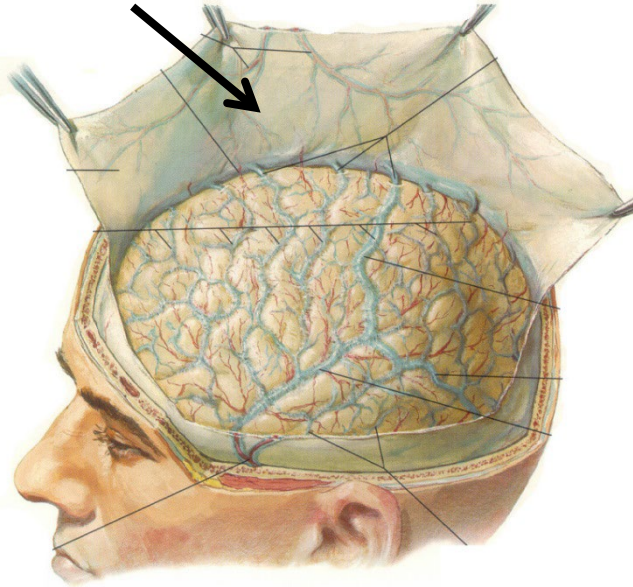


# MENINGES AND VENOUS SINUSES OF BRAIN

## EPIDURAL HEMATOMA



## DURA MATER



## OUTLINE

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

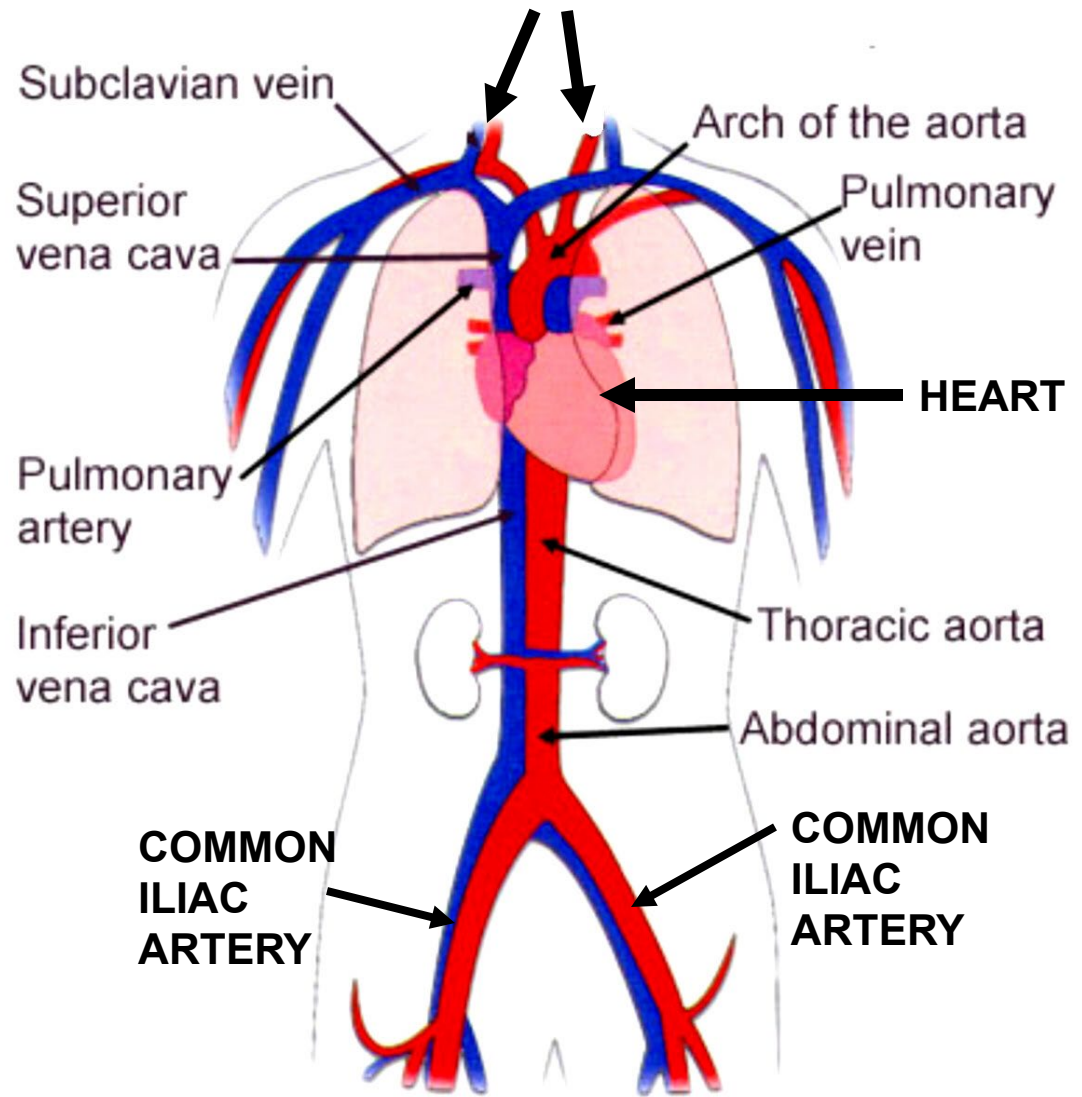
**FACT: CRANIAL CAVITY IS ENCLOSED BY BONE; THERE IS NO ROOM FOR EXPANSION INSIDE SKULL**

**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?

## COMMON CAROTID ARTERIES



# OVERVIEW OF BLOOD SUPPLY TO HEAD

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

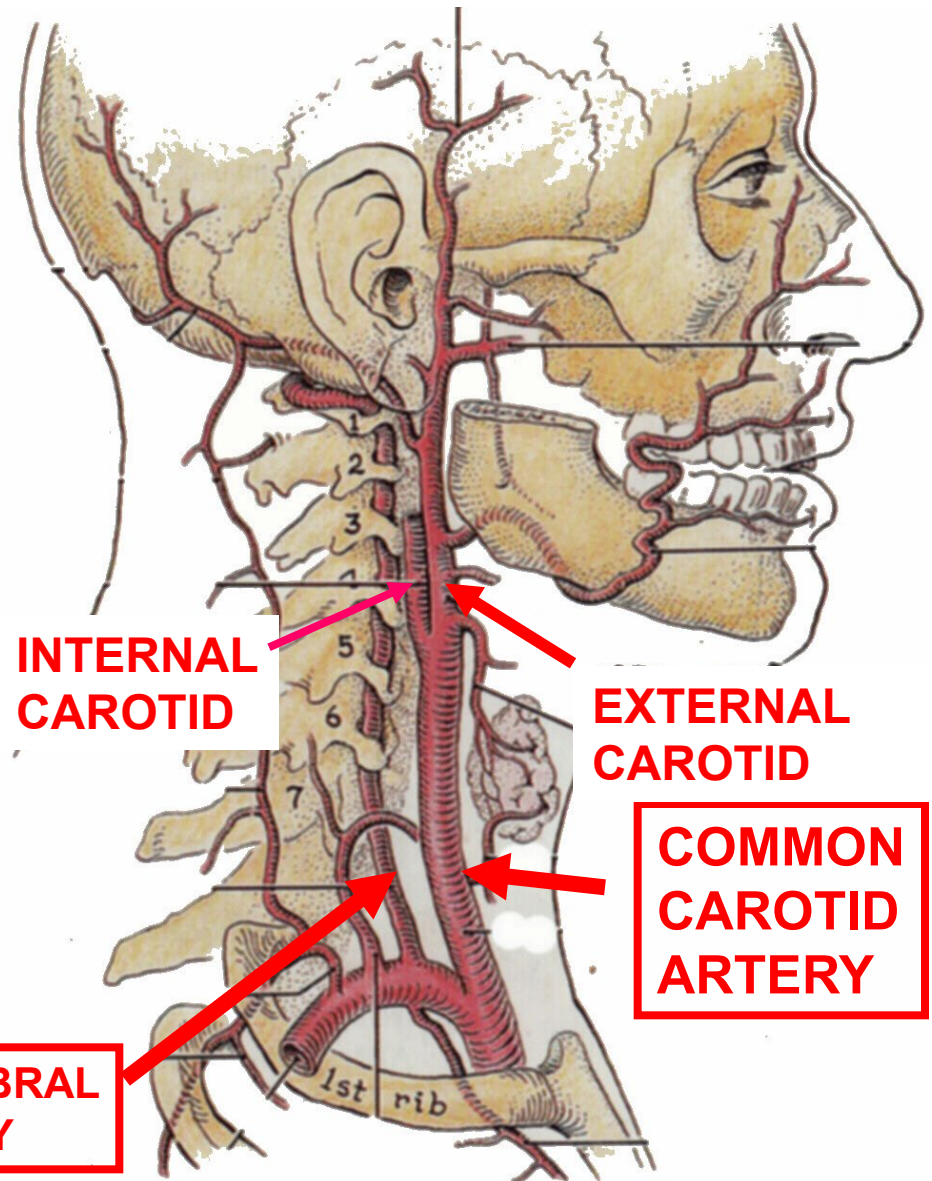
2) INTERNAL CAROTID ARTERY AND VERTEBRAL ARTERY SUPPLY BRAIN

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

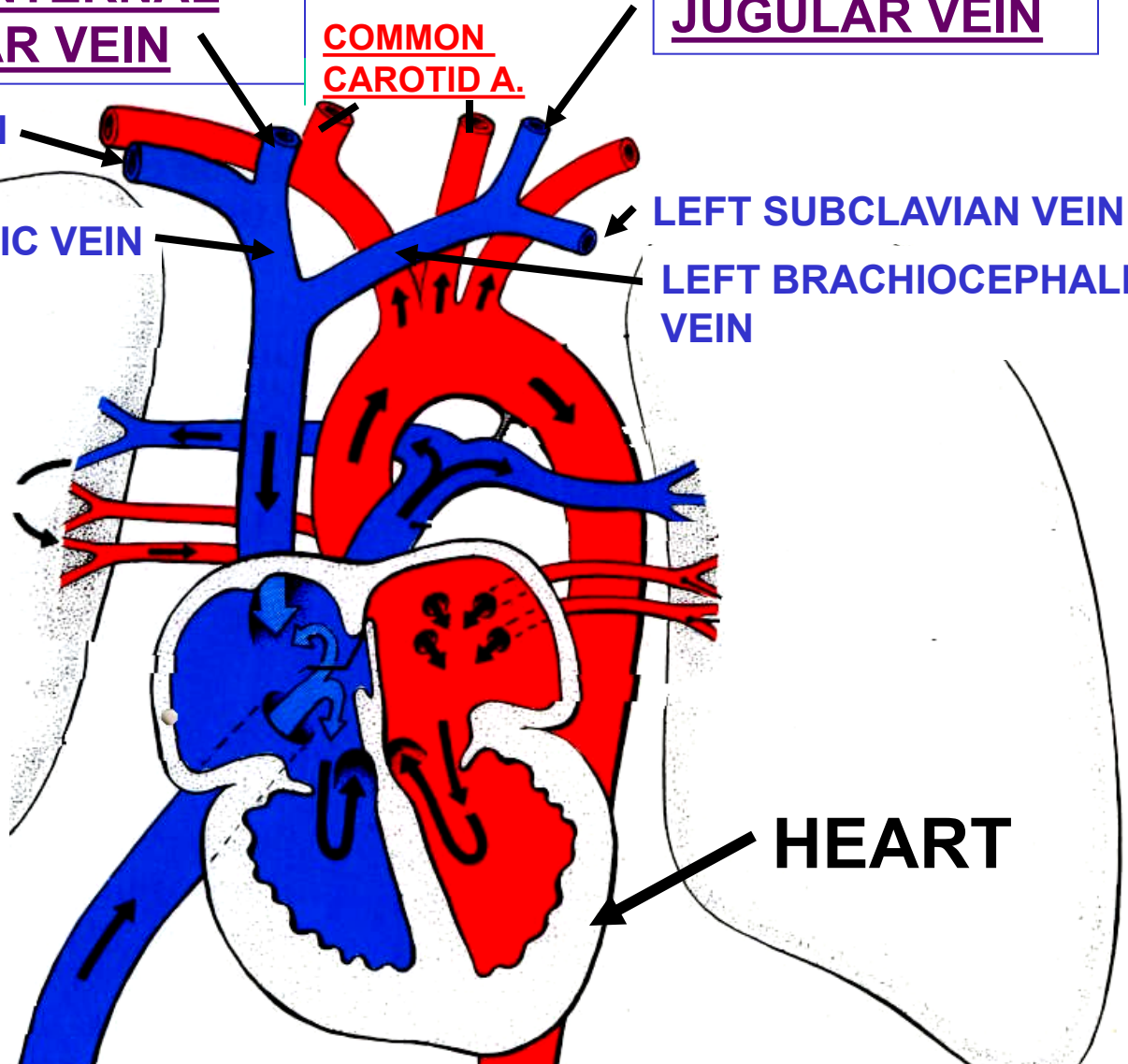
INTERNAL JUGULAR VEINS JOIN SUBCLAVIAN VEINS TO FORM BRACHIOCEPHALIC VEINS

RIGHT AND LEFT BRACHIOCEPHALIC VEINS FORM SUPERIOR VENA CAVA

LEFT SUBCLAVIAN VEIN

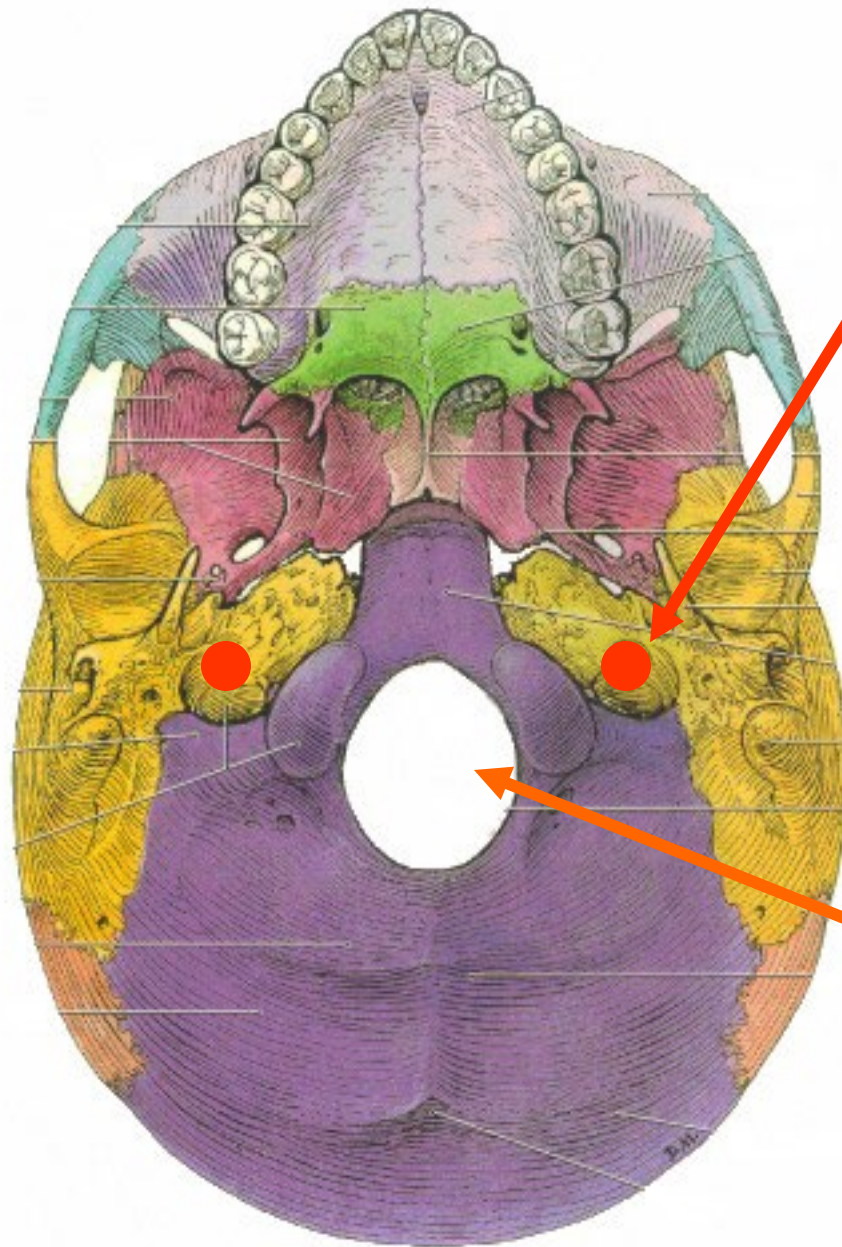
LEFT BRACHIOCEPHALIC VEIN

HEART







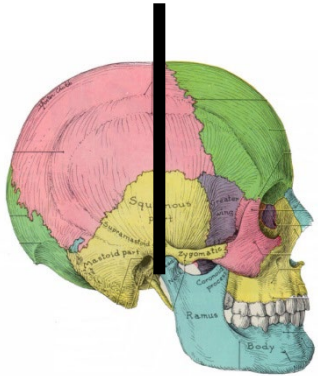


Internal Carotid Artery-  
enters skull  
via Carotid Canal  
And Foramen  
Lacerum

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

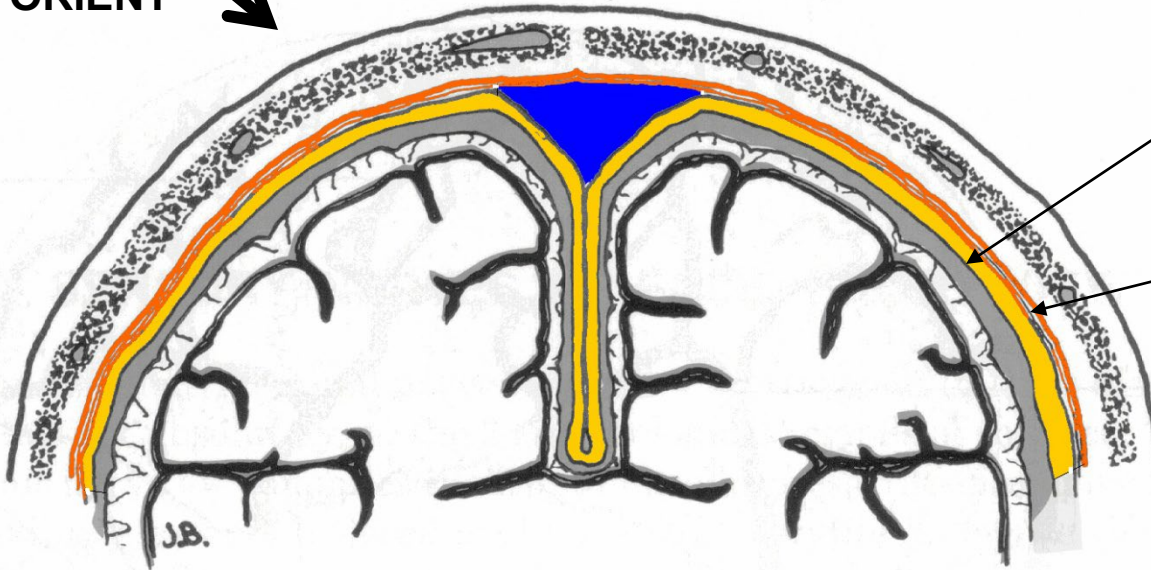
**A. DURA MATER - tough connective tissue layer, composed of two layers -**

**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**

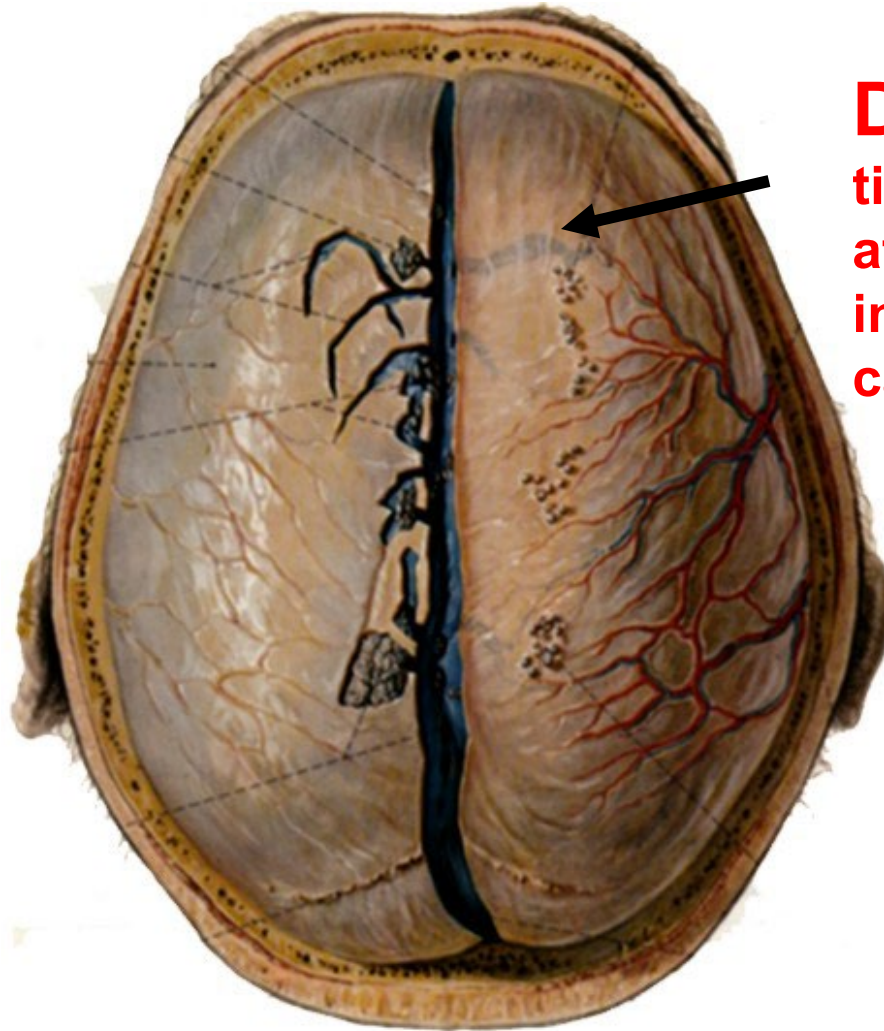
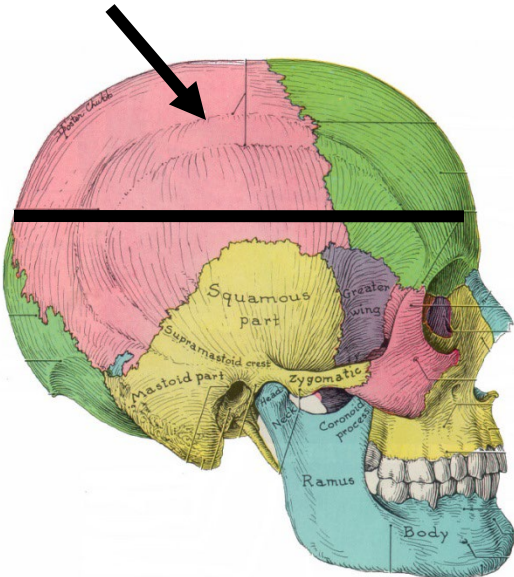
**Note: There is normally NO EPIDURAL SPACE IN SKULL as dura is fused to bone**





# DURA - 2 LAYERS ARE FUSED IN MOST PLACES

Orient - remove  
**CALVARIUM =  
SKULL  
CAP**



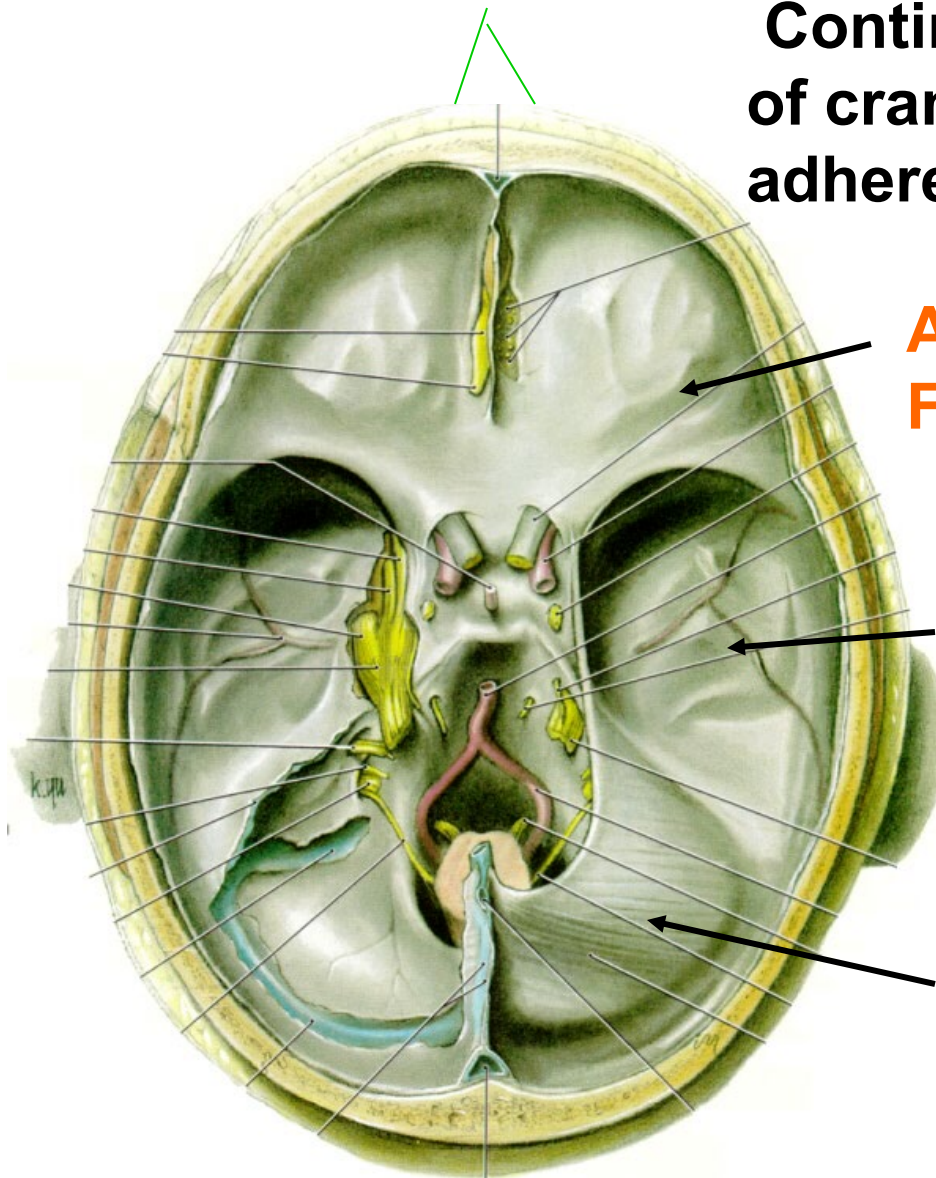
**DURA** is  
tightly  
attached to  
inner side of  
calvarium

**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**

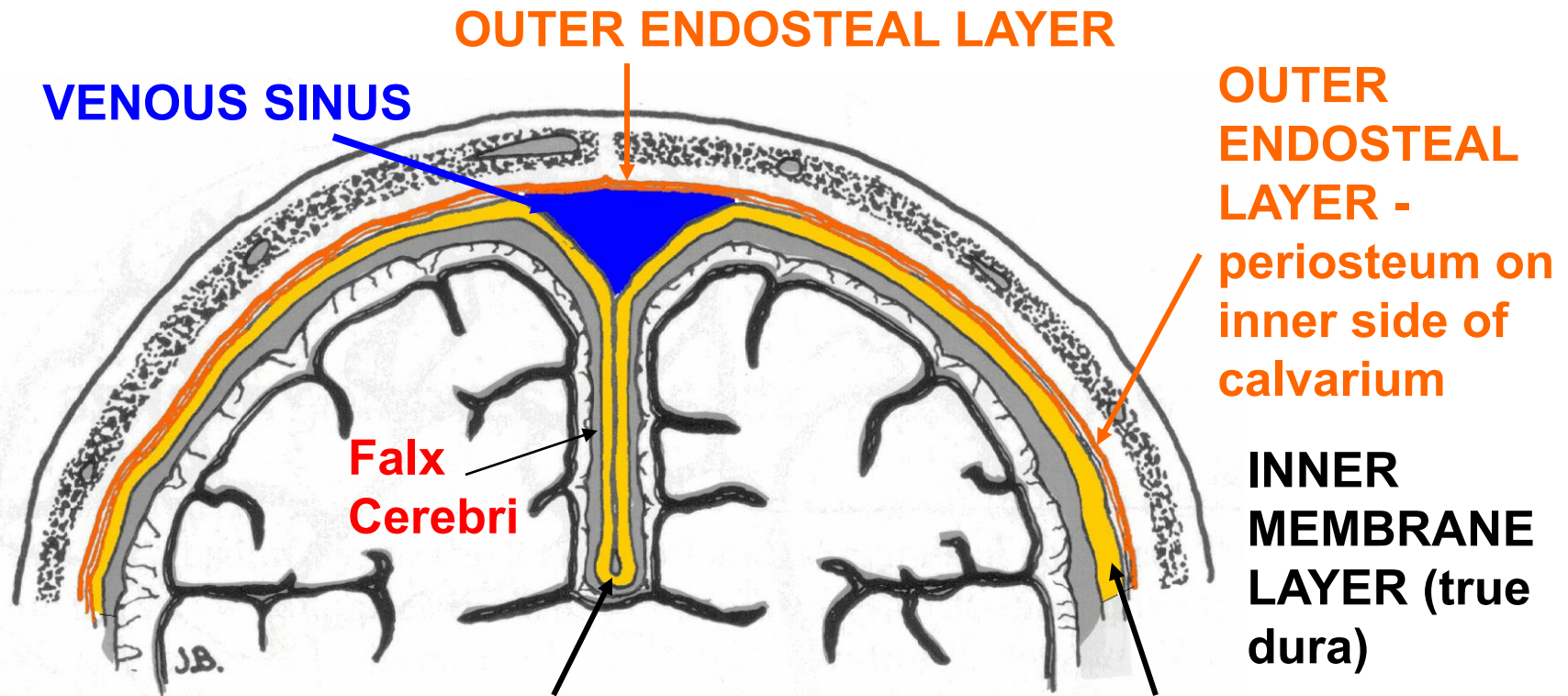
**Middle Cranial Fossa**

**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)**

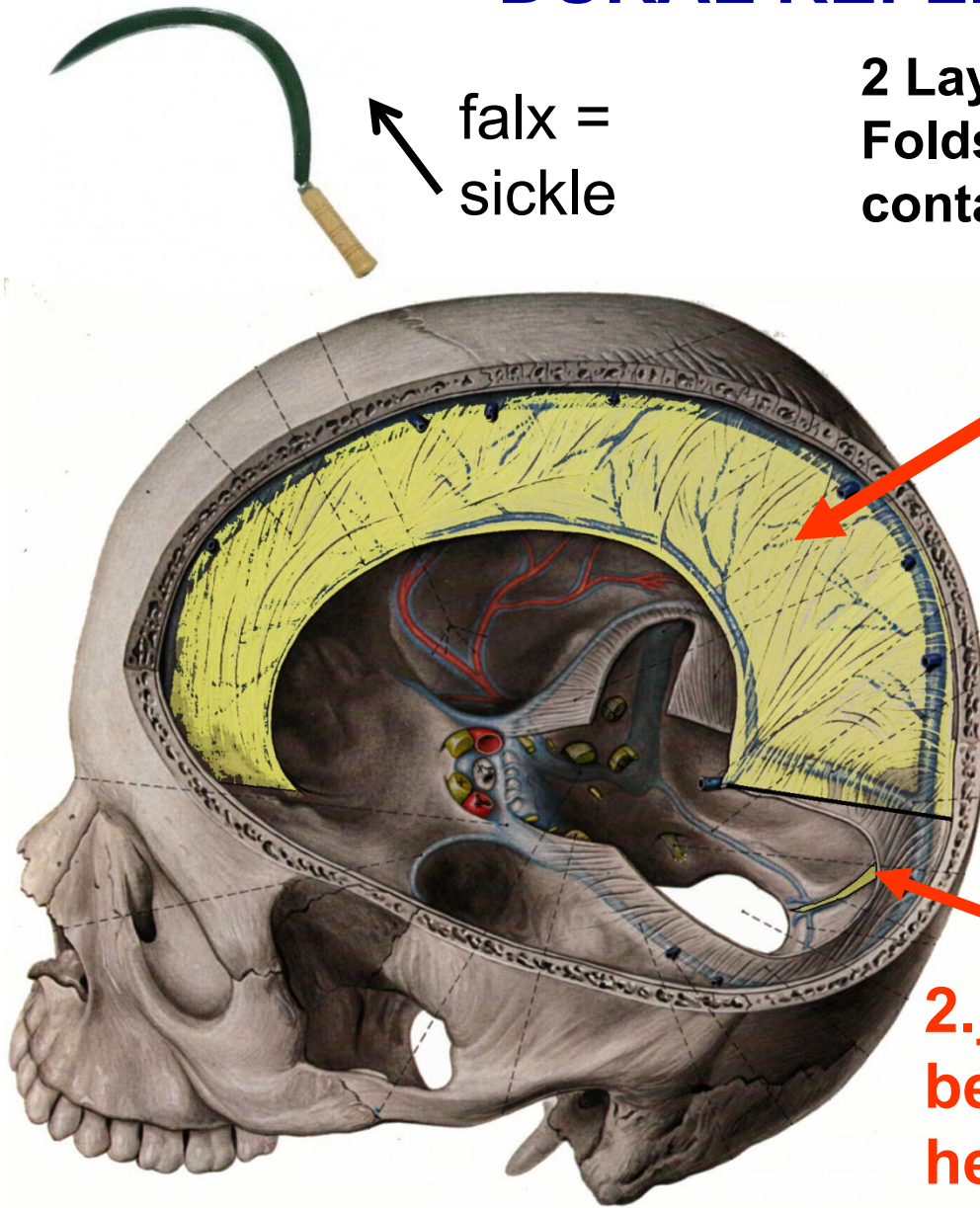
**Reflection = dura**  
**projects out and turns**  
**back**

# DURAL REFLECTIONS

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

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

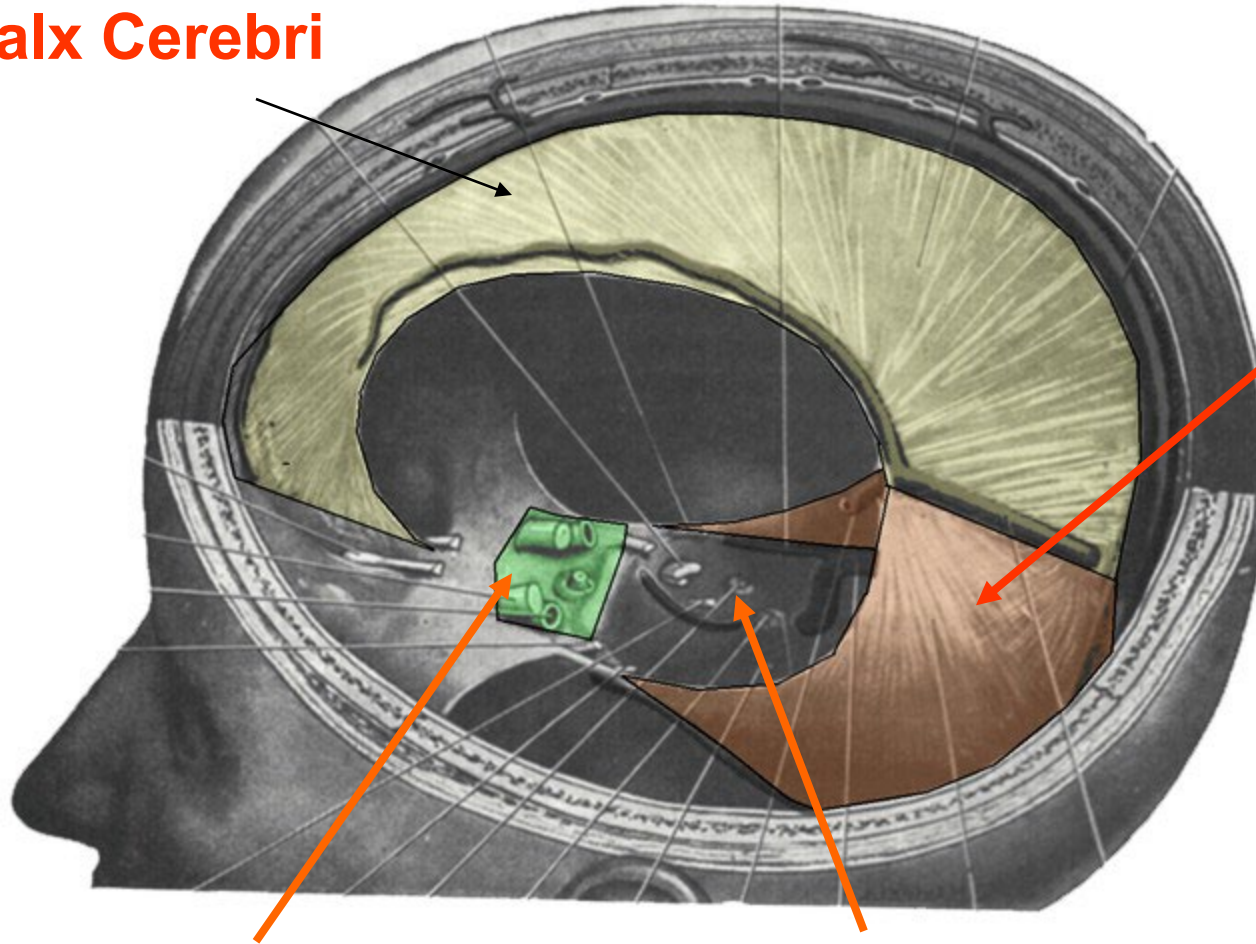
2. Falx Cerebelli - smaller between cerebellar hemispheres along post. wall of Post. Cran. Fossa





# DURAL REFLECTIONS

**Falx Cerebri**



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

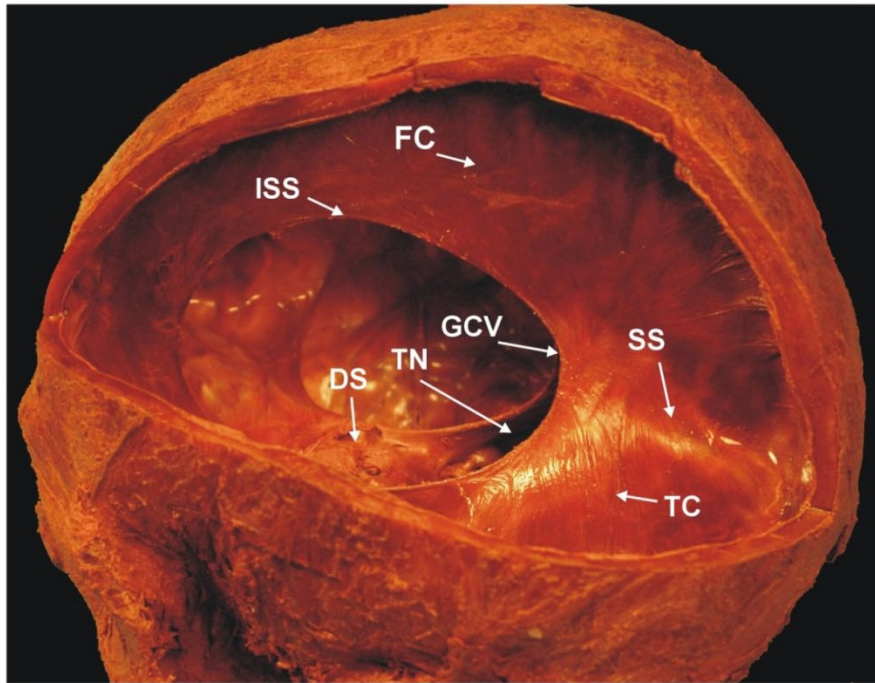
**4. Diaphragma Sella – fold over sella turcica**

**Tentorial Notch – opening for brainstem**

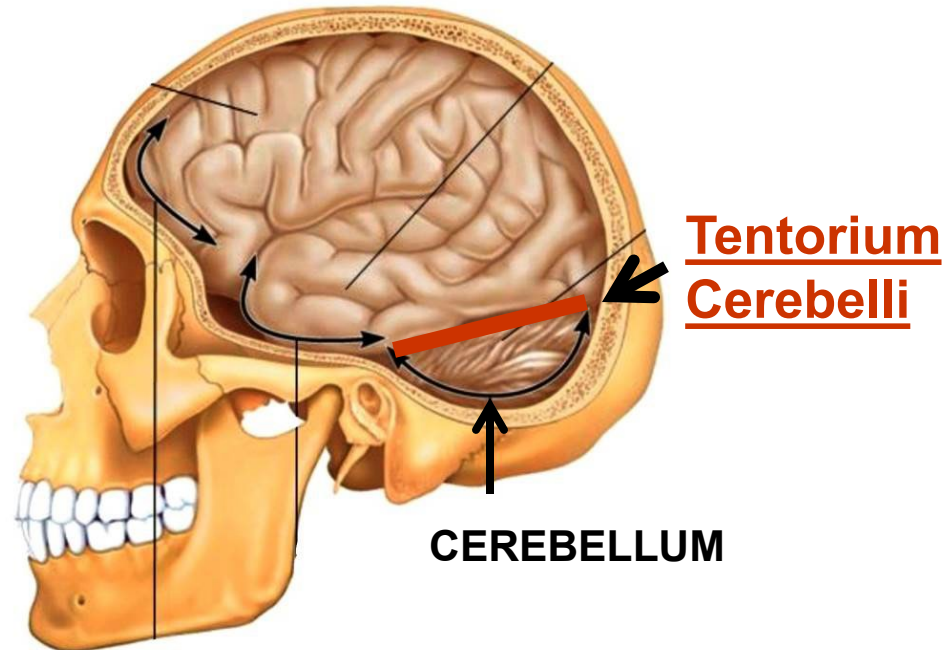
# LOOK AT PROSECTION 279 – 'RED HEAD'

279

## DURAL REFLECTIONS AND VENOUS SINUS



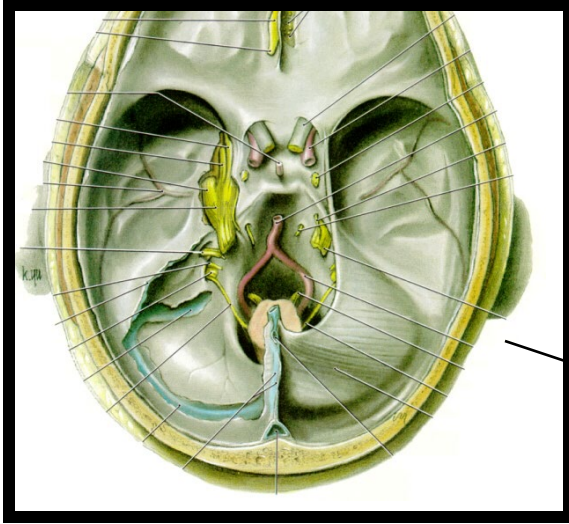
- FC - FALX CEREBRI
- TC - TENTORIUM CEREBELLI
- ISS - LOCATION OF INFERIOR SAGITTAL SINUS
- SS - LOCATION OF STRAIGHT SINUS
- GCV - OPENING OF GREAT CEREBRAL VEIN OF GALEN
- DS - DIAPHRAGMA SELLA
- TN - TENTORIAL NOTCH



Tentorium Cerebelli =  
roof over Cerebellum

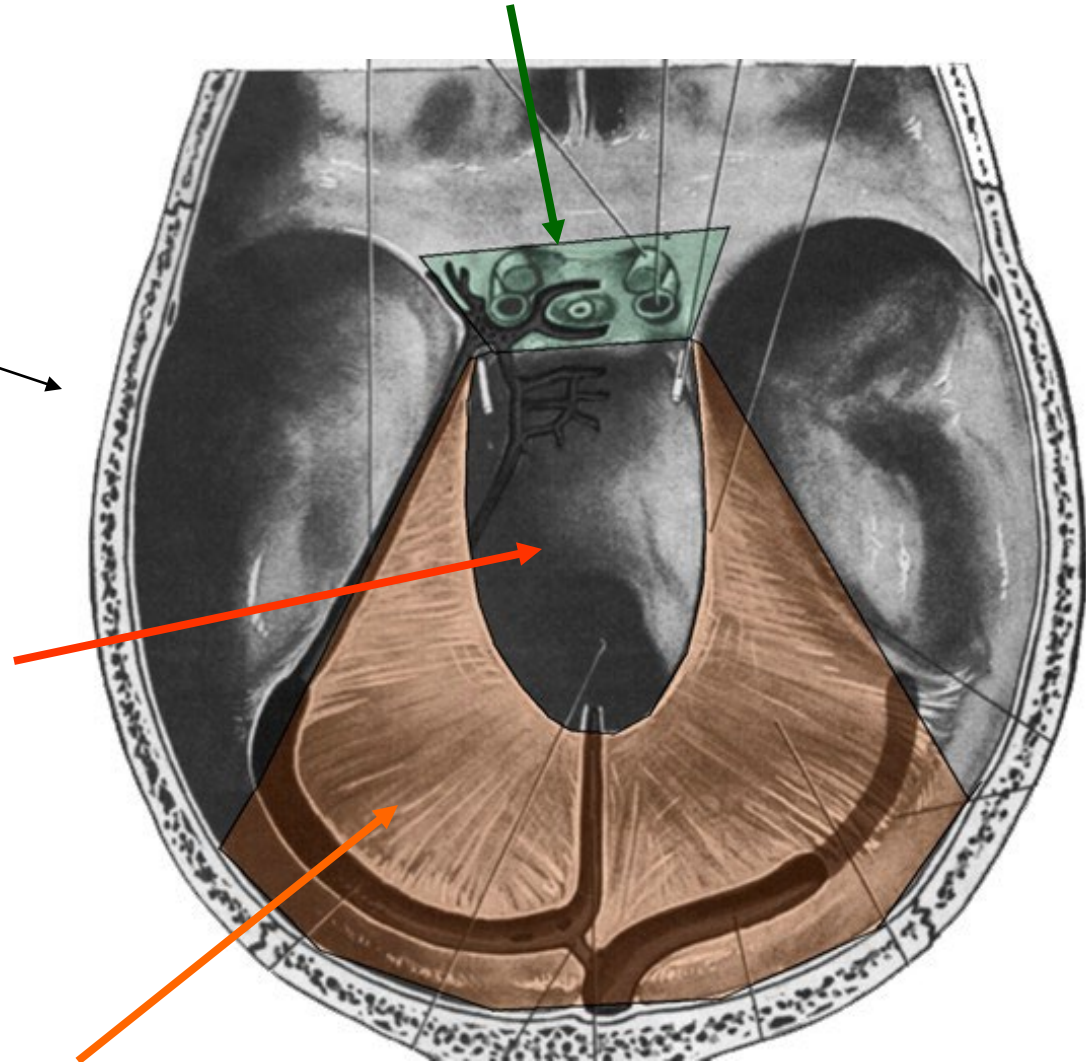
# DURAL REFLECTIONS

## 4. Diaphragma Sella – over sella turcica



view inside cranial cavity

**Tentorial Notch** –  
opening for  
brainstem

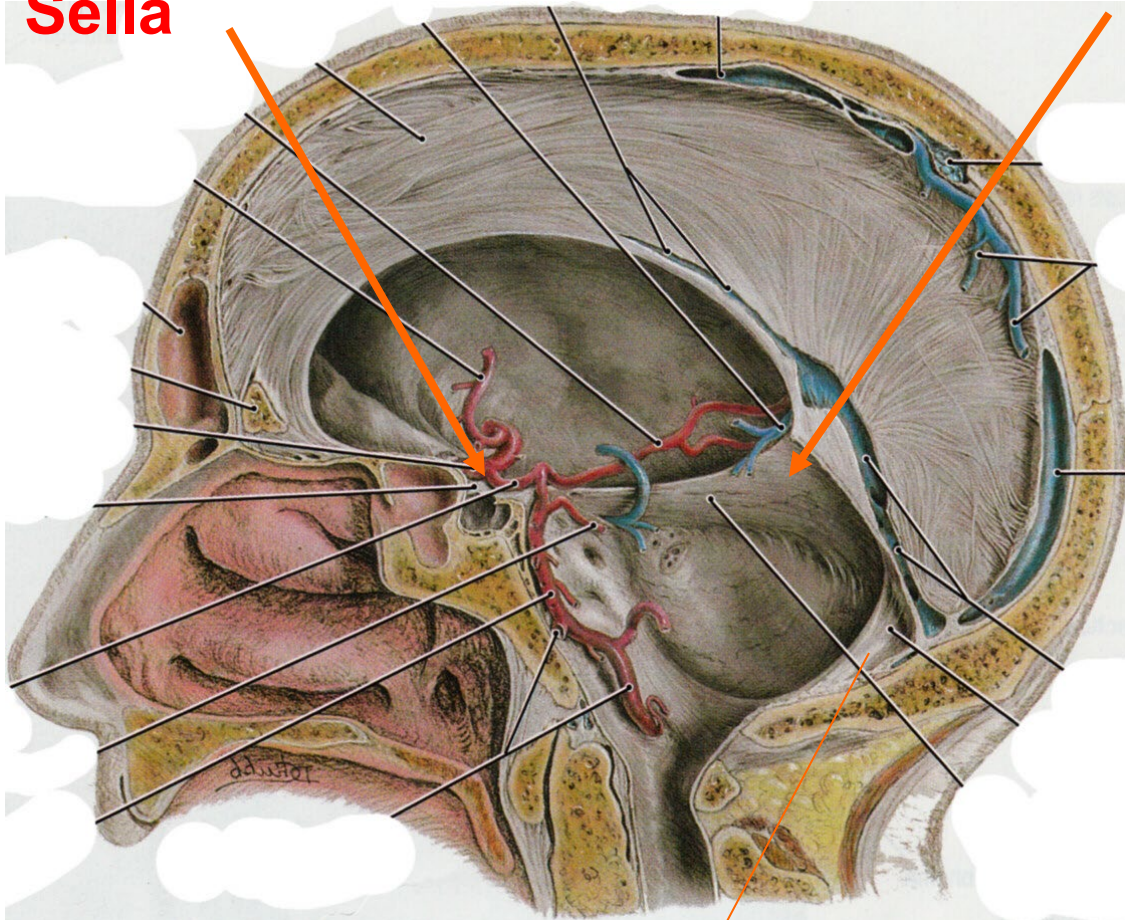


3. Tentorium Cerebelli – forms roof of post. cran. fossa



# DURAL REFLECTIONS

**Diaphragma  
Sella**



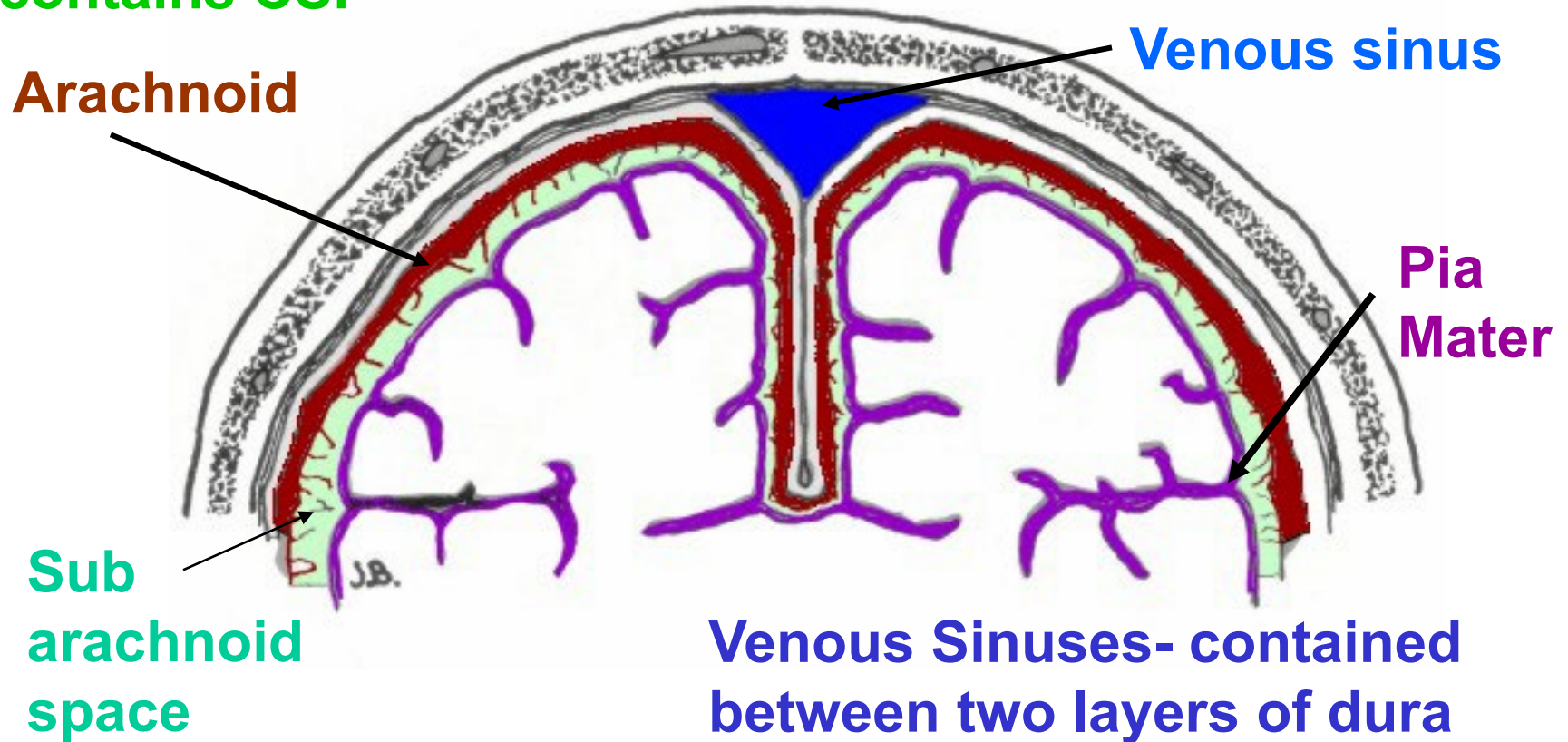
**Falx Cerebelli**

**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

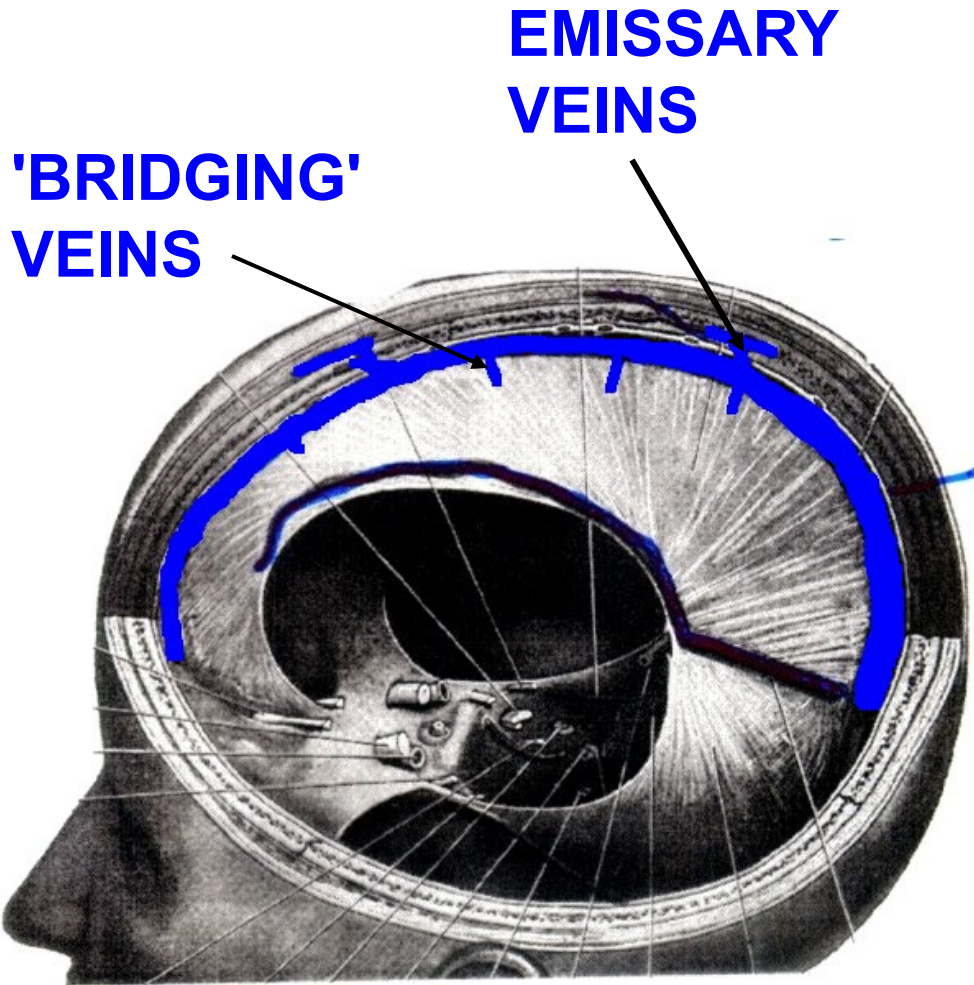
# MENINGES OF BRAIN

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



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)

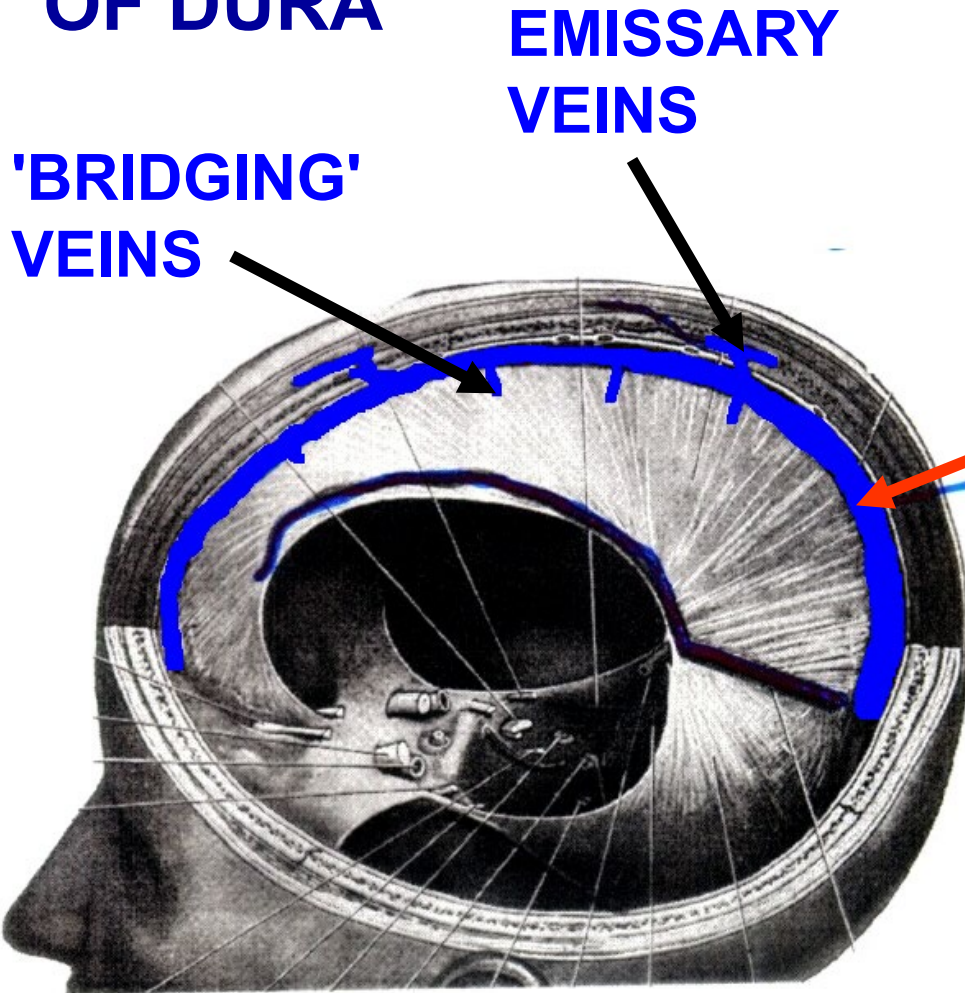
a. EMISSARY VEINS - drain blood from scalp, to venous sinuses

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

Brain removed



# III. VENOUS SINUSES – BETWEEN 2 LAYERS OF DURA



Brain removed

Receive blood from brain, orbit, emissary veins

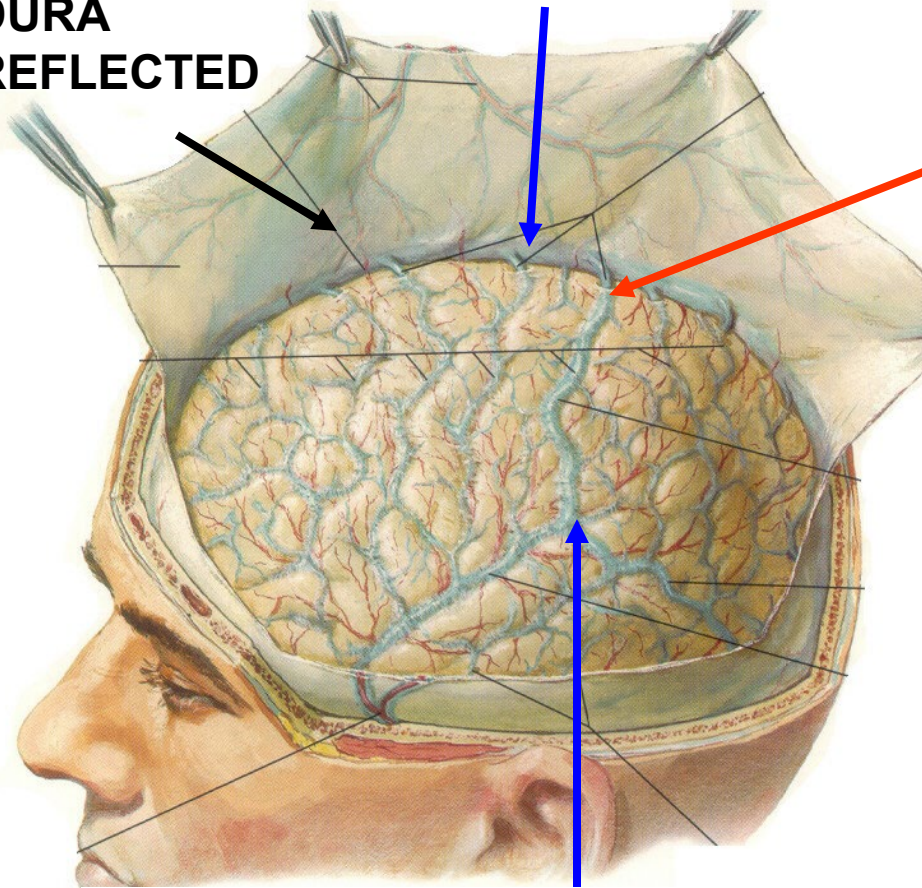
1. Superior Sagittal Sinus – in upper border of falx cerebri; ant. - foramen cecum; post- transverse sinus; - communicates laterally with venous lacunae; blood from Superior Cerebral veins through 'bridging veins'; blood also from emissary veins

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

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

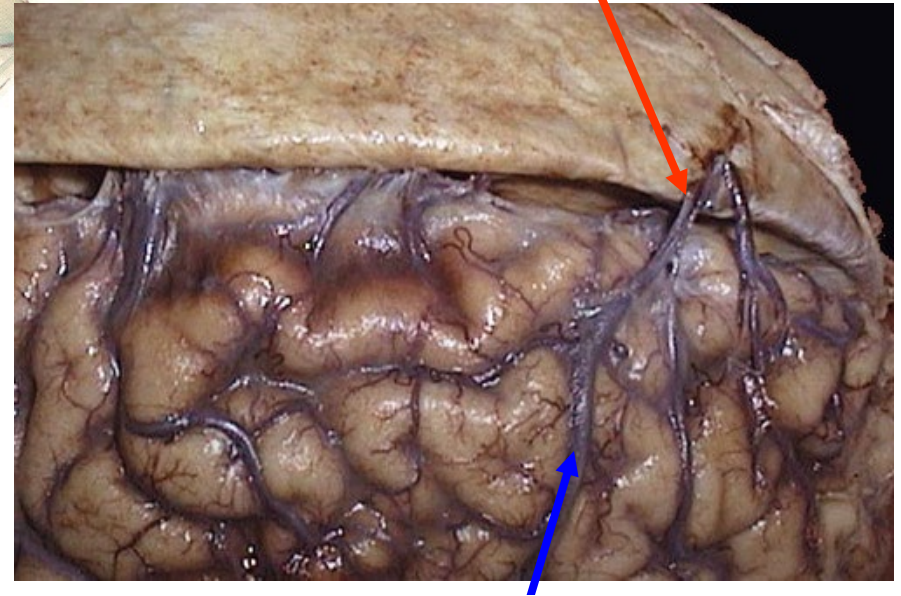
## Superior Sagittal Sinus

DURA REFLECTED



Superior Cerebral veins

**'BRIDGING' VEINS**



Superior Cerebral veins

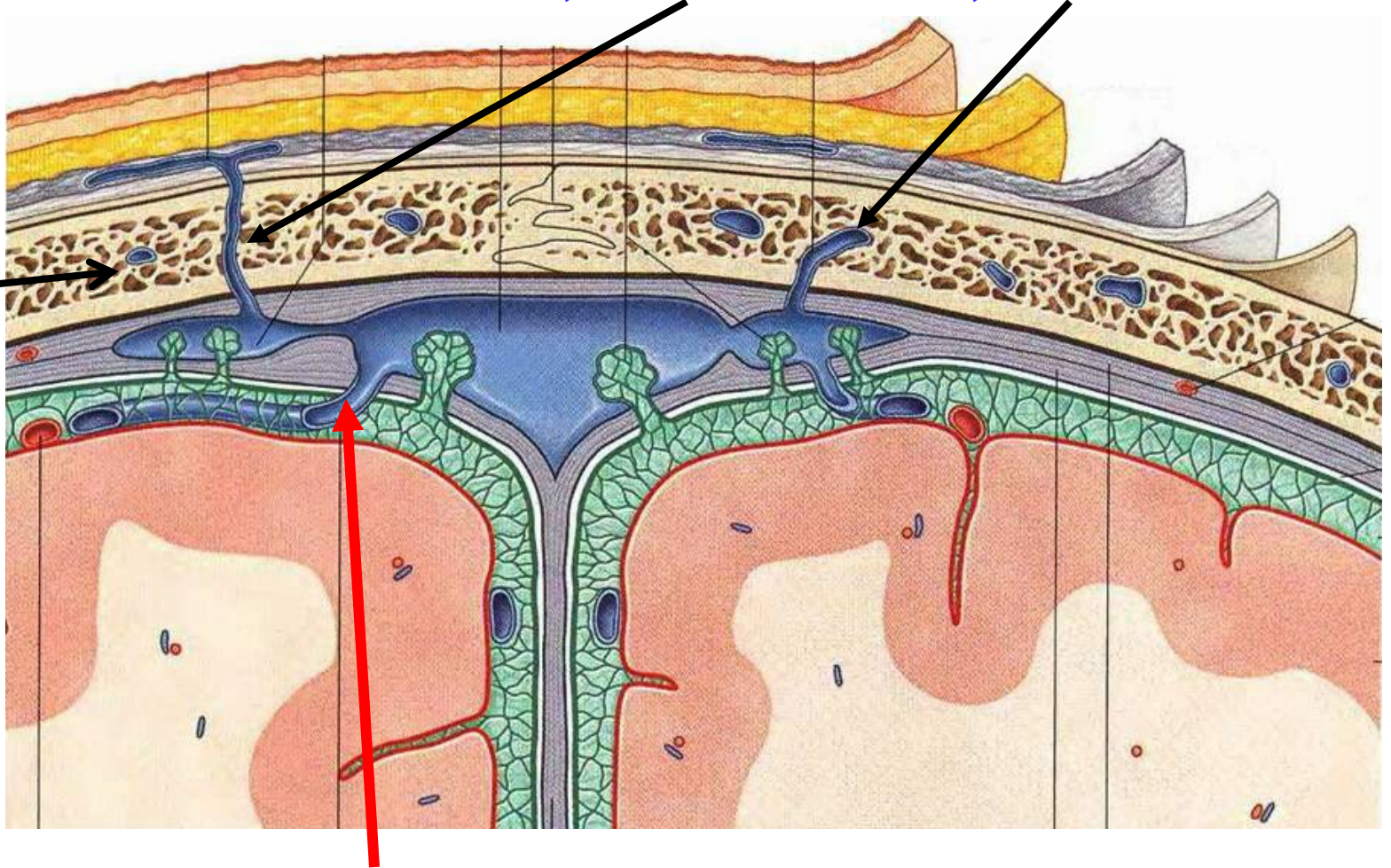
Photo from lecture of Dr. Nancy Norton



# EMISSARY VEINS VS. BRIDGING VEINS

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

DIPLOIC  
VEIN



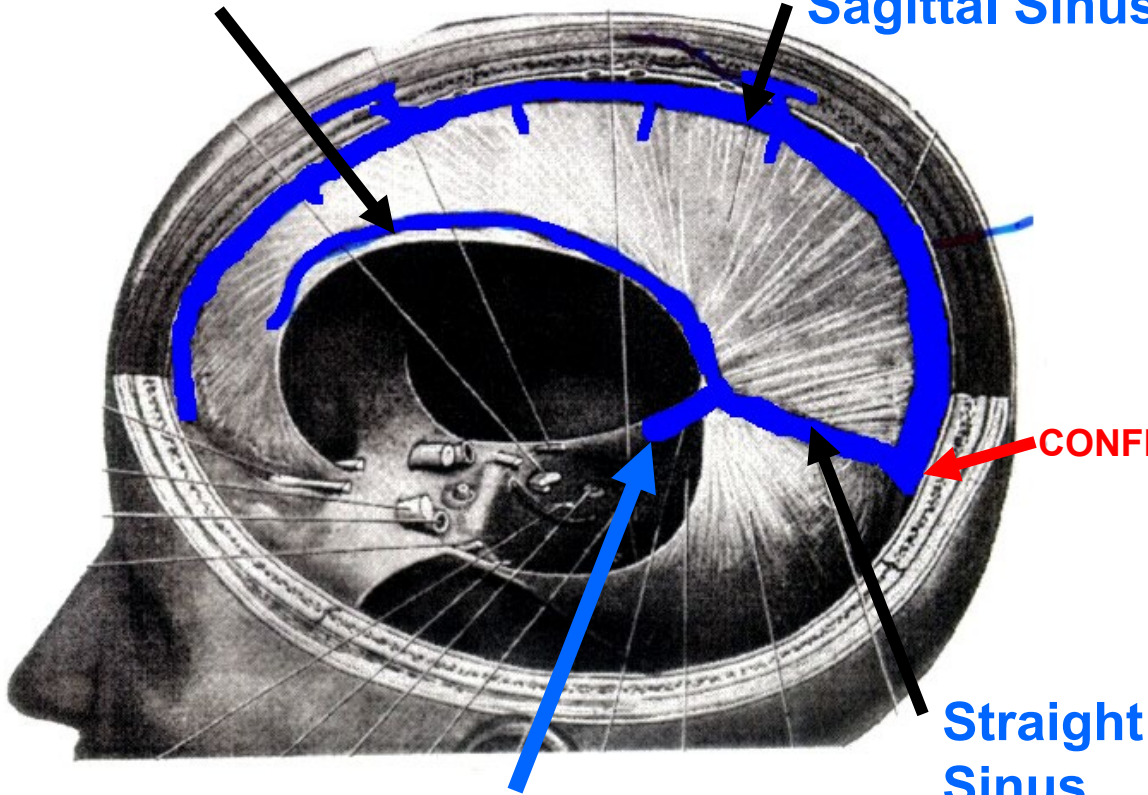
BRIDGING VEIN - CEREBRAL VEIN (BRAIN) TO SINUS



# VENOUS SINUSES

Inferior Sagittal Sinus

Superior Sagittal Sinus



Great Cerebral Vein (of Galen)

Straight Sinus

CONFLUENS

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

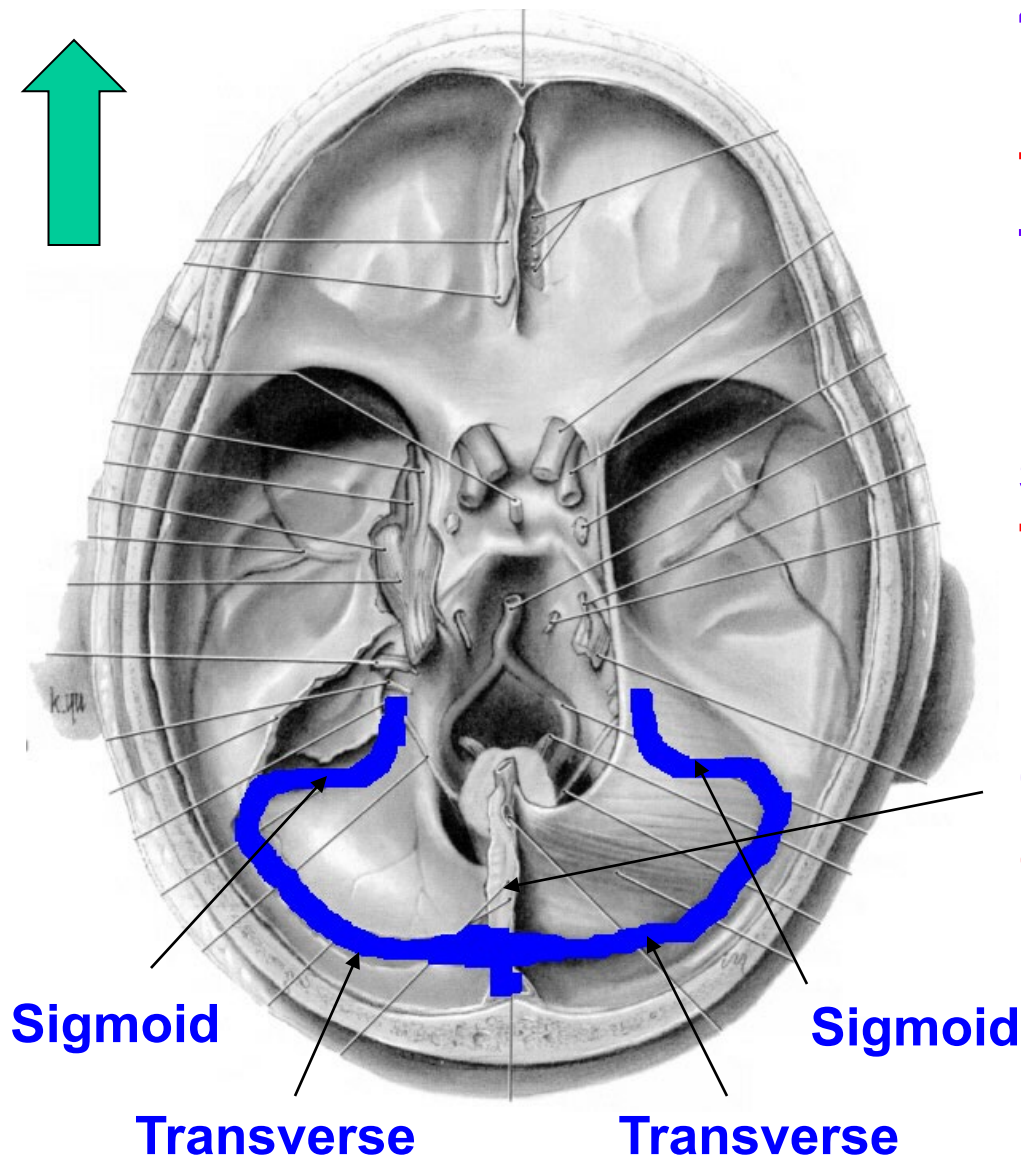
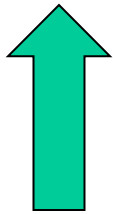
3. Straight sinus - at junction of falx cerebri and tentorium

**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

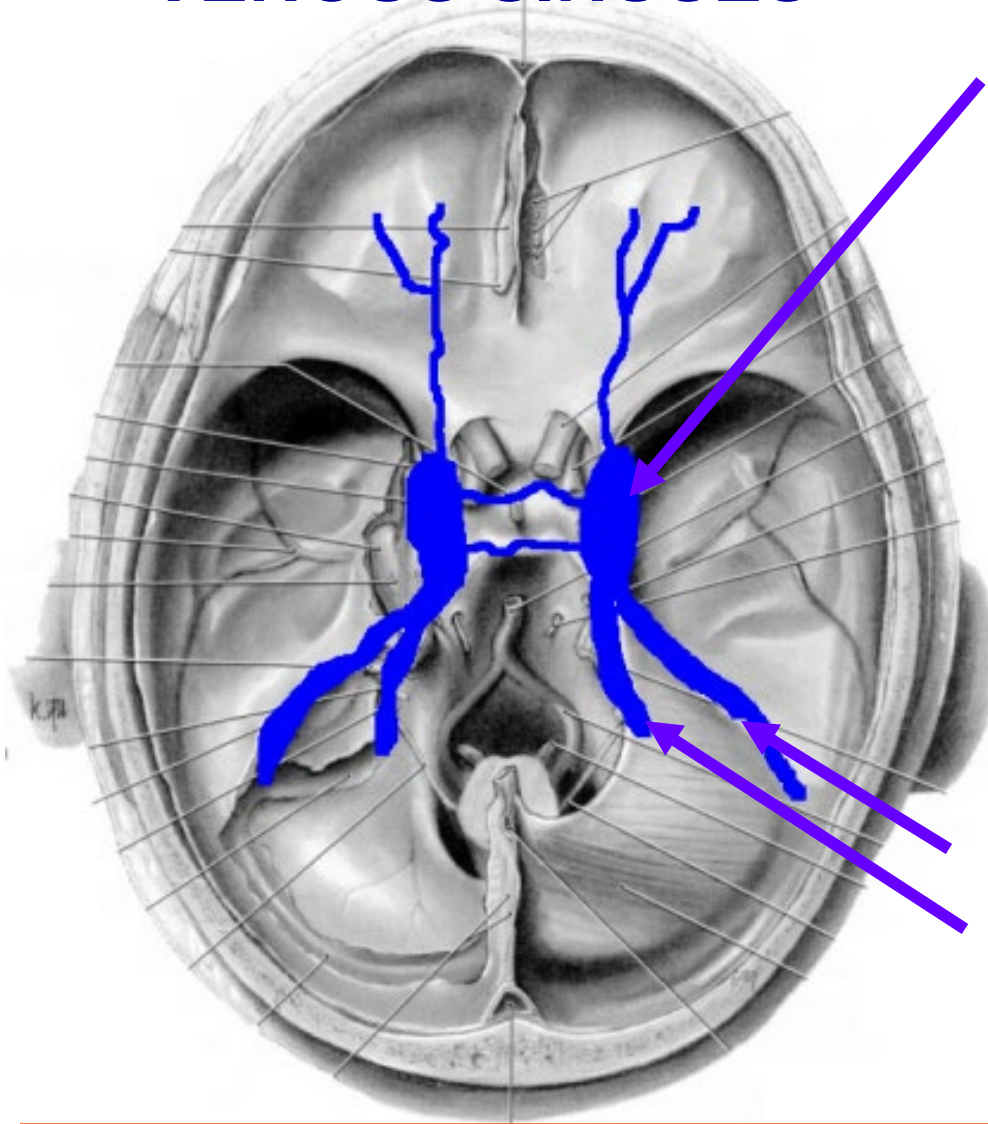


4. Transverse sinuses - in lateral fixed part of tentorium; receives blood from Sup. Sagittal or Confluens

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



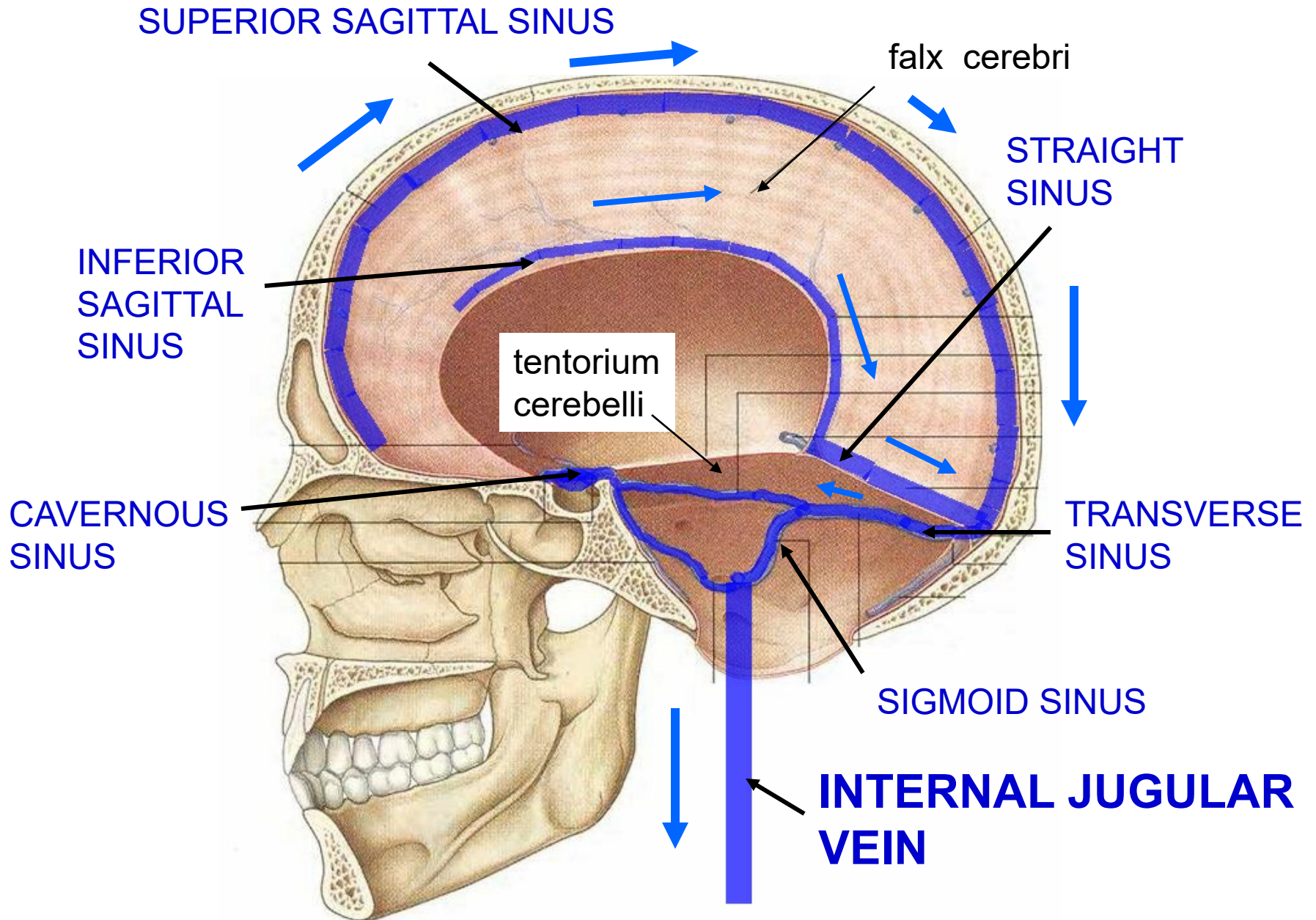
7. Cavernous sinuses - in middle cranial fossa; on side of the body of the sphenoid bone; connected by Intercavernous sinus; receive blood from Sup. and Inf. Ophthalmic veins, Cerebral veins; drain to Sup. and Inf. Petrosal sinuses

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



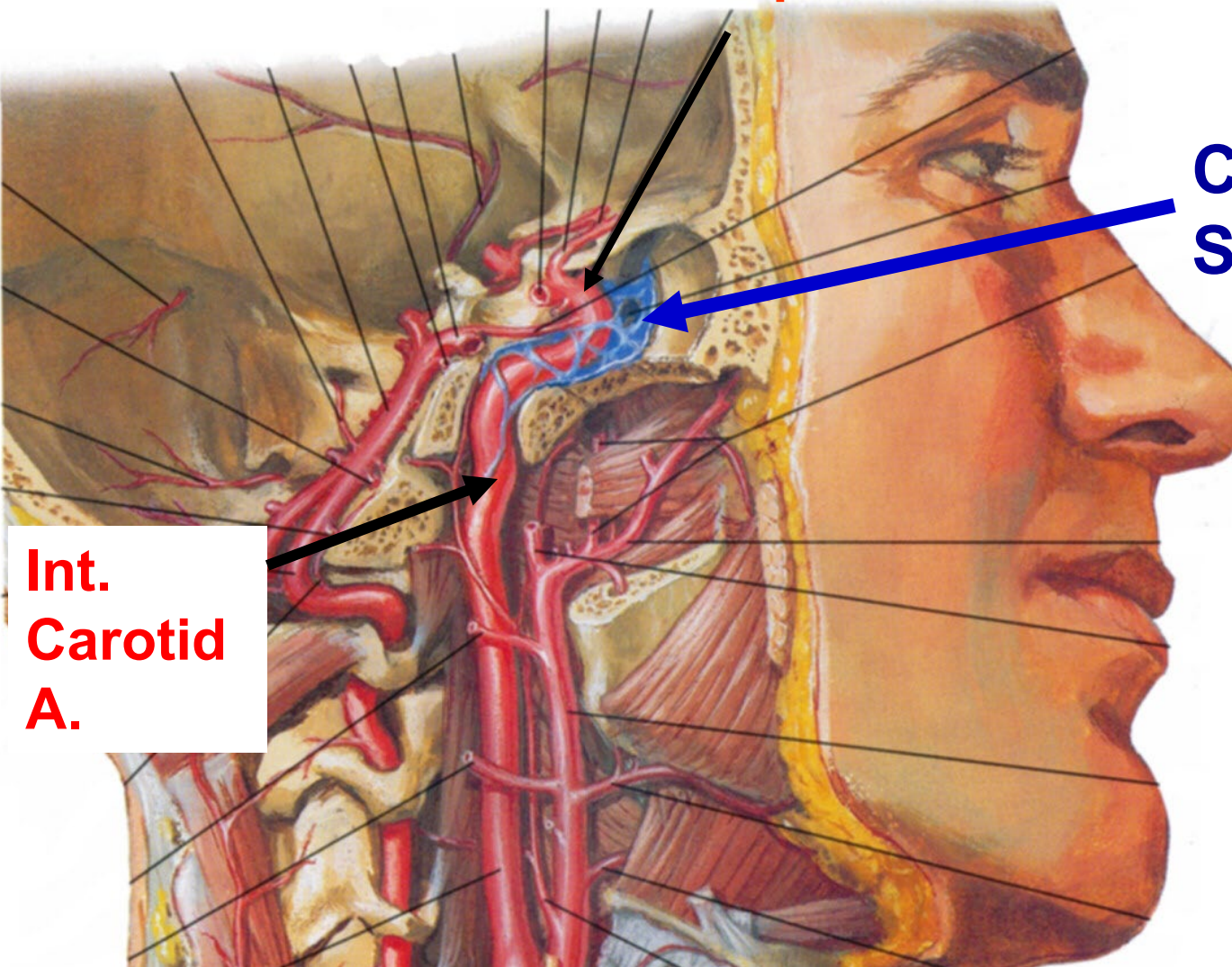
# VENOUS SINUSES OF BRAIN



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

Carotid Siphon

Cavernous Sinus \*\*

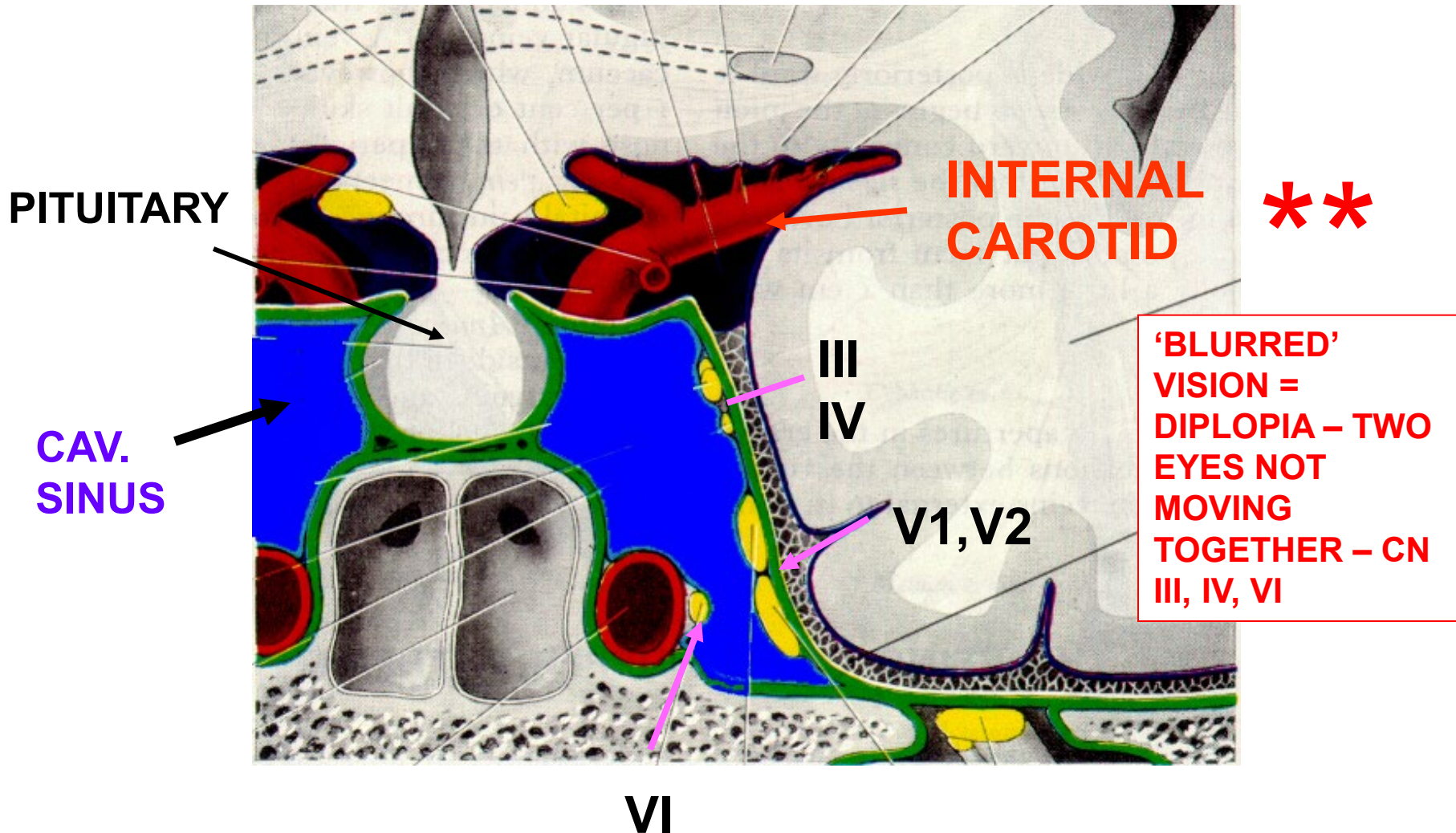


Int.  
Carotid  
A.

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

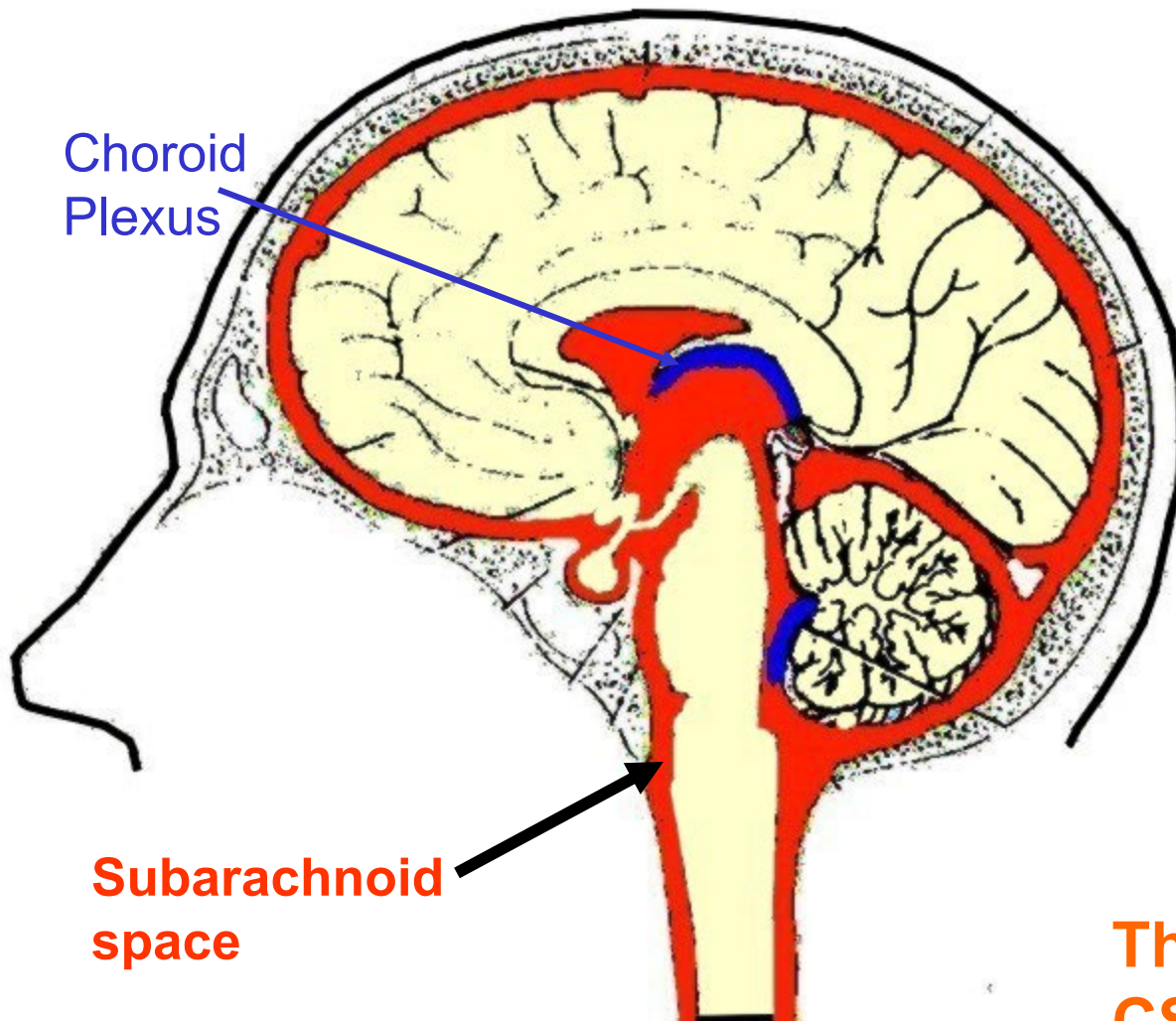


**STRUCTURES PASSING THROUGH WALL OF CAVERNOUS SINUS - Int. Carotid A., Cranial N.'s III, IV, V1, V2, VI;**  
**Clinical sign of Infection in Sinus – ‘BLURRED’ VISION**





## IV. CEREBRO-SPINAL FLUID (CSF)



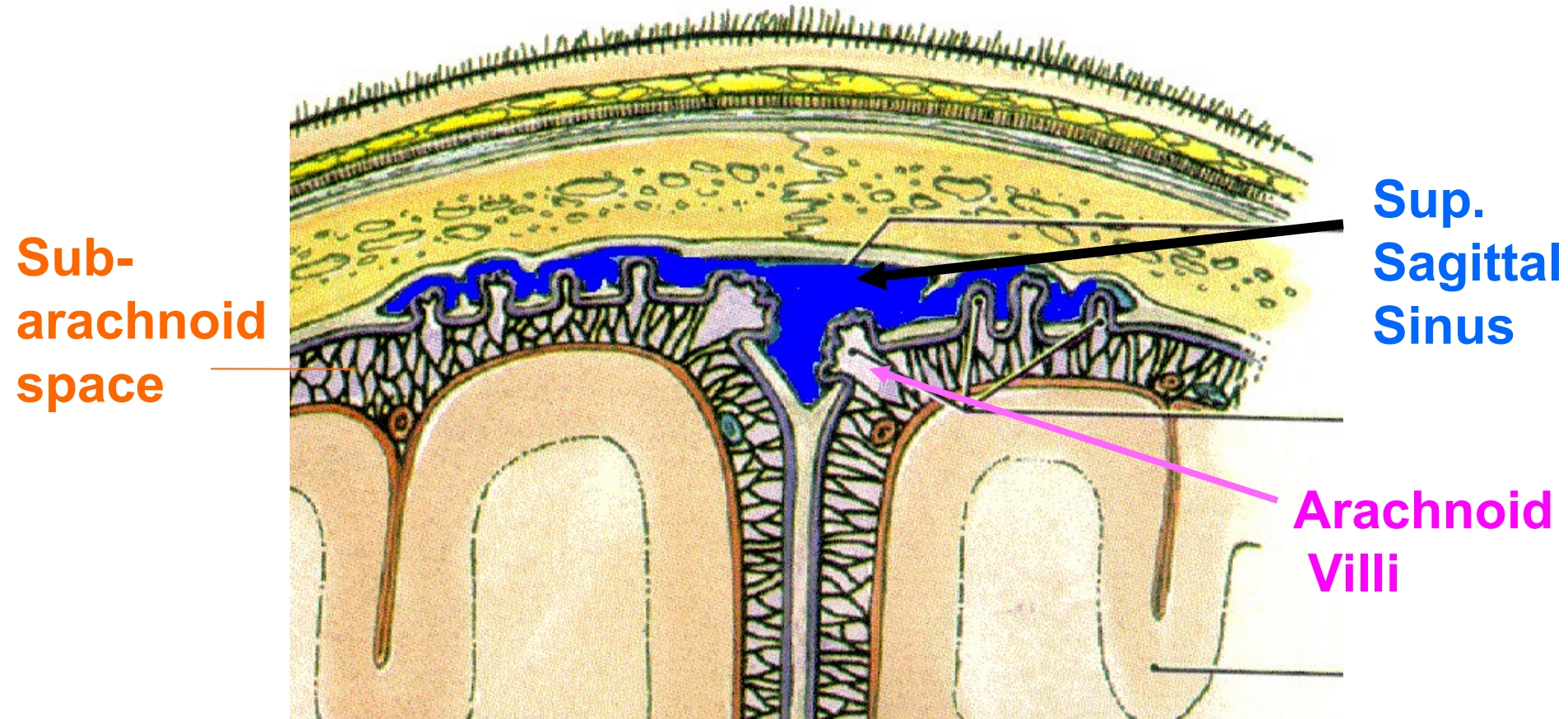
Choroid  
Plexus

Subarachnoid  
space

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

The brain floats in  
CSF - Shock  
Absorber

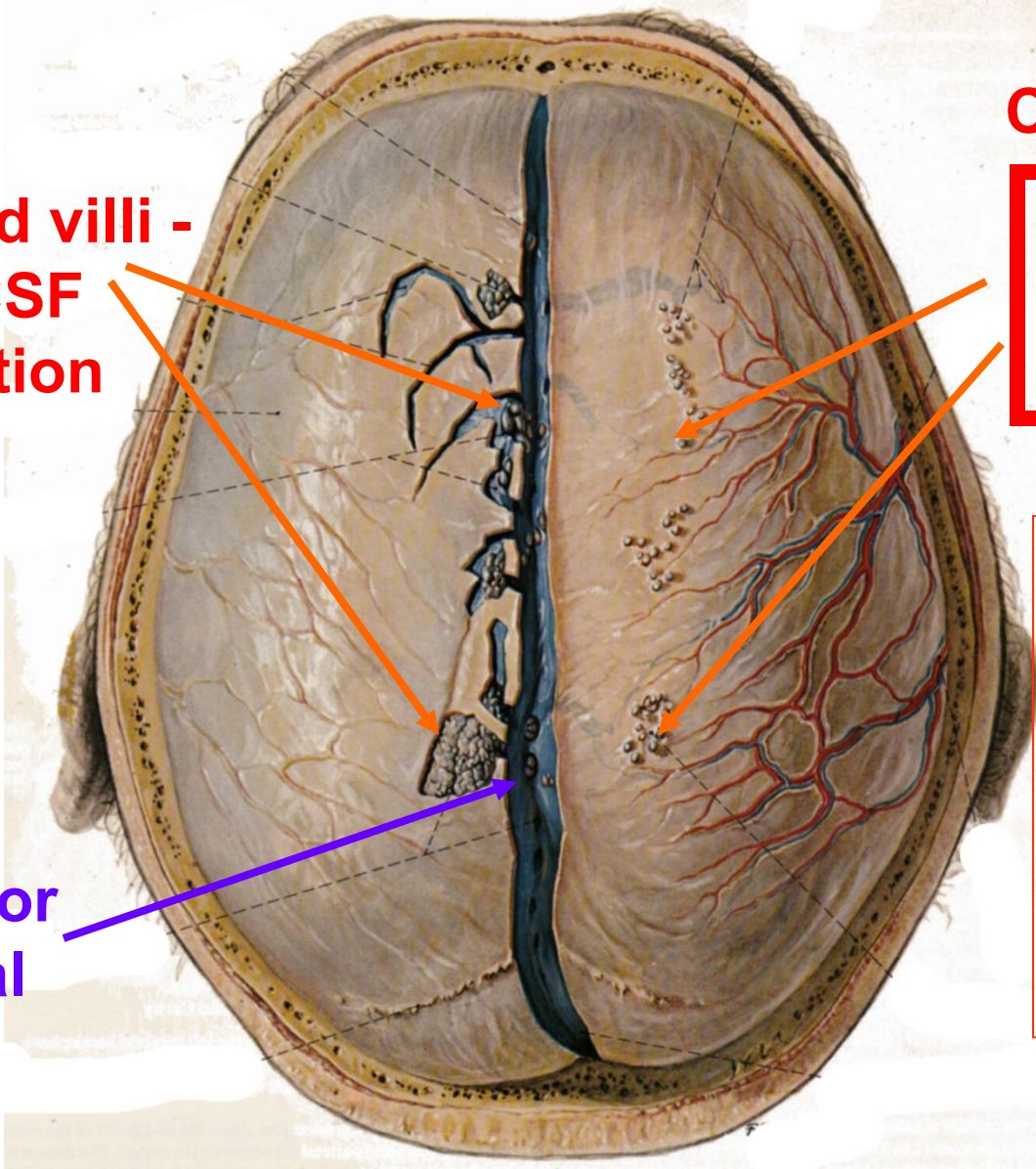
# CSF REABSORBED INTO VENOUS SINUSES



**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



**CLINICAL \*\***

**Arachnoid villi - sites of CSF reabsorption**

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

**Arachnoid villi - sites of CSF reabsorption**

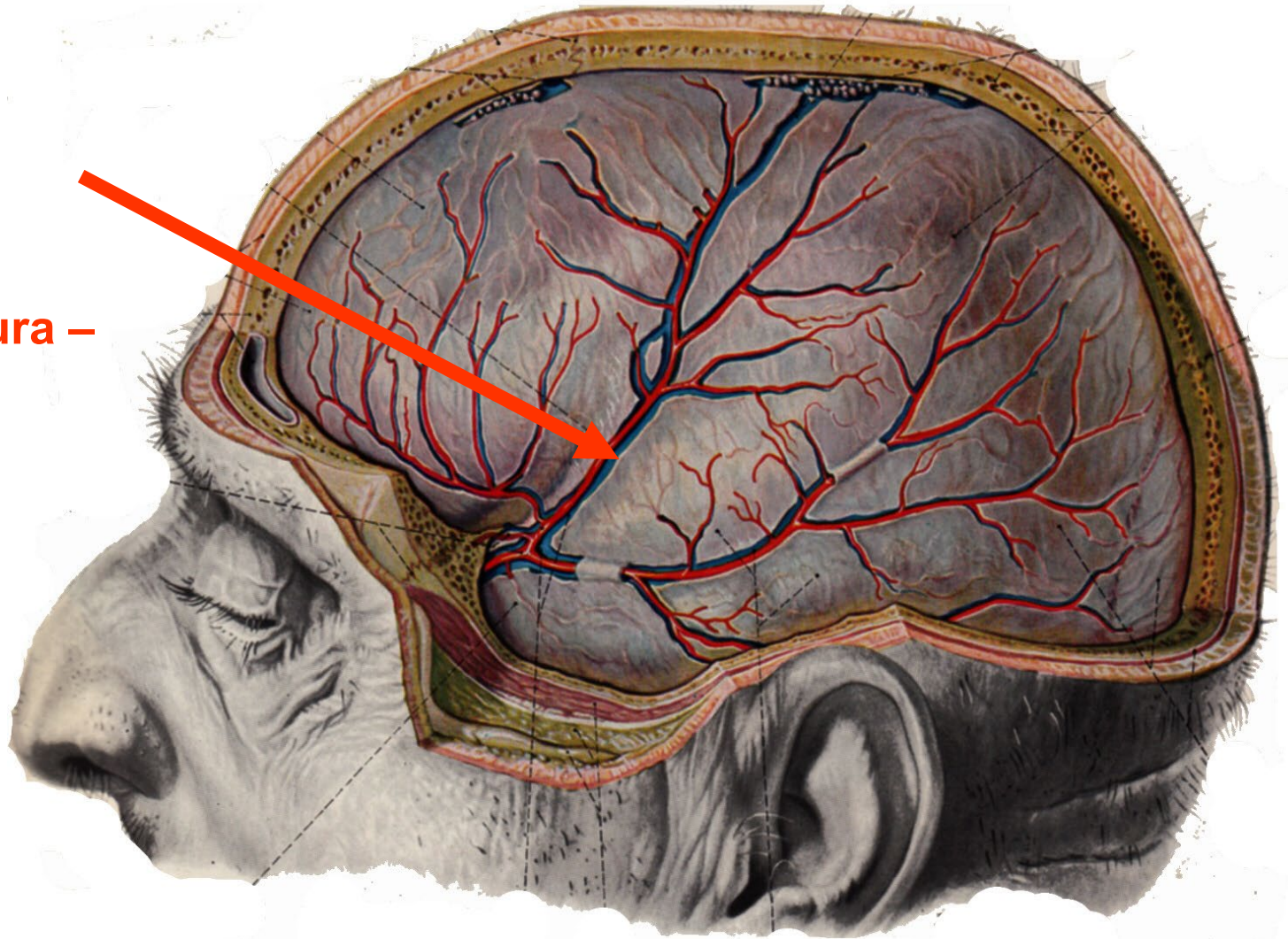
**Superior Sagittal Sinus**



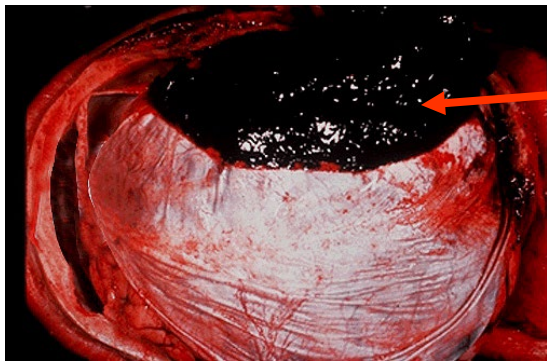
# V. HEMATOMAS - INTERNAL BLEEDS

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

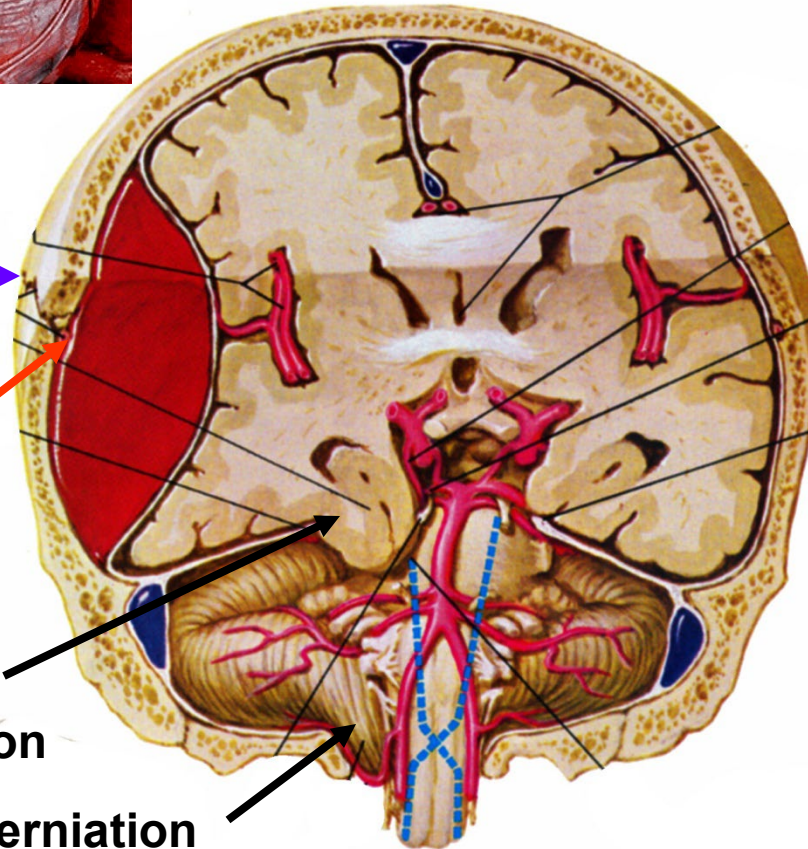
- 1) Skull fracture near Pterion
- 2) Tear Middle Meningeal Artery
- 3) Blood 'peels' dura from bone
- 4) Lens shaped (biconvex) mass on CT

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

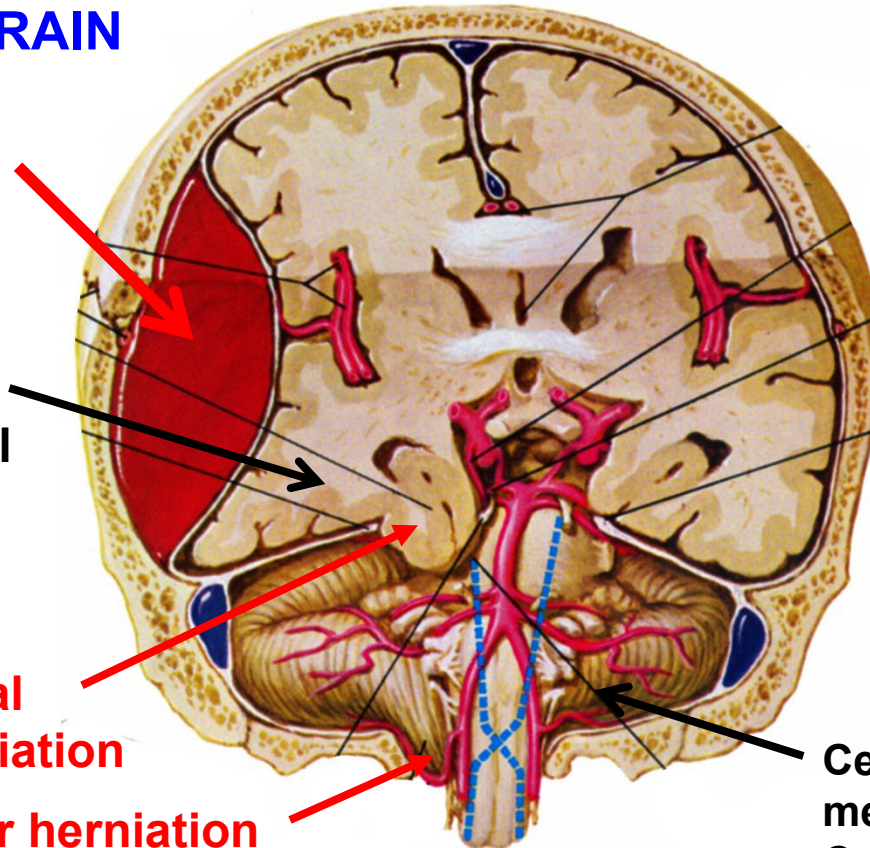
**MASS OF BLOOD CAN  
DISPLACE BRAIN**

**EPIDURAL  
HEMATOMA**

**Temporal Lobe  
Uncus  
(L. Hook) medial  
projection**

**Uncal  
herniation**

**Tonsillar herniation**



**6) Herniation -**

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

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

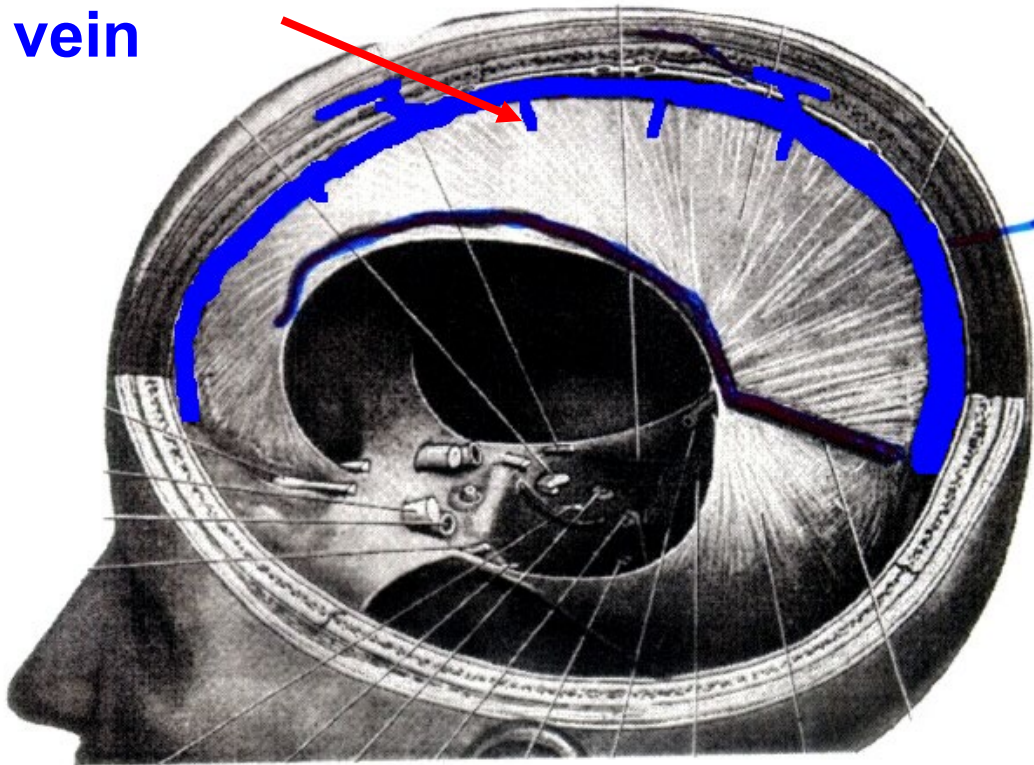
**Cerebellar Tonsil –  
medial projection of  
Cerebellum**

**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

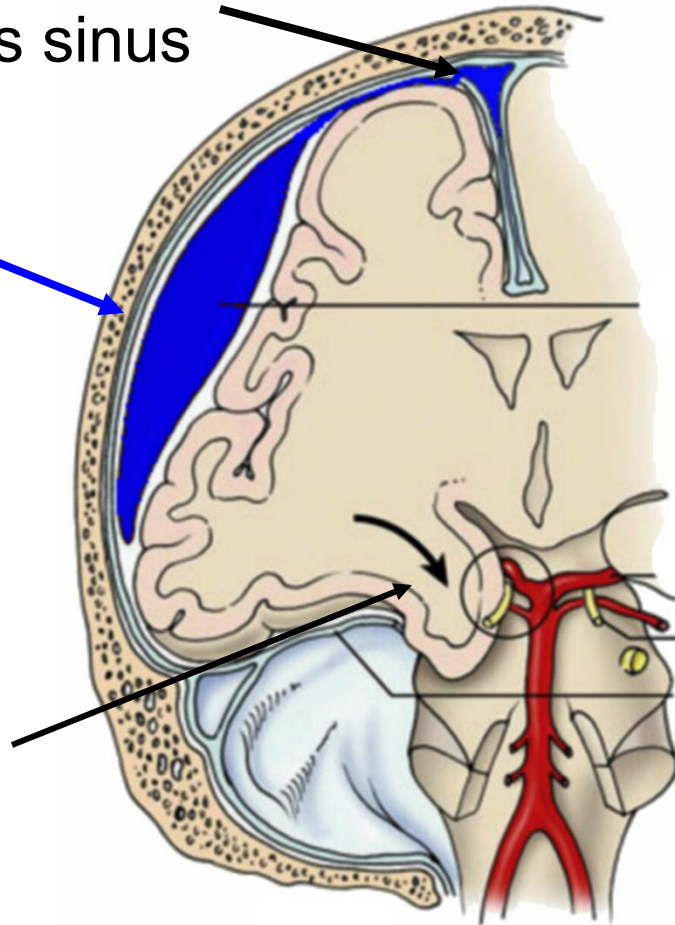
Photo from lecture of Dr. Nancy Norton

# SUBDURAL HEMATOMA

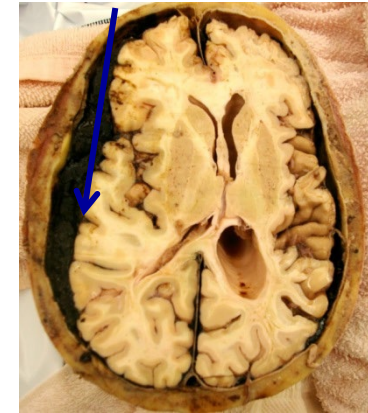
Tear 'bridging' vein  
or venous sinus

Crescent  
shaped  
hematoma  
on CT/MRI

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



SUBDURAL HEMATOMA  
BLOOD



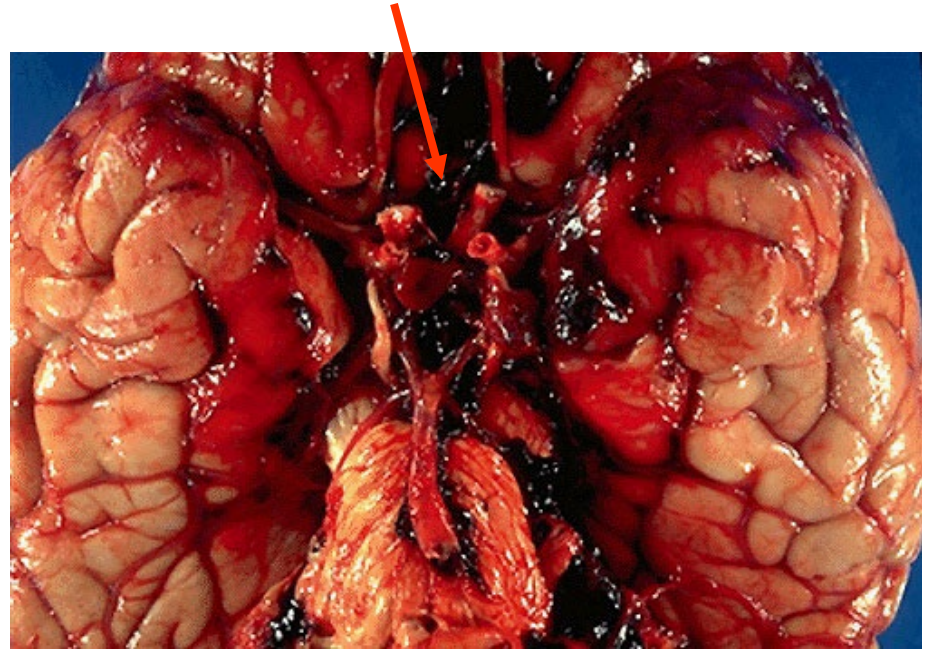
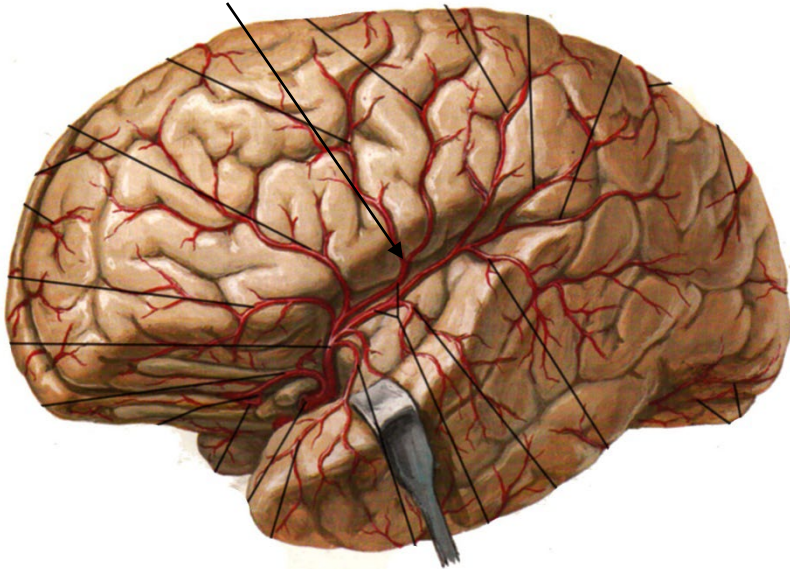
**SUBDURAL \*\*  
HEMATOMA –  
1) VENOUS – often  
BRIDGING VEIN  
2) CRESCENT  
SHAPED MASS  
3) SLOW**

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



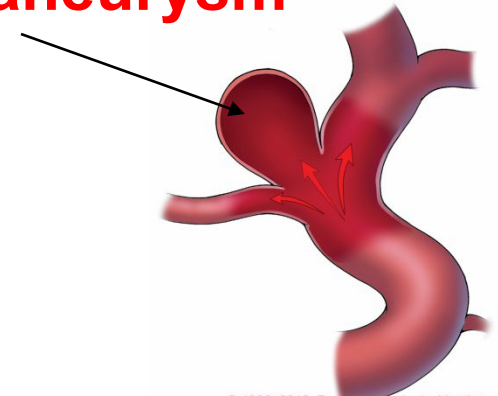
## C. SUBARACHNOID HEMATOMA

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





# SUMMARY CHART HEMATOMAS

## SUMMARY: INTRACRANIAL HEMATOMAS

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

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