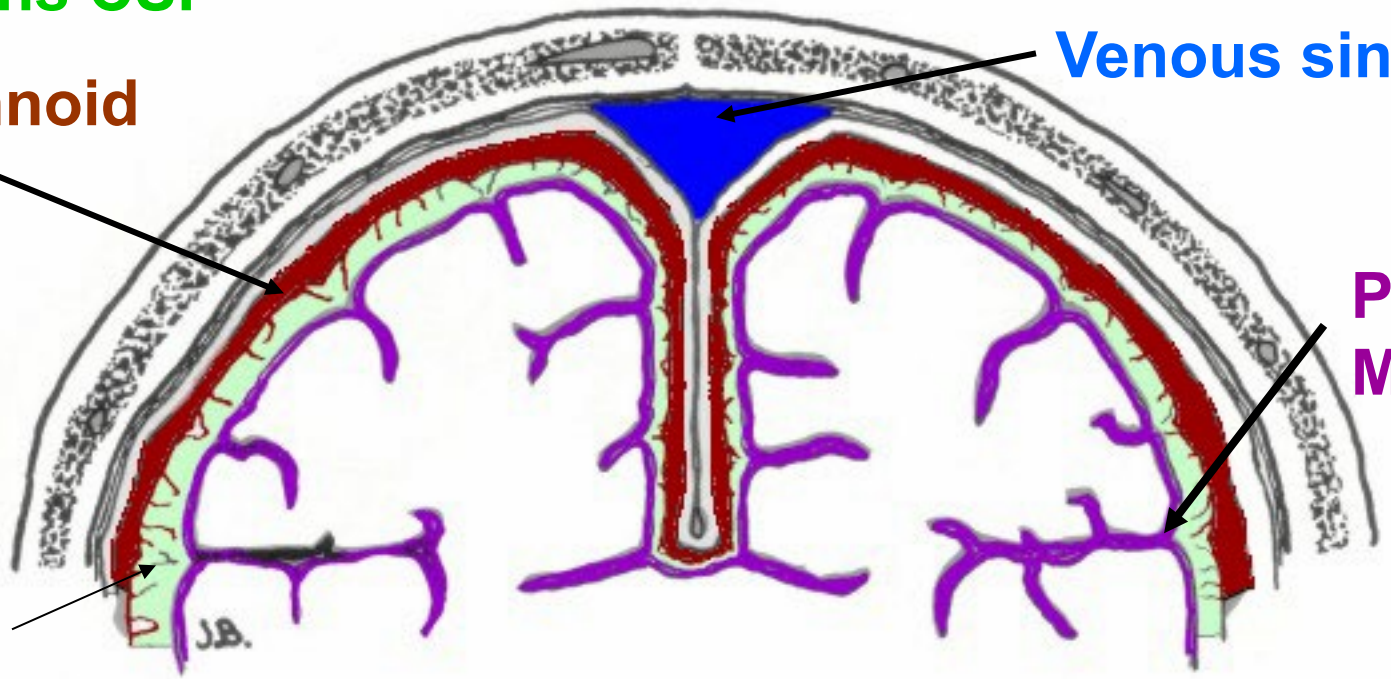


3. Tentorium Cerebelli – crescent shaped, forms roof of post. cranial fossa, has gap- tentorial notch for pass of brainstem

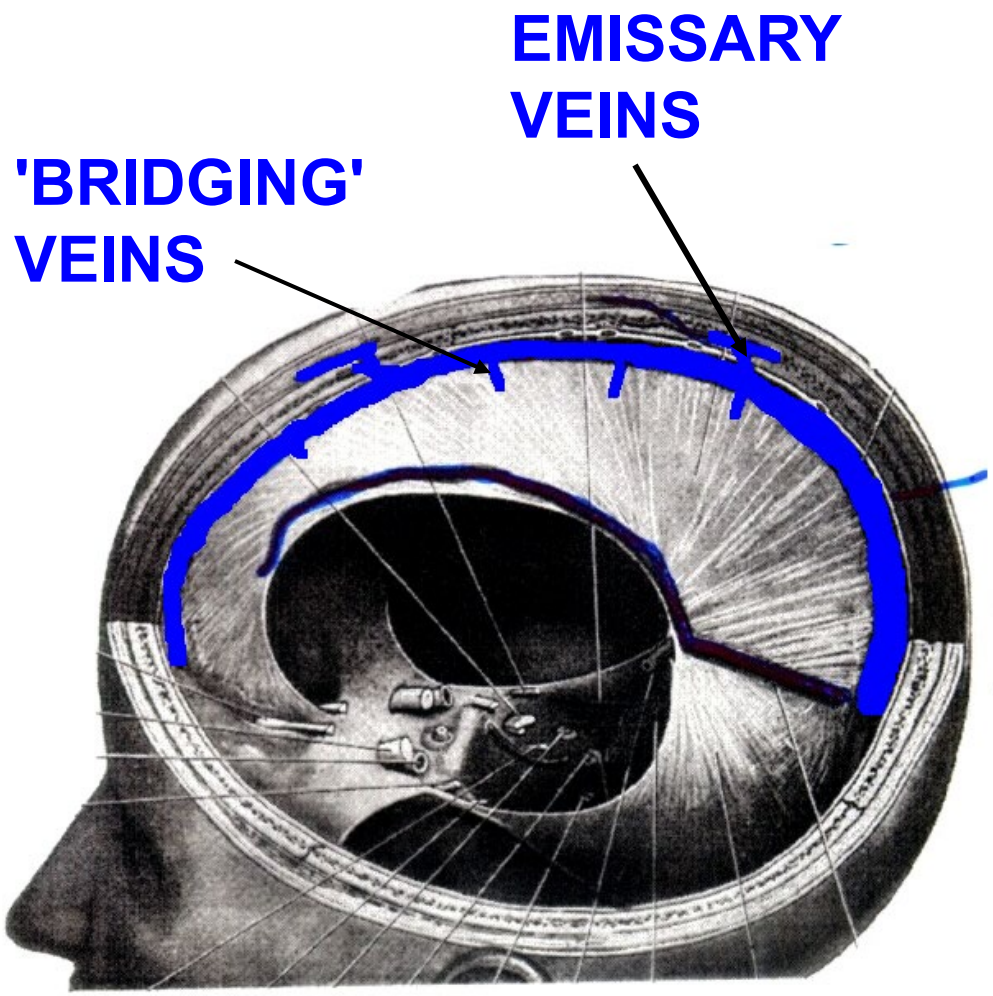
4. Diaphragma Sella – circular fold over sella turcica, has opening for stalk of pituitary

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

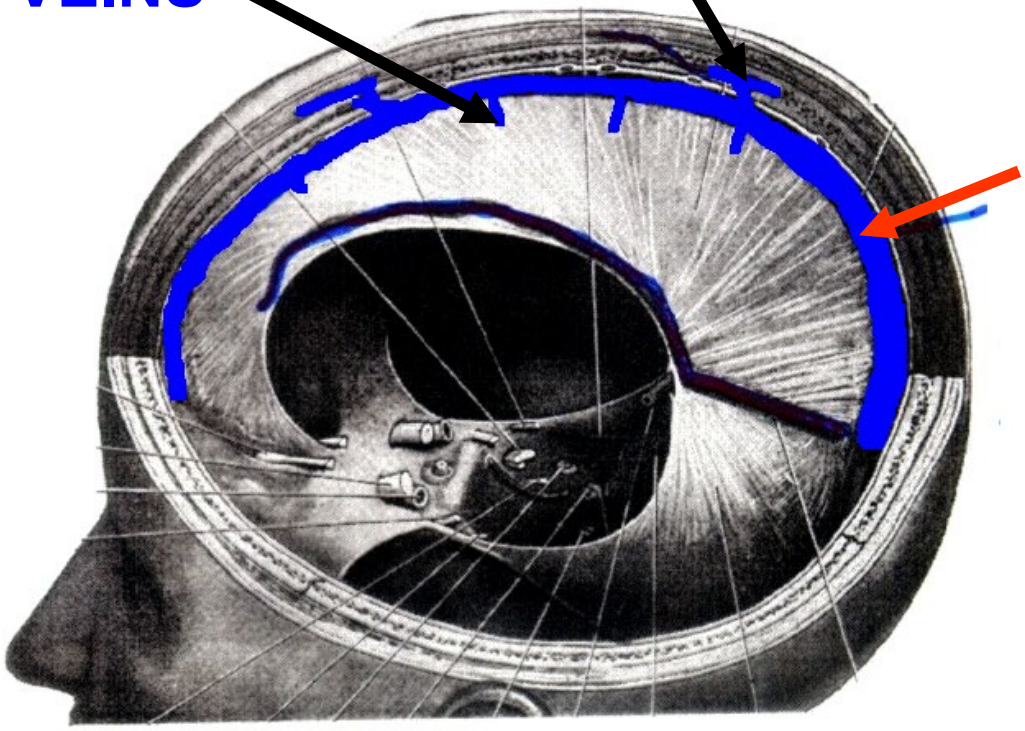
   b. named veins - ex. GREAT CEREBRAL VEIN OF GALEN

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

EMISSARY VEINS

'BRIDGING' VEINS



Brain removed

Receive blood from brain, orbit, emissary veins

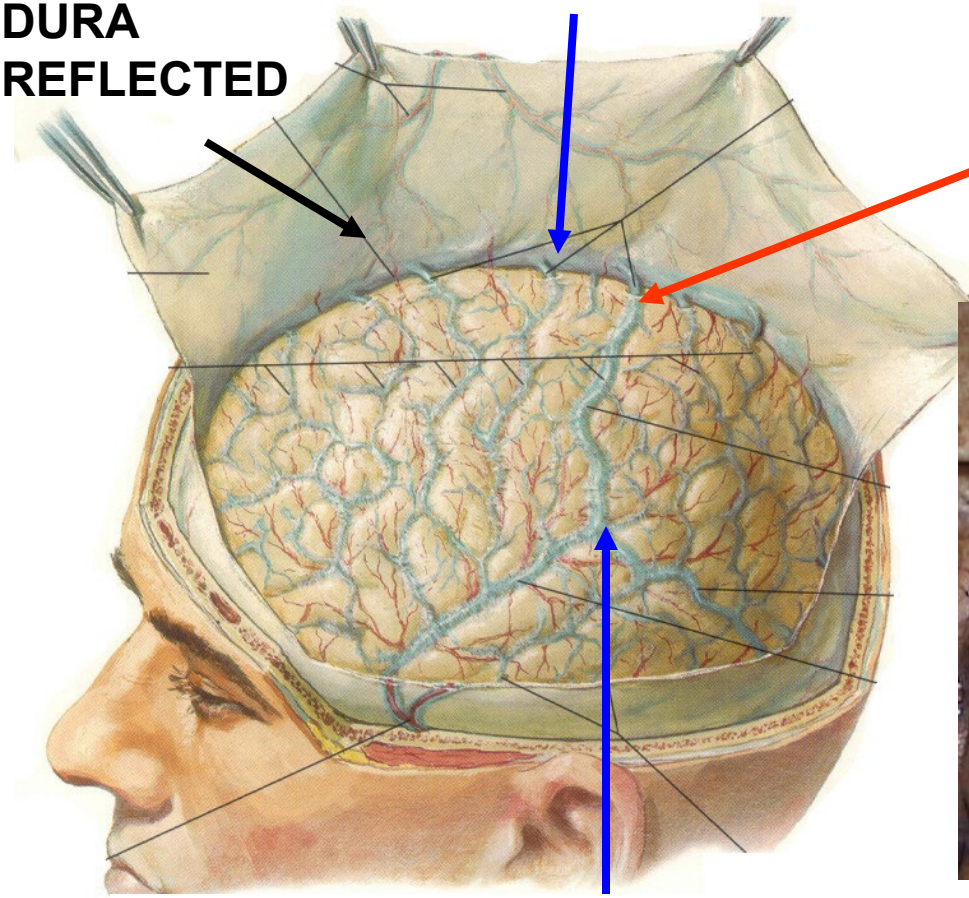
1. Superior Sagittal Sinus – in upper border of falx cerebri; ant. - foramen cecum; post- transverse sinus; - communicates laterally with venous lacunae; blood from Superior Cerebral veins through 'bridging veins'; blood also from emissary veins

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

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

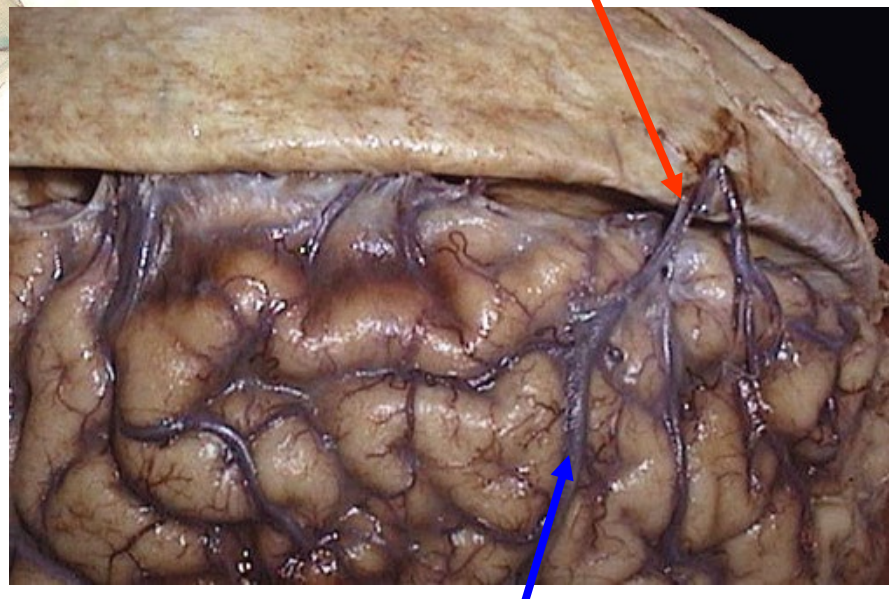
Superior Sagittal Sinus

DURA REFLECTED



Superior Cerebral veins

'BRIDGING' VEINS



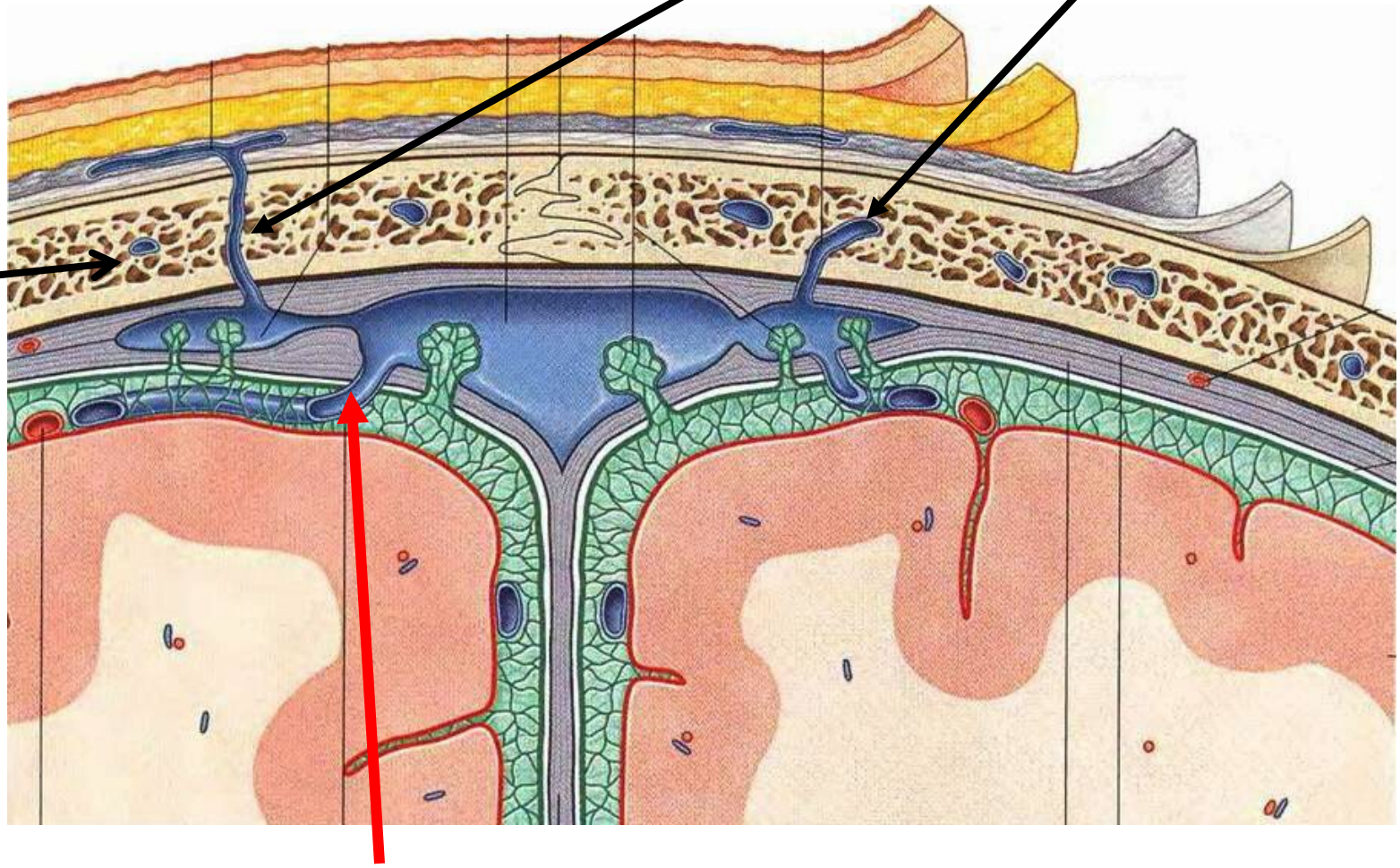
Superior Cerebral veins

Photo from lecture of Dr. Nancy Norton

EMISSARY VEINS VS. BRIDGING VEINS

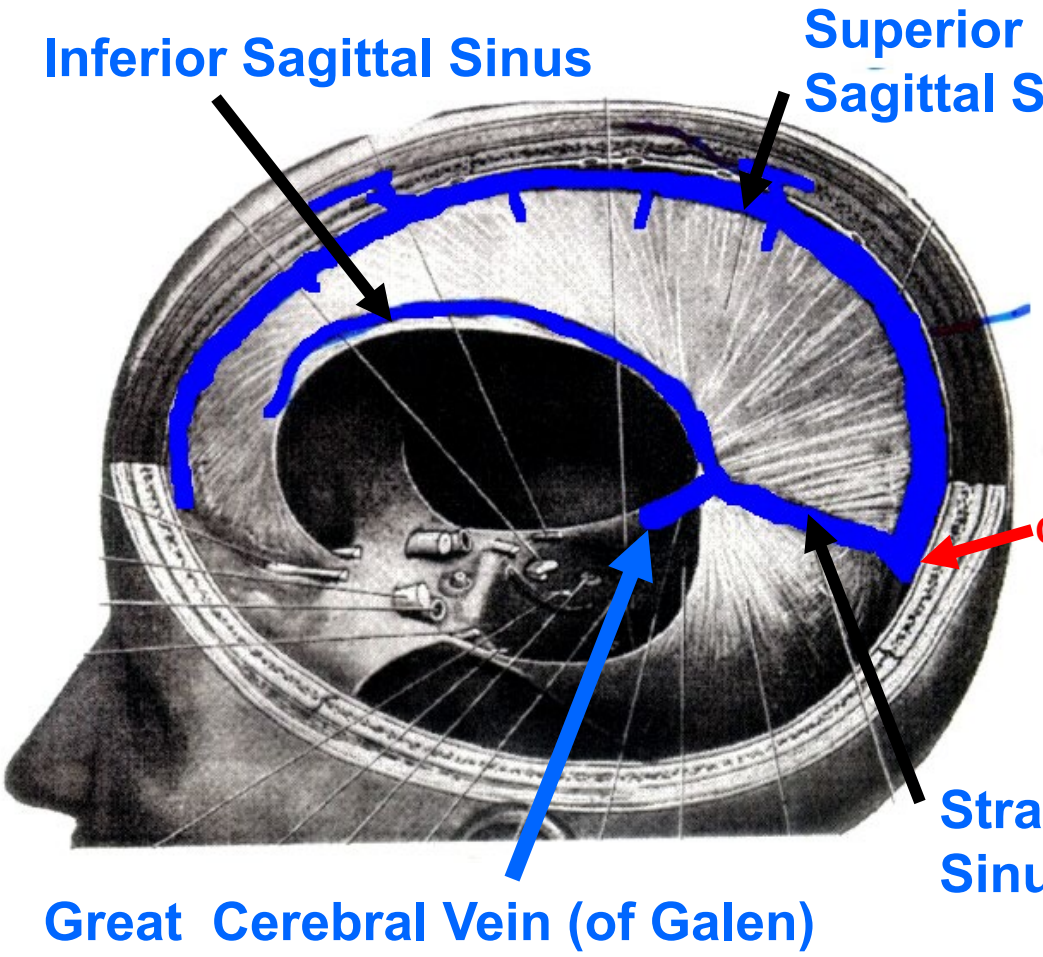
EMISSARY VEIN - SCALP TO SINUS, SCALP TO DIPLOE, DIPLOE TO SINUS

DIPLOIC VEIN



BRIDGING VEIN - CEREBRAL VEIN (BRAIN) TO SINUS

VENOUS SINUSES



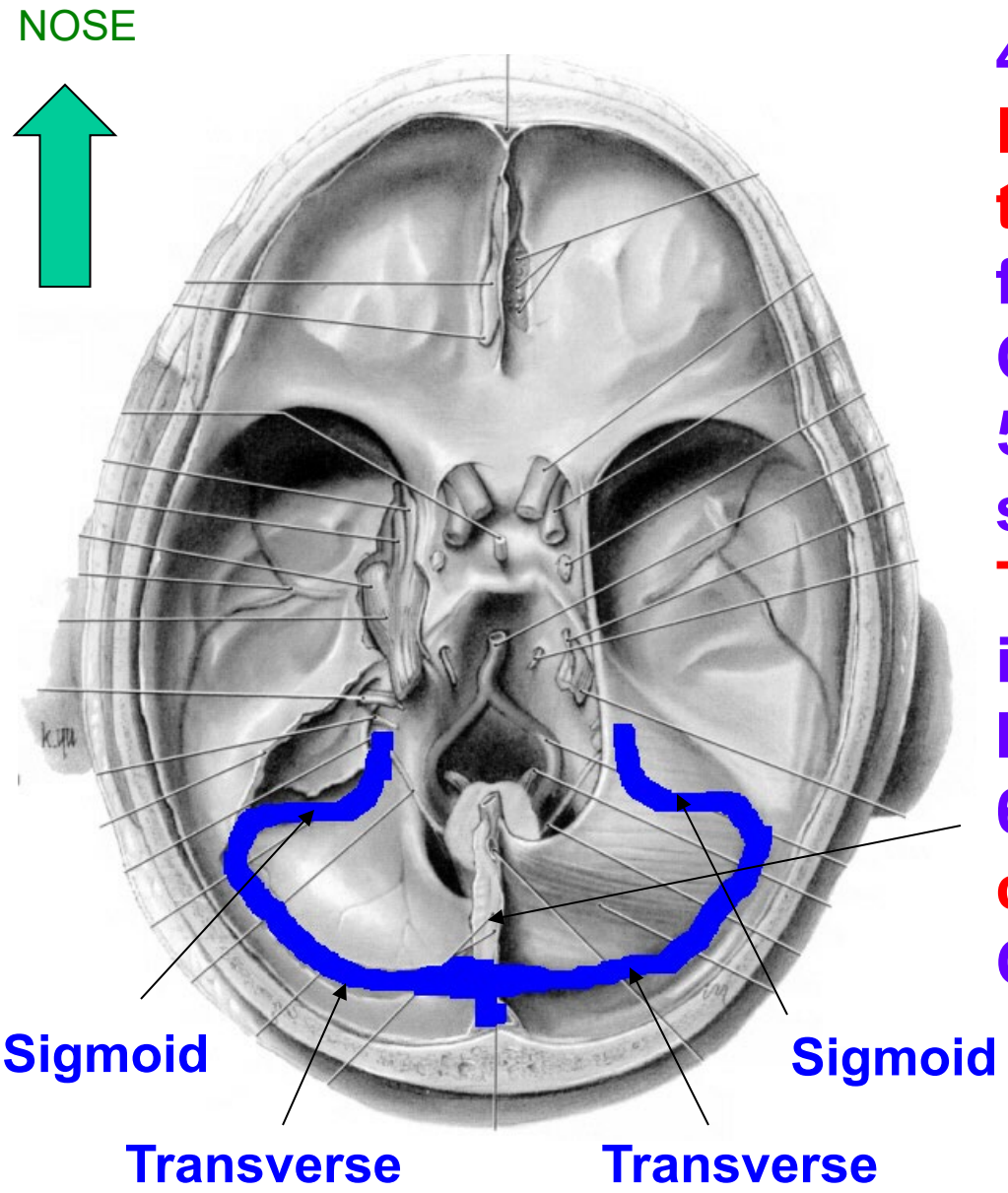
2. <u>Inferior Sagittal Sinus</u> - in lower (free) border of falx cerebri; - joins Great Cerebral V. form Straight Sinus

3. <u>Straight sinus</u> - at junction of falx cerebri and tentorium

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

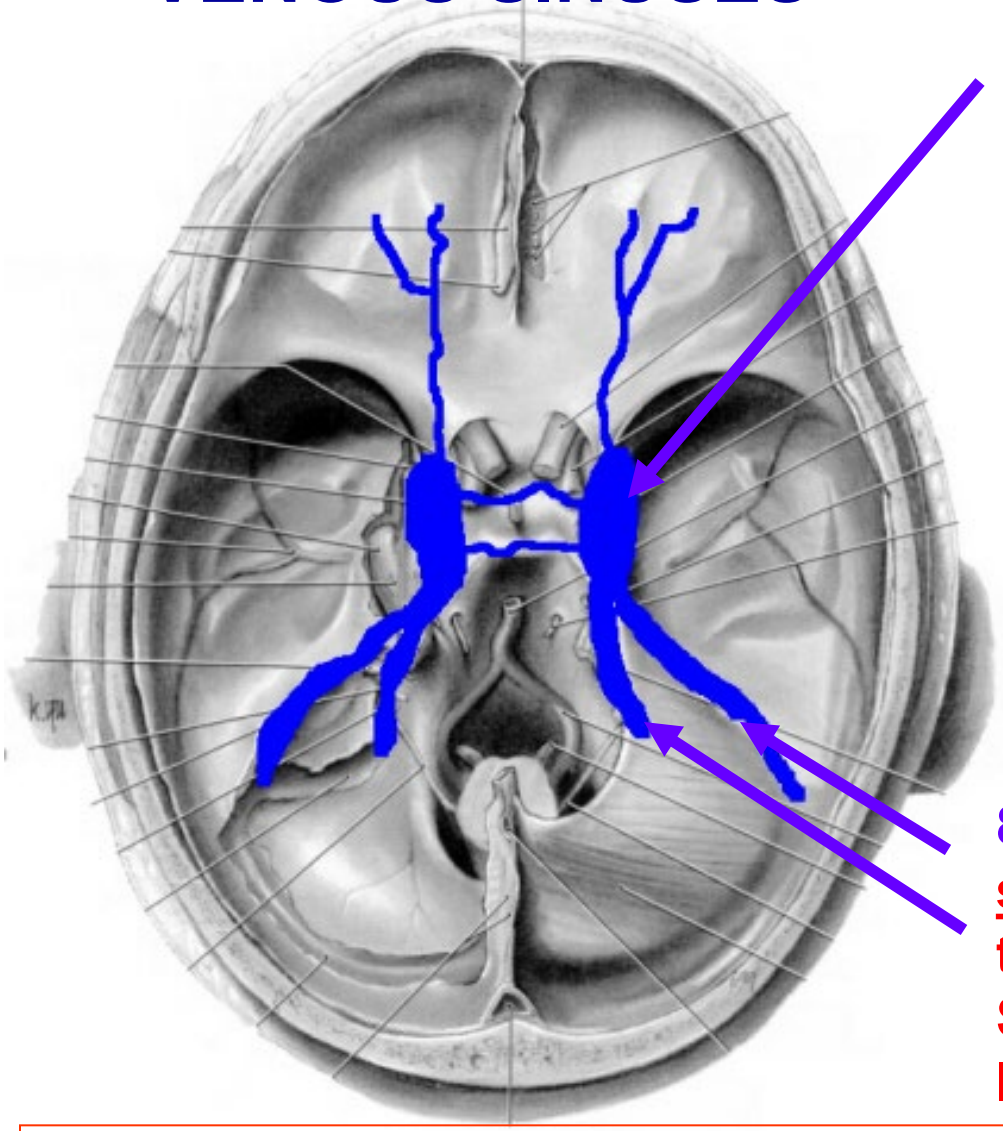
Straight Sinus can join Superior Sagittal Sinus at Confluens of Sinuses or turn left

VENOUS SINUSES



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

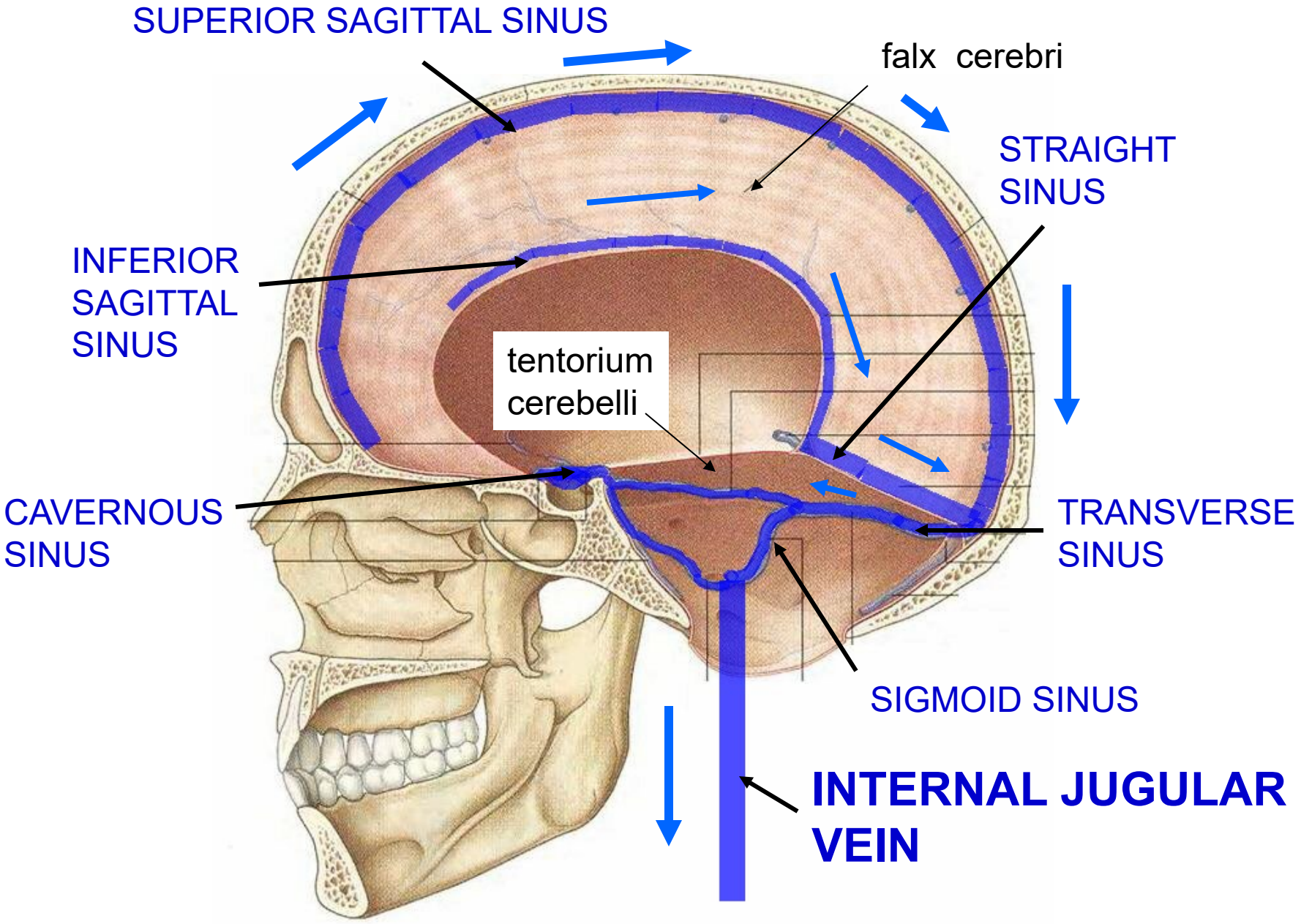


7. Cavernous sinuses - in middle cranial fossa; on side of the body of the sphenoid bone; connected by Intercavernous sinus; receive blood from Sup. and Inf. Ophthalmic veins, Cerebral veins; drain to Sup. and Inf. Petrosal sinuses

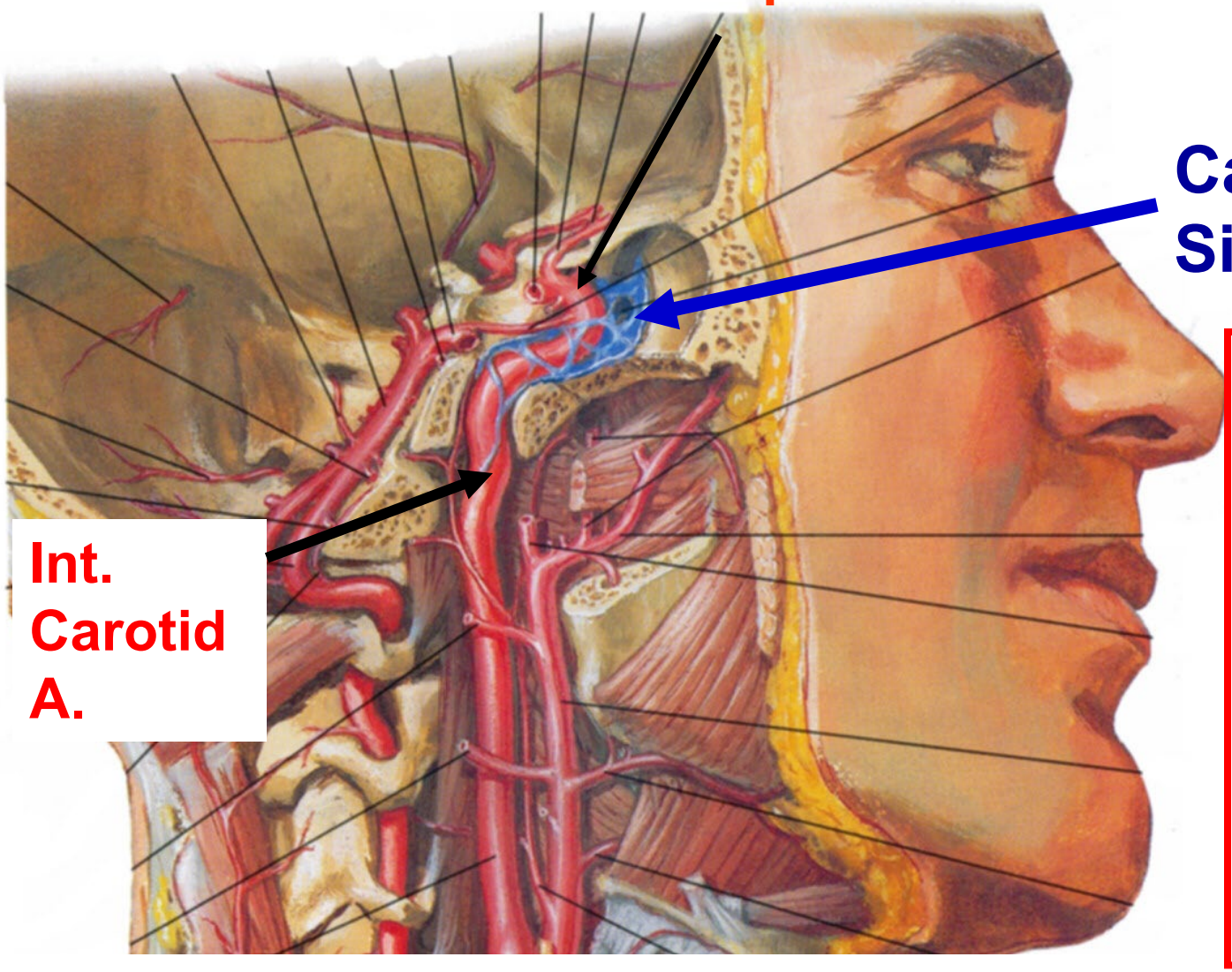
8. Sup. and Inf. Petrosal sinuses - on petrous part of temporal bone
Sup. drains to Transverse
Inf. Drains to Internal Jugular

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

VENOUS SINUSES OF BRAIN

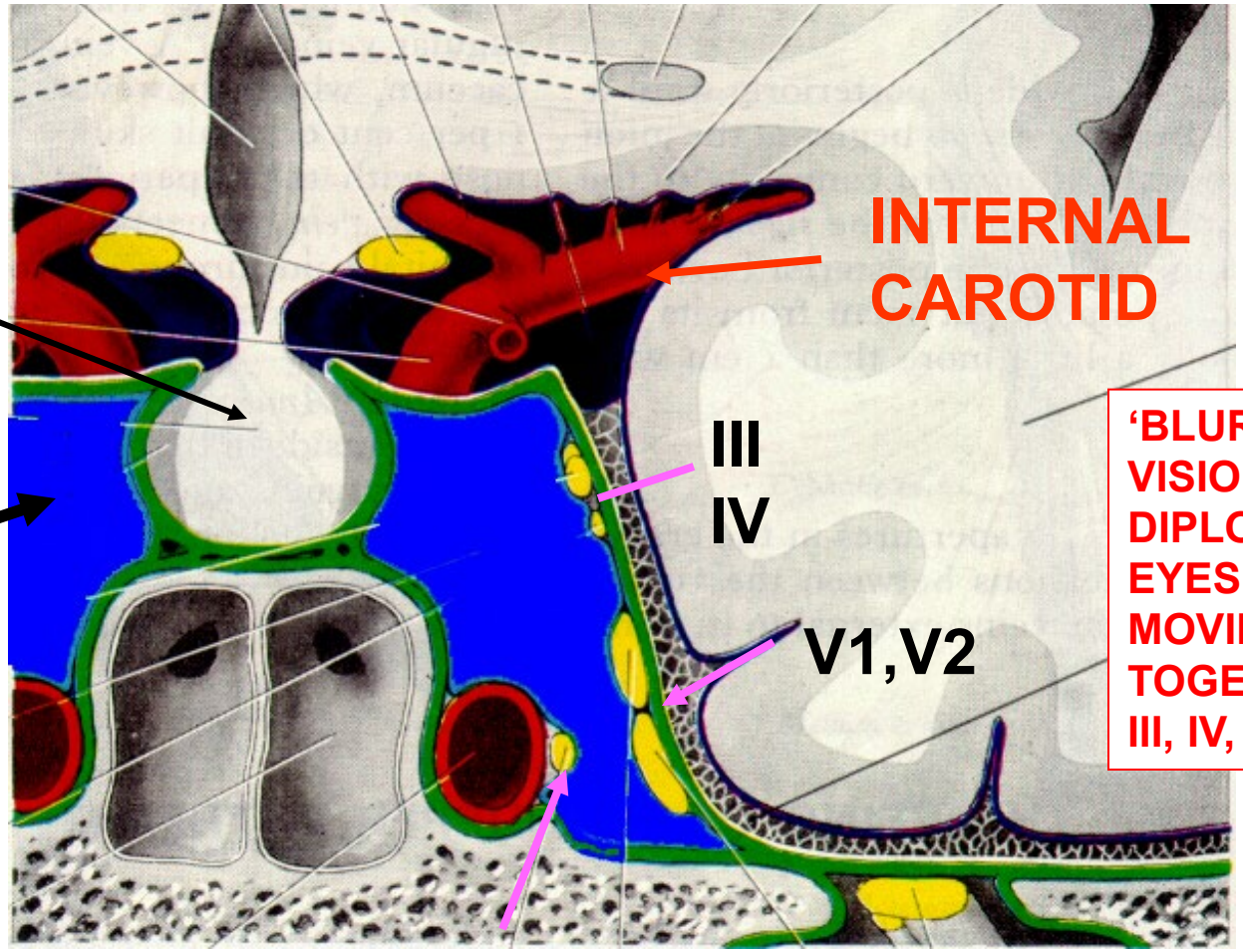


Internal Carotid Artery – Passes Through Wall of Cavernous Sinus **

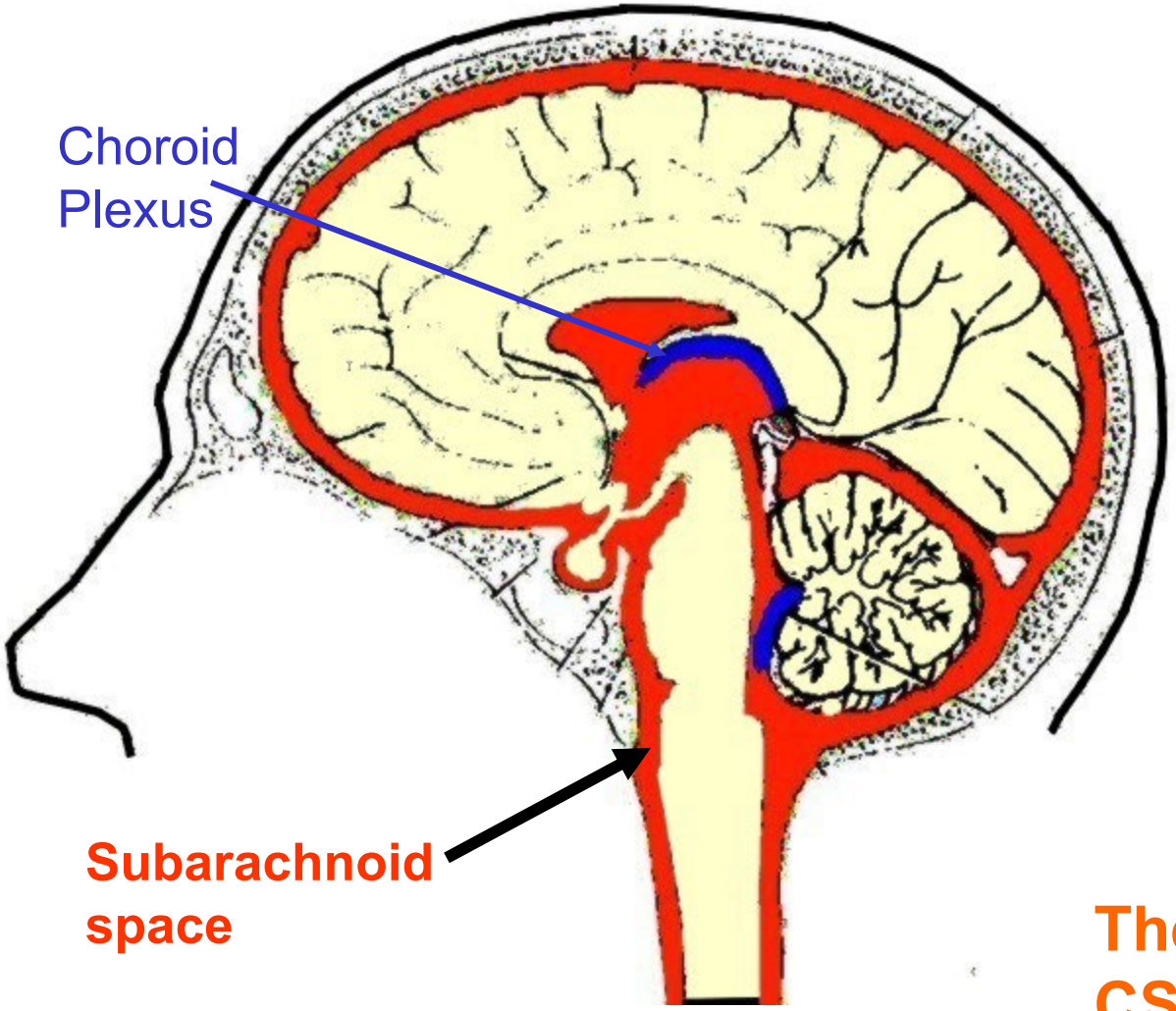


Carotid-Cavernous Fistula - Bleed of Internal Carotid Artery inside Cavernous Sinus

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



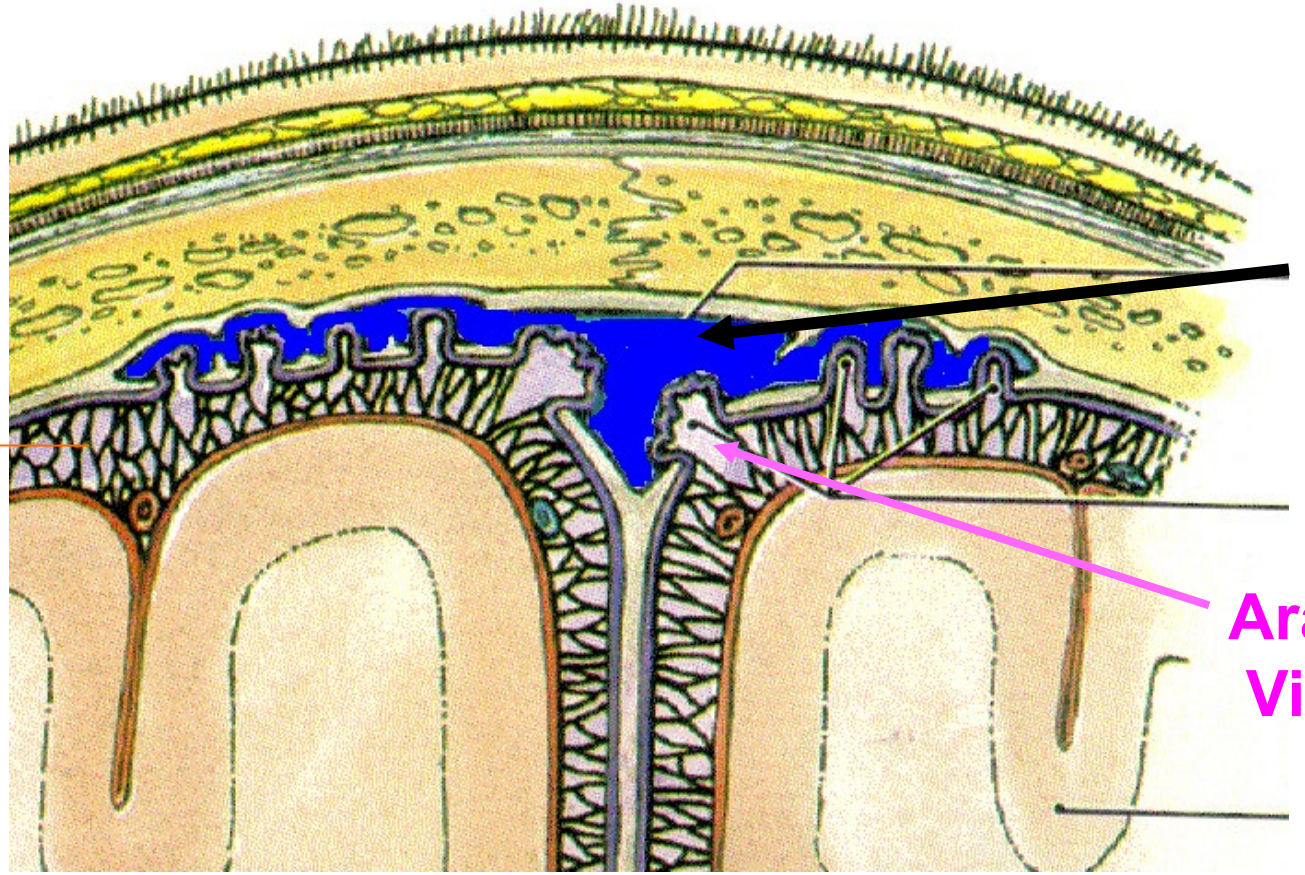
IV. CEREBRO-SPINAL FLUID (CSF)



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

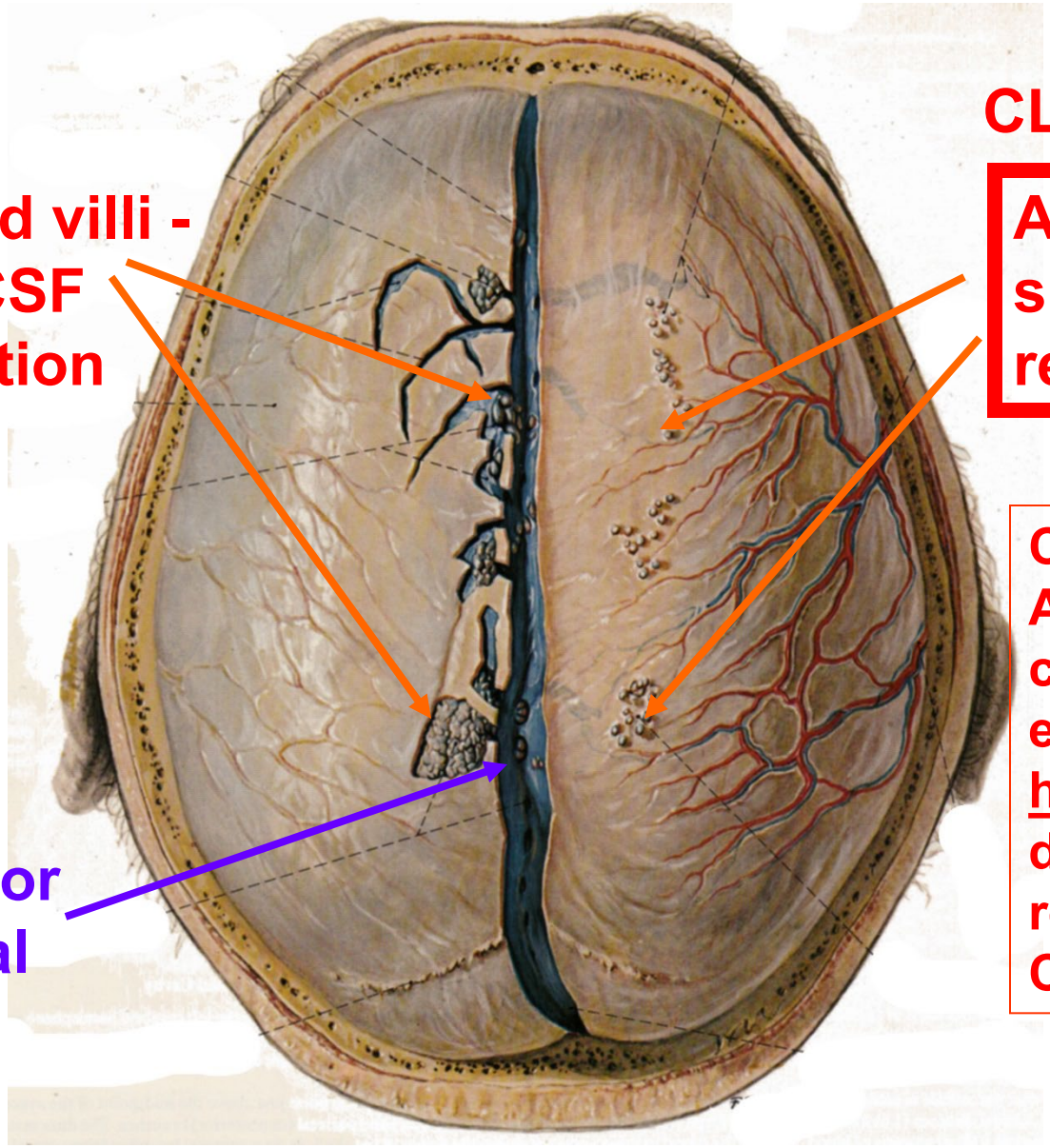
The brain floats in CSF - Shock Absorber

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

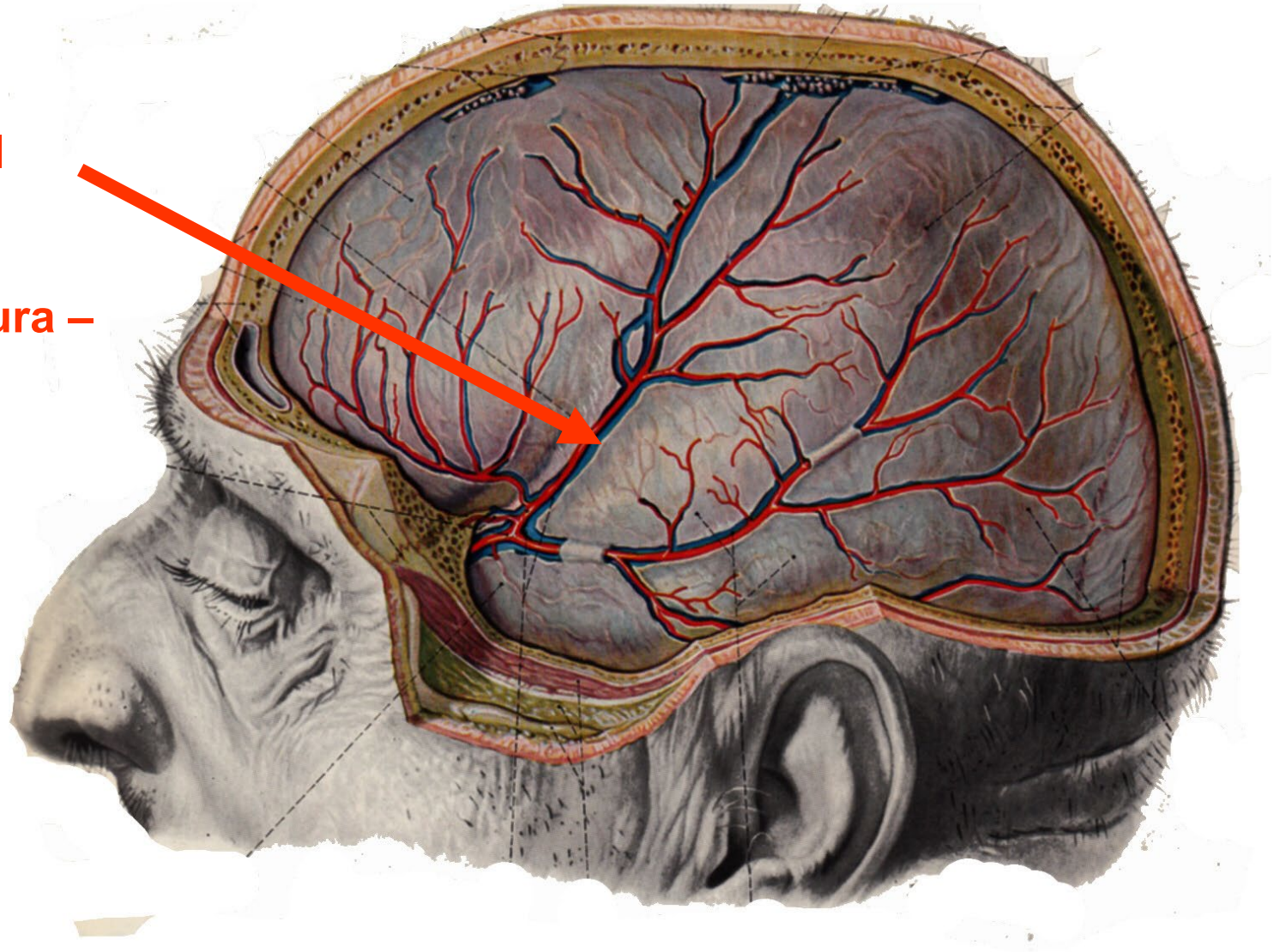
CLINICAL **

Arachnoid villi - sites of CSF reabsorption

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

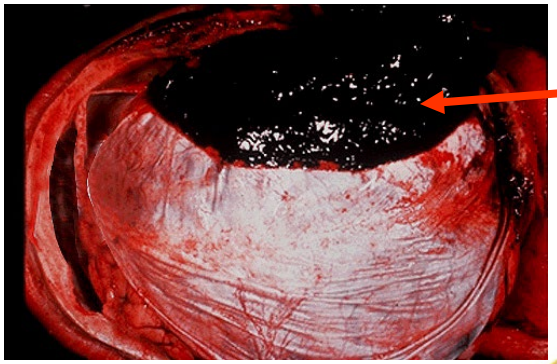
V. HEMATOMAS - INTERNAL BLEEDS

Middle Meningeal Artery – courses outside dura – supplies calvarium

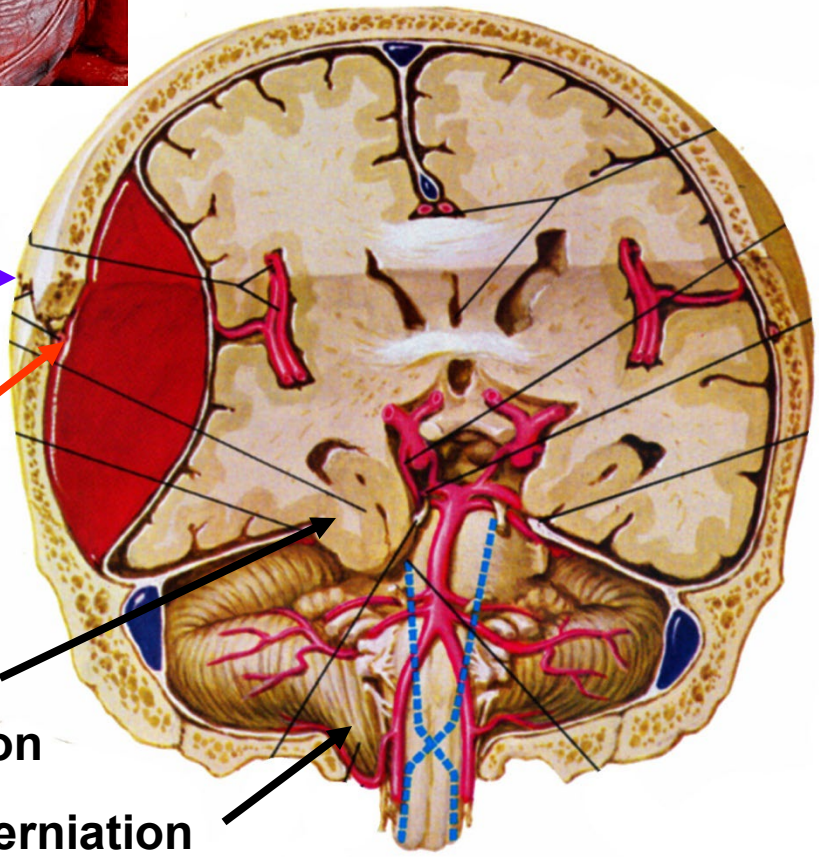


HEMATOMA
= abnormal mass of blood outside blood vessel

A. EPIDURAL HEMATOMA - bleeding between dura and bone



EPIDURAL HEMATOMA



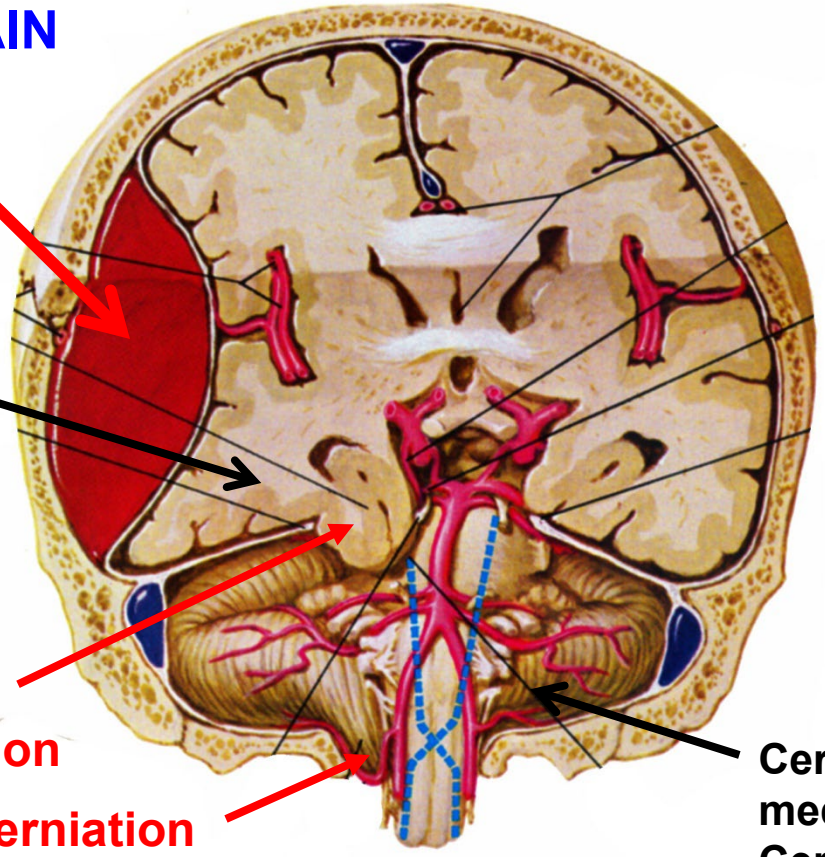
1) Skull fracture near Pterion
2) Tear Middle Meningeal Artery
3) Blood 'peels' dura from bone
4) Lens shaped (biconvex) mass on CT

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



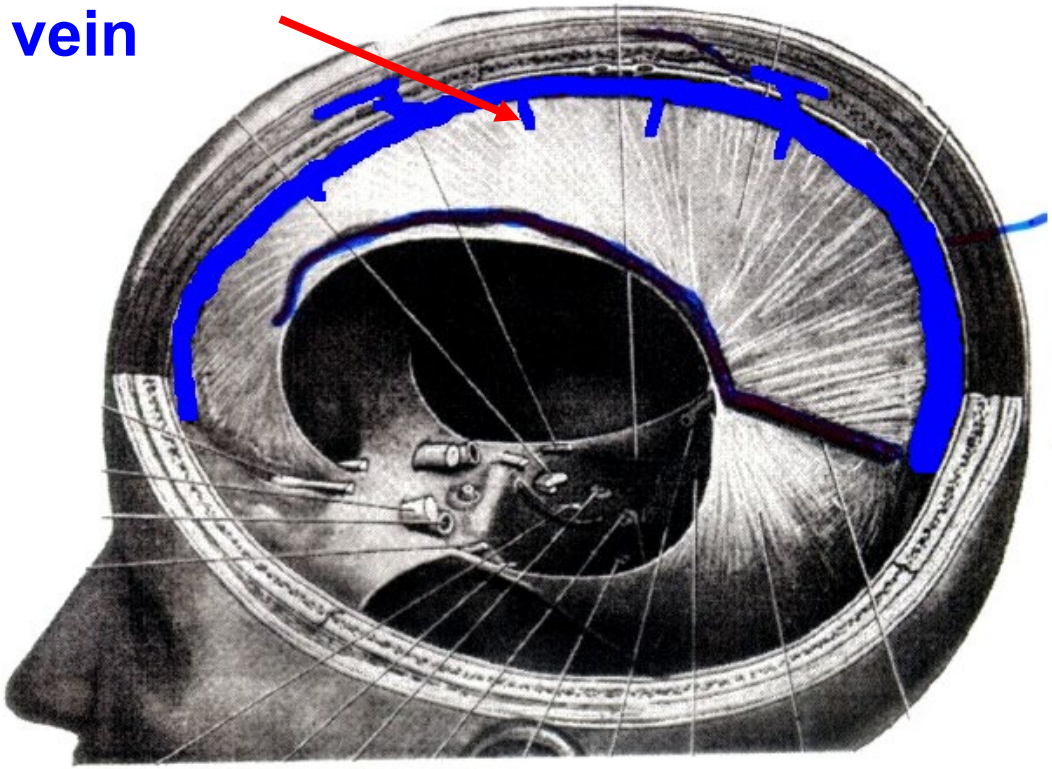
6) Herniation -

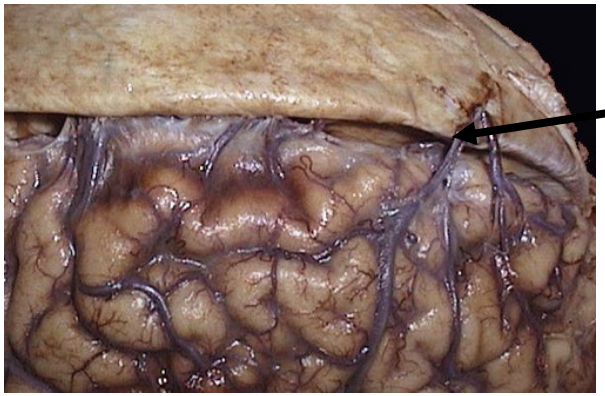
i. Uncal herniation - push Temporal lobe (uncus) through Tentorial Notch

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





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

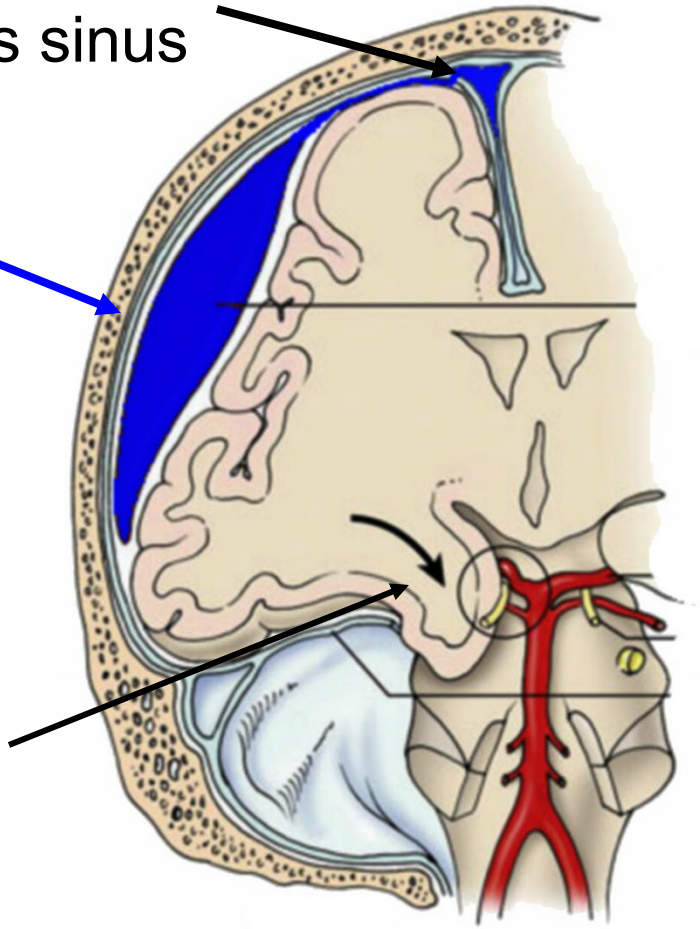
Photo from lecture of Dr. Nancy Norton

SUBDURAL HEMATOMA

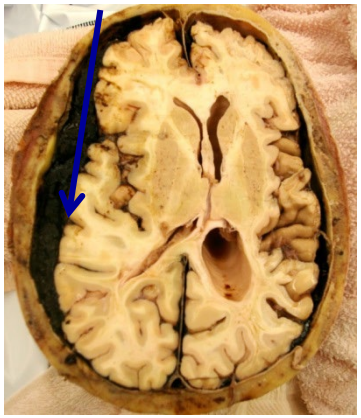
Tear 'bridging' vein
or venous sinus

Crescent
shaped
hematoma
on CT/MRI

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



SUBDURAL HEMATOMA
BLOOD

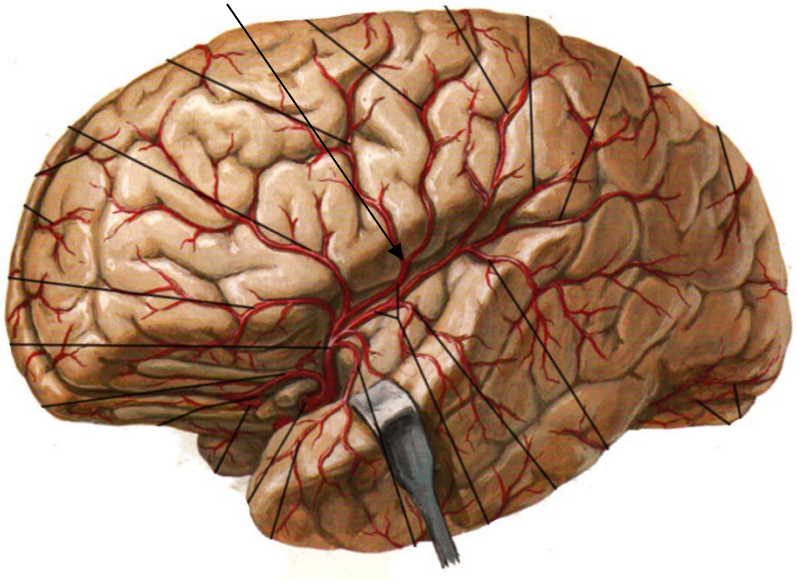


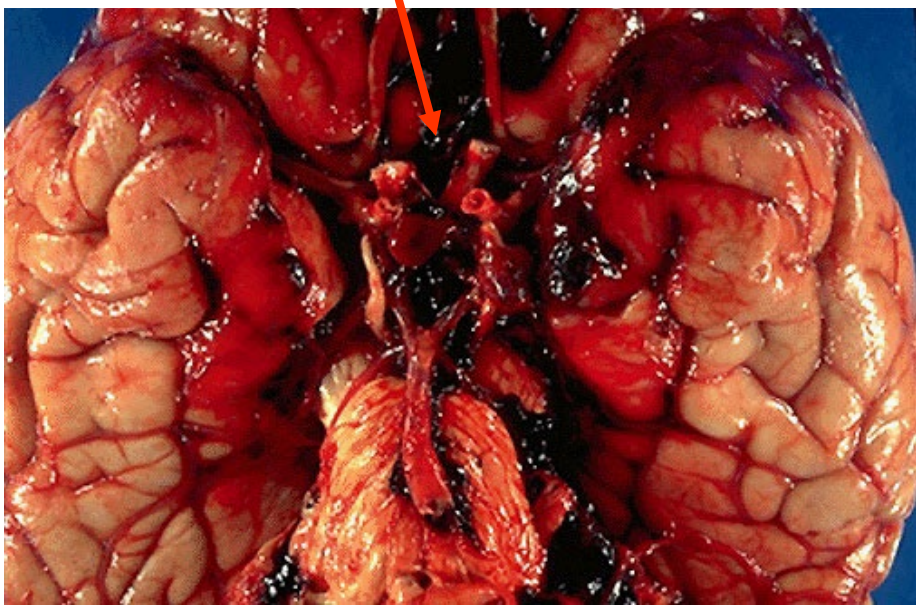
SUBDURAL ** HEMATOMA –
1) VENOUS – often BRIDGING VEIN
2) CRESCENT SHAPED MASS
3) SLOW

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

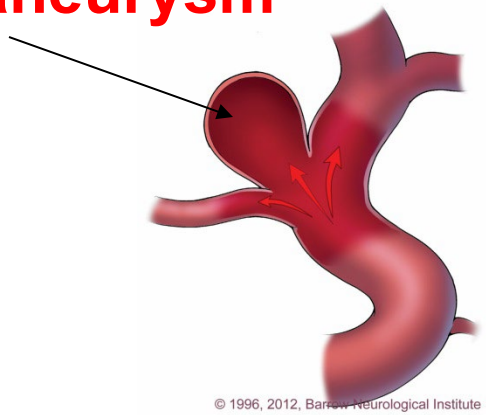
C. SUBARACHNOID HEMATOMA

Cerebral artery





Berry aneurysm



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

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