

CNS Anatomy

Spinal Cord, Meninges, Blood Supply

November 2018



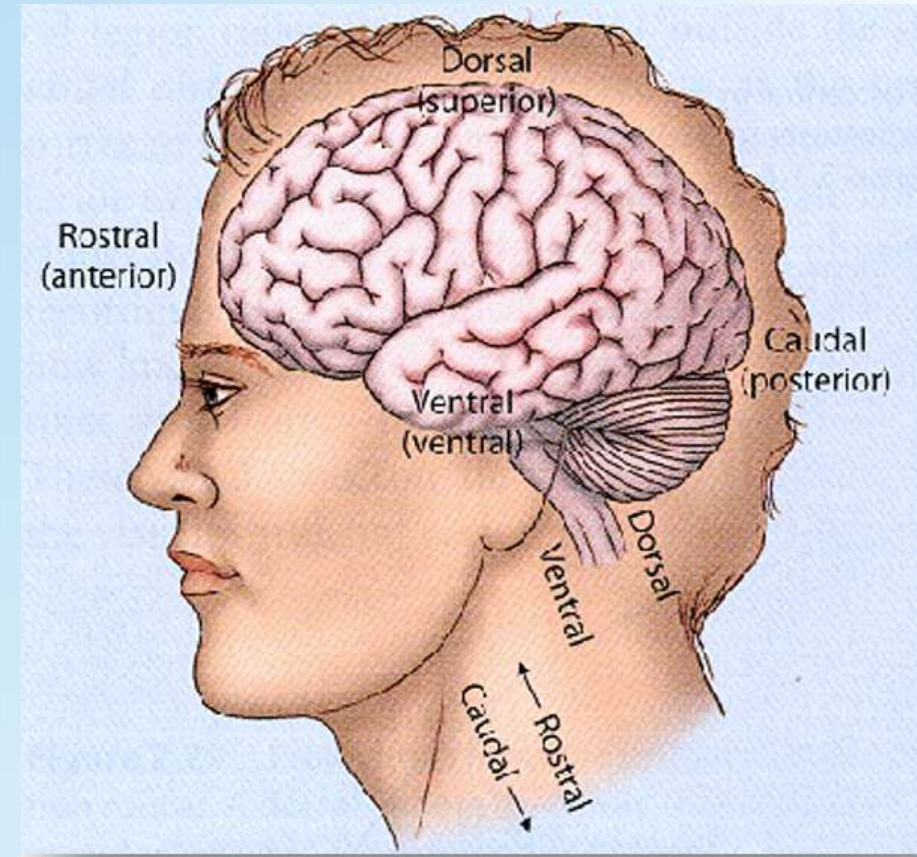
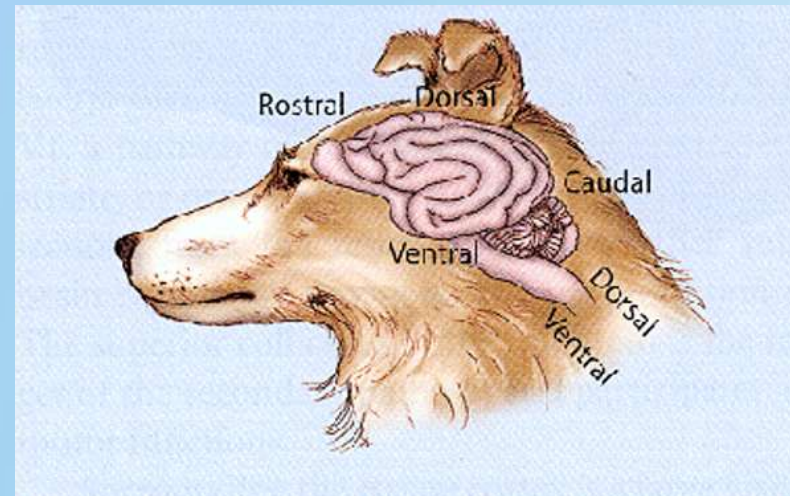
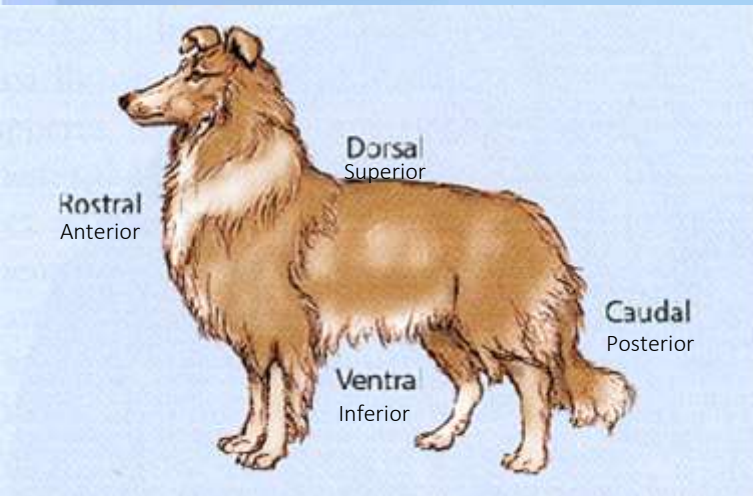
What we will cover...

- Spinal Cord
- Meninges, Ventricles, Blood Supply

CNS Anatomical Directions

What is...?

- Rostral vs caudal
- Dorsal vs ventral








ROSTRAL is closer to **NOSTRIL**
(rhymes?)
That leaves **CAUDAL** to be
closer to the tail.

DORSAL is like a shark dorsal fin
(superior)

- BUT remember how the spinal column changes from horizontal to vertical between a 4-legged animal versus a standing human
- so dorsal is the back of the spinal cord

CNS Divisions

Part	Division	Components	
Spinal Cord	One functional unit	Ascending tracts Descending tracts Interneurons	
Brain	Brainstem	Midbrain Pons Medulla	
	Cerebellum	Anterior lobe Posterior lobe Flocculonodular lobe	
	Diencephalon	Epithalamus Dorsal thalamus Hypothalamus Subthalamus	
	Telencephalon	Cerebral hemispheres Basal nuclei	

Spinal Cord Major Features

Cervical Enlargement: C4-T1

- large group of nerves leaves to make the brachial plexus (upper limb innervation)

Lumbar Enlargement: T11 - conus medullaris

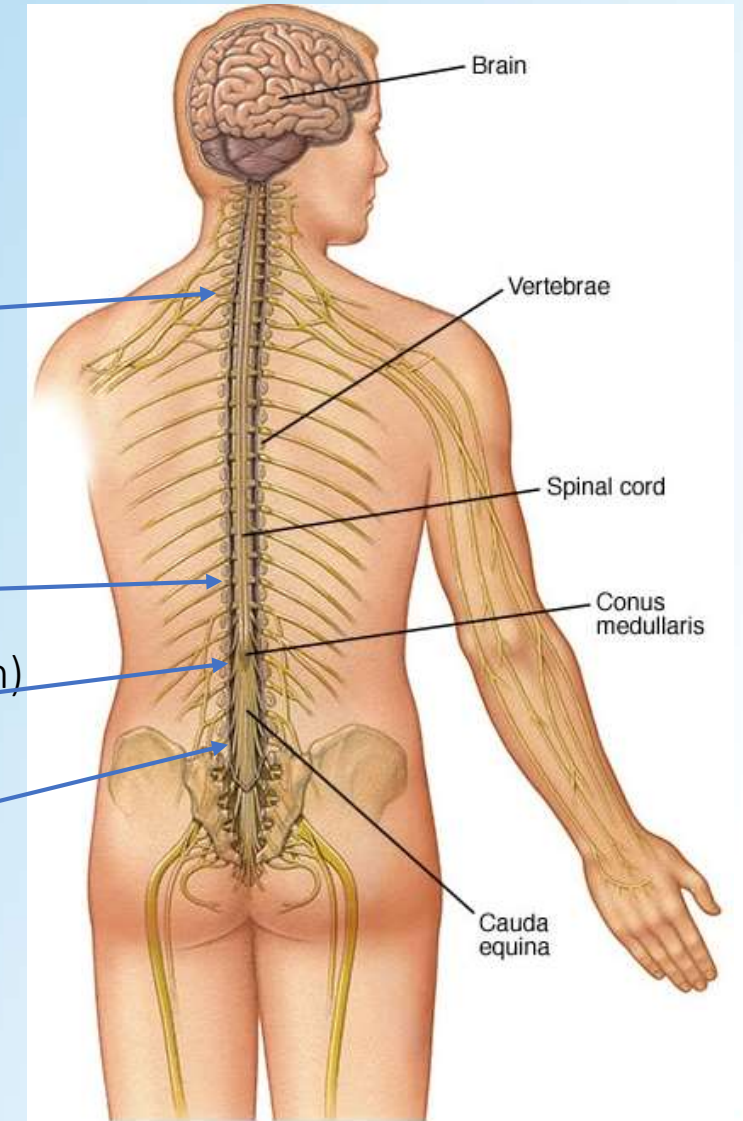
- large group of nerves leaves to make the lumbosacral plexus (lower limb innervation)

Medullary Cone: L1-L2

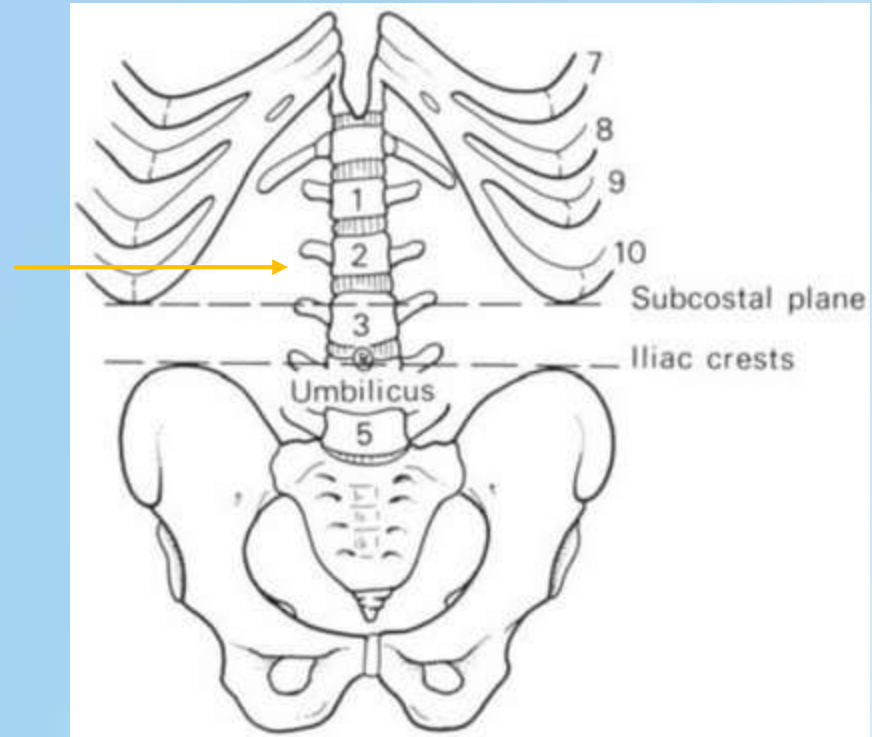
- tapering off of the spinal cord

Cauda Equina: L2-coccygeal

- nerve roots continuing from medullary cone



Vertebra

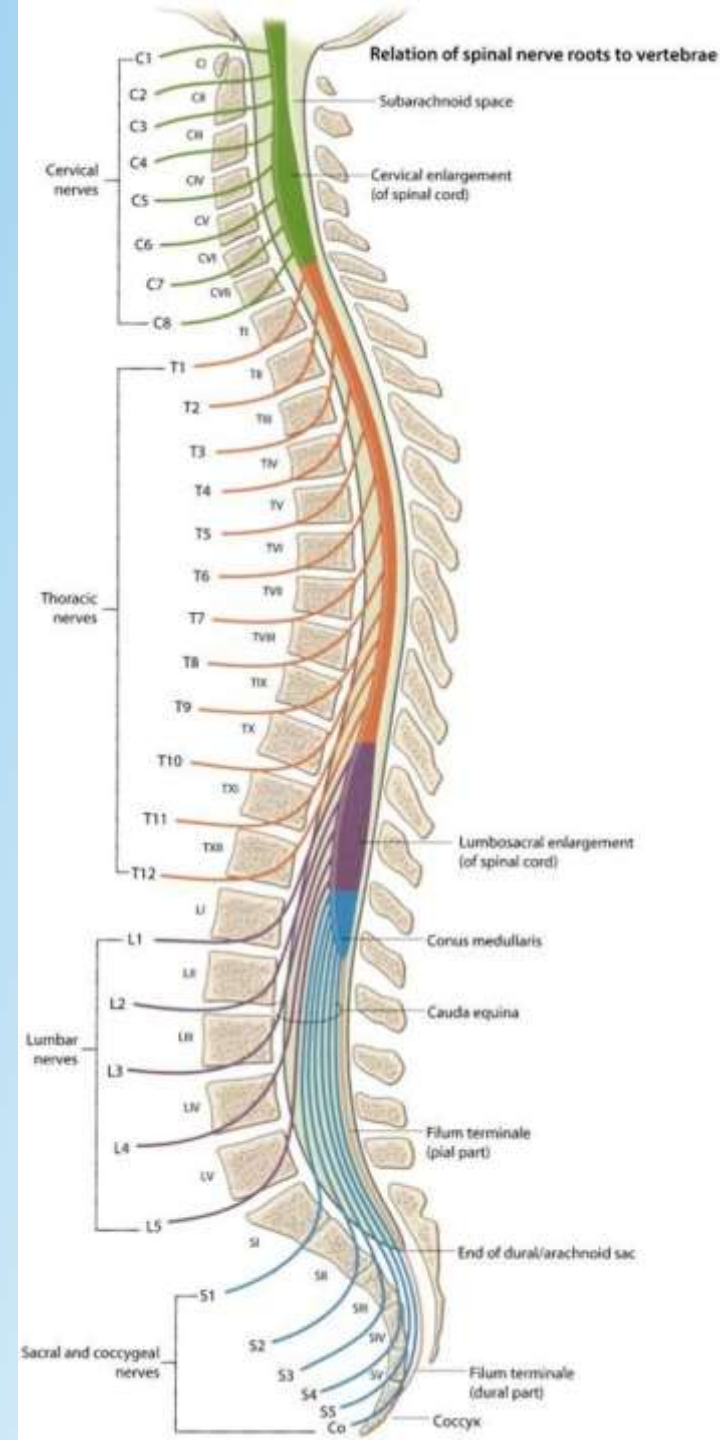


Spinal Nerve Pairs

31 PAIRS of spinal nerves:

- 8 cervical
- 12 thoracic
- 5 lumbar
- 5 sacral
- 1 coccygeal

62 TOTAL spinal nerves



Numbering Spinal Nerves

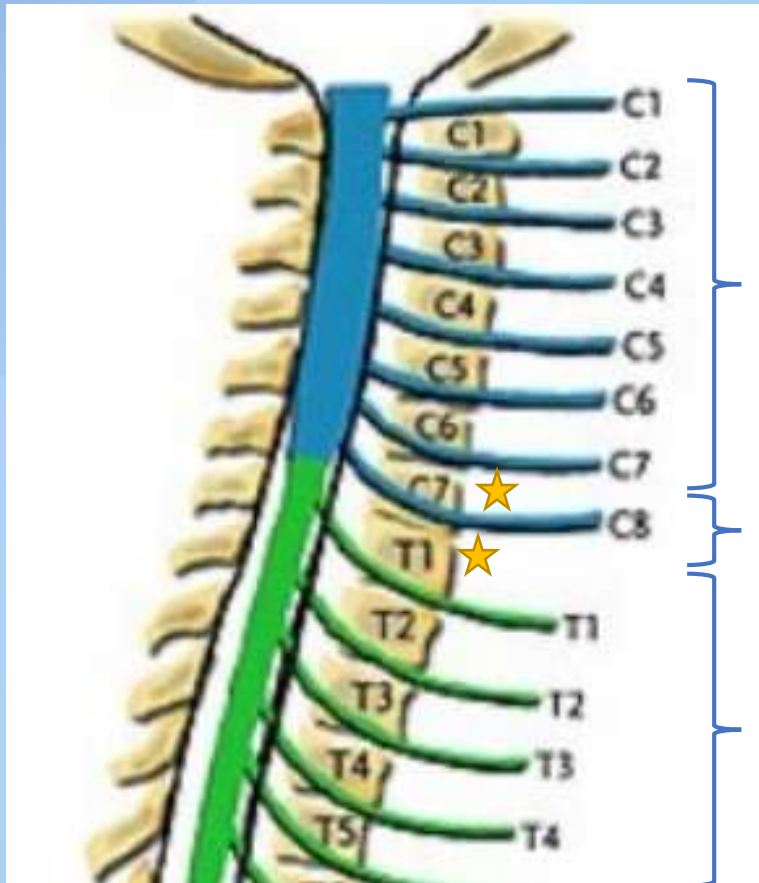
At the top of the spinal cord, start naming the **NERVE FIRST**, then the vertebra.

(e.g. nerve C1, vertebra C1, nerve C2, vertebra C2)

Think of **C8** as a transition nerve.

Below C8, name the **VERTEBRA FIRST**, then the nerve below it.

(e.g. vertebra T1, nerve T1, vertebra T2, nerve T2)



Nerves C1-C7 numbered by the vertebra below

Nerve C8 numbered between C7 and T1 vertebrae

Nerves T1 and all others numbered by the vertebra above

Spinal Cord Cross Section

Gray matter:

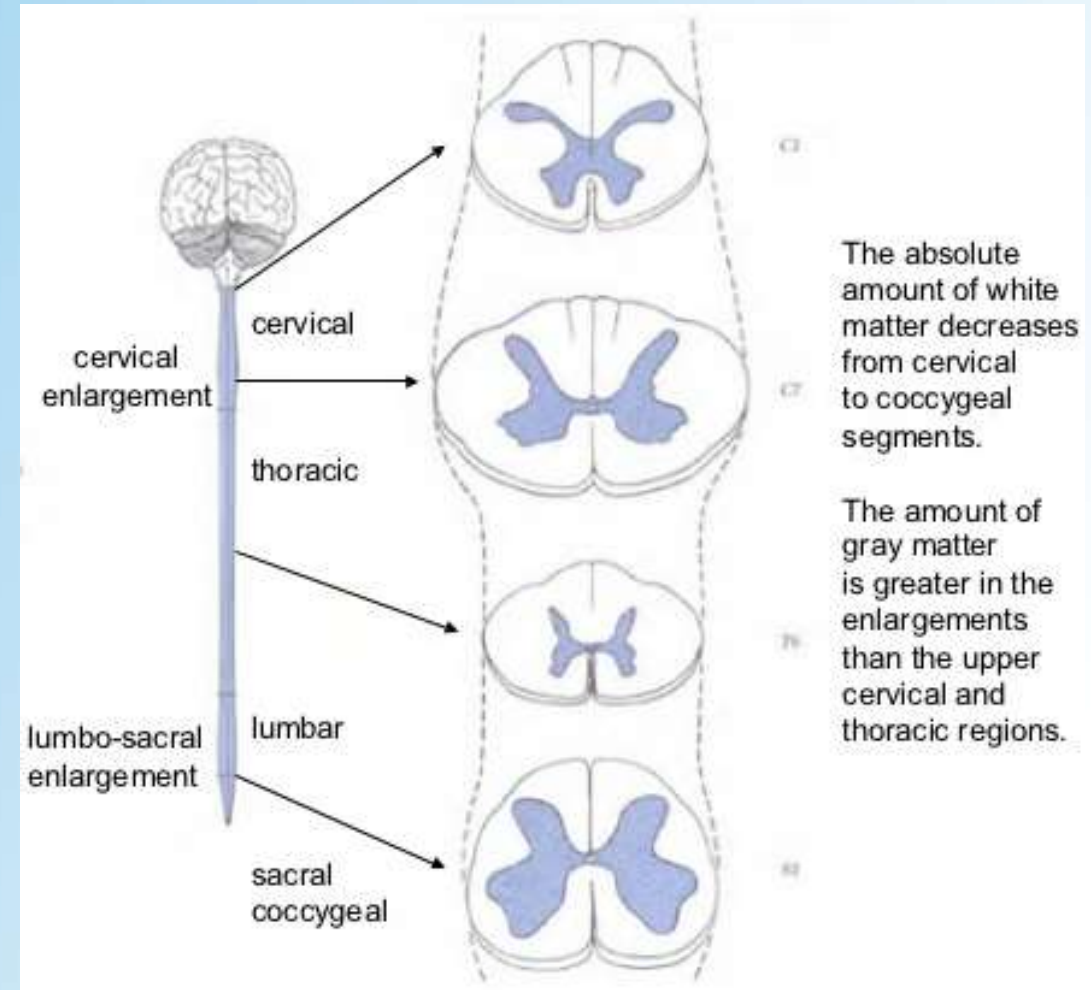
- mostly nerve cell bodies, dendrites, neuroglia

White matter:

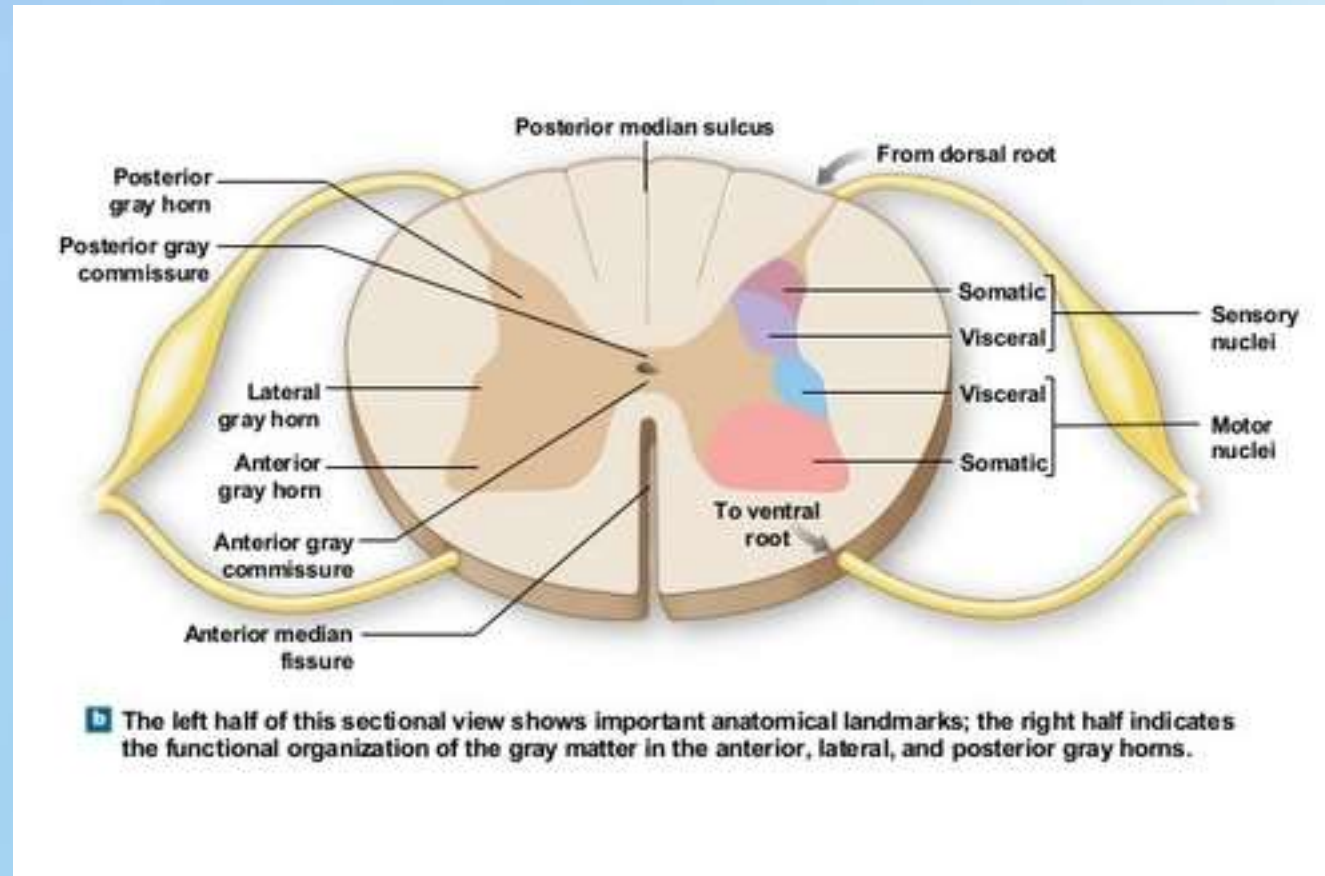
- mostly myelinated axons

Central canal:

- contains cerebrospinal fluid

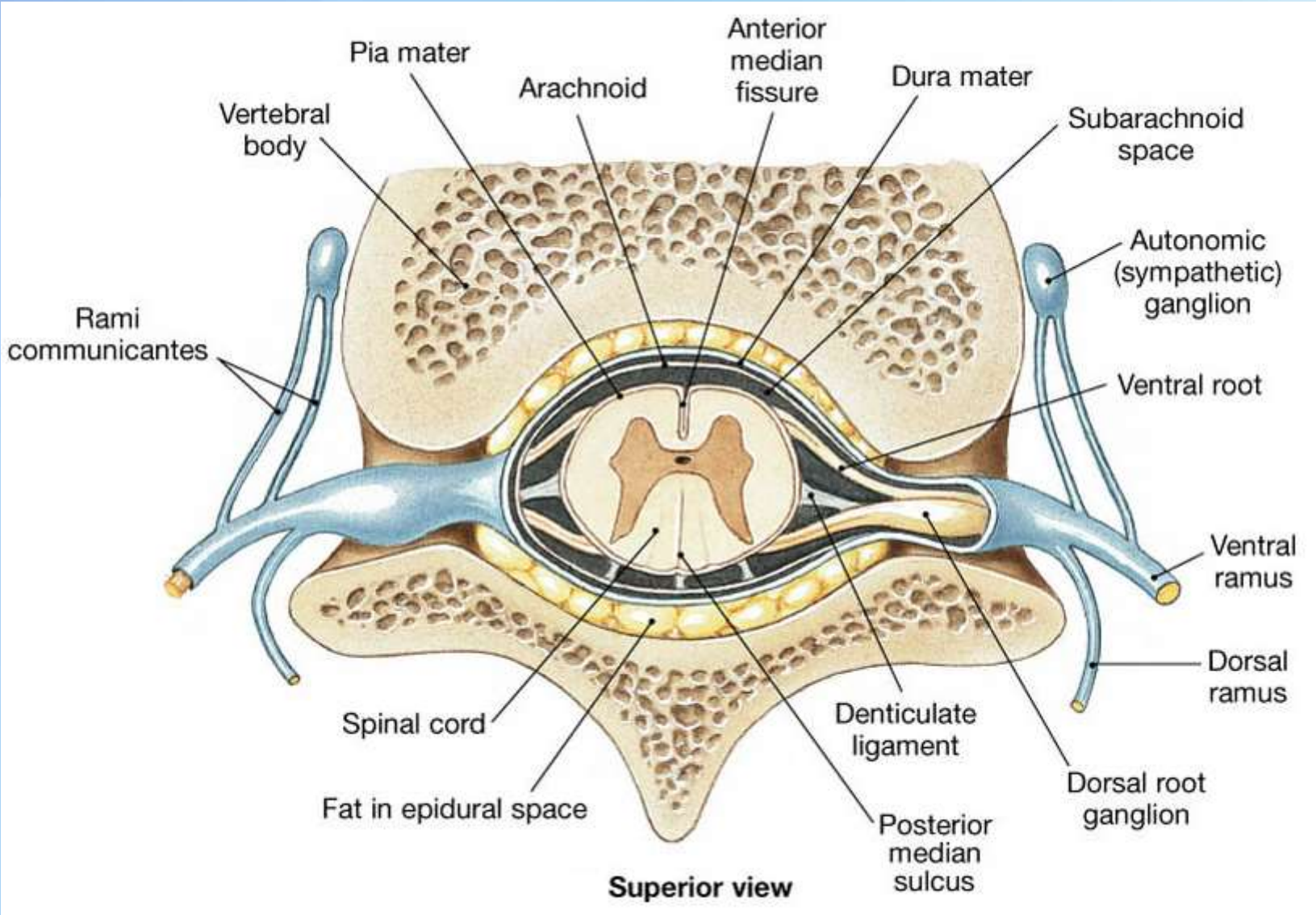


Sectional Organization of Spinal Cord



To remember that **sensory** is on the **dorsal** aspect of the gray matter:
- when someone strokes you, you **FEEL** it on your **BACK**

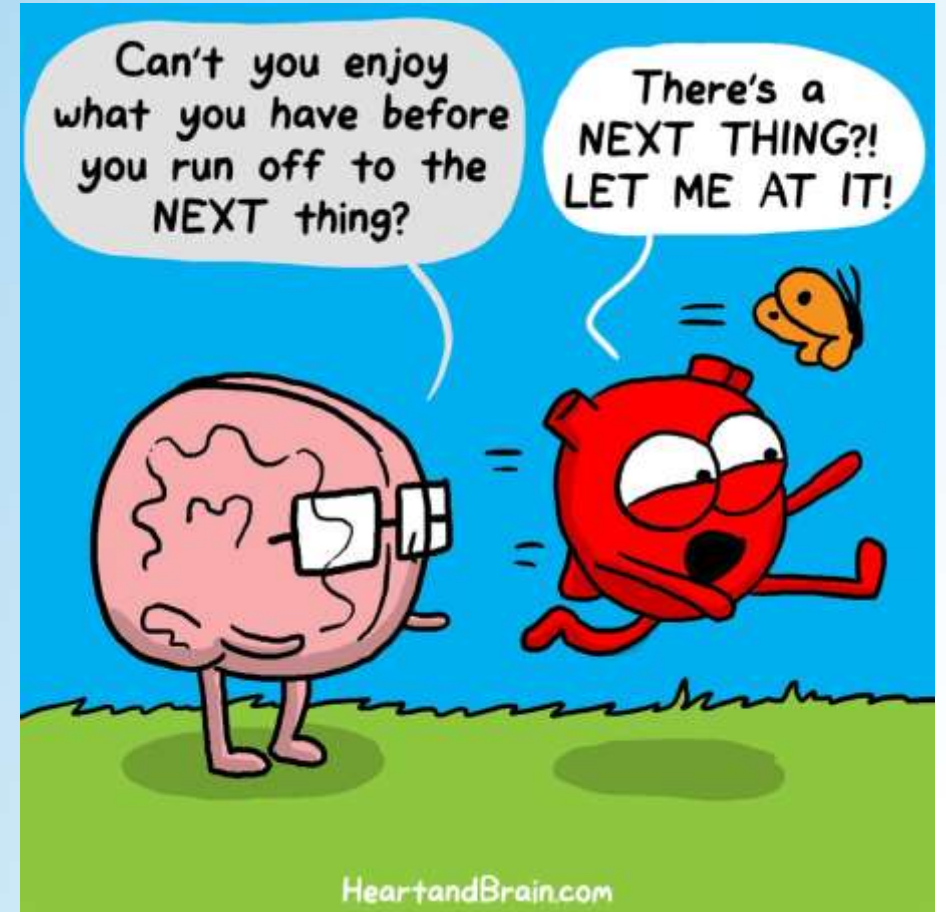
FRONT



BACK

What we will cover...

- ✓ Spinal Cord
- ☐ Meninges, Ventricles, Blood Supply

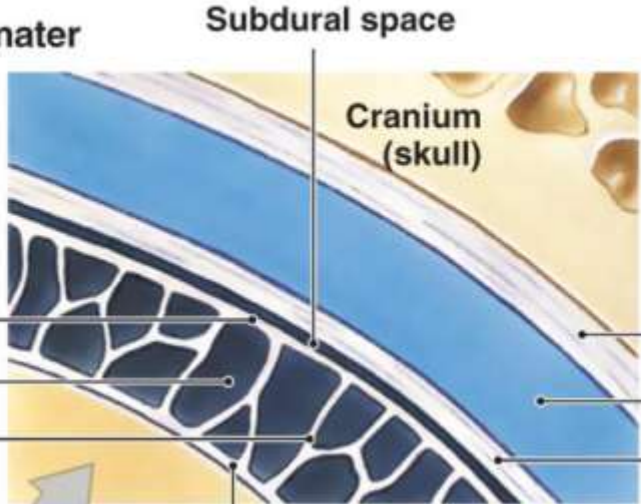


Meningeal Layers

The three layers of the cranial meninges:
the dura mater, arachnoid mater, and pia mater

2 Arachnoid mater

- Arachnoid membrane
- Subarachnoid space
- Arachnoid trabeculae

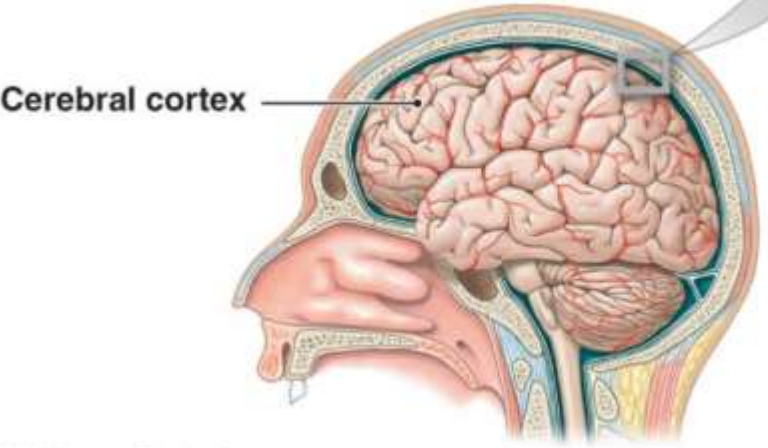


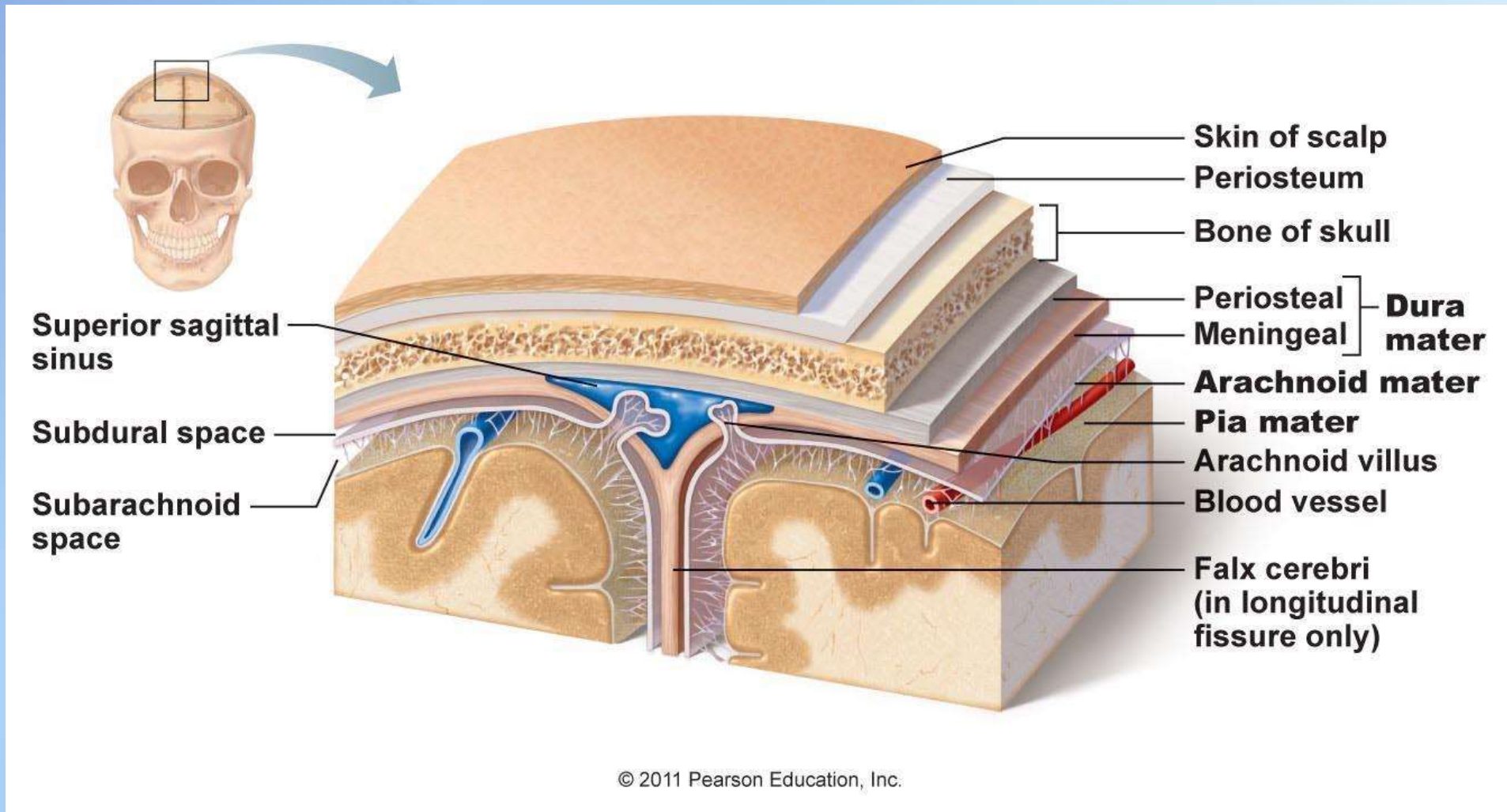
1 Dura mater

- Dura mater (endosteal layer)
- Dural sinus
- Dura mater (meningeal layer)

3 Pia mater

Is bound to the surface of the brain by astrocytes





PAD: pia, arachnoid, dura

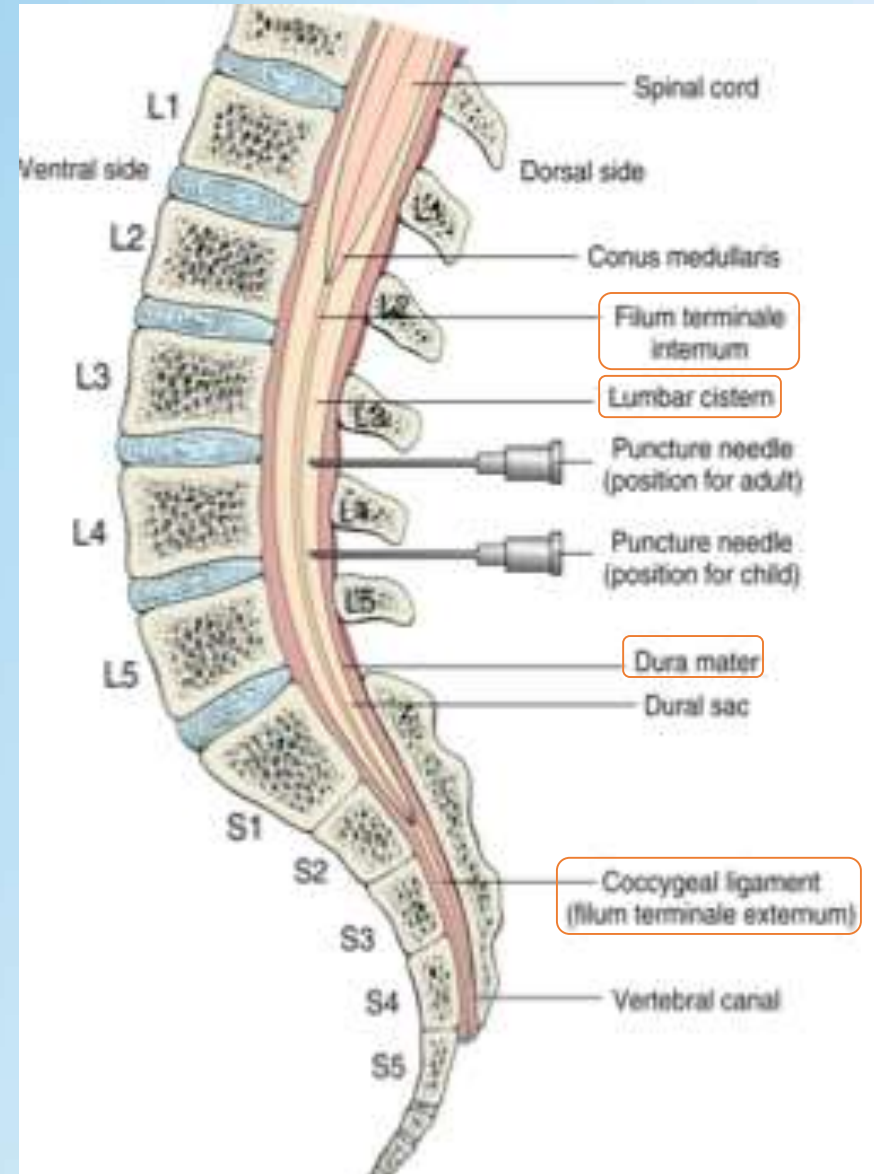
(or PADS: pia, arachnoid, dura, skull)

Meningeal Layers in Spinal Cord

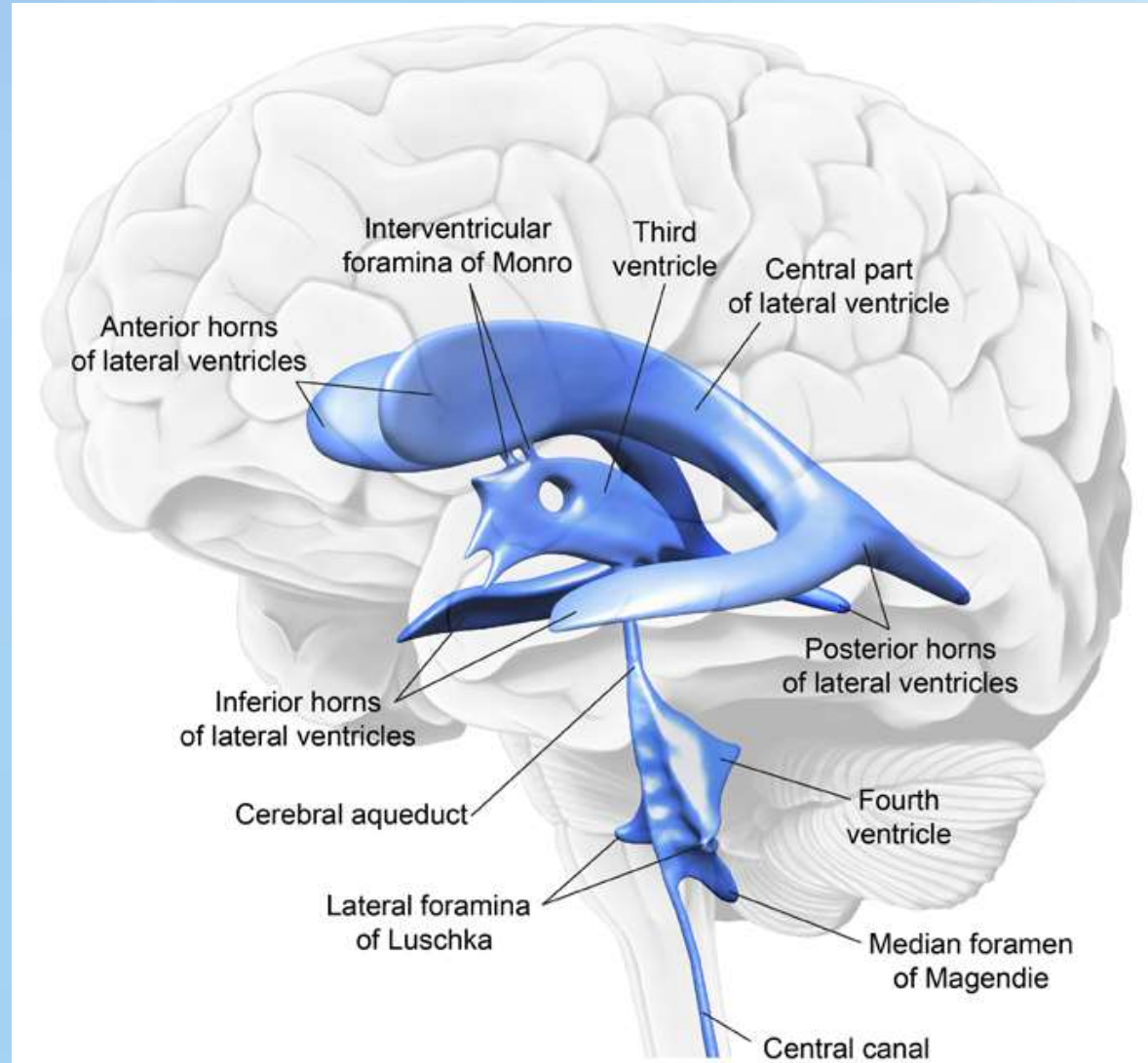
Pia mater continues as *filum terminale*

Dura mater terminates around S2 while the filum terminale continues into the coccygeal ligament

Lumbar cistern: subarachnoid space in the spinal cord, where the dura mater ends, filled with CSF

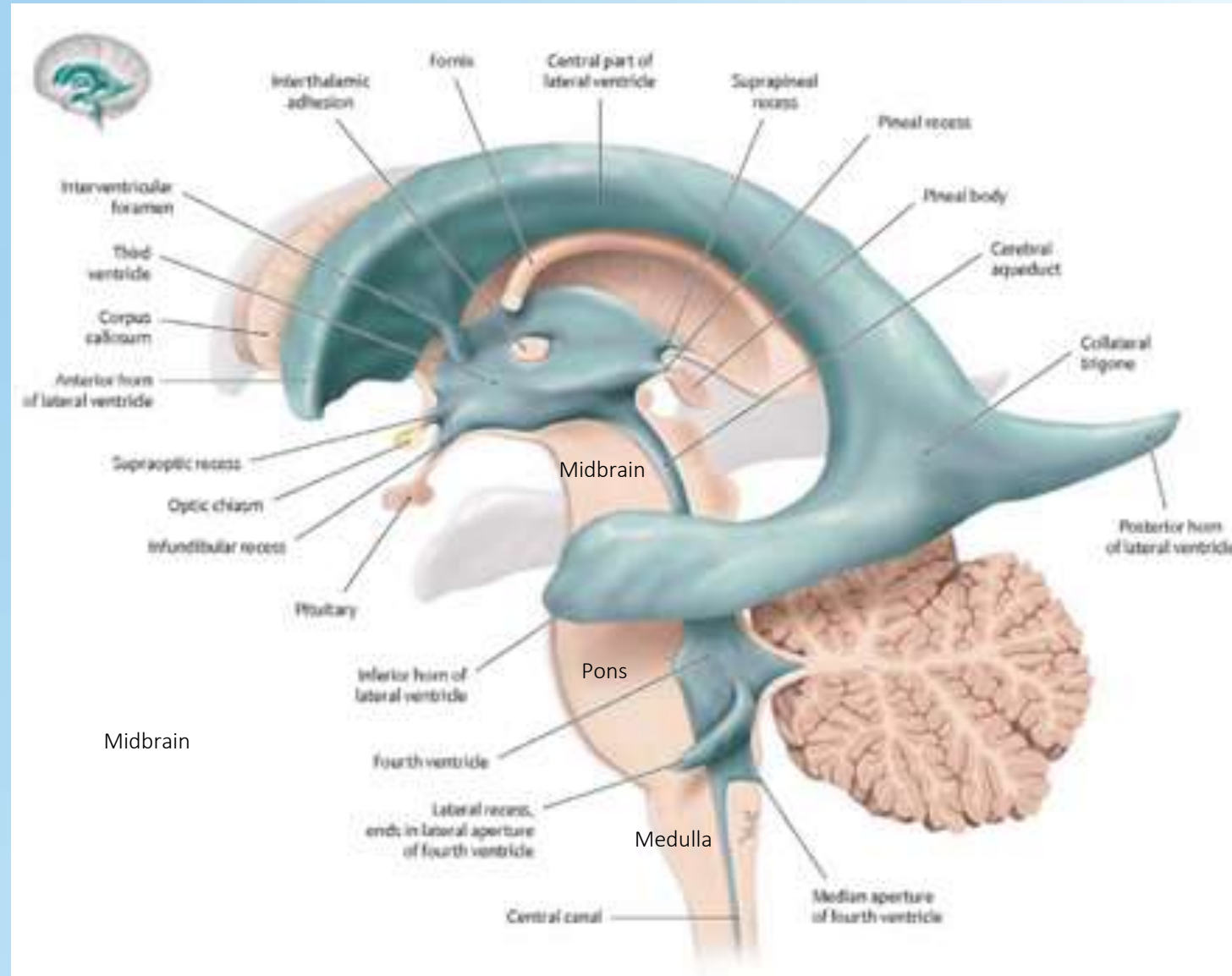


Ventricles

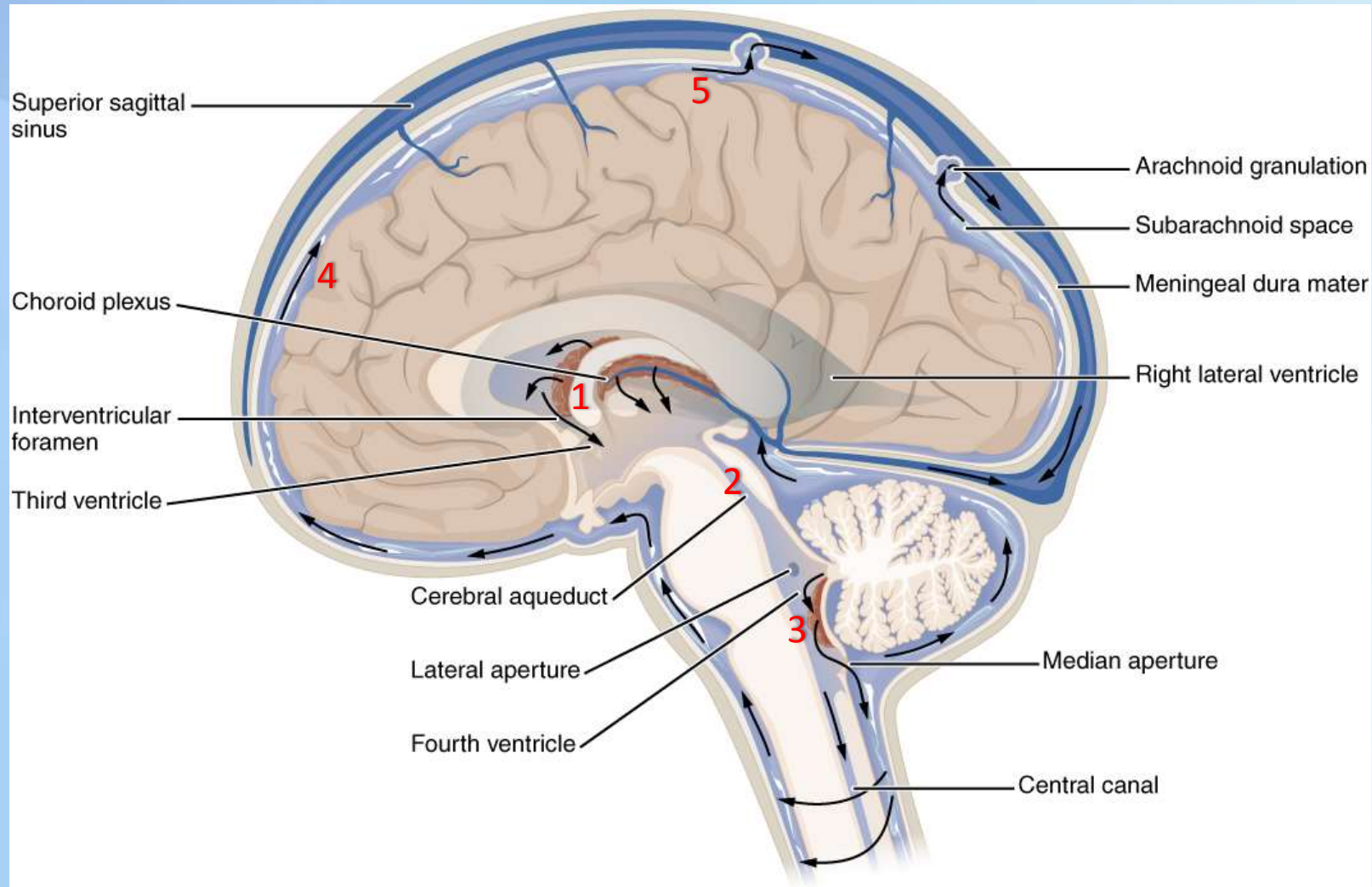


Ventricles

Brain Division	Corresponding Ventricle
Cerebrum + Diencephalon	Lateral Ventricles 3 rd Ventricle
Midbrain	Cerebral aqueduct
Pons Medulla (some) Cerebellum	4 th Ventricle
Spinal Cord	Central Canal



Flow of CSF

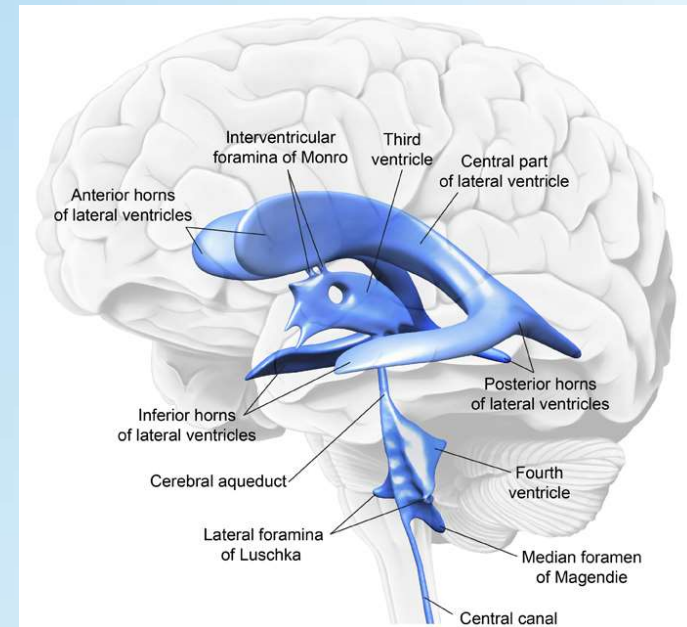


lateral → third → fourth → subarachnoid space → absorbed by arachnoid granulations into venous system

CSF Flow Mnemonic

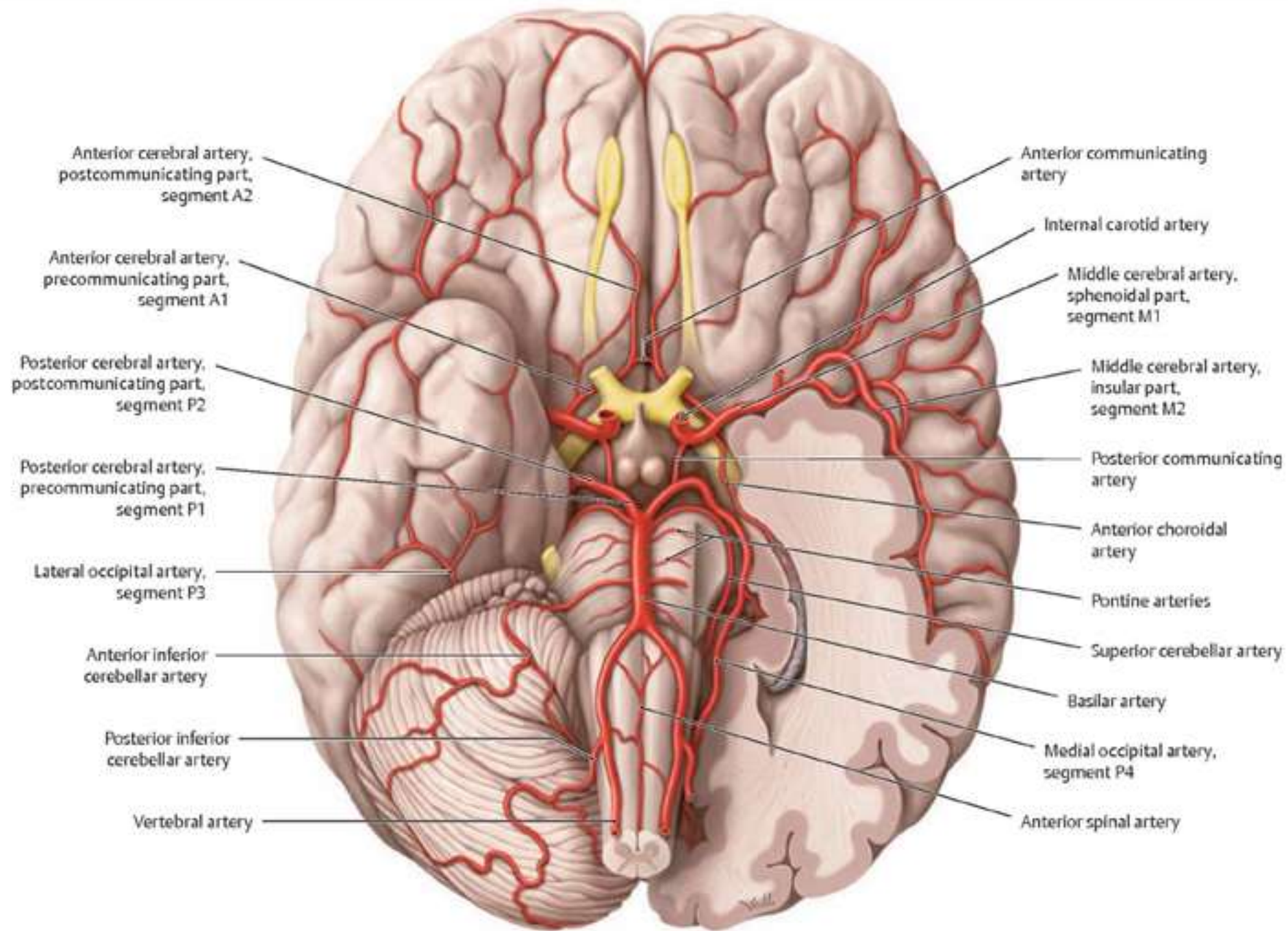
"Lady **Monro** has 3 **Aqueducts** that go to 4 **Luscious** and **Magical Subarachnoid** places."

1. **Lateral Ventricles**
2. **Foramina of Monro**
3. **3rd ventricle**
4. **Cerebral Aqueduct**
5. **4th ventricle**
6. **Foramina of Luschka & Foramen of Magendie**
7. **Subarachnoid Space**



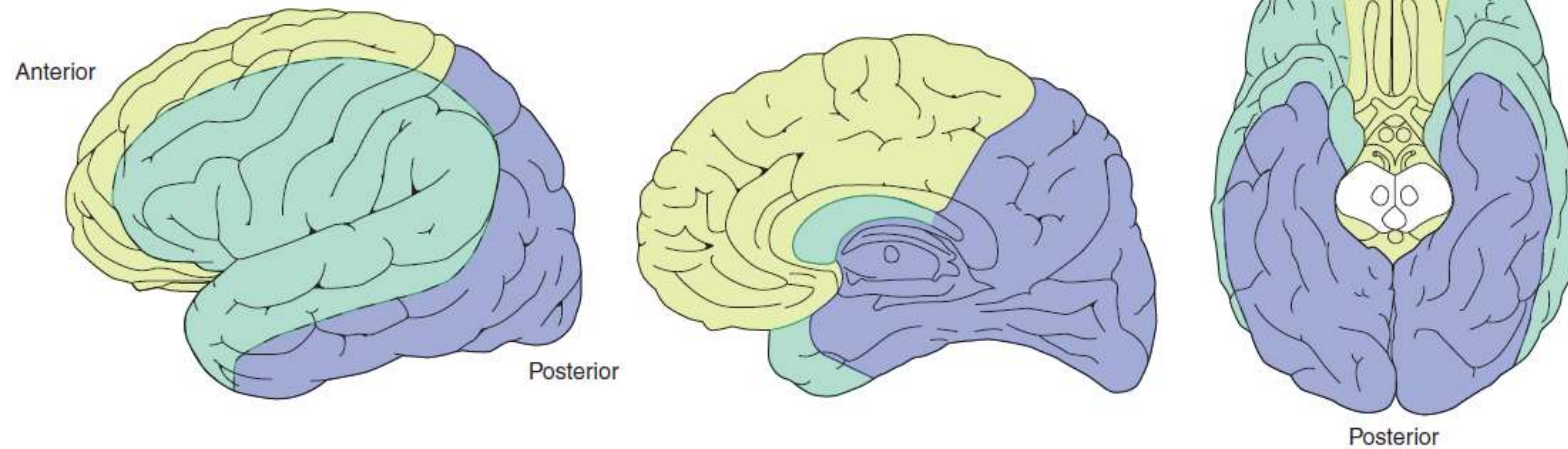
From here the CSF goes to the arachnoid granulations and into the superior sagittal sinus (filled with venous blood).

Blood Supply



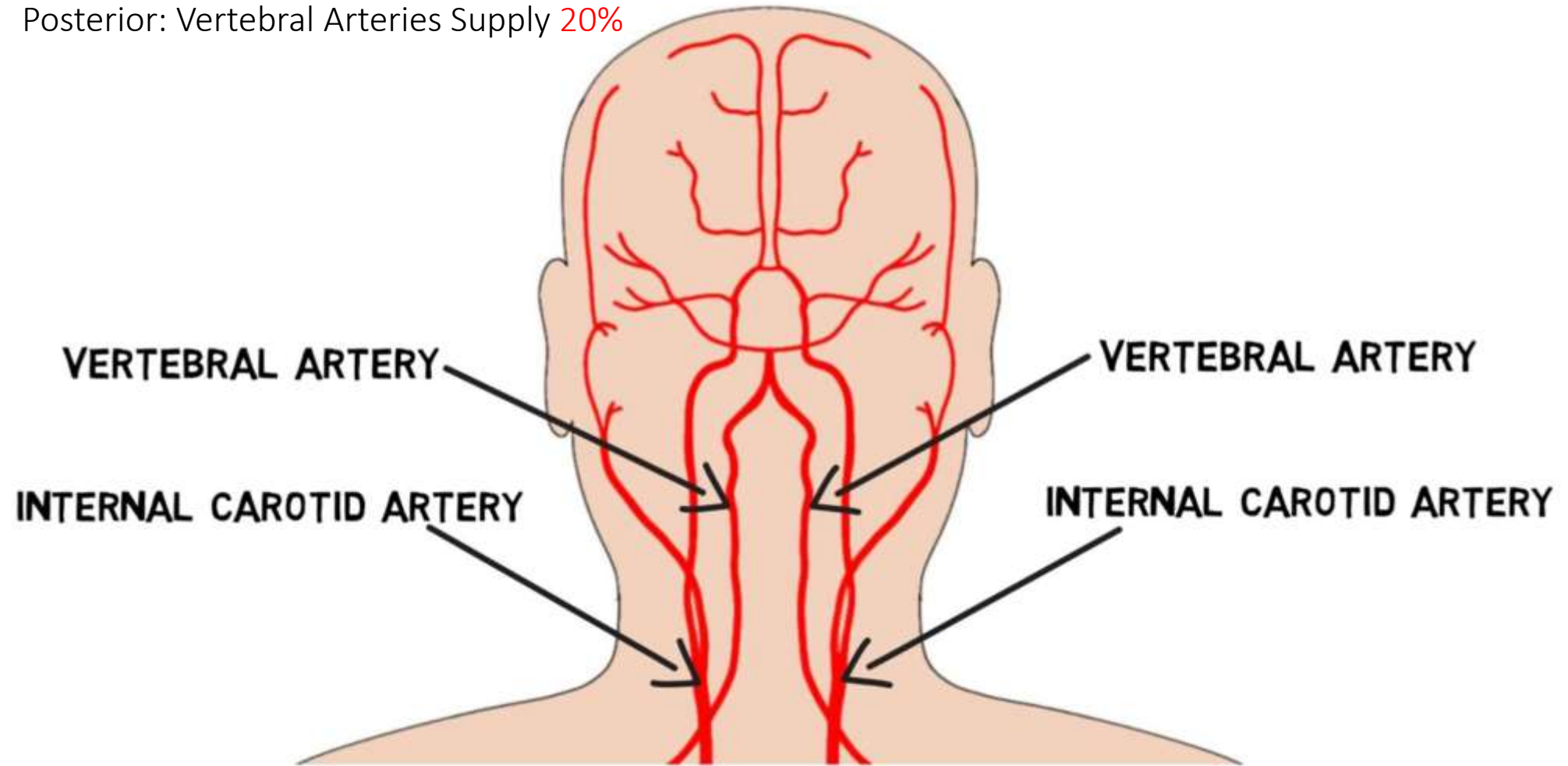
Cerebral arteries—cortical distribution

- Anterior cerebral artery (supplies anteromedial surface)
- Middle cerebral artery (supplies lateral surface)
- Posterior cerebral artery (supplies posterior and inferior surfaces)

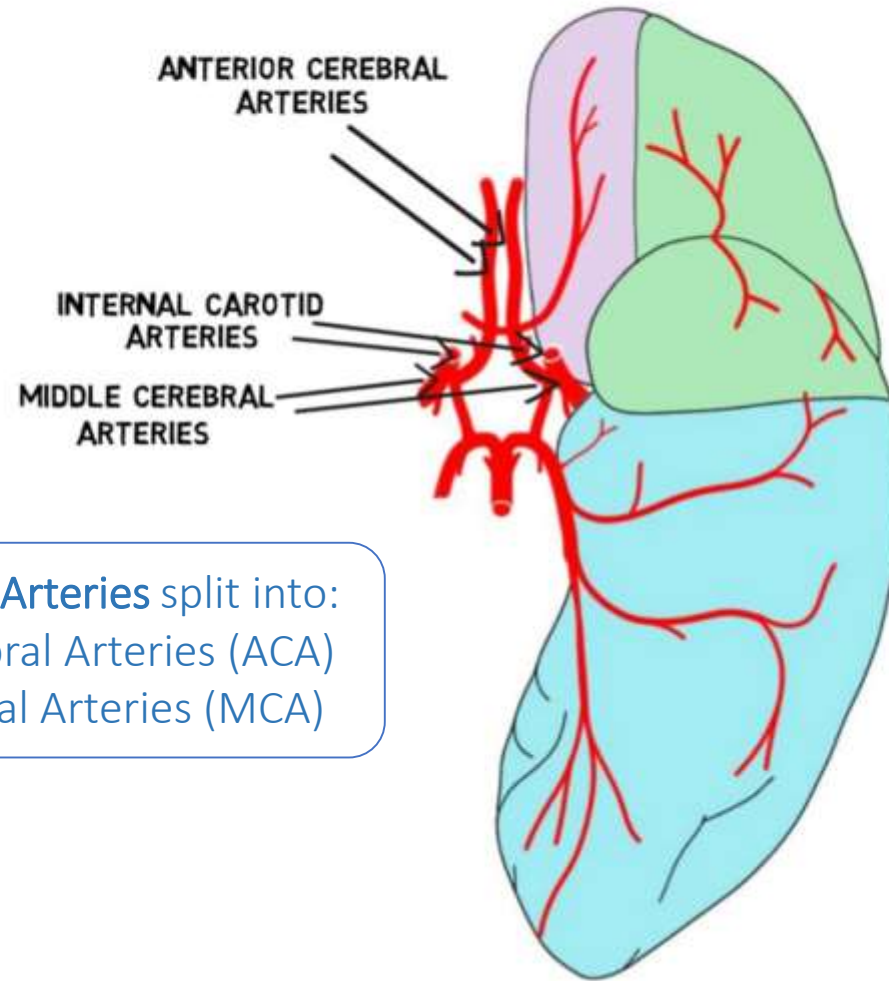


Anterior: Internal Carotid Arteries Supply 80%

Posterior: Vertebral Arteries Supply 20%



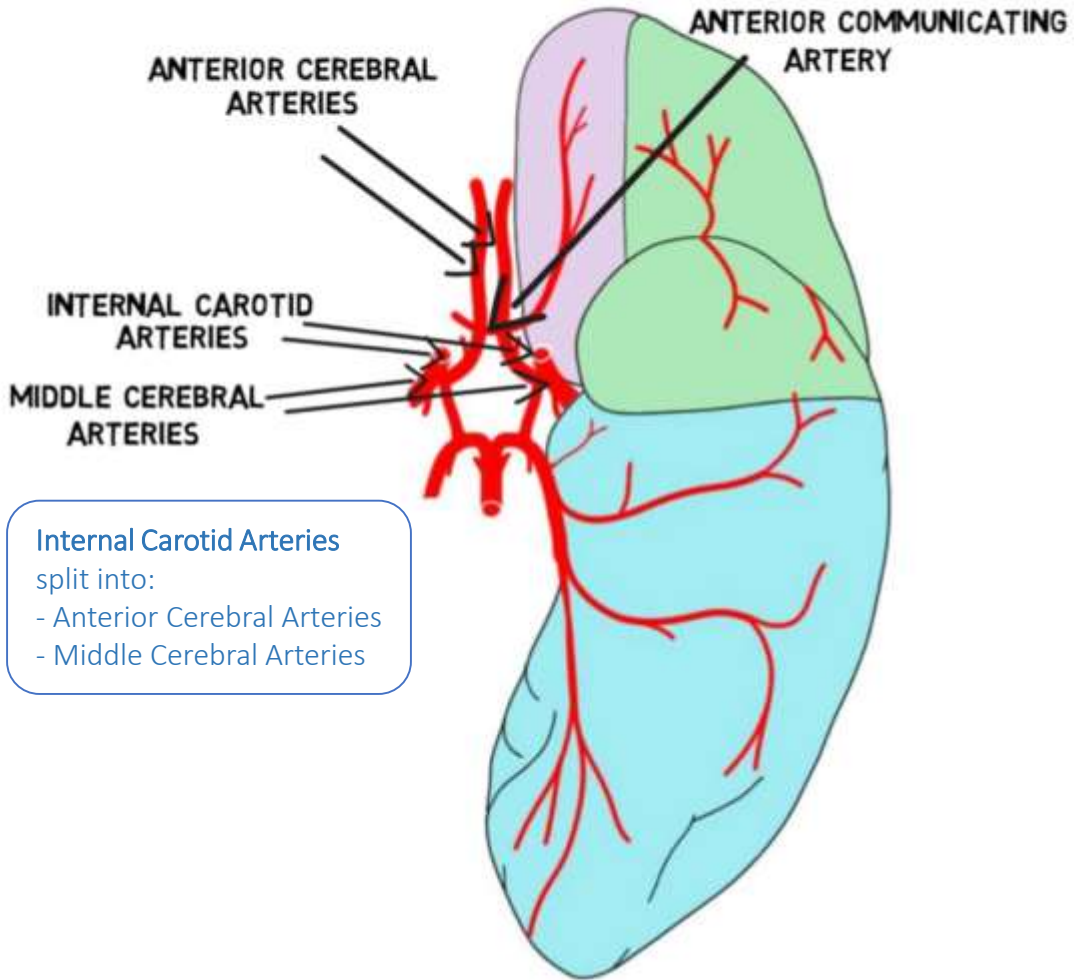
VIEW FROM BOTTOM OF BRAIN



Internal Carotid Arteries split into:

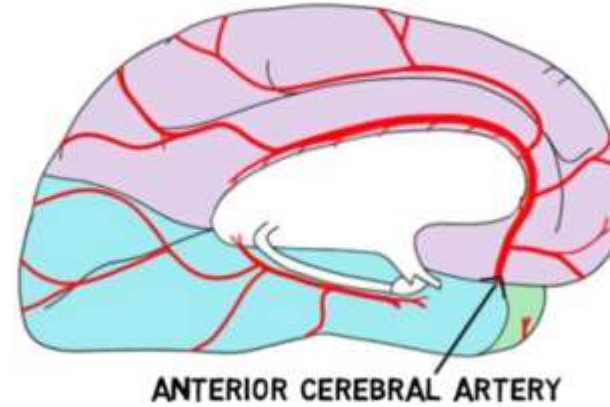
- Anterior Cerebral Arteries (ACA)
- Middle Cerebral Arteries (MCA)

VIEW FROM BOTTOM OF BRAIN

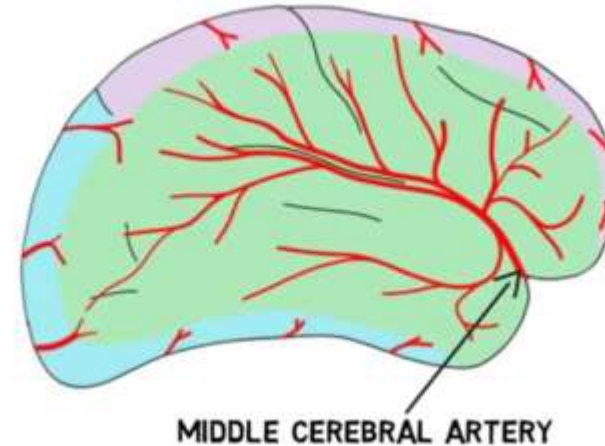


Internal Carotid Arteries
split into:
- Anterior Cerebral Arteries
- Middle Cerebral Arteries

■ = ANTERIOR CEREBRAL TERRITORY

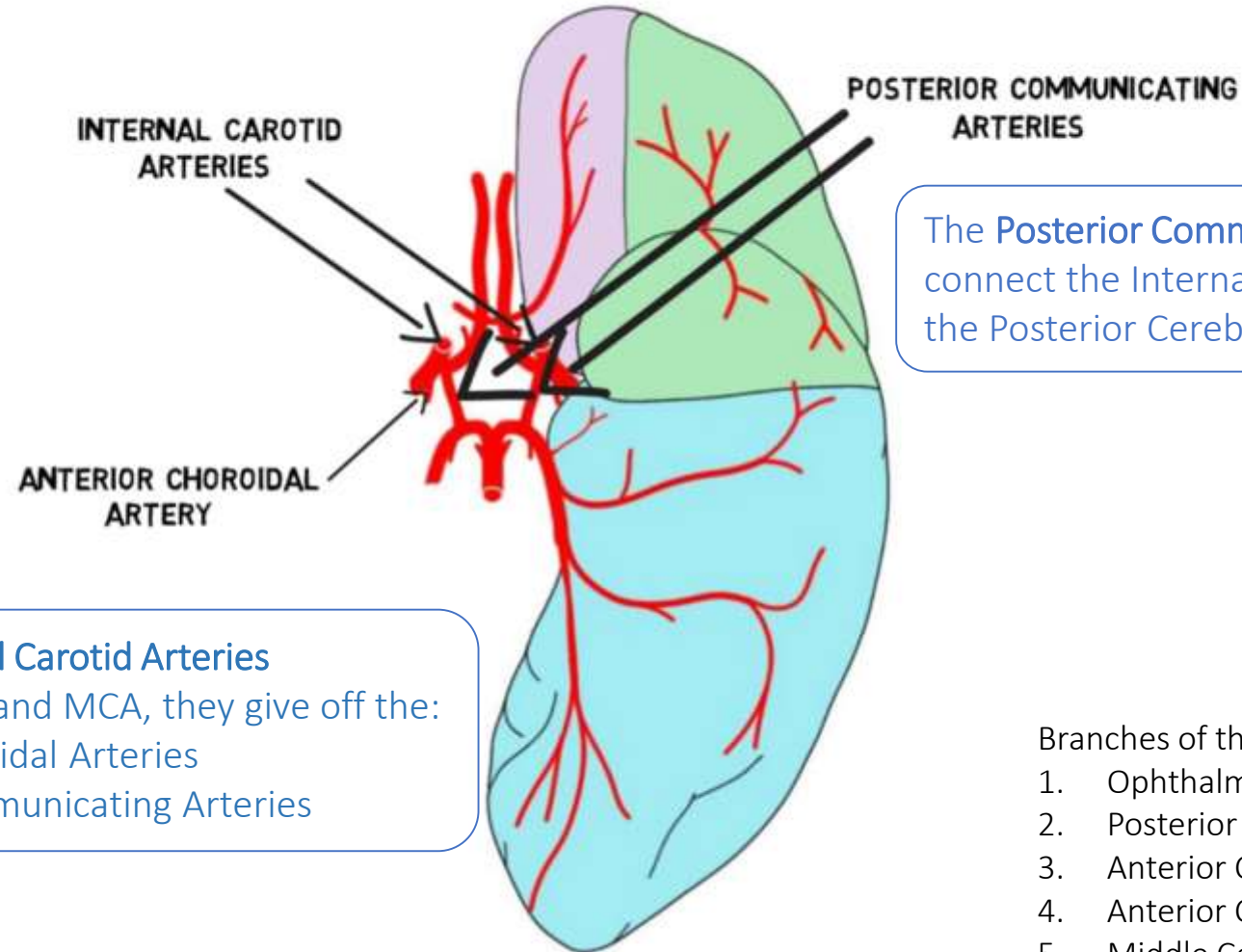


■ = MIDDLE CEREBRAL TERRITORY



Middle Cerebral Artery supplies the lateral part of the cortex.

VIEW FROM BOTTOM OF BRAIN



The Posterior Communicating Arteries connect the Internal Carotid Arteries to the Posterior Cerebral Arteries.

Before the **Internal Carotid Arteries** split into the ACA and MCA, they give off the:

- Anterior Choroidal Arteries
- Posterior Communicating Arteries

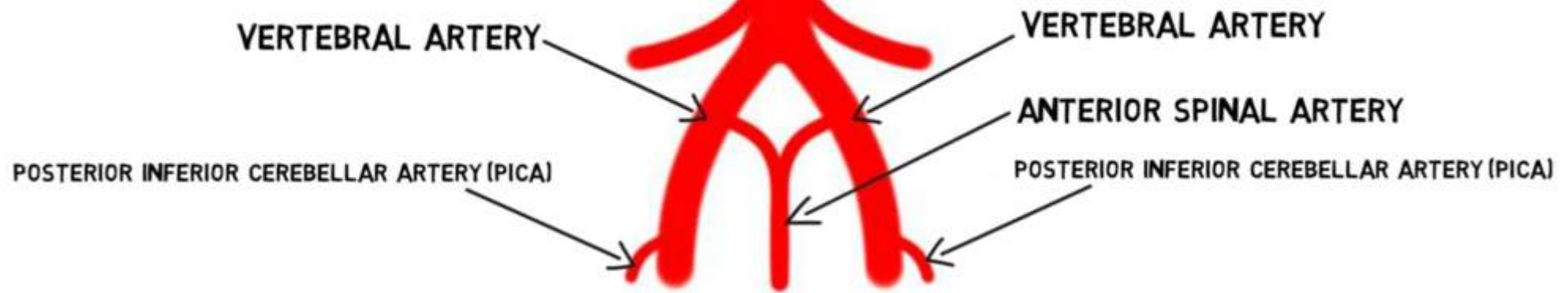
Branches of the **Internal Carotids**:

1. Ophthalmic Artery
2. Posterior Communicating Artery
3. Anterior Choroidal Artery
4. Anterior Cerebral Artery
5. Middle Cerebral Artery

The Vertebral Arteries give off the **Posterior Inferior Cerebellar Arteries (PICA)**.
- PICA supply the inferior surface of the cerebellum

Vertebral Arteries give off the **Anterior Spinal Artery** (to supply the anterior spinal cord).

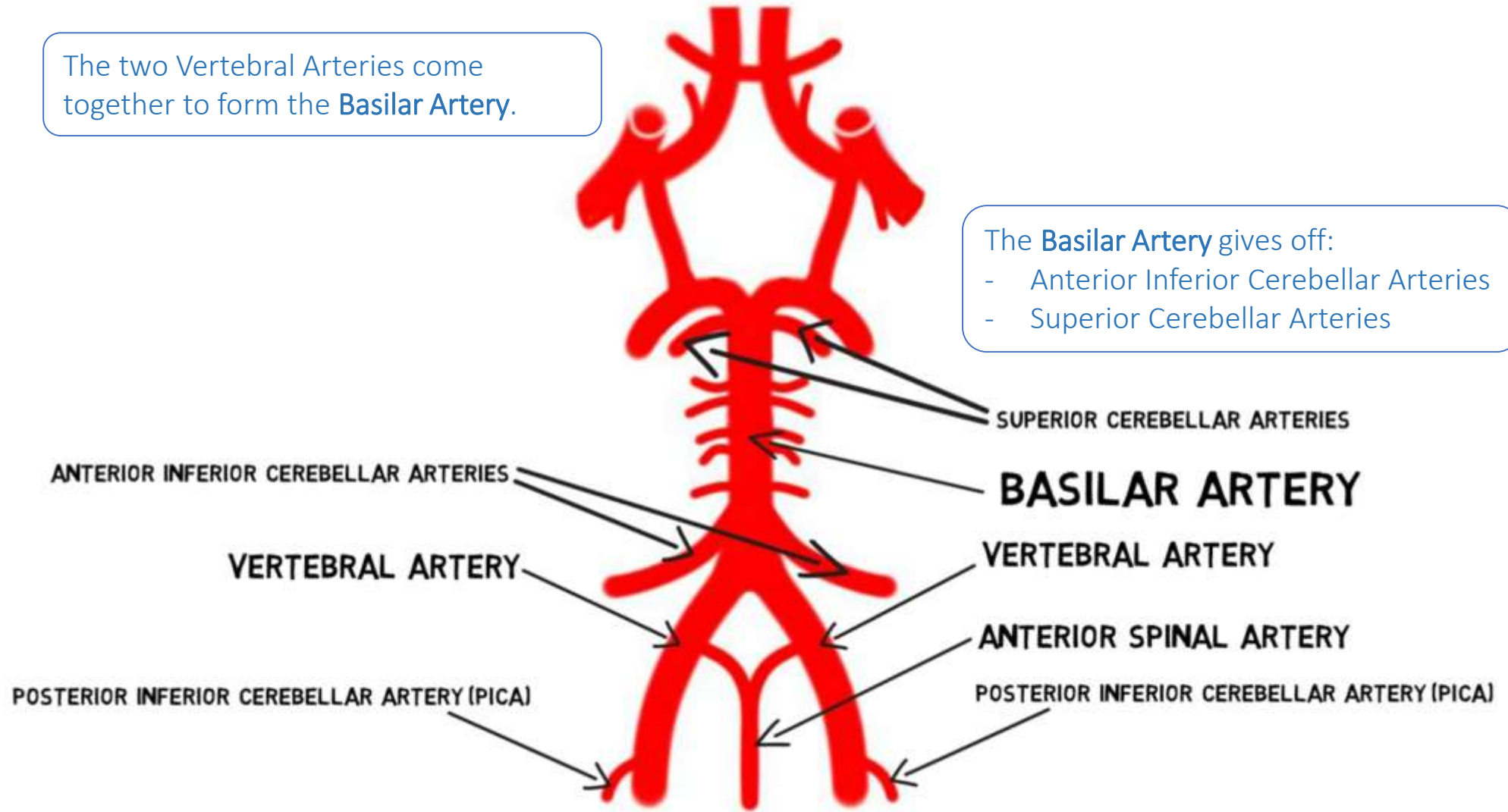
PICA usually give off the **Posterior Spinal Artery** (to supply posterior spinal cord).



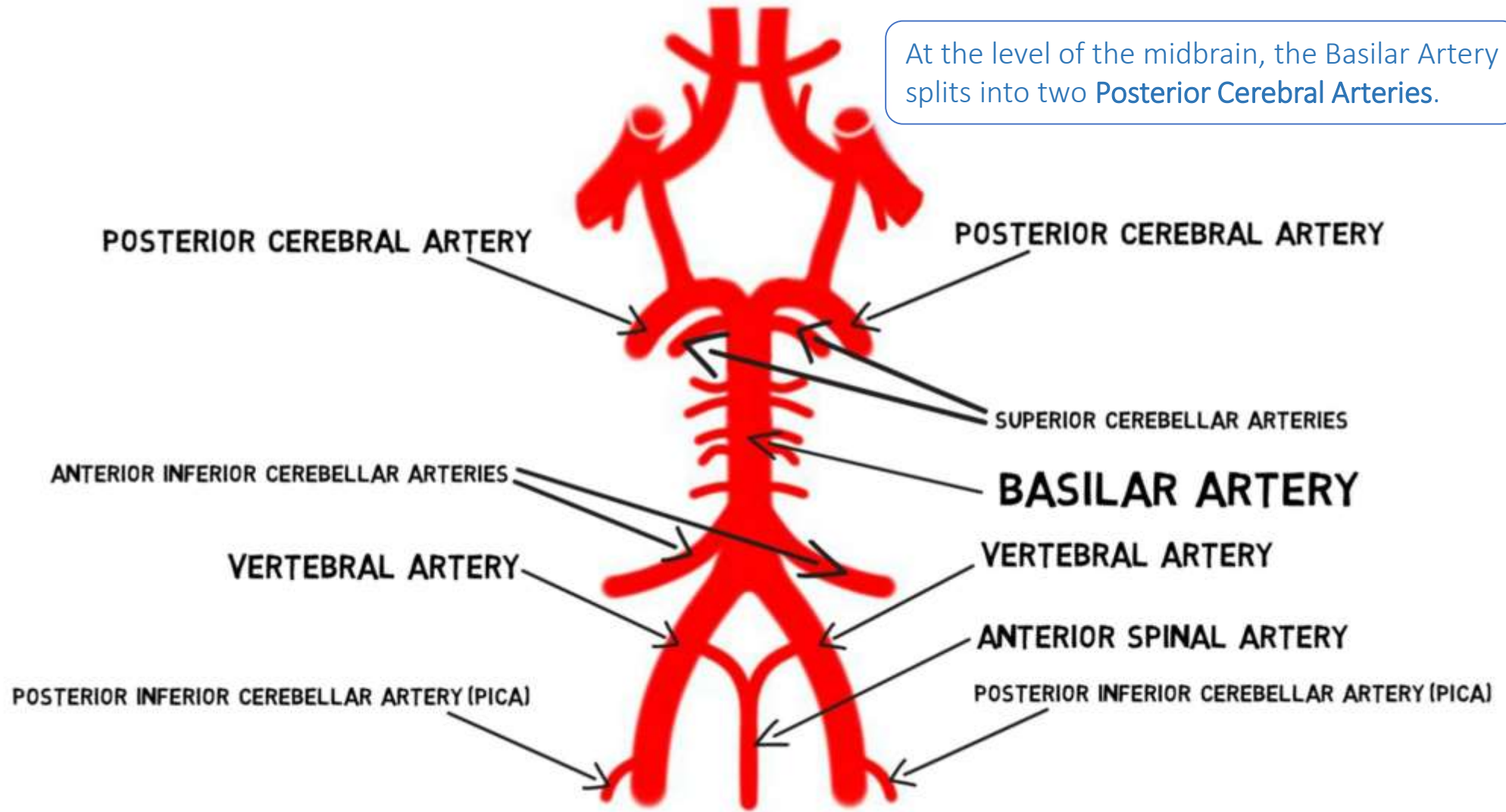
The two Vertebral Arteries come together to form the **Basilar Artery**.

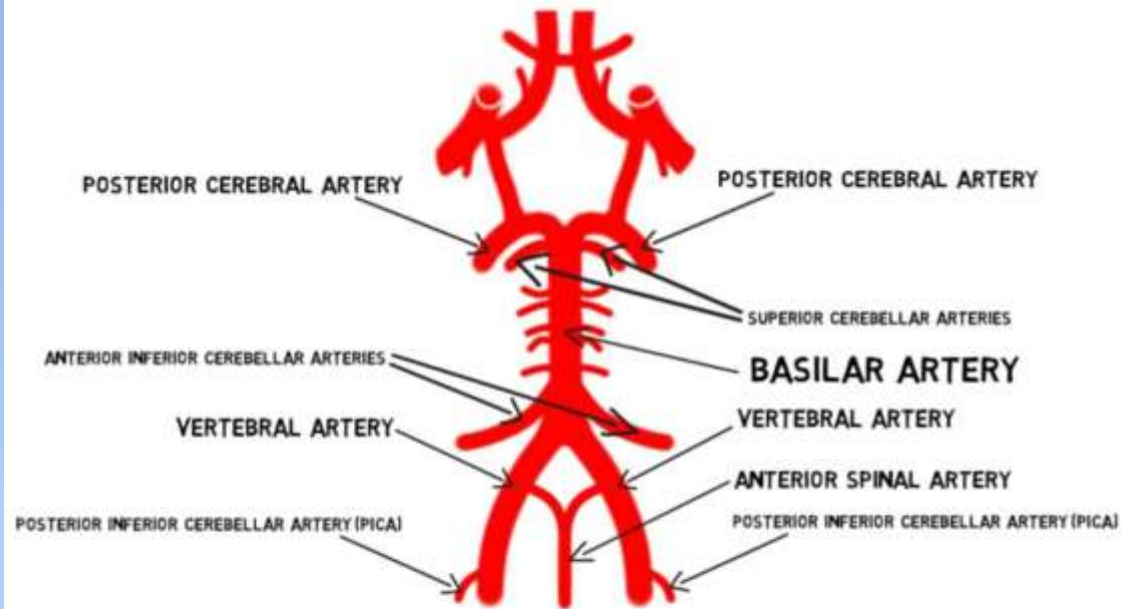
The **Basilar Artery** gives off:

- Anterior Inferior Cerebellar Arteries
- Superior Cerebellar Arteries

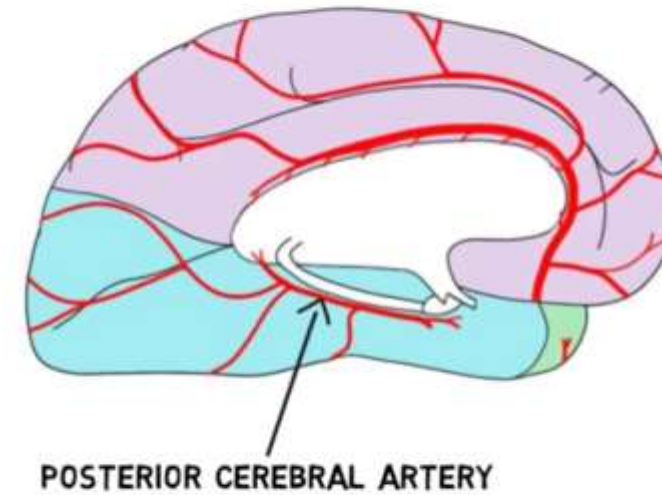


At the level of the midbrain, the Basilar Artery splits into two Posterior Cerebral Arteries.



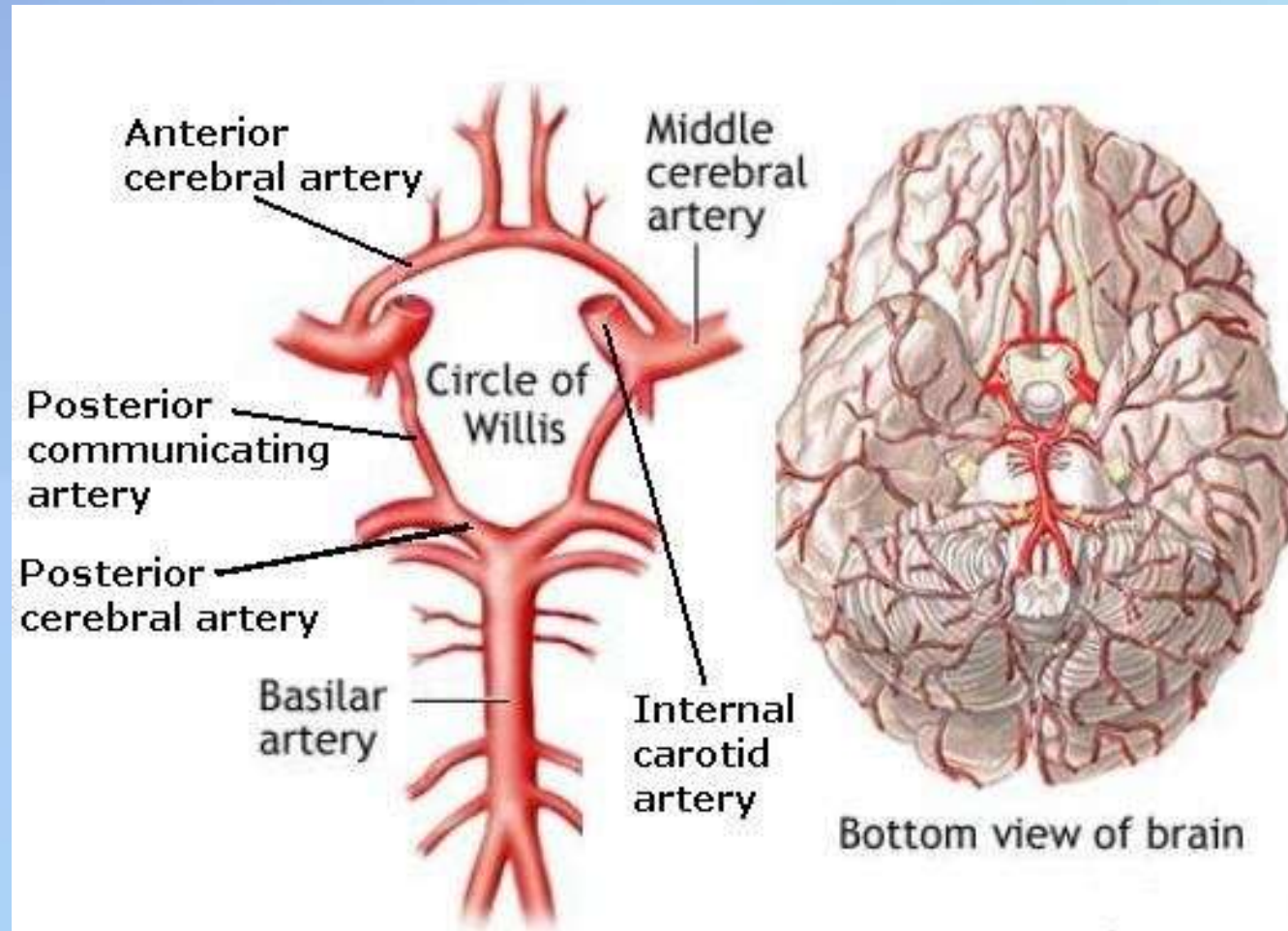


 = POSTERIOR CEREBRAL TERRITORY



The **Posterior Cerebral Arteries** supply the medial and inferior surface of the occipital and temporal lobes.

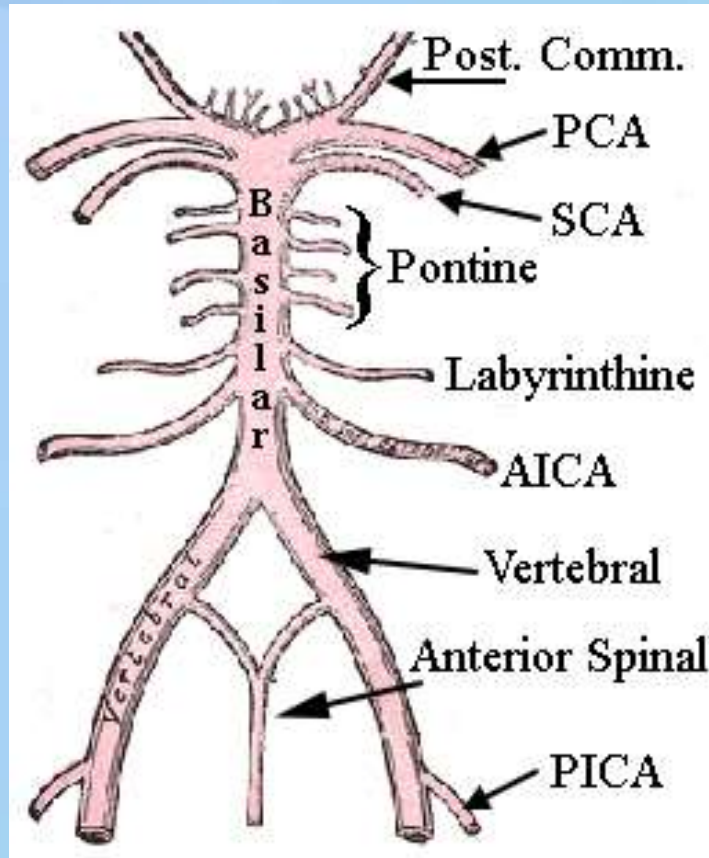
Circle of Willis



Formed by the:

1. Internal carotid
2. Anterior cerebral
3. Anterior communicating
4. Posterior cerebral
5. Posterior communicating

Basilar Artery Branches



Branches of the **Basilar Artery**:

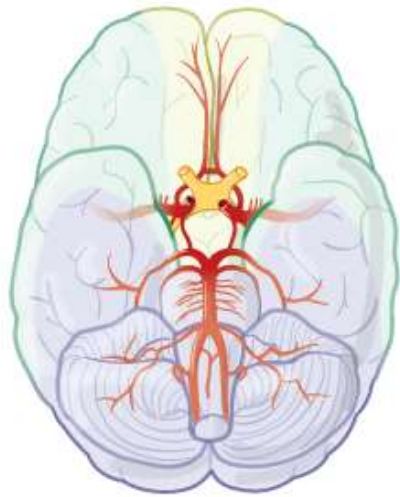
1. Pontine
2. Labyrinthine
3. Anterior-Inferior Cerebellar
4. Superior Cerebellar
5. Posterior Cerebral

“PLAISP”

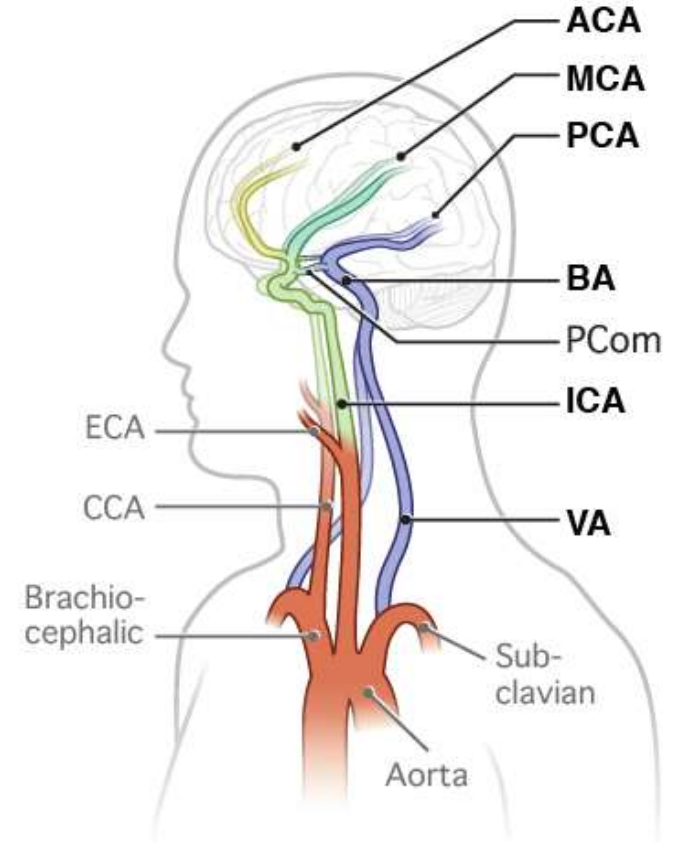
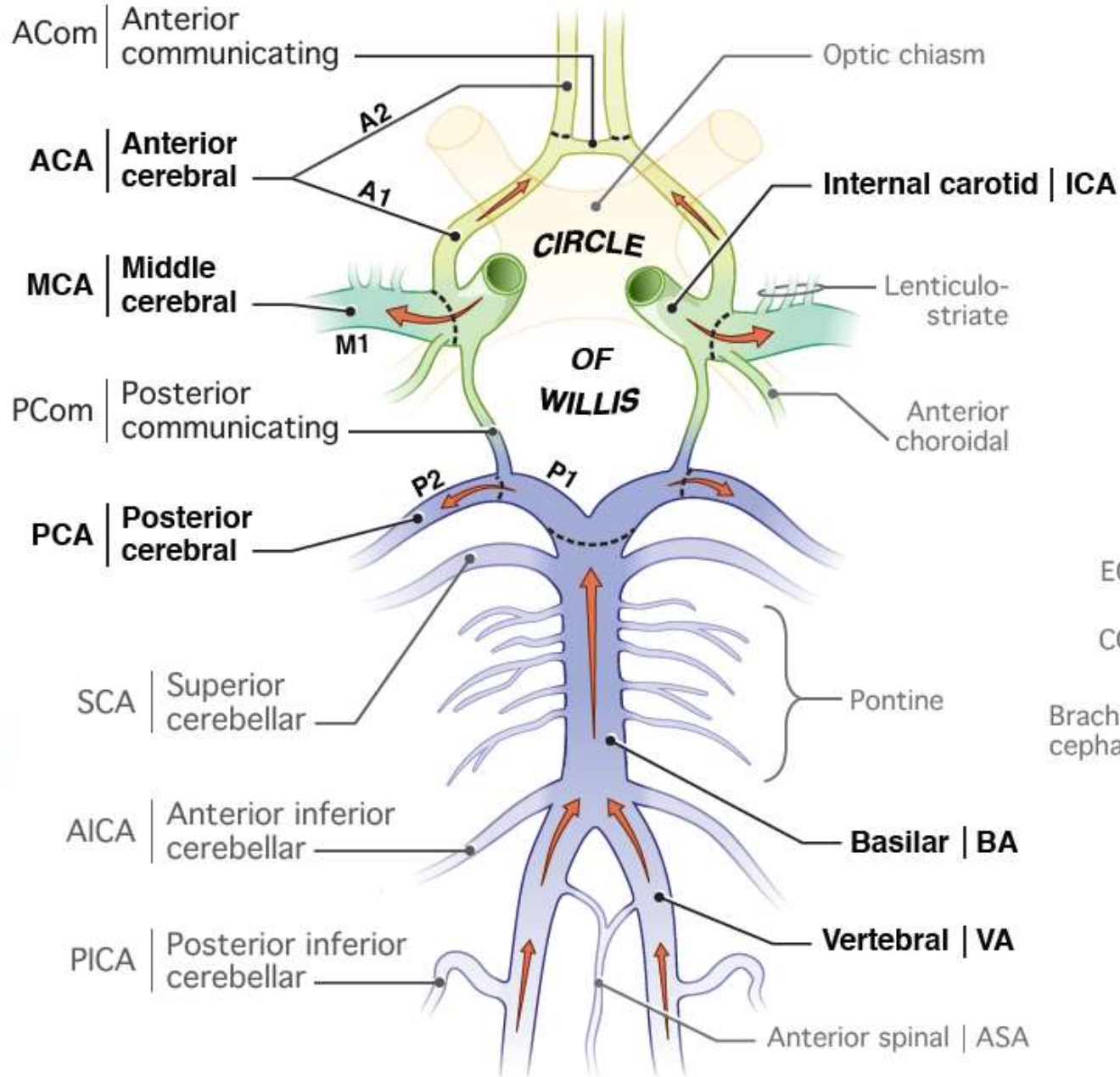
Circle of Willis

System of anastomoses between anterior and posterior blood supplies to brain.

- Anterior circulation
- ACA
- ICA
- MCA
- Posterior circulation



INFERIOR VIEW



OBLIQUE-LATERAL VIEW

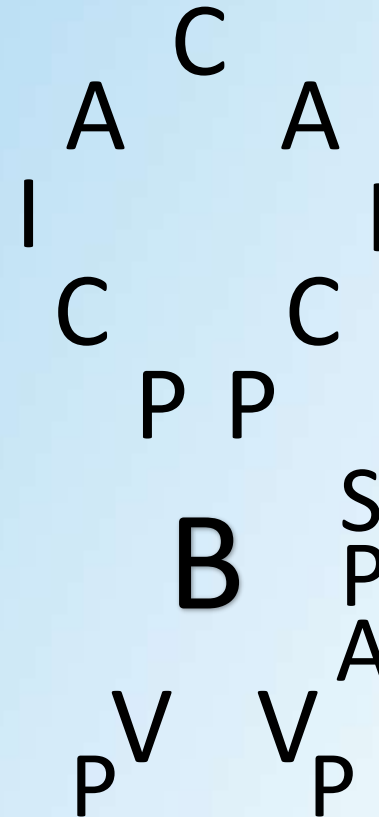


- C Anterior **C**ommunicating
- A Anterior Cerebral
- I Internal Carotid
- C Posterior **C**ommunicating

- P Posterior Cerebral
- B Basilar

- S Superior Cerebellar
- P Pontine
- A Anterior Inferior Cerebellar

- V Vertebral
- P Posterior Inferior Cerebellar



For description, check out:
https://www.youtube.com/watch?v=_U0U1c7i4xM

Venous Sinuses

