

CEREBRAL BLOOD CIRCULATION

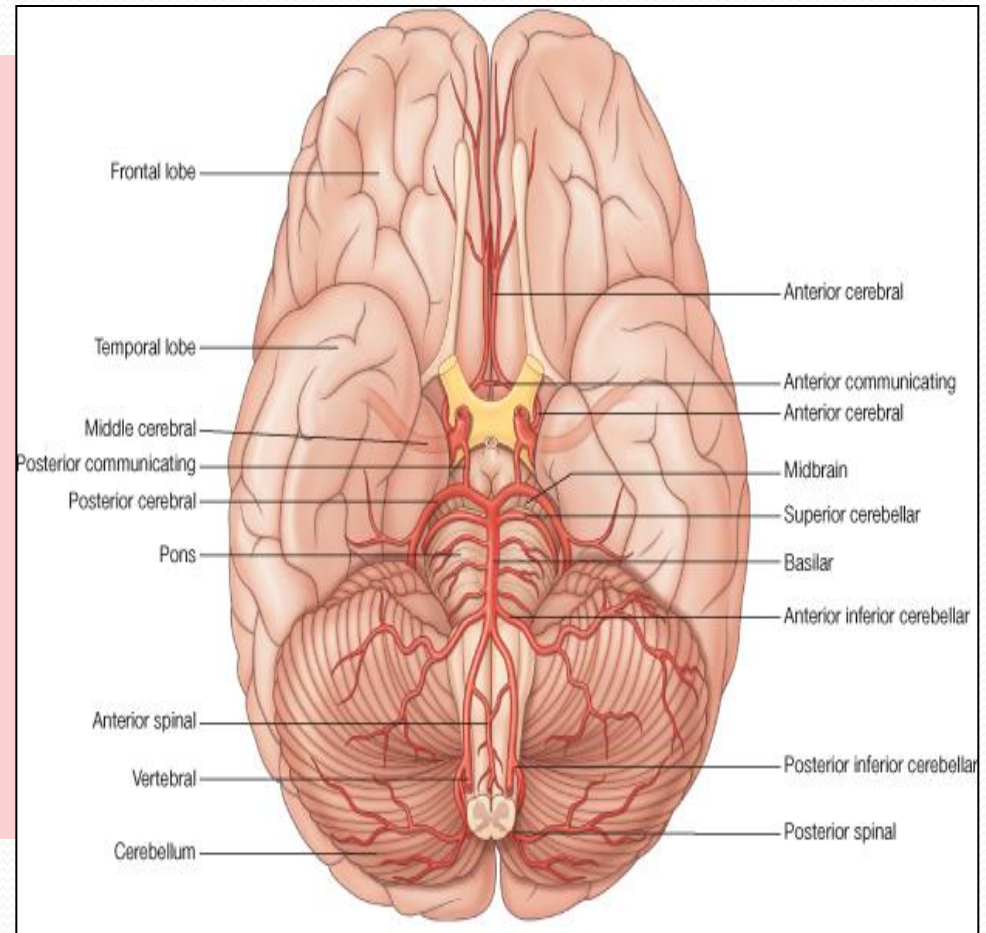
DR JAMILA EL MEDANY

OBJECTIVES

- **At the end of the lecture, students should be able to:**
- **List the cerebral arteries.**
- **Describe the cerebral arterial supply regarding the origin, distribution and branches.**
- **Describe the arterial Circle of Willis .**
- **Describe the cerebral venous drainage and its termination.**
- **Describe arterial & venous vascular disorders and their clinical manifestations.**

CEREBRAL ARTERIAL SUPPLY

- It is composed of two arterial systems:
 - **A. Carotid System**
 - **B. Vertebro Basilar System**



CAROTID SYSTEM

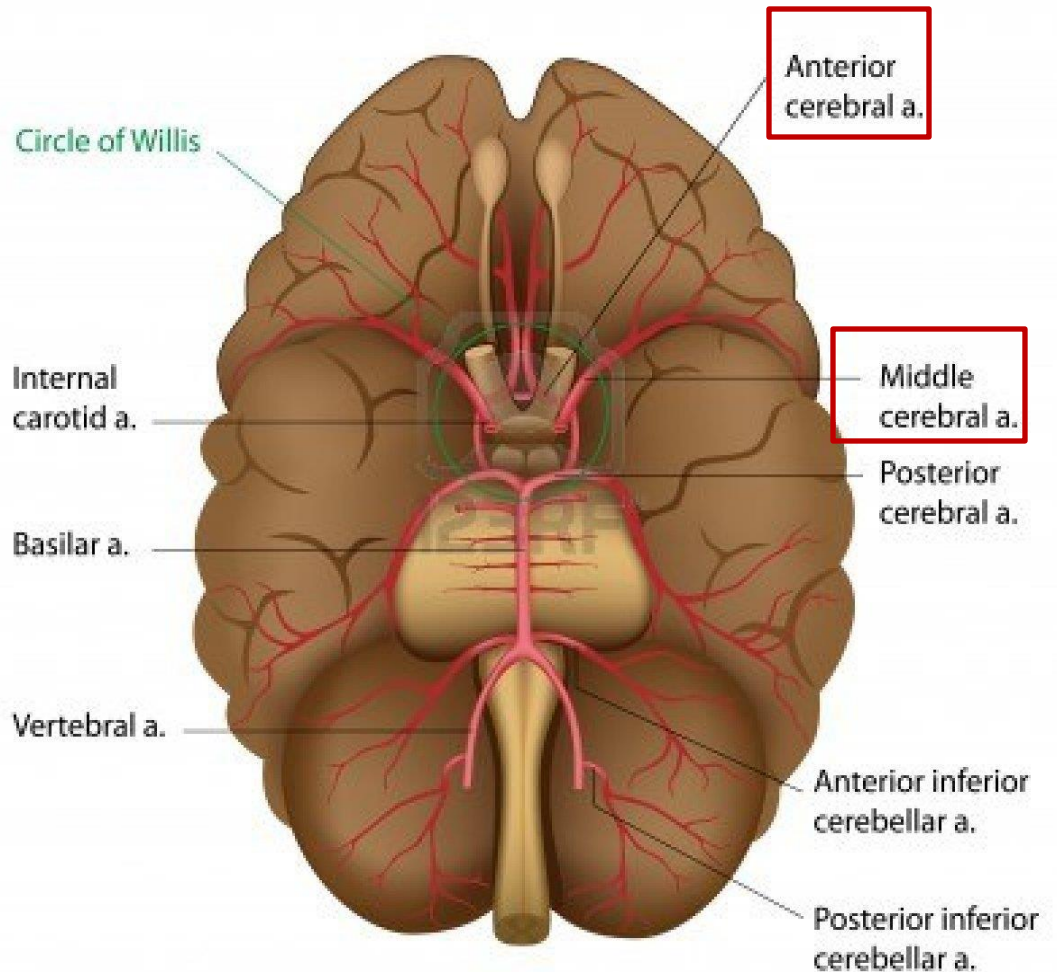
It is composed of:

Internal carotid artery and its branches:

Anterior cerebral artery &

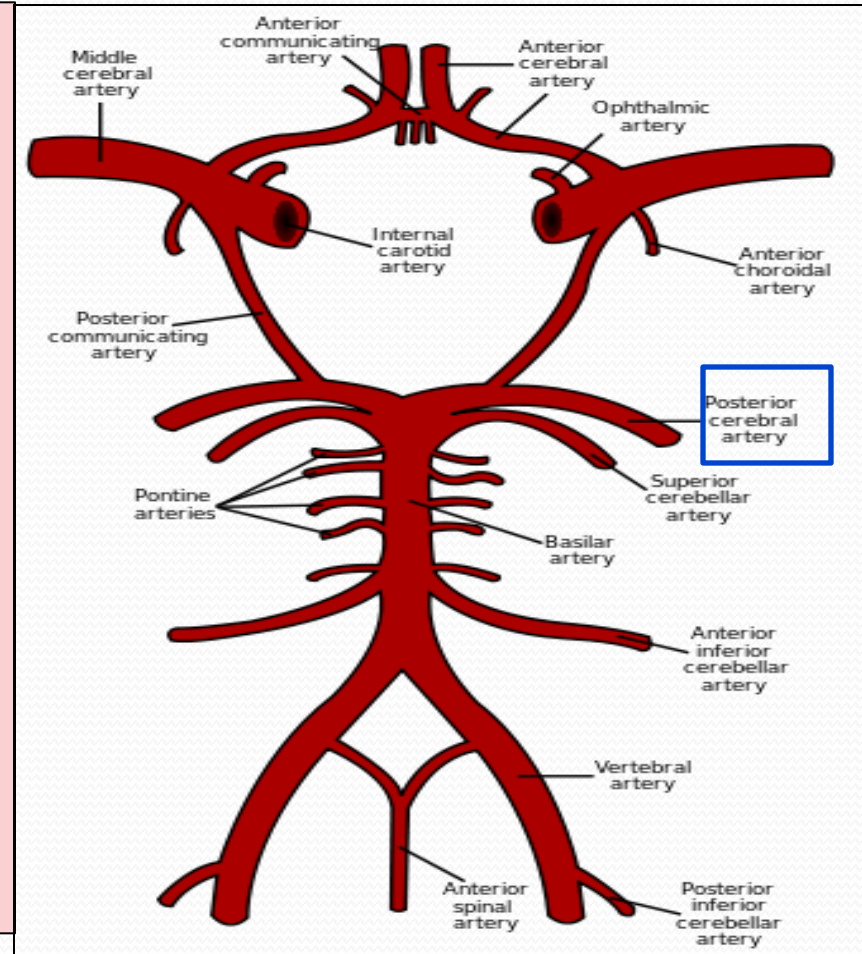
Middle cerebral artery

Blood Supply of the Brain

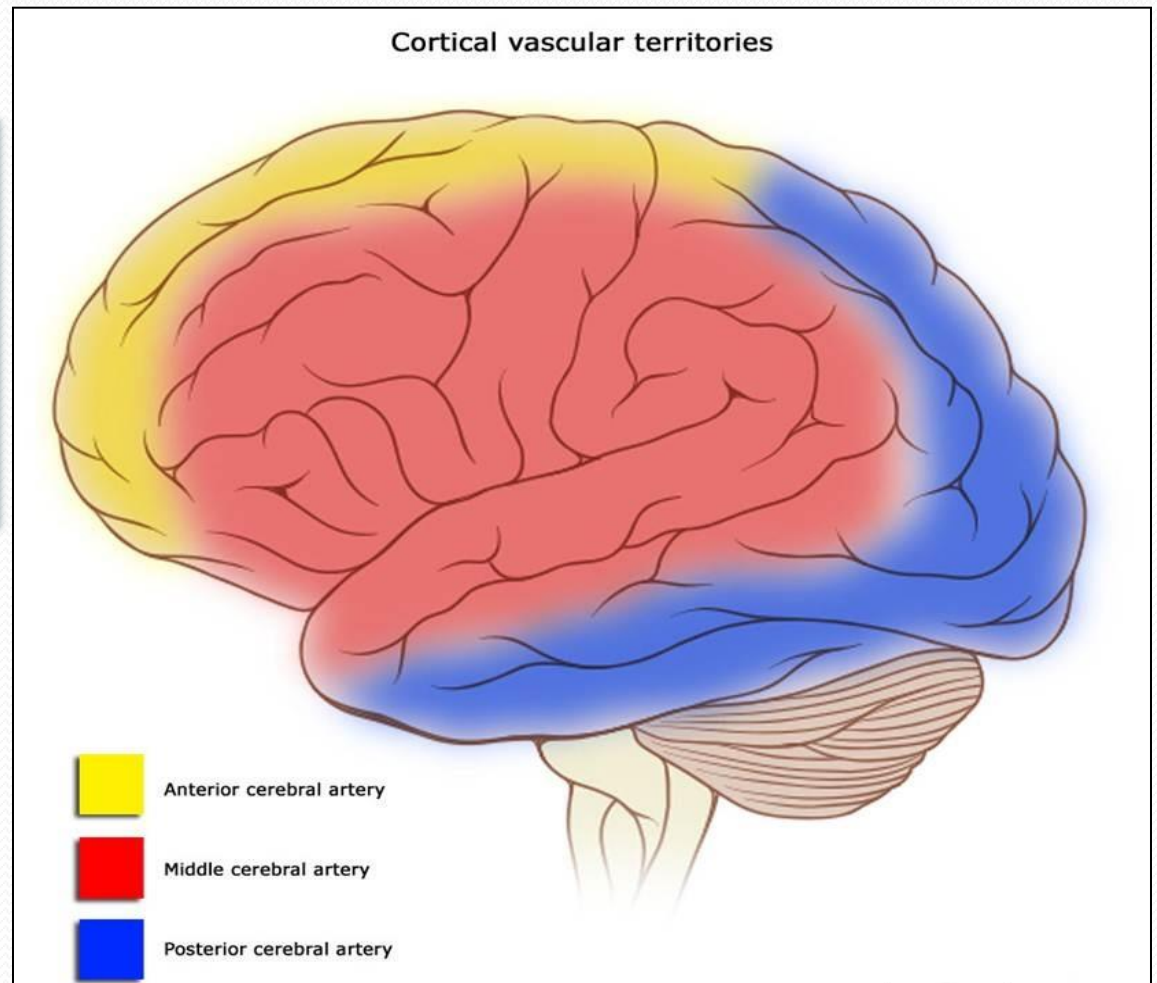


VERTEBRO BASILAR SYSTEM

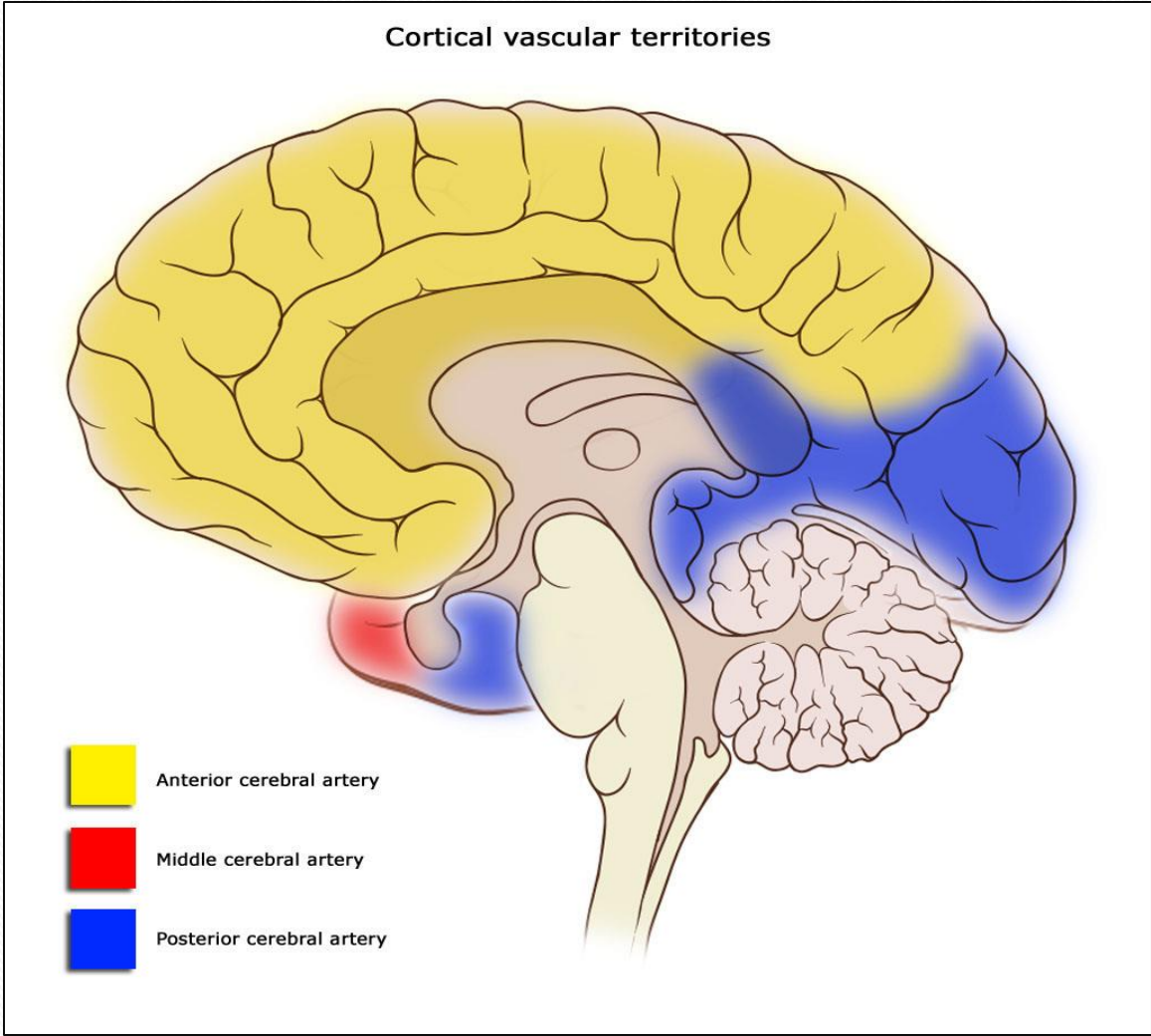
- The two **Vertebral** arteries (from **Subclavian artery**) unite to form **Basilar** artery.
- It divides at the upper border of the pons into two **Posterior Cerebral** arteries.



Distribution of the cerebral arteries on the superolateral surface of the cerebral H

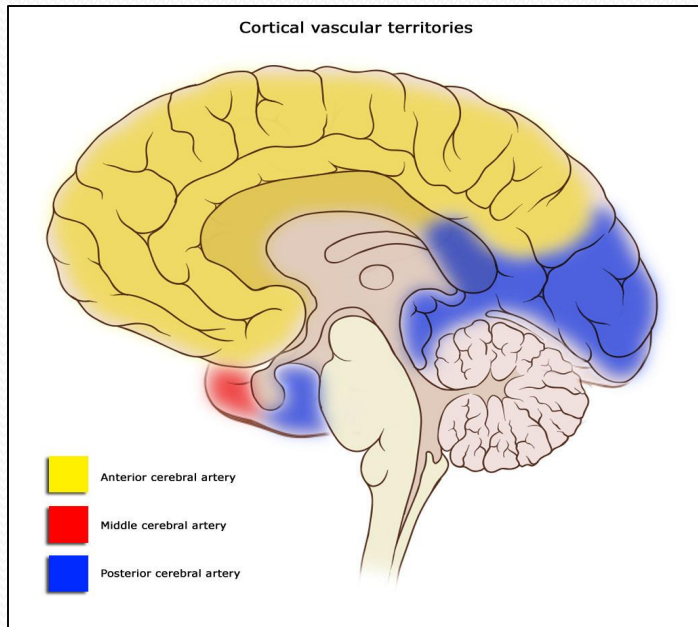


Distribution of the cerebral arteries on the medial surface of the cerebral H

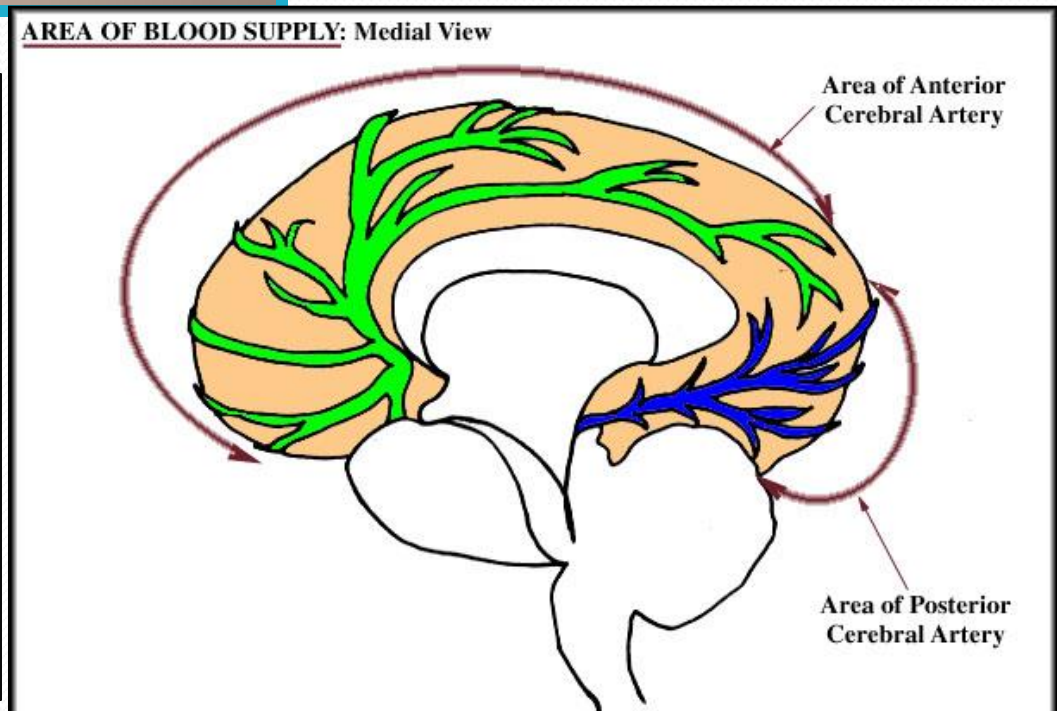


ANTERIOR CEREBRAL ARTERY

- **Supplies** : orbital and medial surfaces of the **frontal** and **parietal** lobes
- A narrow part on the superolateral surface.



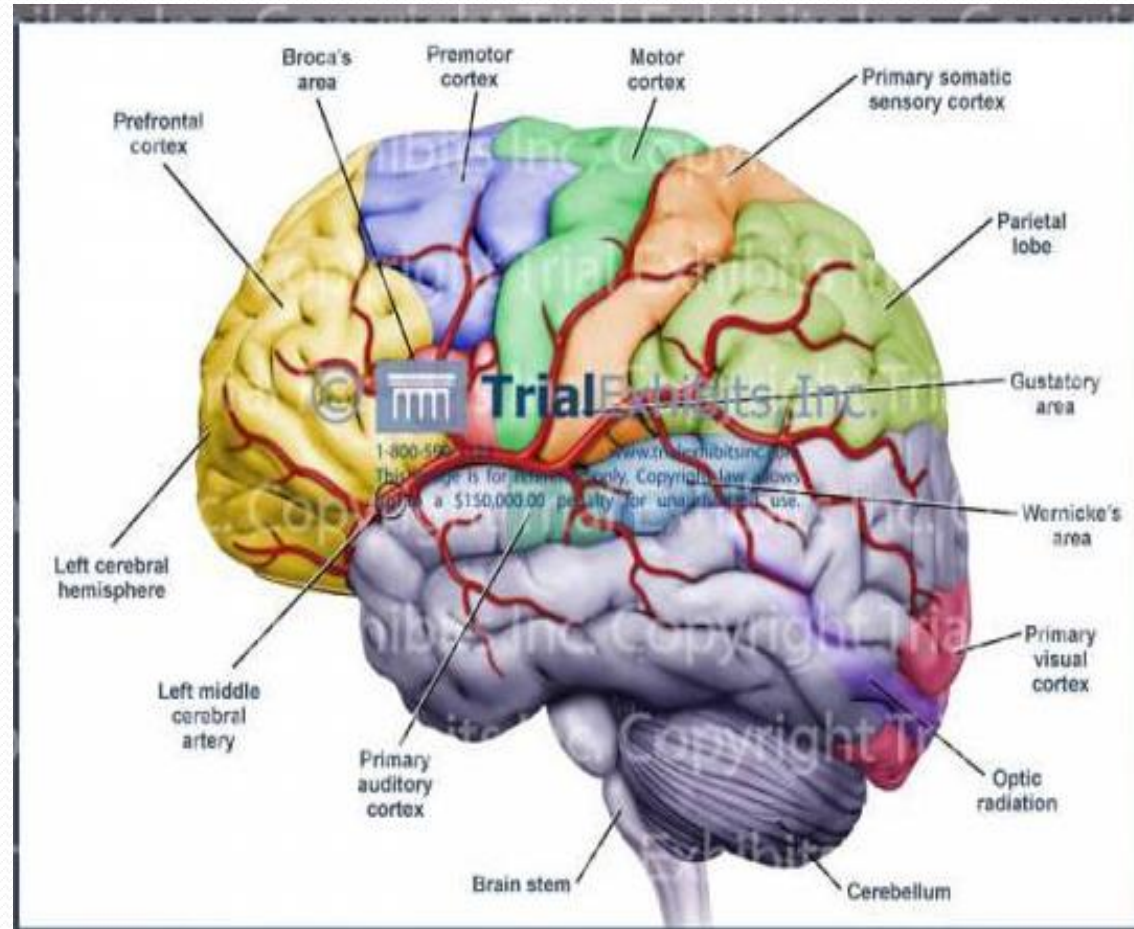
AREA OF BLOOD SUPPLY: Medial View



MIDDLE CEREBRAL ARTERY

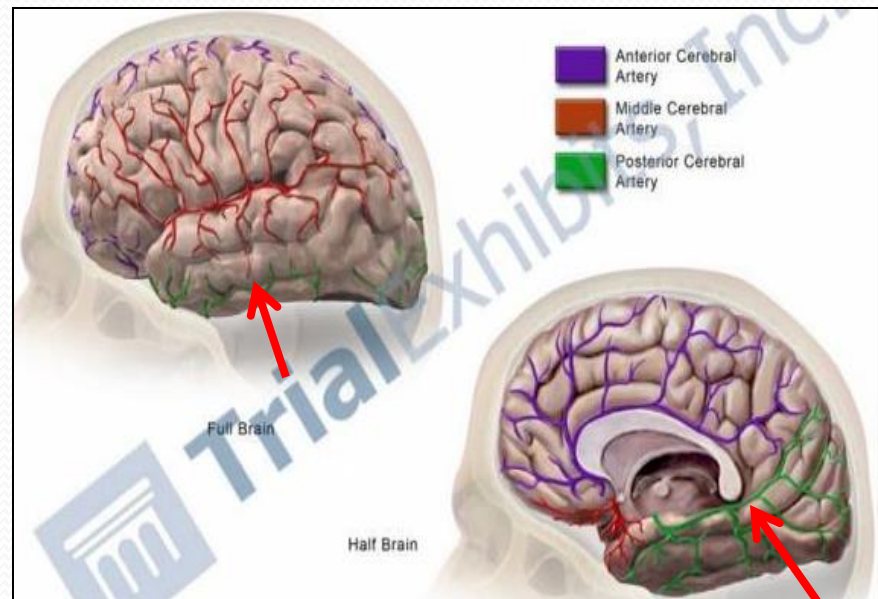
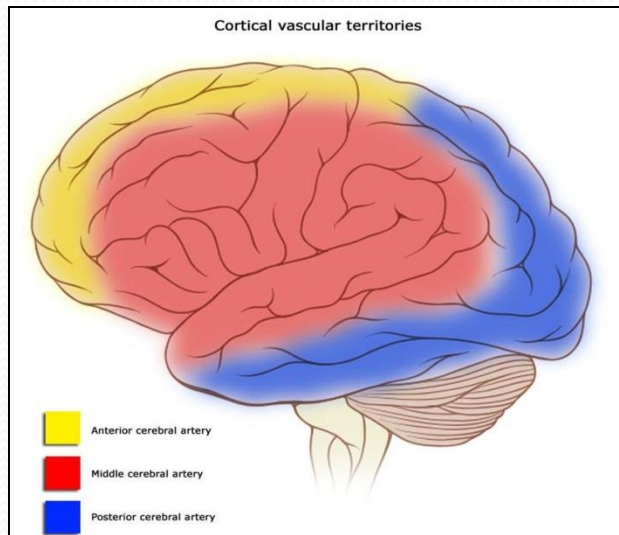
- **Supplies** entire Superolateral surface:

- **Somatosensory Cortex**
- **Motor Cortex**
- **Language areas:**
- **Broca's Area**
- **Wernicke's Area)**
- **Auditory areas:**
- **Primary auditory area**
- **Auditory association (Heschl's Gyrus**

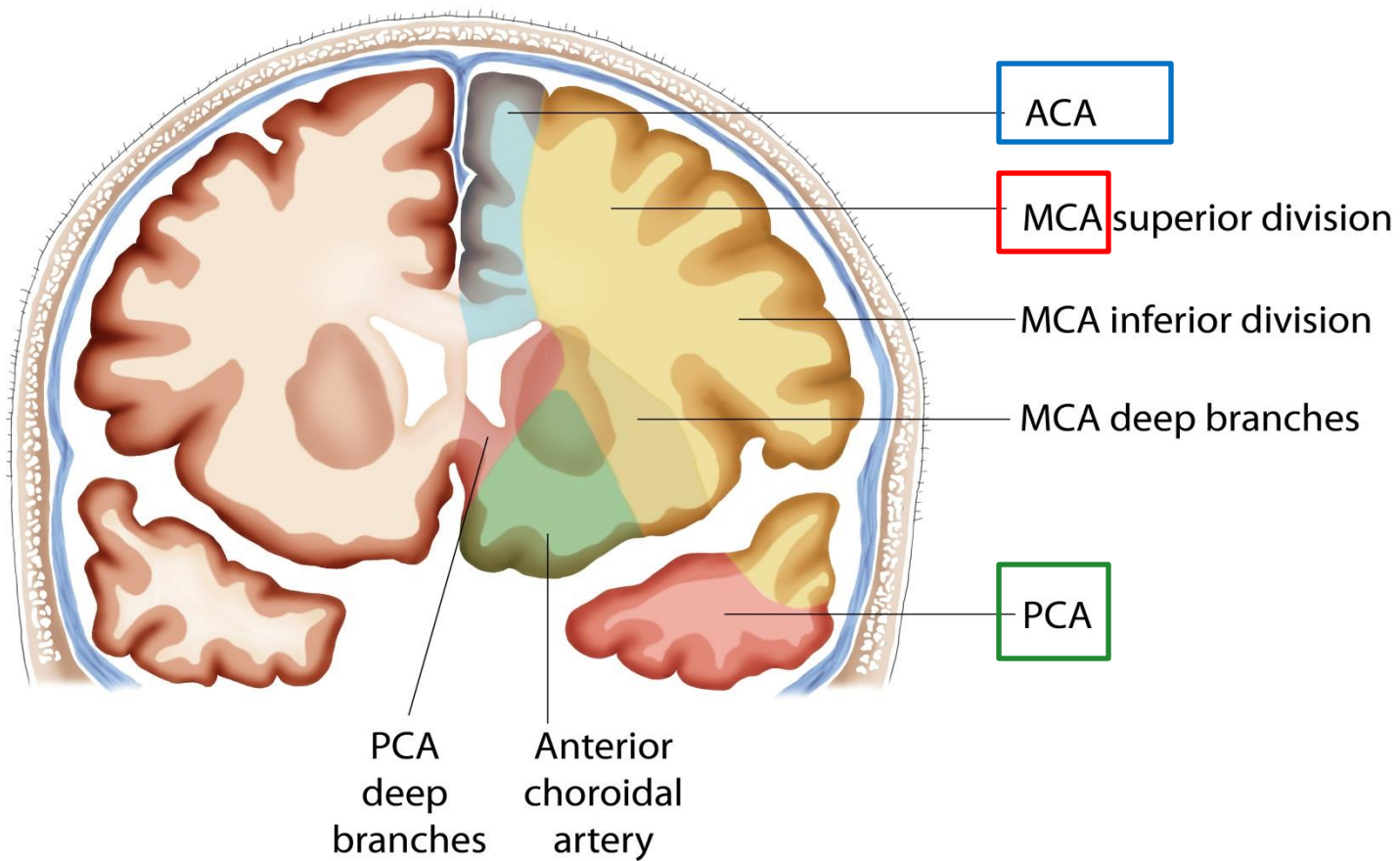


POSTERIOR CEREBRAL ARTERY

- **Supplies:**
- Anterior and inferior parts of temporal lobe, Uncus, Inferior temporal gyrus,
- Inferior and Medial parts of Occipital lobe (visual areas)

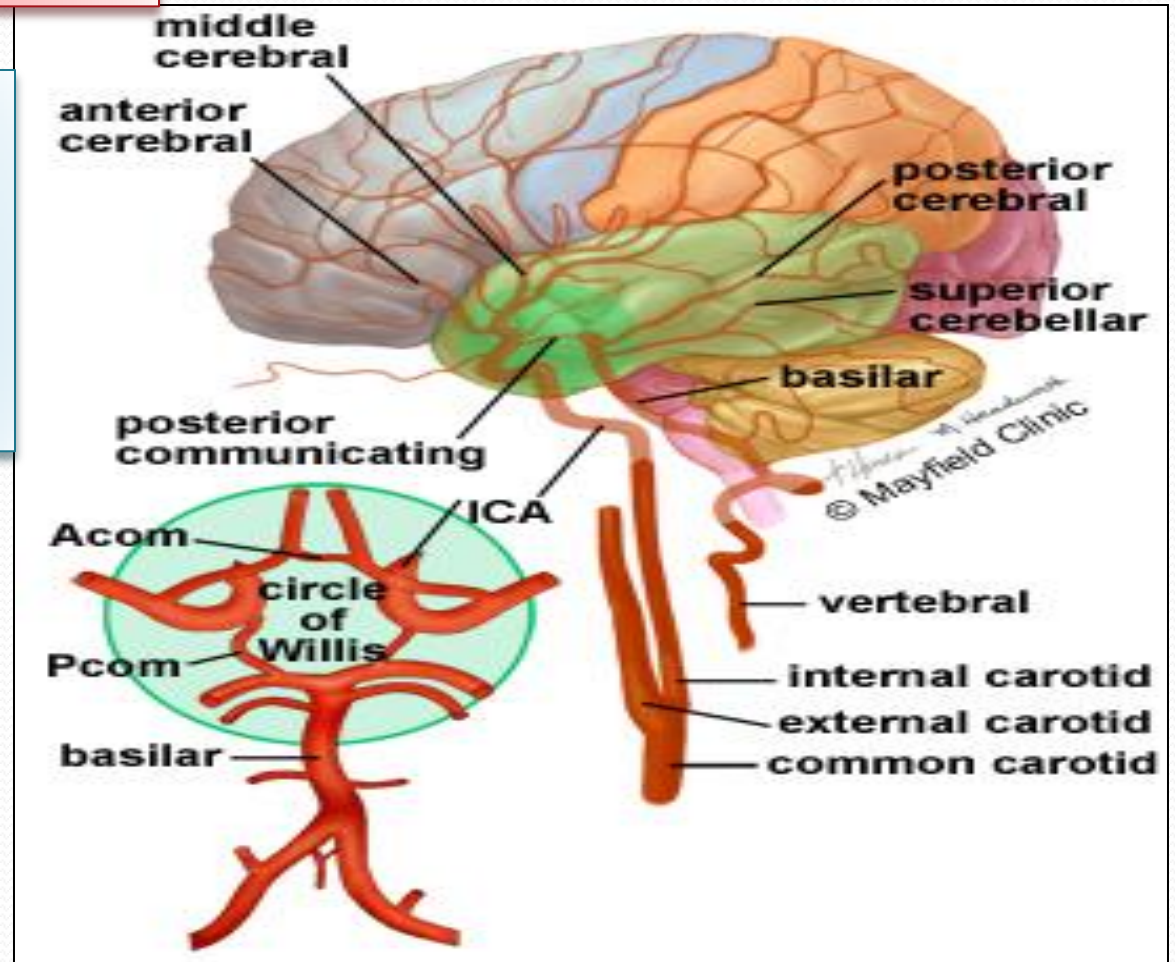


Coronal section of brain showing the supply territories of the cerebral vessels

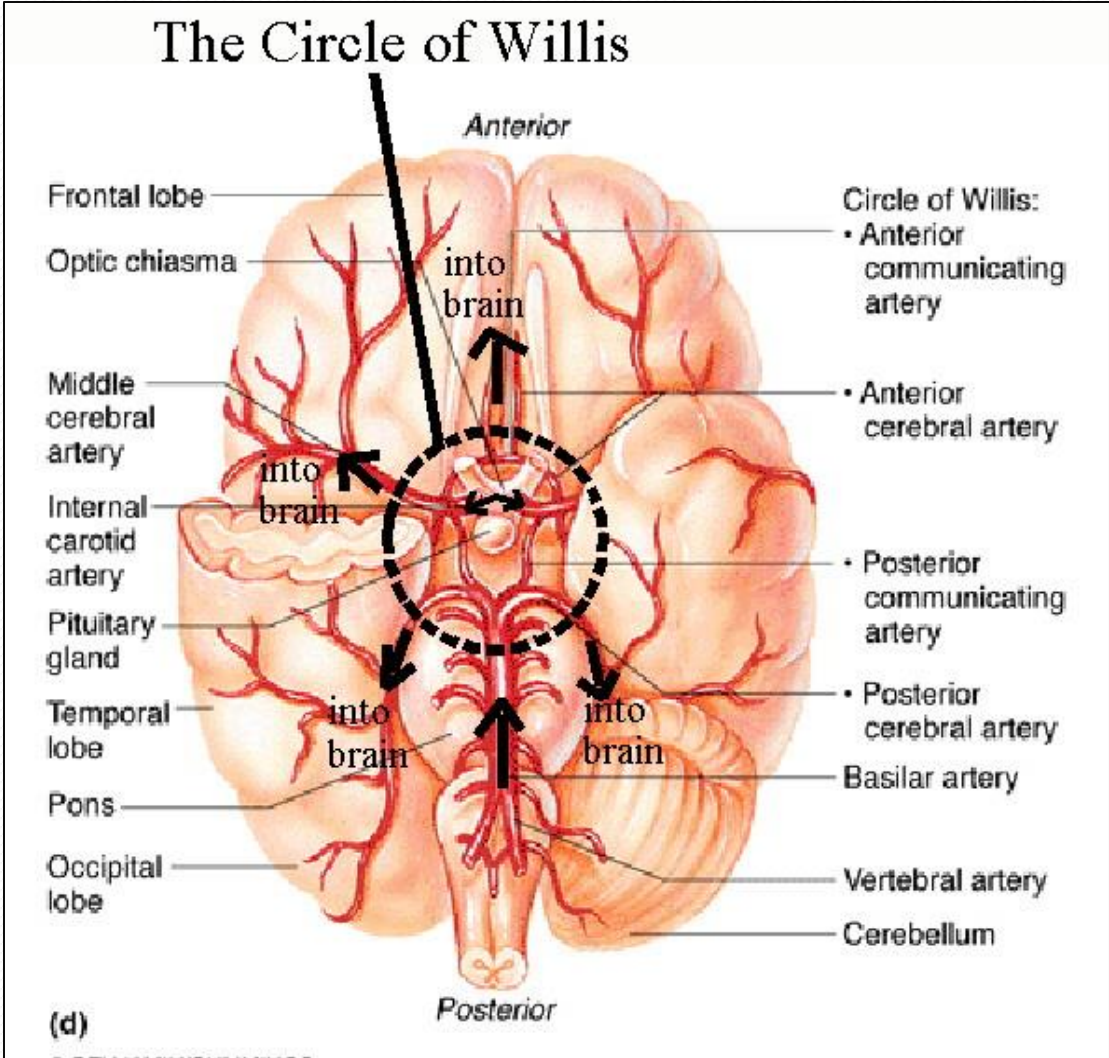


CIRCULUS ARTERIOSUS (OF WILLIS)

It joins the Carotid & Vertebrobasilar systems

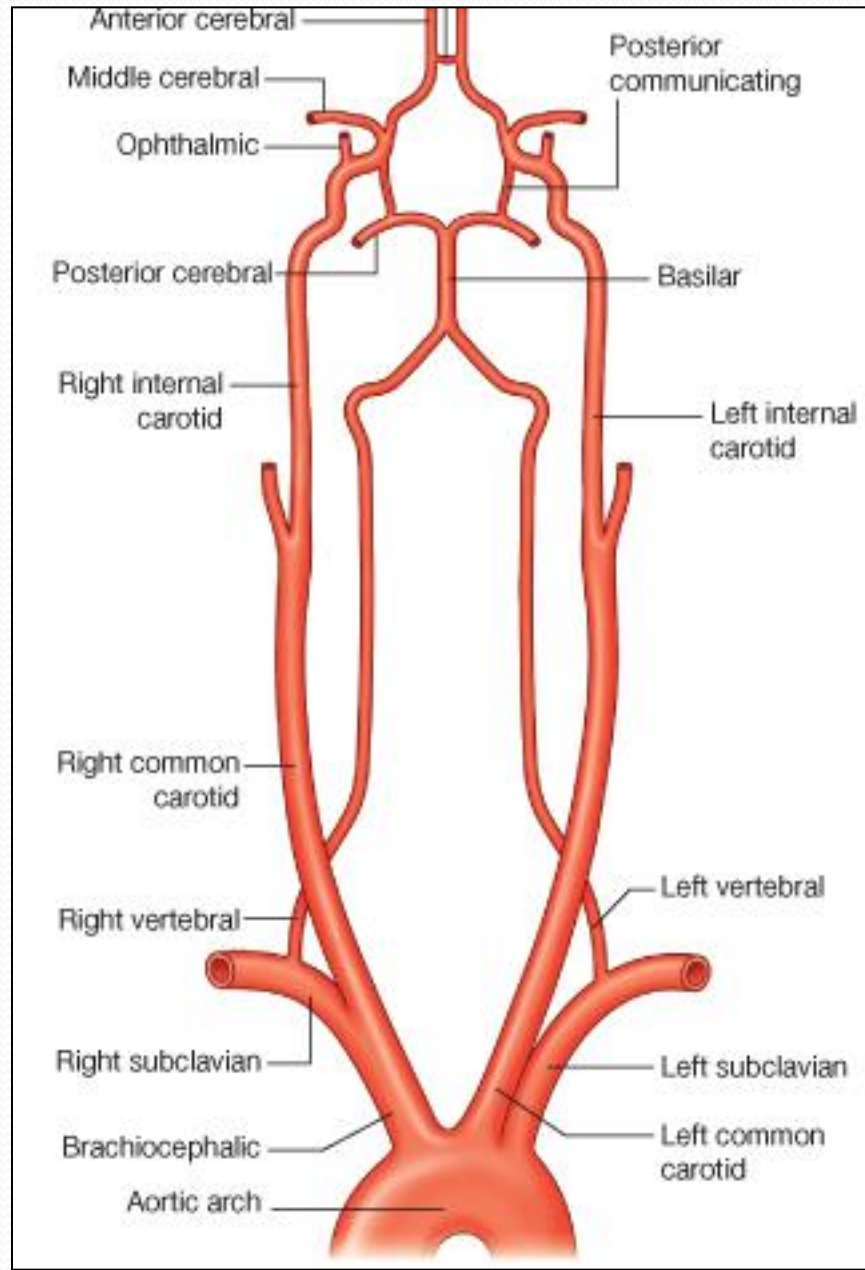


- **located** on the base of the brain
- **It encircles:**
- **Optic Chiasma, Hypothalamus, Pituitary gland, Midbrain.**

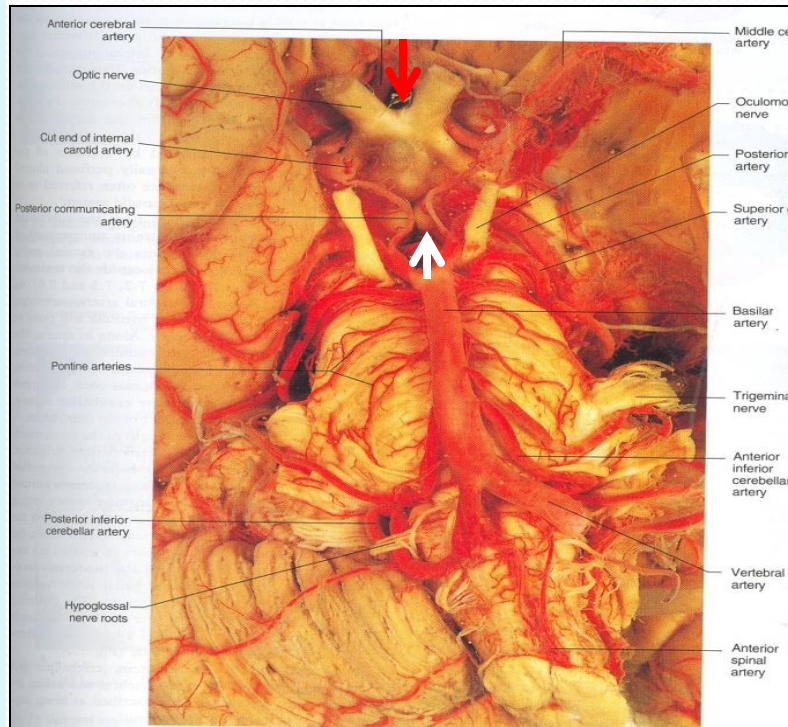
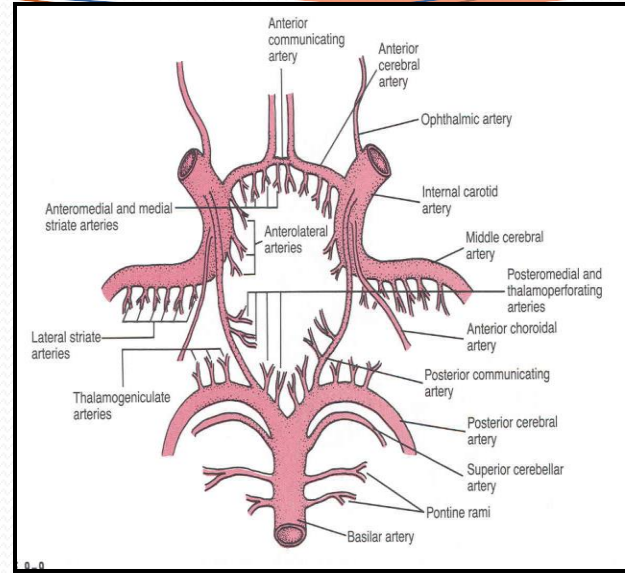


- **Composed of:**

- **2** Anterior cerebral arteries
- **2** Internal carotid arteries
- **2** Posterior cerebral arteries
- **2** Posterior communicating arteries
- **1** Anterior communicating artery



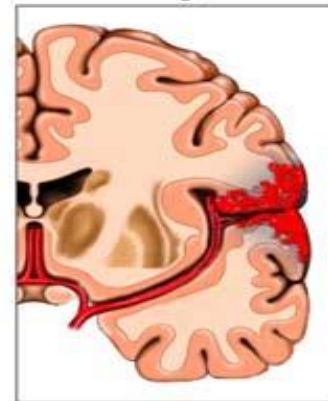
- **Branches:**
- **Perforating arteries (Anterior & Posterior):**
- Numerous small vessels that penetrate the surface of the brain through the **anterior and posterior perforating substances.**
- **APA supply:**
- Large part of Basal Ganglia,
- Optic chiasma,
- Internal capsule & Hypothalamus
- **PPA supply:**
- Ventral portion of Midbrain, parts of Subthalamus and Hypothalamus



ARTERIAL DISORDERS

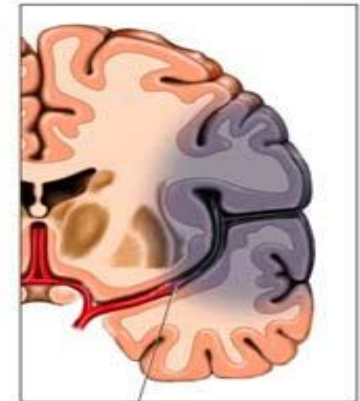
- **A. STROKE** (Sudden occlusion of the blood supply):
- It can be:
 - 1. Hemorrhagic
 - 2. Ischemic
- **B. ANEURYSM**
- **C. ANGIOMA**

Hemorrhagic Stroke

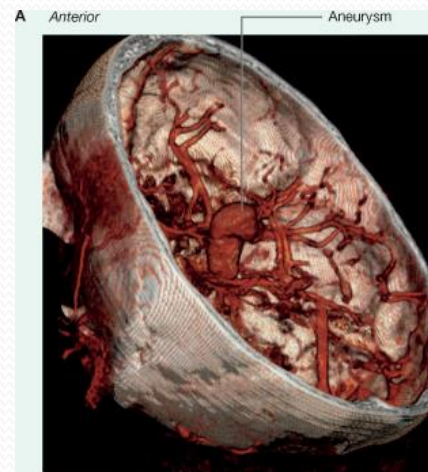


Hemorrhage/blood leaks into brain tissue

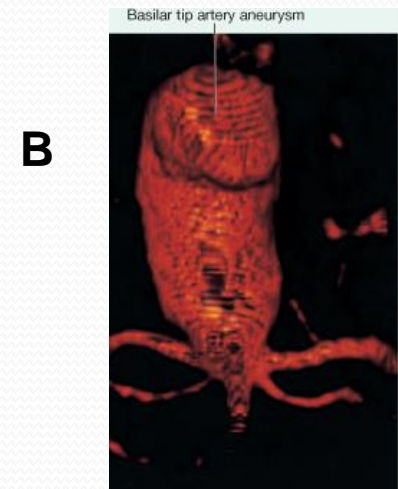
Ischemic Stroke



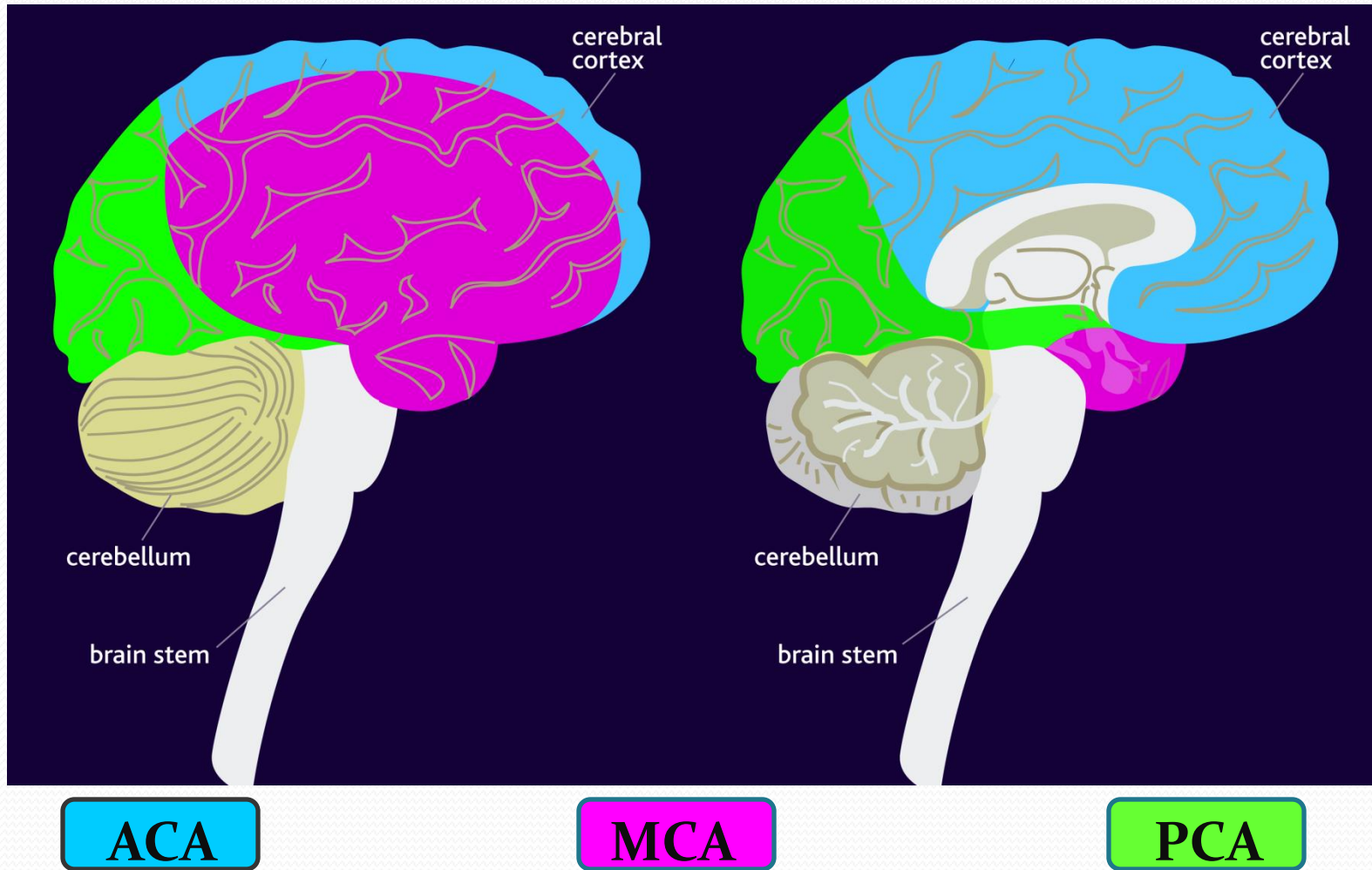
Clot stops blood supply to an area of the brain



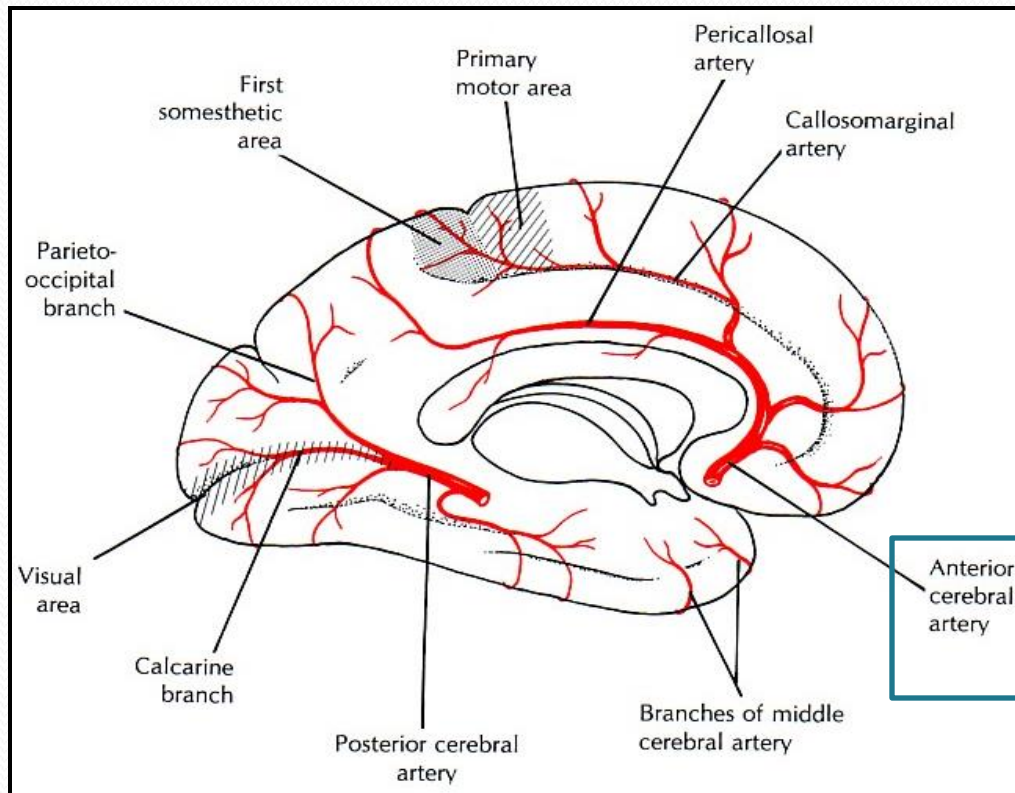
Posterior



EFFECT OF OCCLUSION OF CEREBRAL ARTERIES

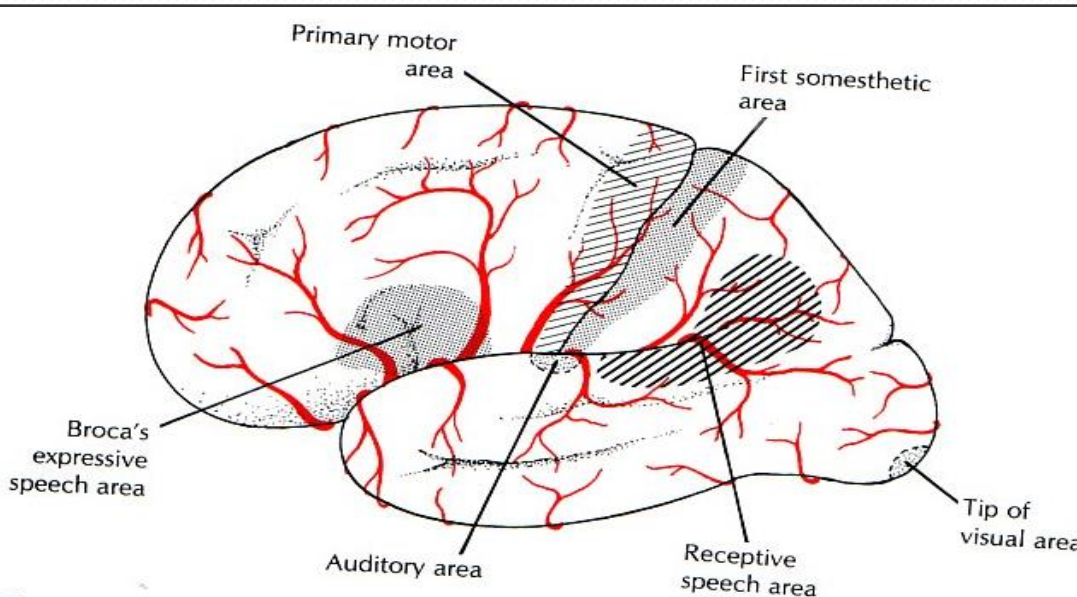


ACA



- **1. Motor & sensory disturbances in the contralateral distal leg**
- **2. Difficulty in the Prefrontal lobe functions:**
 - **Cognitive thinking, Judgment,**
 - **Motor initiation and**
 - **Self monitoring**

MCA



- **1. Contralateral weakness of:**
 - Face, Arm & Hand (more than leg)
- **2. Contralateral sensory loss of:**
 - Face, Arm & Hand (more than leg)
- **3. Visual field cut (damage to optic radiation)**
- **4. Aphasia (language disturbances)**
 - Broca's: production
 - Wernicke's: comprehension

PCA

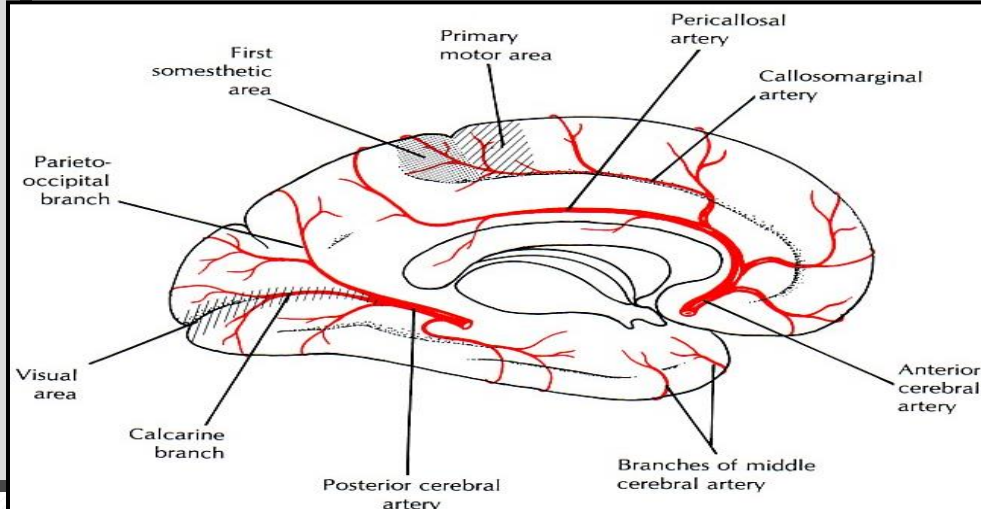
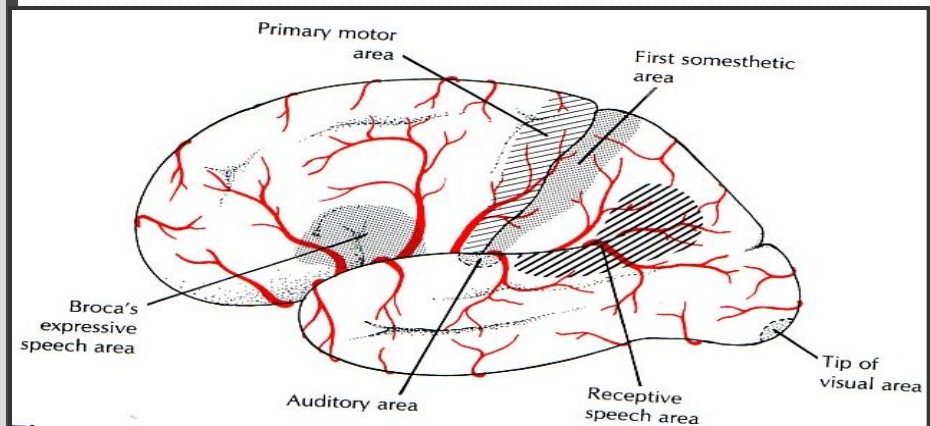
• 1. Visual disturbances

- Contralateral homonymous hemianopia
- In Bilateral lesions:
Cortical Blindness

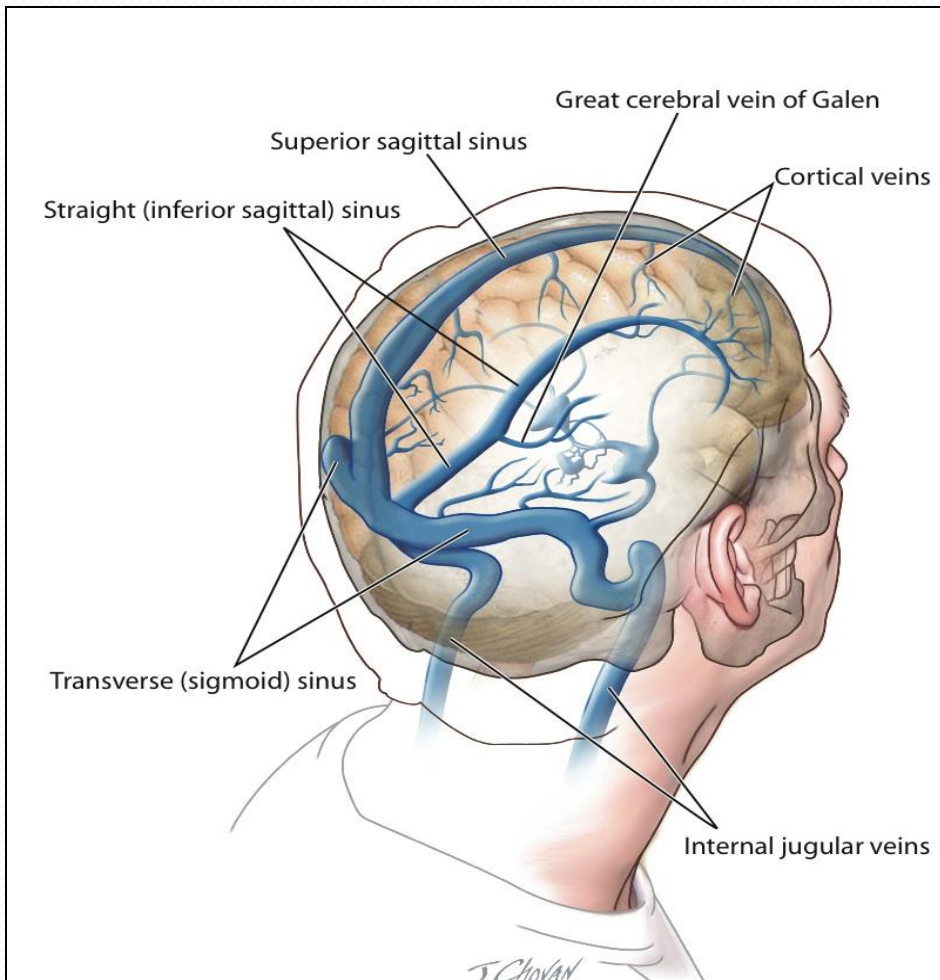
- patients unaware they cannot see (**Anton's syndrome**)

• 2. Memory impairment

- If the temporal lobe is affected



CEREBRAL VENOUS DRAINAGE

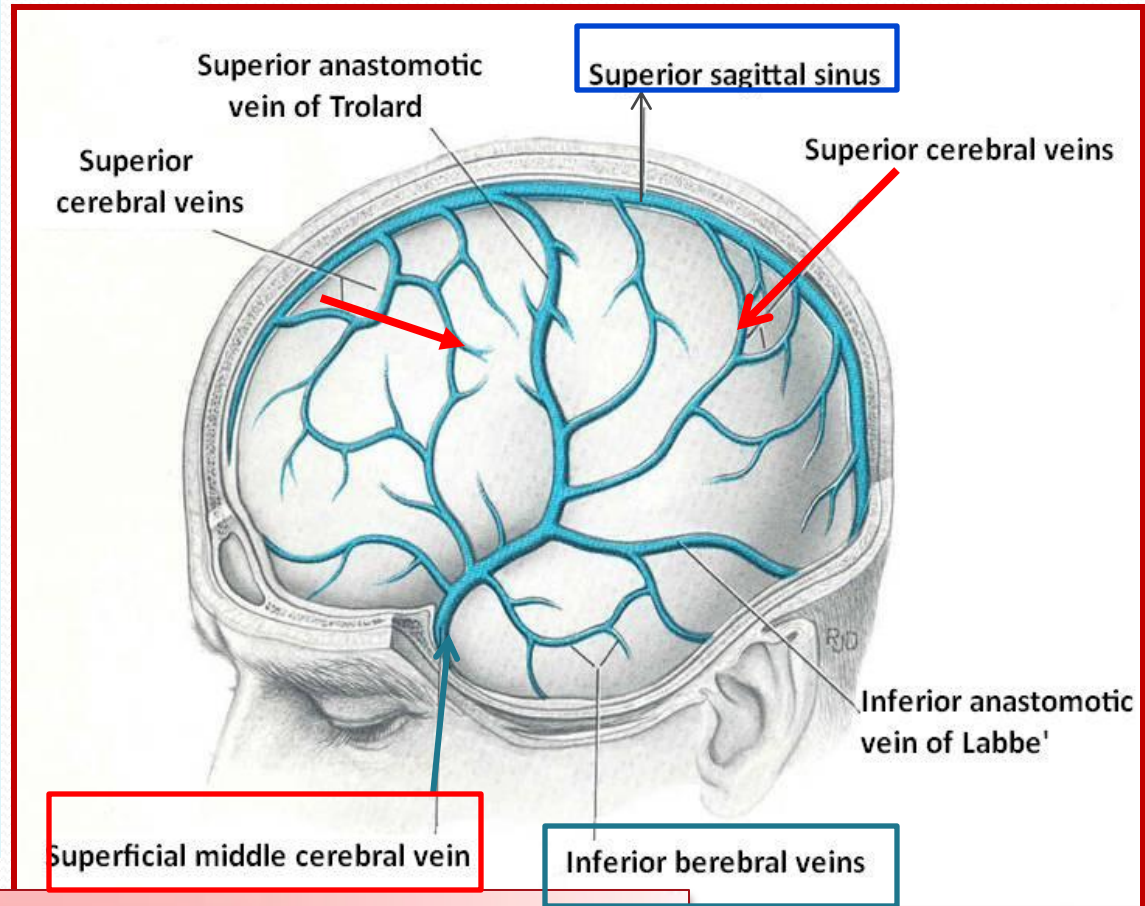


- **CORTICAL VEINS:**
- **(A) Superficial**
- found in the **Subarchnoid space**
Drain the cortical surfaces
- **(B) Deep veins:**
- Drain the deeper structures
- These veins are **thin walled** and **devoid of valves.**
- They ultimately drain into the
- **Dural Venous Sinuses**

SUPERFICIAL CORTICAL VEINS

- 1. **Superior cerebral veins (6 to 12)**

- Drain lateral surface of brain above the lateral sulcus
- Terminate mainly into the **Superior Sagittal sinus**, and partly into **Superficial middle cerebral vein**.

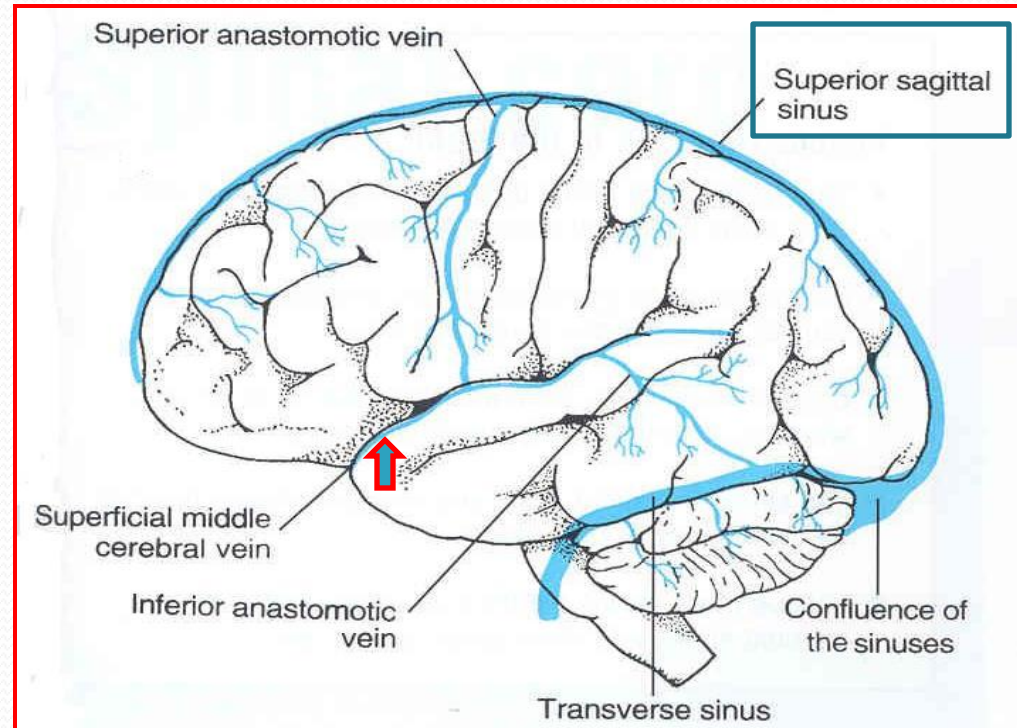


- 2. **Inferior cerebral veins:**

- Run below the lateral sulcus
- Drain the lateral surface of the temporal lobe
- Terminate partly into **superficial middle cerebral vein** & partly into **Transverse sinus**.

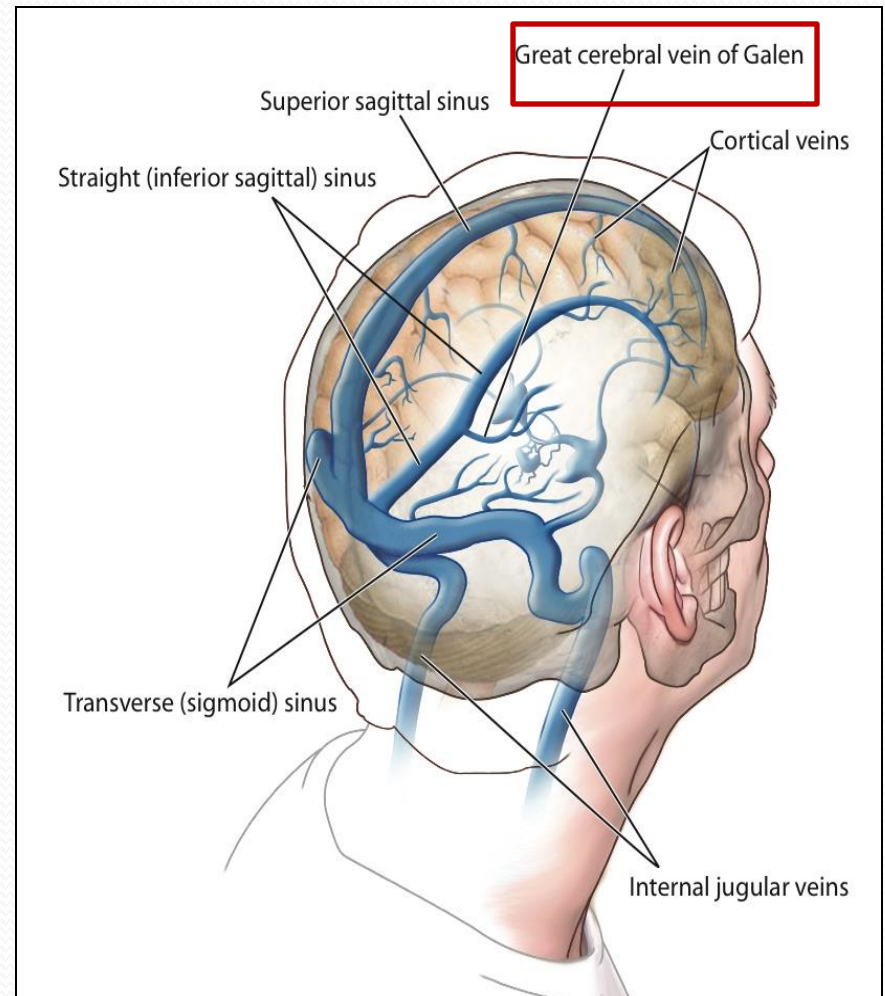
- **3. Superficial middle cerebral vein:**

- Runs along the lateral sulcus
- Terminates into the **Cavernous sinus**
- It is connected posteriorly through **Superior & Inferior anastomotic veins** to **Superior Sagittal & Transverse sinuses**.



DEEP CEREBRAL VEINS

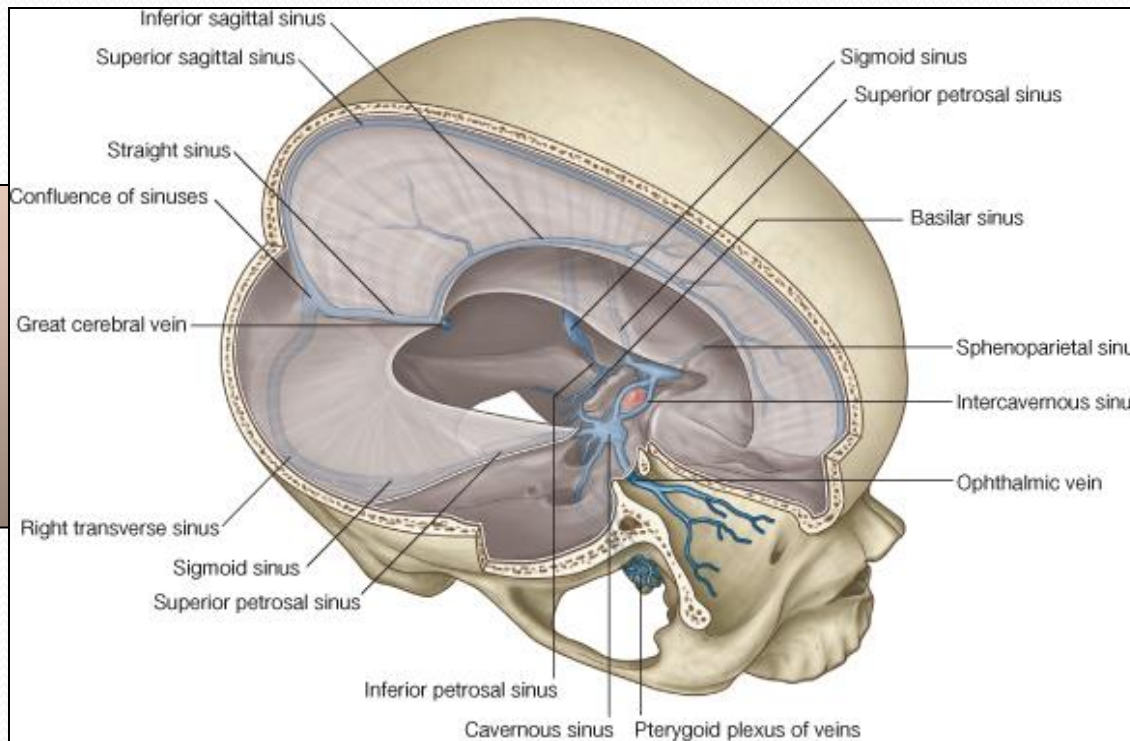
- Drain the internal structures (basal ganglia, internal capsule, thalamus)
- They merge to form two **Internal Cerebral Veins.**
- The two veins unite in the midline to form the **Great Cerebral vein.**
- This short vessel joins the Inferior Sagittal sinus to form the **Straight S**



DURAL VENOUS SINUSES

Paired

**Transverse.
Sigmoid.
Cavernous.
Petrosal
(Sup & Inf)**



Single

**Superior sagittal.
Inferior sagittal.
Straight.
Occipital**

Blood flows from **transverse & sigmoid sinuses** into **IJV**

VENOUS DISORDERS

- **Infarction.**
- **Sinus thrombosis:**
- **(SSS thrombosis)** can complicates ear infection .
- **Cavernous S thrombosis** (as a complication of infection in the dangerous area of the face)
- **Obstruction of venous drainage of the brain leads to Cerebral edema and raised ICP**





Thank You & Good Luck