# CEREBRAL BLOOD CIRCULATION

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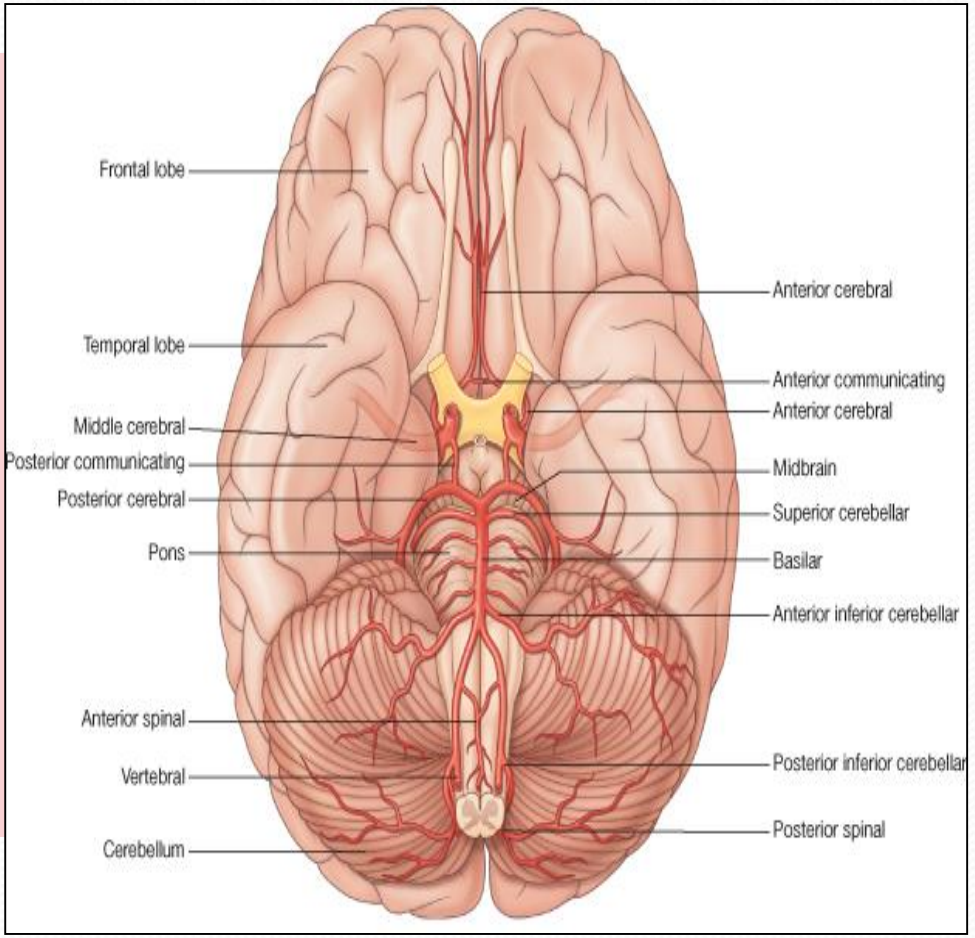
# OBJECTIVES

- **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

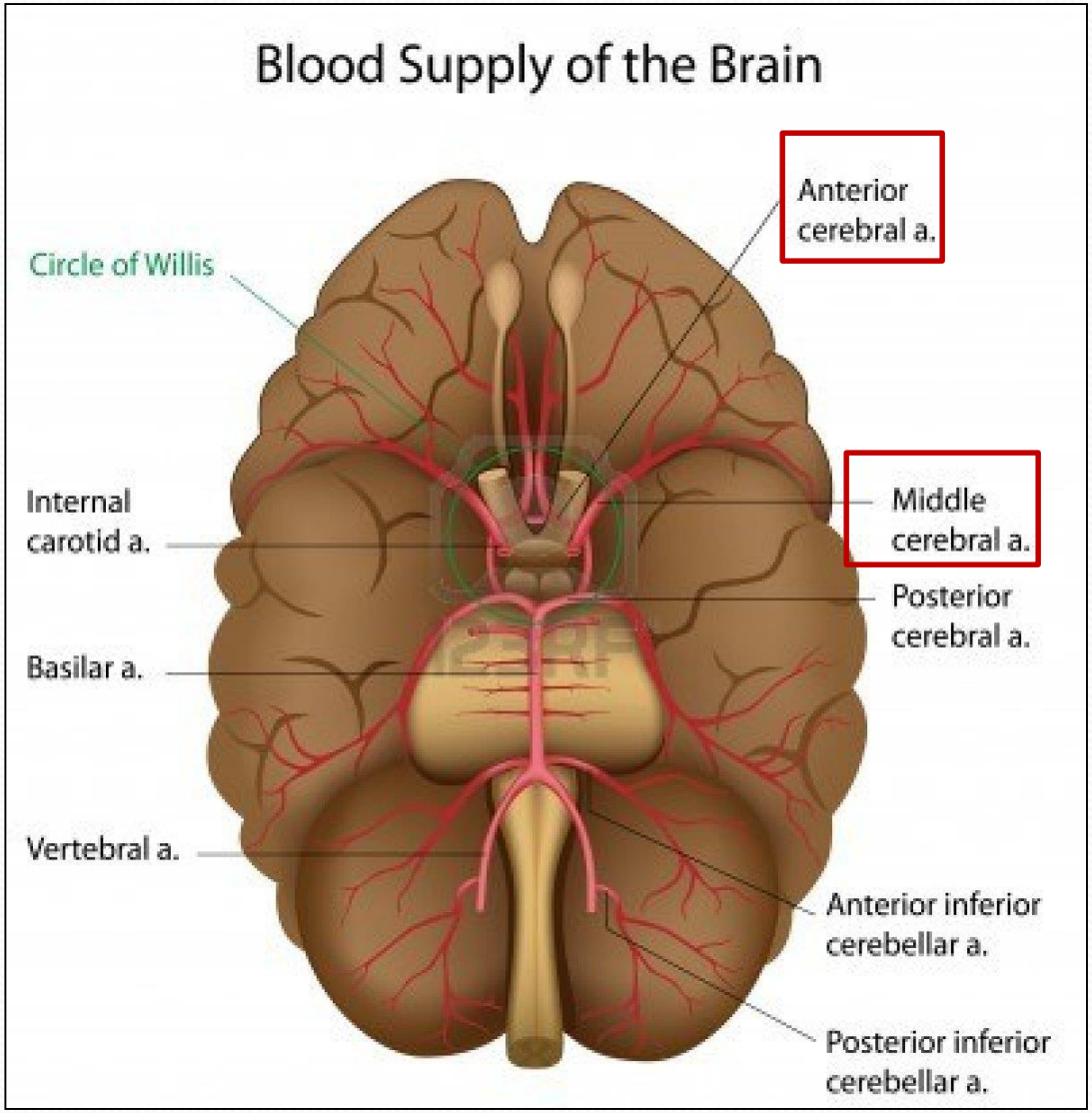
It is composed of:

**Internal carotid artery**

**and its branches:**

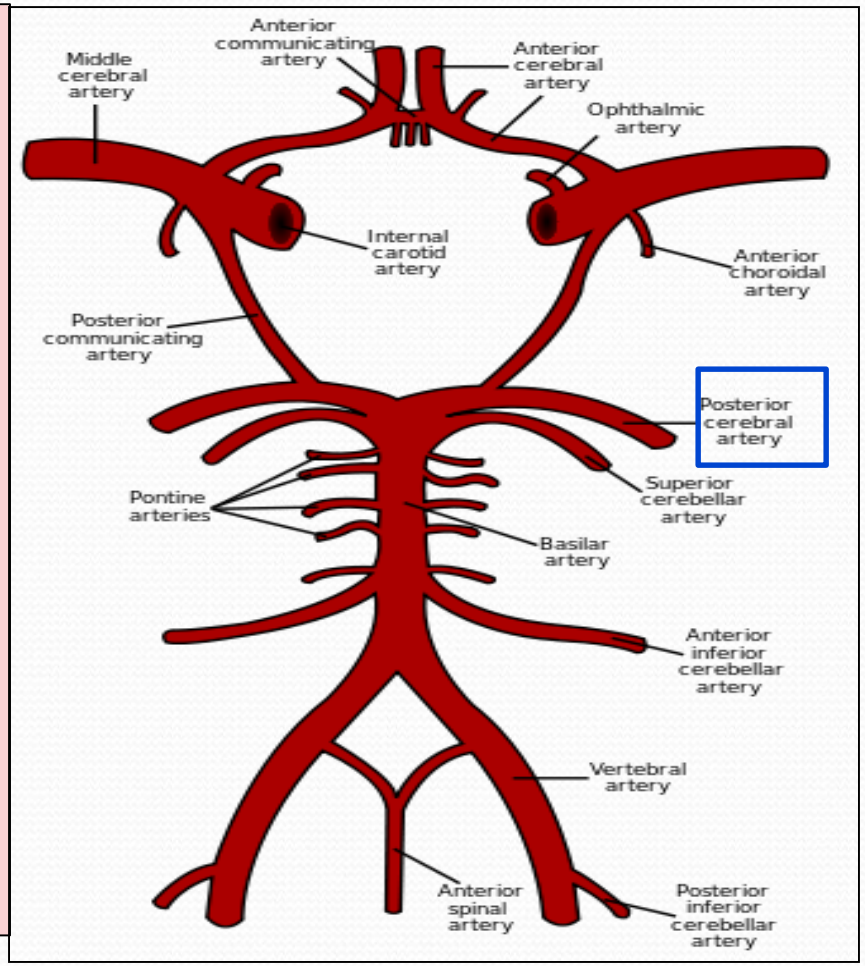
**Anterior cerebral artery&**

**Middle cerebral artery**

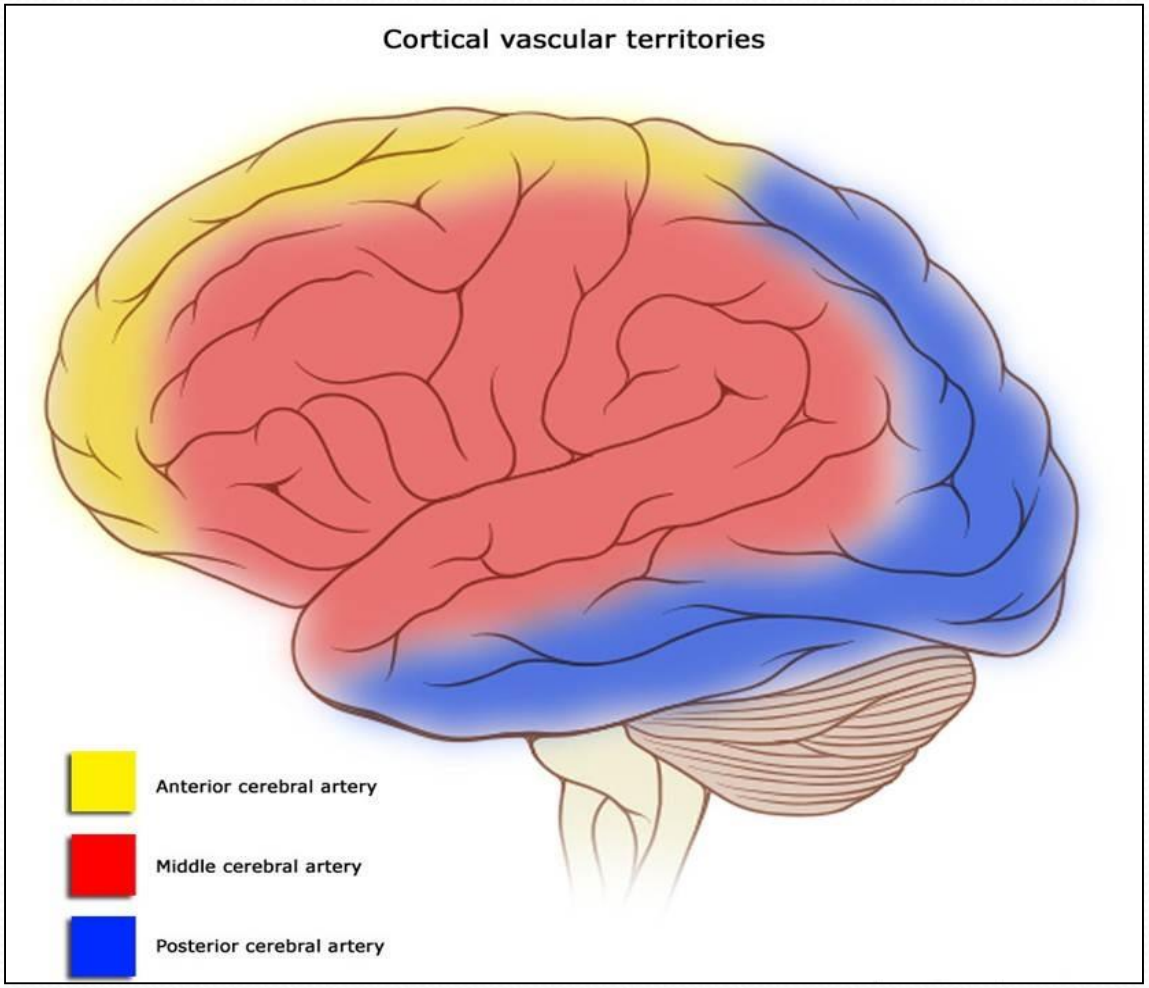


# VERTEBRO BASILAR SYSTEM

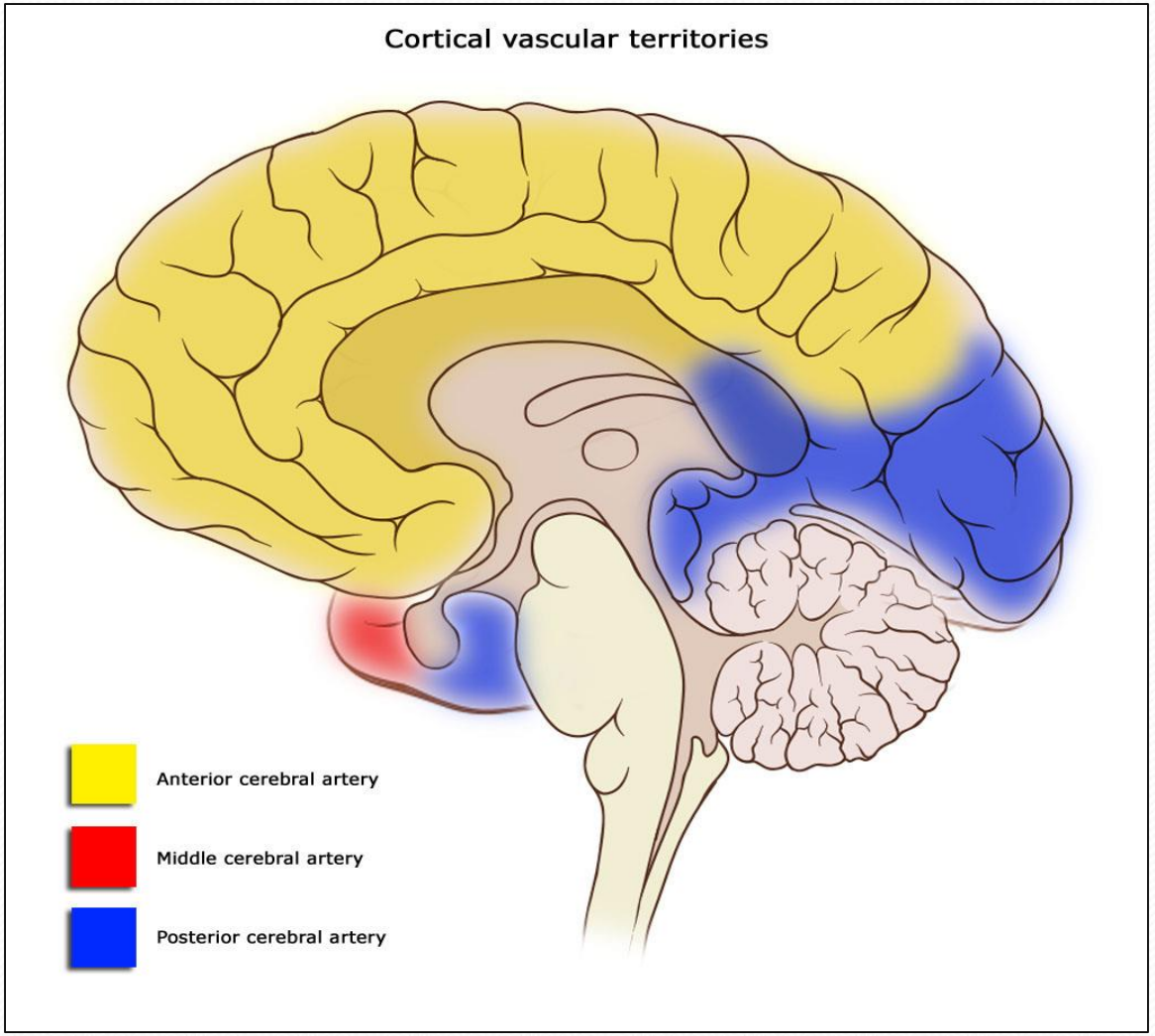
- The two **Vertebral** arteries ( from **Subclavian artery**) unite to form **Basilar** artery.
- It divides at the upper border of the pons into two **Posterior Cerebral arteries**.



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

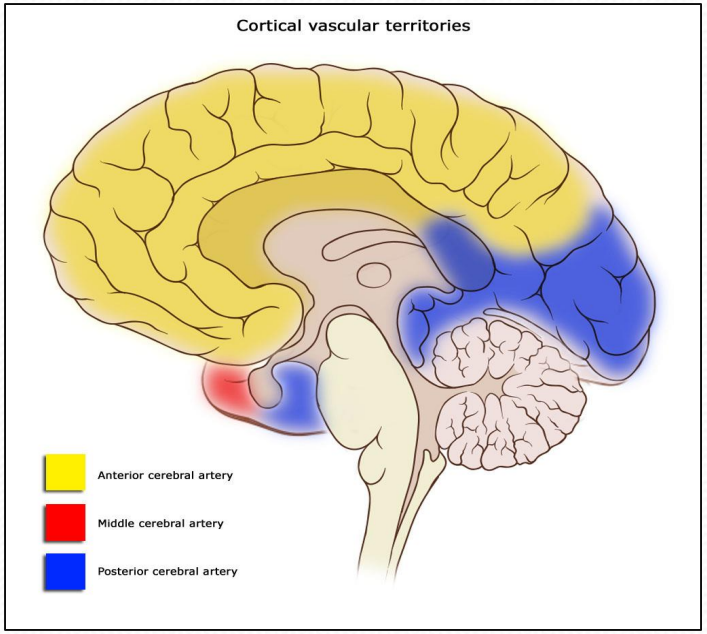


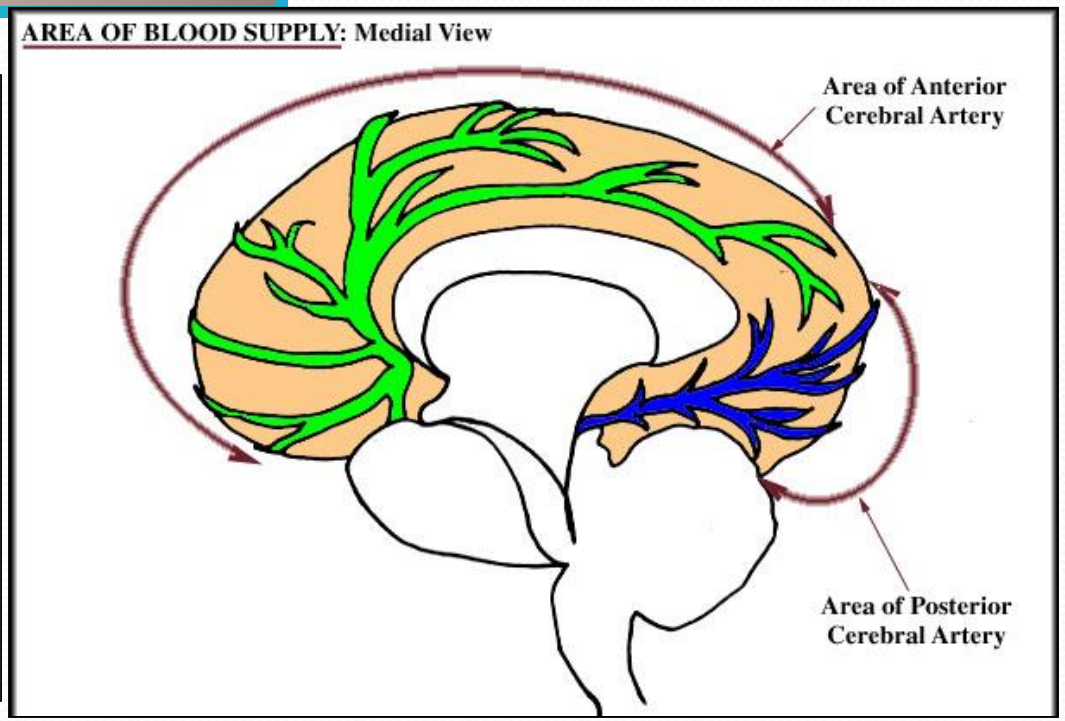
**Distribution of the cerebral arteries on the medial surface of the cerebral H**



# ANTERIOR CEREBRAL ARTERY

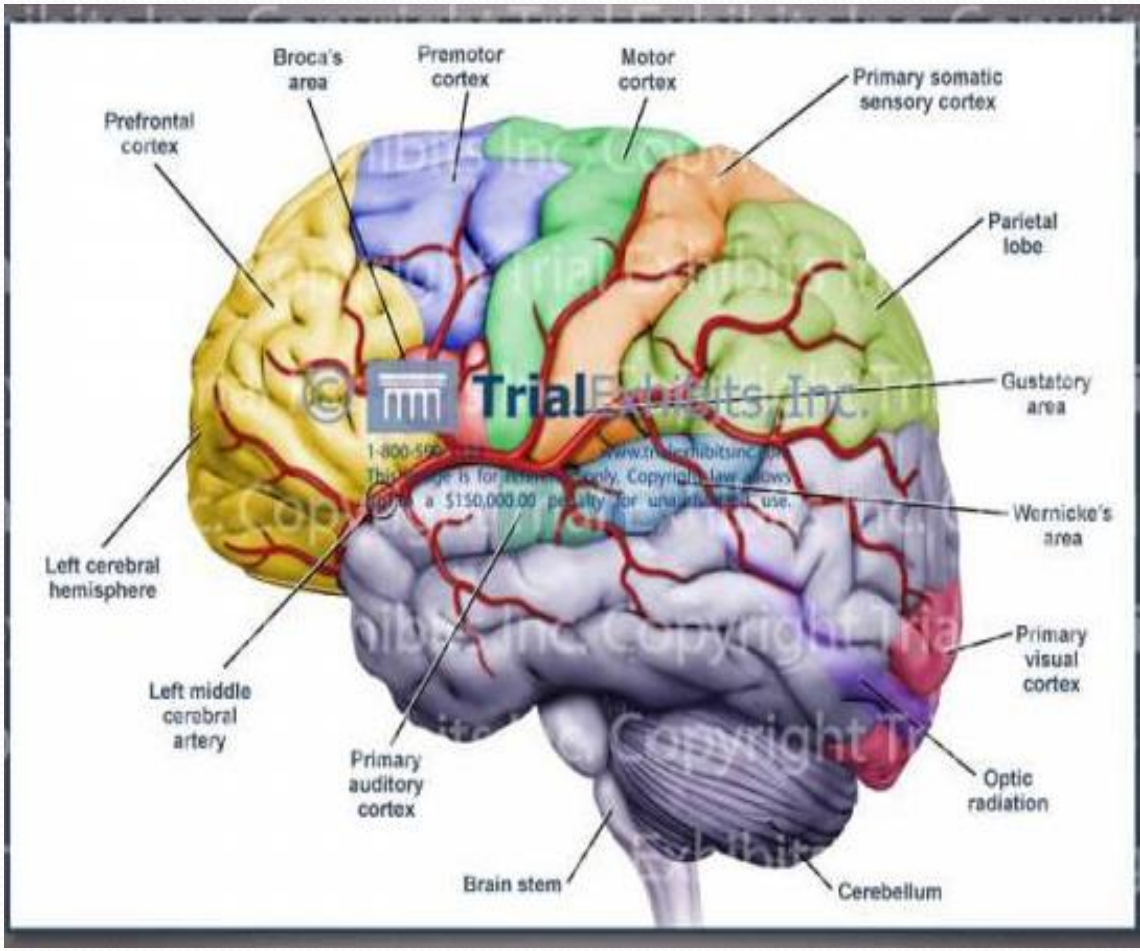
- **Supplies : orbital and medial surfaces of the frontal and parietal lobes**
- **A narrow part on the superolateral surface.**



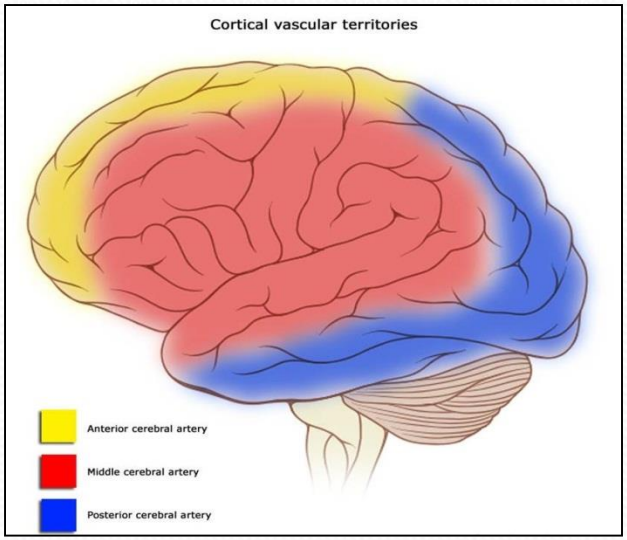
# MIDDLE CEREBRAL ARTERY

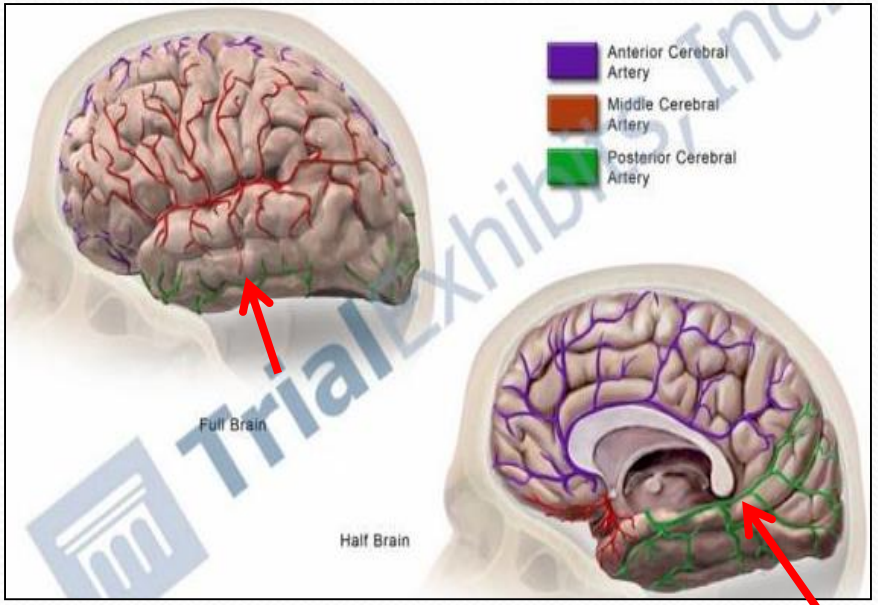
- **Supplies entire Superolateral surface:**
  - **Somatosensory Cortex**
  - **Motor Cortex**
  - **Language areas:**
  - **Broca's Area**
  - **Wernicke's Area)**
  - **Auditory areas:**
  - **Primary auditory area**
  - **Auditory association (Heschl's Gyrus**



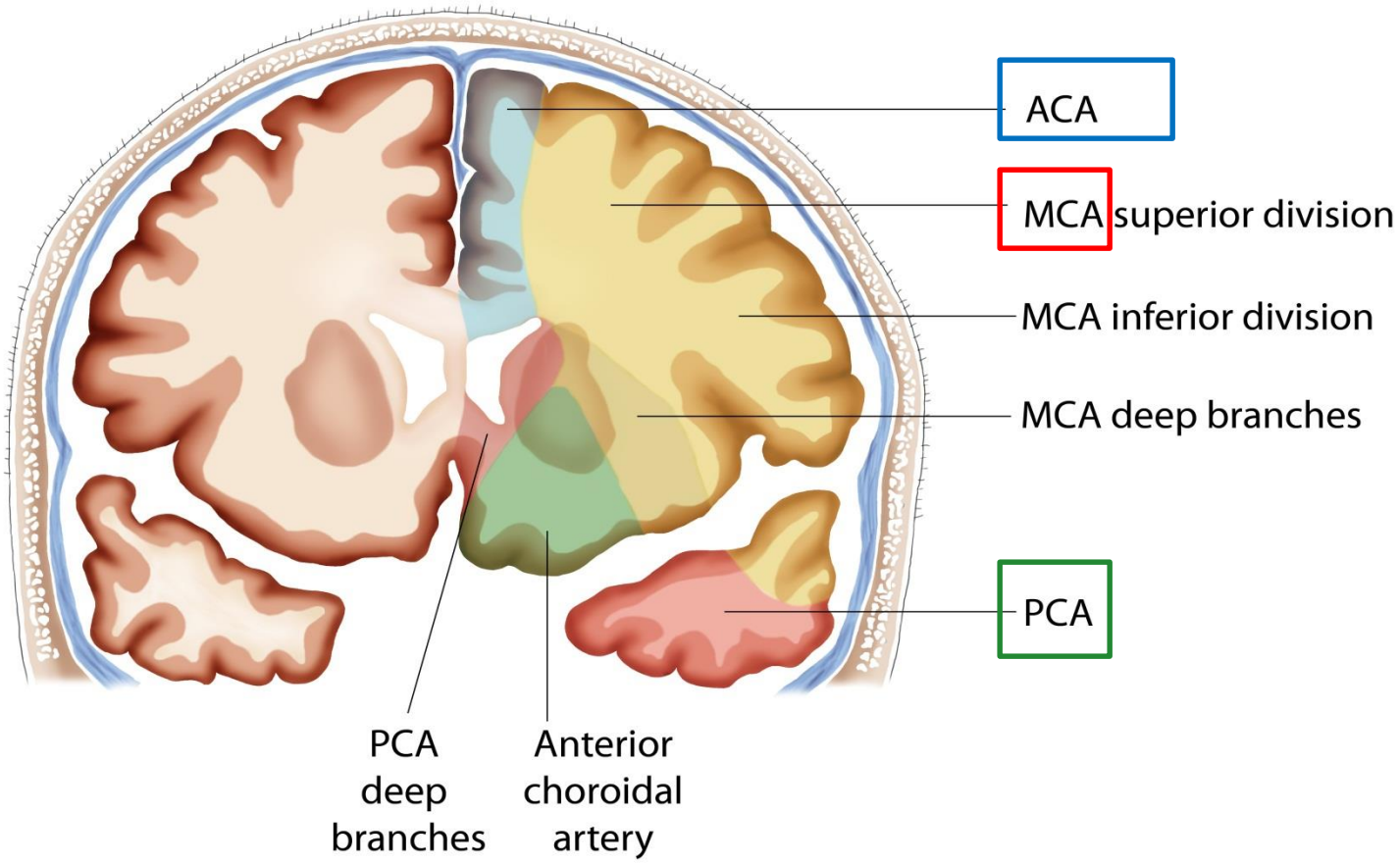
# POSTERIOR CEREBRAL ARTERY

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



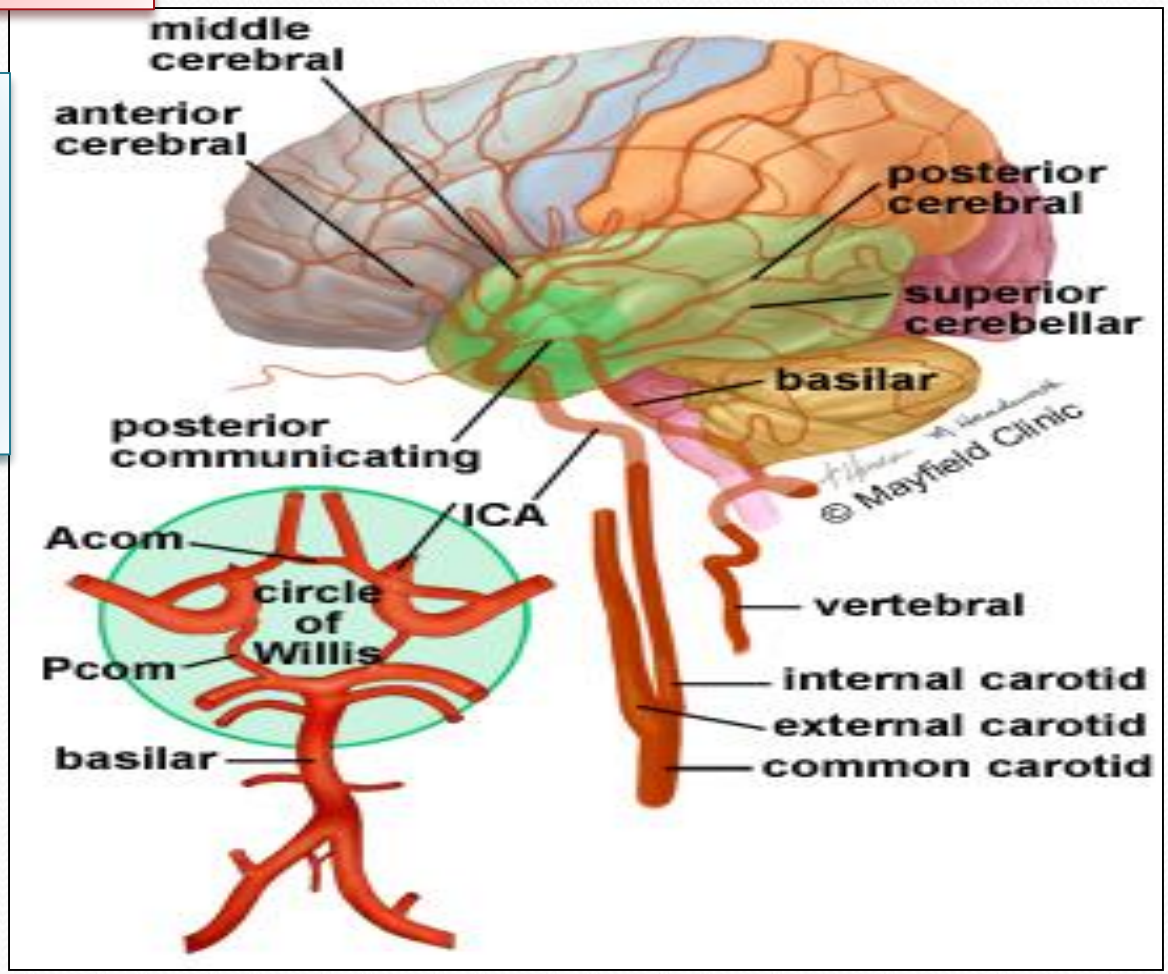



Coronal section of brain showing the supply territories of the cerebral vessels

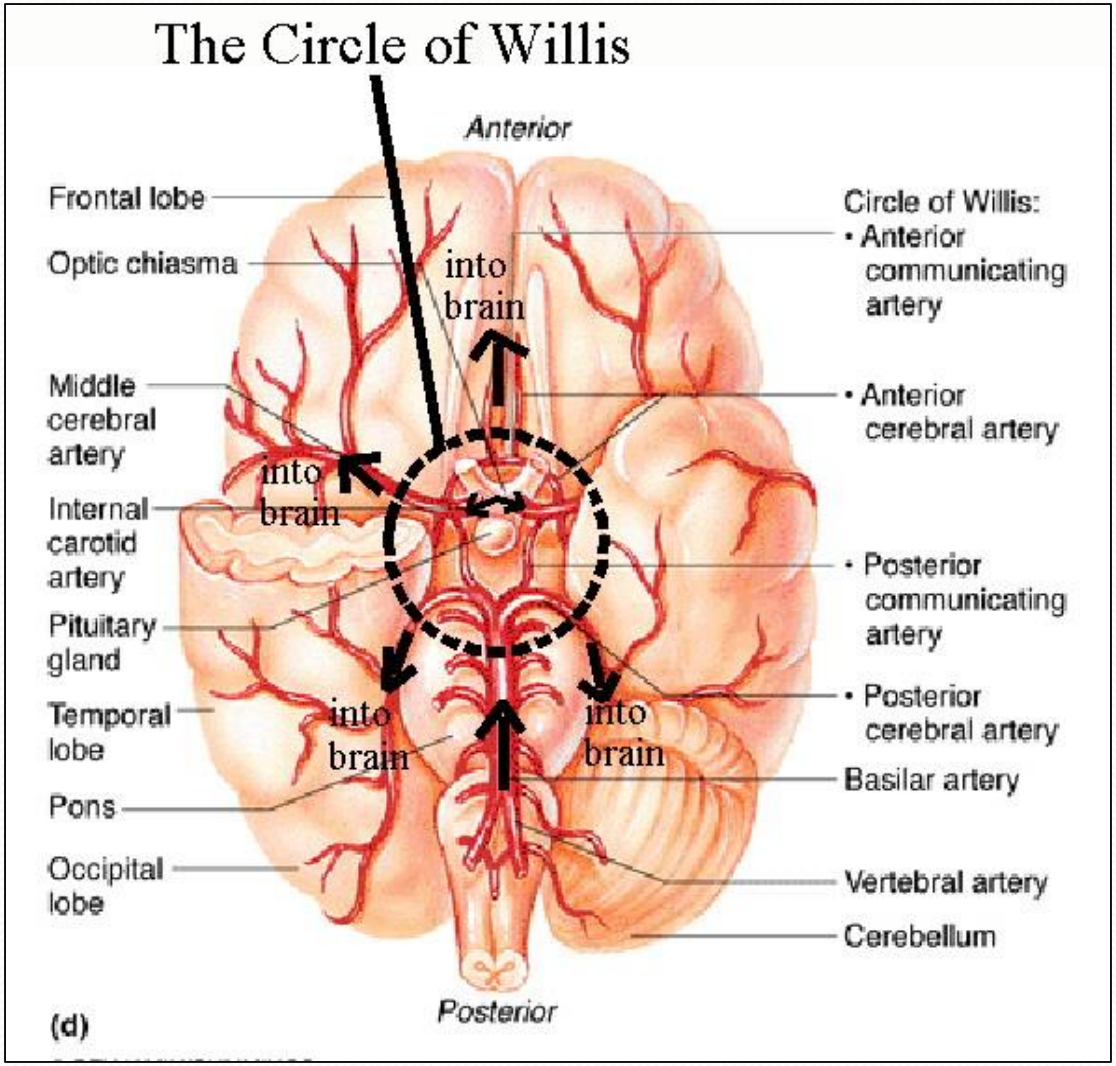


# CIRCULUS ARTERIOSUS (OF WILLIS)

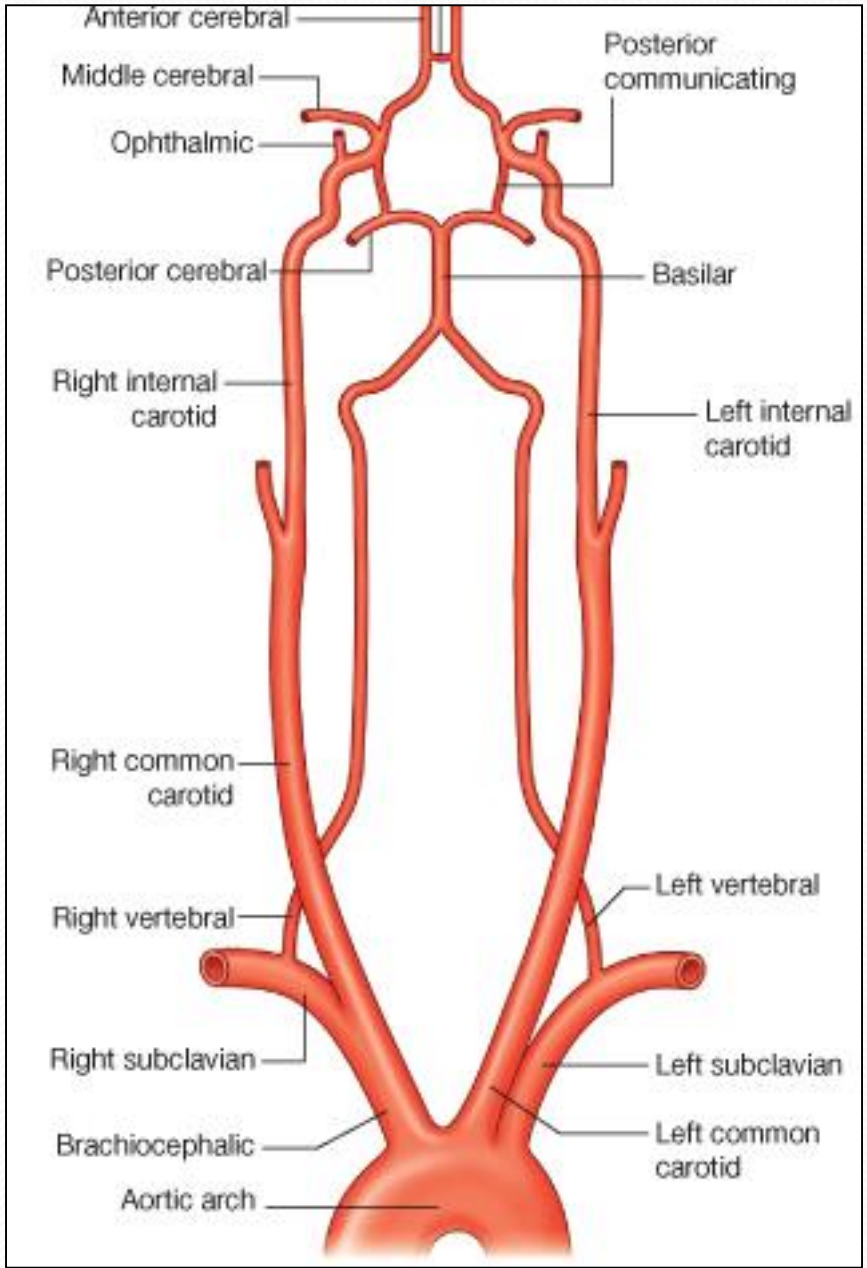
It joins the Carotid & Vertebrobasilar systems



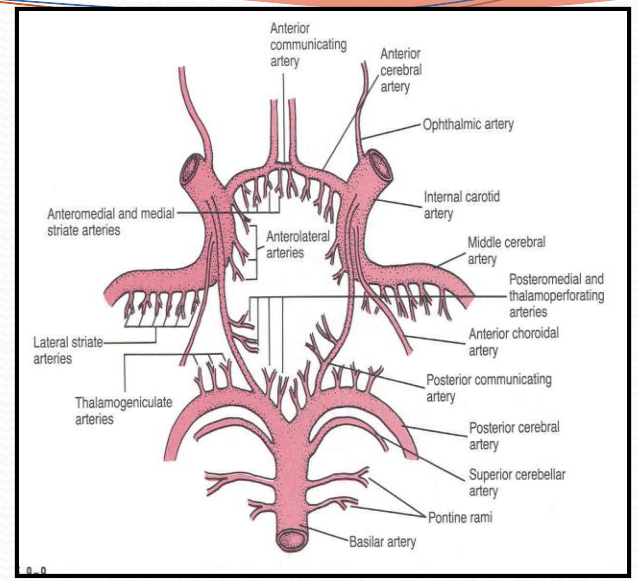
- **located on the base of the brain**
- **It encircles:**
- **Optic Chiasma, Hypothalamus Pituitary gland Midbrain.**

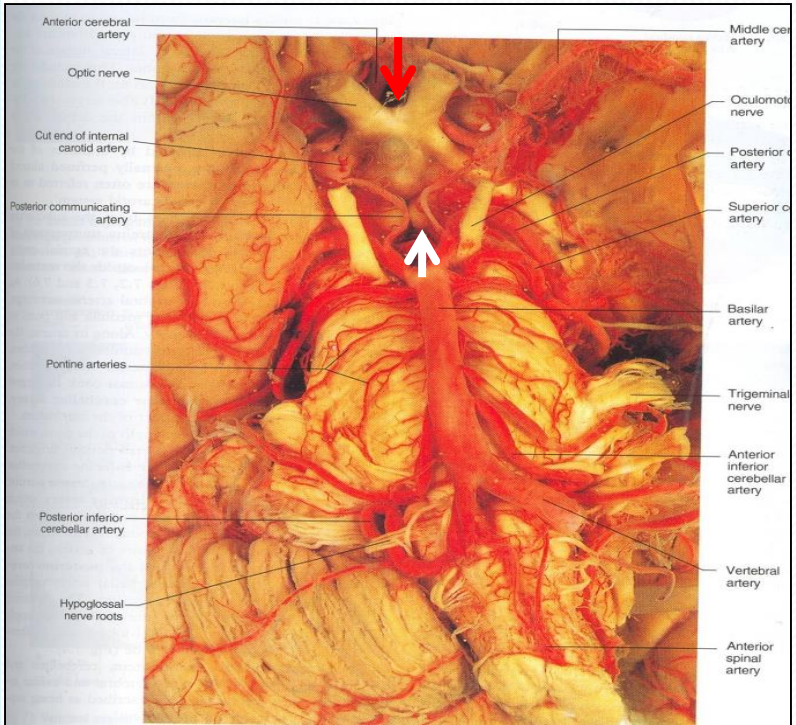


- **Composed of:**
  - 2 **Anterior cerebral arteries**
  - 2 **Internal carotid arteries**
  - 2 **Posterior cerebral arteries**
  - 2 **Posterior communicating arteries**
  - 1 **Anterior communicating artery**



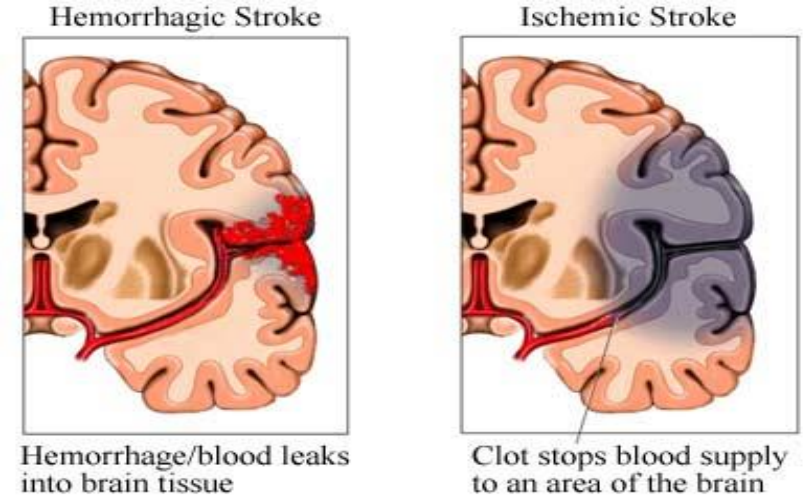
- **Branches:**
- **Perforating arteries (Anterior& Posterior):**
- **Numerous small vessels that penetrate the surface of the brain through the anterior and posterior perforating substances.**
- **APA supply:**
- **Large part of Basal Ganglia,**
- **Optic chiasma,**
- **Internal capsule & Hypothalamus**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

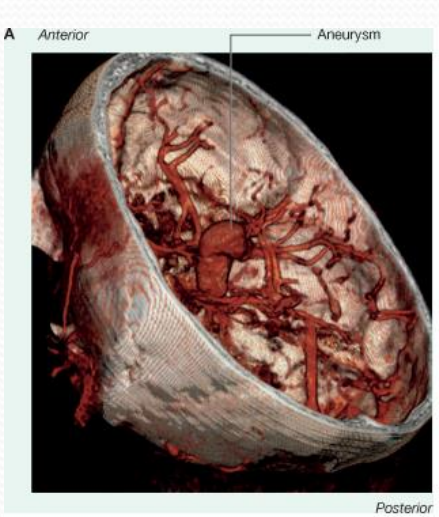


# ARTERIAL DISORDERS

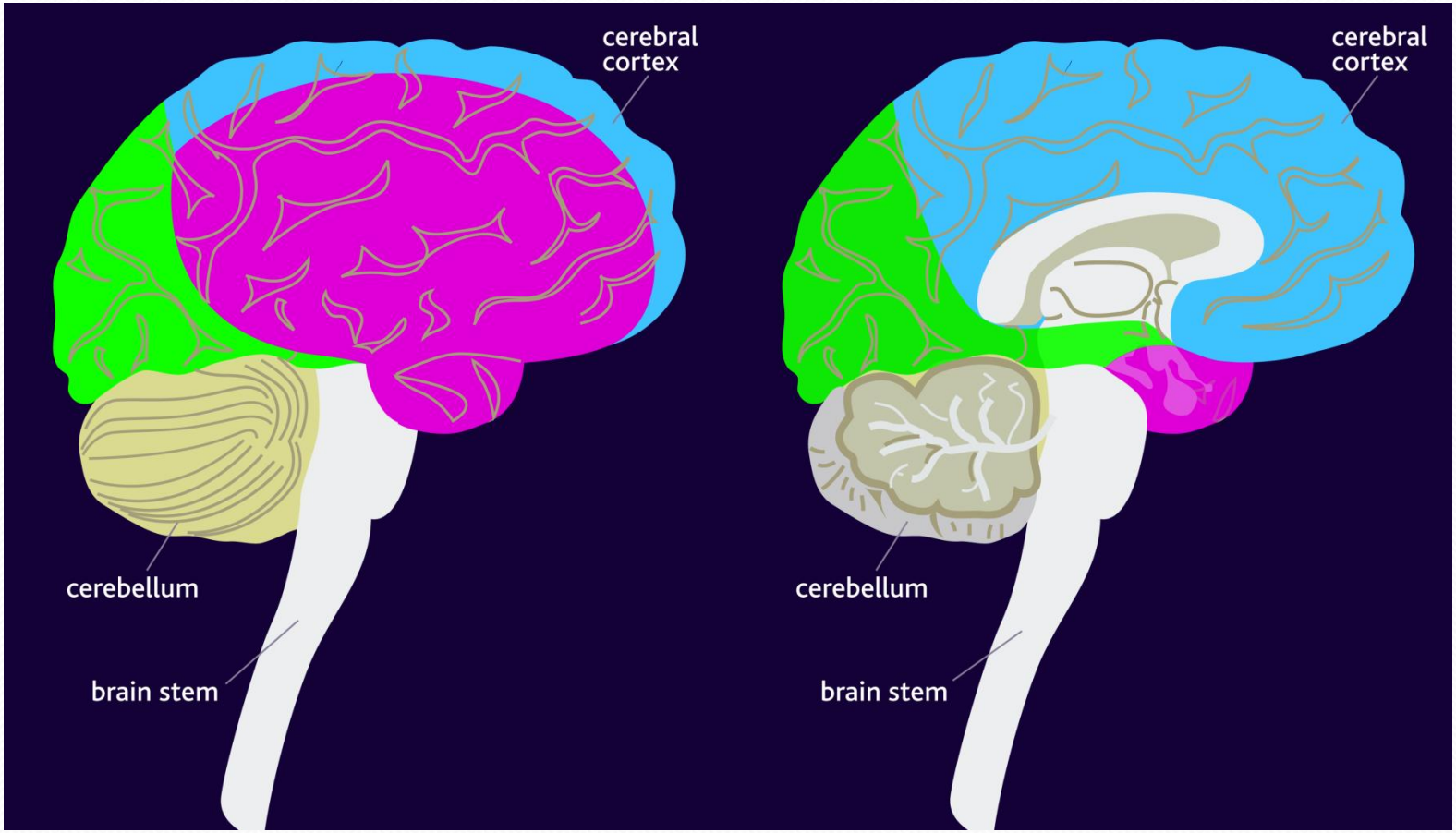
- **A. STROKE** (Sudden occlusion
- of the blood supply):
- It can be:
  - 1. Hemorrhagic
  - 2. Ischemaic
  - B. ANEURYSM
- C. ANGIOMA




B

# EFFECT OF OCCLUSION OF CEREBRAL ARTERIES

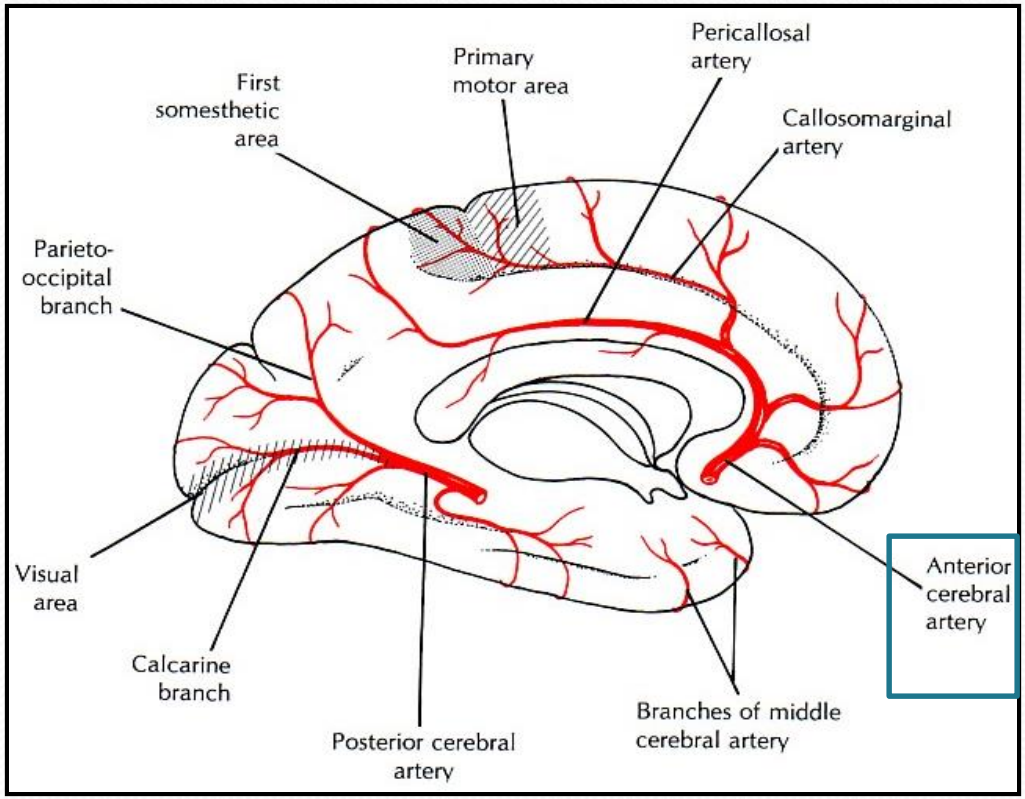



ACA

MCA

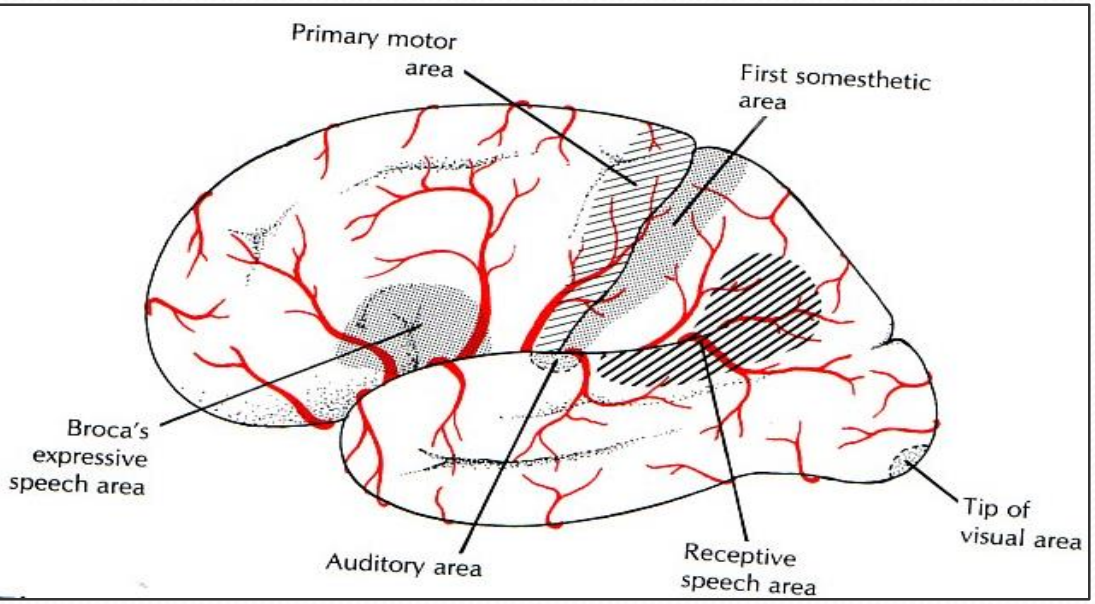
PCA

# 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**

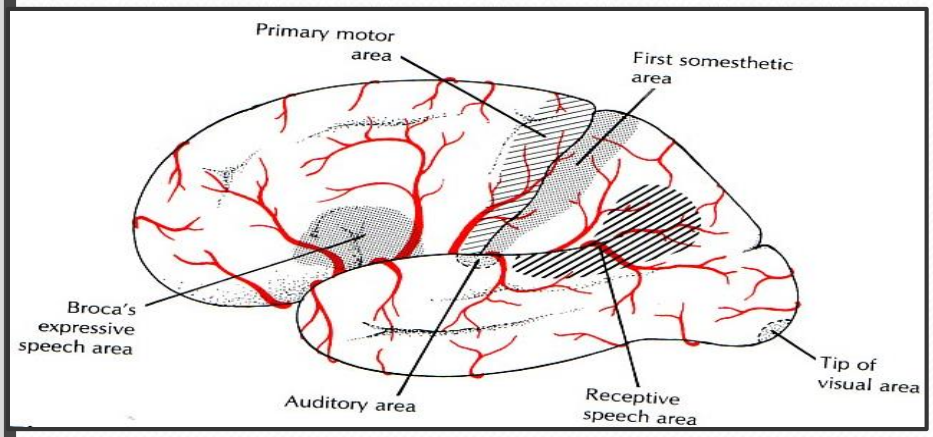
# MCA

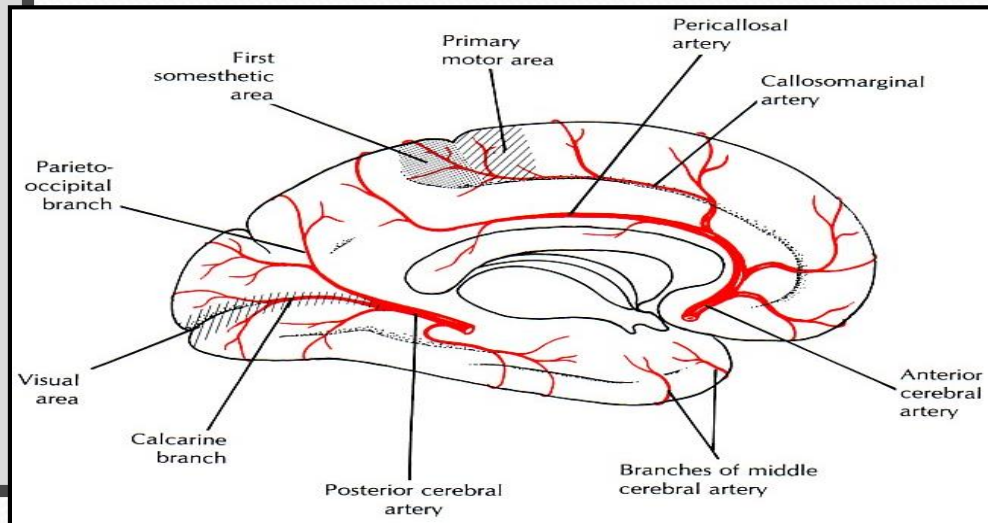



- 1. **Contralateral weakness of:**
  - **Face, Arm & Hand (more than leg)**
- **2.Contralateral sensory loss of:**
- **Face, Arm & Hand (more than leg)**
  - **3. Visual field cut (damage to optic radiation)**
- **4. Aphasia (language disturbances )**
  - **Broca's: production**
  - **Wernicke's: comprehension**

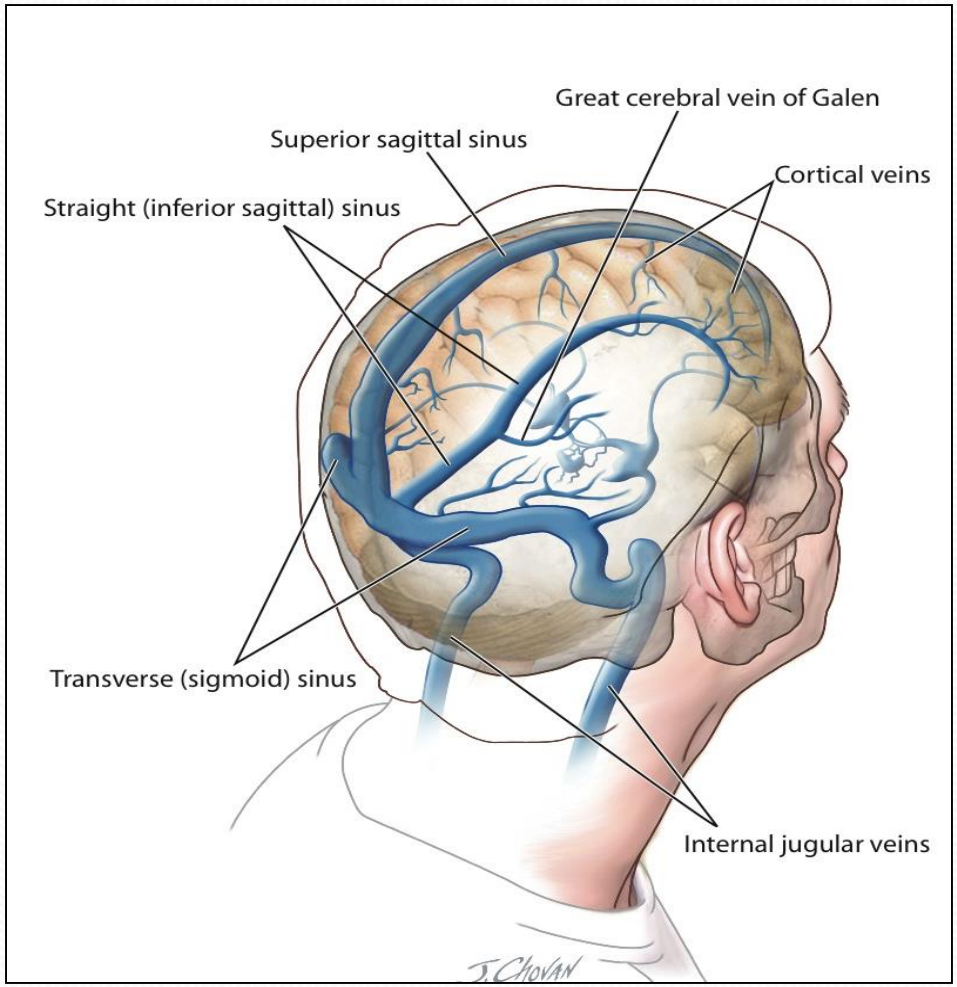
# PCA

- 1. **Visual disturbances**
  - **Contralateral homonymous hemianopia**
  - **<u>In Bilateral lesions:</u> Cortical Blindness**
    - **patients unaware they cannot see (Anton's syndrome)**
- 2. **Memory impairment**
- **If the temporal lobe is affected**



# CEREBRAL VENOUS DRAINAGE

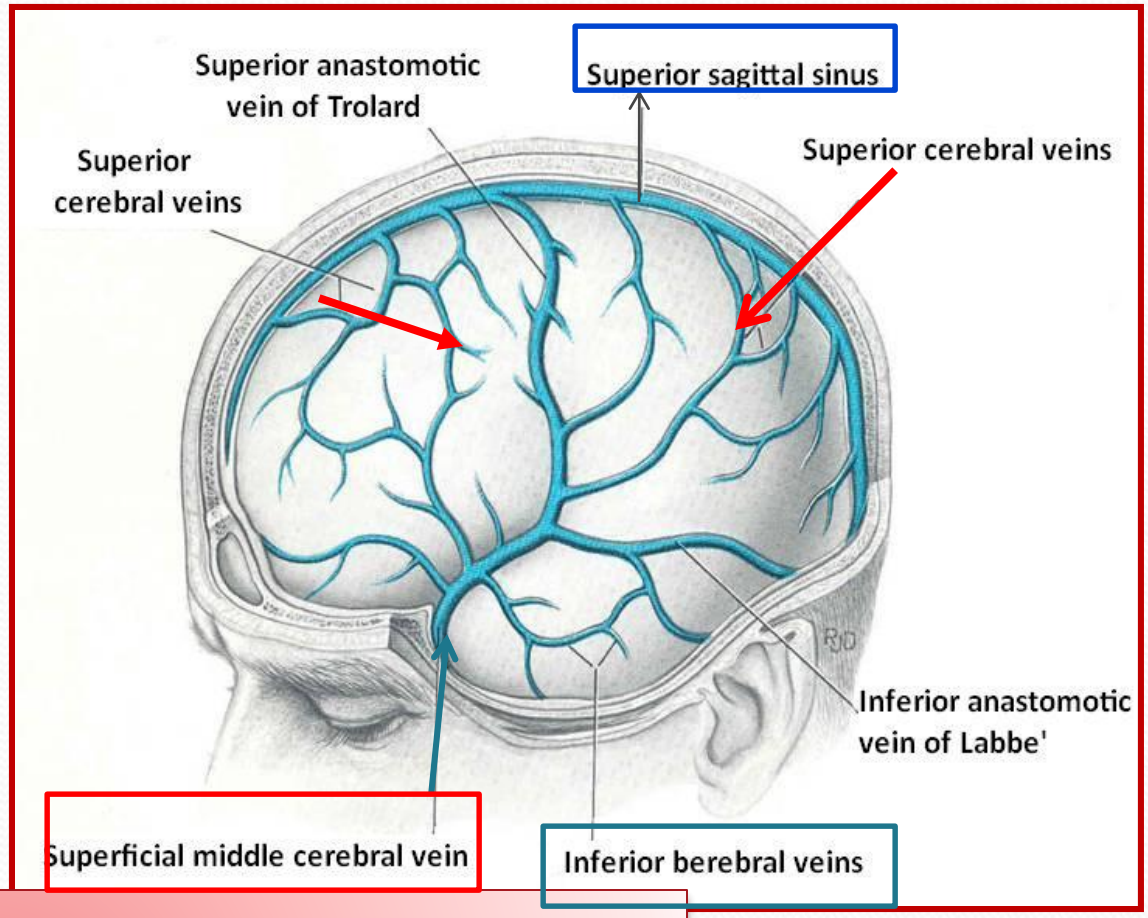



- **CORTICAL VEINS:**
- **(A) Superficial**
- found in the **Subarchnoid space** Drain the cortical surfaces
- **(B) Deep veins:**
- Drain the deeper structures

- These veins are **thin walled** and **devoid of valves.**
- They ultimately drain into the
- **Dural Venous Sinuses**

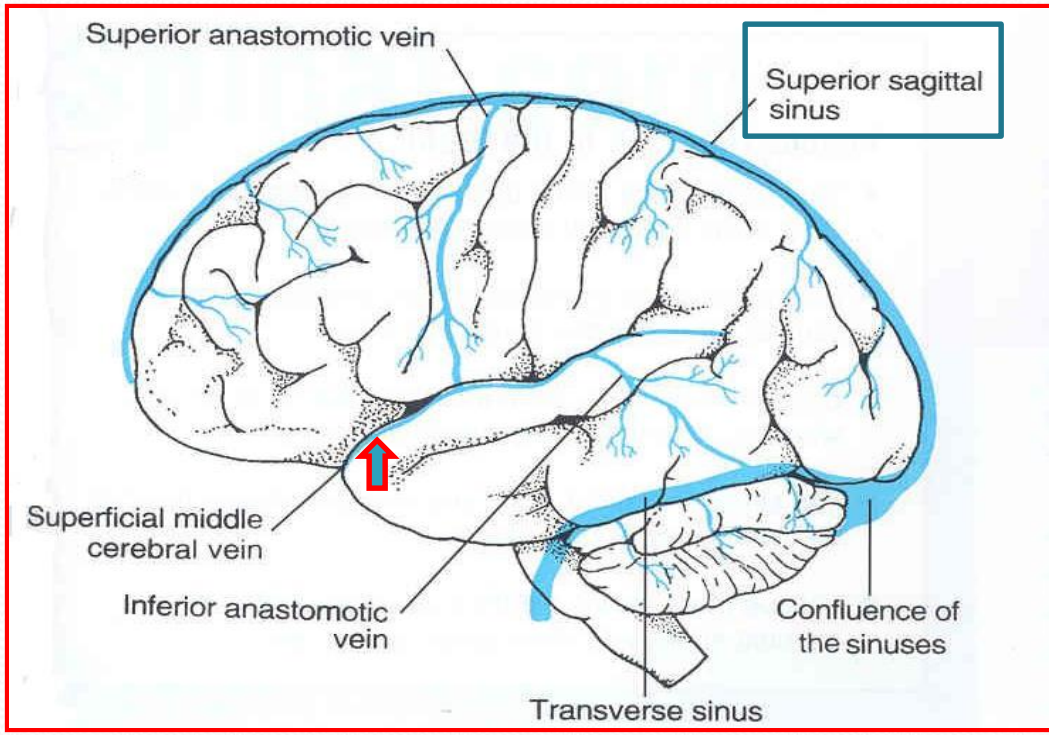
# SUPERFICIAL CORTICAL VEINS

- **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**.



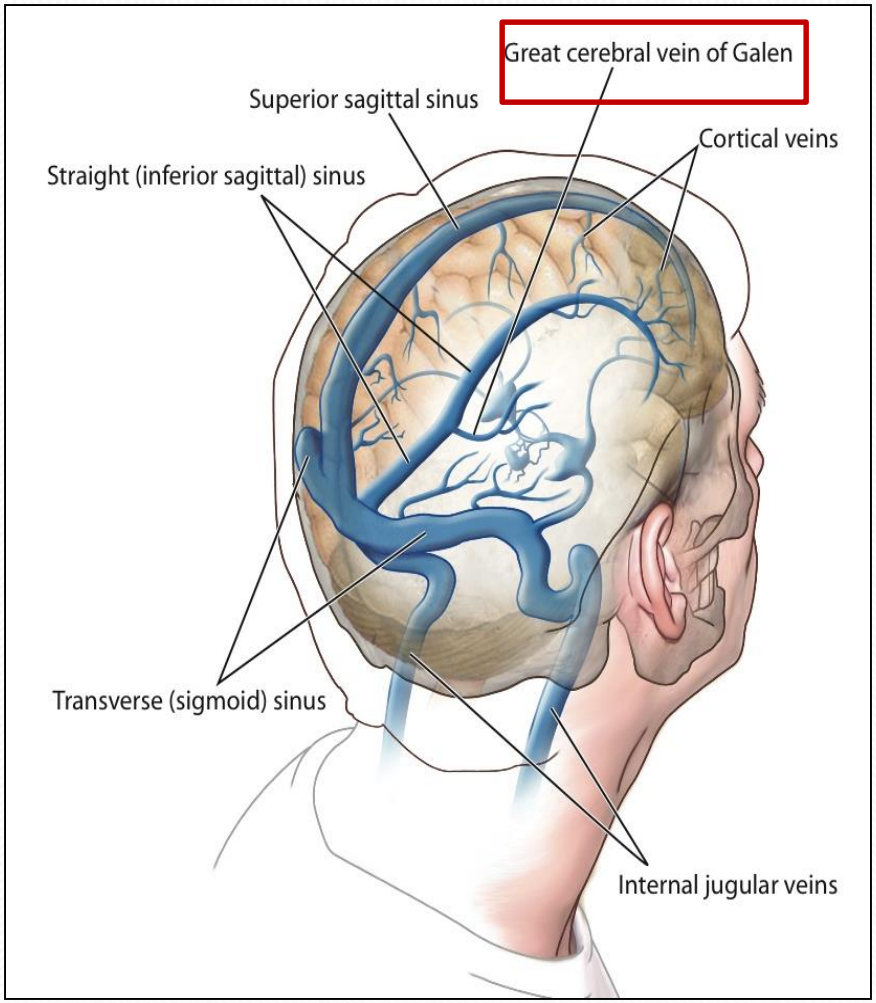

- **2. Inferior cerebral veins:**
  - Run below the lateral sulcus
  - Drain the lateral surface of the temporal lobe
  - Terminate partly into **superficial middle cerebral vein** & partly into **Transverse sinus**.

- **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

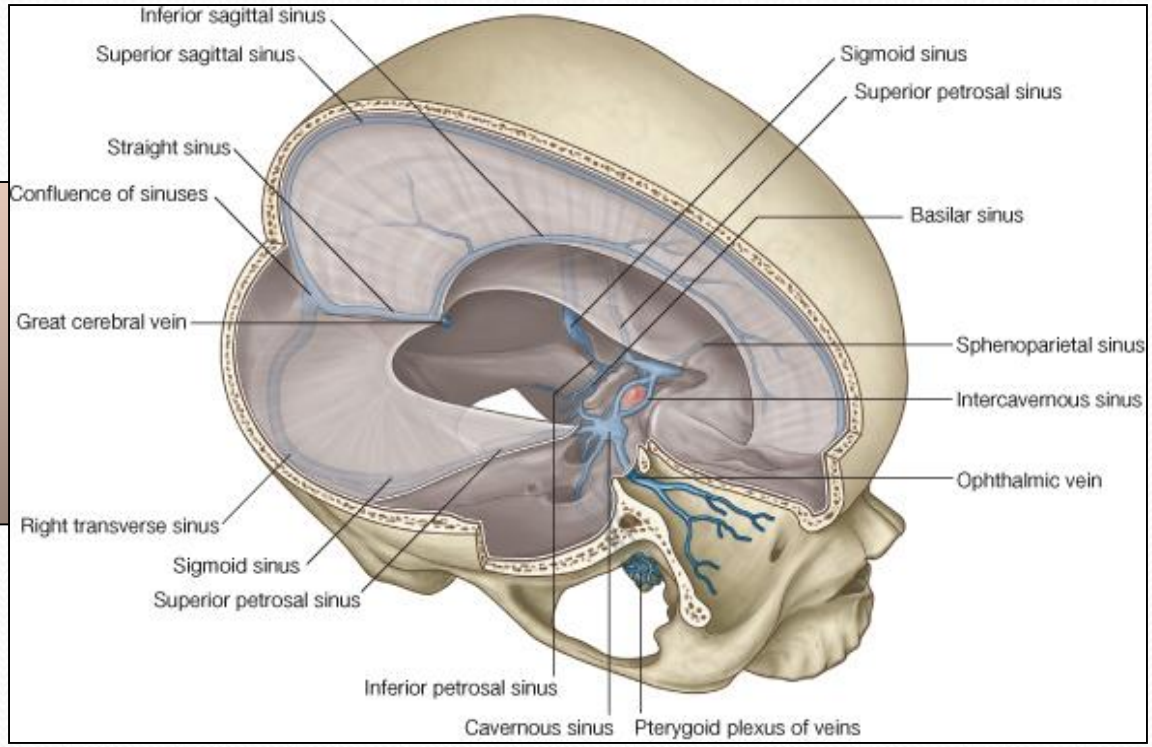
- Drain the internal structures (**basal ganglia**, **internal capsule**, **thalamus**)
- They merge to form two **Internal Cerebral Veins**.
- The two veins unite in the midline to form the **Great Cerebral vein**.
- This short vessel joins the **Inferior Sagittal sinus** to form the **Straight S**



# 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

- **Infarcation.**
- **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