

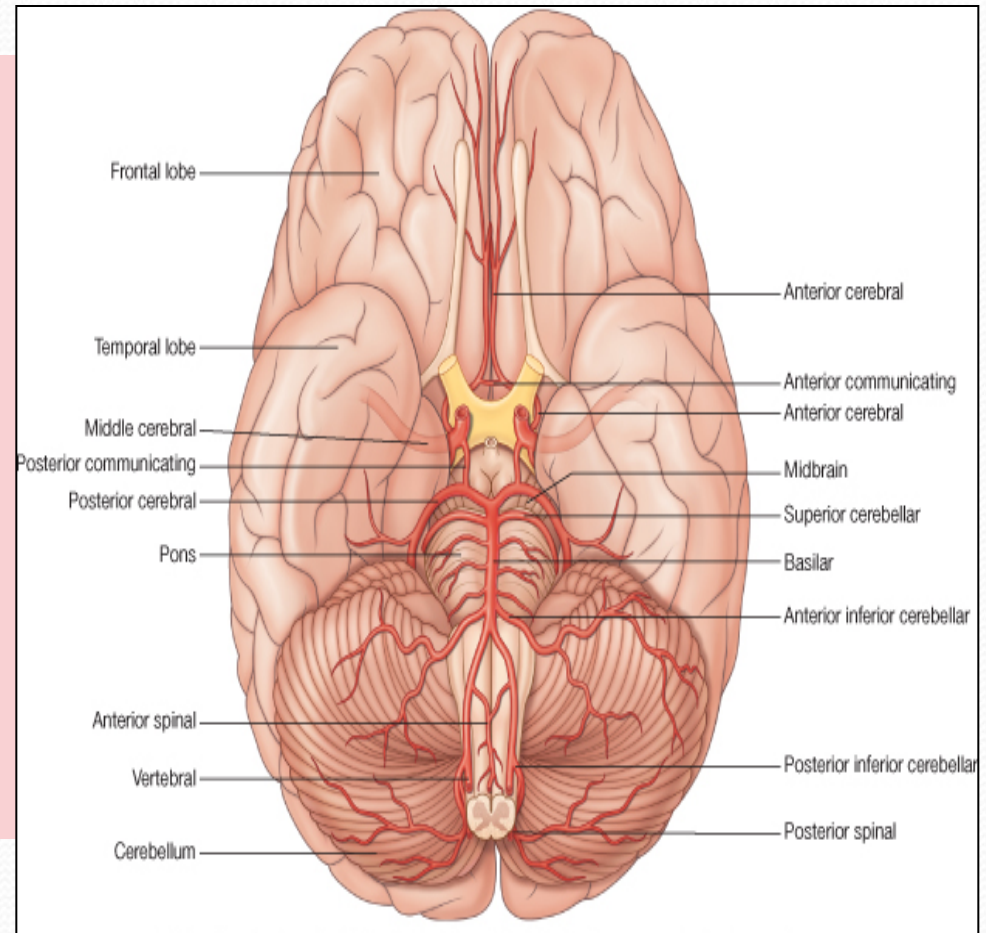
# **CEREBRAL BLOOD CIRCULATION**

# 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:

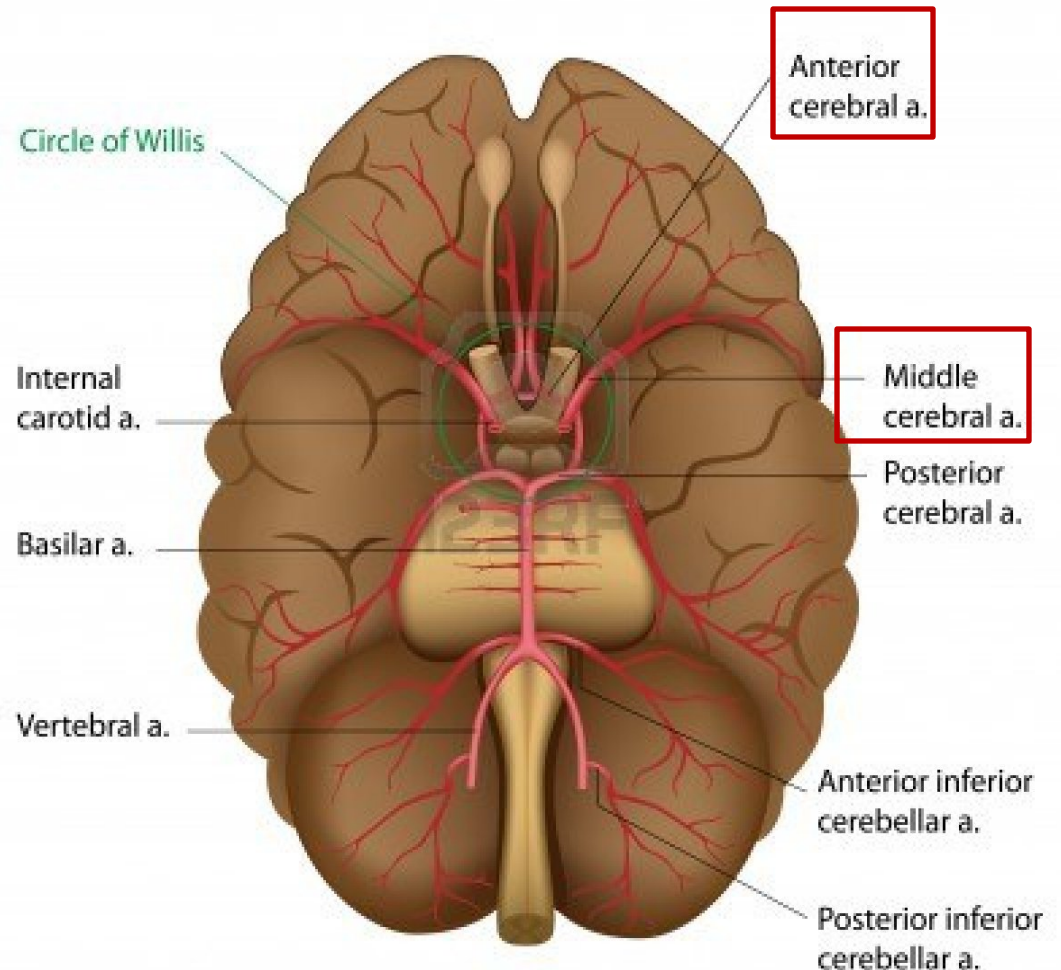
**Internal carotid artery**

and its branches:

**Anterior cerebral artery &**

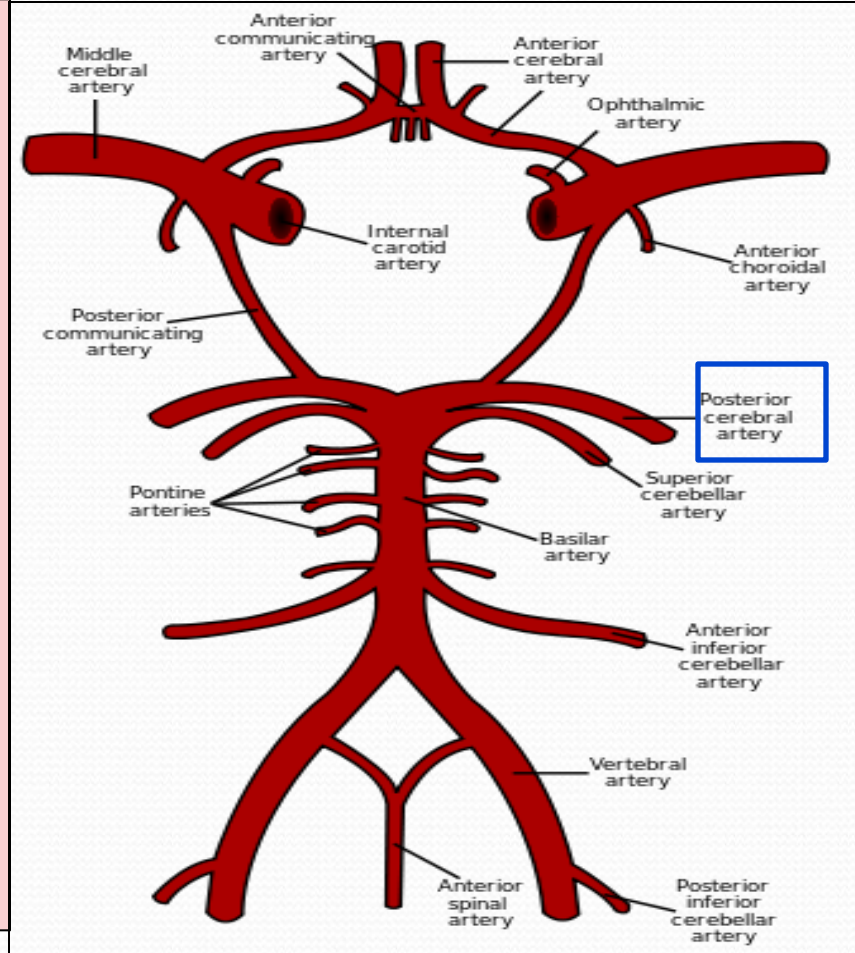
**Middle cerebral artery**

## Blood Supply of the Brain



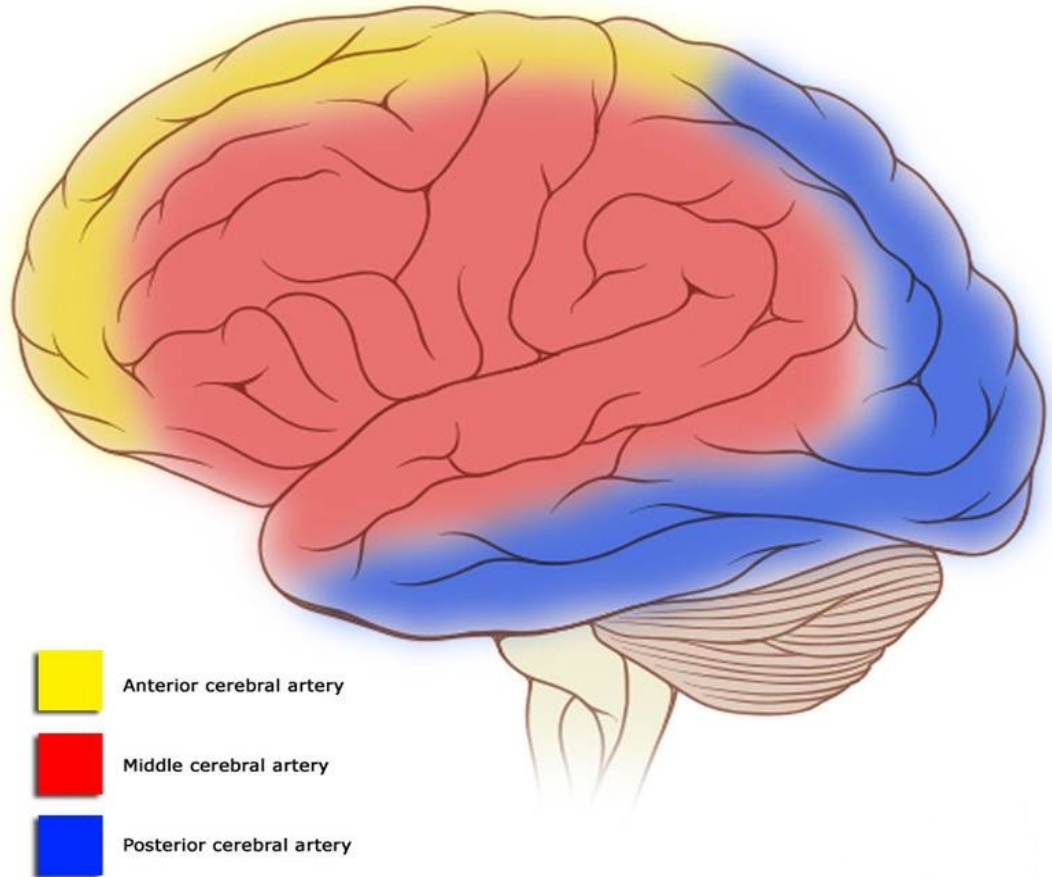
# VERTEBRO BASILAR SYSTEM

- 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**.



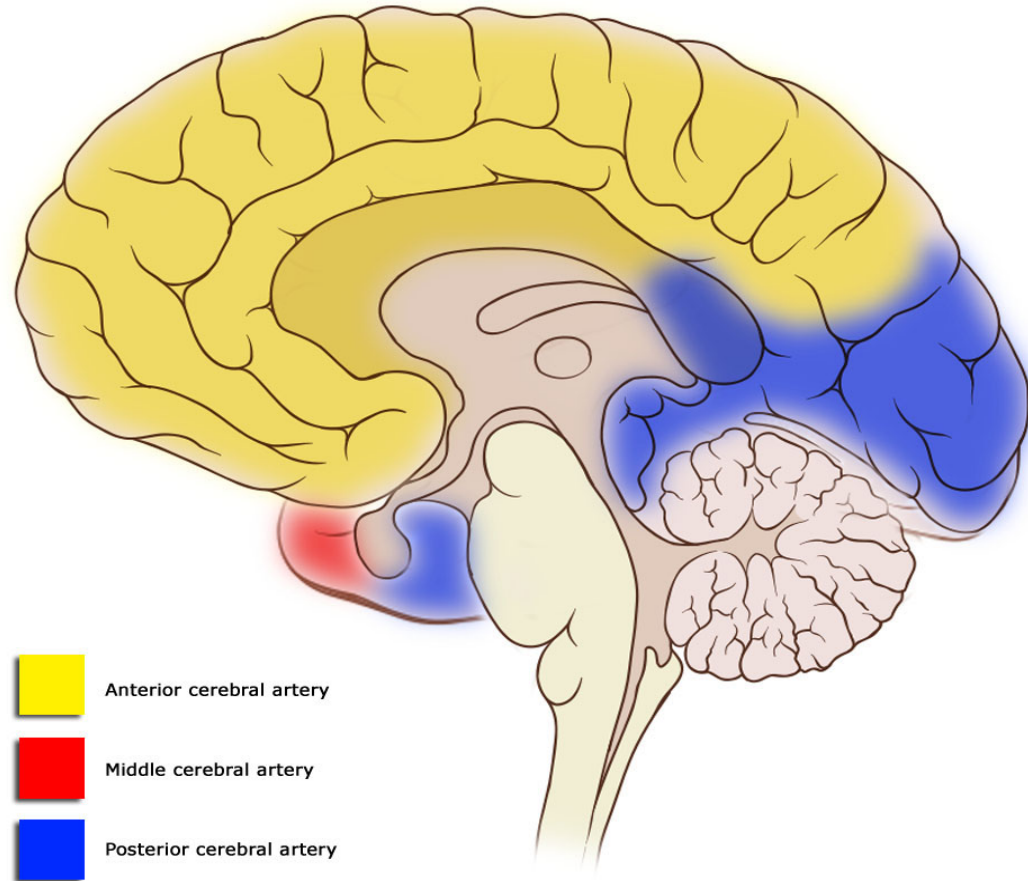
**Distribution of the cerebral arteries on the superolateral surface of the cerebral H**

Cortical vascular territories



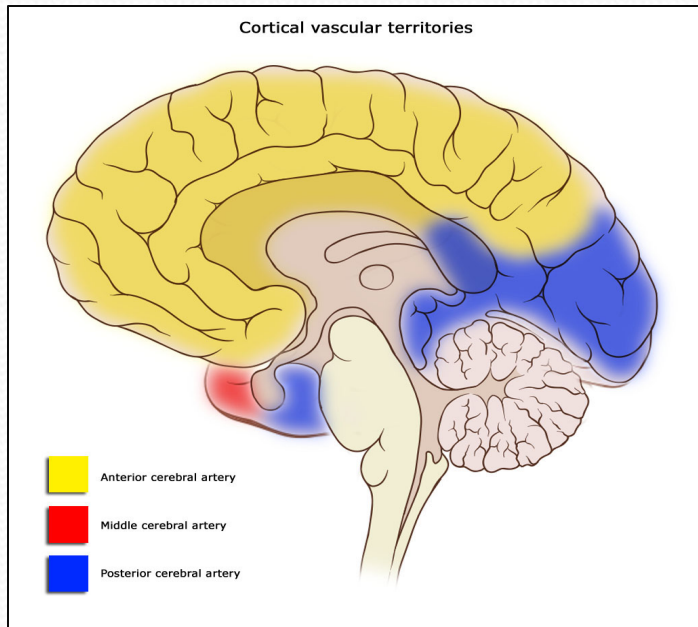
# Distribution of the cerebral arteries on the medial surface of the cerebral H

Cortical vascular territories

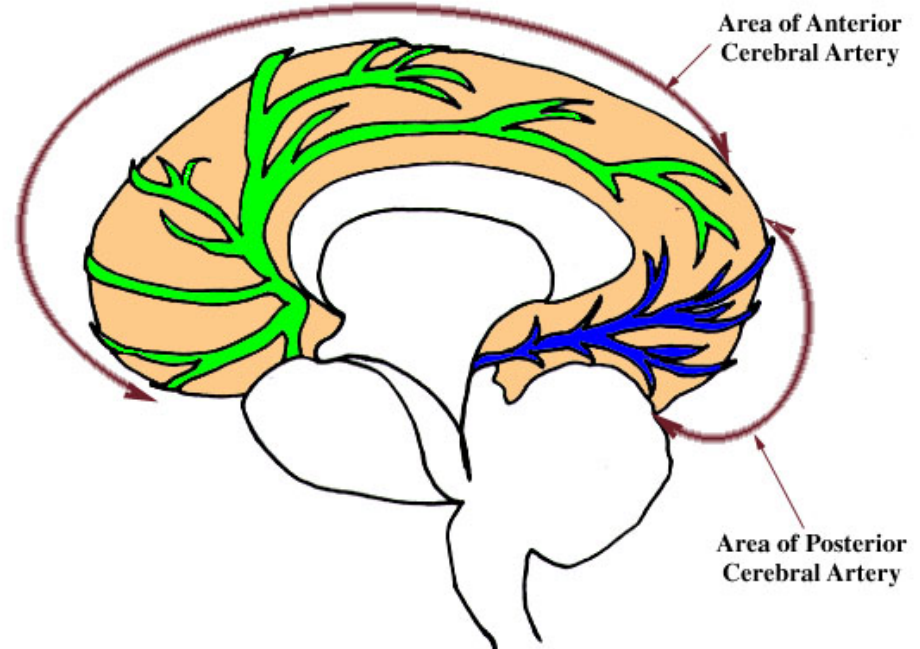


# Anterior Cerebral Artery

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



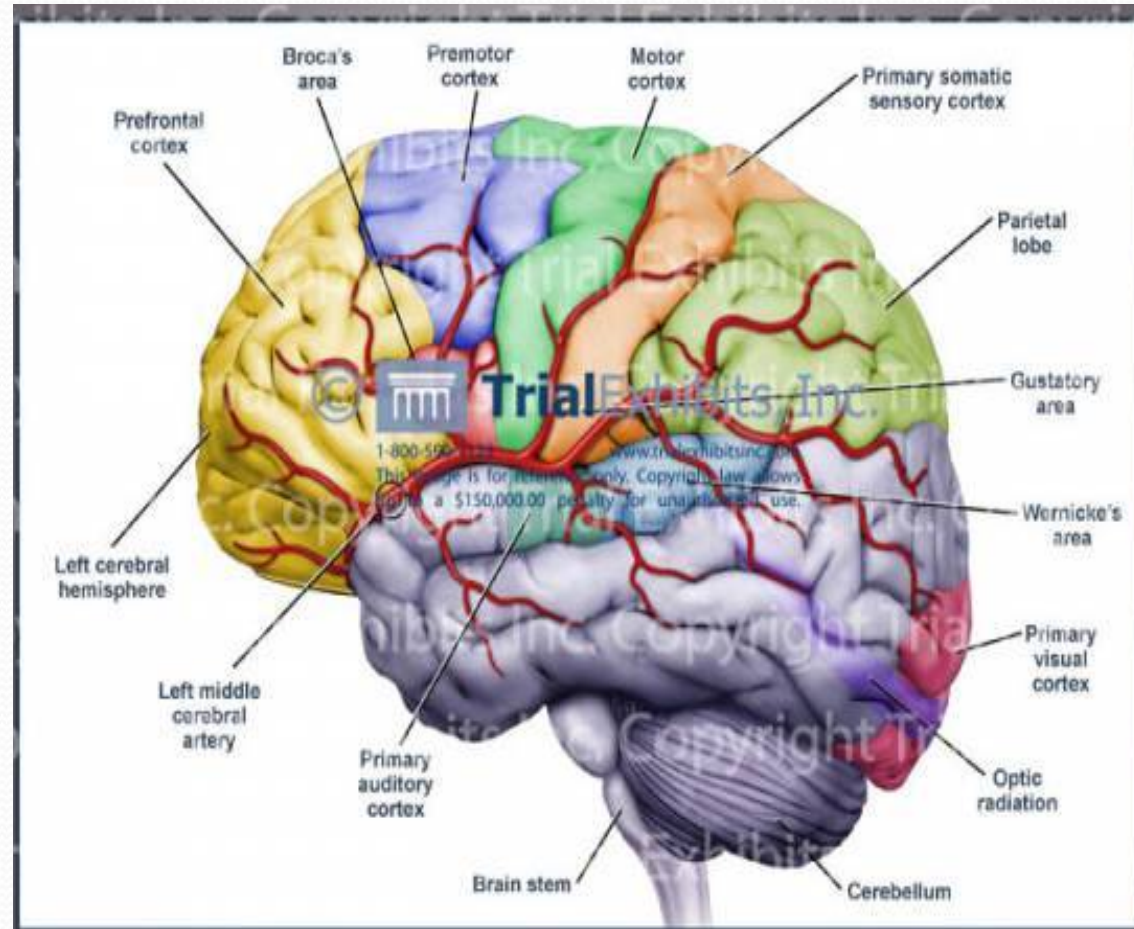
AREA OF BLOOD SUPPLY: Medial View





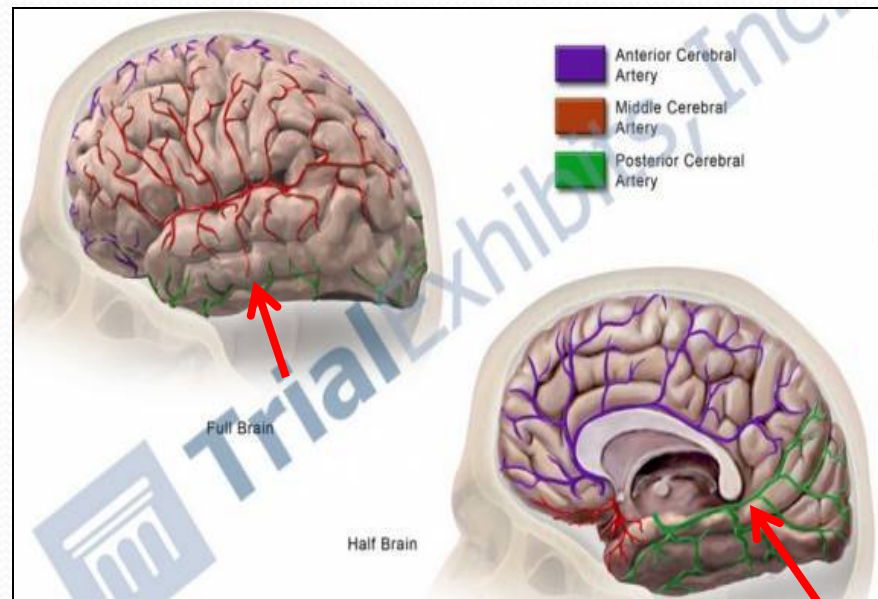
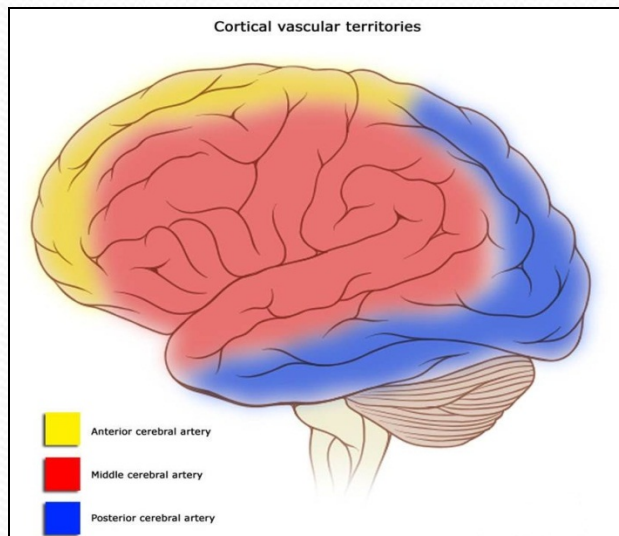
# Middle Cerebral Artery

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

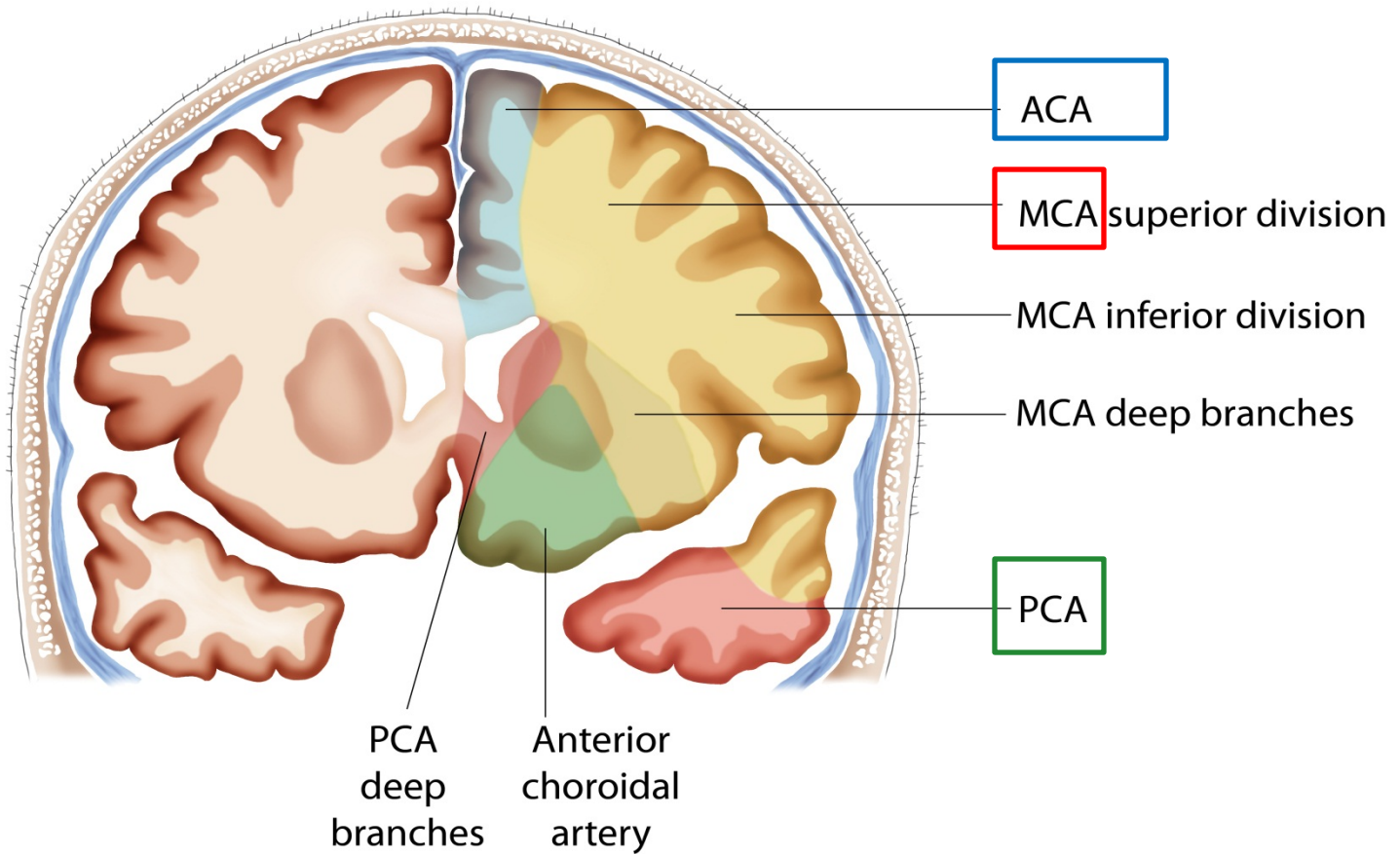


# Posterior Cerebral Artery

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

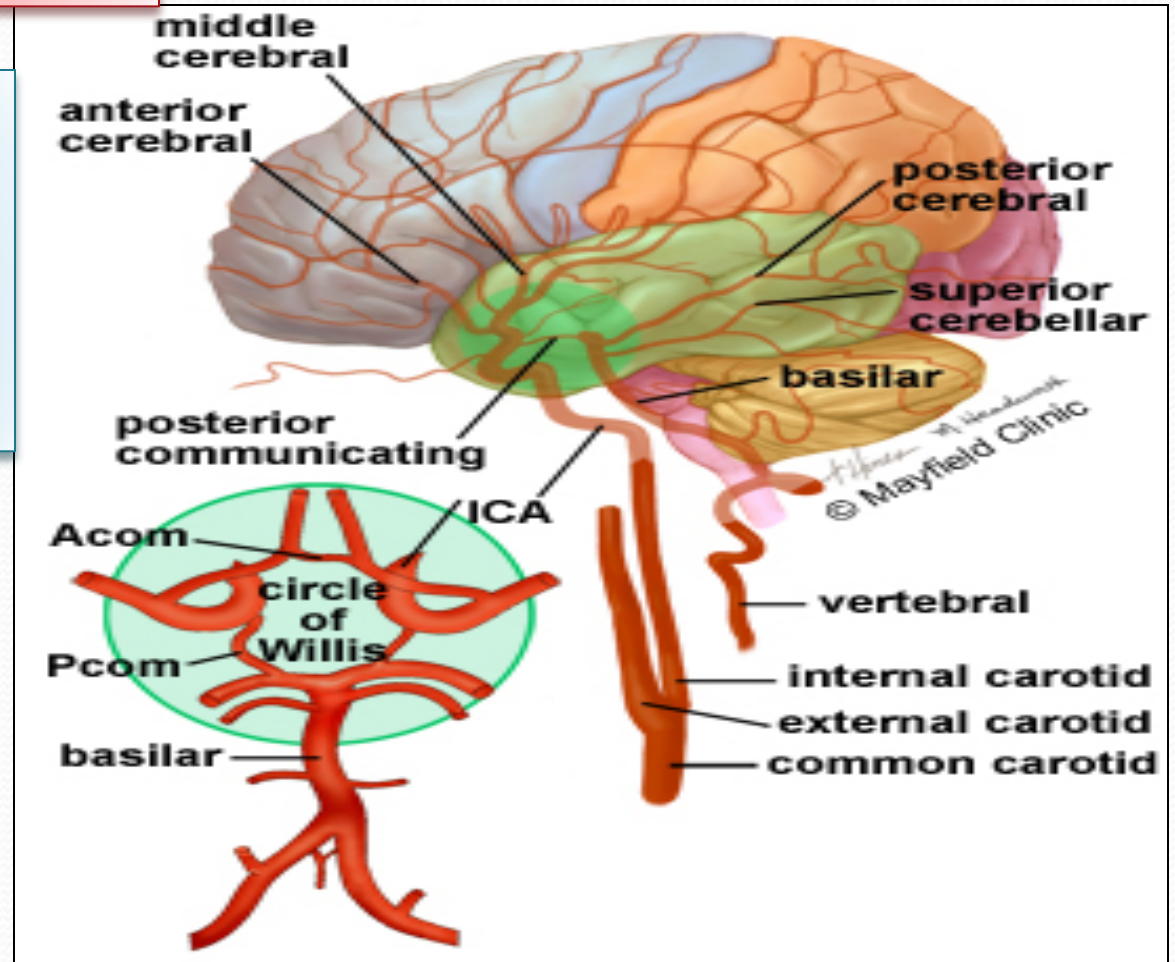


Coronal section of brain showing the supply territories of the cerebral vessels

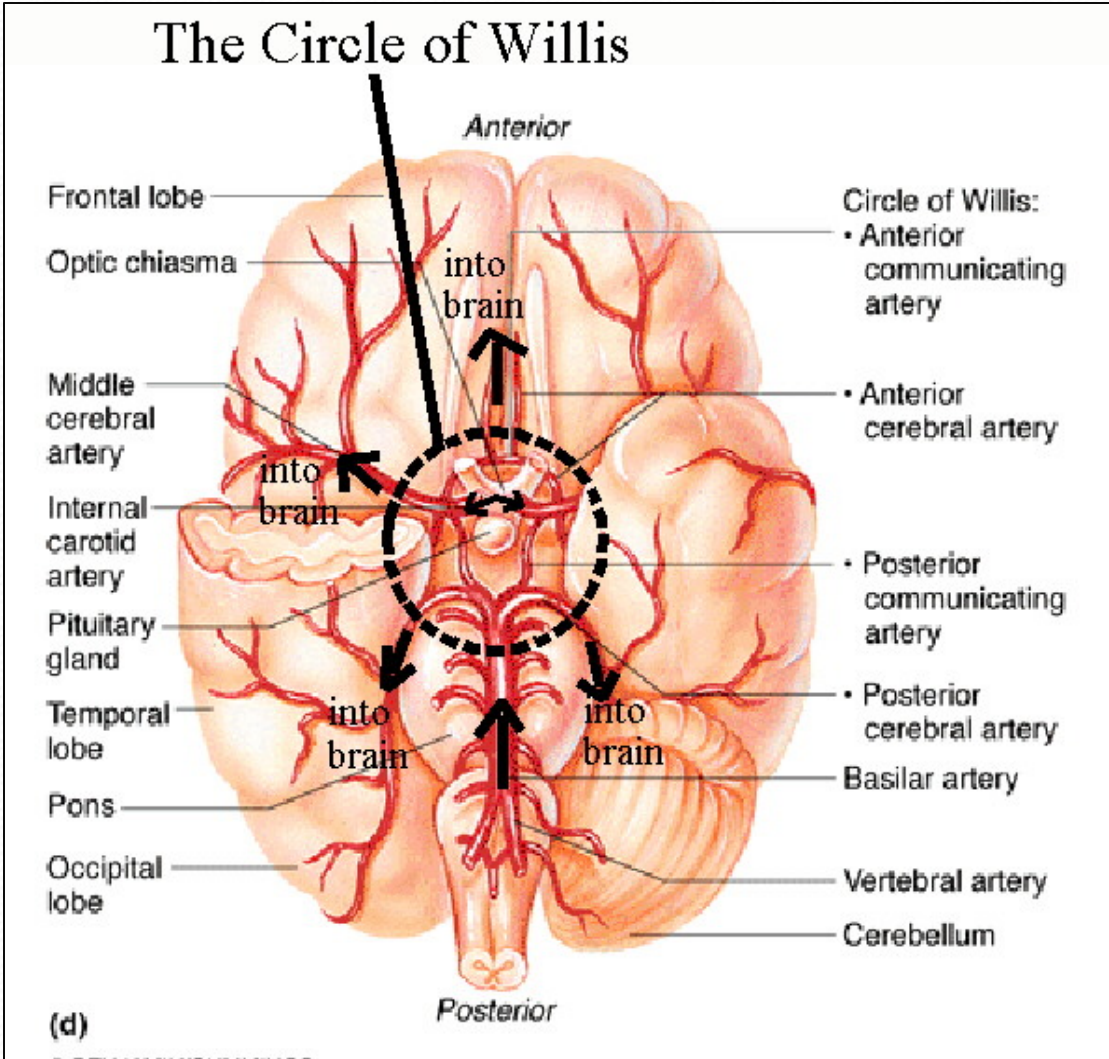


# Circulus Arteriosus (of Willis)

It joins the Carotid & Vertebrobasilar systems

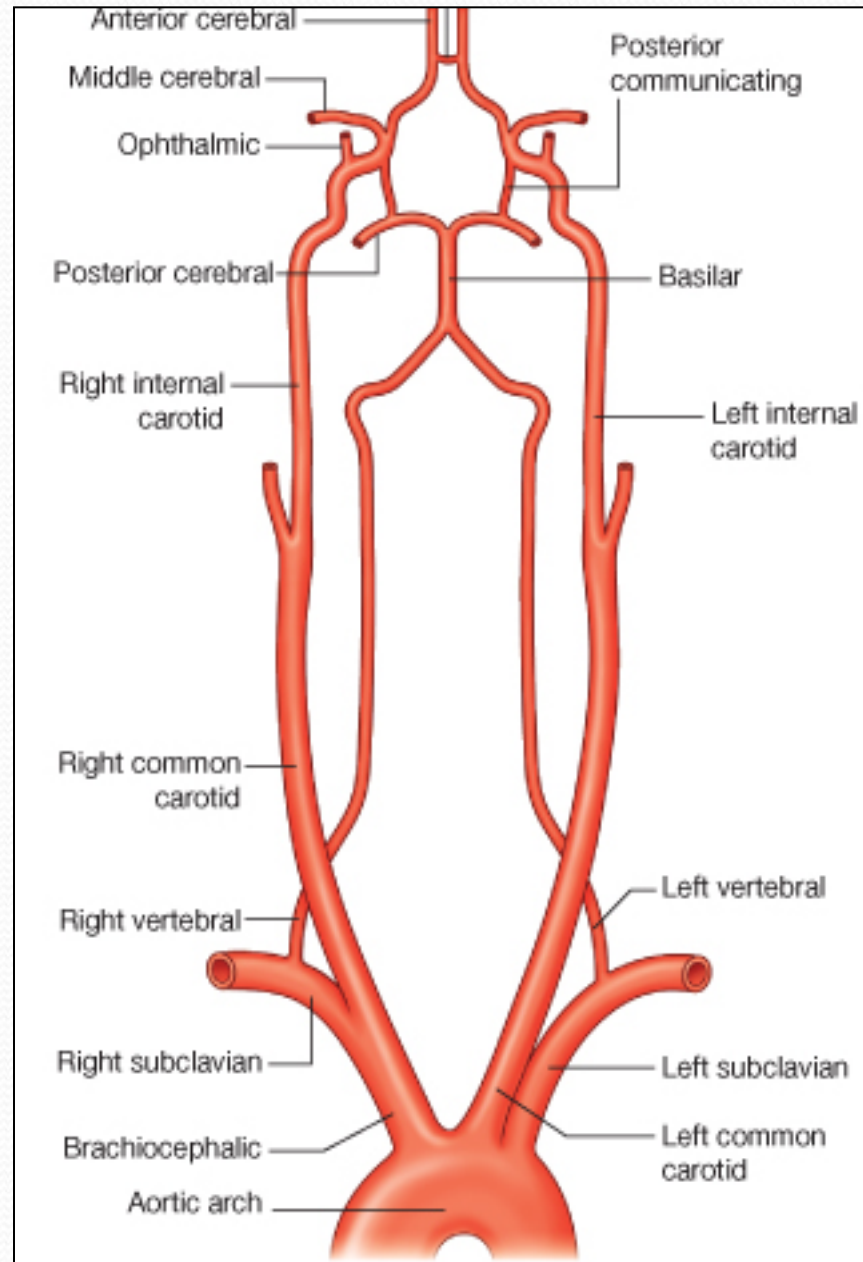


- **located** on the base of the brain
- **It encircles:**
- **Optic Chiasma, Hypothalamus, Pituitary gland, Midbrain.**

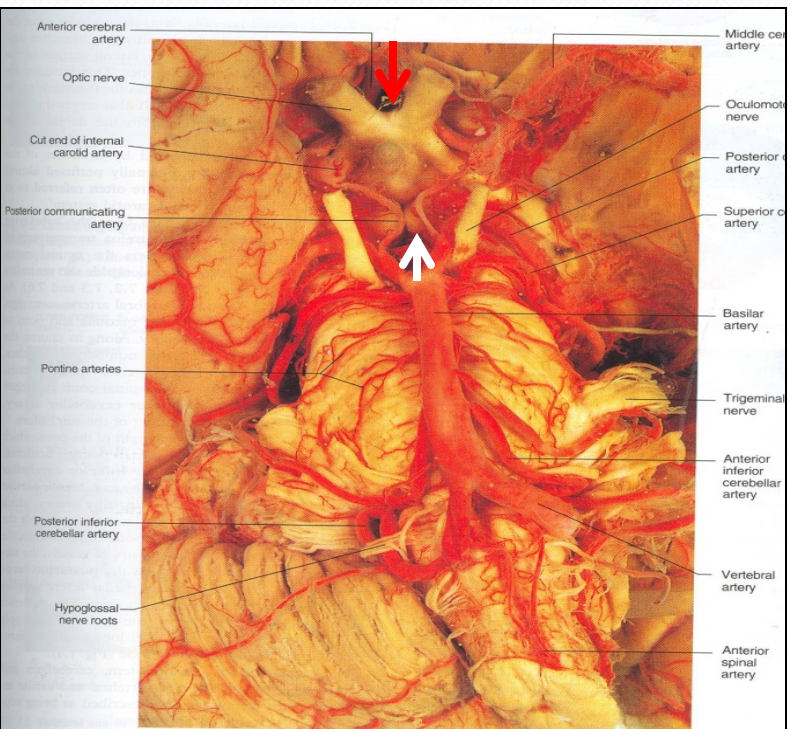
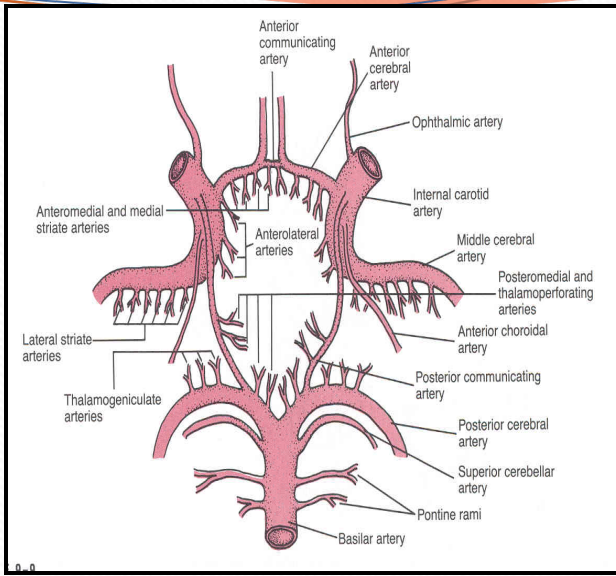


● **Composed of:**

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



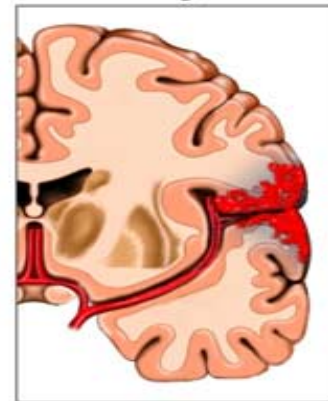
- **Branches:**
- **Perforating arteries (Anterior & Posterior):**
- **Numerous small vessels that penetrate the surface of the brain through the anterior and posterior perforating substances.**
- **APA supply:**
- **Large part of Basal Ganglia,**
- **Optic chiasma,**
- **Internal capsule & Hypothalamus**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



# Arterial Disorders

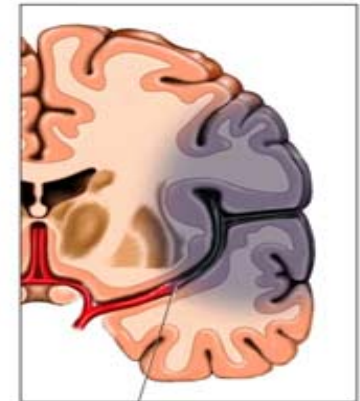
- **A. Stroke** (Sudden occlusion of the blood supply):
- It can be:
  - 1. Hemorrhagic
  - 2. Ischemic
- **B. Aneurysm**
- **C. Angioma**

Hemorrhagic Stroke

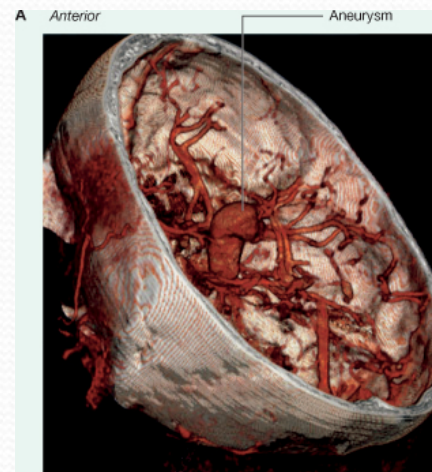


Hemorrhage/blood leaks into brain tissue

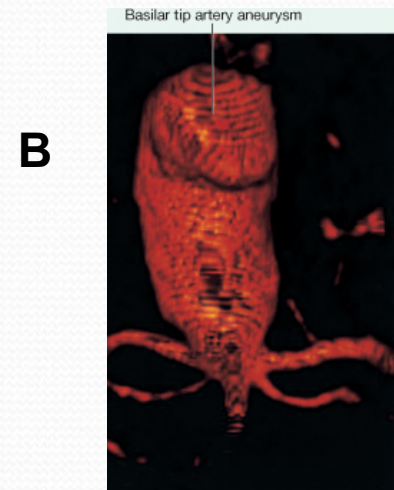
Ischemic Stroke



Clot stops blood supply to an area of the brain

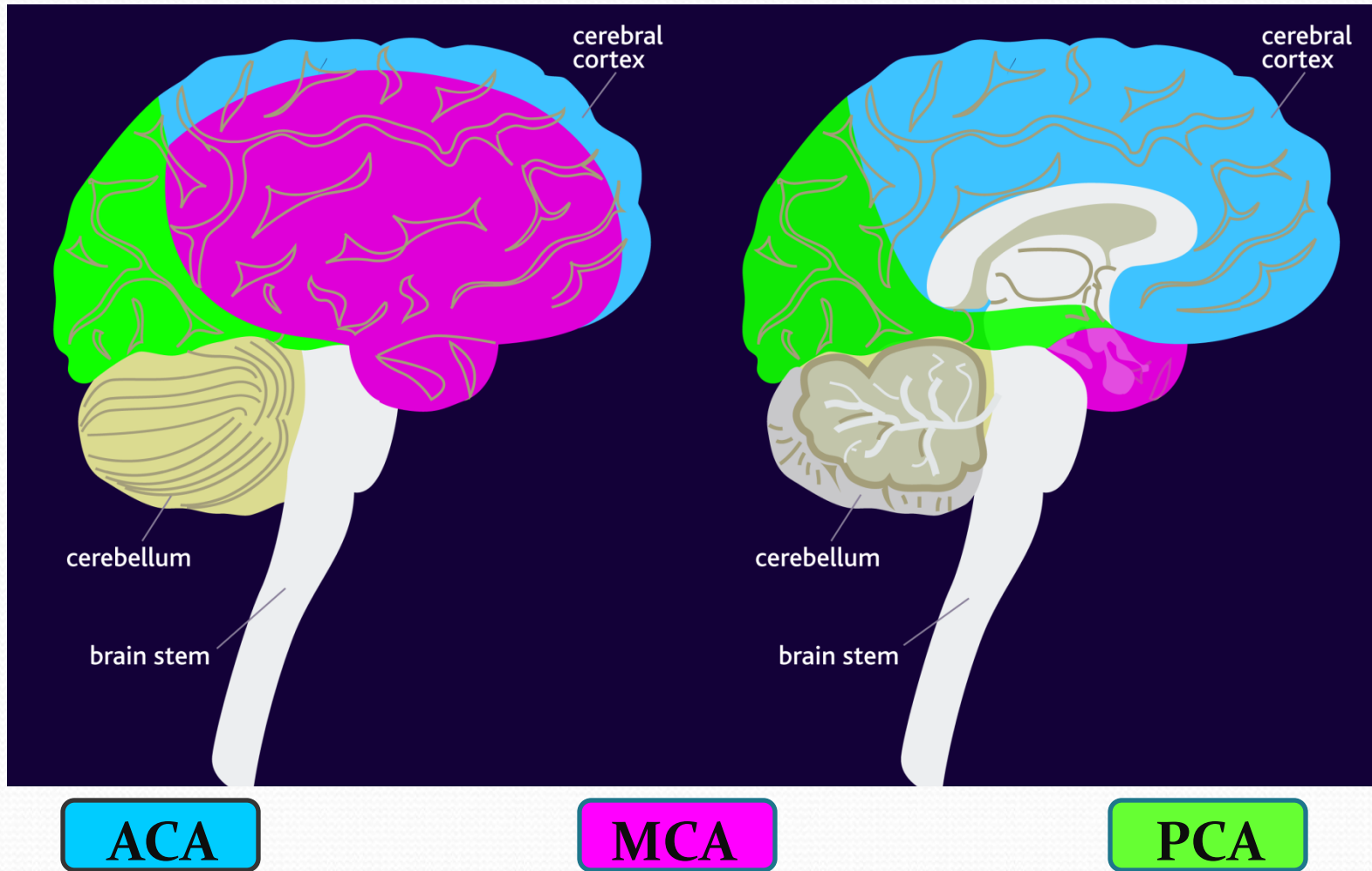


Posterior

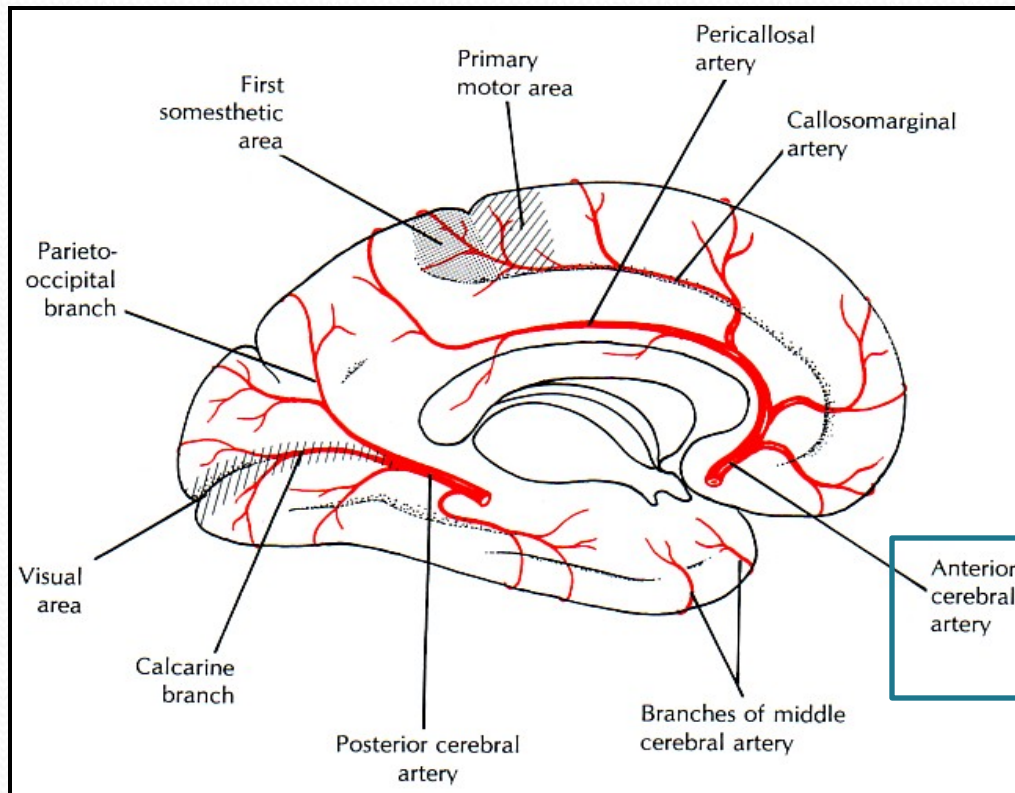




# EFFECT OF OCCLUSION of Cerebral arteries

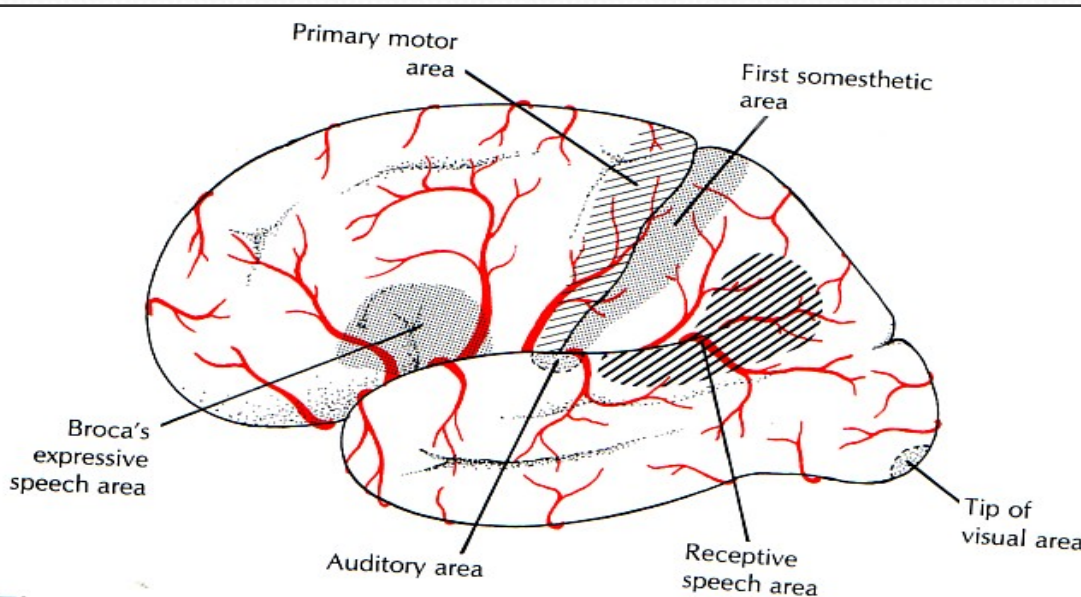


# ACA



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

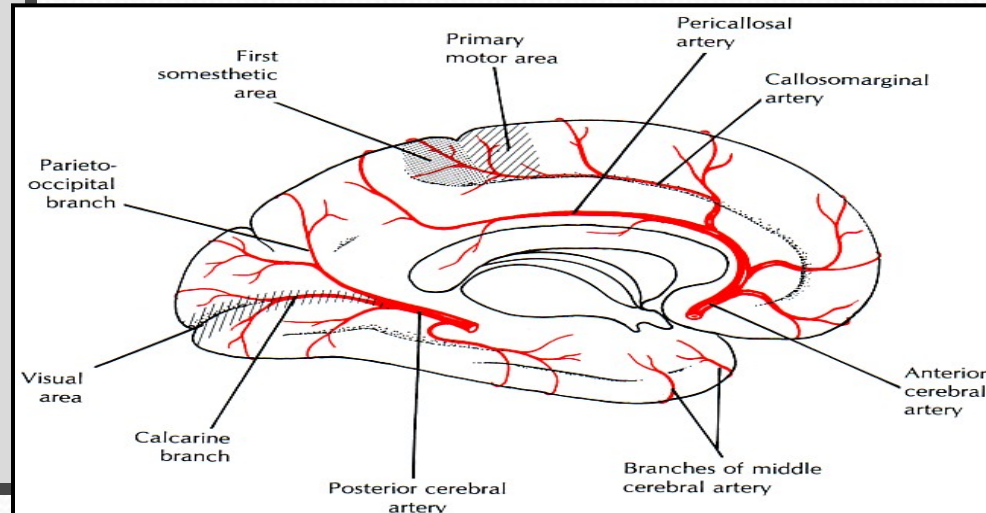
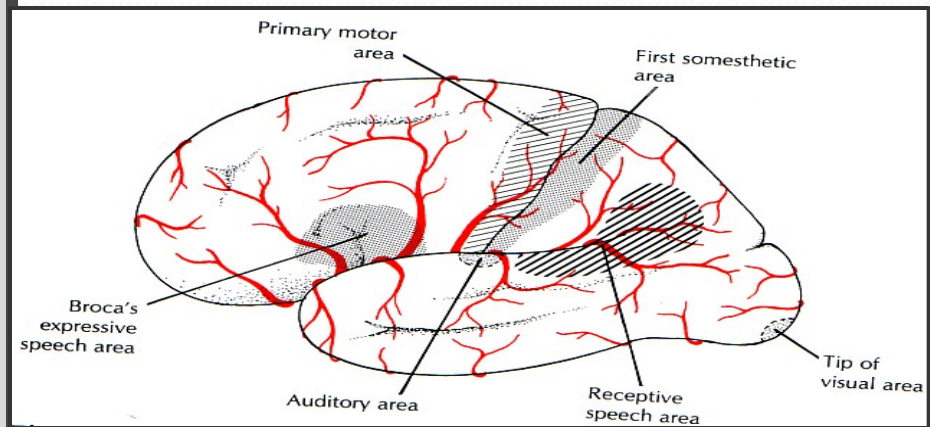
# MCA



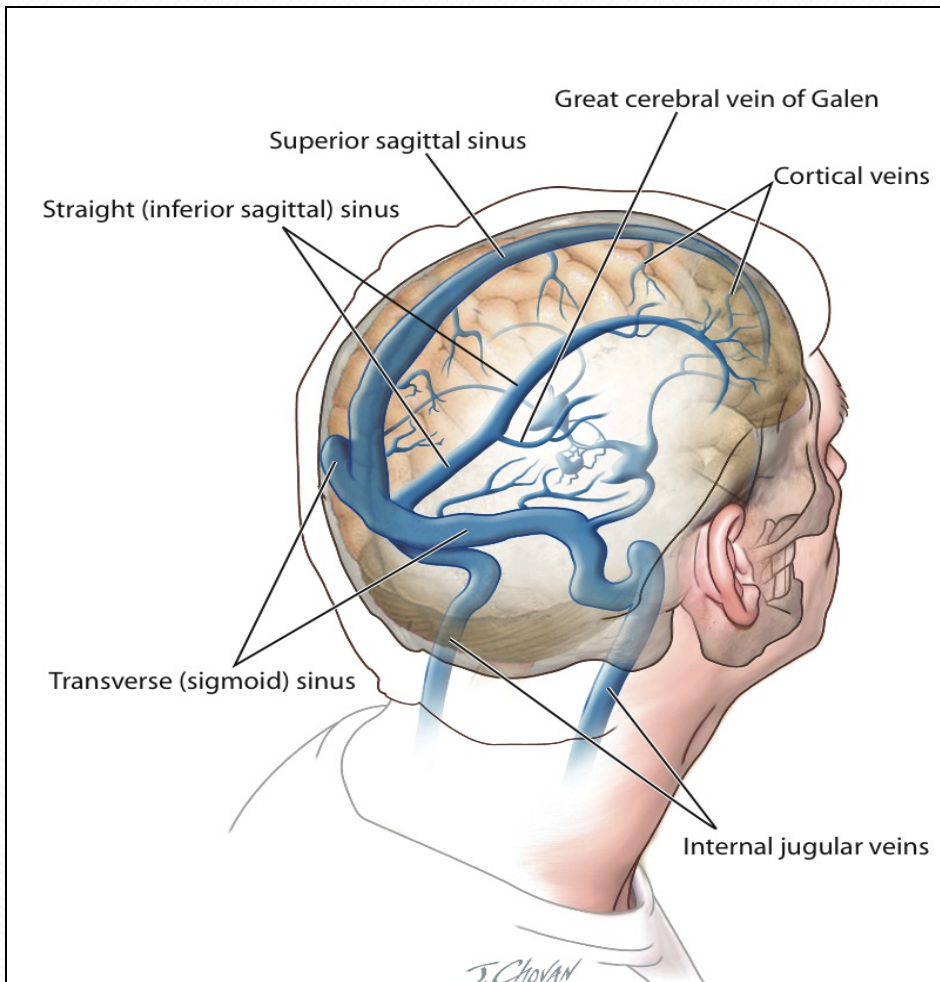
- **1. Contralateral weakness of:**
  - **Face, Arm, Hand & leg**
  - **2. Contralateral sensory loss of:**
- **Face, Arm & Hand & leg**
- **3. Visual field cut (damage to optic radiation)**
- **4. Aphasia (language disturbances )**
  - **Broca's: production**
  - **Wernicke's: comprehension**

# 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

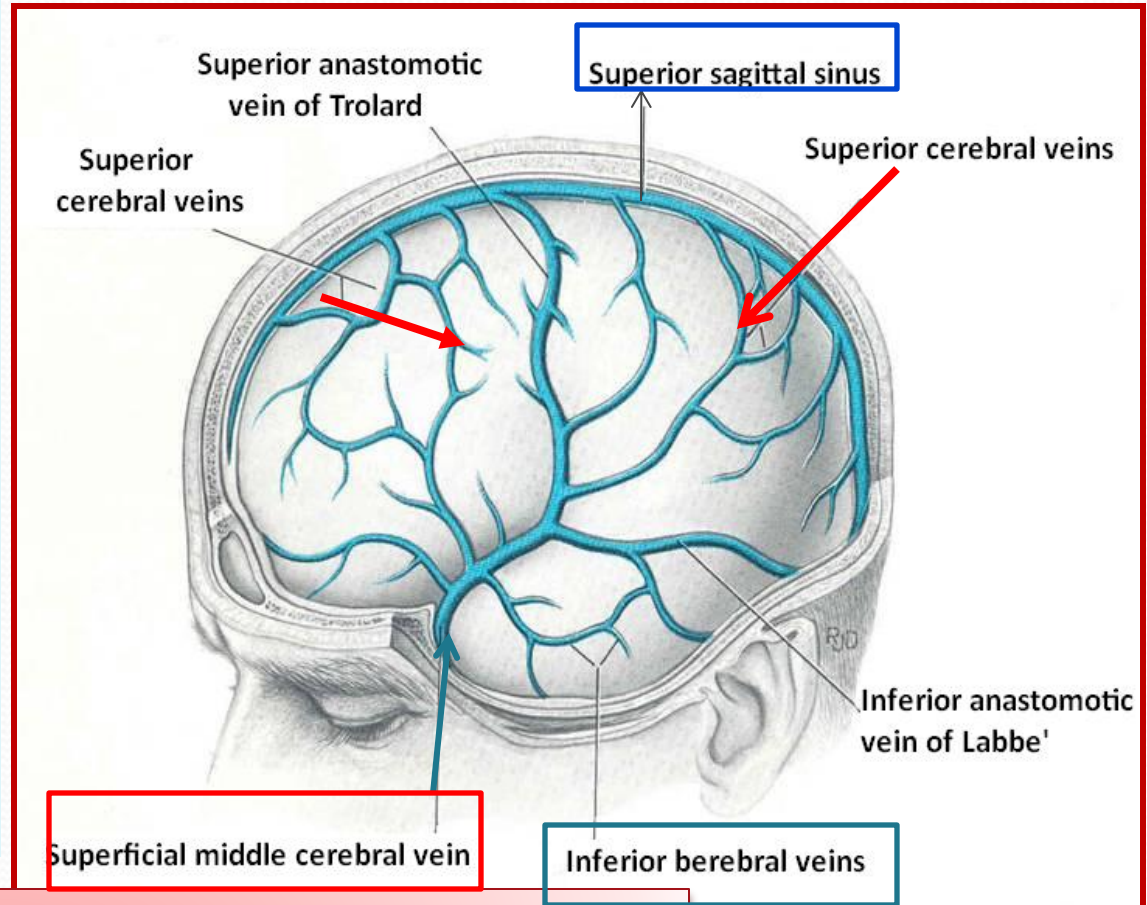


- **Cortical Veins:**
- **(A) Superficial**
- found in the **Subarchnoid space**  
Drain the cortical surfaces
- **(B) Deep veins:**
- Drain the deeper structures
- These veins are **thin walled** and **devoid of valves.**
- They ultimately drain into the
- **Dural Venous Sinuses**

# 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**.

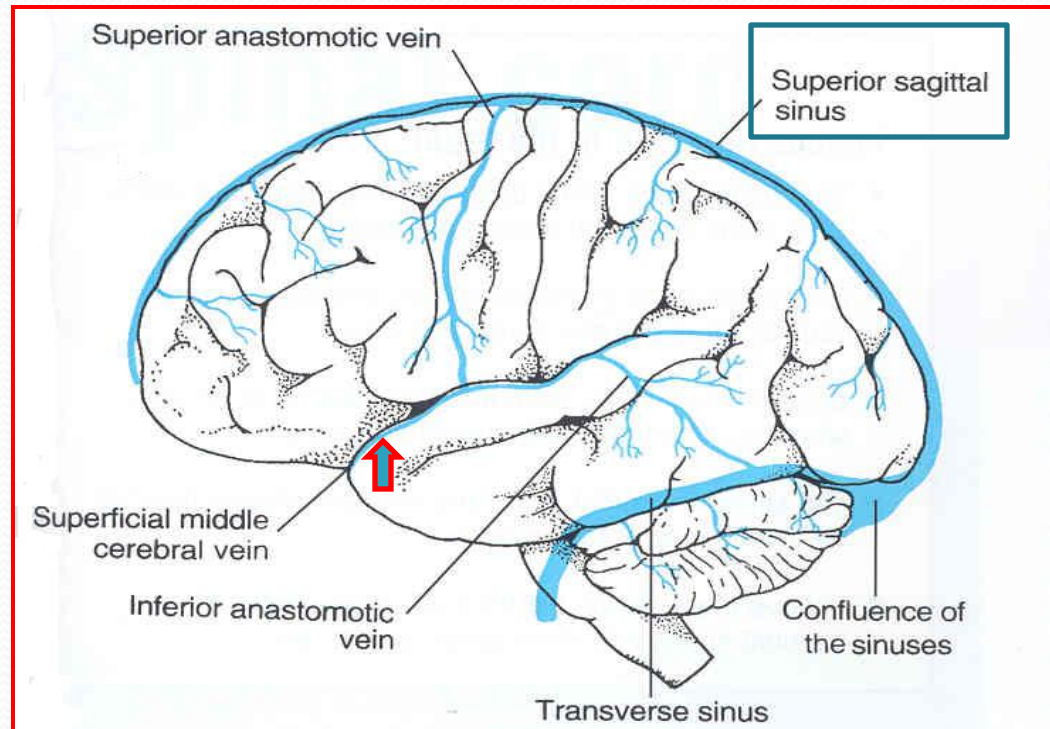


- 2. **Inferior cerebral veins:**

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

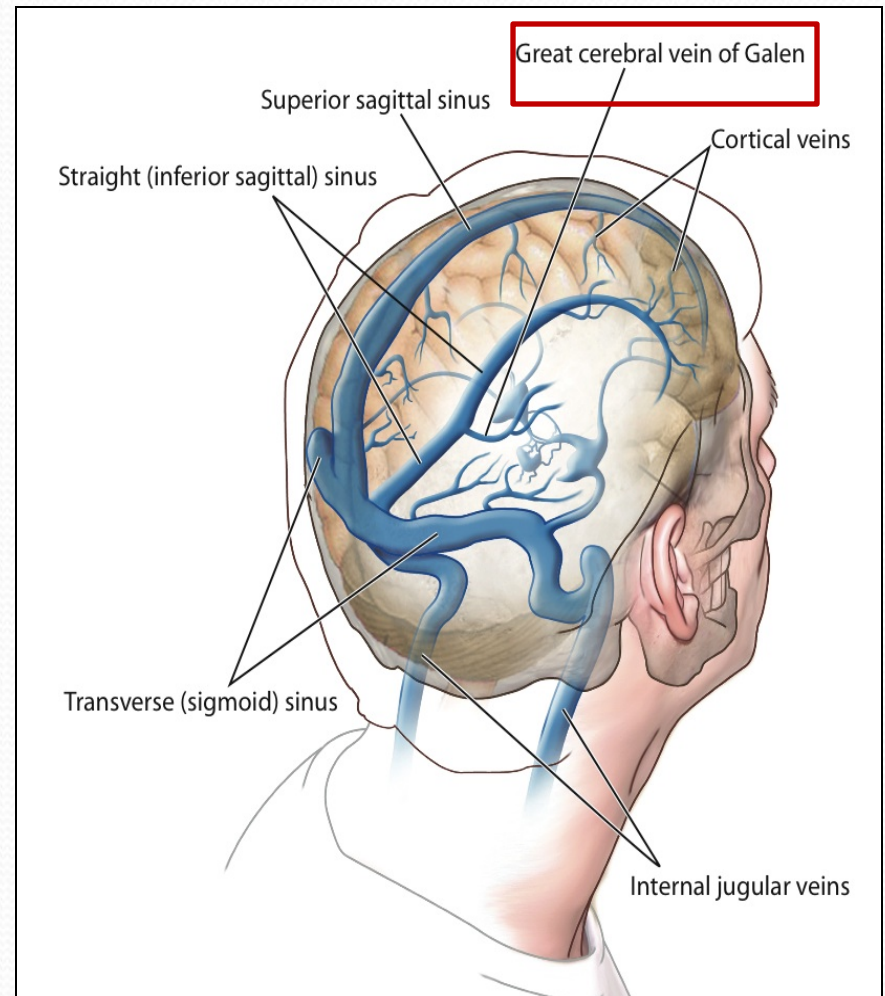
- **3. Superficial middle cerebral vein:**

- 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**

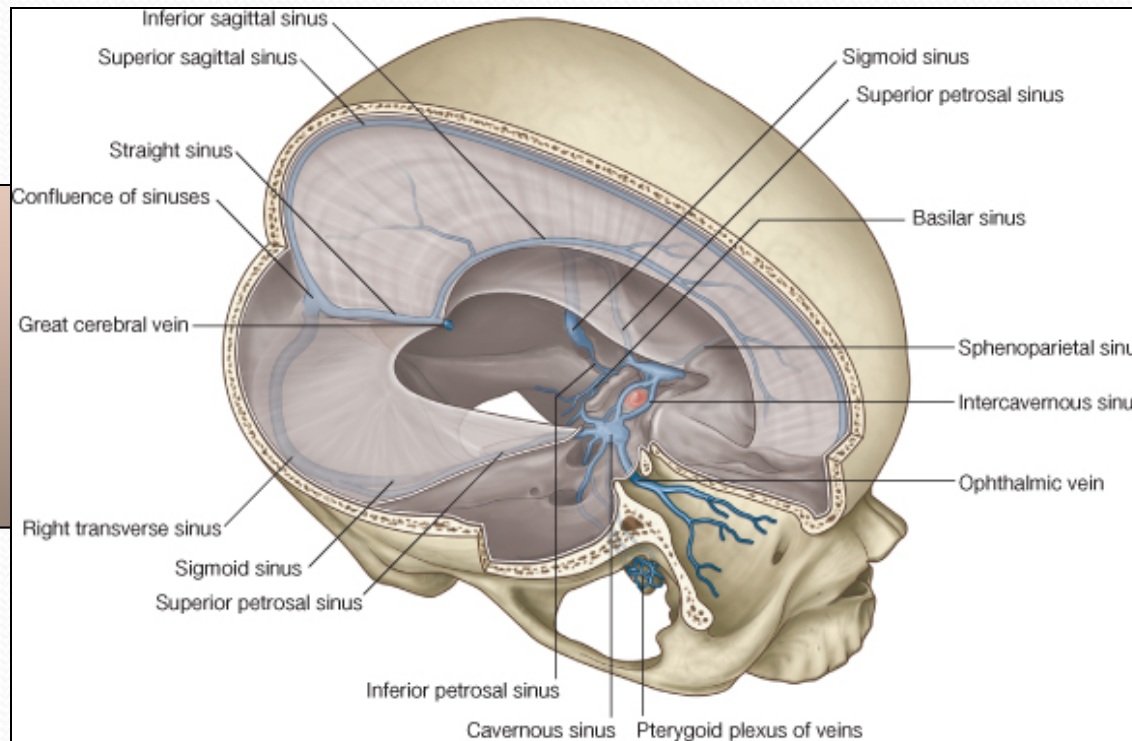




# Dural Venous Sinuses

**Paired**

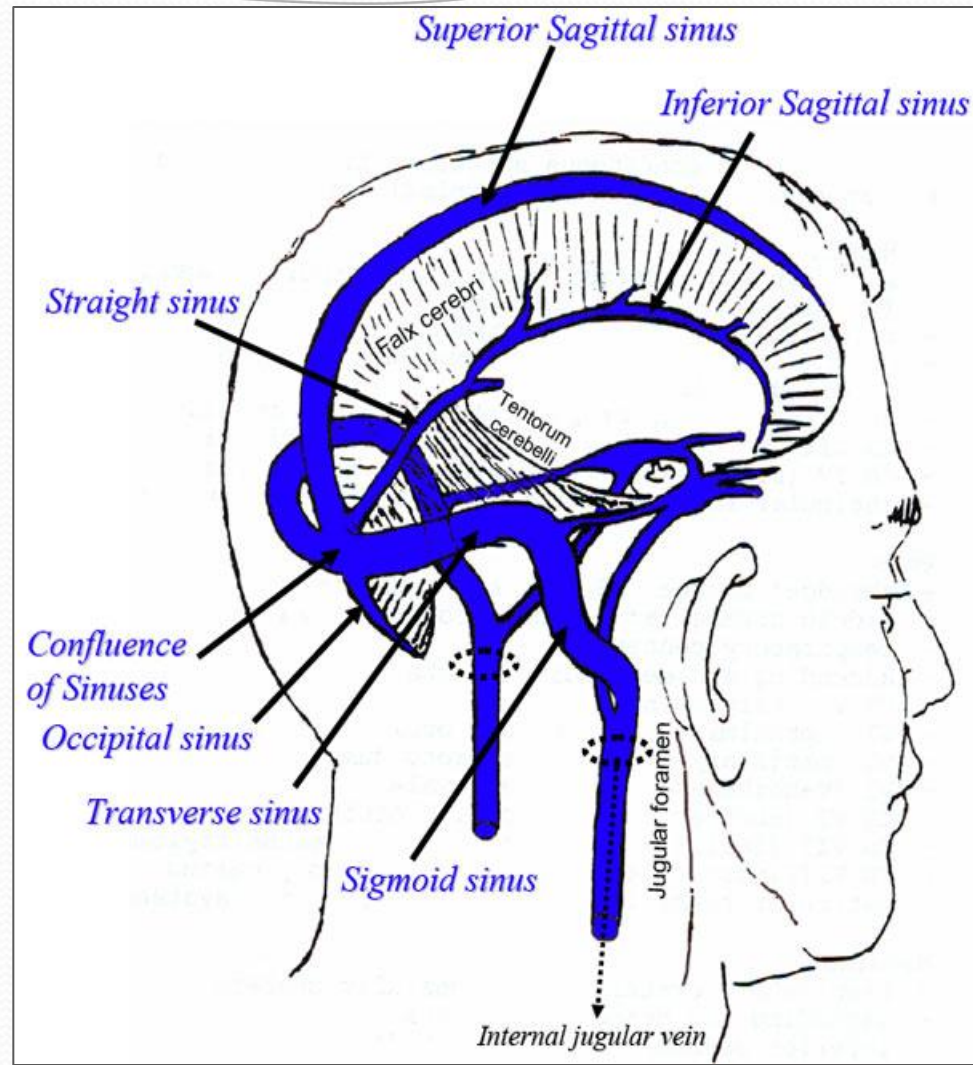
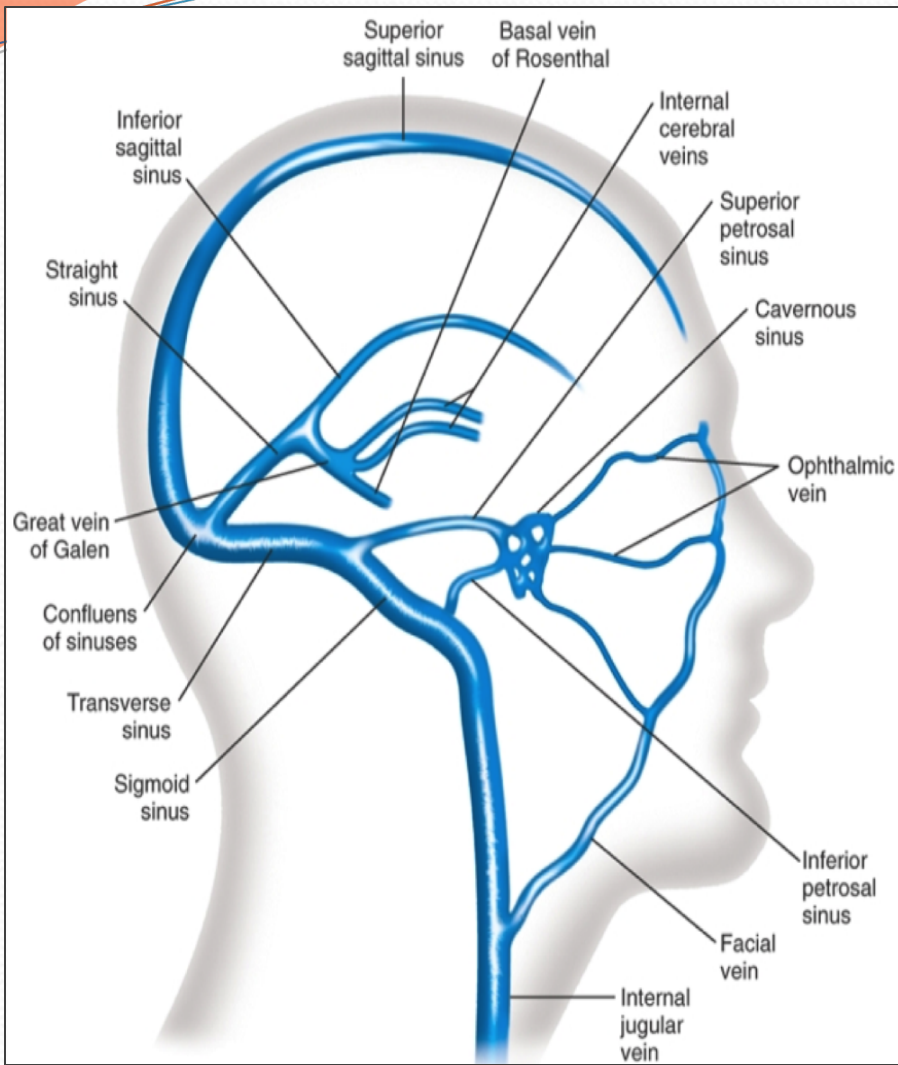
**Transverse.  
Sigmoid.  
Cavernous.  
Petrosal  
(Sup & Inf)**



**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