

# **CEREBRAL BLOOD CIRCULATION**

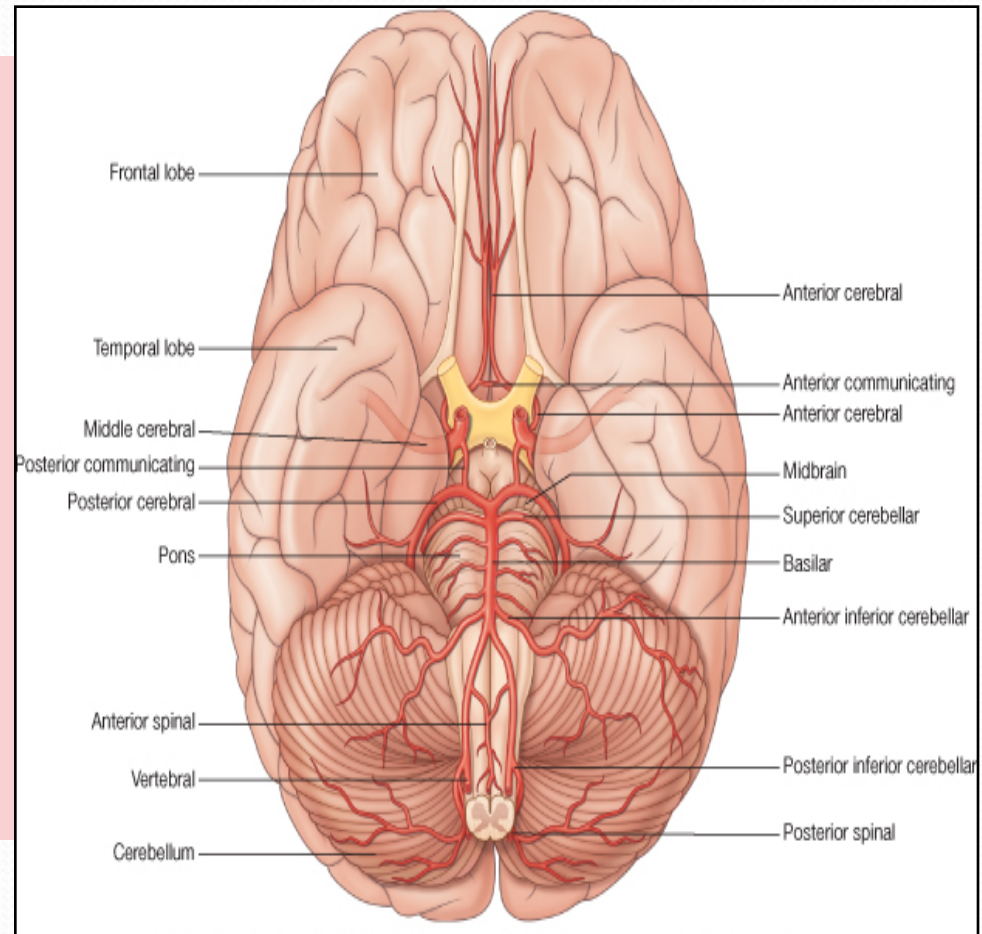
**DR JAMILA EL MEDANY**

# 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**

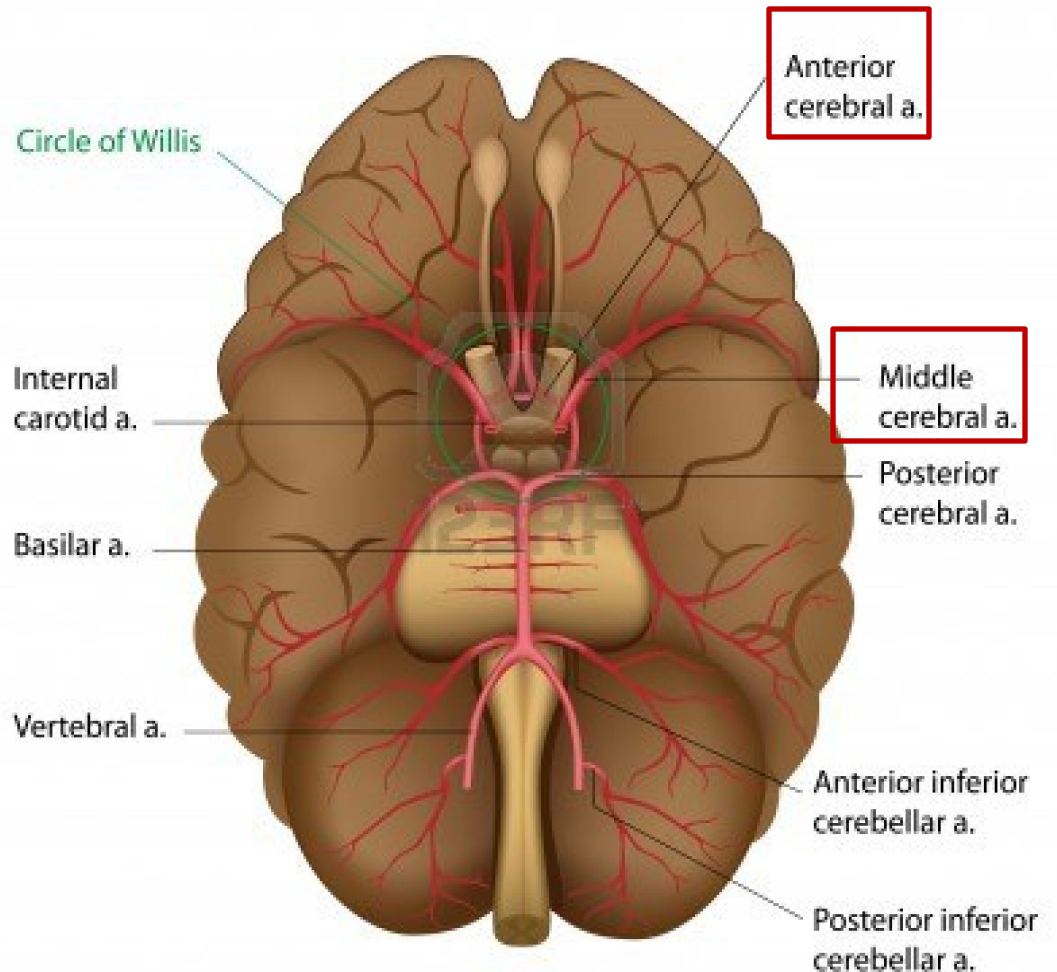


# CAROTID SYSTEM

It is composed of:

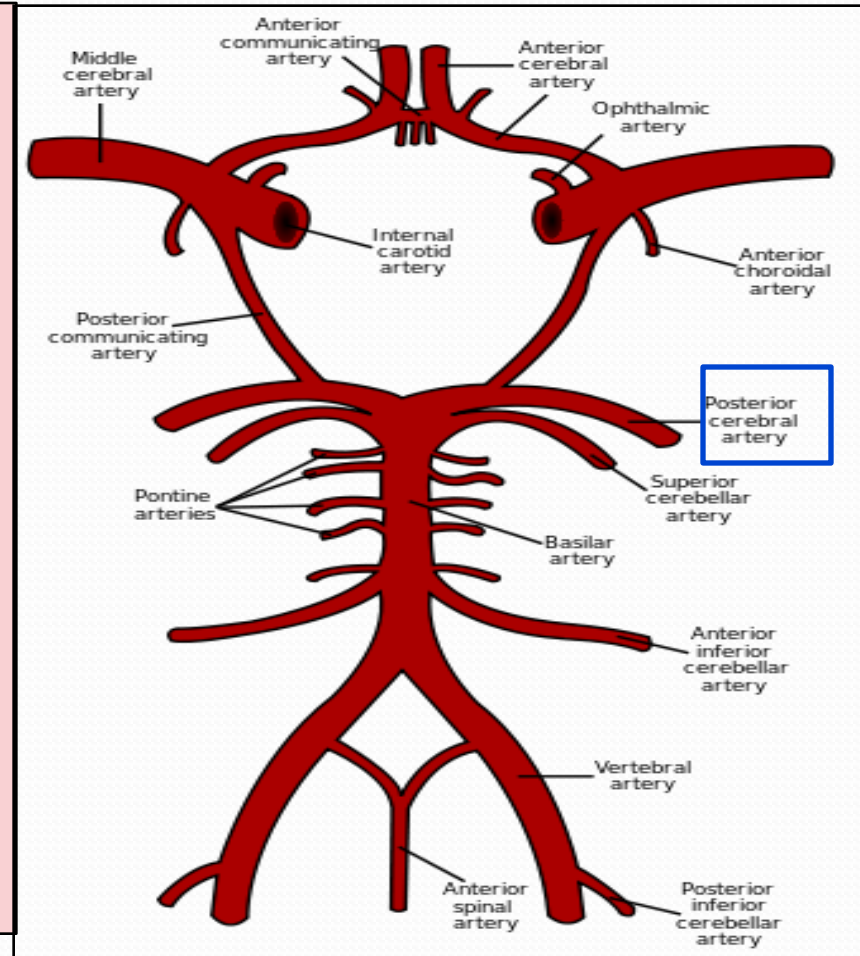
**Internal carotid artery** and its branches:  
**Anterior cerebral artery** &  
**Middle cerebral artery**

## Blood Supply of the Brain

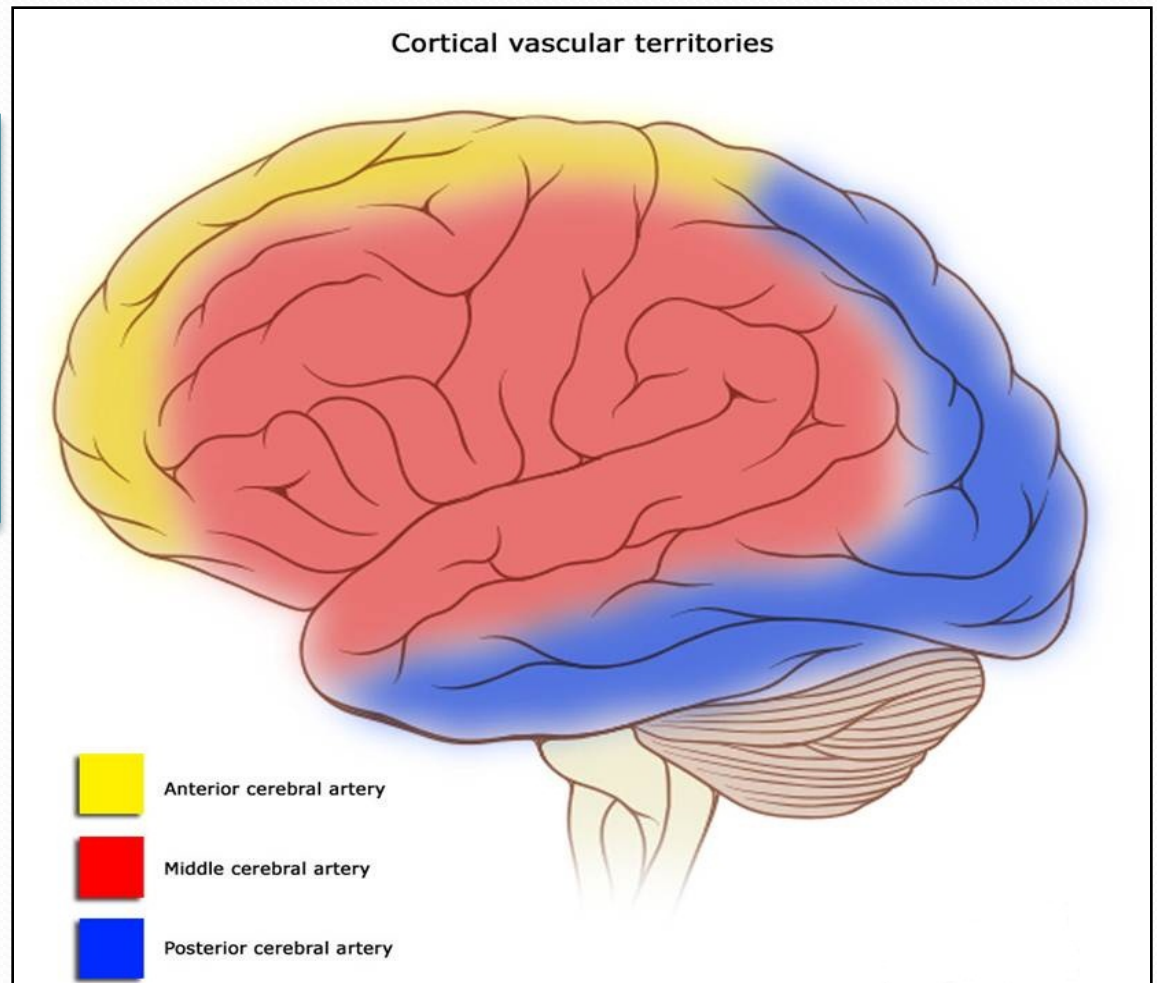


# VERTEBRO BASILAR SYSTEM

- 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.

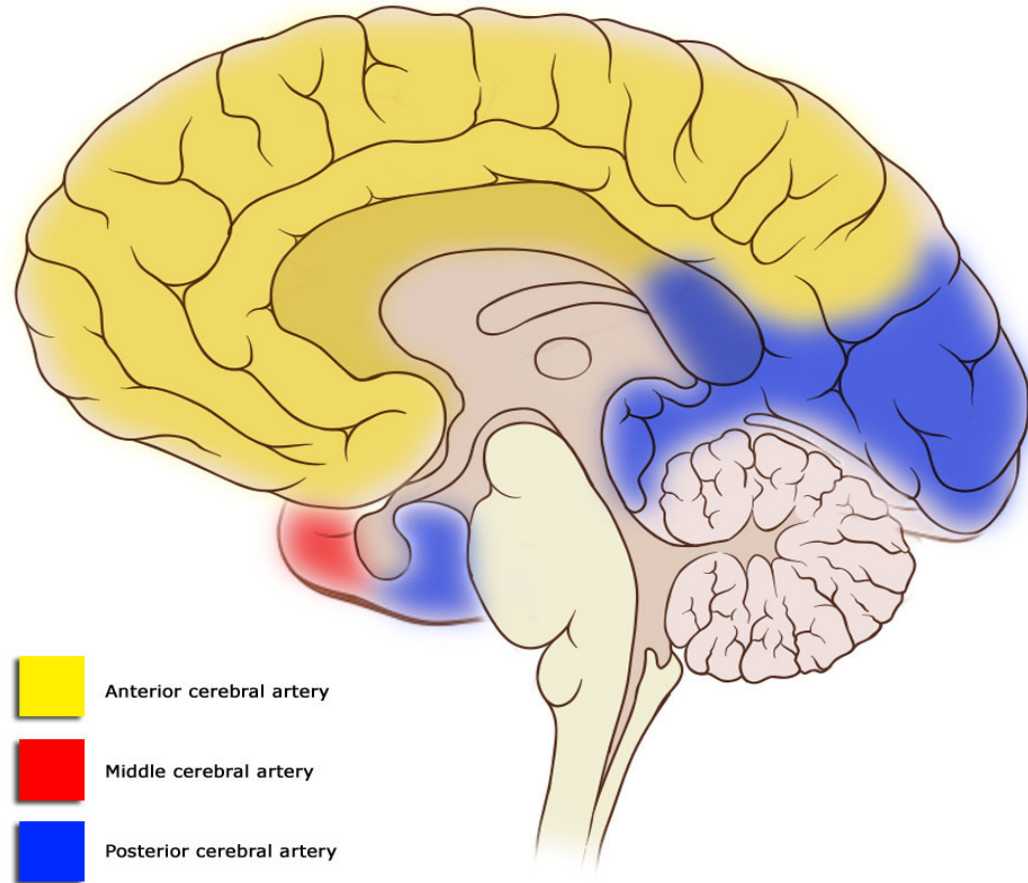


**Distribution of the cerebral arteries on the superolateral surface of the cerebral H**



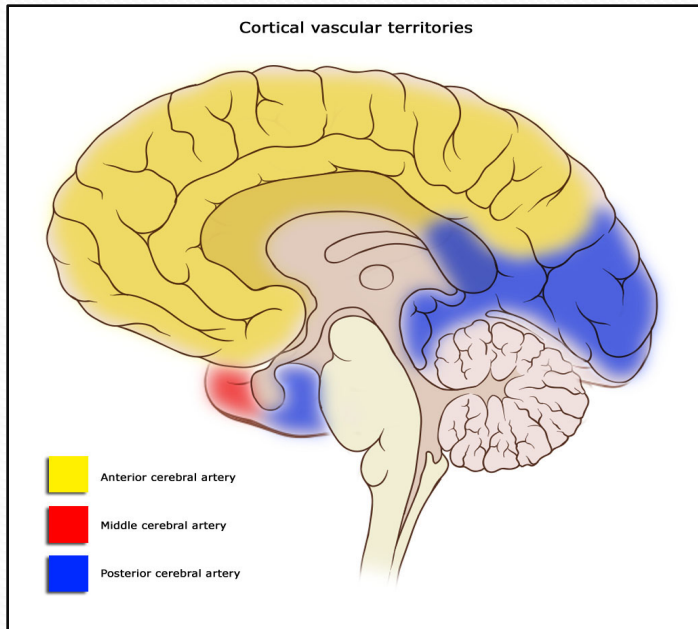
# Distribution of the cerebral arteries on the medial surface of the cerebral H

Cortical vascular territories

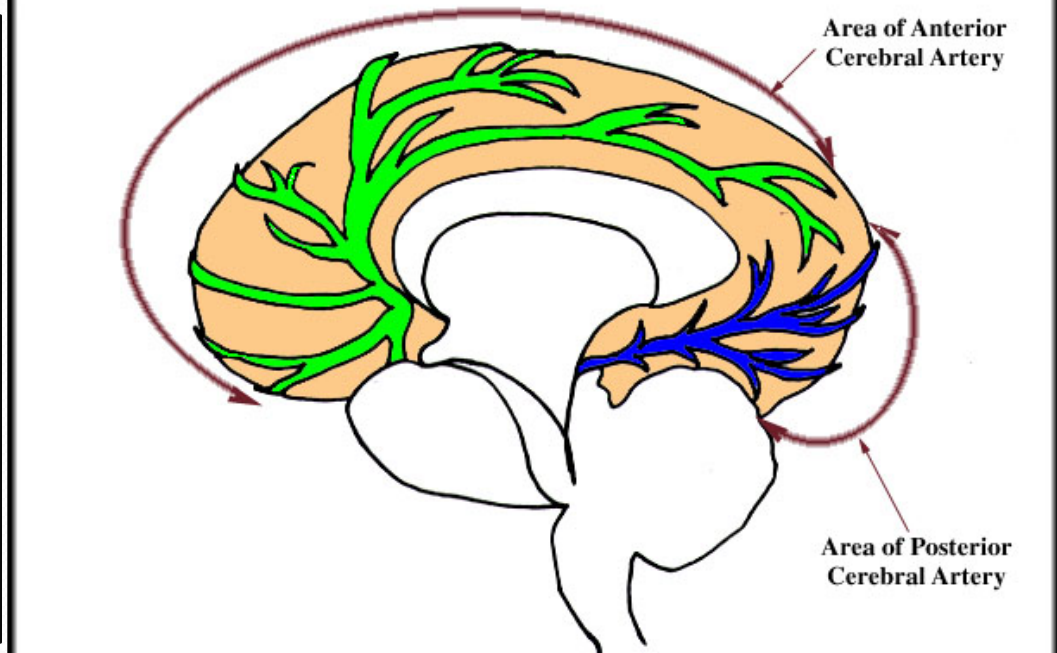


# Anterior Cerebral Artery

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



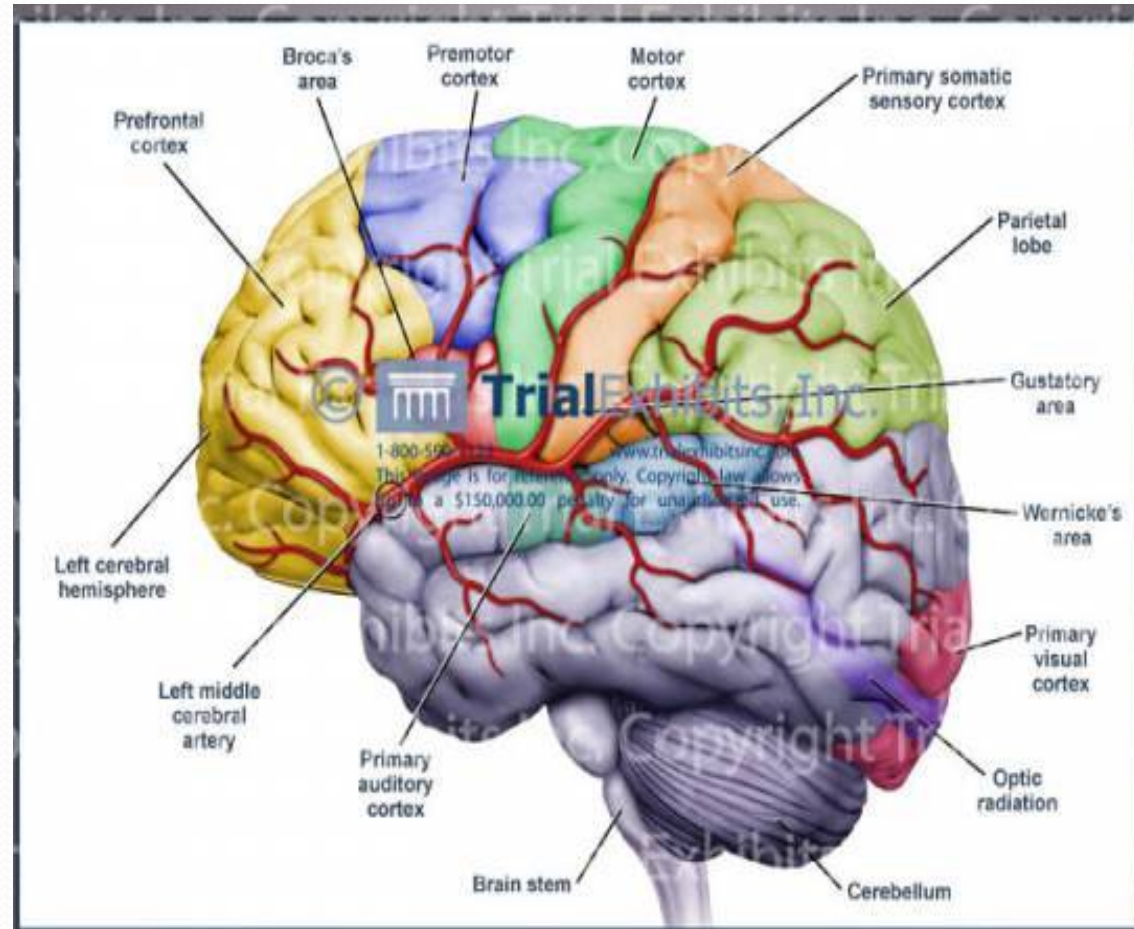
AREA OF BLOOD SUPPLY: Medial View





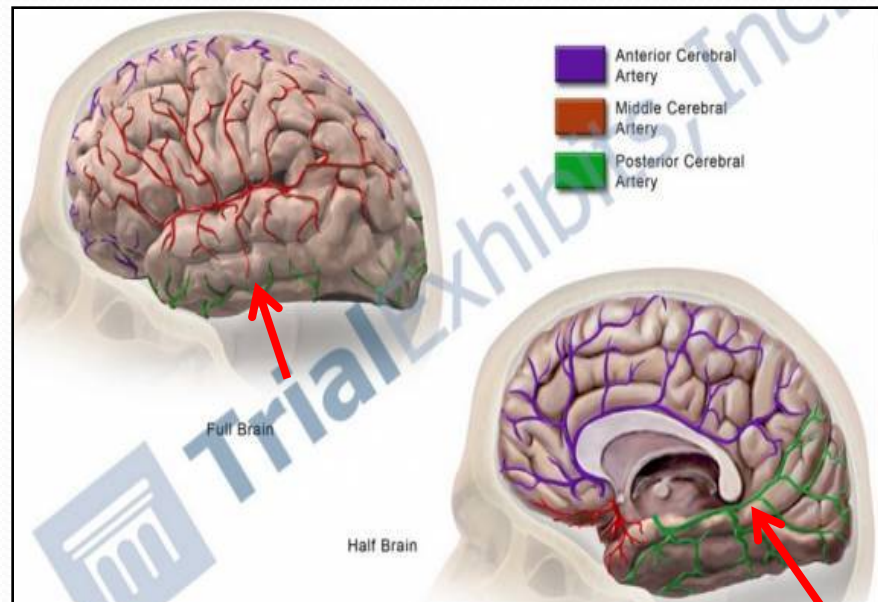
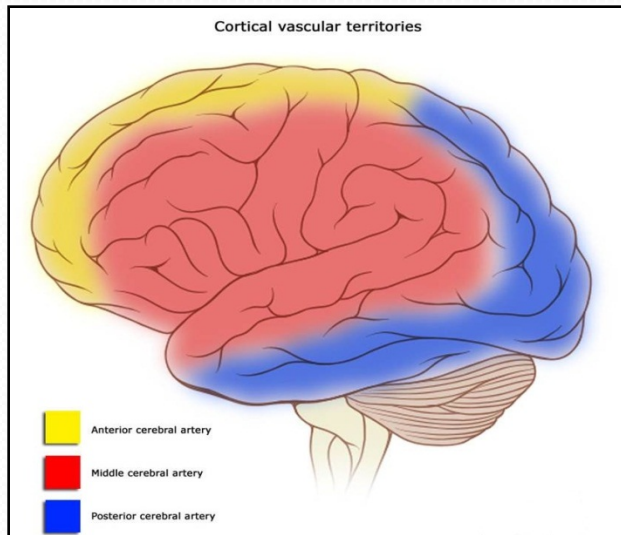
# Middle Cerebral Artery

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

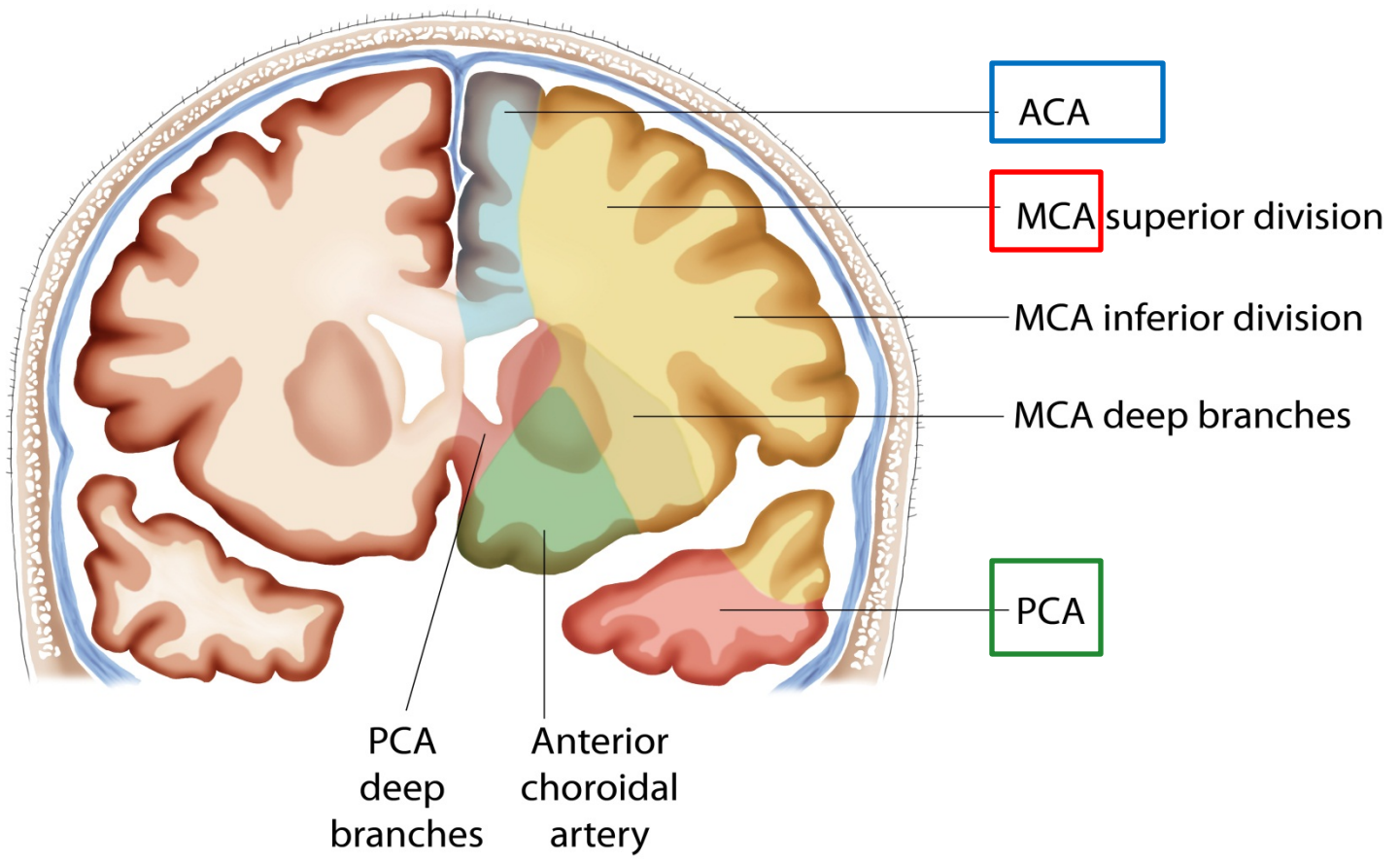


# Posterior Cerebral Artery

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

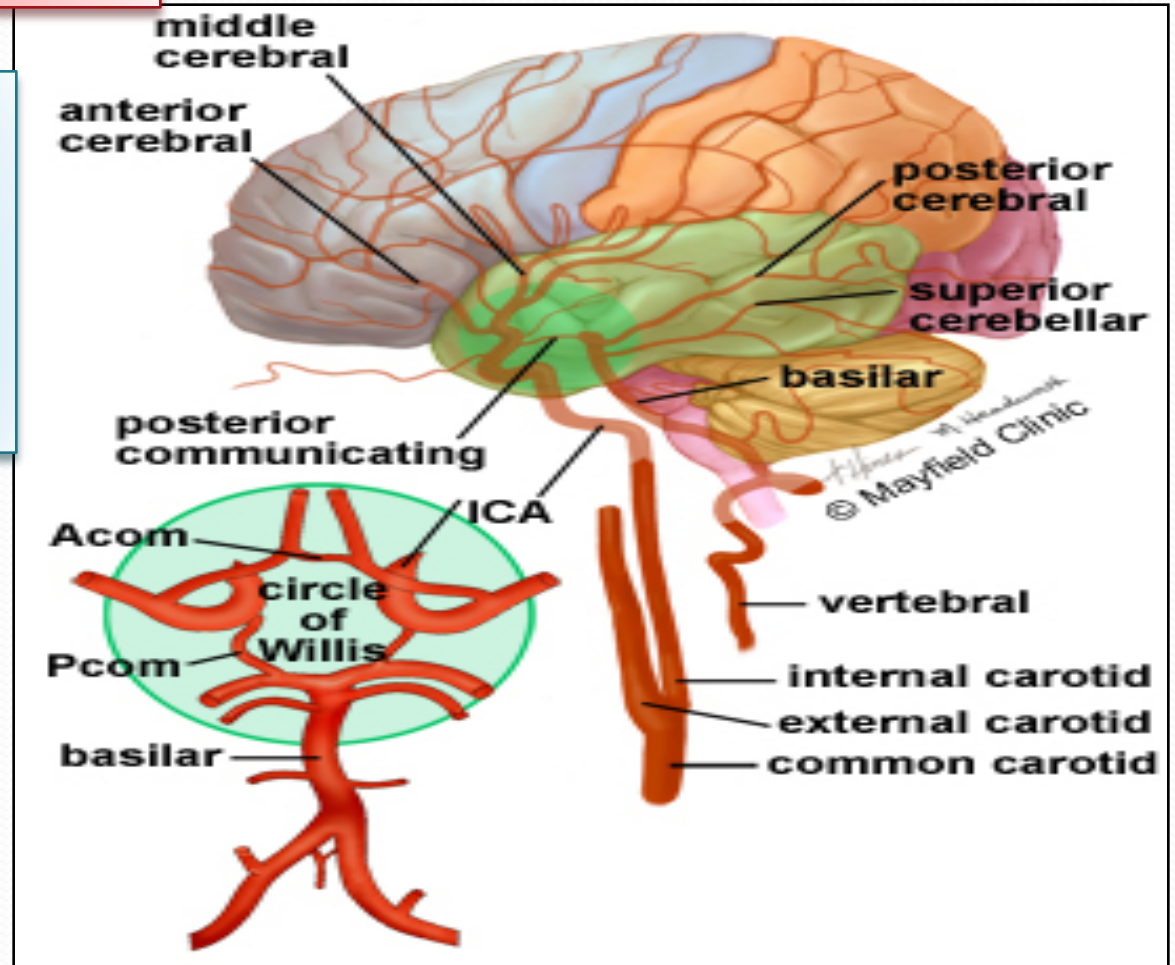


Coronal section of brain showing the supply territories of the cerebral vessels

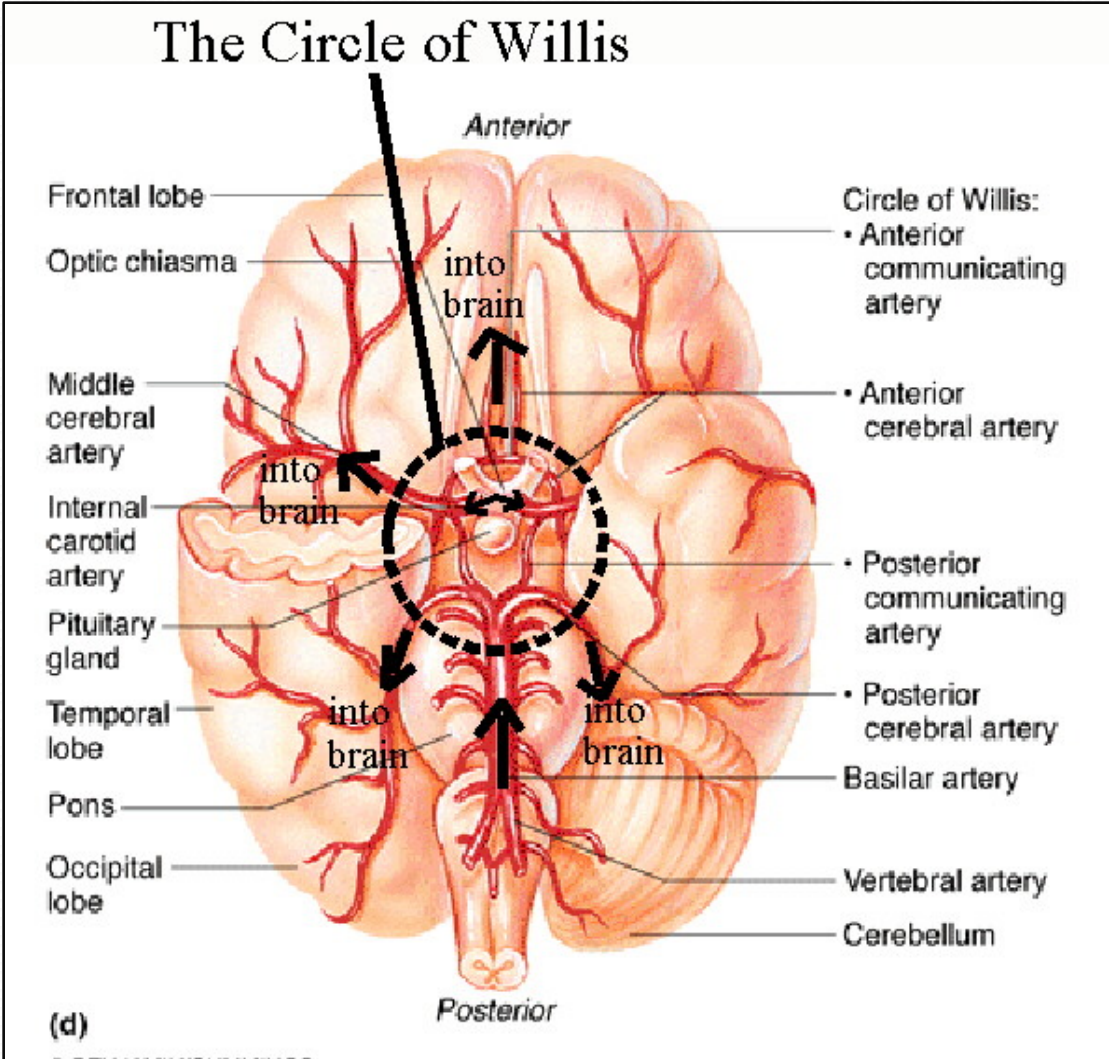


# Circulus Arteriosus (of Willis)

**It joins the Carotid & Vertebrobasilar systems**

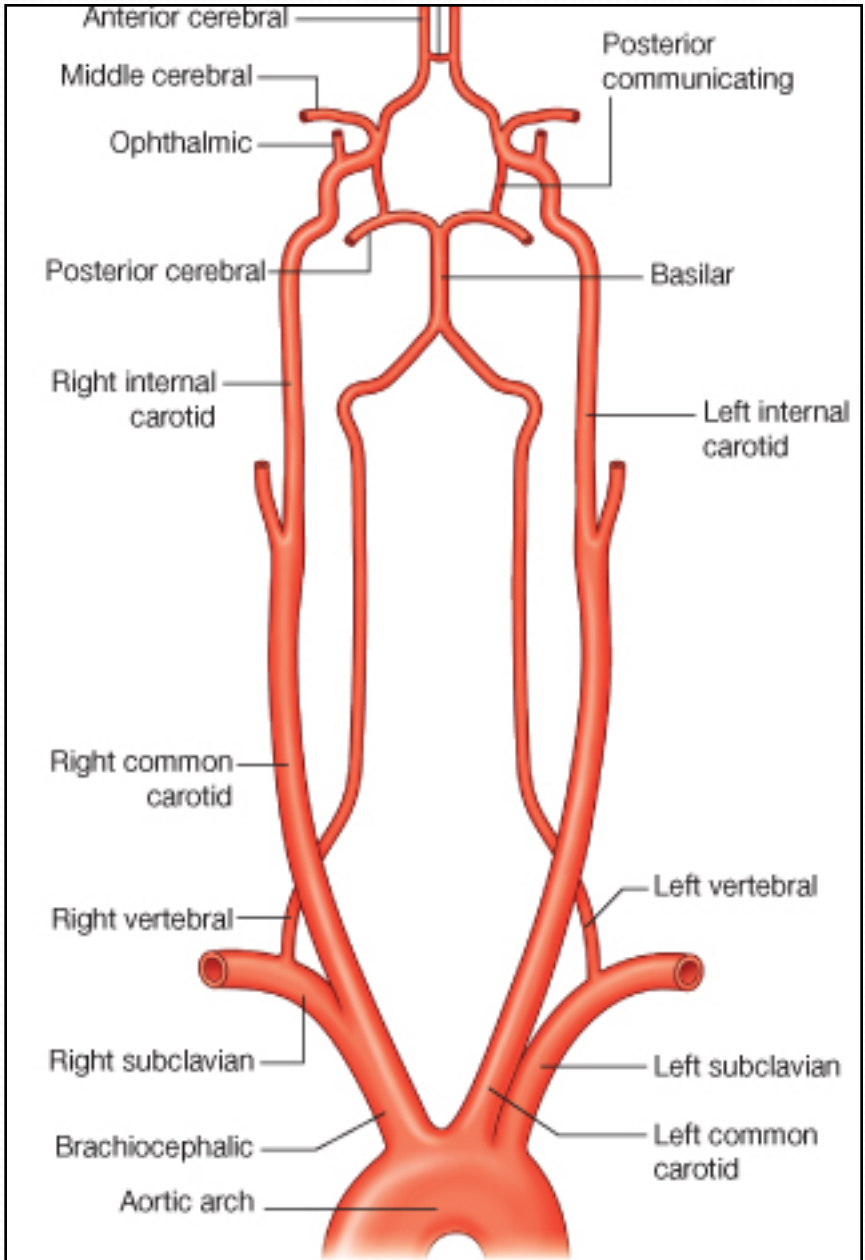


- **located** on the base of the brain
- **It encircles:**
- **Optic Chiasma,  
Hypothalamus  
Pituitary gland  
Midbrain.**

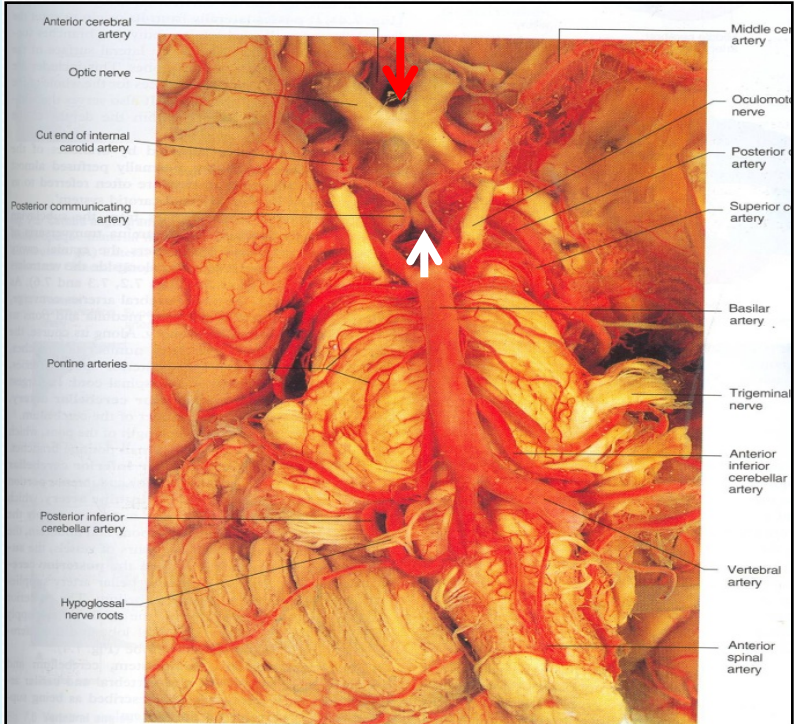
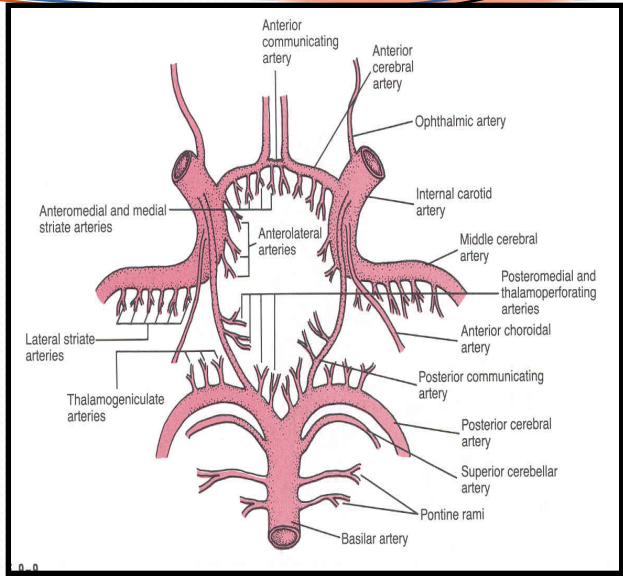


• **Composed of:**

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



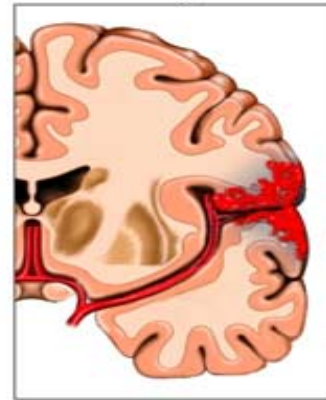
- **Branches:**
- **Perforating arteries (Anterior & Posterior):**
- Numerous small vessels that penetrate the surface of the brain through the **anterior and posterior perforating substances.**
- **APA supply:**
- Large part of Basal Ganglia,
- Optic chiasma,
- Internal capsule & Hypothalamus
- **PPA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



# Arterial Disorders

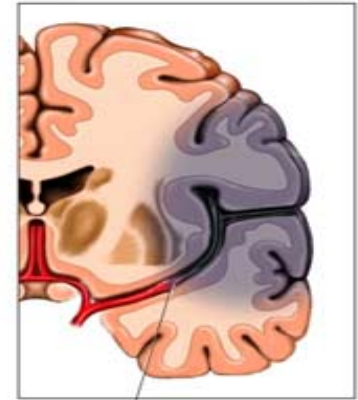
- A. Stroke (Sudden occlusion of the blood supply):
- It can be:
  - 1. Hemorrhagic
  - 2. Ischemic
  - B. Aneurysm
- C. Angioma

Hemorrhagic Stroke

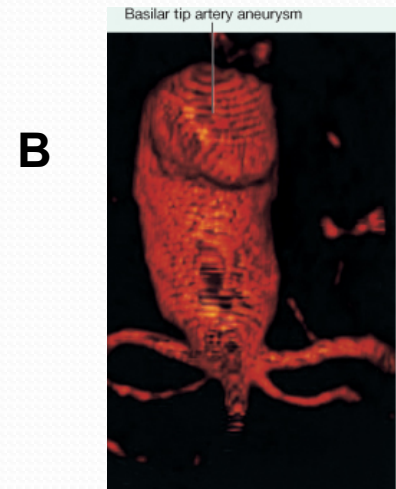
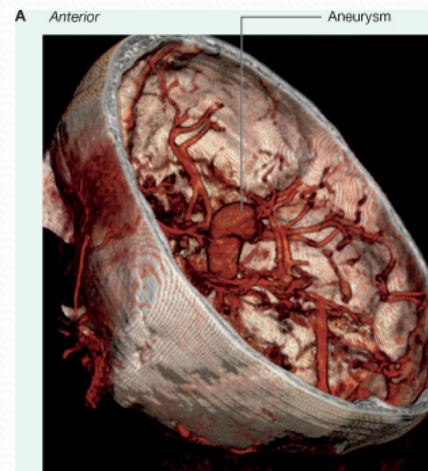


Hemorrhage/blood leaks into brain tissue

Ischemic Stroke

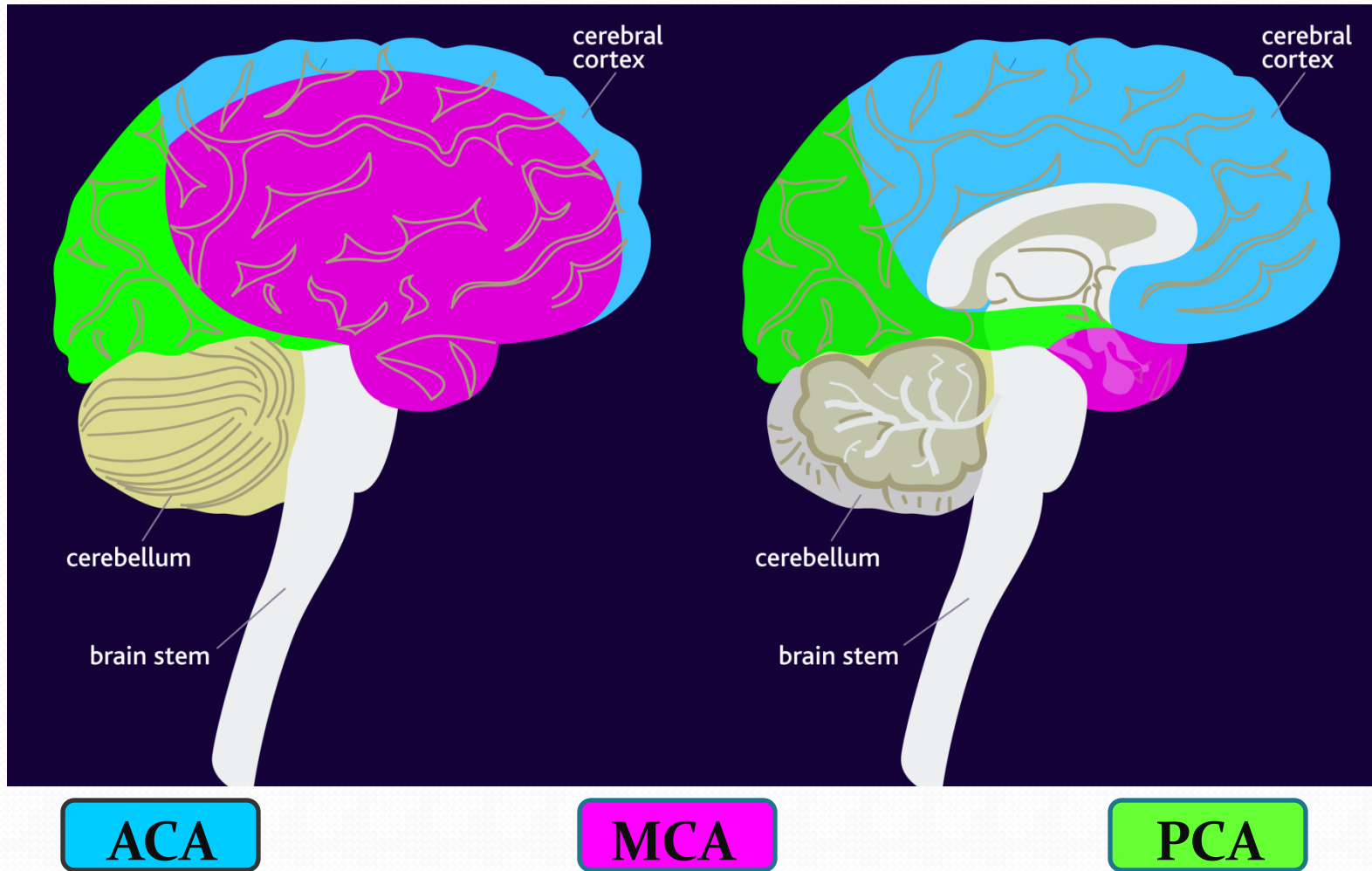


Clot stops blood supply to an area of the brain

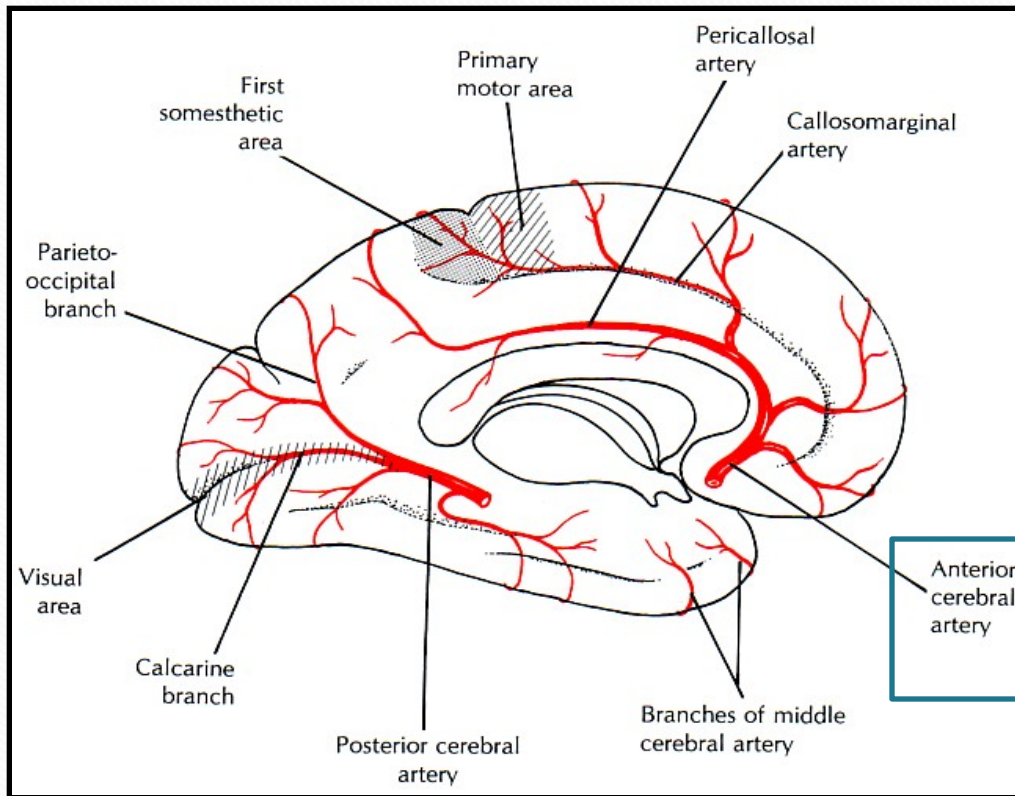




# EFFECT OF OCCLUSION of Cerebral arteries

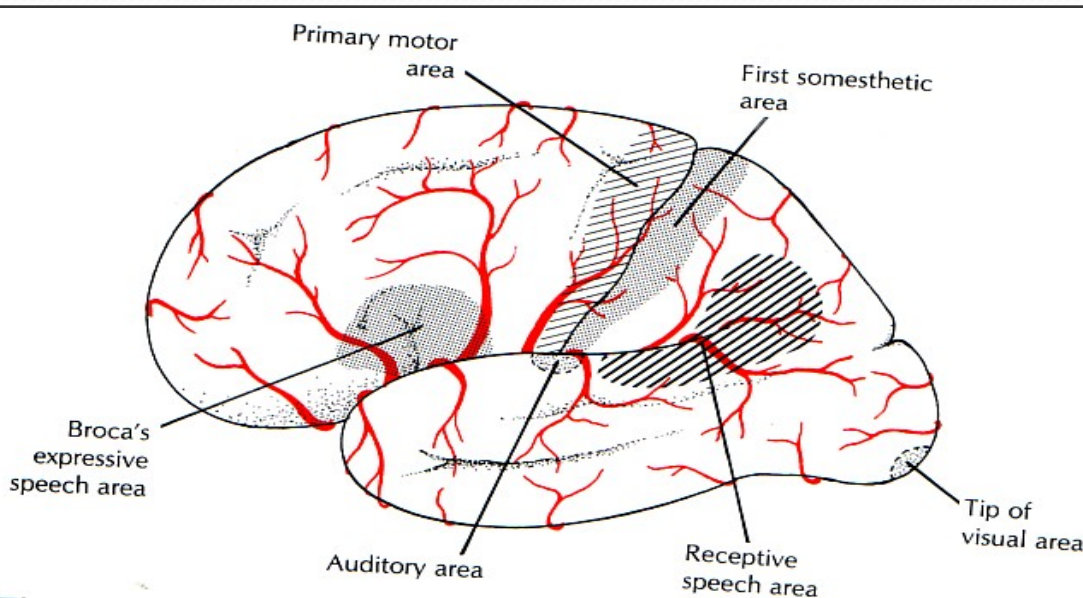


# ACA



- **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**

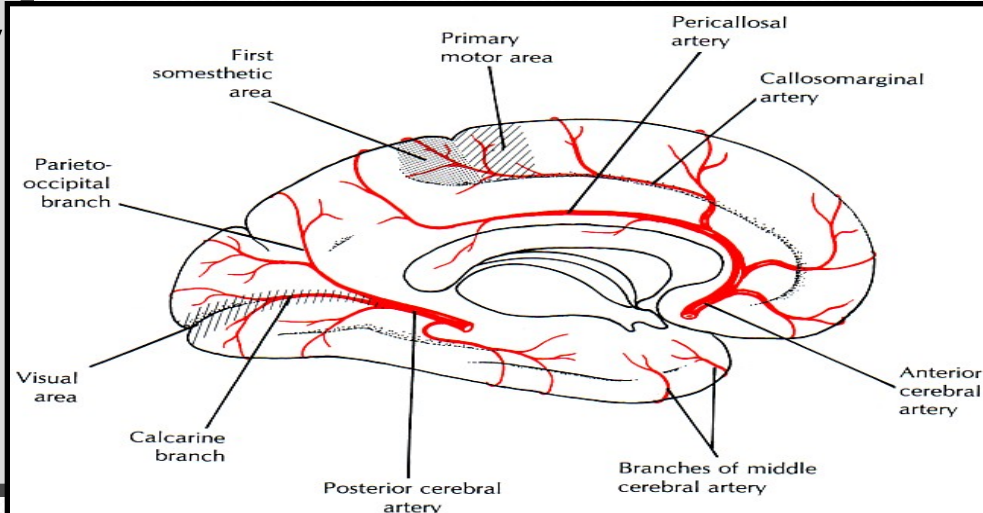
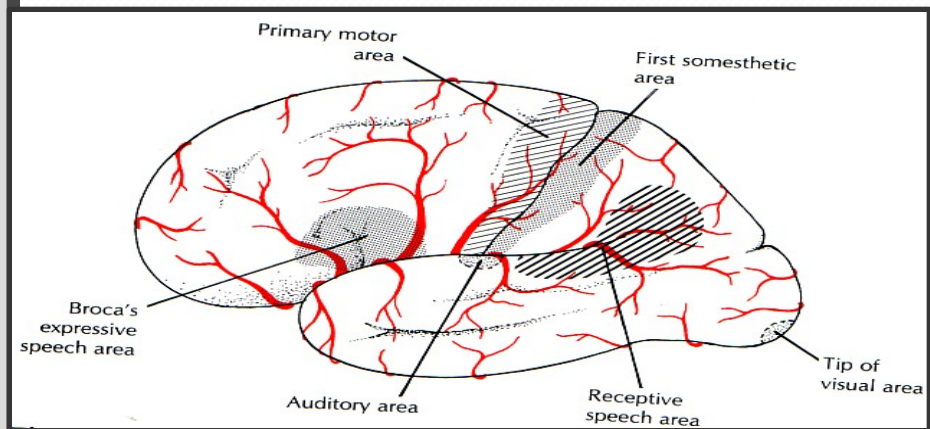
- **Contralateral homonymous hemianopia**

- **In Bilateral lesions:  
Cortical Blindness**

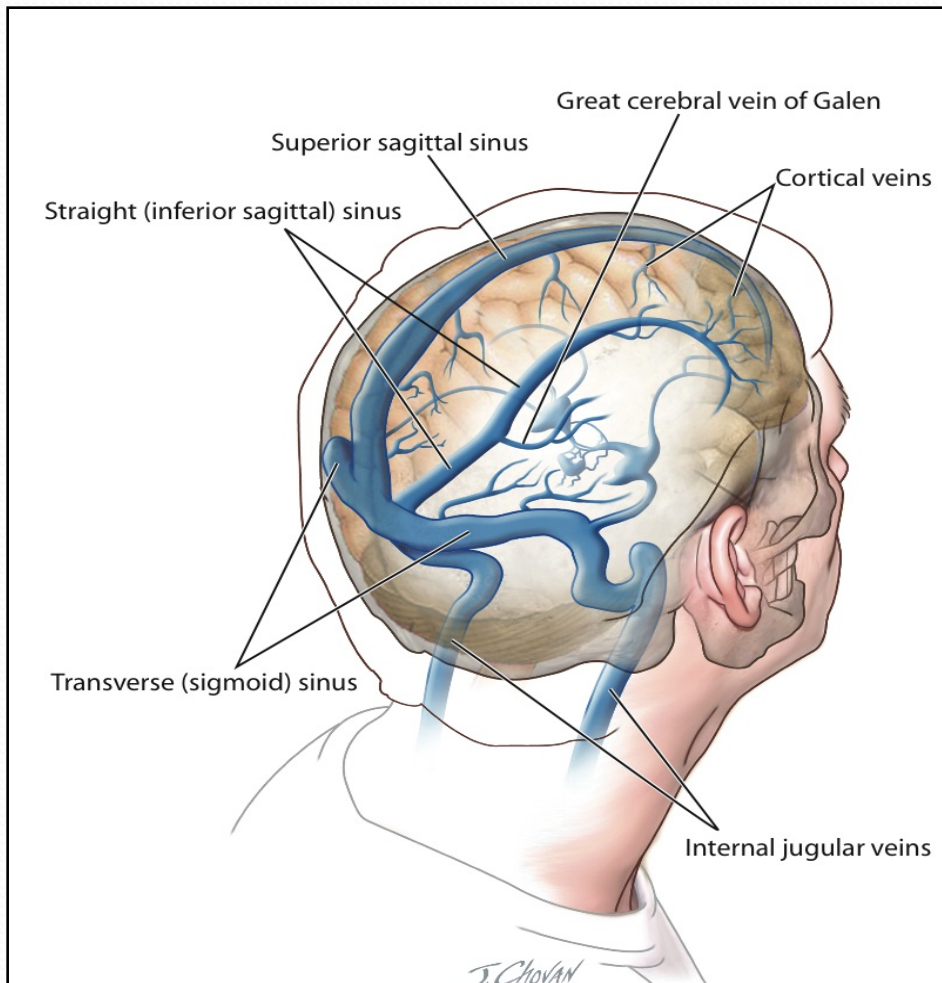
- patients unaware they cannot see (**Anton's syndrome**)

- 2. **Memory impairment**

- If the temporal lobe is affected



# Cerebral Venous Drainage

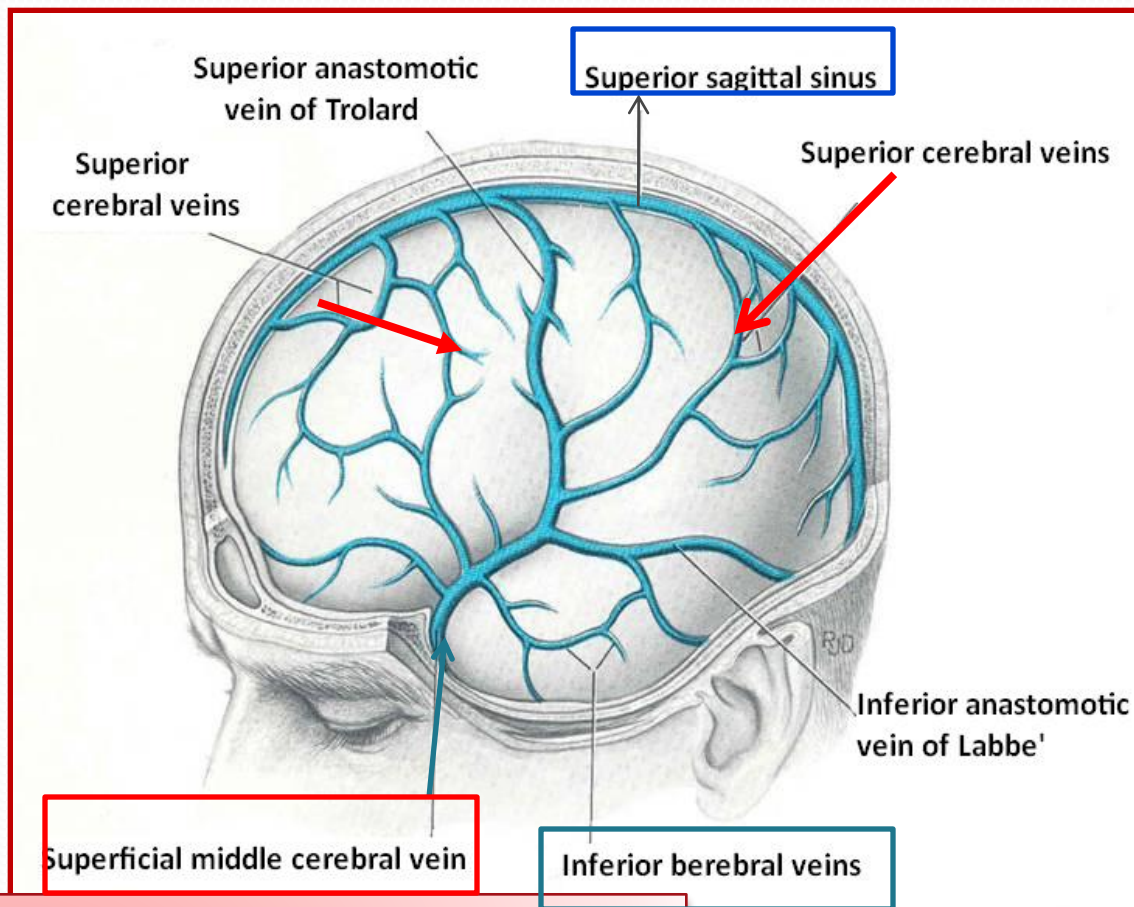


- **Cortical Veins:**
- **(A) Superficial**
- found in the **Subarchnoid space**  
Drain the cortical surfaces
- **(B) Deep veins:**
- Drain the deeper structures
- These veins are **thin walled** and **devoid of valves.**
- They ultimately drain into the
- **Dural Venous Sinuses**

# Superficial Cortical Veins

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

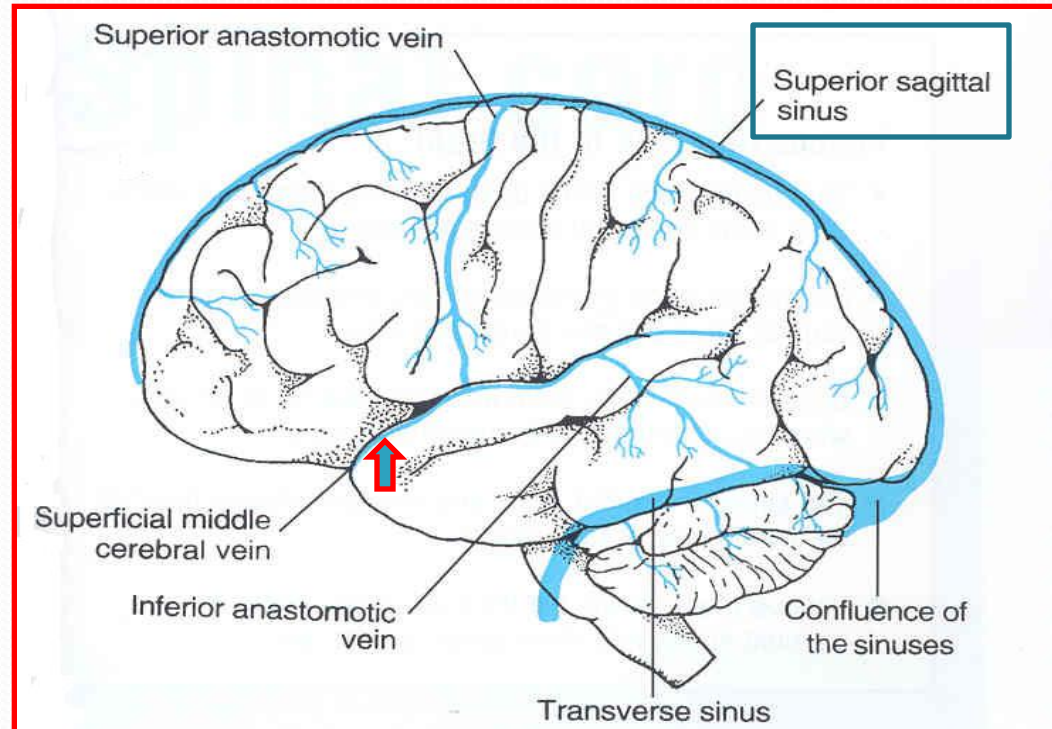
- Drain lateral surface of brain above the lateral sulcus
- Terminate mainly into the **Superior Sagittal sinus**, and partly into **Superficial middle cerebral vein**.



- 2. **Inferior cerebral veins:**

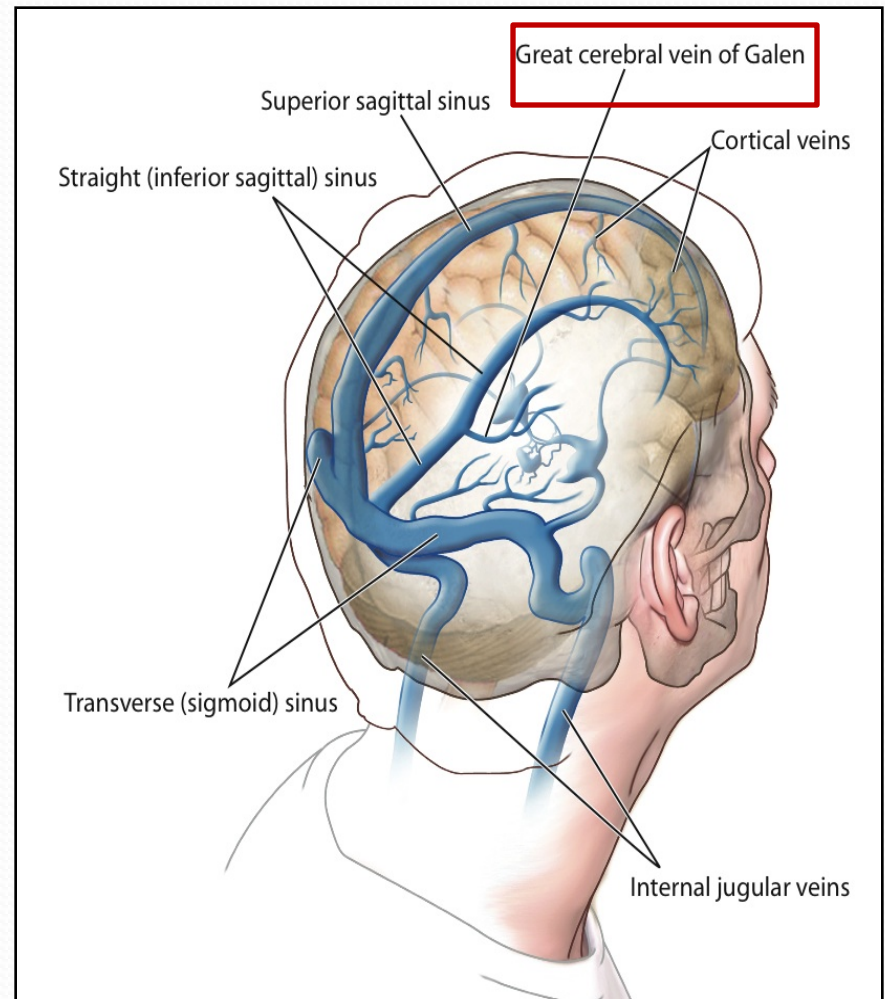
- Run below the lateral sulcus
- Drain the lateral surface of the temporal lobe
- Terminate partly into **superficial middle cerebral vein** & partly into **Transverse sinus**.

- **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**

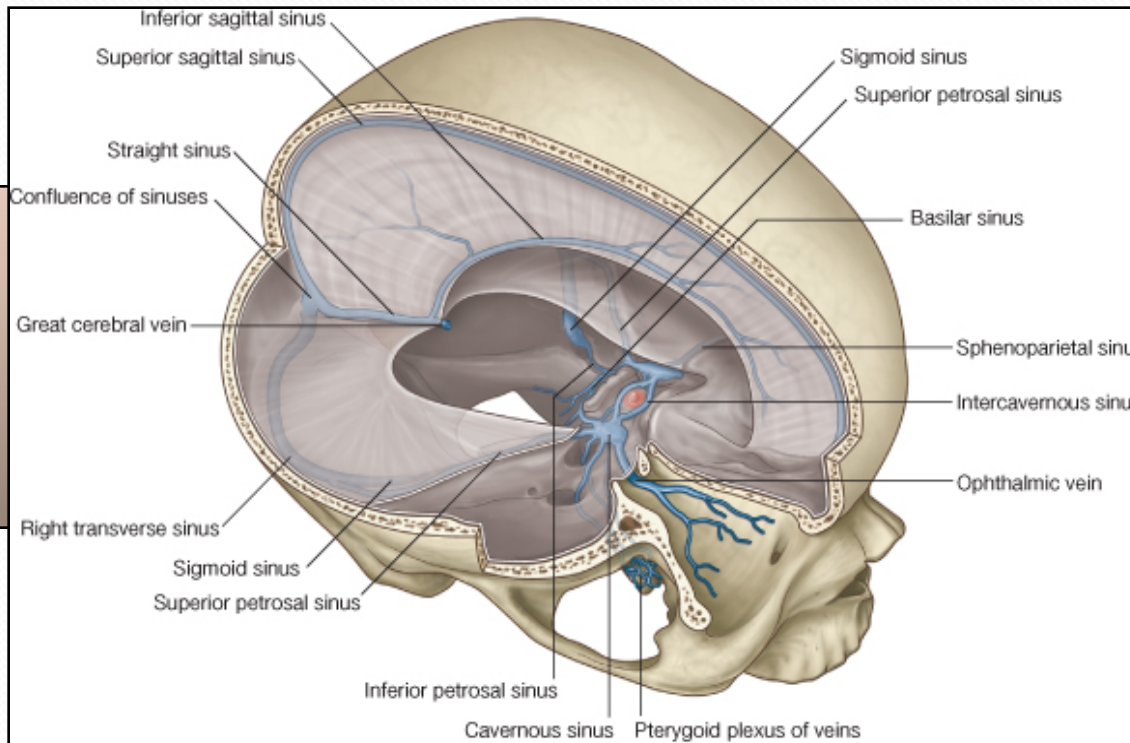




# Dural Venous Sinuses

**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