

# **Scalp, Meninges, Cranial Cavity**

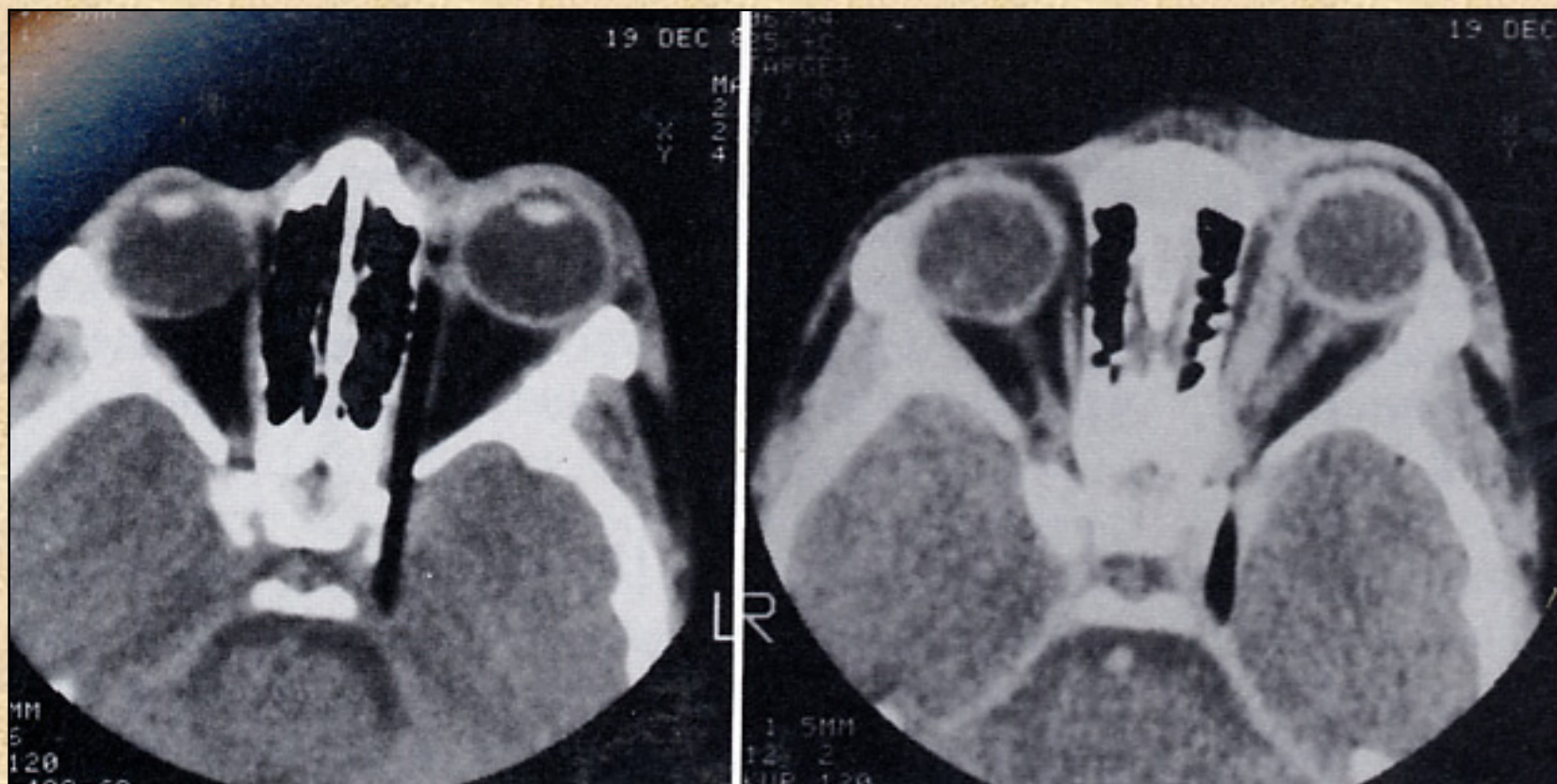
# Objectives

- Identify the *layers of scalp* in purpose of suturing lacerations
- Learn the *layers of meninges* for locating the intracranial hemorrhages
- Understand the *vascular supply of brain* to evaluate infarcts & *hemorrhages*
- Learn the *venous sinuses* and their contents as related nerve compressions syndromes
- Understand *cerebrospinal fluid* production & flow to evaluate hydrocephalus
- Review the *foramina of the skull* and their contents to perceive nerve compression points

# Scalp, Meninges, Cranial Cavity

- Lecture: Moore's text book, review Scalp sections between pages 842 – 865; Cranial Meninges 865 – 889
- Laboratory: Tank's Dissector: Scalp pages 228 – 229; Interior of Skull, 235-245

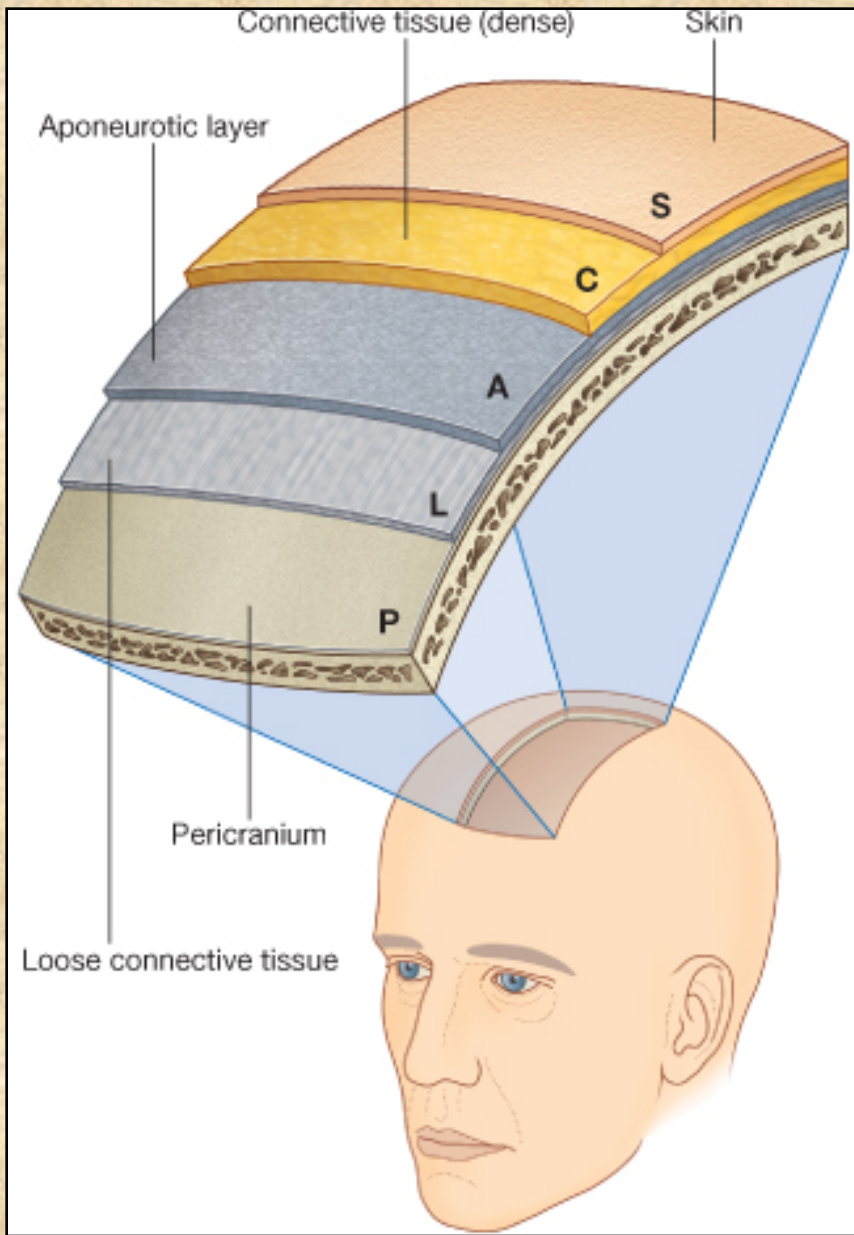




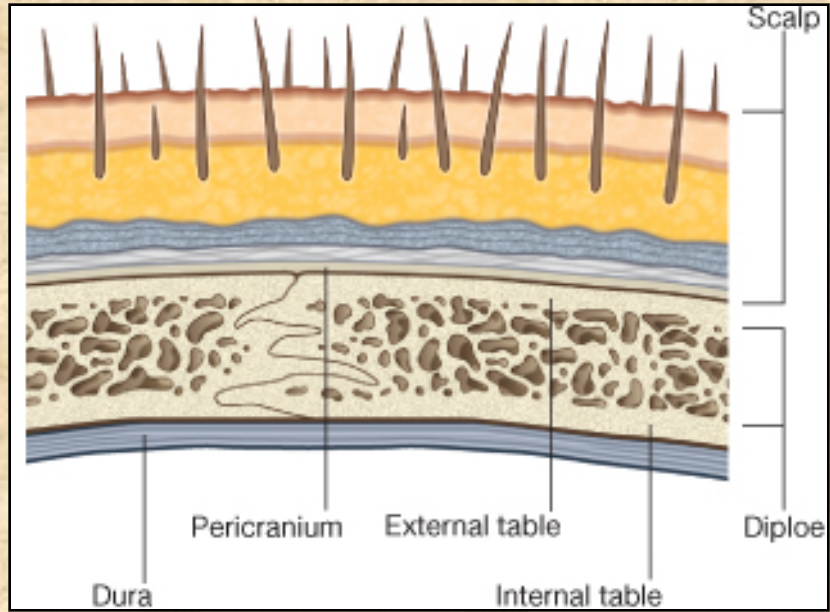


# Scalp

- 5 layers (first letters spell **SCALP**)
  - **S**kin: thin with sweat gland and tightly bound to underlying layer
  - **C**onnective tissue: subcutaneous, strong, and fibrous
  - **A**poneurosis (galae aponeurotica + epicranial muscles): cut and a gapping wound results
  - **L**oose connective tissue: allows movement of layers 1-3 (SCA)
  - **P**ariosteal layer: periosteum of bone



# Scalp





# Scalp Lacerations

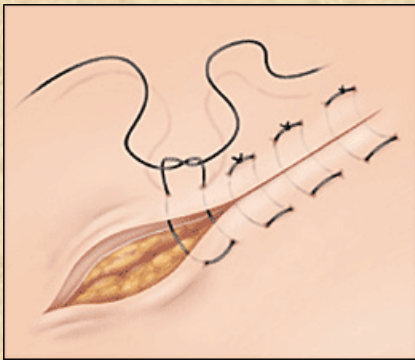
12 million wounds are treated annually in ER

goals – hemostasis, avoid infection, restore function, achieve functional scar that is cosmetically acceptable

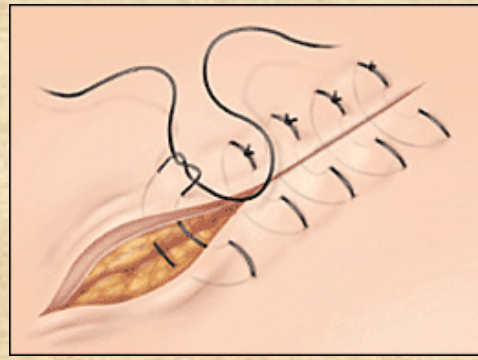
Usually sutured or stapled

staple - no risk of needle stick injury; More rapid; wound must have straight edges

<https://www.youtube.com/watch?v=U4-y3kCgxNI>



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Horizontal – spreads tension along the wound edge

Vertical prevents inversion

Adhesives - 3 to 4 layers over 30 seconds



# Scalp Nerve & Blood Supply

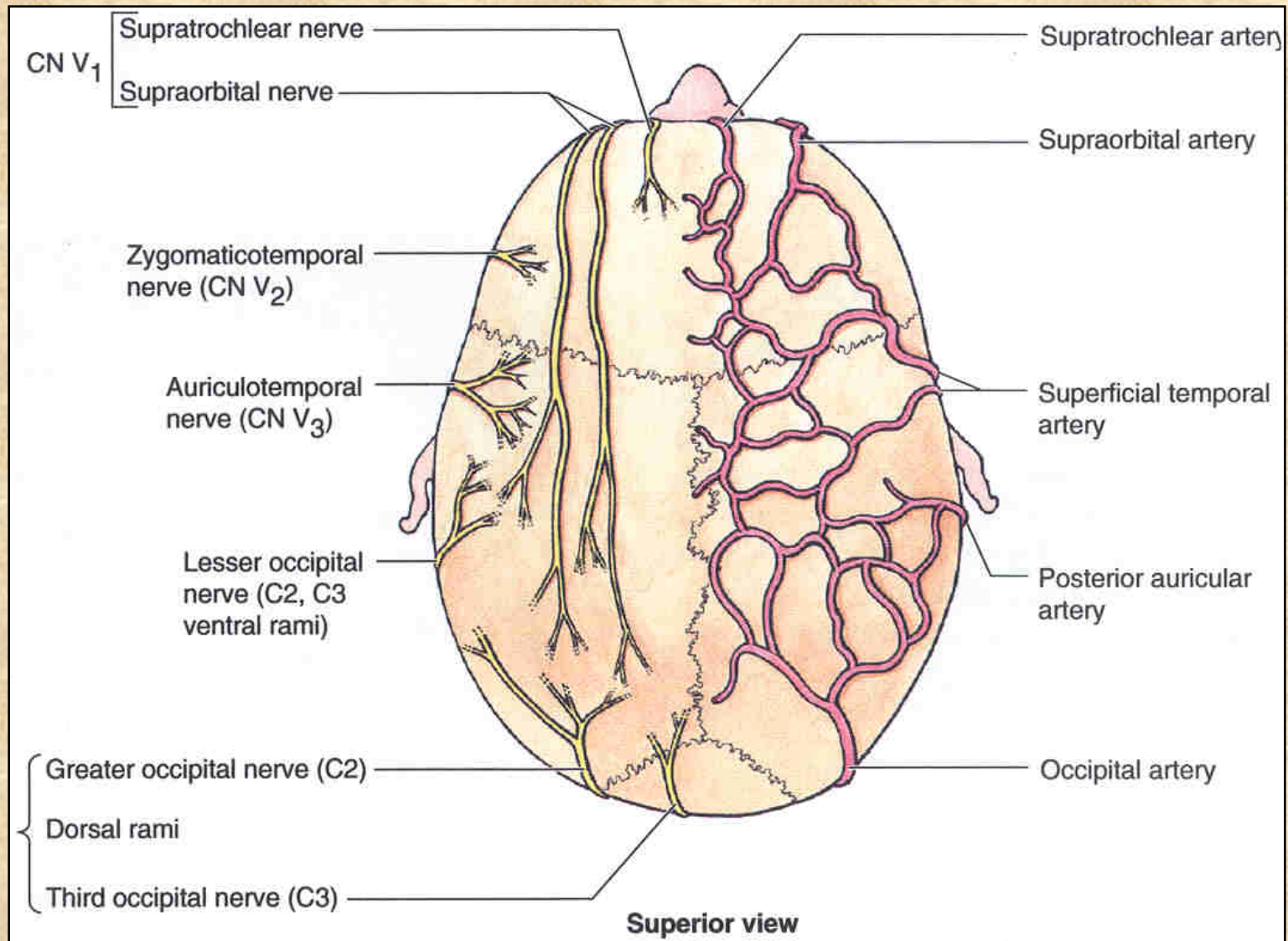
- **Cutaneous Nerves** of Scalp

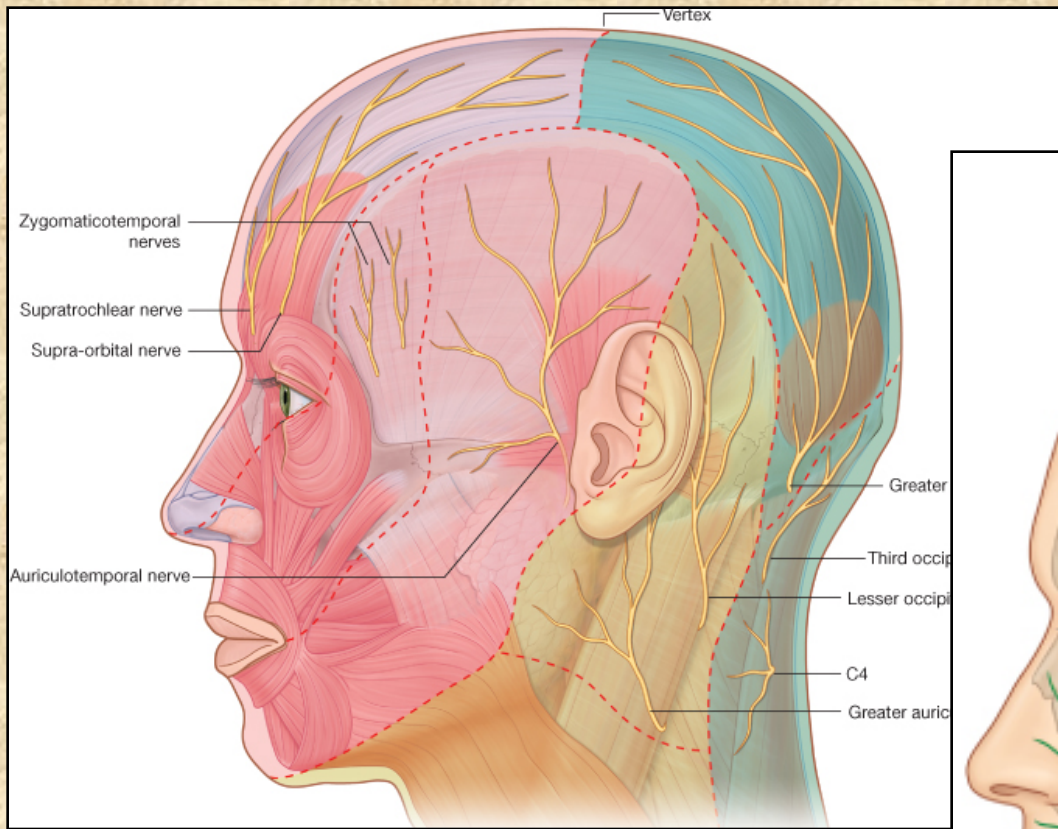
- Supraorbital n.
- Supratrochlear n.
- Auriculotemporal n.
- Greater Occipital (C2 dorsal spinal n.)
- Lesser Occipital n. from cervical plexus (ventral rami of C2,3)

- **Arteries** of scalp

- Occipital a. (ext. carotid a.)
- Posterior auricular a. (ext. carotid a.)
- Superficial temporal a. (ext. carotid a.)
- Supraorbital a. from ophthalmic a.
- Supratrochlear a. from ophthalmic a.

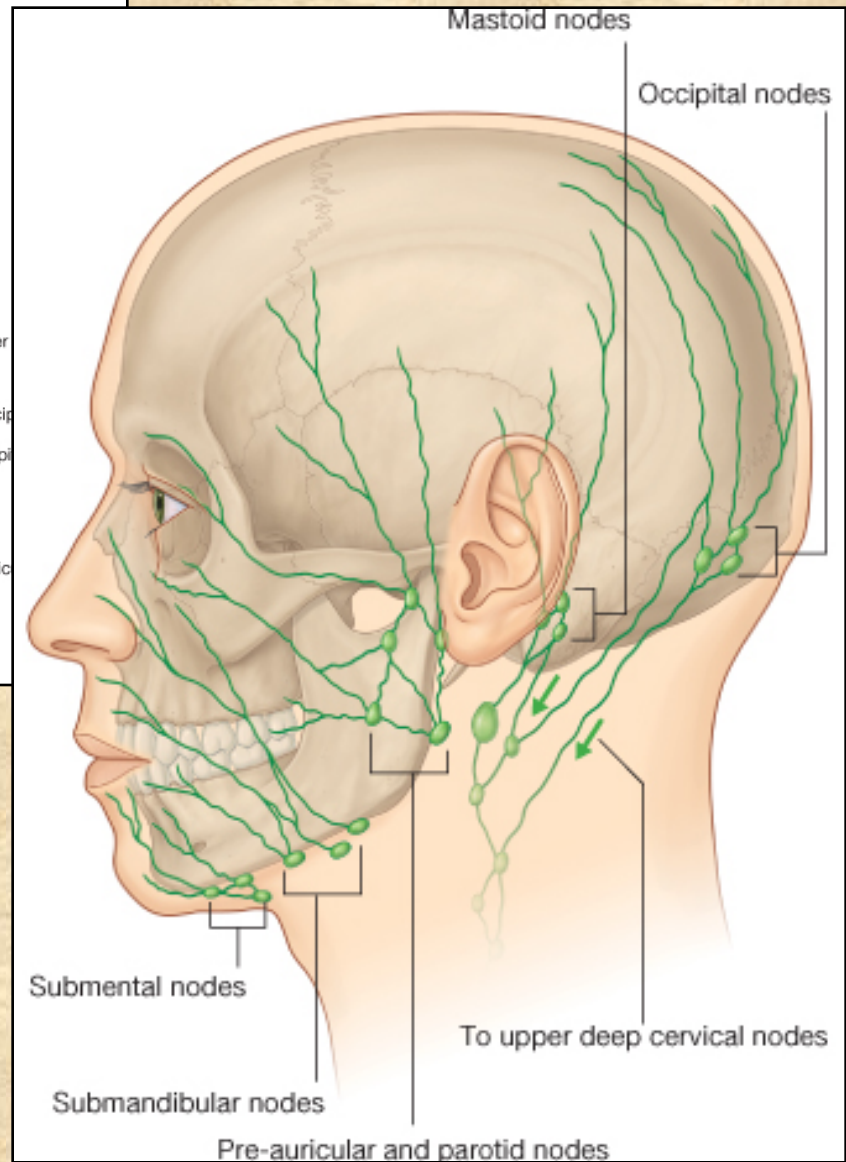
# Cutaneous Nerves and Arteries of Scalp





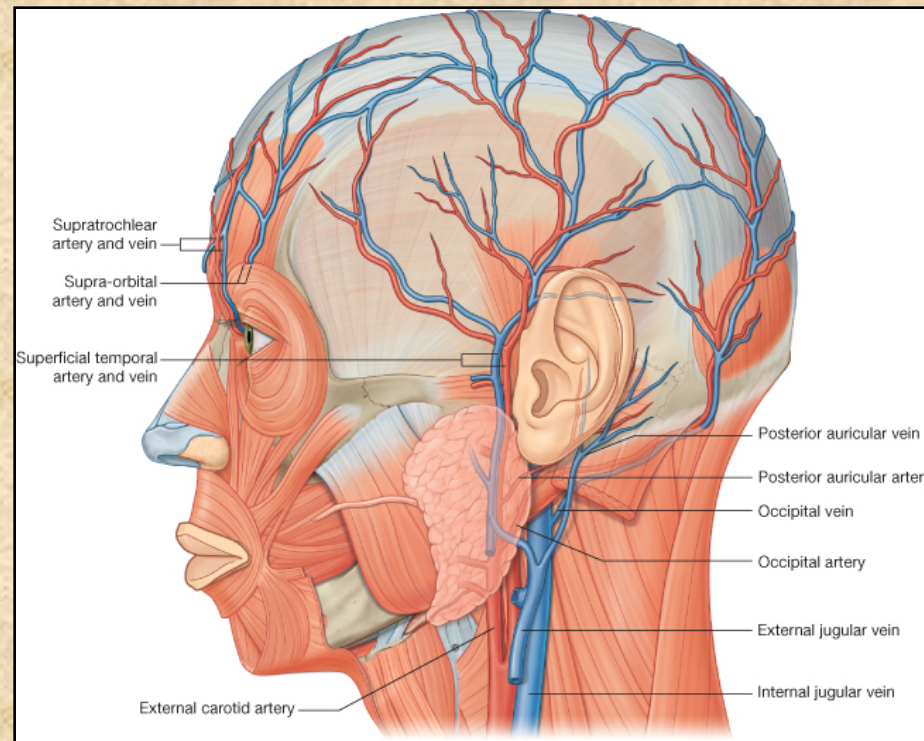
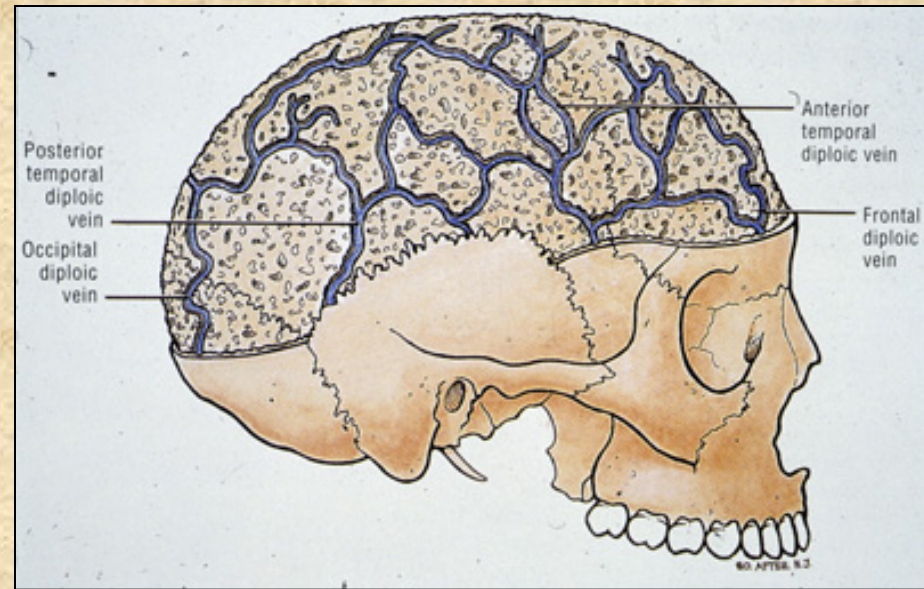
# Cutaneous nerves

# Lymphatics



# Scalp Venous Drainage

- **Veins** of Scalp
  - Diploic veins - drain diploe
  - Emmisary veins - connect internal and external veins (valveless)
  - Supraorbital and supratrochlear vv. (forms angular and facial vv.)
    - Communicates with ophthalmic veins to cavernous sinus for disease spread



# Meninges

- General
  - 3 layers of protective membranes over brain and spinal cord
  - Pia, Arachnoid, Dura
- **Pia**
  - Vascular membrane
  - Thin, delicate, and follows blood vessels closely
    - Forms blood brain barrier: pia and glial membrane
    - endothelium and basement membrane restricts free flow

# Meninges

- **Arachnoid**
  - Thicker and non-vascular membrane that follows contours of brain, but does not enter the sulci
    - Arachnoid trabeculae extend from arachnoid and joins pia
    - This space is called subarachnoid space and contains cerebrospinal fluid (**CSF**)
    - Main arteries of brain are within subarachnoid space

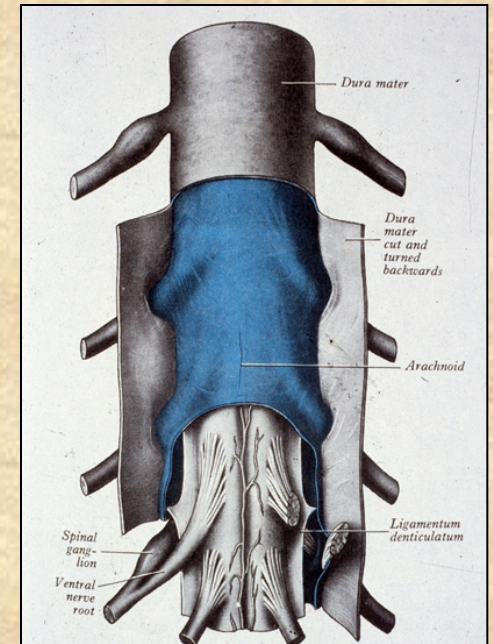
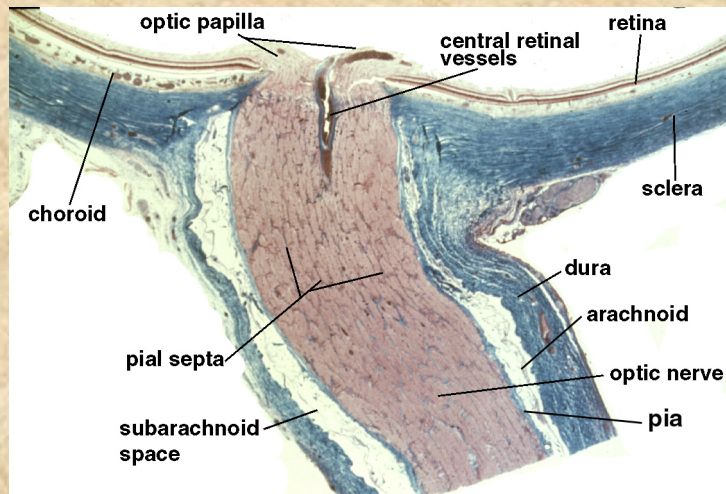
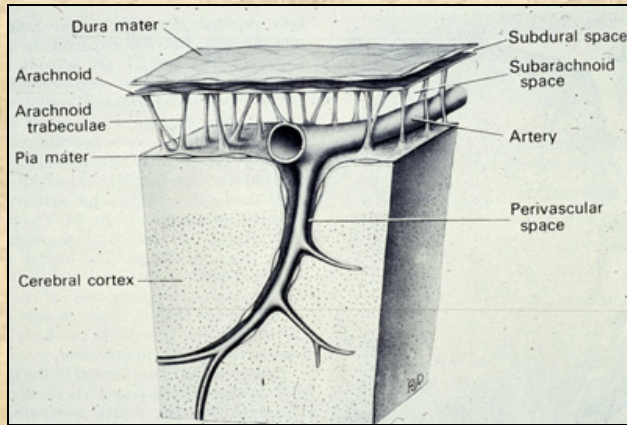
# Meninges

- **Dura Mater** (means tough mother)
  - Thick dense fibrous tissue that protects brain and spinal cord
  - Simple, one-layer thick with tubular structure in spinal cord
  - More complicated in brain
    - Double layered
      - Outer layer = periosteum
      - Inner layer = meningeal layer
        - » Separation of layers **form** dural venous sinuses
        - » Falx cerebri separates cerebral hemispheres and contains superior sagittal sinus and inferior sagittal sinus
        - » Tentorium cerebelli separates cerebrum and cerebellum and contains transverse and straight sinus
        - » Falx cerebelli - separates cerebellar hemispheres and contains occipital sinus
  - Supplied by middle meningeal artery
  - Nerve supply primarily from **CN V** but some X and IX

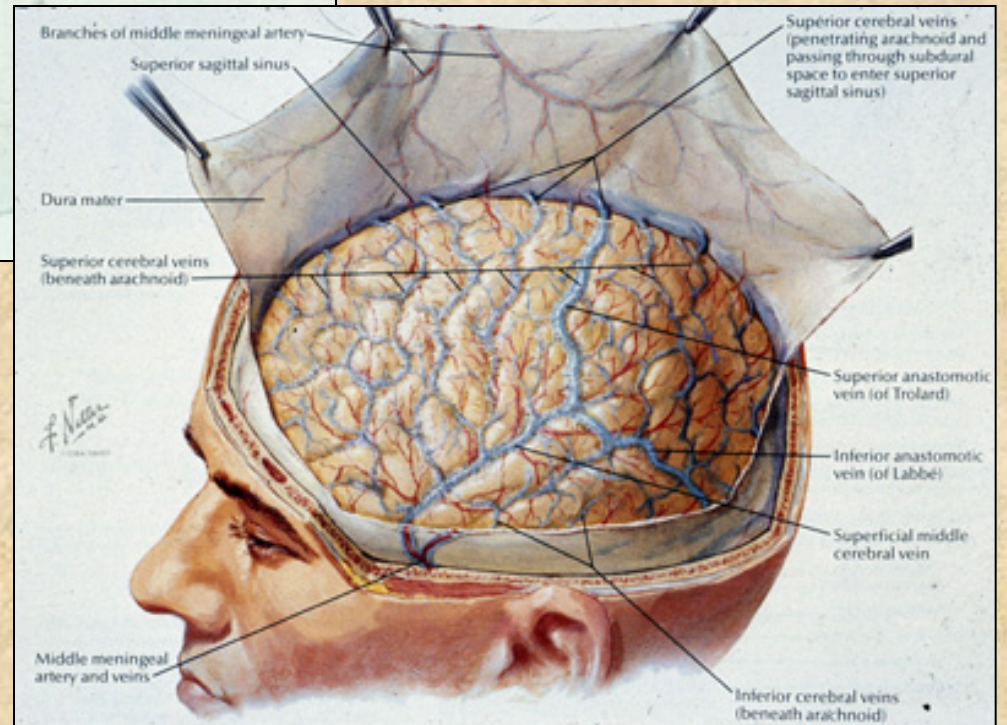
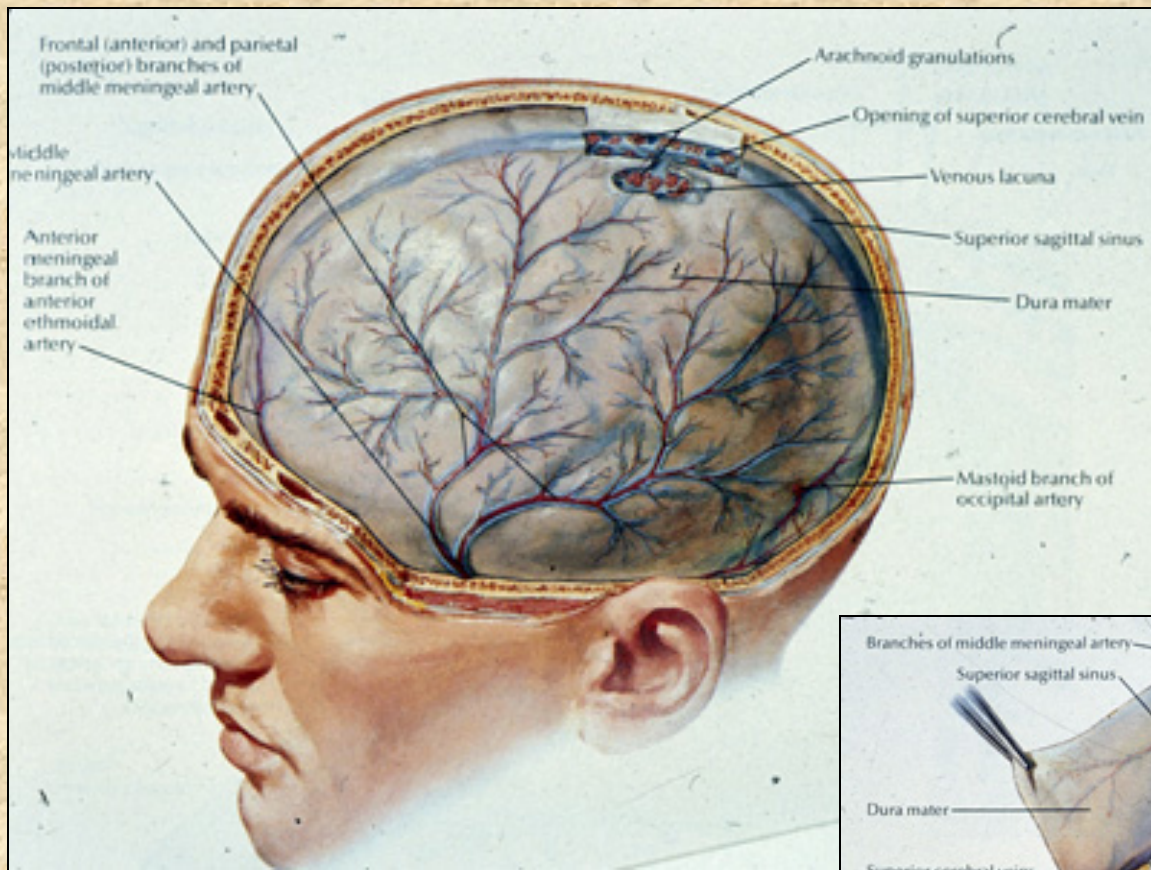


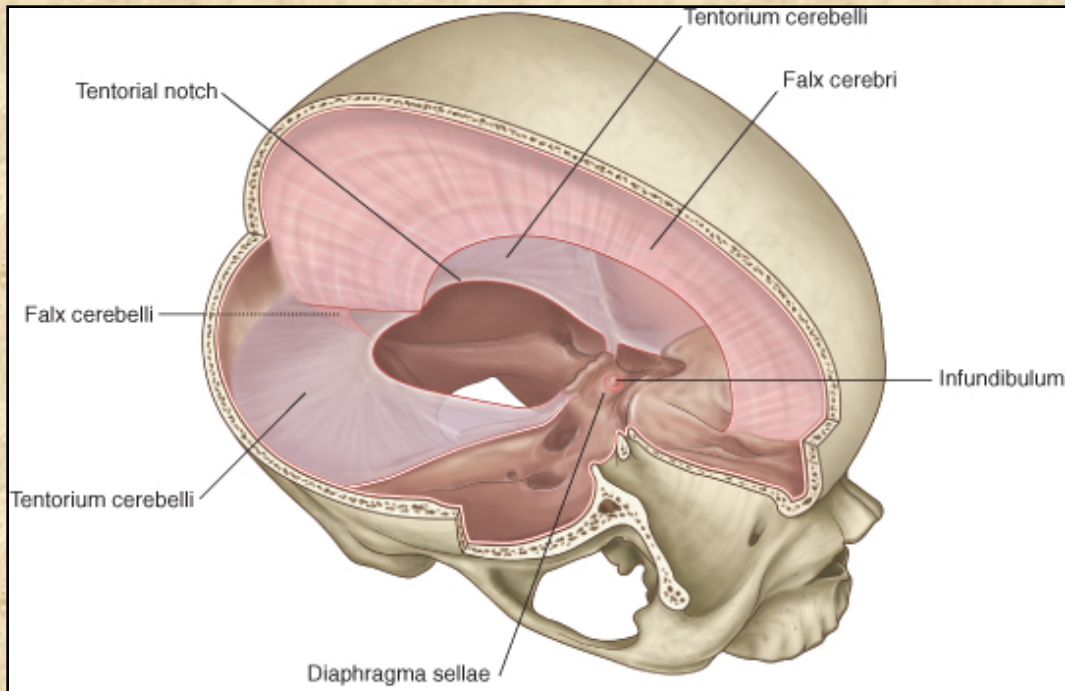
# Meninges

- Dura (Double)
- Arachnoid
- Pia



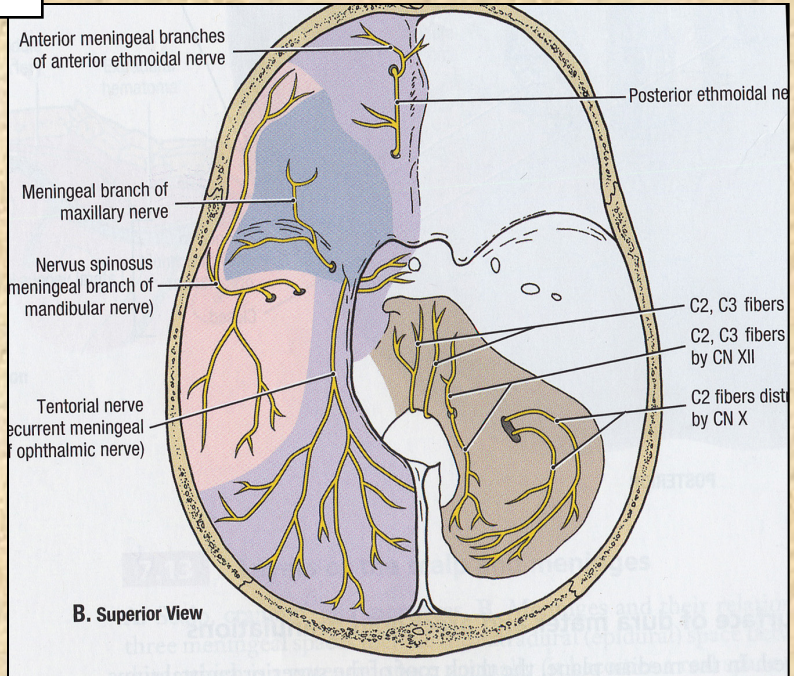
# Meninges





# Meninges

Supplied by Middle Meningeal a., and CN V<sub>1,2,3</sub>



# Meningitis

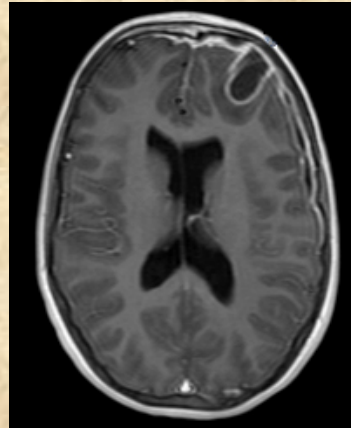
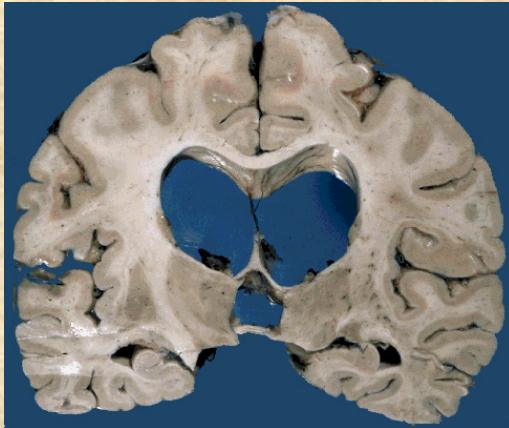
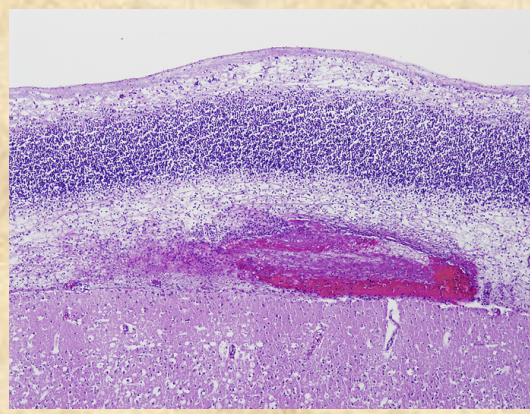
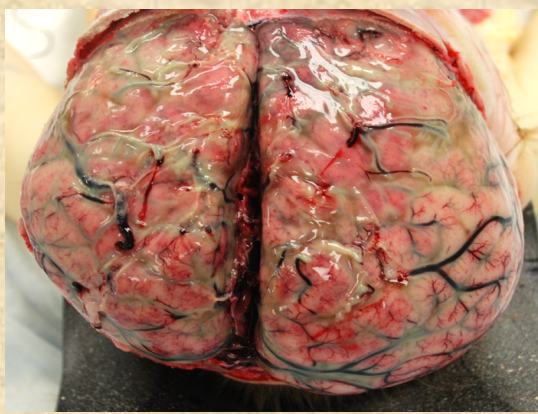
Bacteria that causes meningitis present in nasopharynx & enter blood stream

Bacteria multiply in CSF (few phagocytes)

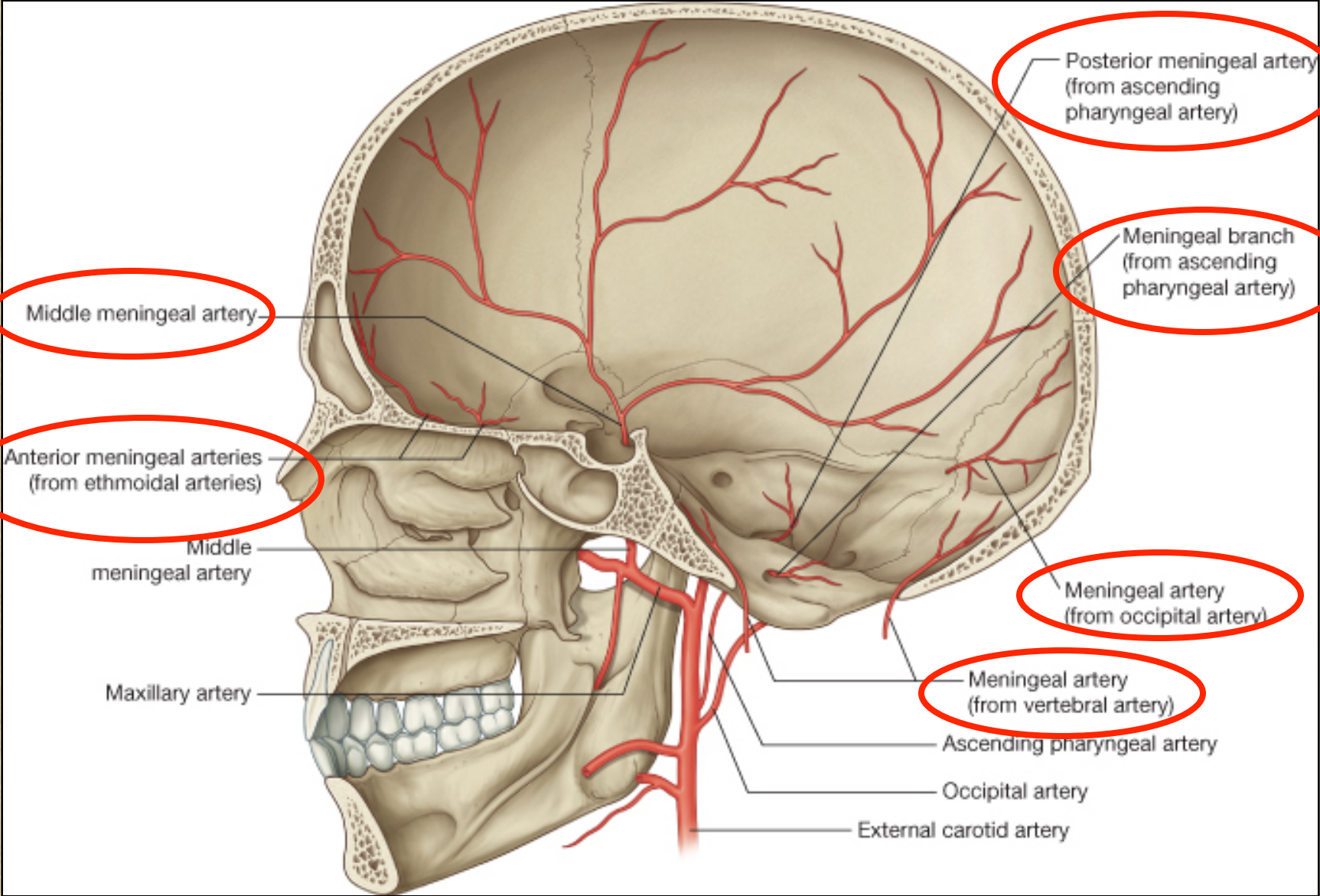
Bacteria damage nervous tissue and blood vessels directly

Cause disseminated intravascular coagulation (DIC) and inflammatory response

Vasculitis causes clotting and infarcts & increase in intracranial pressure



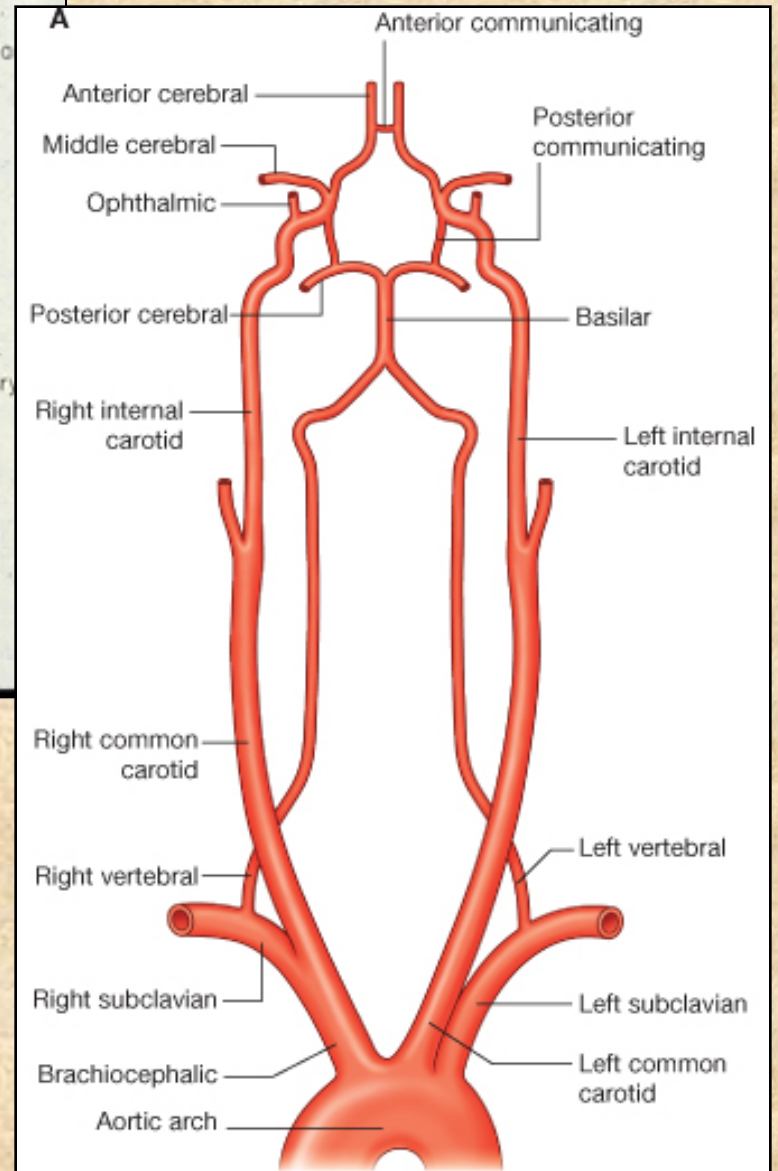
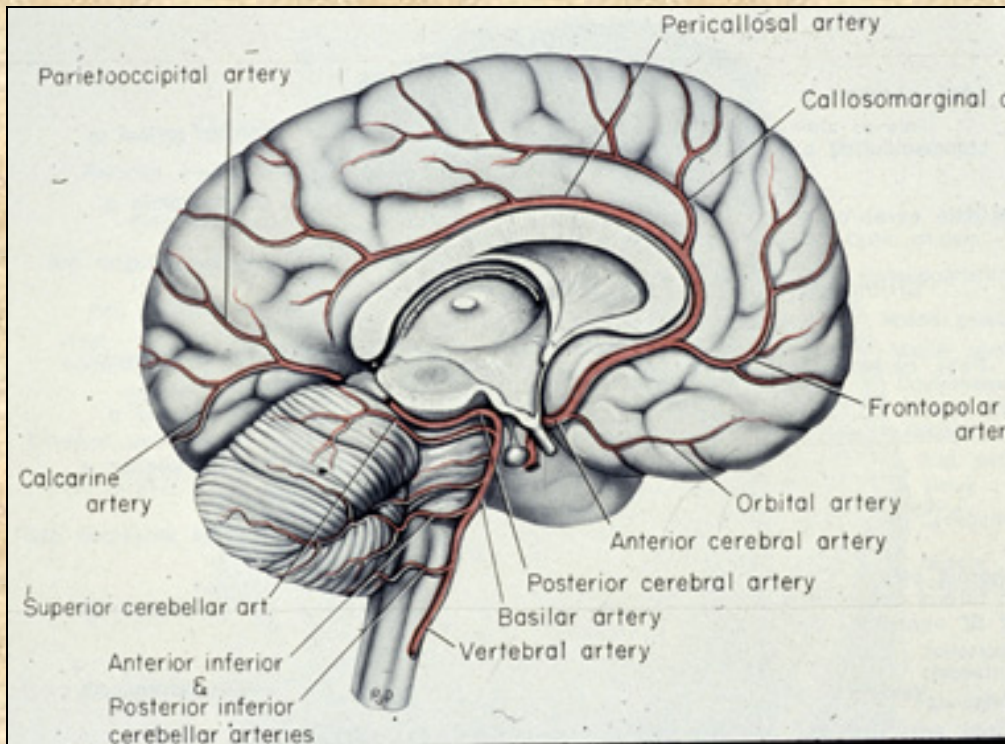
# Meningeal Arteries



# Vasculature of Brain

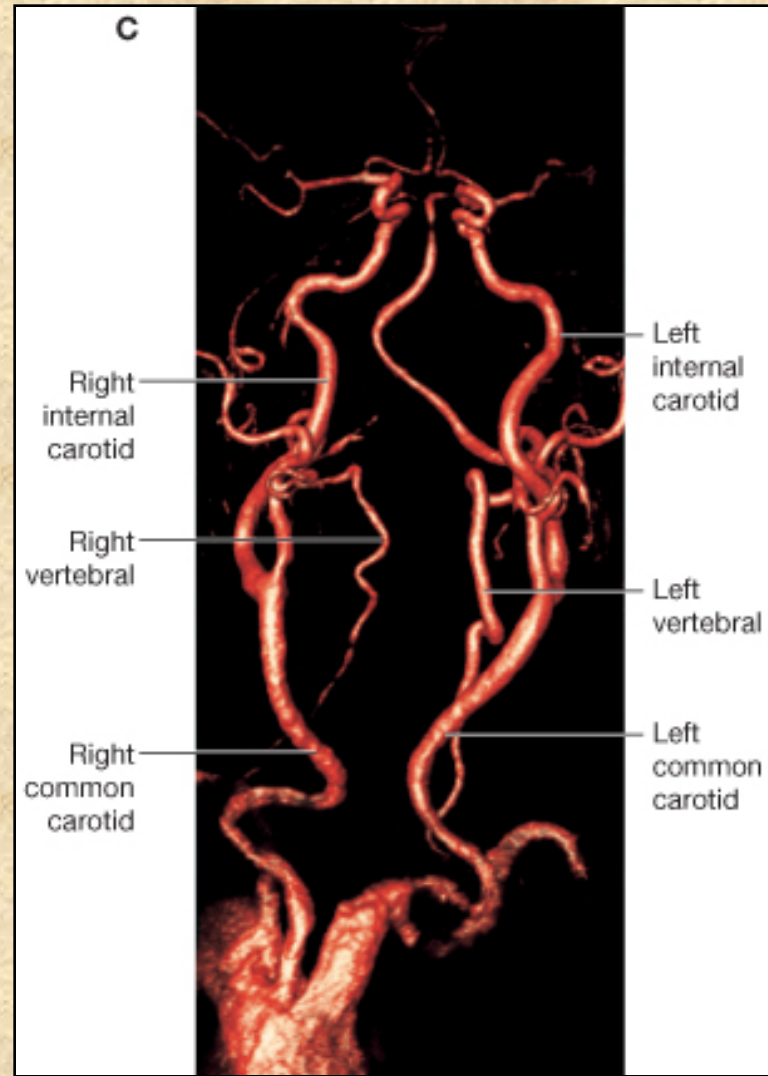
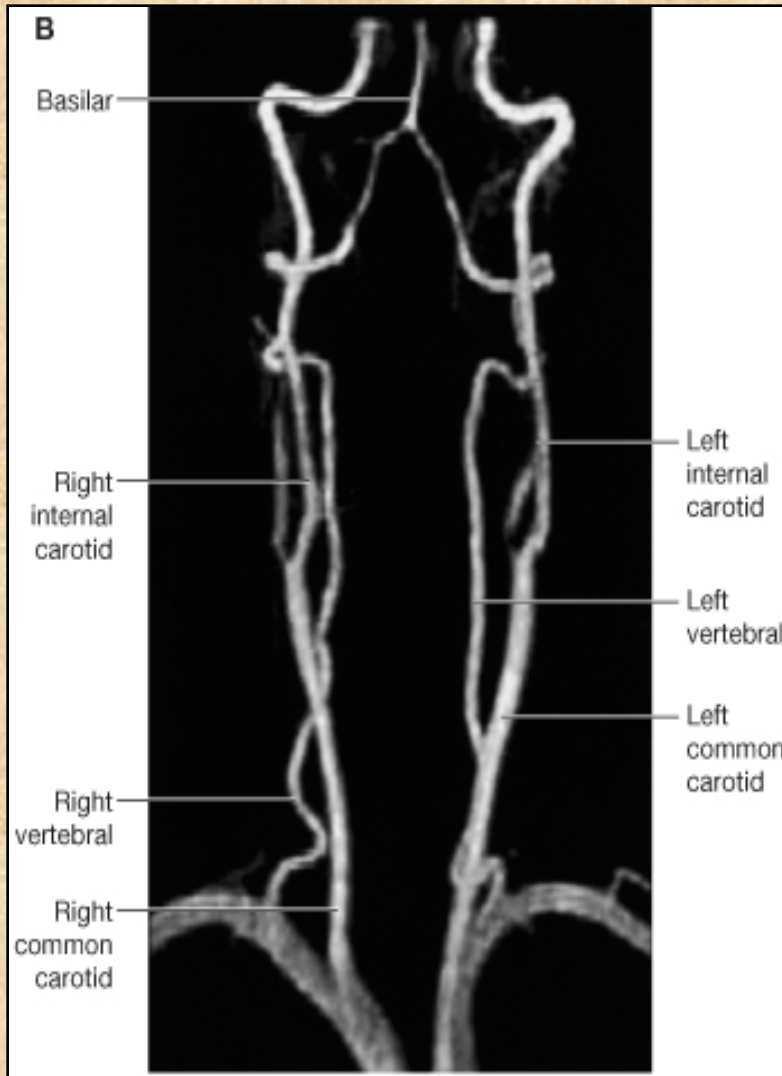
- **Arteries**

- **Vertebral** arteries
- **Basilar** - joining of the 2 vertebrals
  - Pontine
  - Labyrinthine - supplies internal ear
  - Anterior and posterior inferior cerebellar
  - Superior cerebellar
  - Posterior cerebral
- **Internal carotid**
  - Ophthalmic artery to orbit
  - Posterior communicating anastomoses with posterior cerebral of basilar
  - Anterior cerebral communicate via anterior communicating artery
  - Middle cerebral artery
  - Circle of Willis - combination of internal carotid and basilar branches; equalizes pressure under condition of fluctuating BP

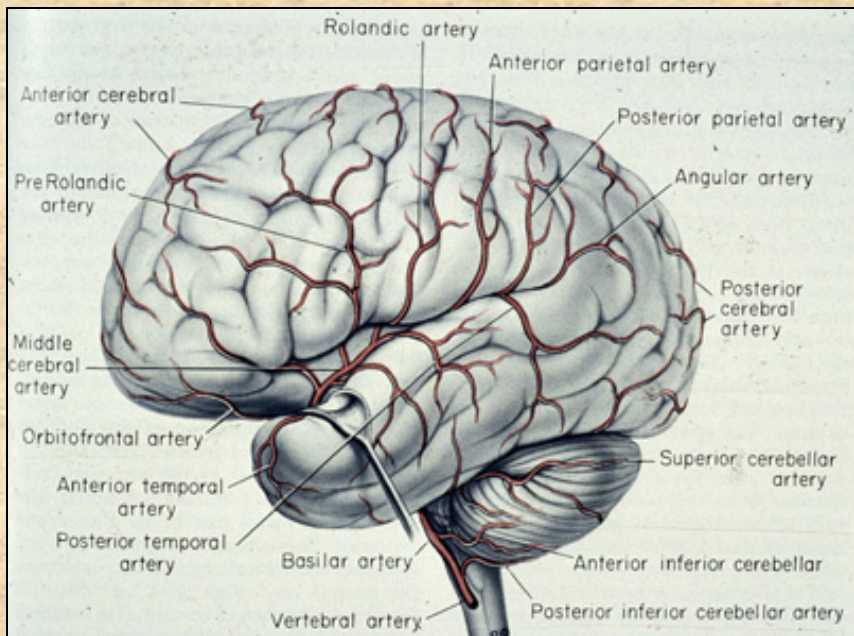


# Vasculature of Brain

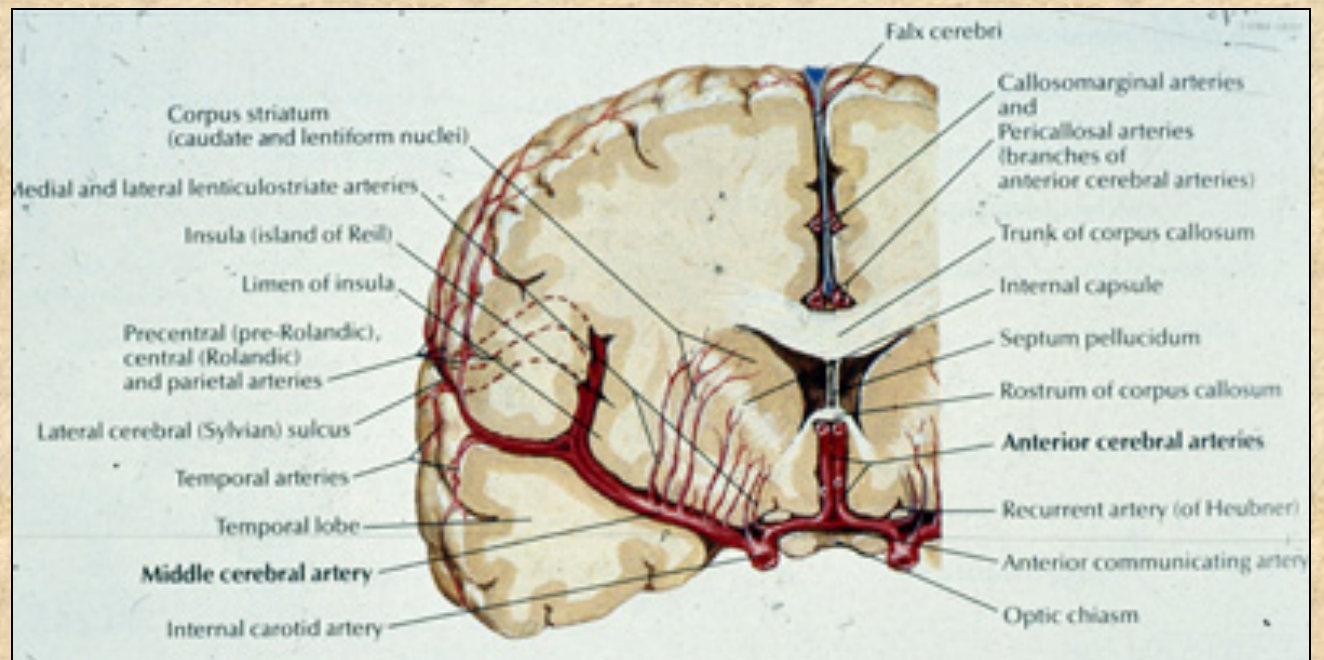
# Circle of Willis





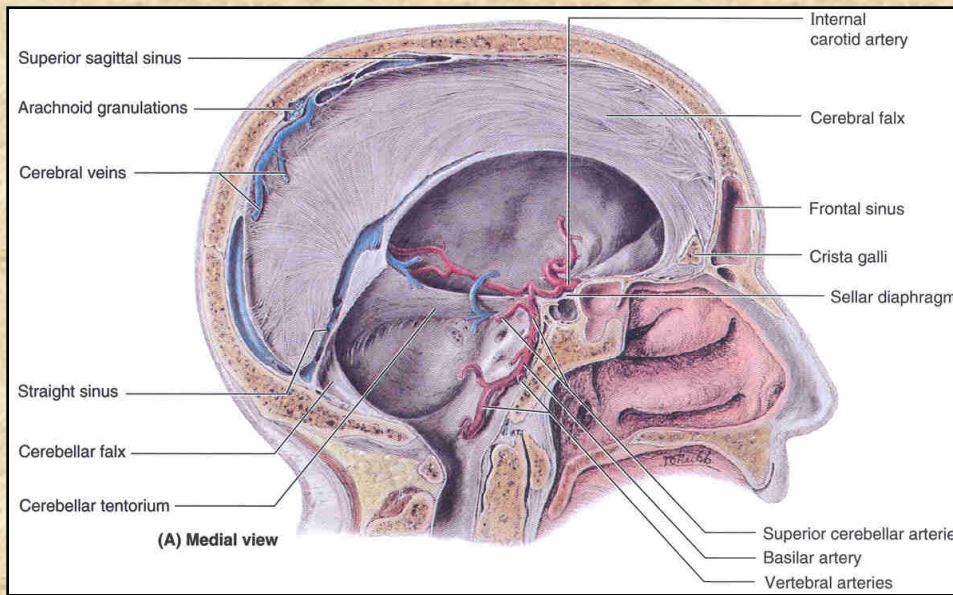


# Vasculature of Brain

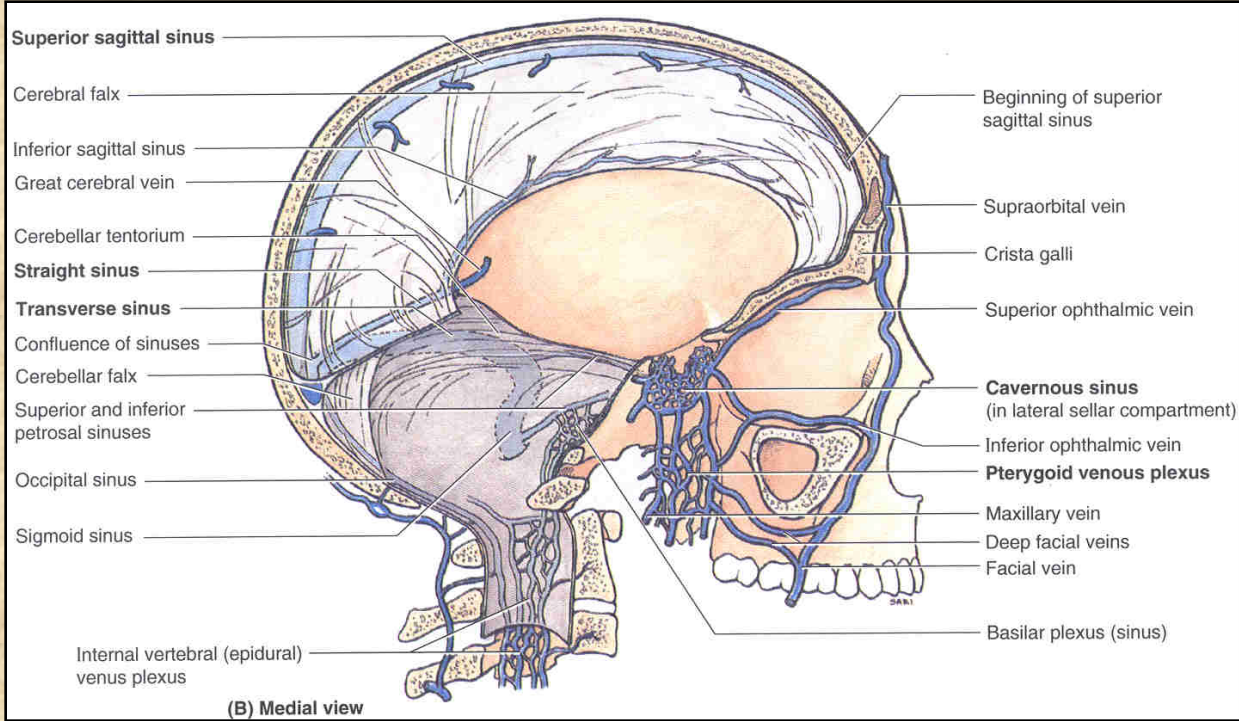


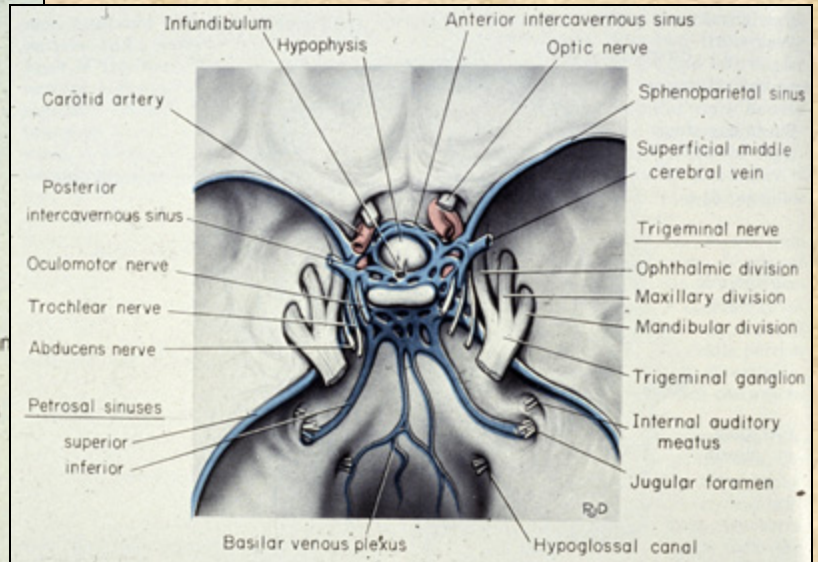
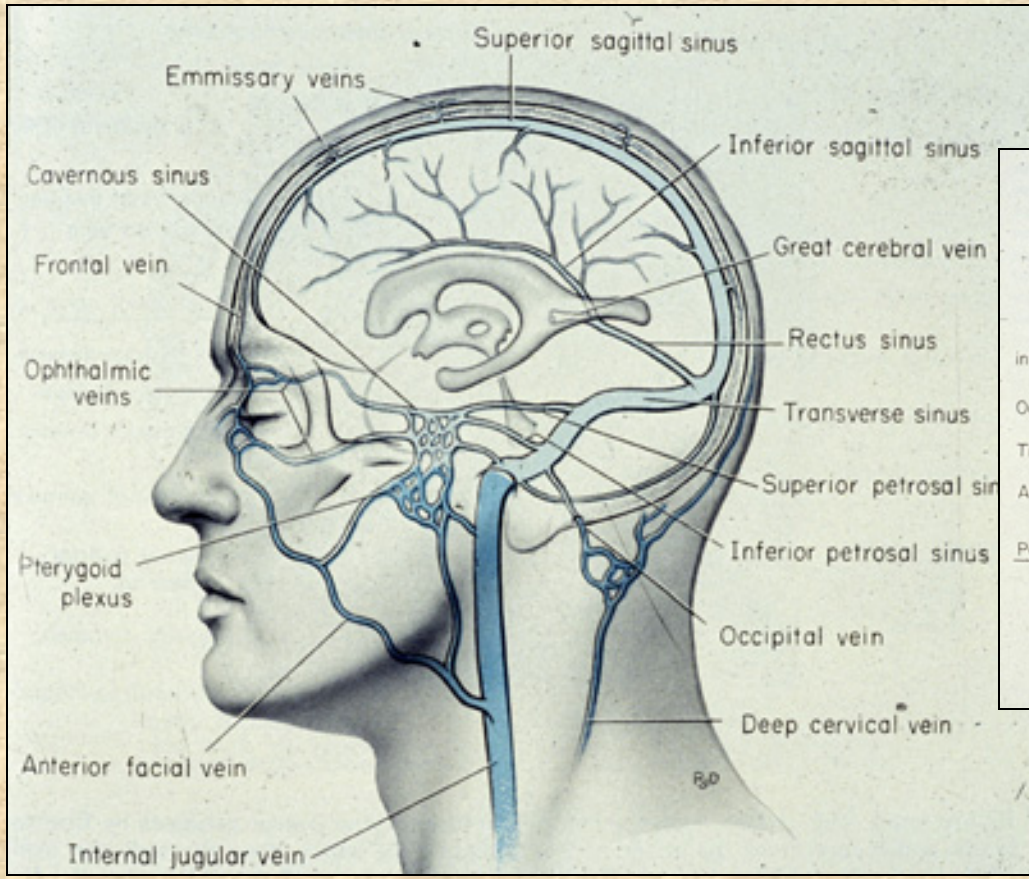
# Venous Sinuses

- General Configuration
  - Superior sagittal, inferior sagittal are connected by straight sinus at confluens; 2 transverse sinuses collect from the superior and inferior petrosal sinuses as well as the occipital sinus
  - Transverse sinuses become sigmoid which becomes internal jugular vein
  - Cavernous sinuses lie on either side of sphenoid

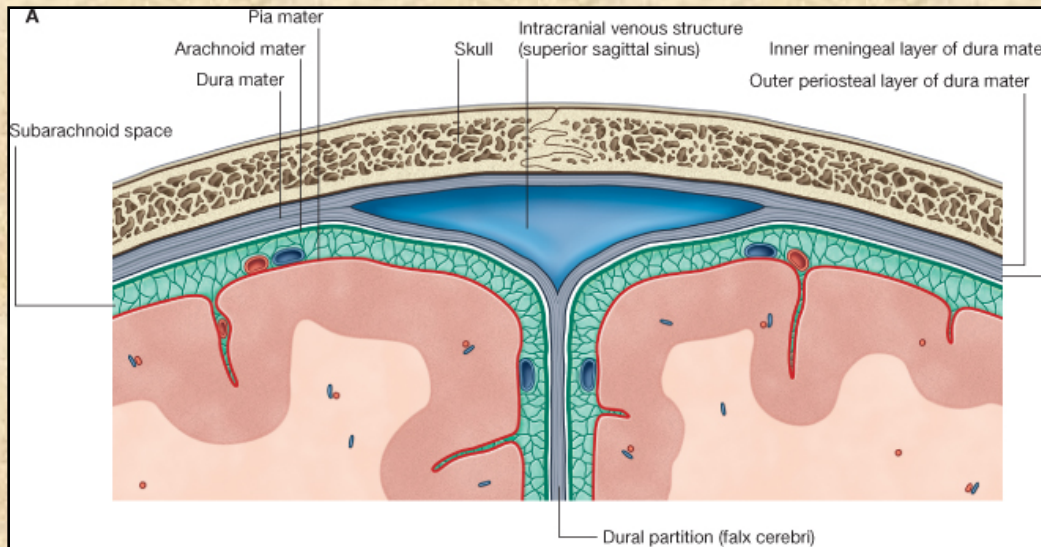
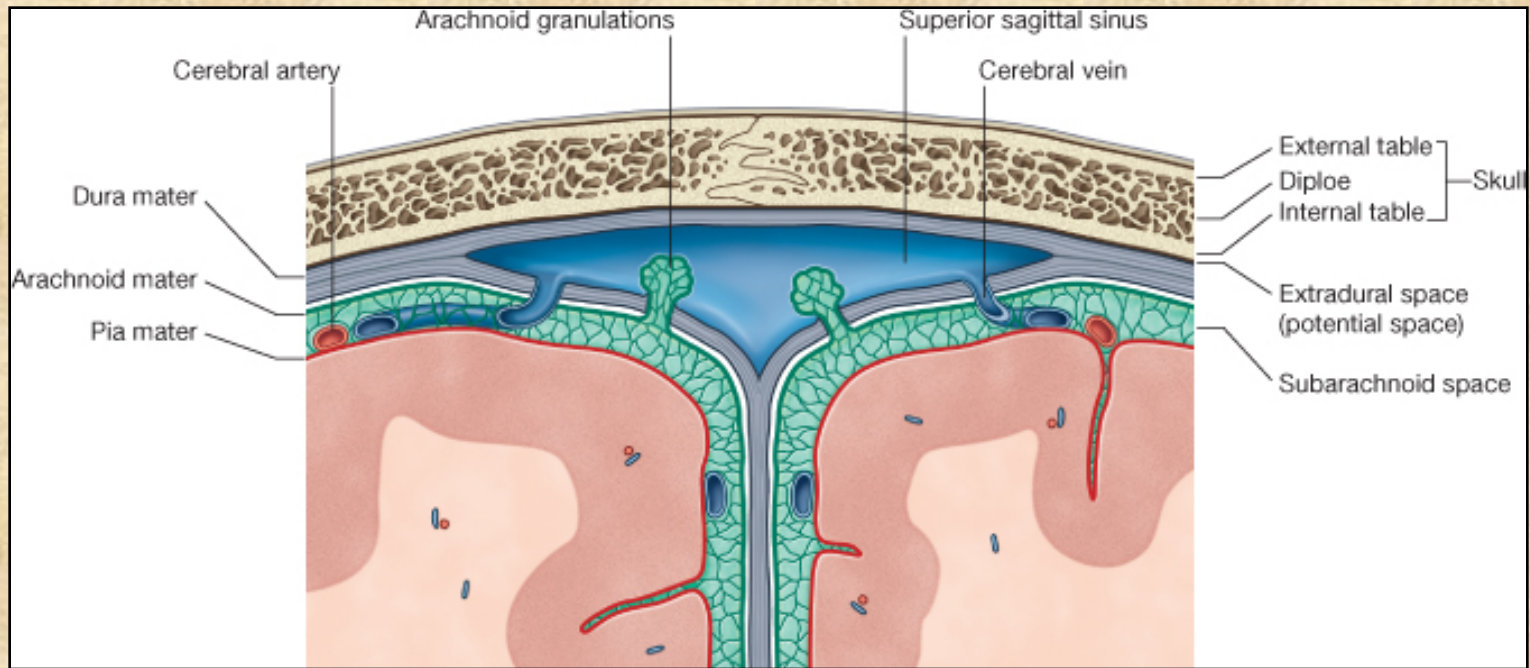


# Venous Sinuses





# Venous Drainage of Brain

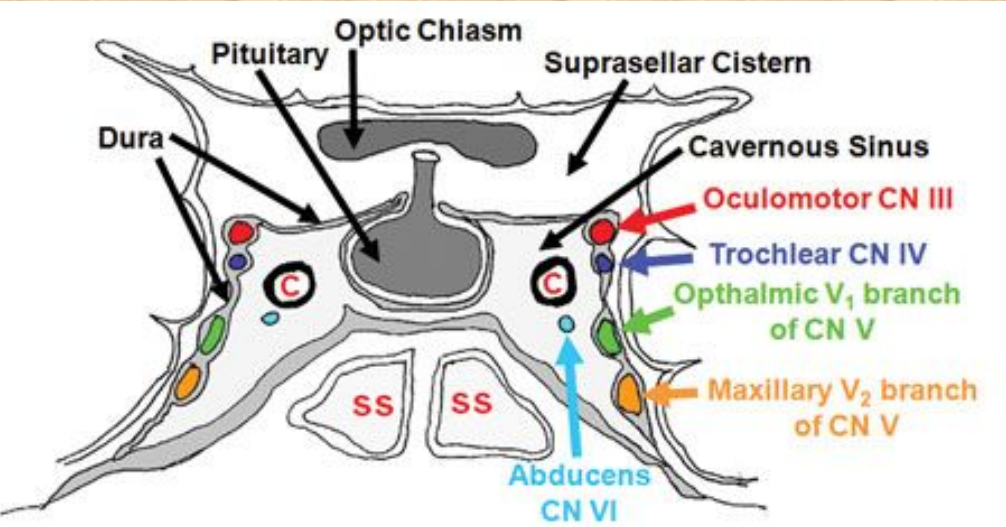


## Venous Sinuses

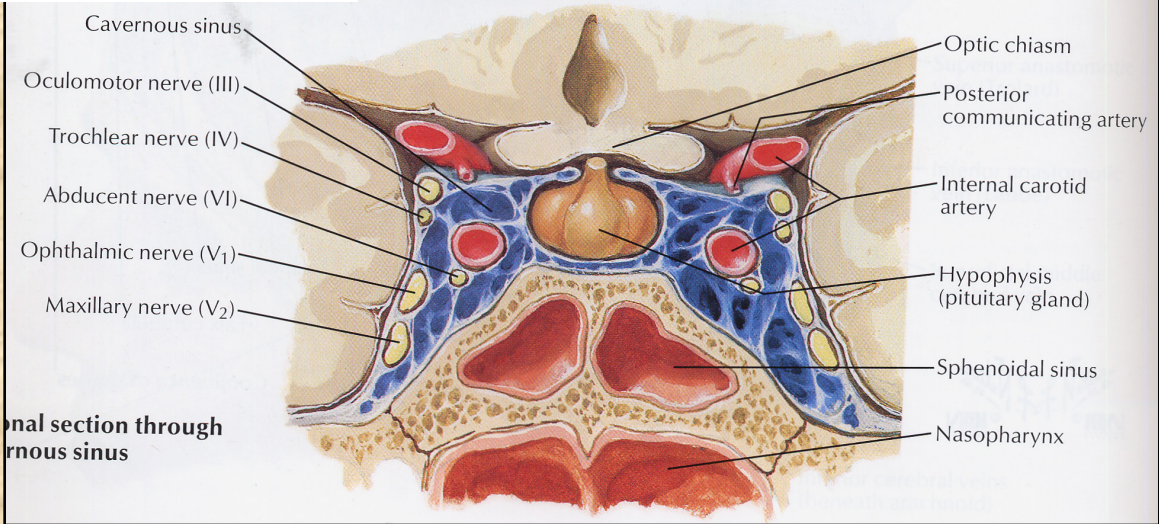
# Cavernous Sinus

- Located on either side of sphenoid bone
- Formed between meningeal and periosteal layers of dura
- Contents
  - Outer wall
    - Oculomotor nerve
    - Trochlear nerve
    - Ophthalmic and maxillary branch of CN V
  - Coursing right through
    - Internal carotid artery
    - Abducens nerve
  - Communications
    - Receives ophthalmic vv. and terminates in superior and inferior petrosal sinuses
    - Also connects to cavernous sinus on contralateral side passing around stalk of pituitary gland

# Cavernous Sinus

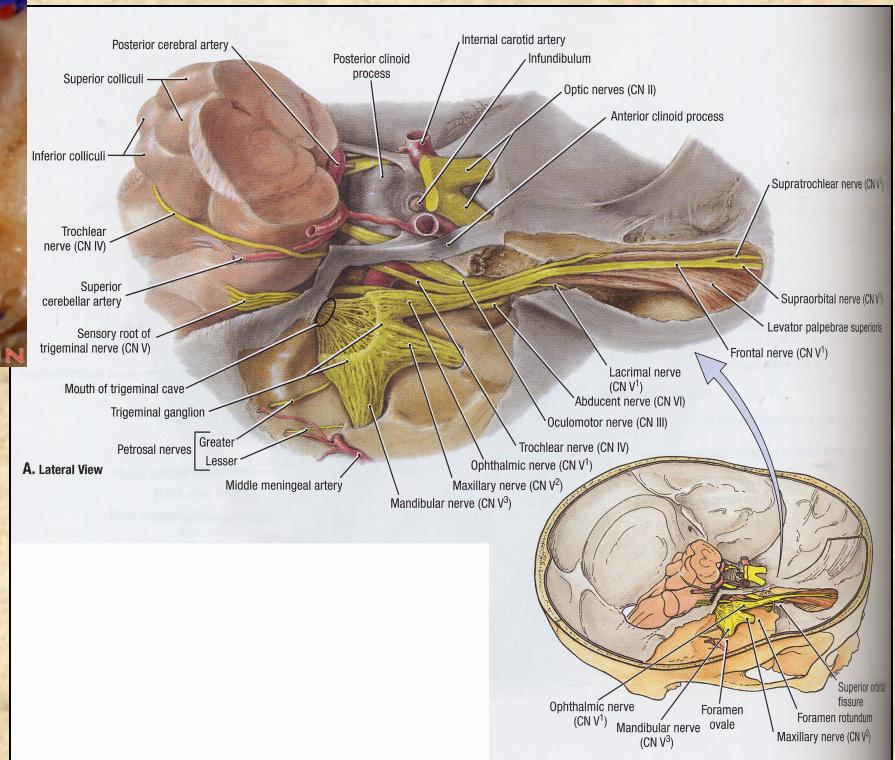
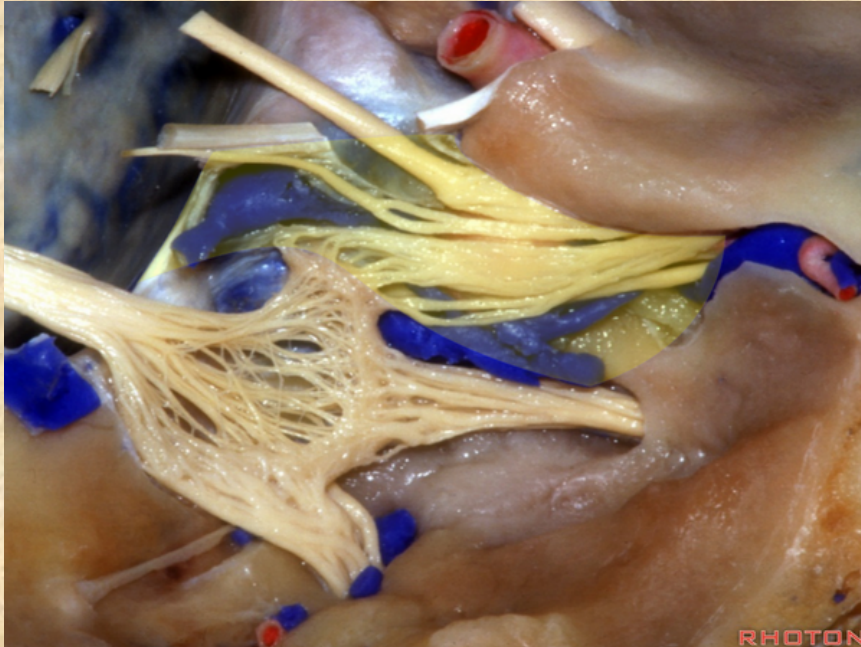


Venous pouch (dural)



Coronal section through cavernous sinus

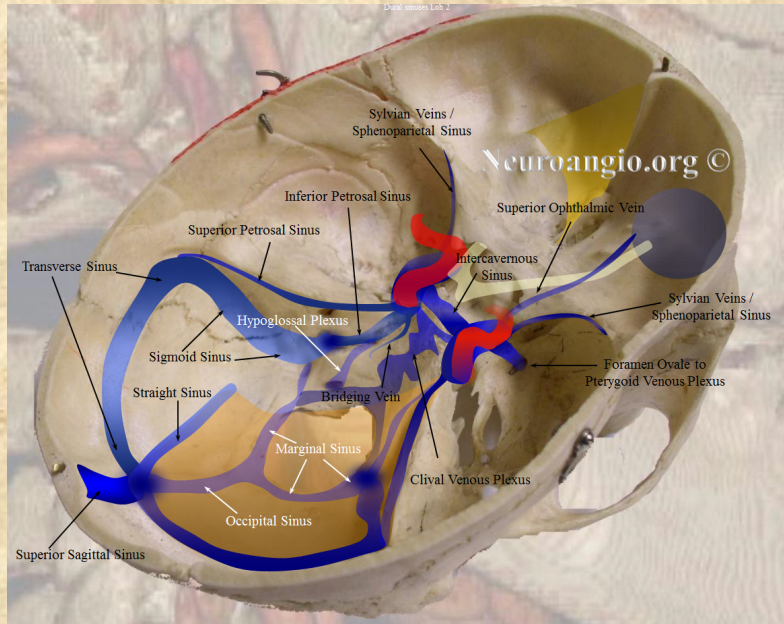
# Trigeminal Ganglion (V)



Cavernous sinus is closely associated with V

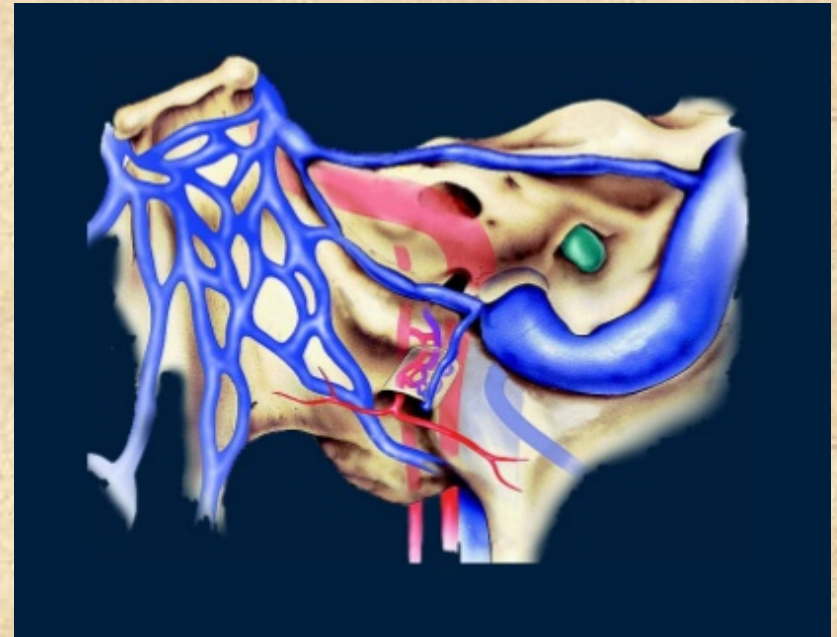


# Cavernous Sinus



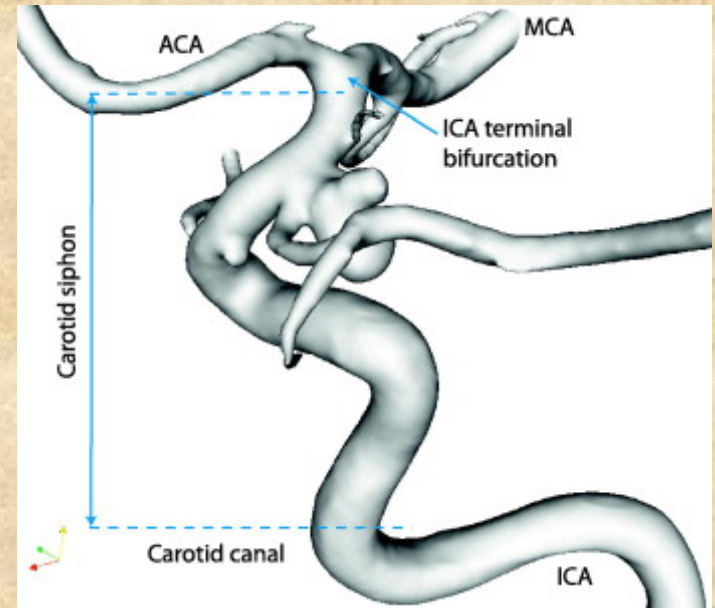
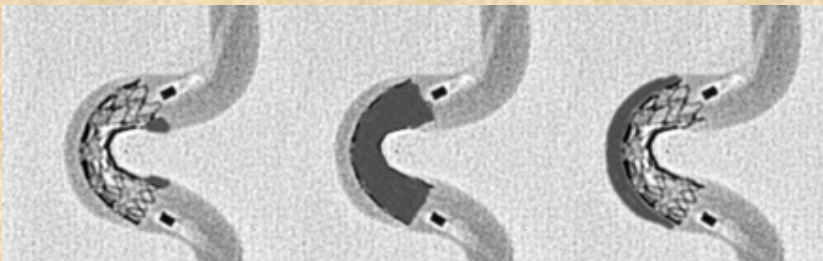
Closely associated with carotid artery and V

Venous pool formed between layers of dura



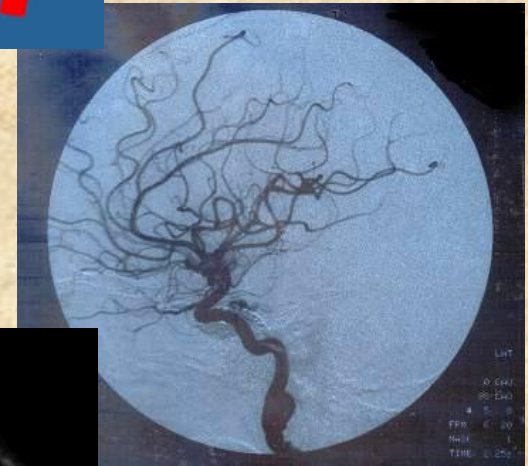
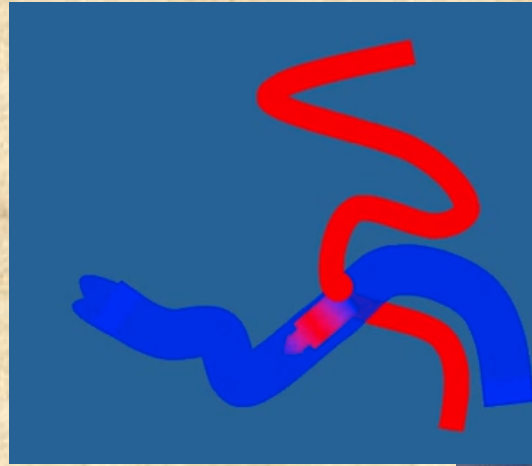
# Carotid Siphon

Portion of the carotid artery that runs through the cavernous sinus



# CC Fistula

Eye Pain  
Diplopia (no lateral rectus)  
Pulse tinnitus



# Hemorrhage

- **Epidural**

- Occurs between skull and dura due to rupture of middle meningeal a.
- Intracranial pressure rises rapidly (unconsciousness, then regain consciousness but disoriented, the rapid coma)

- **Subdural**

- Occurs between dura and arachnoid
- Tearing of cerebral vein from trauma
- Slow accumulation causing clot that must be removed surgically
- Much slower in effects due to decreased venous pressure

- **Subarachnoid**

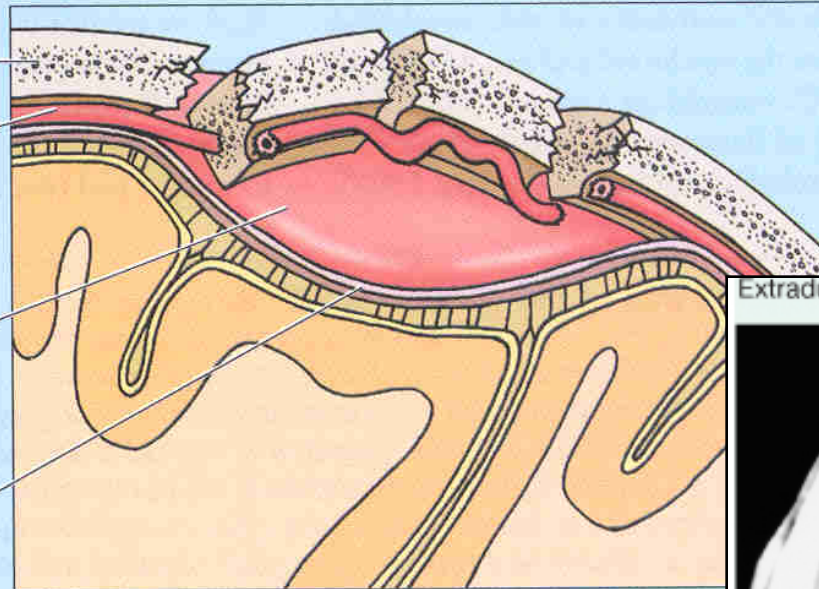
- Confined between arachnoid and pia
- Caused by arterial bleeding following aneurysm, blood in CSF

Calvaria

Middle  
meningeal  
artery

Extradural  
or epidural  
hematoma

Dura



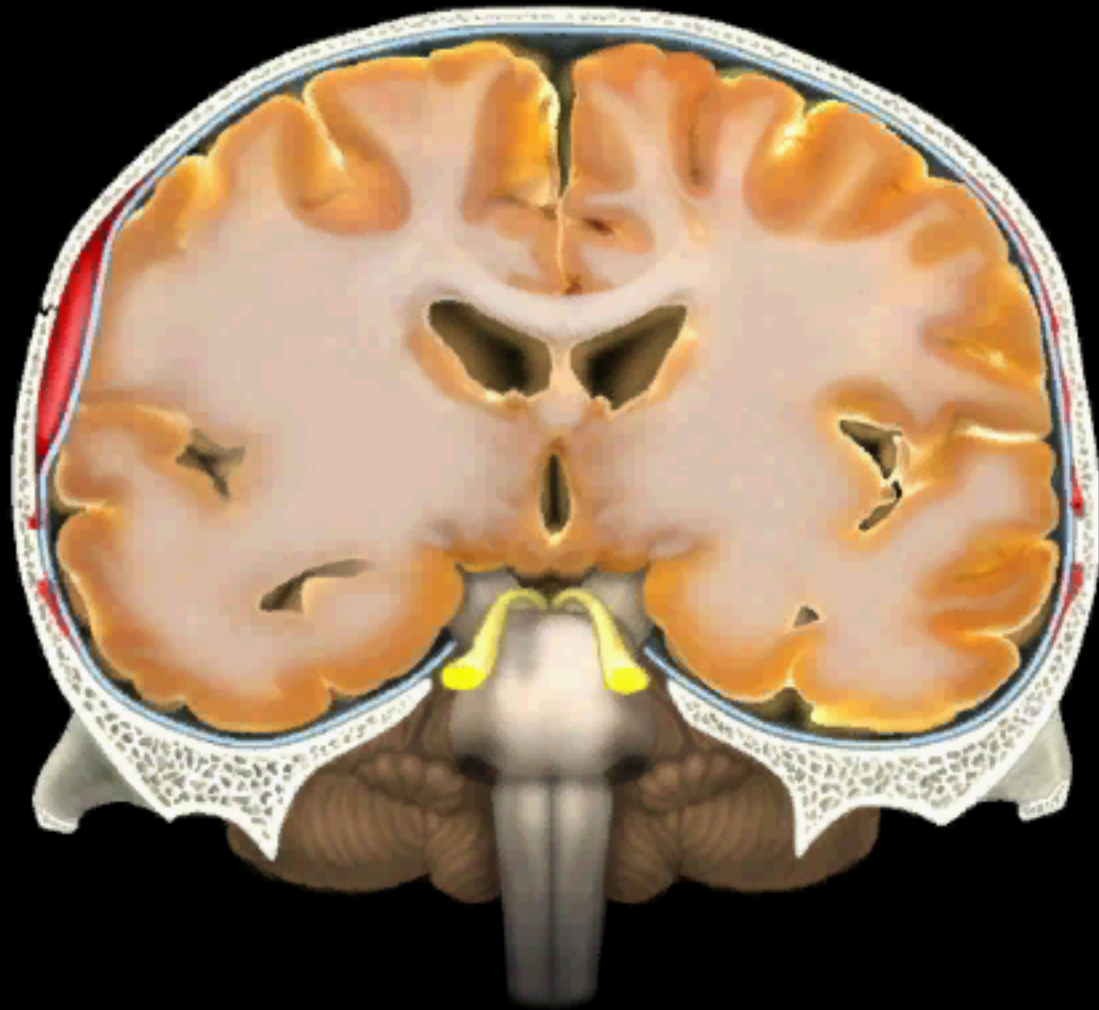
Extradural or epidural hemorrhage

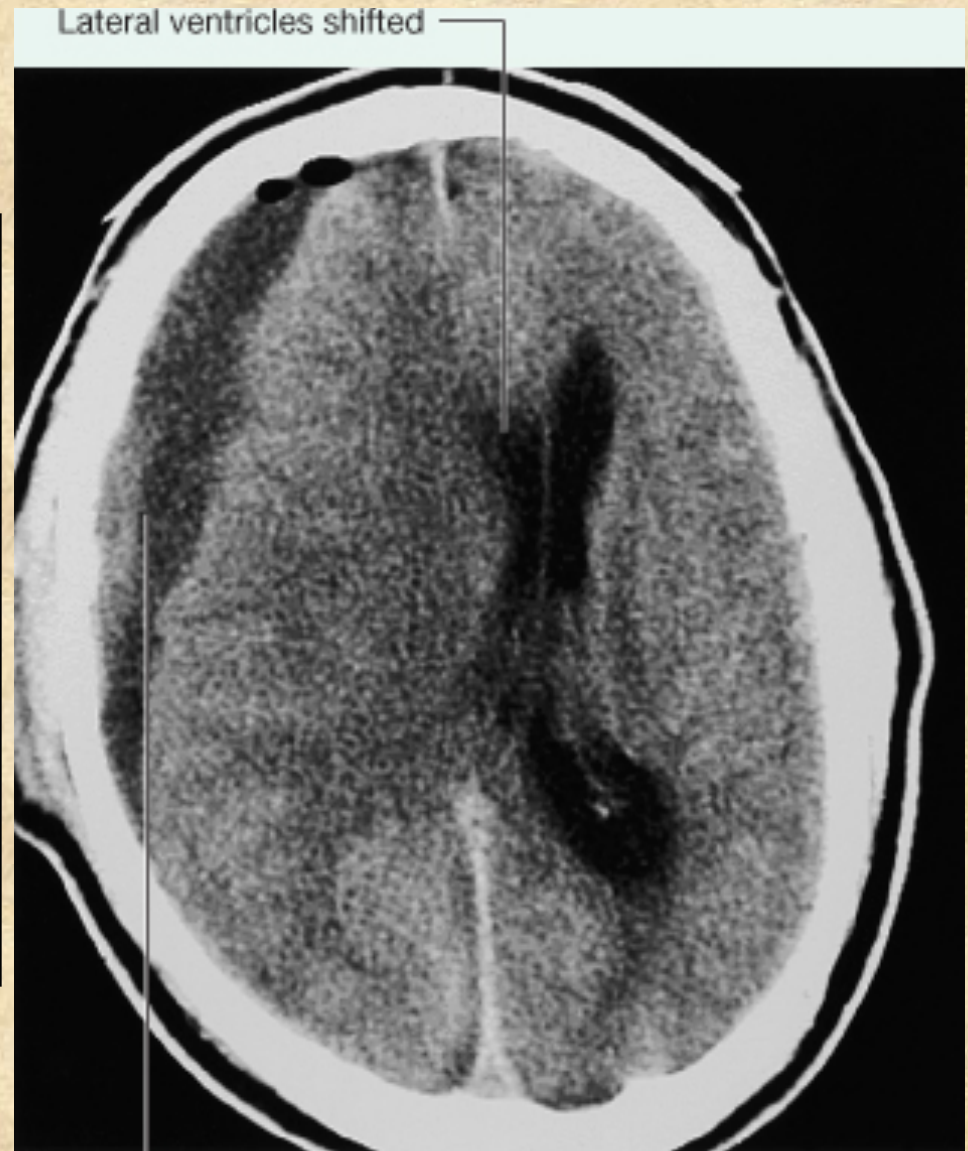
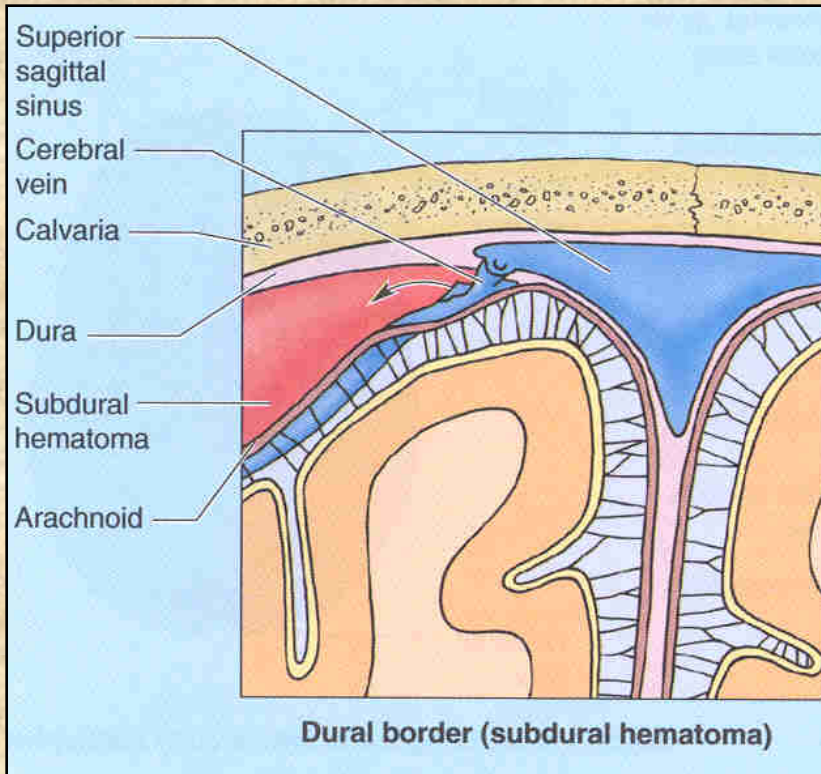
Extradural hematoma

Shift of the falx cerebri



# Epidural Hemorrhage





# Brain

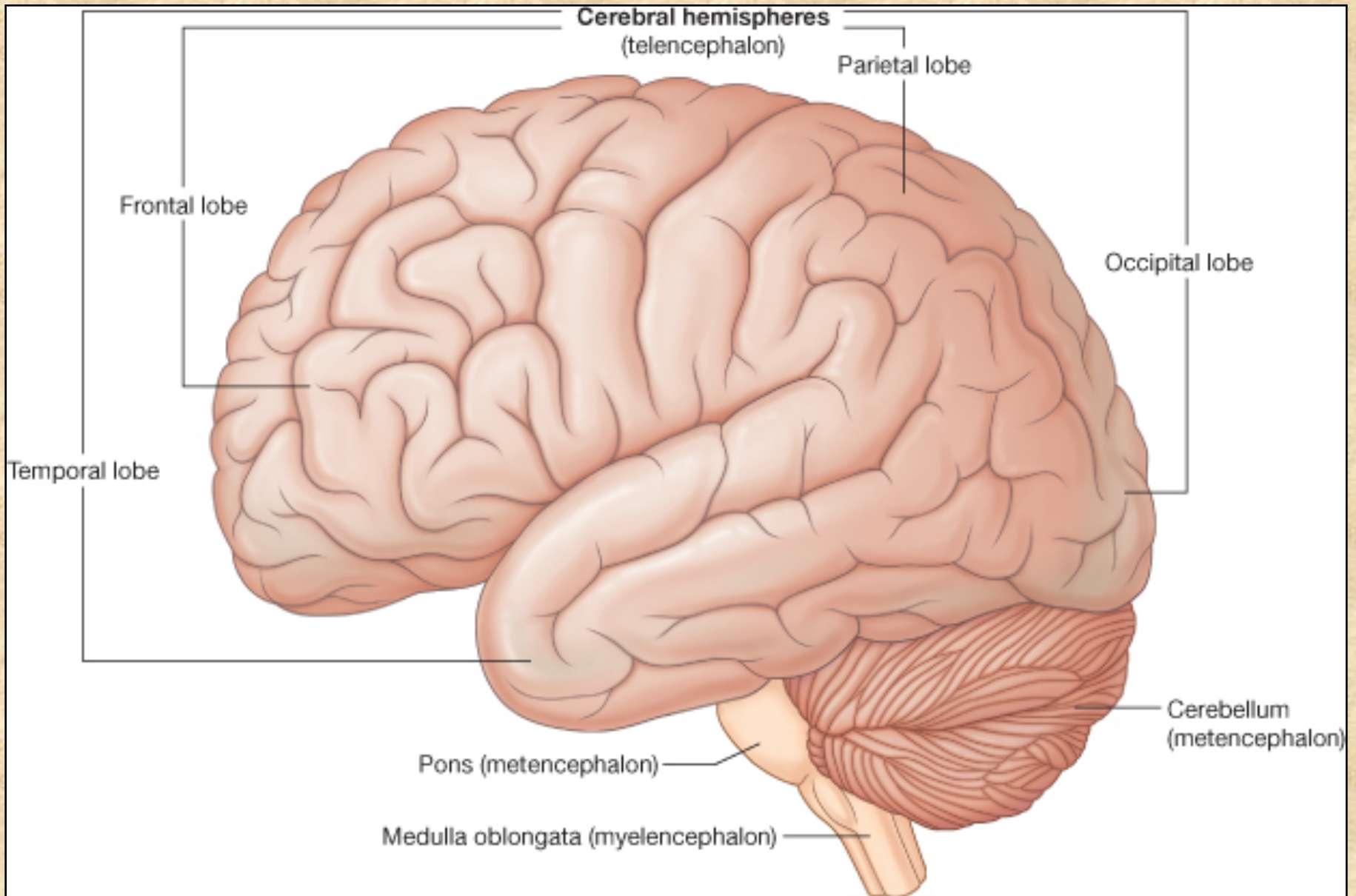
- Cerebrum, Cerebellum, Brain Stem
- Gyri (folds), sulci (grooves), fissure (clefts)
- Cerebrum
  - Includes cerebral hemispheres separated by falx cerebri within the longitudinal vertebral fissure
  - Central sulcus divides cerebrum into frontal and parietal lobes
  - Lateral sulcus separates the temporal lobe
  - Parieto-occipital sulcus separates the occipital lobes



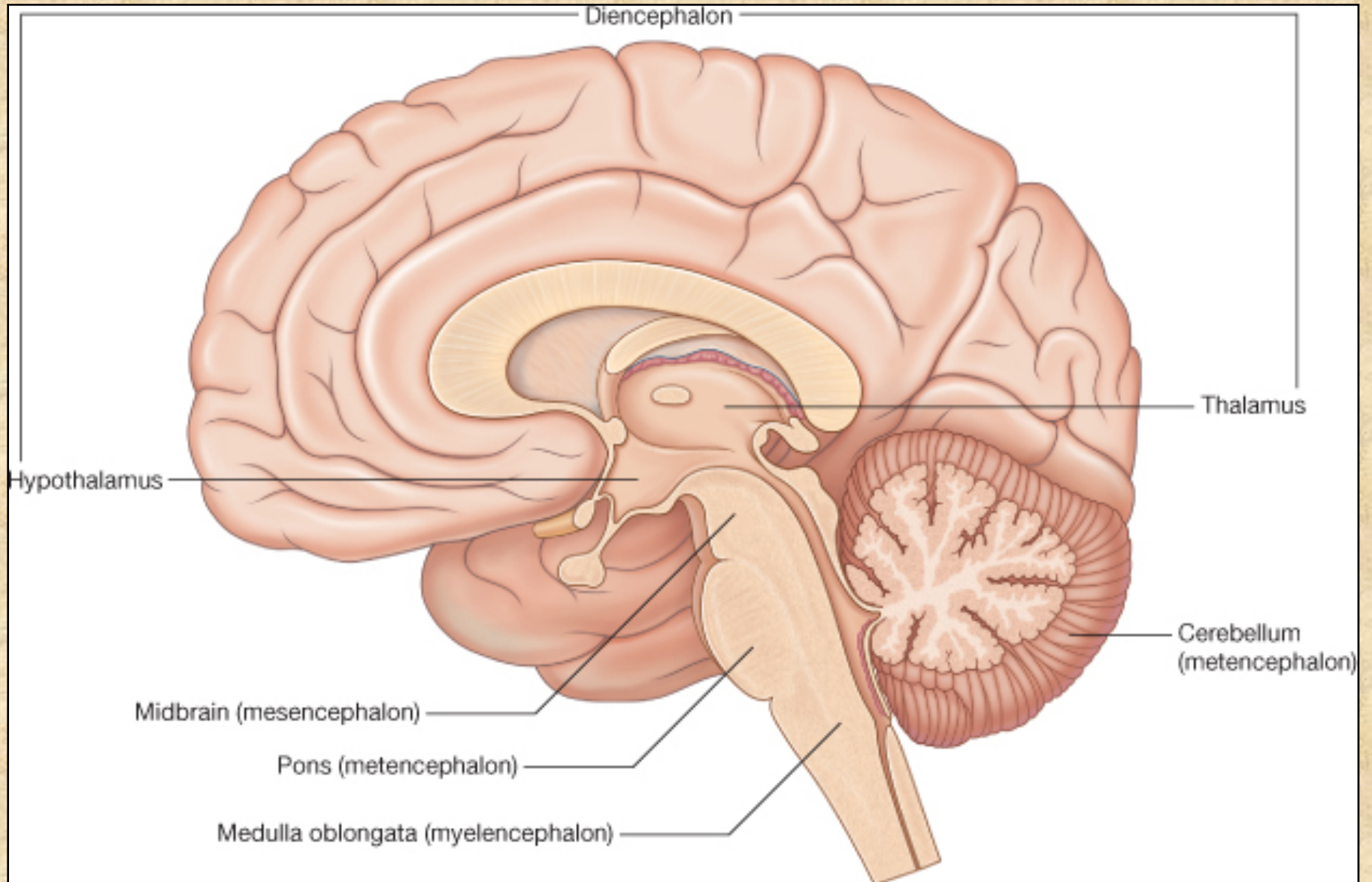
# Brain

- Ventricles
  - Lateral ventricles with interventricular foramen
  - 3rd ventricle is a slit-like cavity between diencephalon and continuous with cerebral aqueduct
  - 4th ventricle receives from cerebral aqueduct and terminates as median and lateral apertures
- Subarachnoid Cisterns (many)
  - Widely separated areas of pia and arachnoid resulting in ‘pools’ of CSF
  - Posterior cerebello-medullary cistern used for obtaining CSF during cistern puncture

# Brain



# Brain

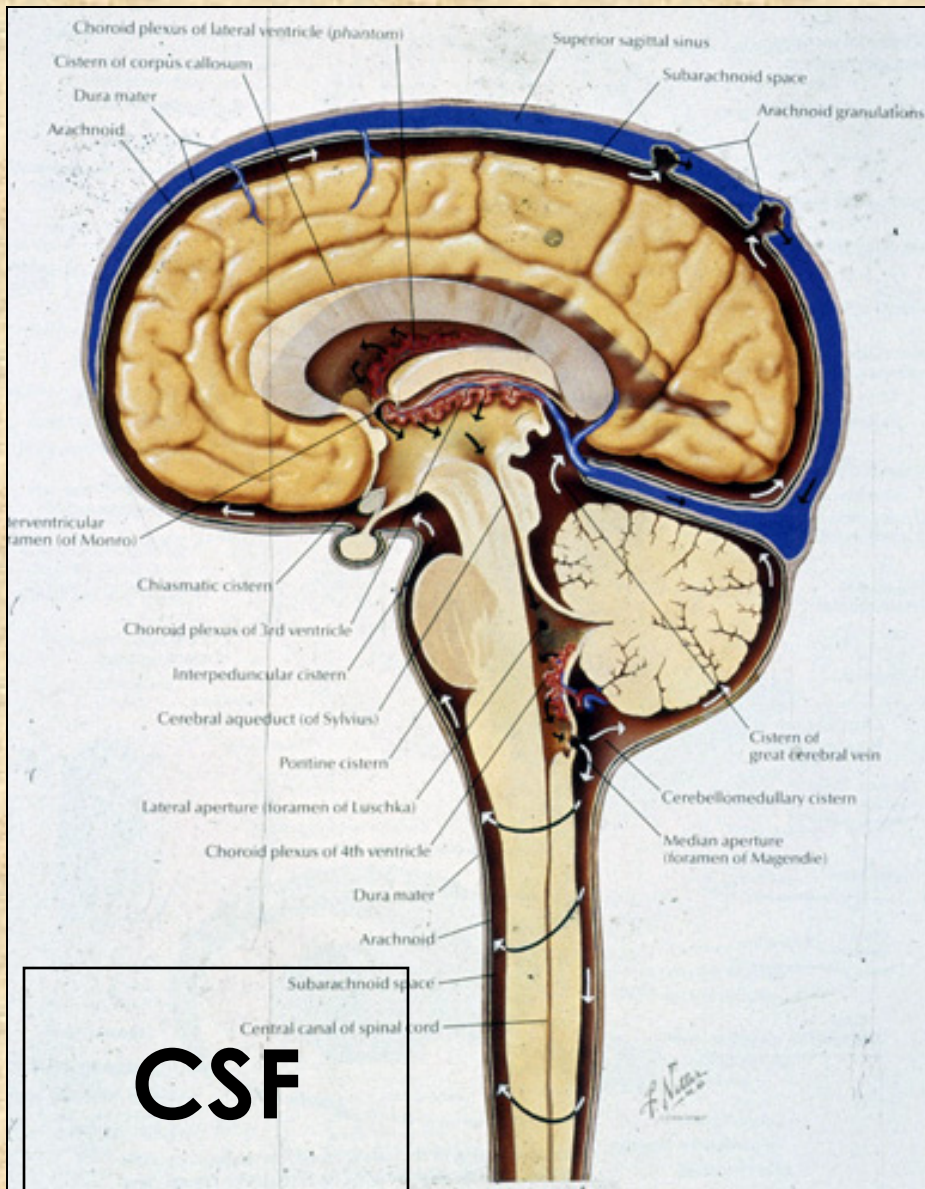


# Cerebrospinal Fluid (CSF)

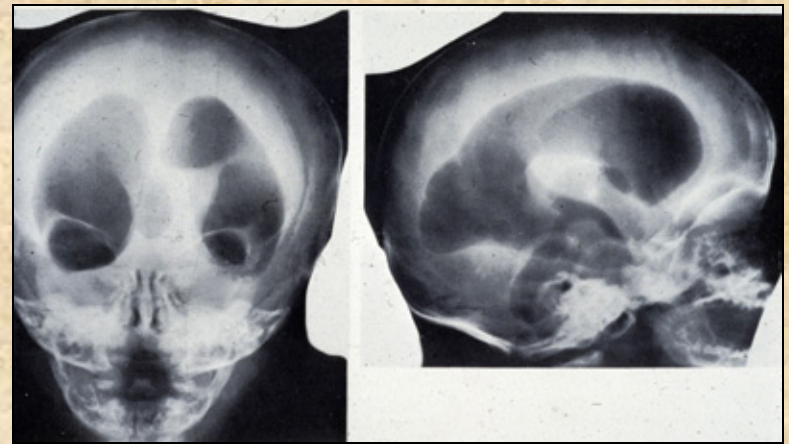
- Watery alkaline substance similar to plasma
- Formed by choroid plexus
  - Membrane lining central canal of spinal cord and lateral ventricles
  - Circulation
    - Forms in ventricles
    - Travels into third and fourth ventricles out of foramen of Luschka (lateral apertures) and foramen of Magendie (median aperture) into subarachnoid space of brain and spinal cord
  - Total volume is 140 mL, but rate of formation is 600-700 mL/day

# Cerebrospinal Fluid (CSF)

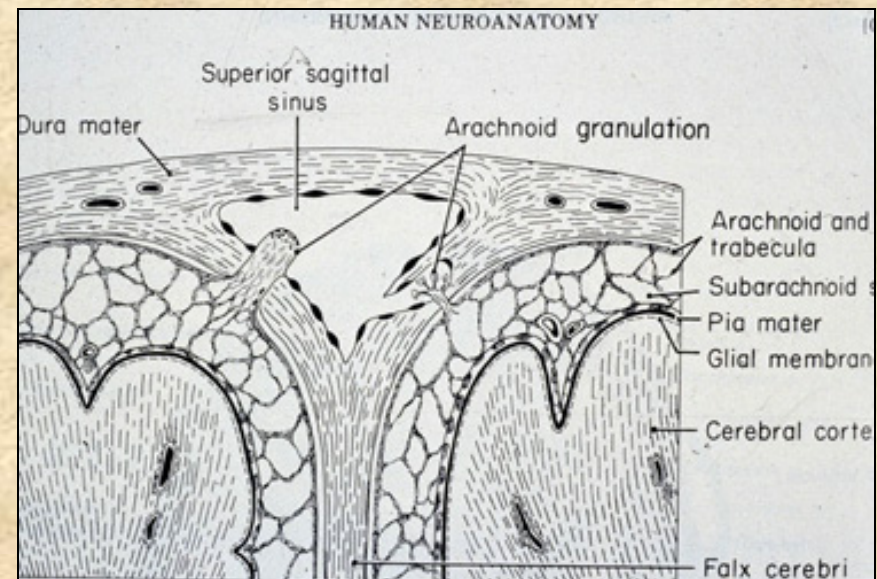
- Absorbed through arachnoid villi
  - Small projections into dural sinuses
  - Moves into venous sinuses via passive diffusion
  - Villi act as 1-way valves
  - Negative pressure in venous sinuses permits CSF to enter venous system
  - Positive pressure in venous sinuses causes valves to close preventing backflow
  - Excessive production or blockage in 3rd, 4th ventricles causes hydrocephalus
- Arachnoid Granulations
  - Projections that become calcified - seen inside sagittal sinus



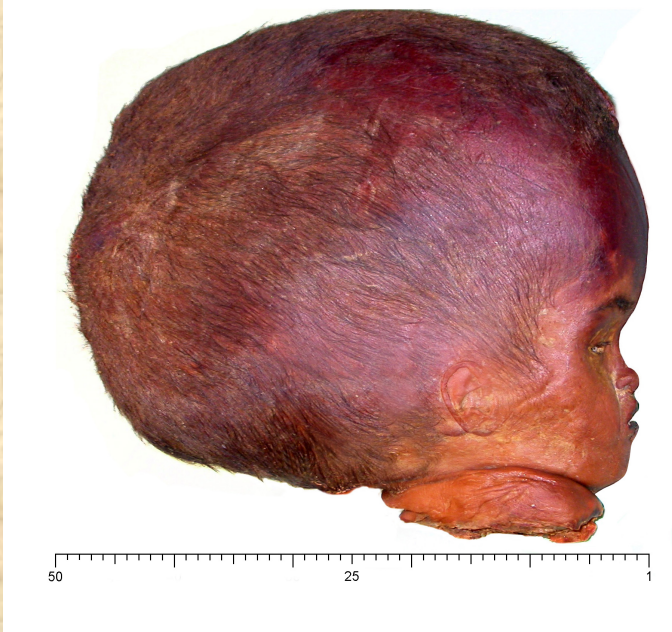
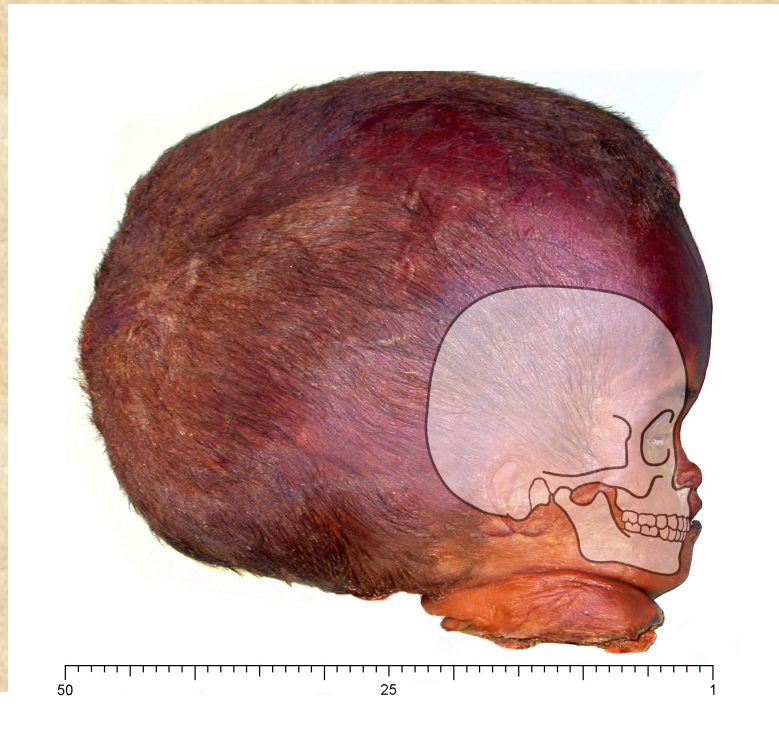
**CSF**



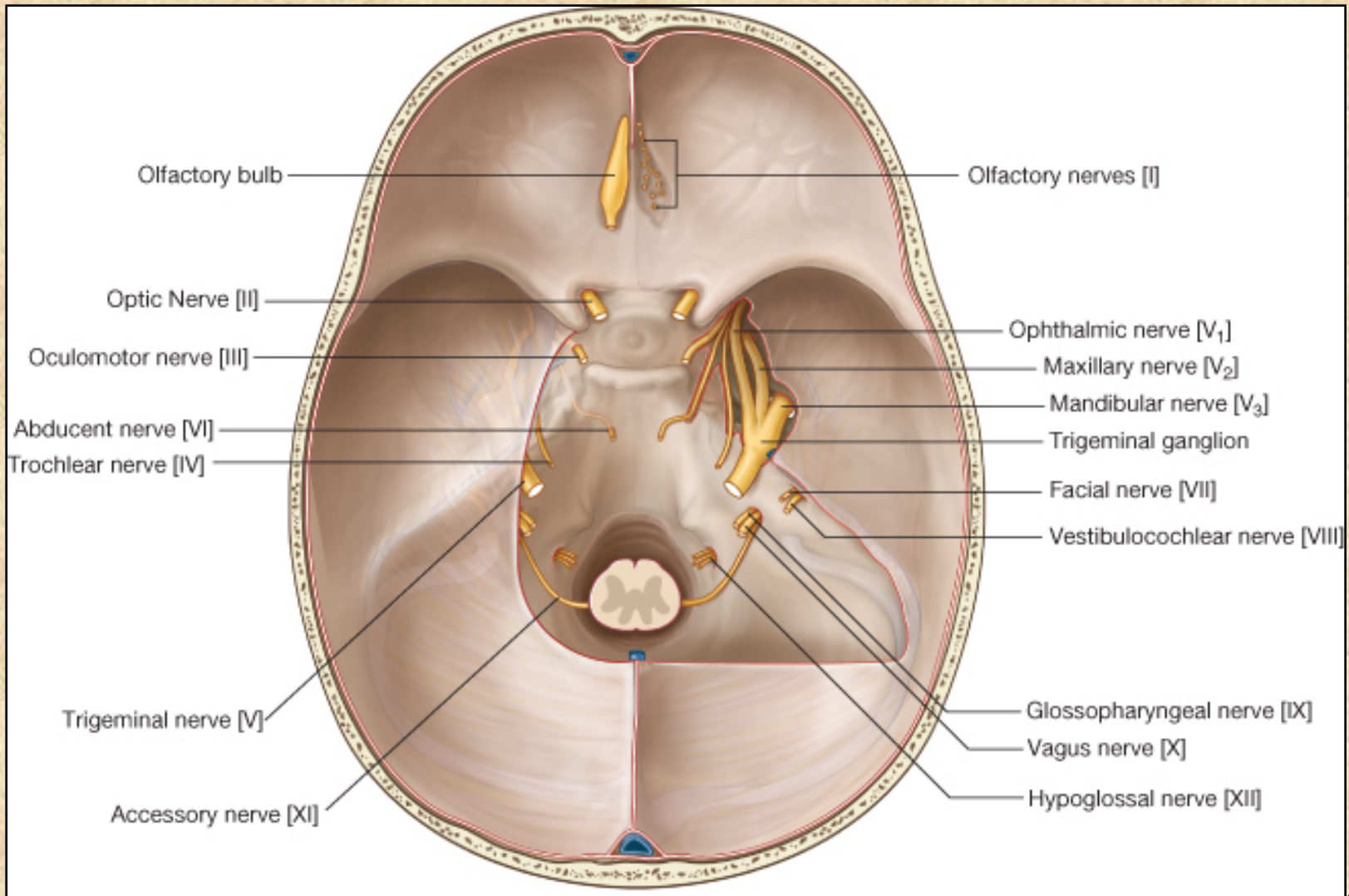
# Hydrocephalus



# Hydrocephalus

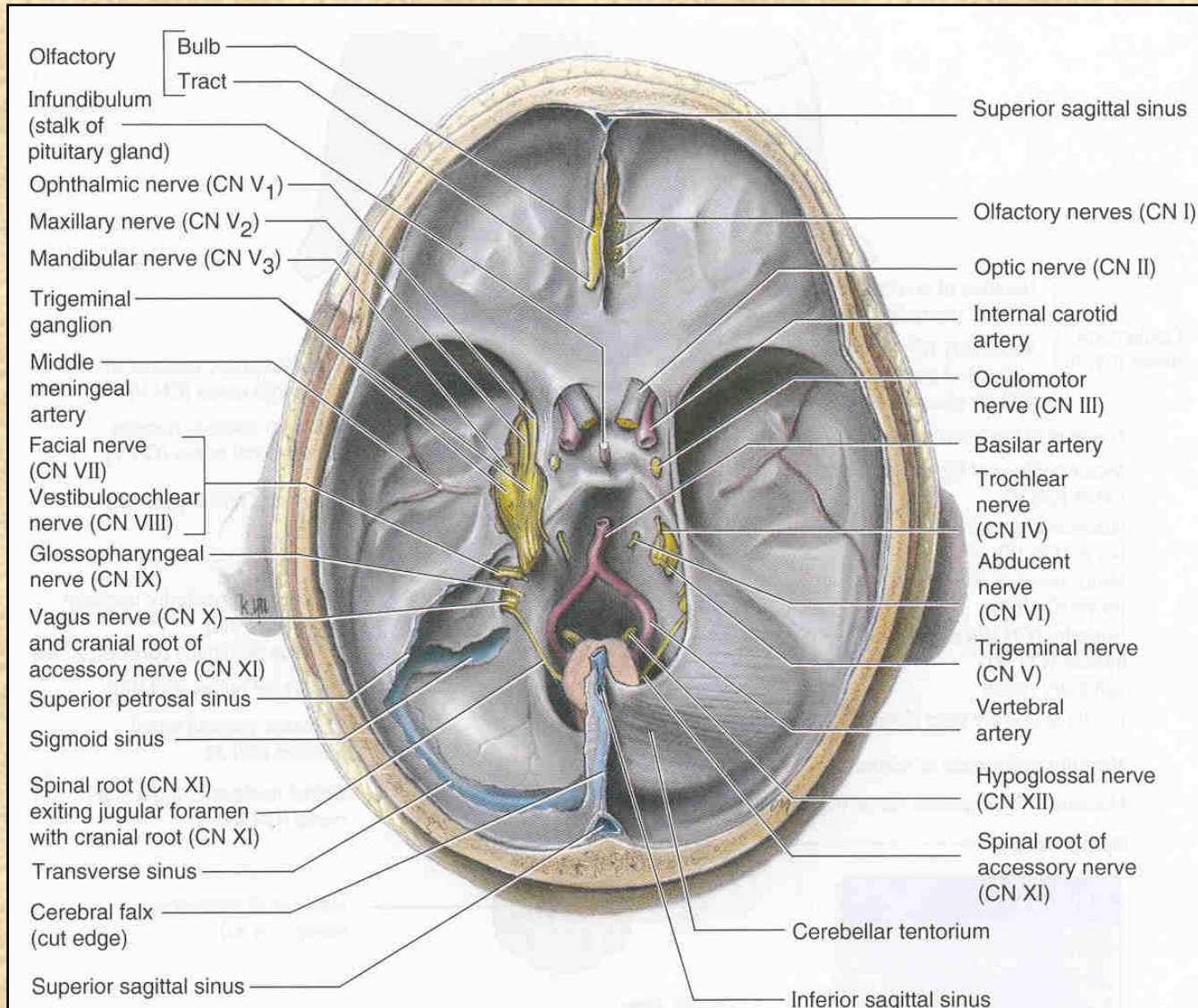


# Cranial Foramina





# Cranial Foramina





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