

Blood Supply Review

Barb Puder, PhD

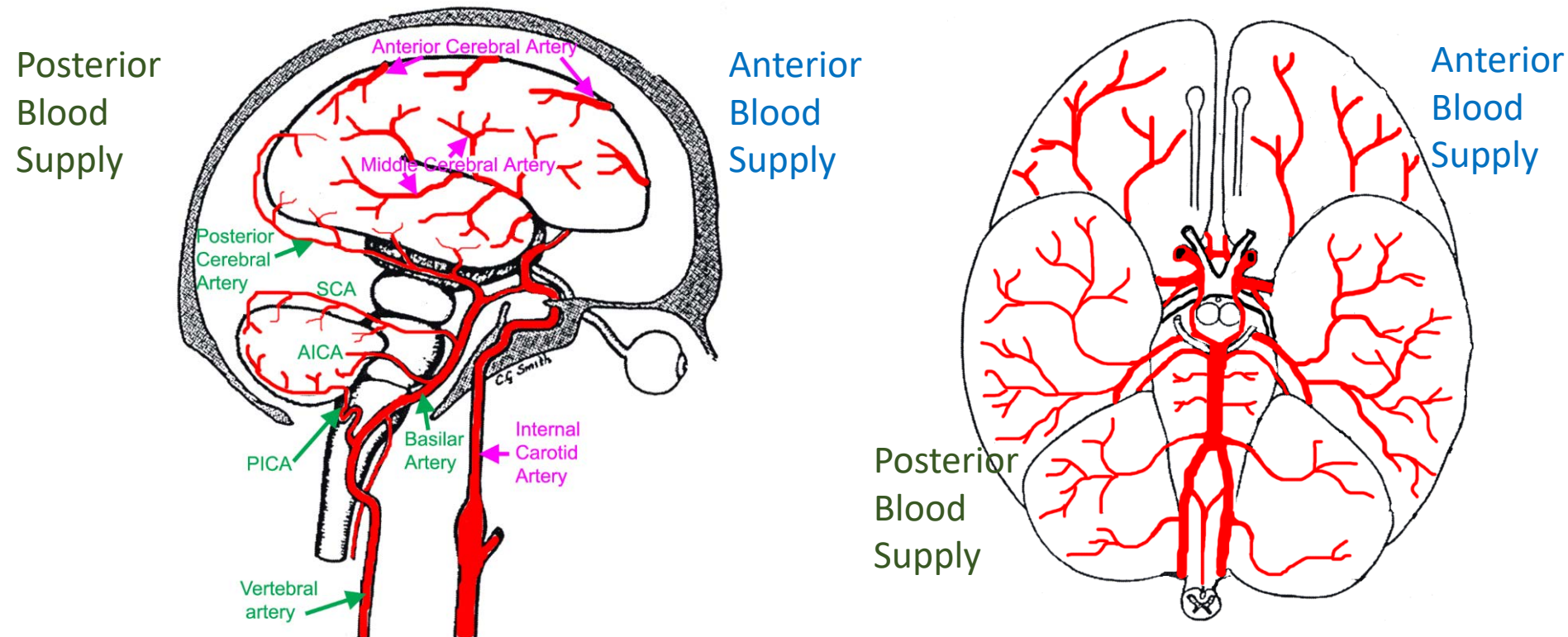
Blood Supply: General Information

- 50% of problems in the cranial cavity are vascular and will result in neurological deficits.
- The brain consumes 20% of the oxygen used by the body.
- If the brain is deprived of blood for 10-12 seconds, loss of consciousness can occur and if the brain is deprived of oxygen after 3-5 minutes, brain damage may occur.

Blood Supply to the Brain

The blood supply to the brain is divided into 2 main divisions:

1. The **anterior blood supply** consists of **2 internal carotid arteries** which will give off several branches.
2. The **posterior or vertebrobasilar** system consists of **2 vertebral arteries** which join to form **1 basilar artery**. The posterior blood supply gives off several branches.

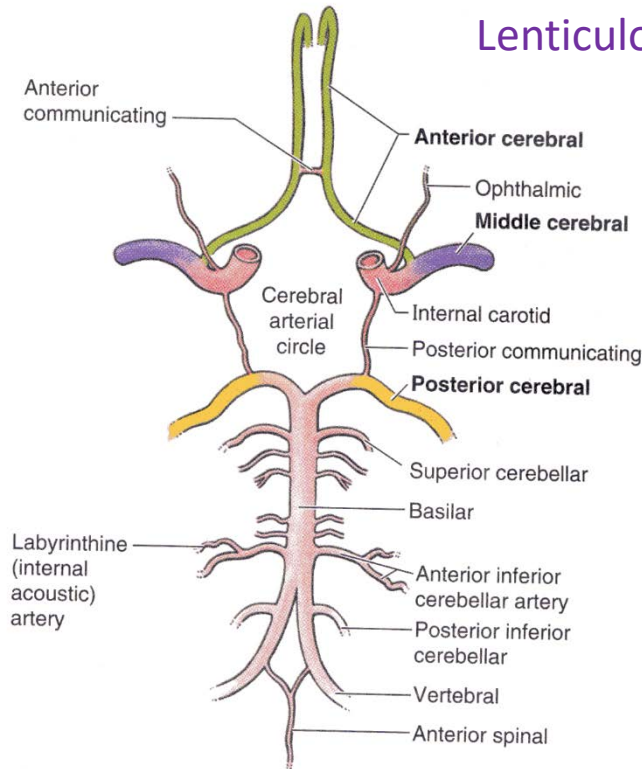
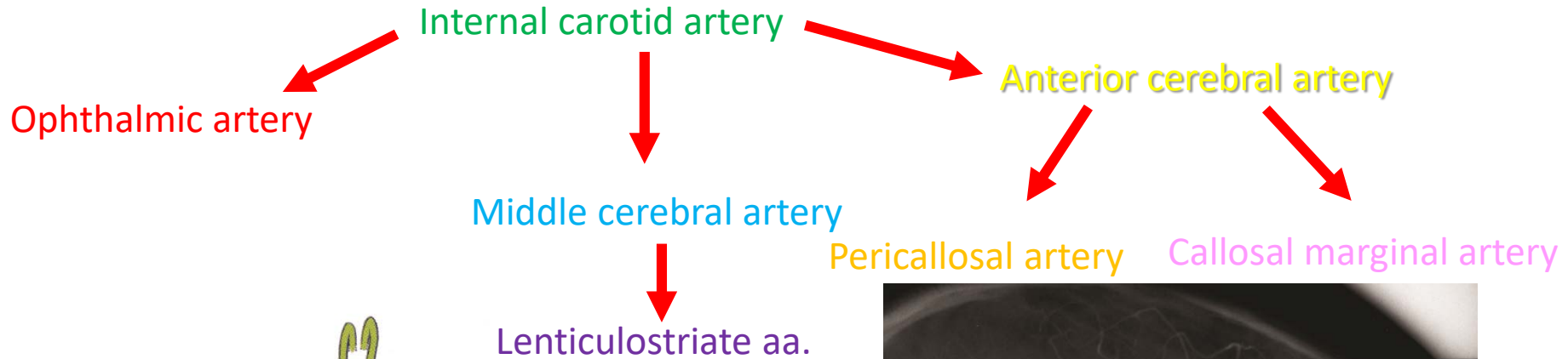


Lateral view of blood supply to the CNS

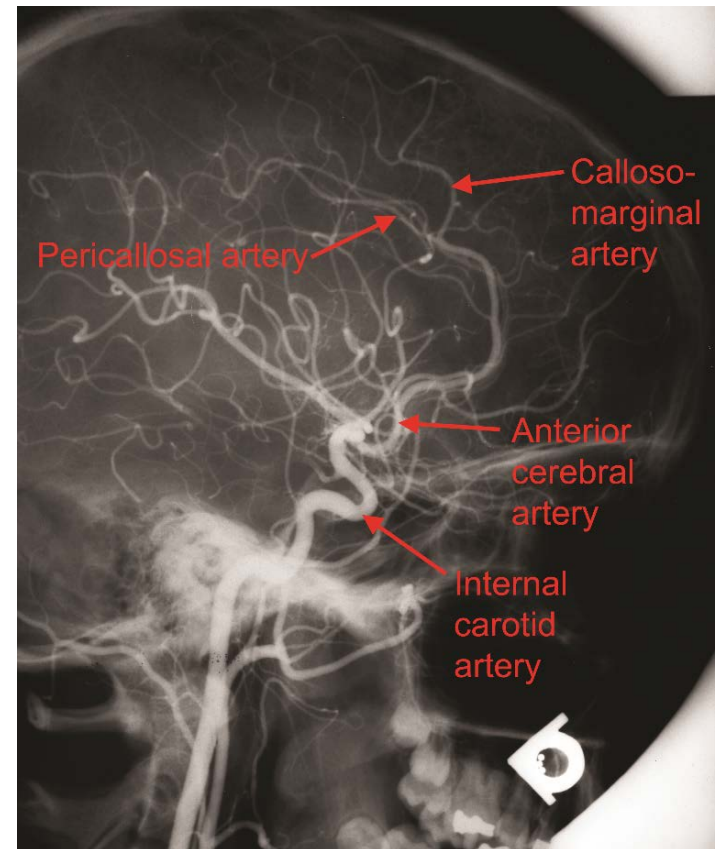
Inferior (ventral) view of blood supply to the CNS

Anterior Blood Supply

On each brain hemisphere:



Blood supply image from Moore & Daily
Clinically Oriented Anatomy

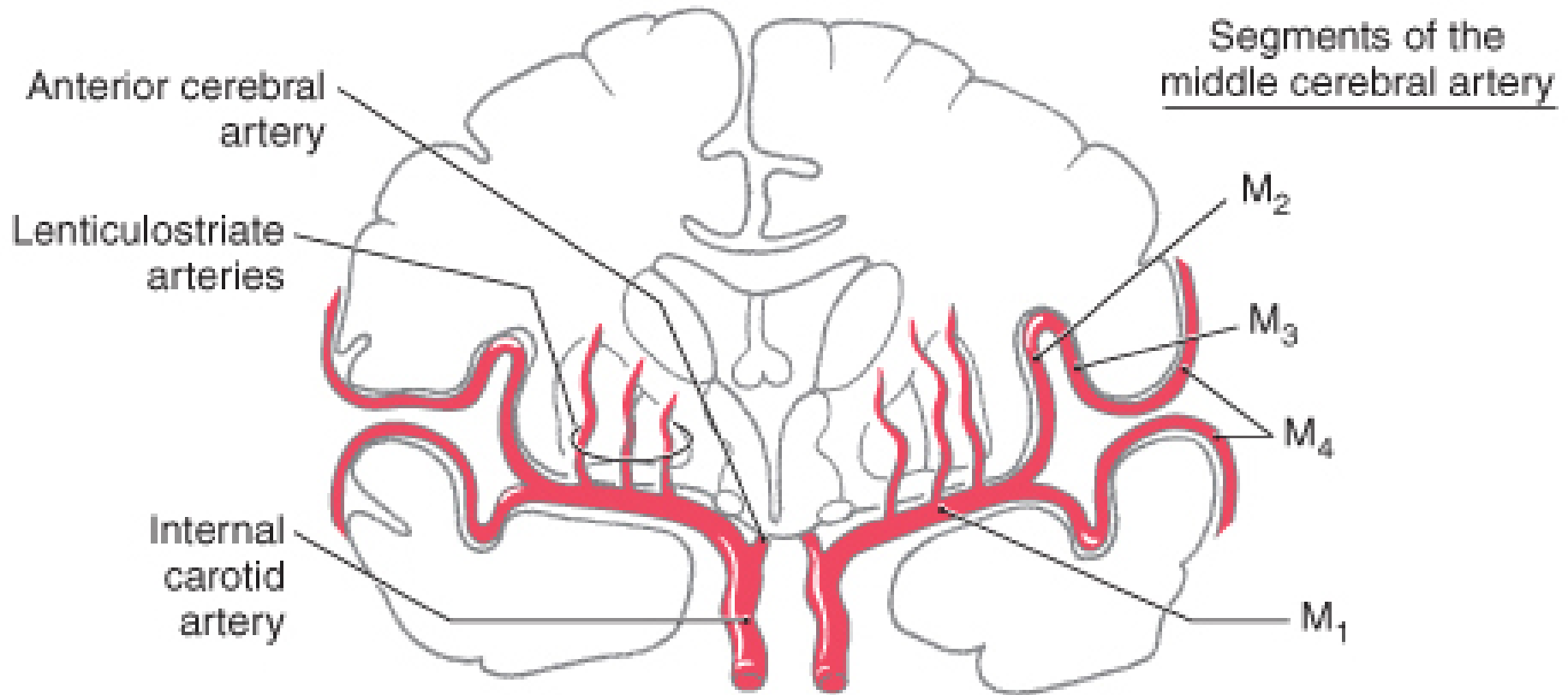


Angiogram lateral view

Middle cerebral and Lenticulostriate arteries

Lenticulostriate (lateral striate) arteries are branches off the Middle cerebral artery and give blood supply to major internal brain structures.

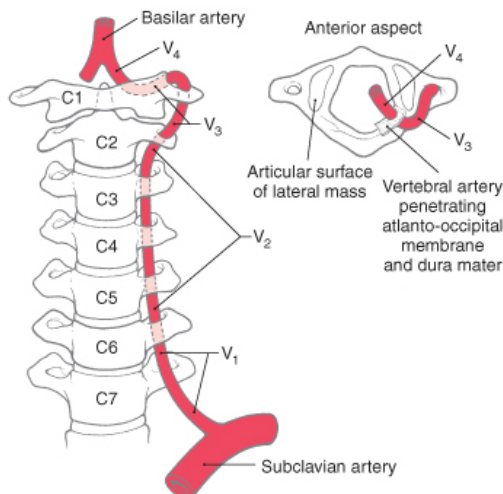
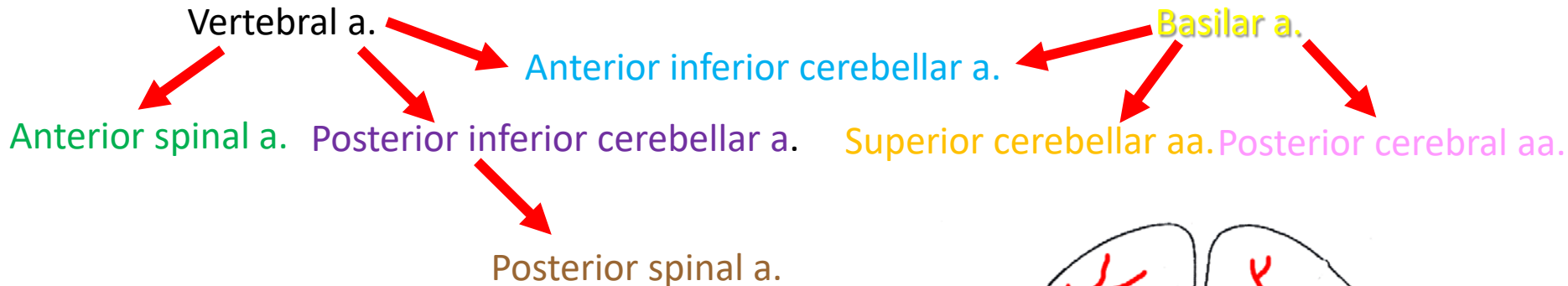
Lenticulostriate arteries are vulnerable to cerebrovascular problems and when damaged, cause “classic” stroke symptoms.



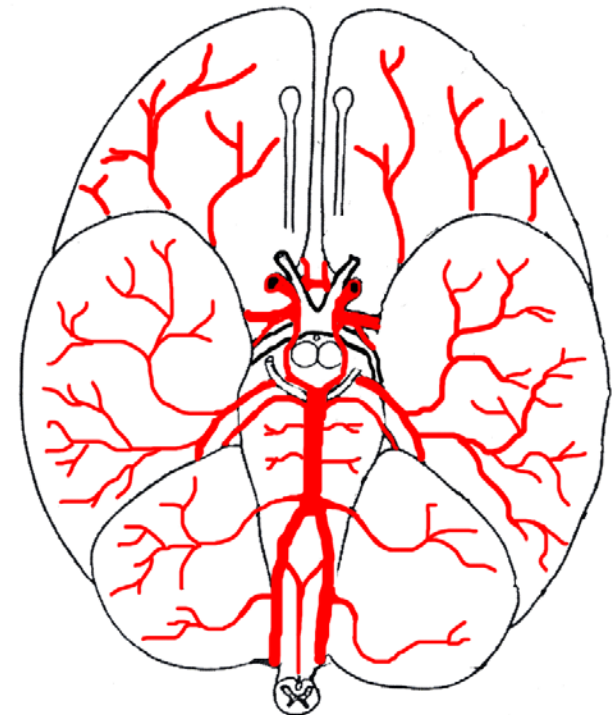
Coronal brain section featuring middle cerebral and Lenticulostriate arteries

Vertebrobasilar system (Posterior blood supply)

The 2 vertebral arteries join together to form the basilar artery.
Several arterial branches arise from the vertebral and basilar arteries:



Anterior view of spinal column depicting 1 vertebral artery.
Image from Fundamental Neuroscience for Basic and clinical applications, D.E. Haines



Inferior view of CNS blood supply

Vertebrobasilar system (Posterior blood supply)

Vertebral aa.

Anterior spinal a.

Posterior inferior cerebellar aa.

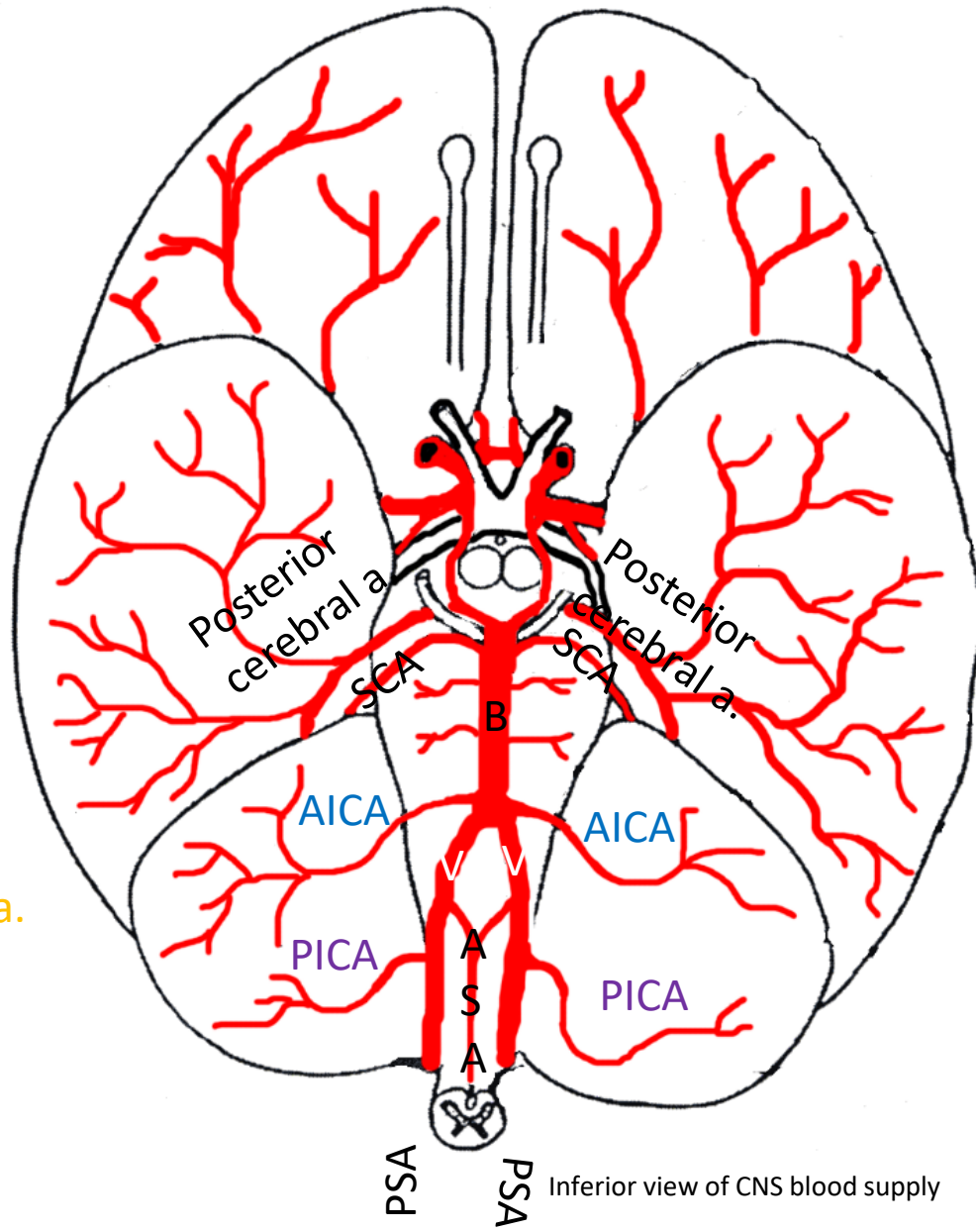
Posterior spinal aa.

Basilar a.

Anterior inferior cerebellar aa.

Superior cerebellar aa.

Posterior cerebral aa.



Inferior view of CNS blood supply

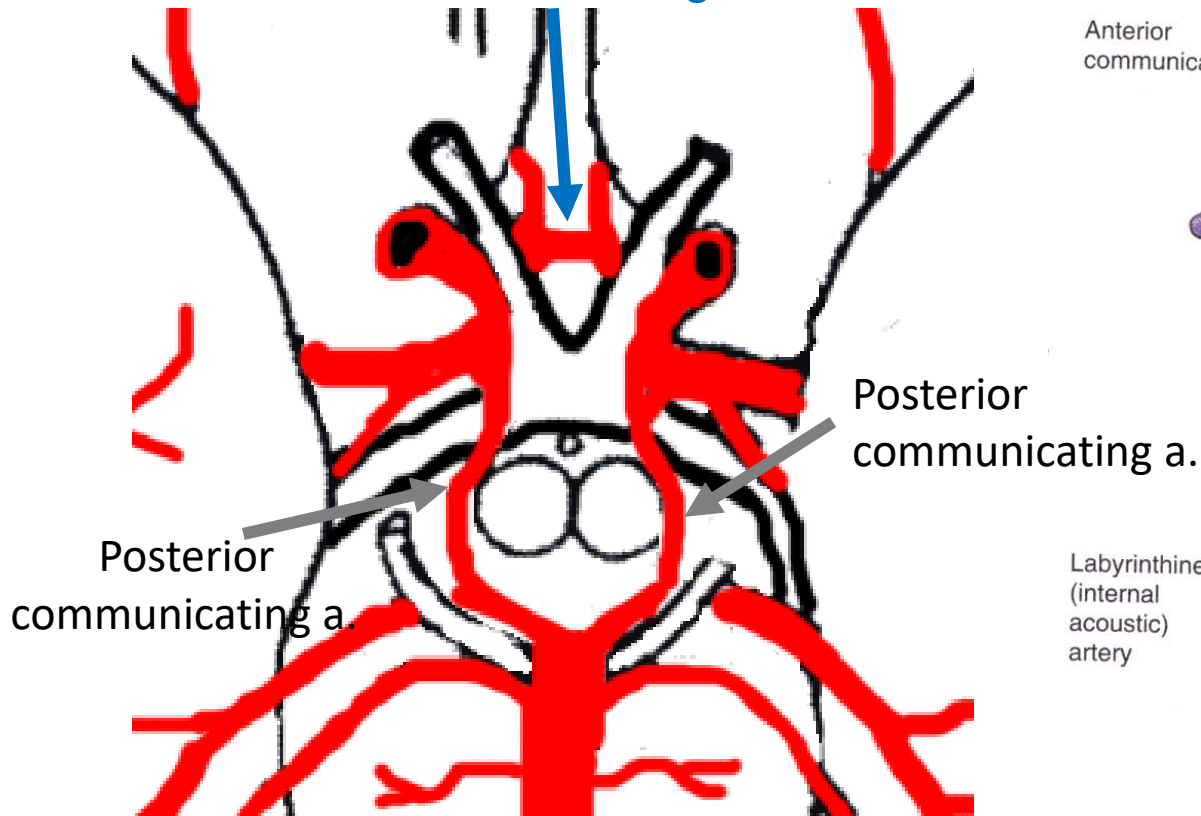
Circle of Willis

The circle of Willis is formed by the anastomosis of the anterior and posterior blood systems.

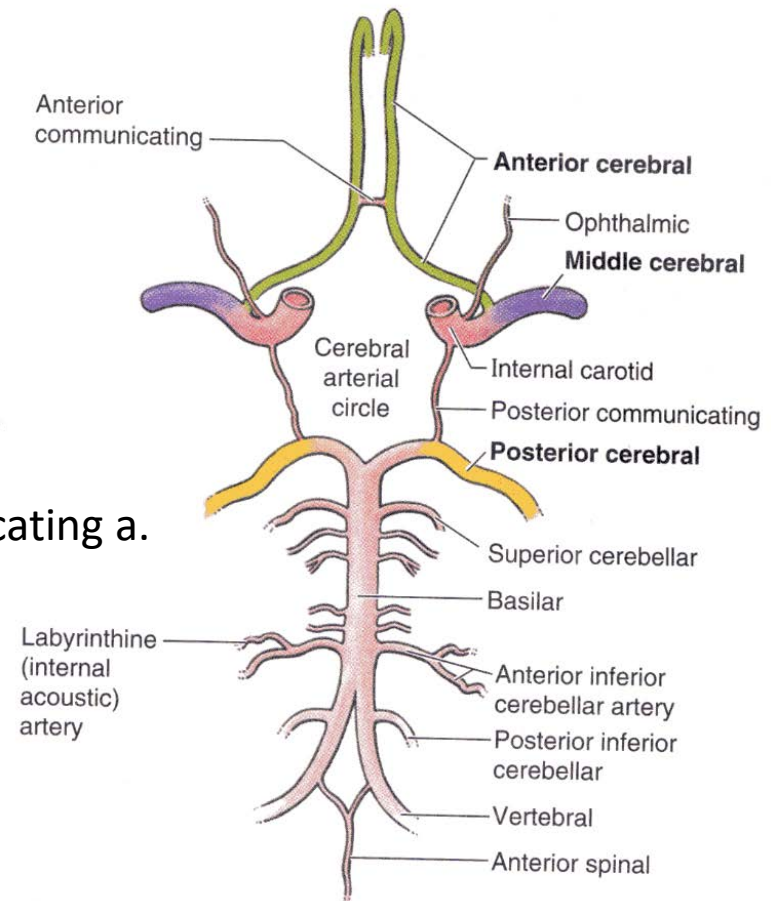
2 posterior communicating aa. join the anterior and posterior blood systems.

1 anterior communicating a. connects the 2 anterior cerebral aa. to form the anterior aspect of the circle.

Anterior
communicating a.



Inferior view of CNS blood supply
featuring the Circle of Willis

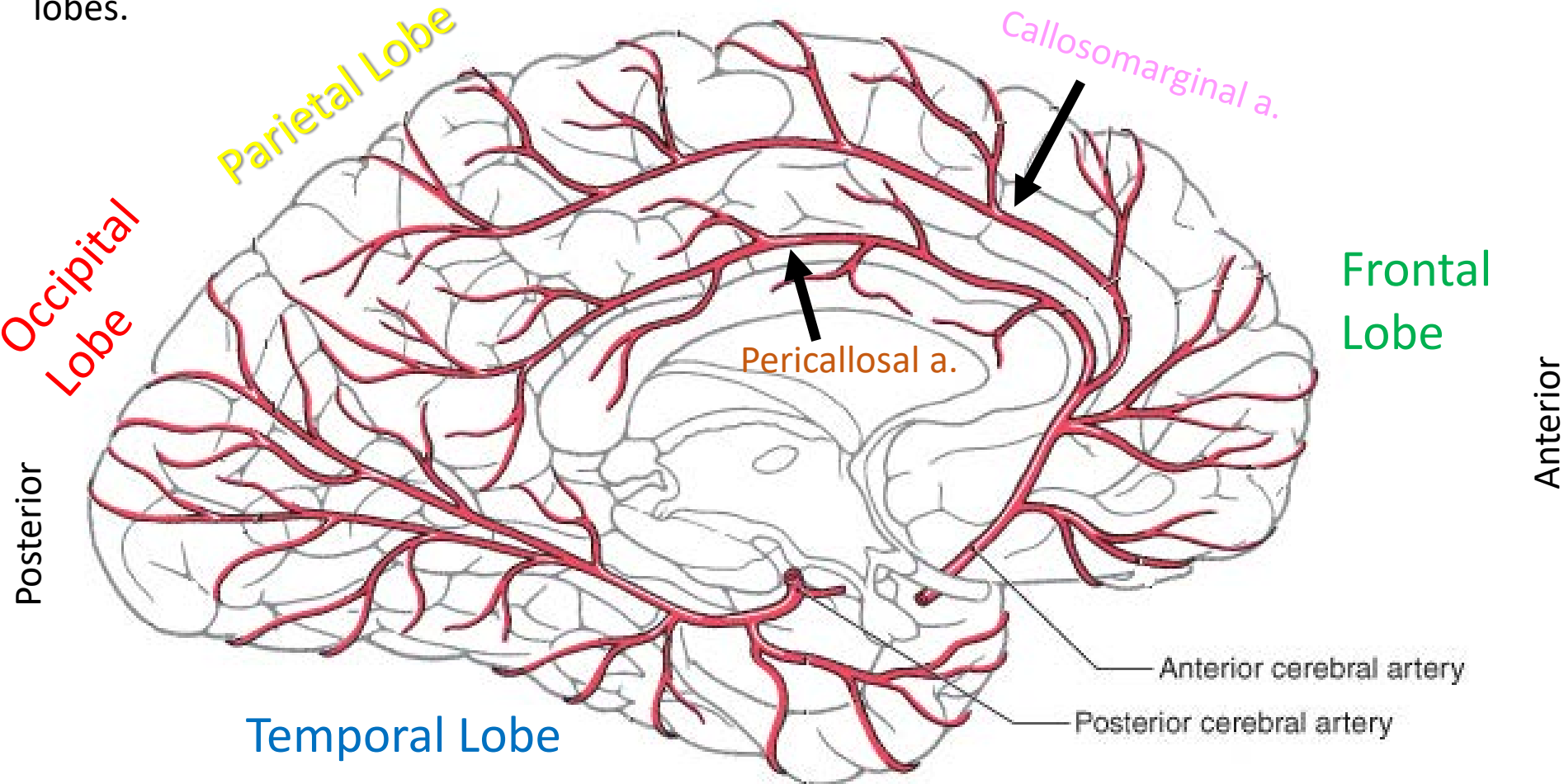


Blood supply image from Moore & Daily
Clinically Oriented Anatomy

Distribution of anterior and posterior cerebral aa.

Anterior cerebral aa. – supplies the inferior, medial, and superior aspects of the frontal lobe and the medial and superior aspects of the parietal lobes.

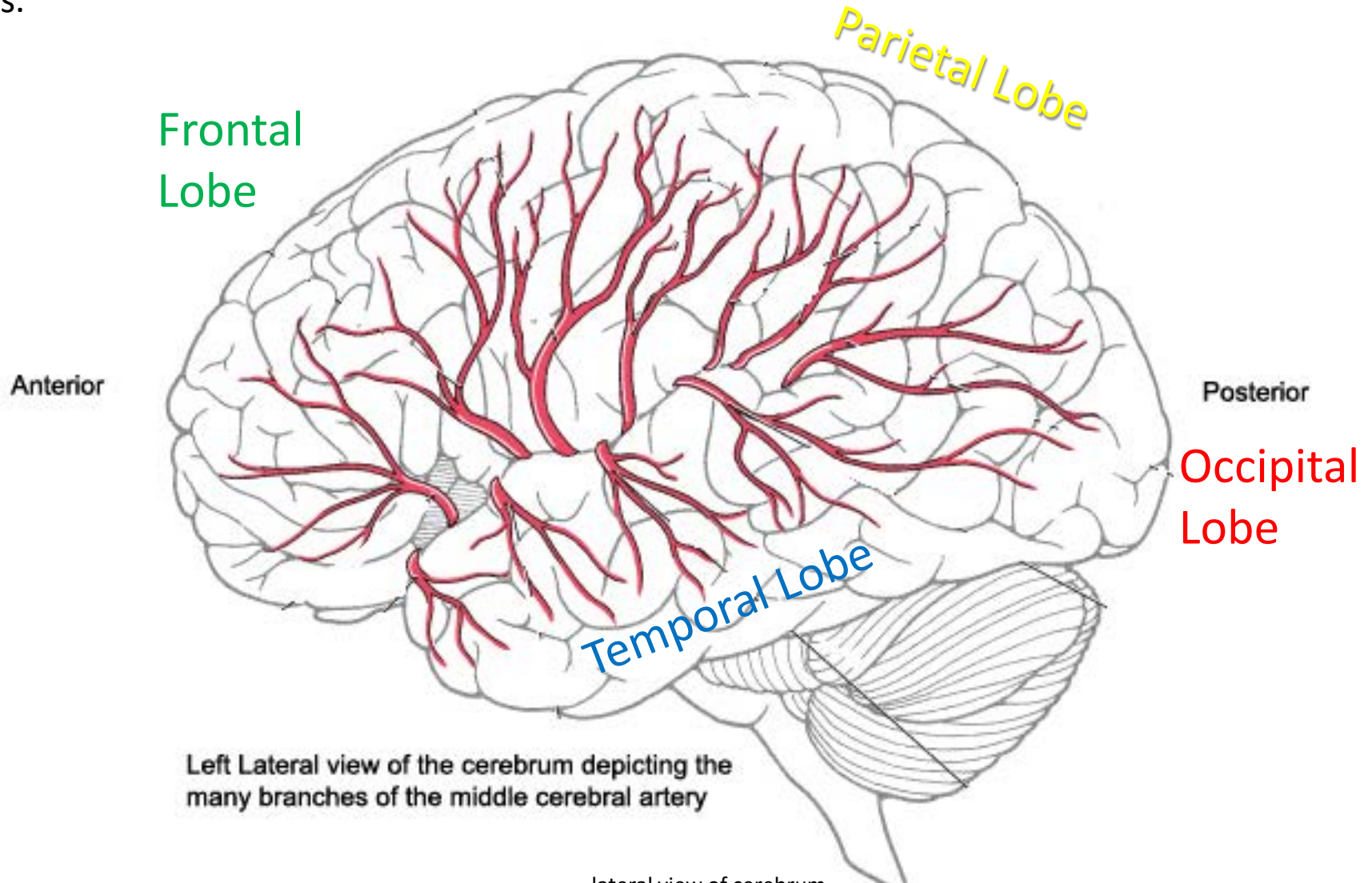
Posterior cerebral aa. – supplies the medial and inferior aspects of the occipital and temporal lobes.



Medial view of cerebrum

Distribution of Middle cerebral a.

Middle cerebral aa. – supply the lateral aspects of the frontal, parietal, occipital and temporal lobes.

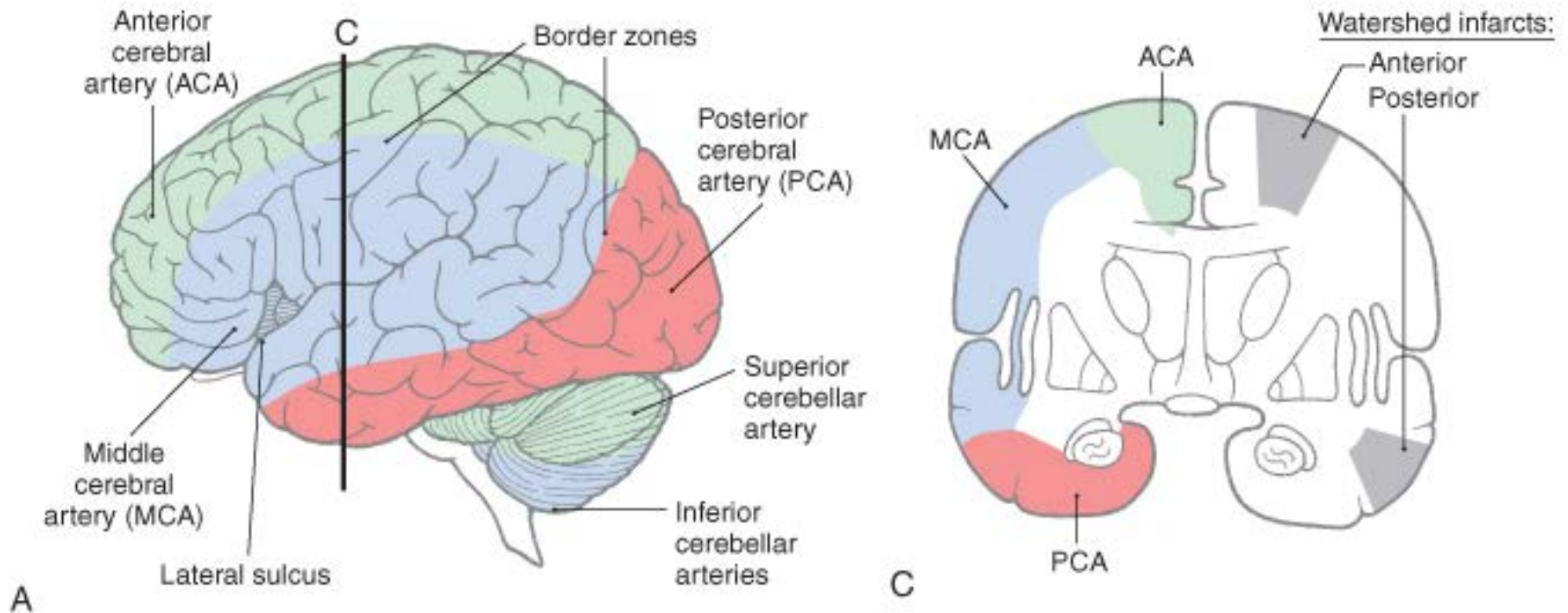


Left Lateral view of the cerebrum depicting the many branches of the middle cerebral artery

lateral view of cerebrum

Watershed areas

Watershed areas are where 2 major cerebral arteries terminate in the same location. Brain tissue in watershed areas are susceptible to damage during hypo and hypertensive events.

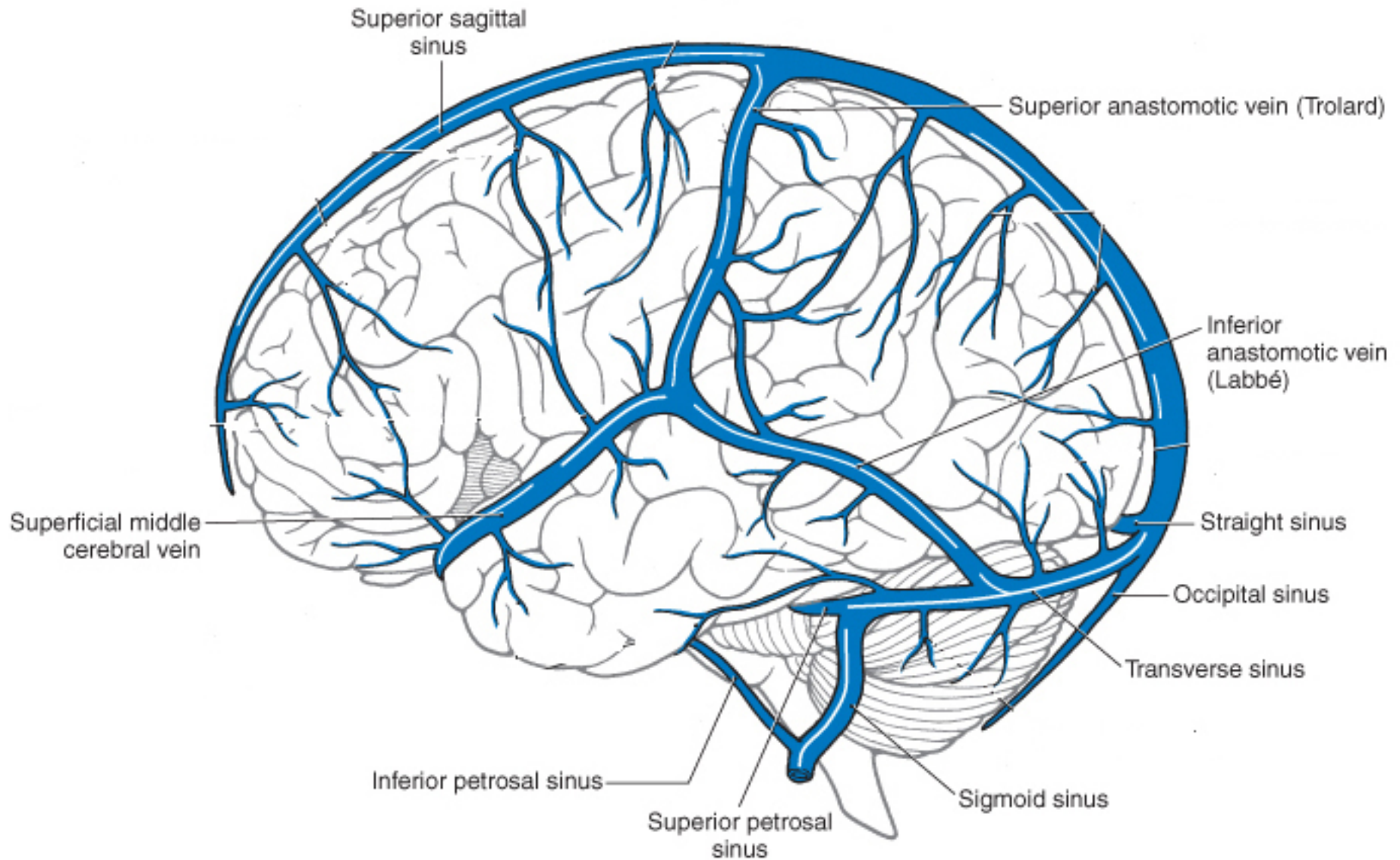


Images from Fundamental Neuroscience for Basic and clinical applications, D.E. Haines

Anterior watershed area = terminal branches of the anterior and middle cerebral aa.

Posterior watershed area = terminal branches of the middle and posterior cerebral aa.

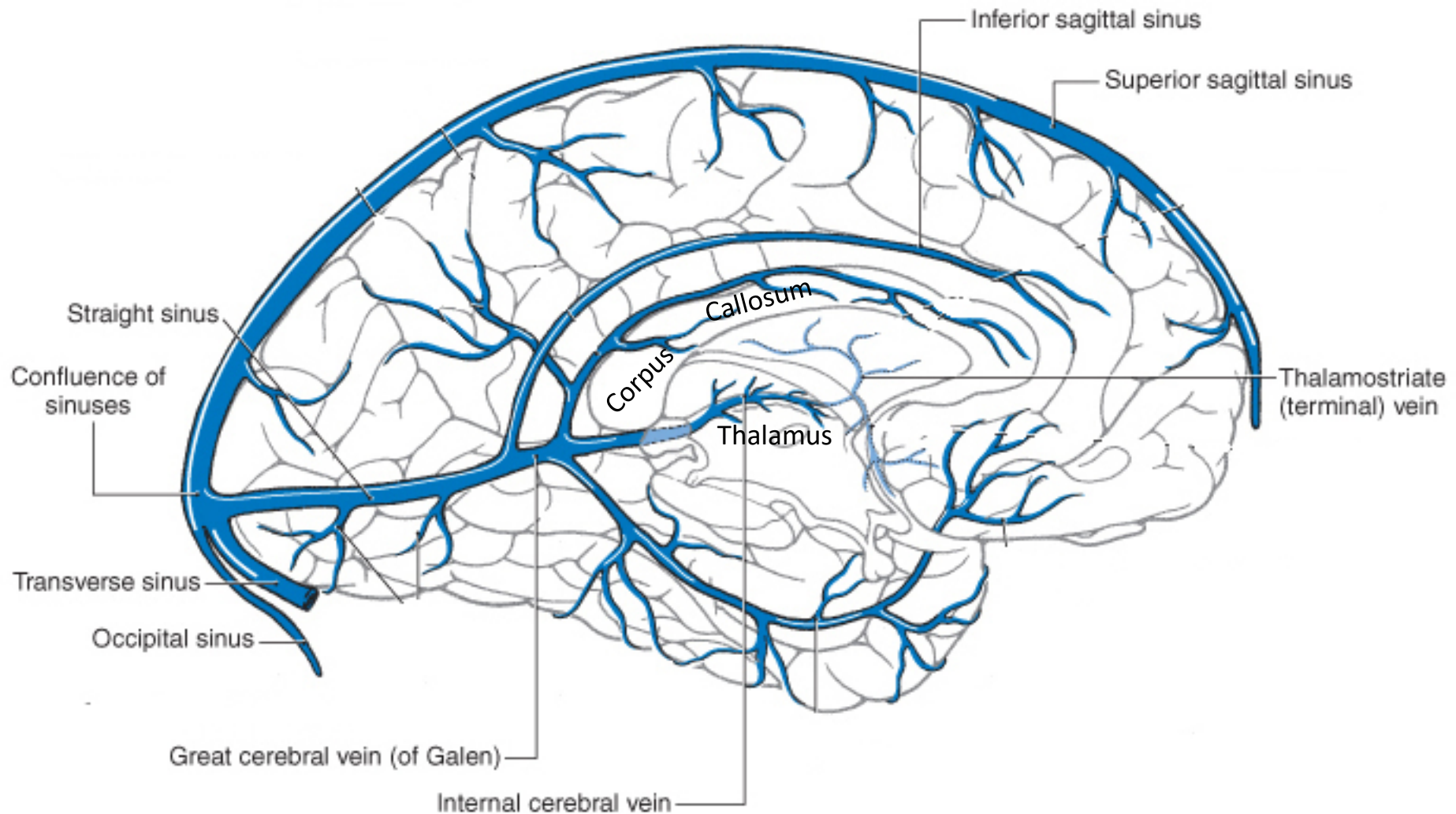
Veins and Venous sinuses – Lateral view



lateral view of cerebrum

Image from Fundamental Neuroscience for Basic and clinical applications, D.E. Haines

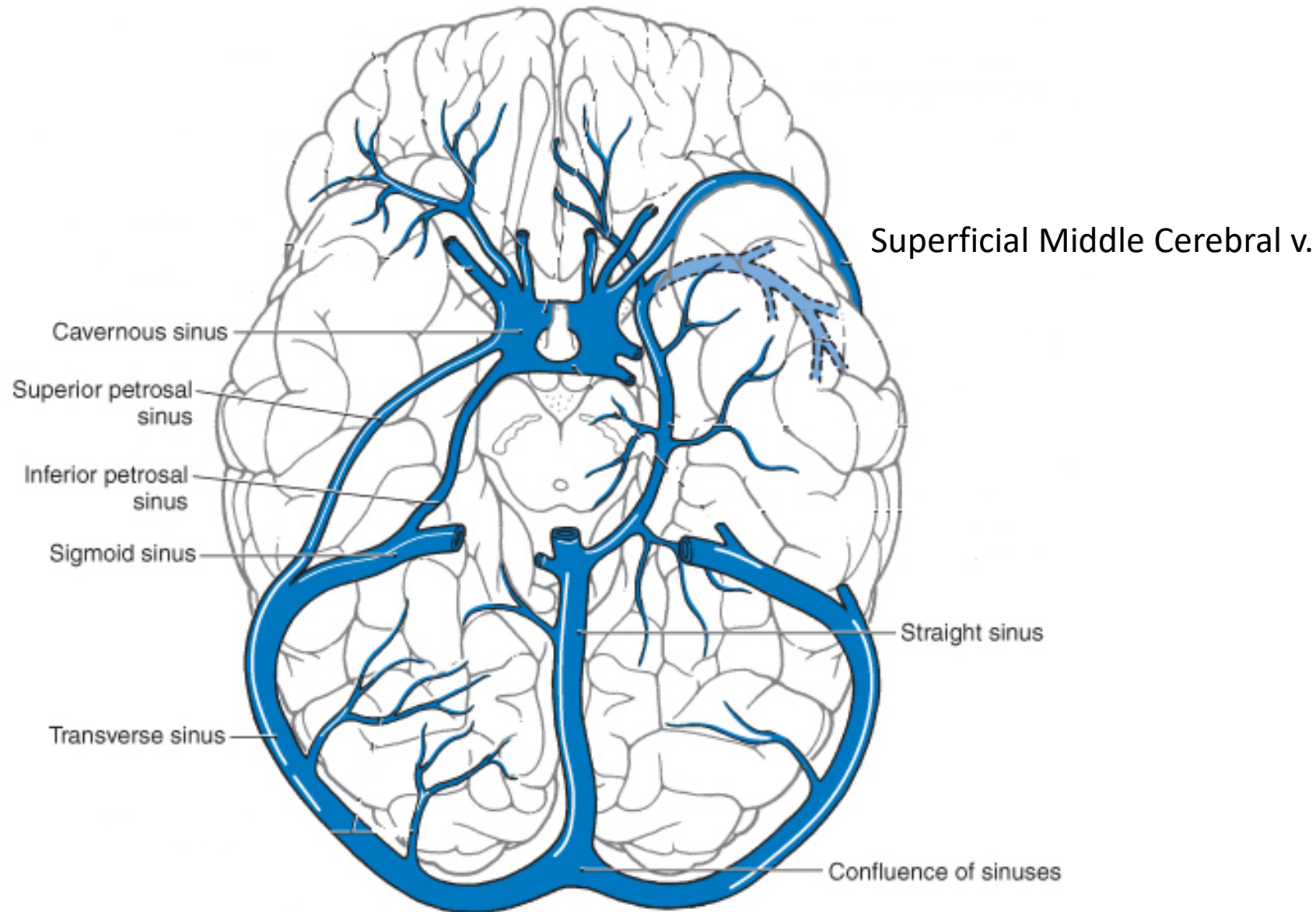
Veins and Venous sinuses – Mid-sagittal view



mid-sagittal view of cerebrum

Image from Fundamental Neuroscience for Basic and clinical applications, D.E. Haines

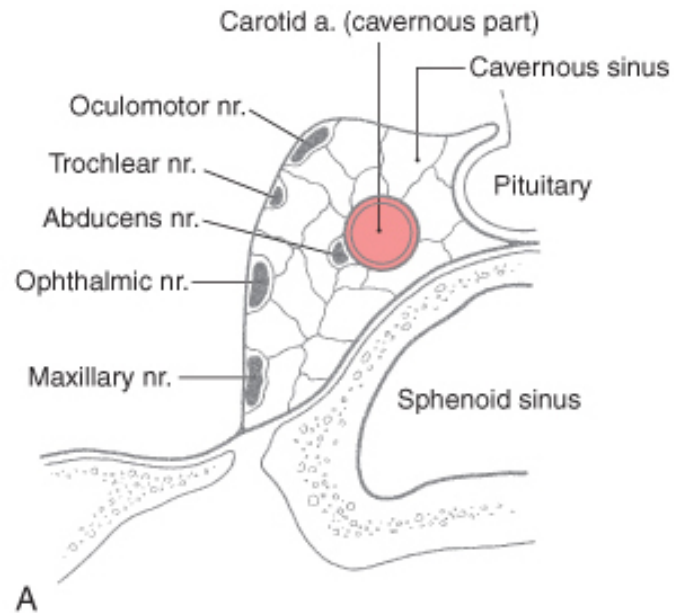
Veins and Venous sinuses – Inferior view



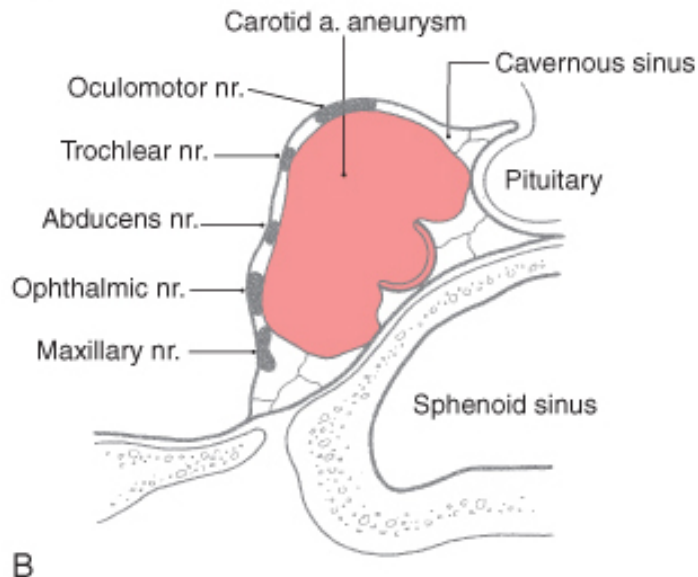
inferior view of cerebrum

Image from Fundamental Neuroscience for Basic and clinical applications, D.E. Haines

Clinical Aspect – Cavernous sinus and Internal carotid a.

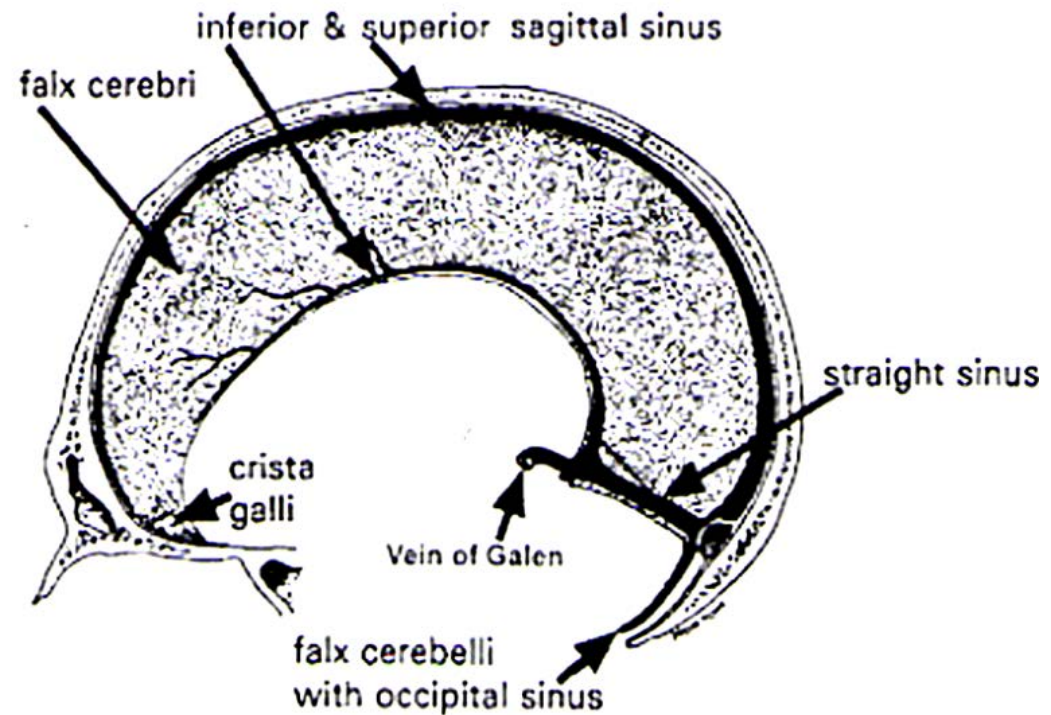
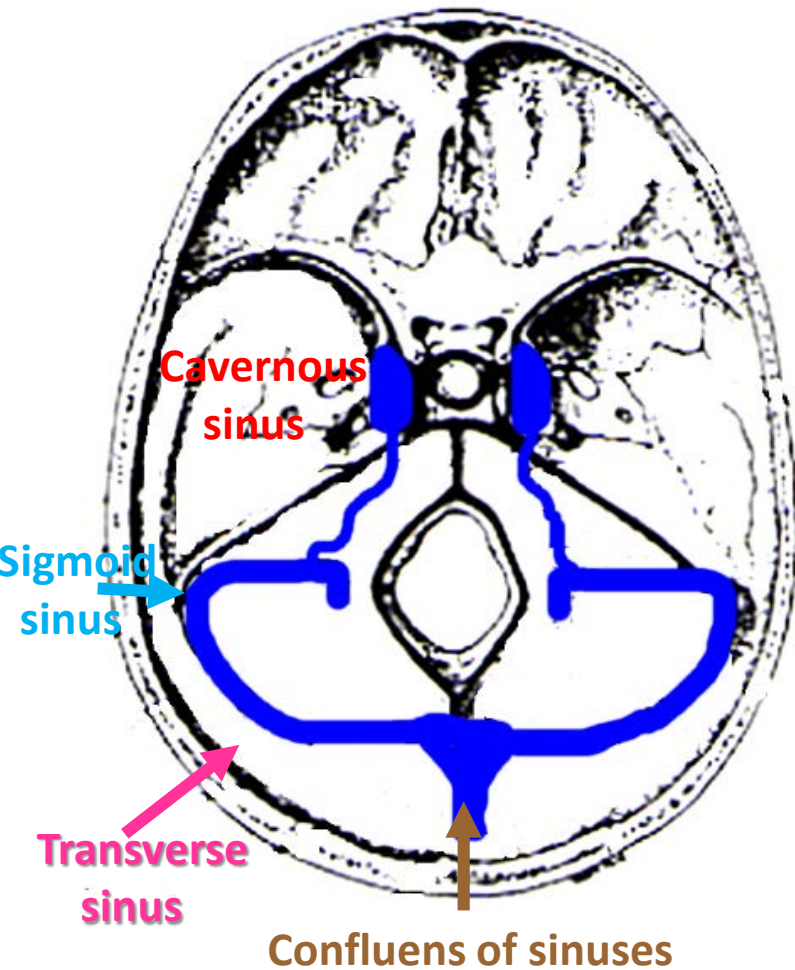


The internal carotid a. travels through the cavernous sinus along with cranial nerves III, IV, V1, V2, and VI.

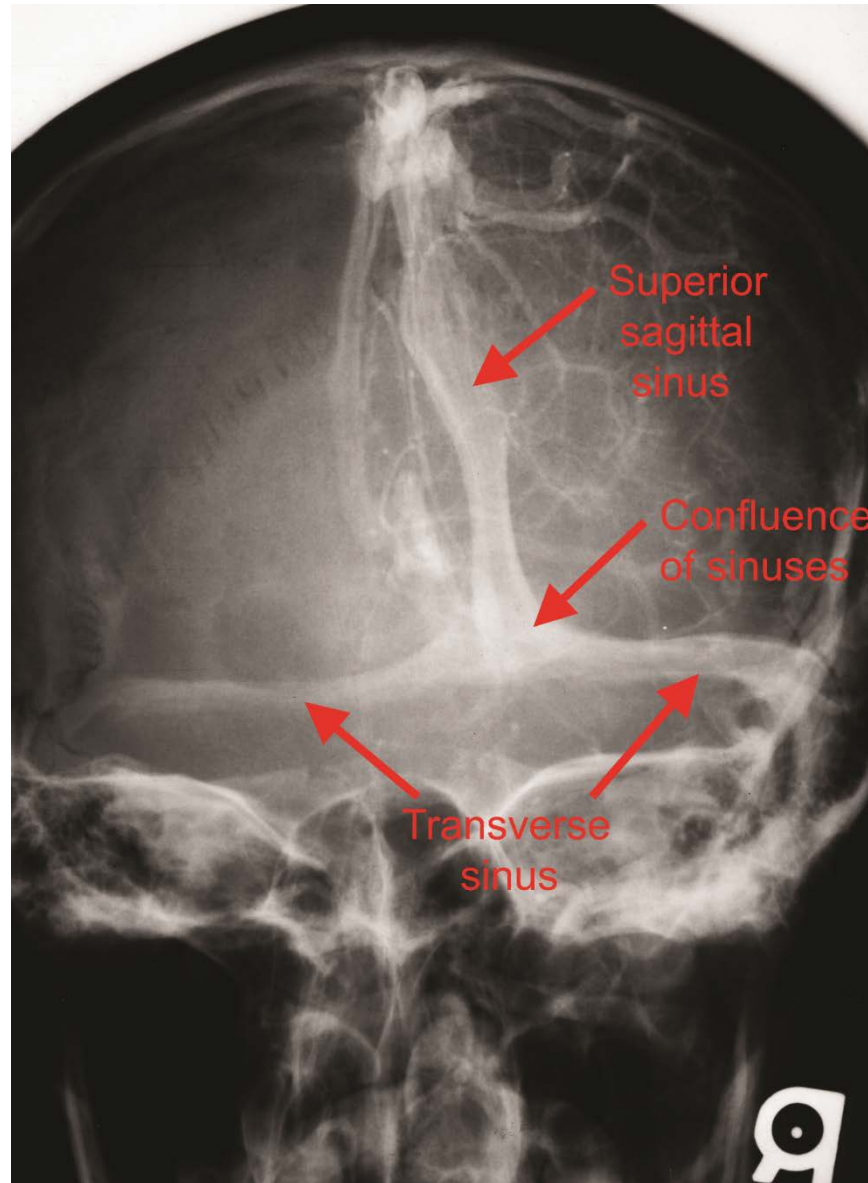


If the carotid a. would rupture in the cavernous sinus area, it would affect blood supply to cortical brain areas and affect the cranial nerves that travel through the cavernous sinus.

Veins and Venous sinuses – Cranial vault and falx cerebri

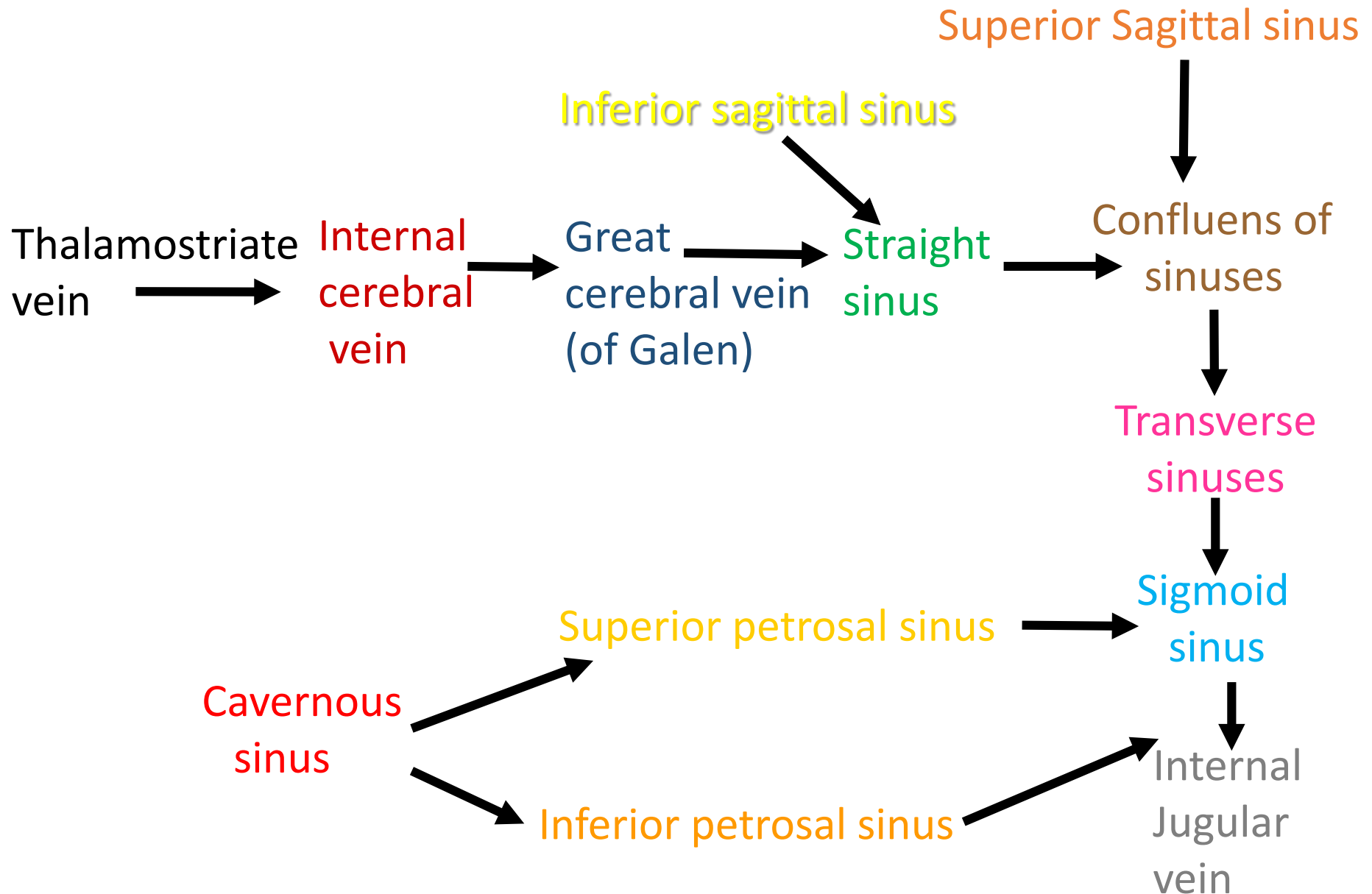


Venogram – anterior/posterior view



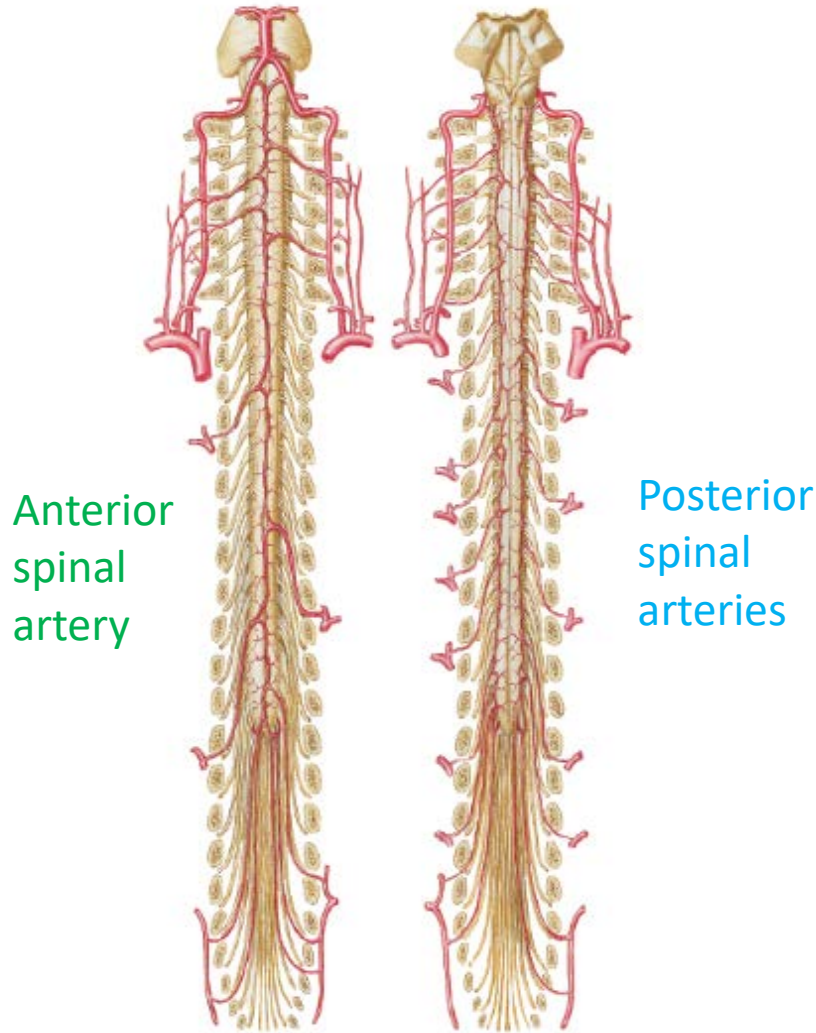
AP view of venogram

Venous flow



Blood supply to the spinal cord

Arteries of Spinal Cord - Schema



Longitudinal view of spinal cord
Left image = anterior side
Right image = posterior side

1 **anterior spinal artery** – supplies anterior 2/3 of the spinal cord

Anterior spinal artery



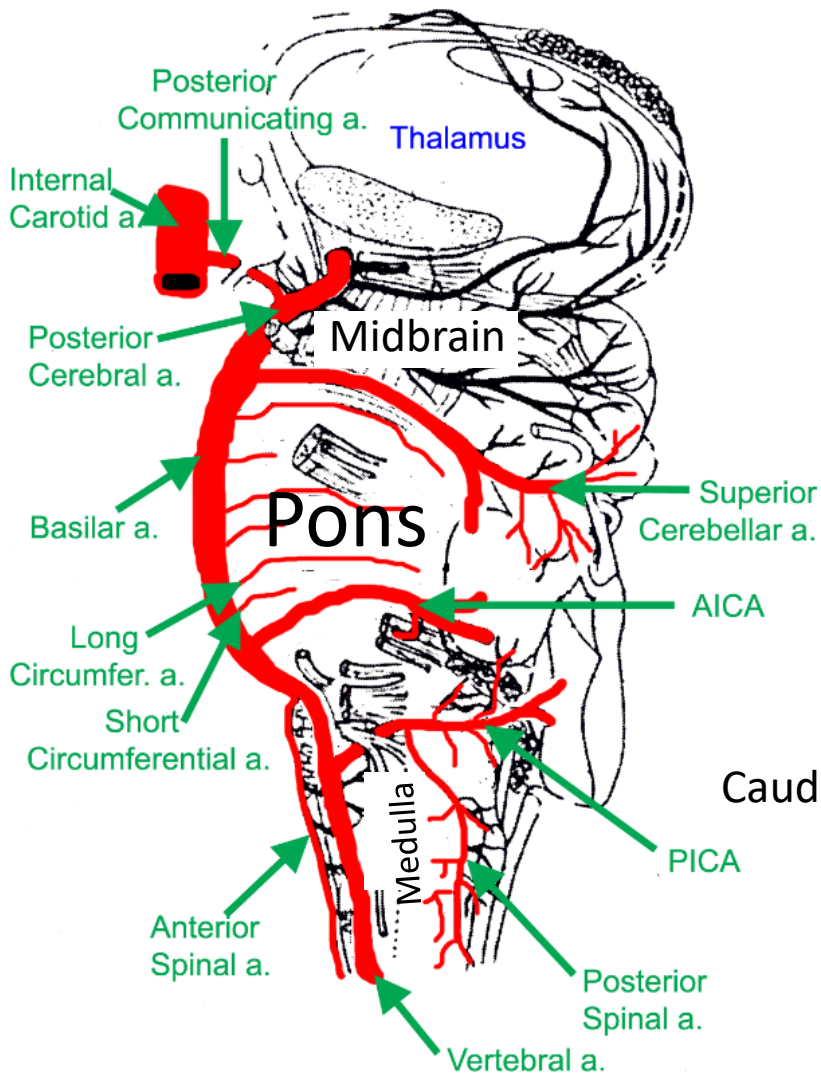
Posterior spinal arteries

2 **posterior spinal arteries** – supplies the posterior column of the spinal cord

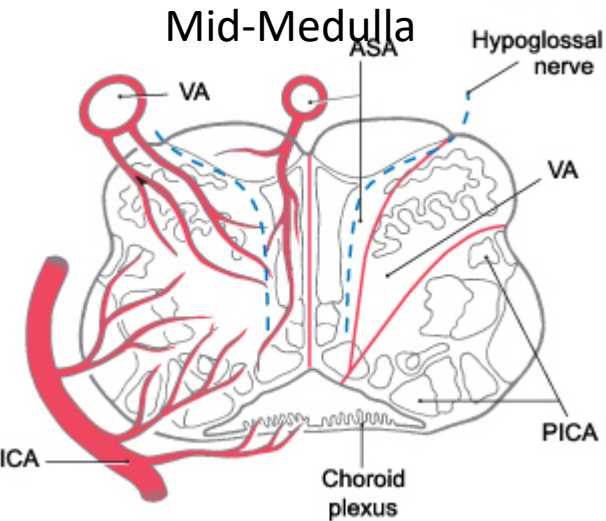
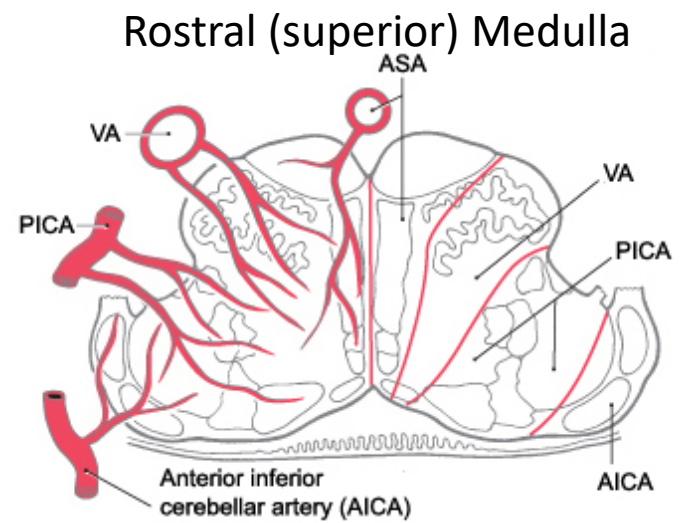
Transverse section of spinal cord depicting anterior and posterior spinal artery zones

F. Netter M.D.
© 1975

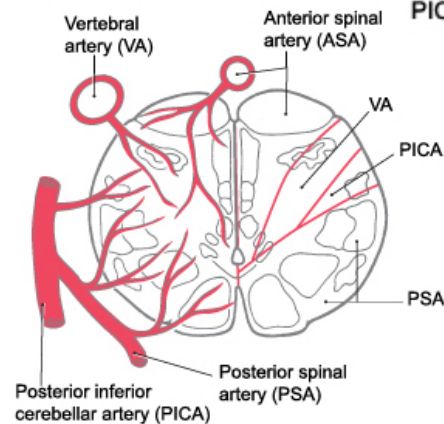
Blood supply to the Medulla



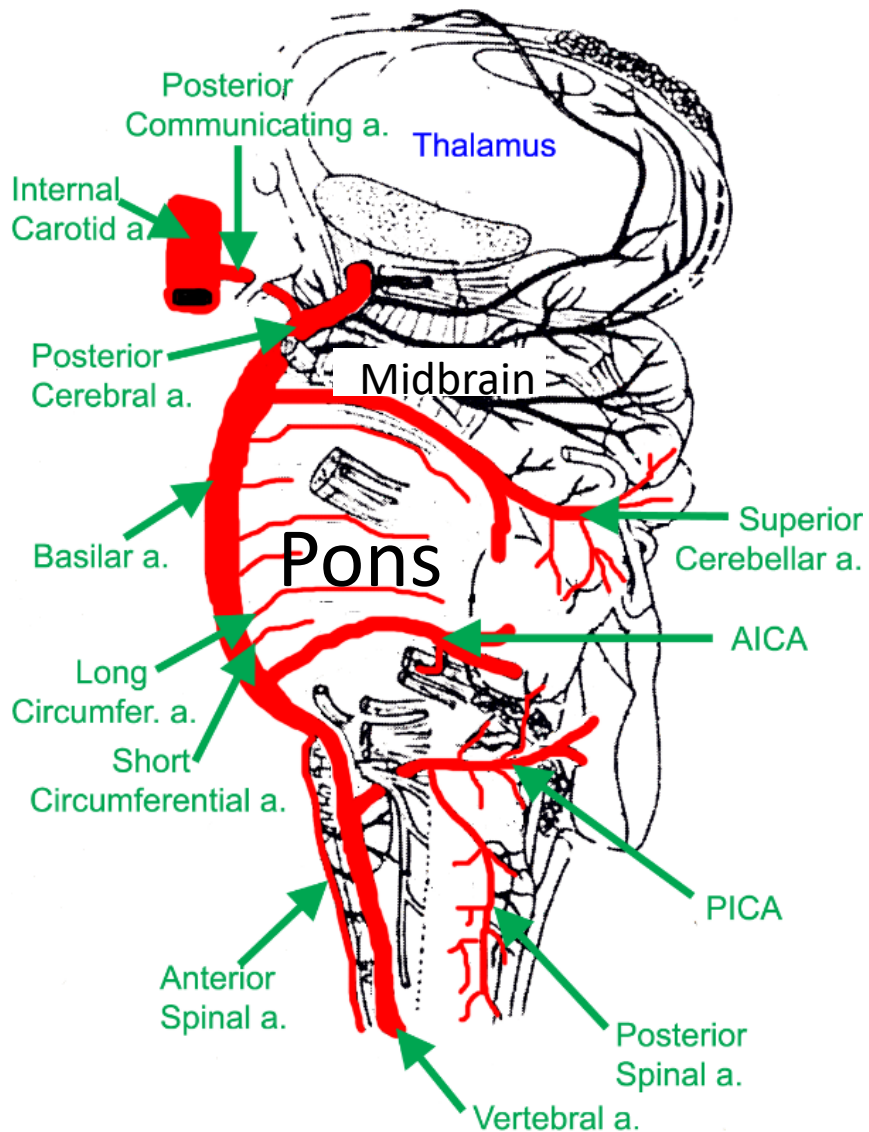
Left lateral view of the brainstem and blood supply



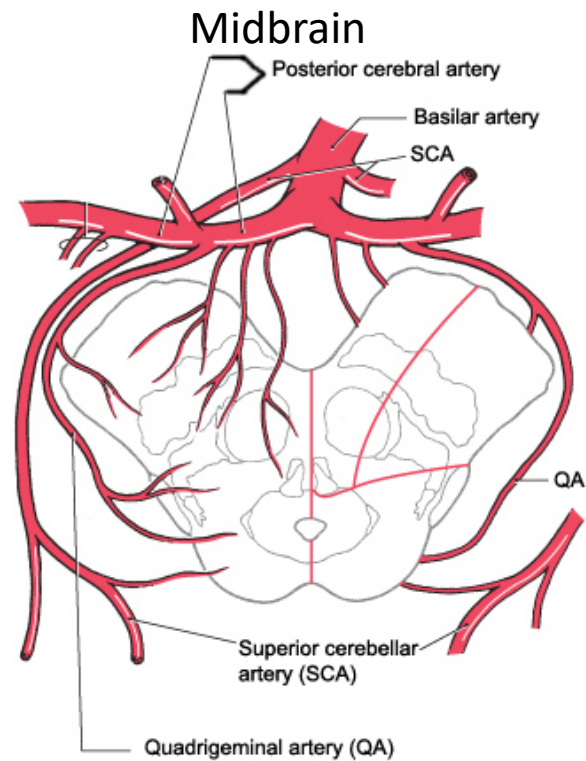
Caudal (inferior) Medulla



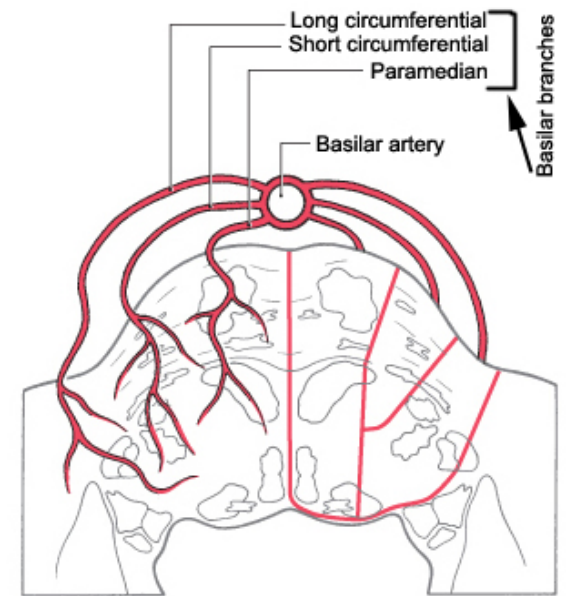
Blood supply to the Pons and Midbrain



Left lateral view of the brainstem and blood supply

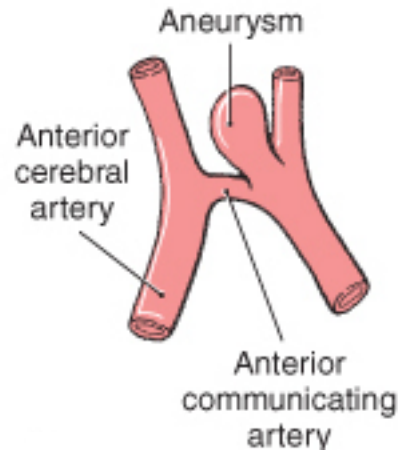


Pons

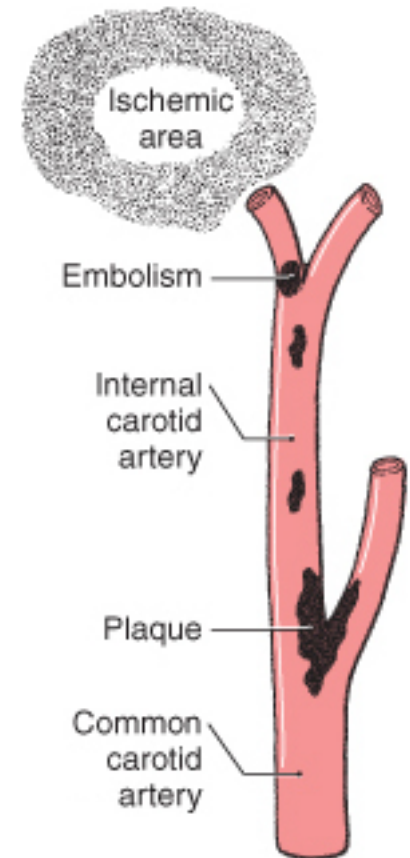


Events that lead to cerebrovascular problems

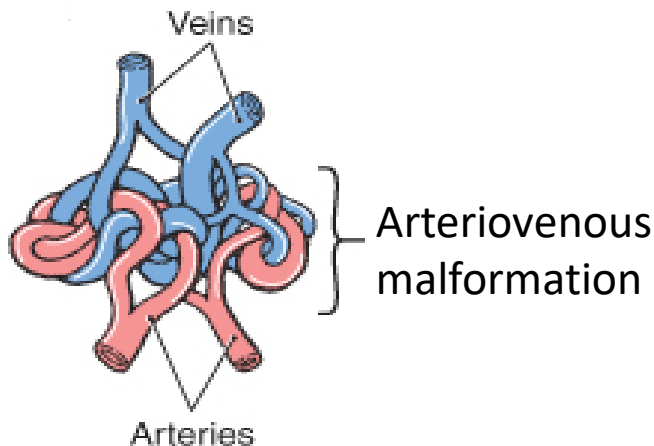
1. Aneurysm : dilation of a blood vessel wall



2. Cerebral embolism : occlusion of the inside of a vessel

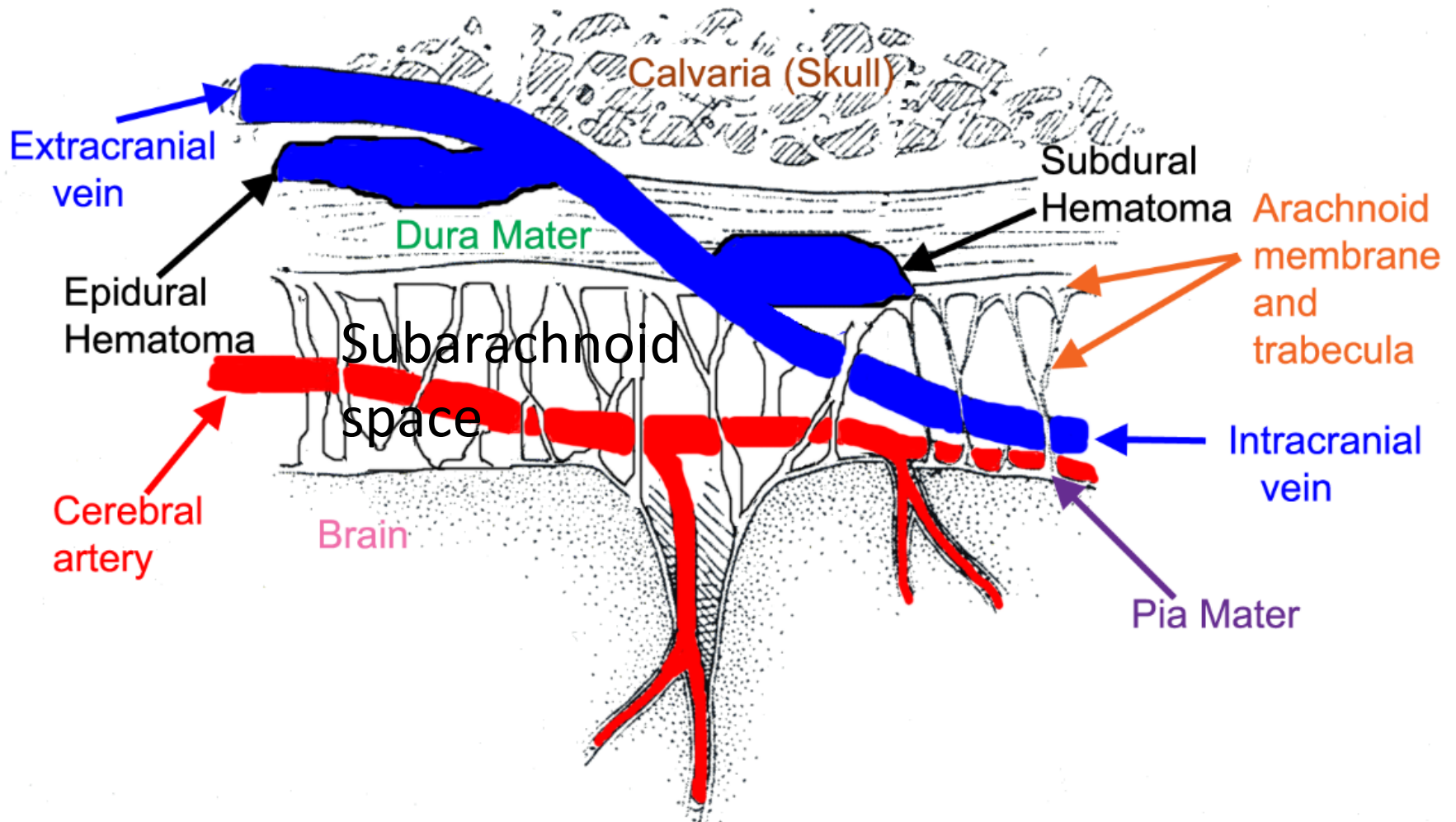


3. Arteriovenous malformation: major arteries and veins do not develop normally



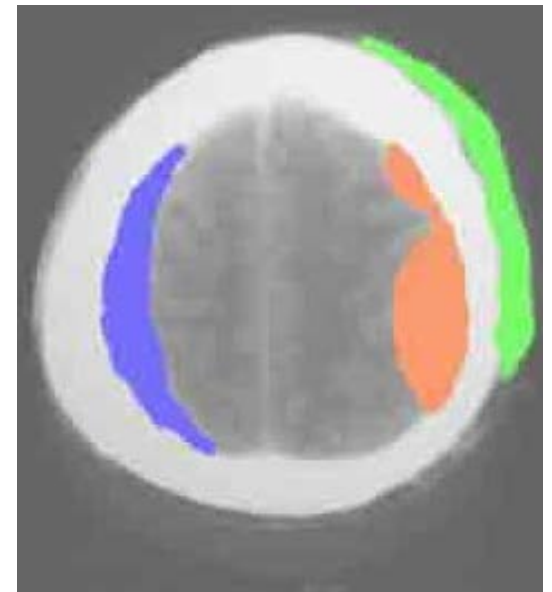
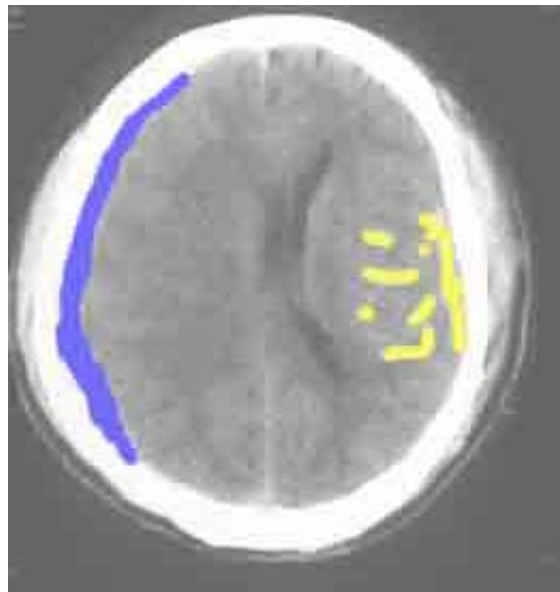
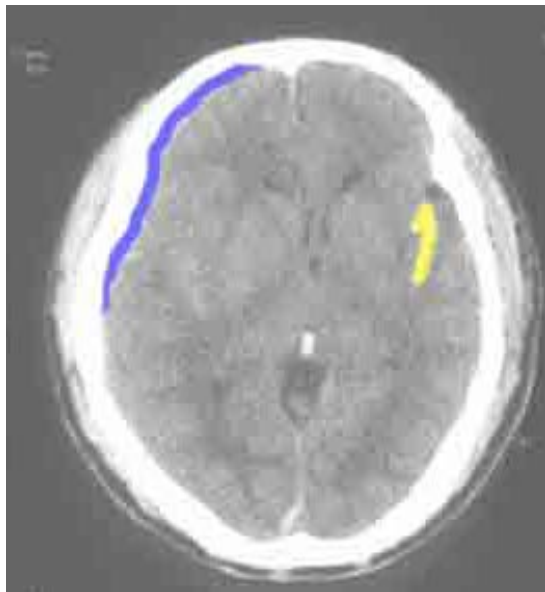
Meningeal Hemorrhages

1. Epidural hemorrhage – bleeding of vessels superficial to dura
2. Subdural hemorrhage – bleeding of vessels between dura mater and arachnoid membrane
3. Subarachnoid hemorrhage – bleeding of vessels in subarachnoid space



CT scan of meningeal hemorrhages

1. **Epidural hemorrhage** – appears short and wide on a CT as blood cannot cross the cranial suture lines. (Colored orange in scan on the right.)
2. **Subdural hemorrhage** – appears long and thin on CT as the blood is separating the dura mater from the arachnoid membrane. (Colored blue in all 3 scans.)
3. **Subarachnoid hemorrhage** – appears in subarachnoid space and in brain parenchyma (in sulci). (Colored yellow in the scans on the left and middle.)



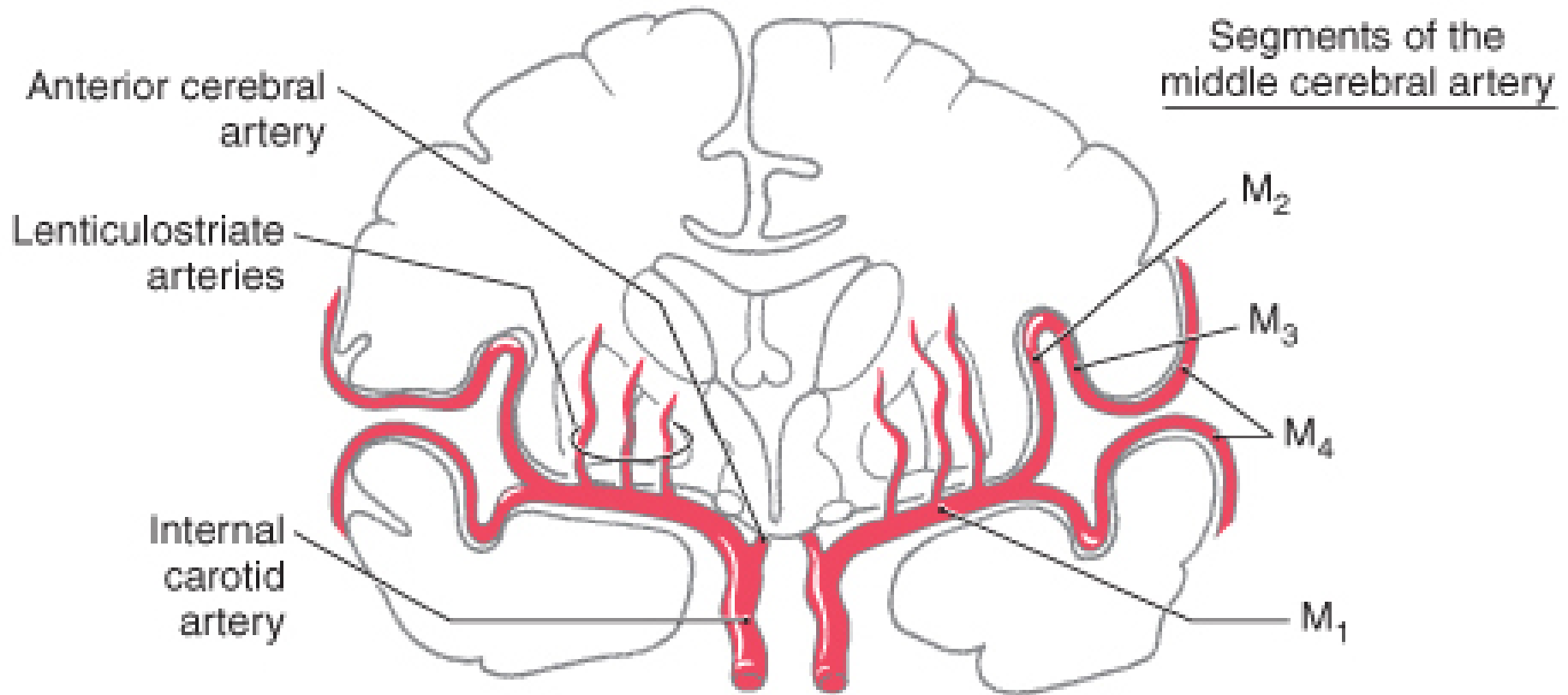
- Subdural Hemorrhage
- Epidural Hemorrhage
- Subarachnoid Hemorrhage

Horizontal view of the cerebrum

Middle cerebral and Lenticulostriate arteries

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Coronal brain section featuring middle cerebral and Lenticulostriate arteries