Introduction to Neuroanatomy

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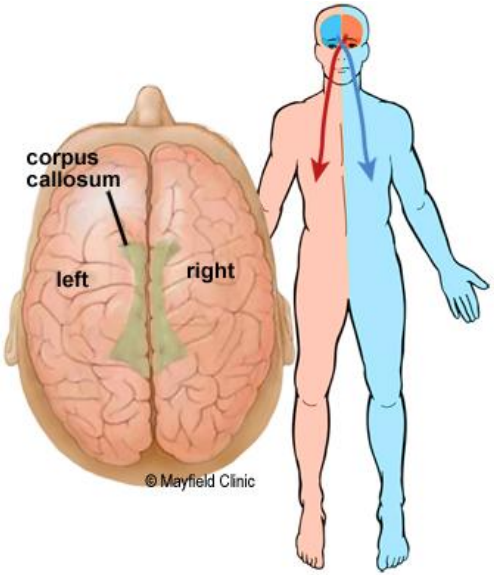


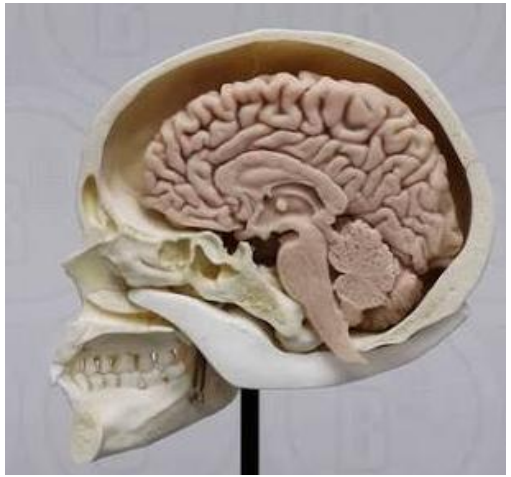
Agenda

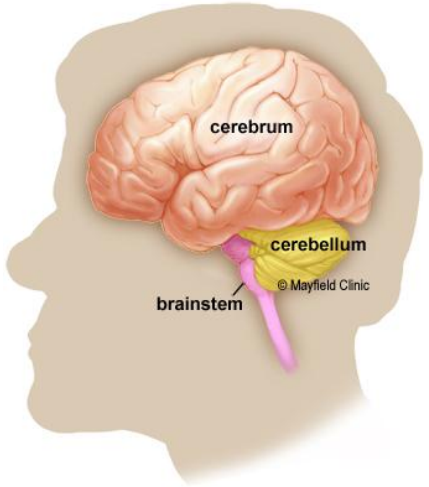
- Identify major neuroanatomic structures relevant to stroke, including the cerebral lobes, brainstem, cerebellum, and major motor and sensory pathways.
- Describe the major cerebral vascular territories supplied by the anterior cerebral artery (ACA), middle cerebral artery (MCA), posterior cerebral artery (PCA), and vertebrobasilar circulation.
- Correlate common neurologic deficits with lesion location, including motor weakness, sensory loss, aphasia, neglect, visual field deficits, ataxia, and cranial nerve abnormalities.
- Apply basic neuroanatomic localization to a patient presenting with acute neurologic deficits to support rapid stroke recognition, communication, and interdisciplinary care.

The Basics

- Protected by the skull, three meningeal layers, and cerebrospinal fluid.
- Three major divisions: cerebrum, cerebellum, and brainstem.
- The cerebrum has right and left hemispheres, connected by the corpus callosum.

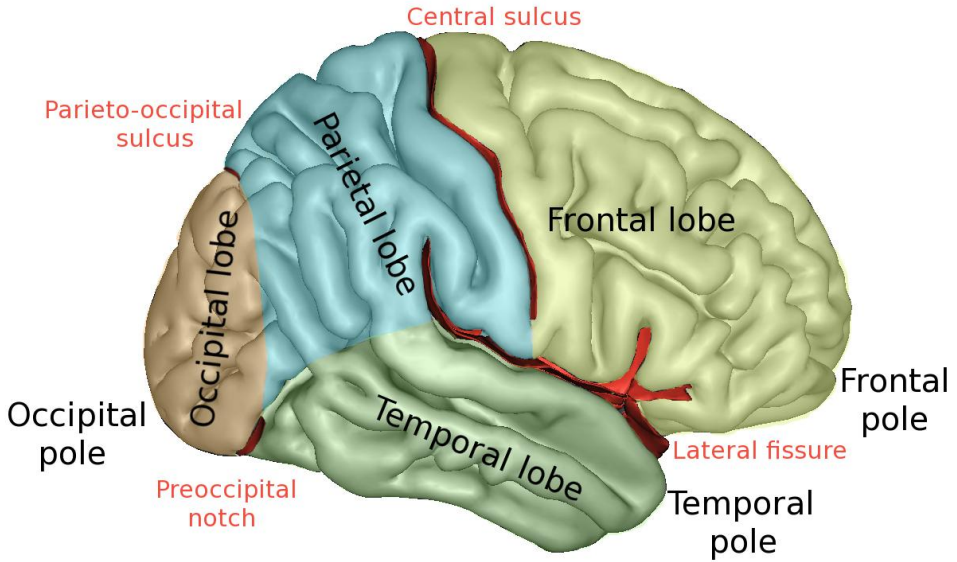






The Basics

- Each hemisphere has four main surface lobes: frontal, parietal, temporal, and occipital.
- The cerebral surface has folds (gyri) and grooves (sulci) that increase its surface area.
- The brainstem connects the brain to the spinal cord; together, the brain and spinal cord form the central nervous system.



Cerebrovascular System

- Internal Carotid
  - Forms ophthalmic, ACA, MCA
- Anterior Cerebral
  - Supplies frontal lobe
- Middle Cerebral
  - Largest branch off of ICA
  - Supplies lateral hemispheres, internal capsule
- Posterior Cerebral
  - Supplies inferior and lateral surface of temporal and occipita
- Posterior Communicating
  - Supplies thalamus, hypothalamus, optic chiasm
- Basilar
  - Supplies cerebellum, brainstem
  - Formed from two vertebral arteries
- Vertebral
  - Spinal arteries

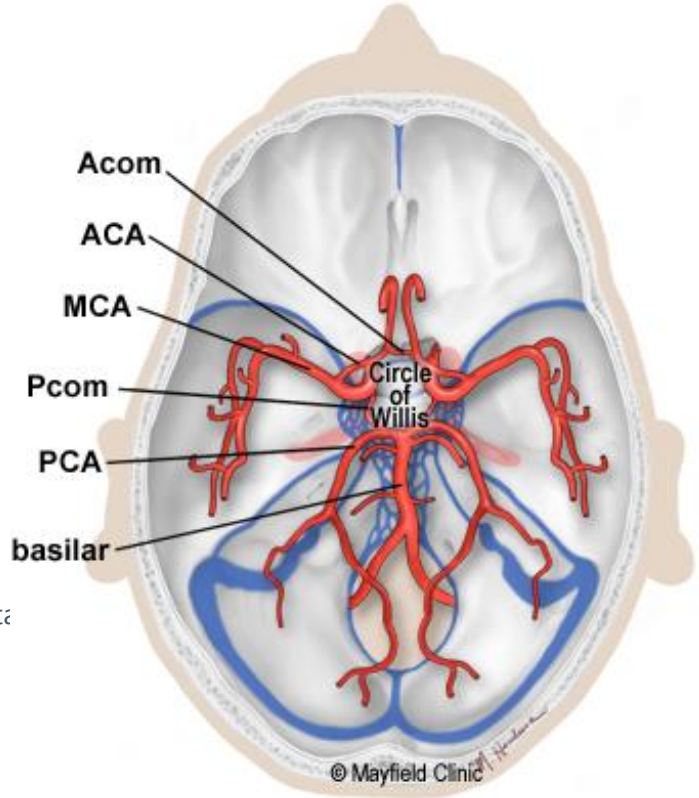
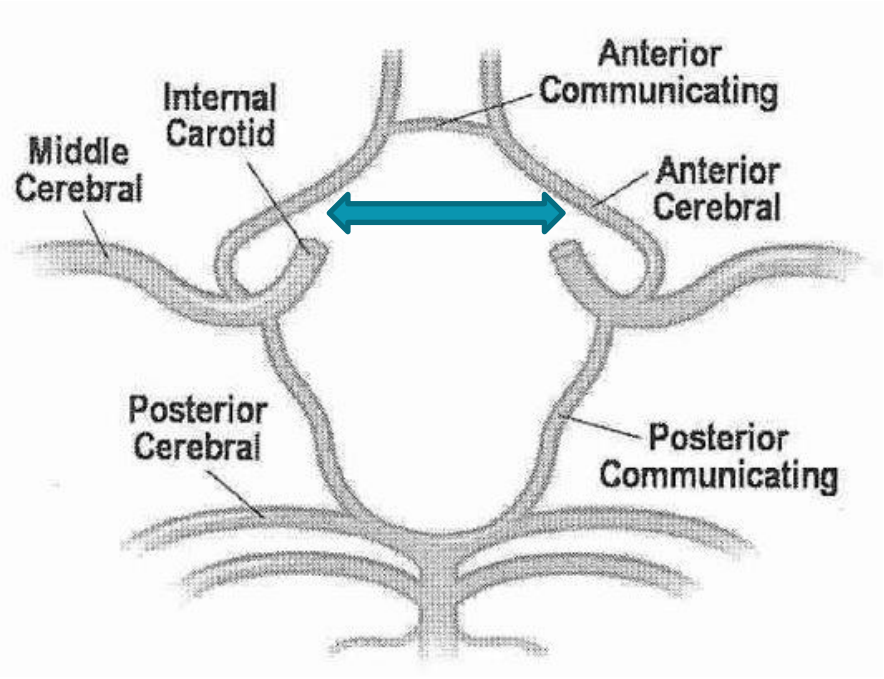


Illustration by Tonya Hines, CMI. © Mayfield Clinic. Source: *Anatomy of the brain*.

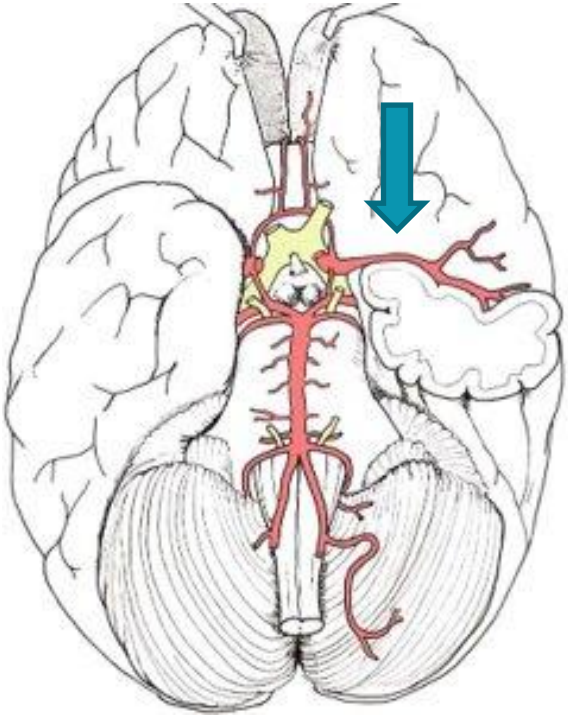
Anterior Cerebral Artery

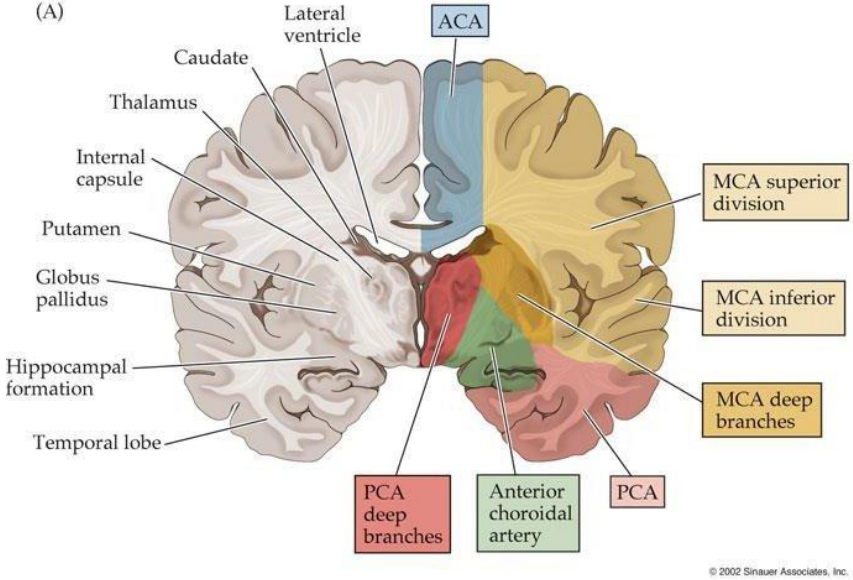
- Primarily supplies the medial and superior aspects of the frontal and parietal lobes



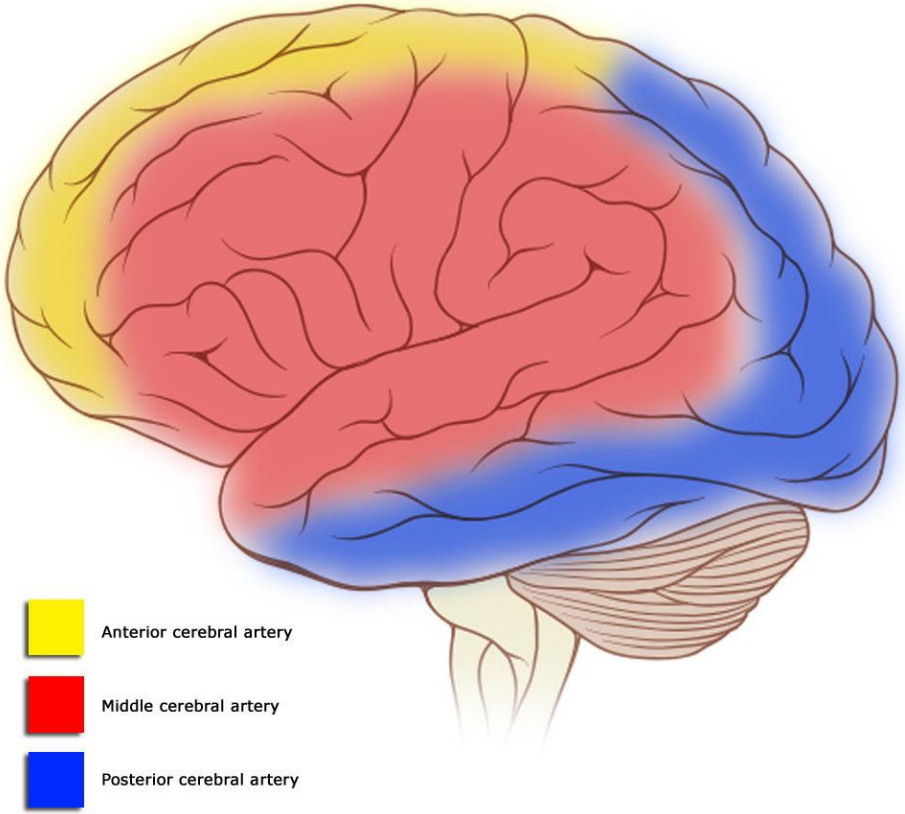
Middle Cerebral Artery (MCA)

- 2/3 of ischemic strokes
- MCA stroke can involve the frontal, temporal, and parietal lobes





Cortical vascular territories

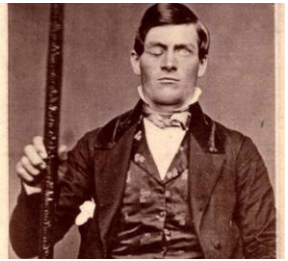


Frontal Lobe

- Prefrontal networks support planning, inhibition, judgment, and initiation.
- Dominant frontal language network supports fluent language production.
- Primary motor cortex initiates voluntary movement.

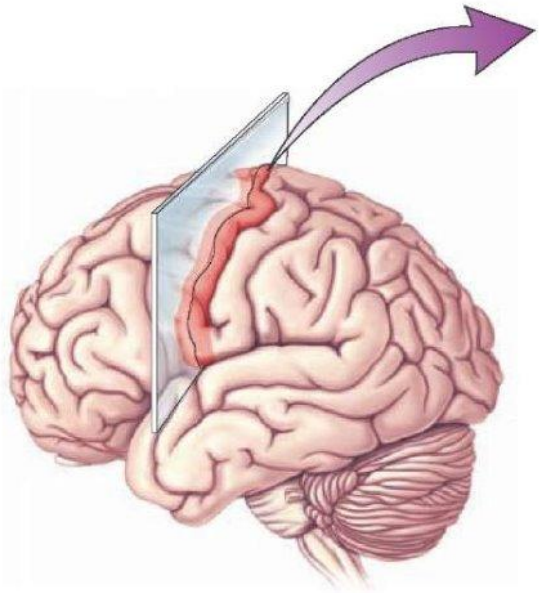


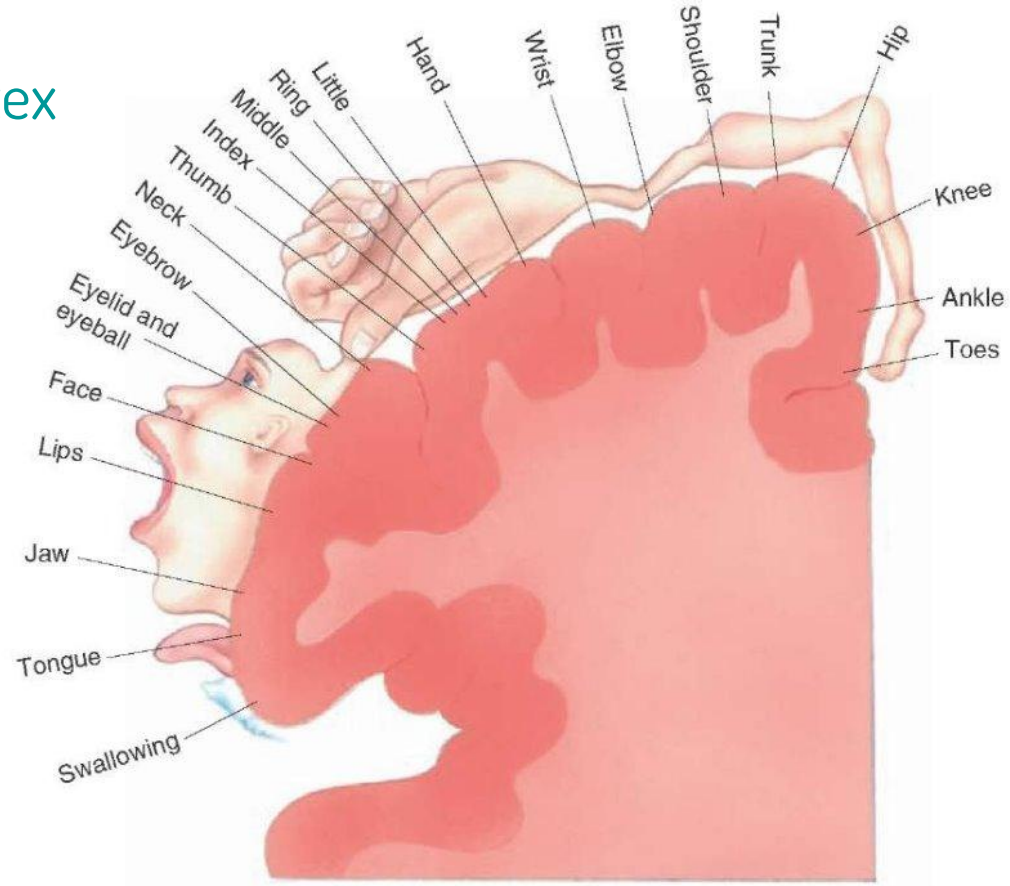


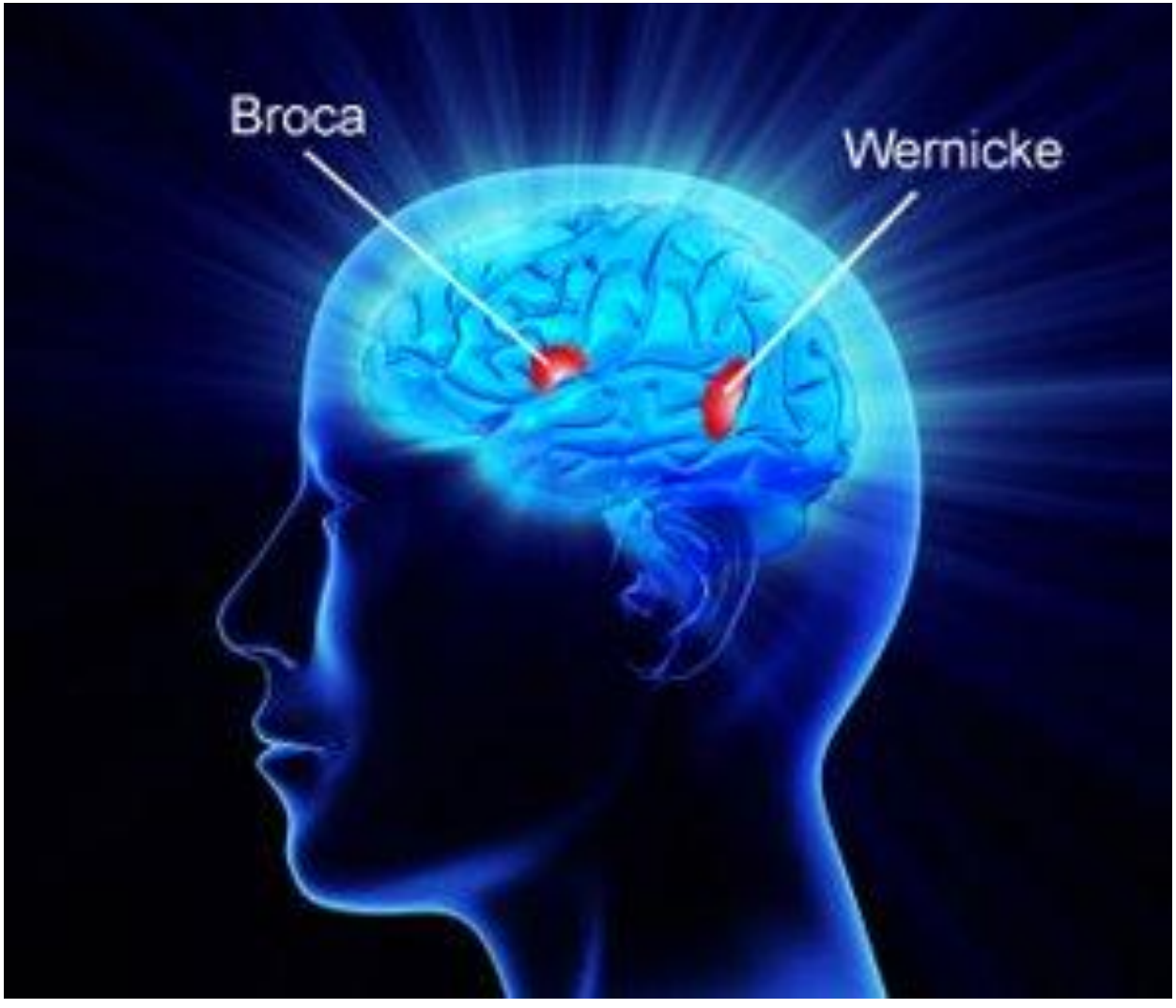


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Frontal Lobe: Motor Cortex



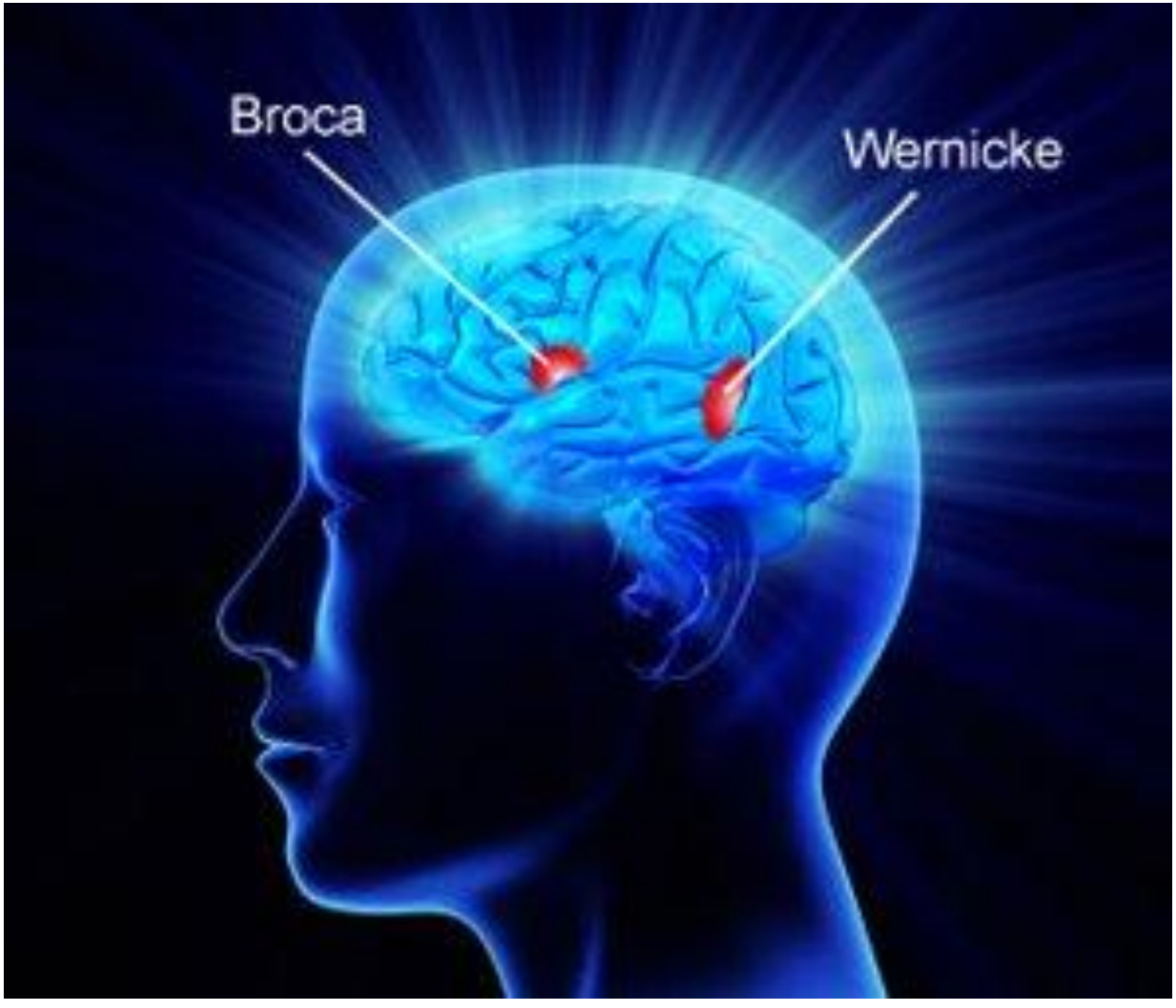



Broca
Wernicke

Temporal Lobe

- Auditory cortex processes sound.
- Posterior temporal networks contribute to language comprehension in the dominant hemisphere
- Medial temporal structures support new memory formation.
- Visual and facial recognition

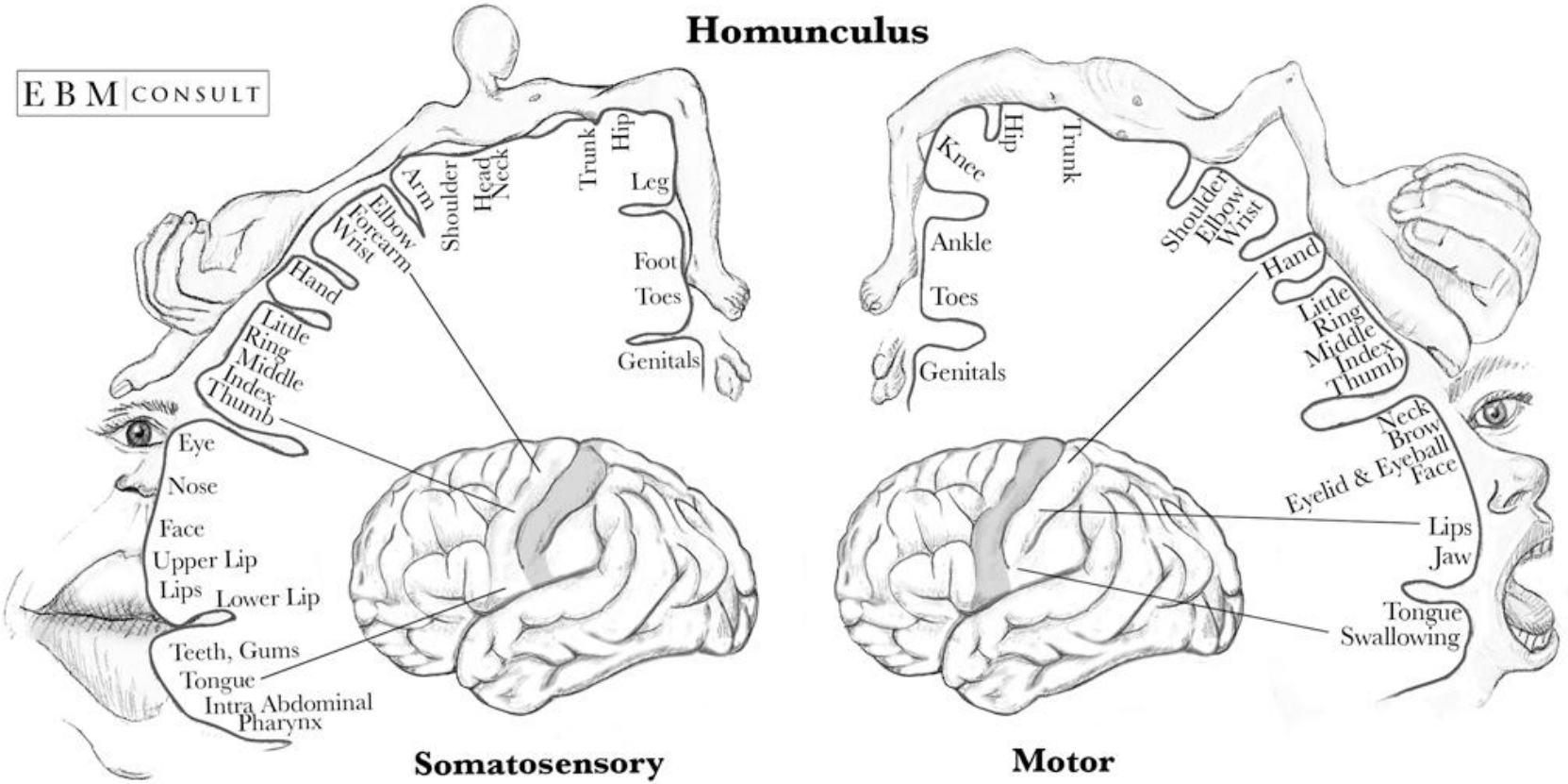



Broca
Wernicke

Parietal Lobe

- Primary sensory cortex receives information from the opposite body.
- Association networks integrate body position and spatial information.
- Learned movements: writing
- Dominant parietal network injury may impair skilled actions, writing, or calculation.

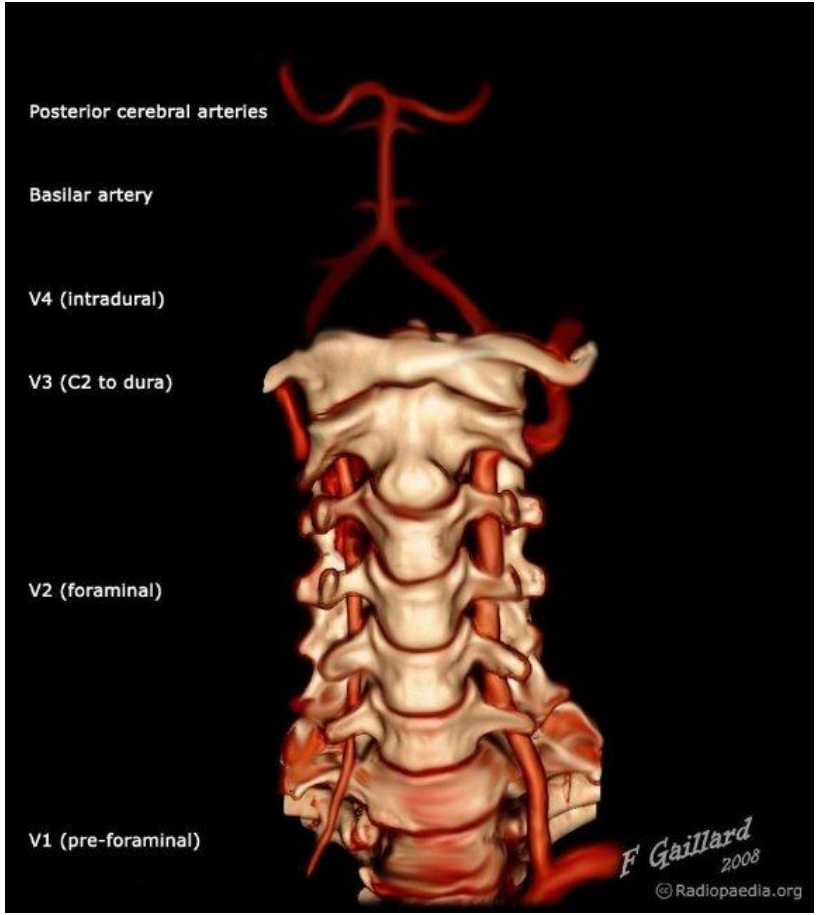




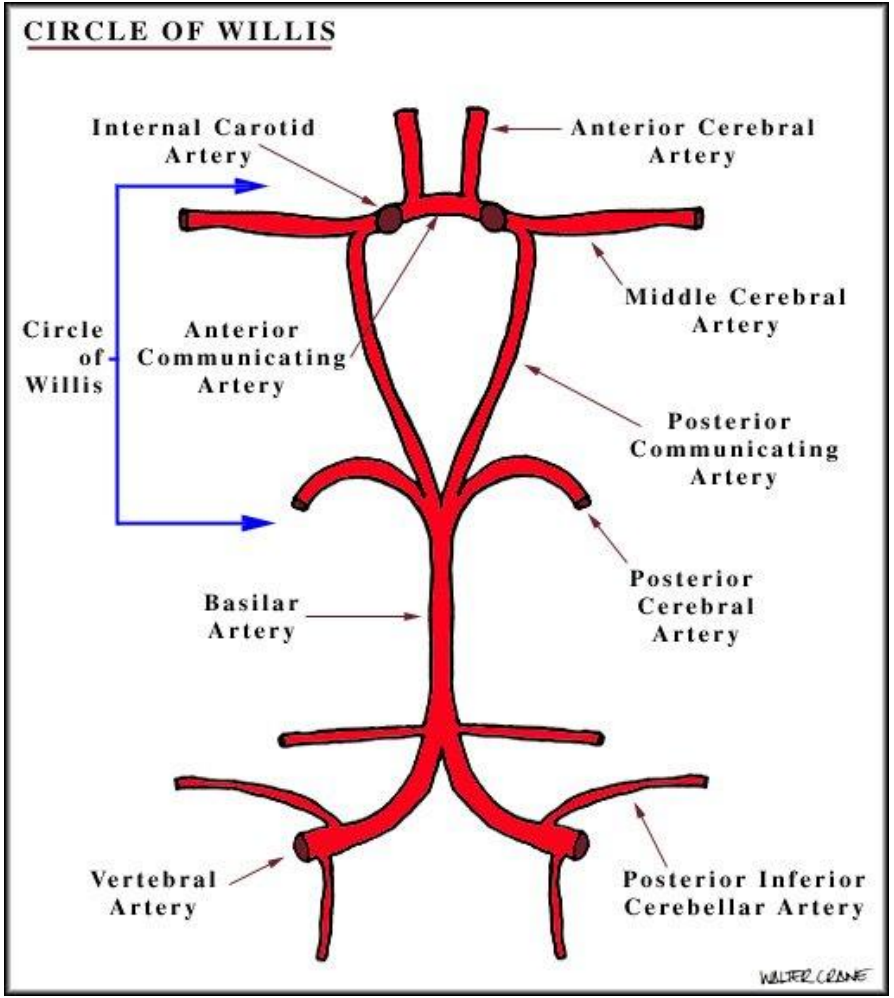
(EBM Consult,2015)

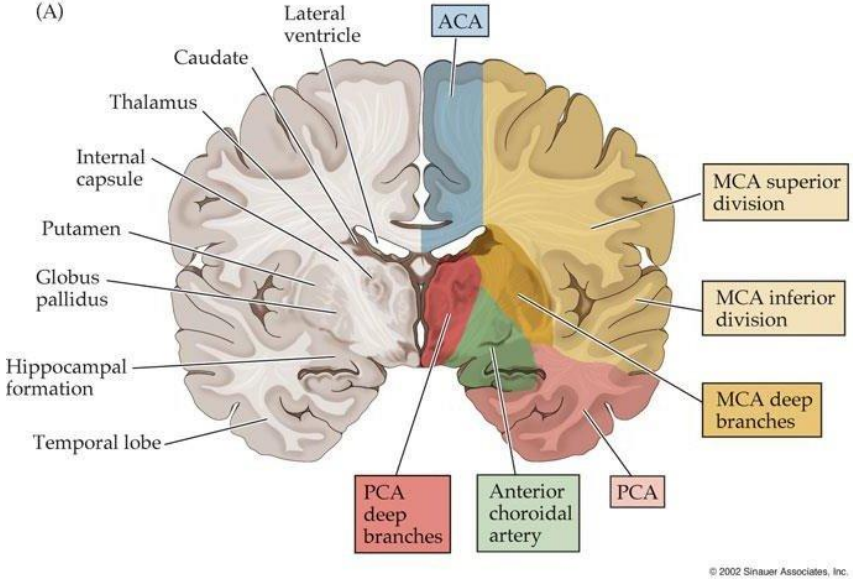
Vertebrobasilar System

- Forms the brain's posterior circulation
  - Brainstem, cerebellum, occipital lobes, parts of the temporal lobes and thalami

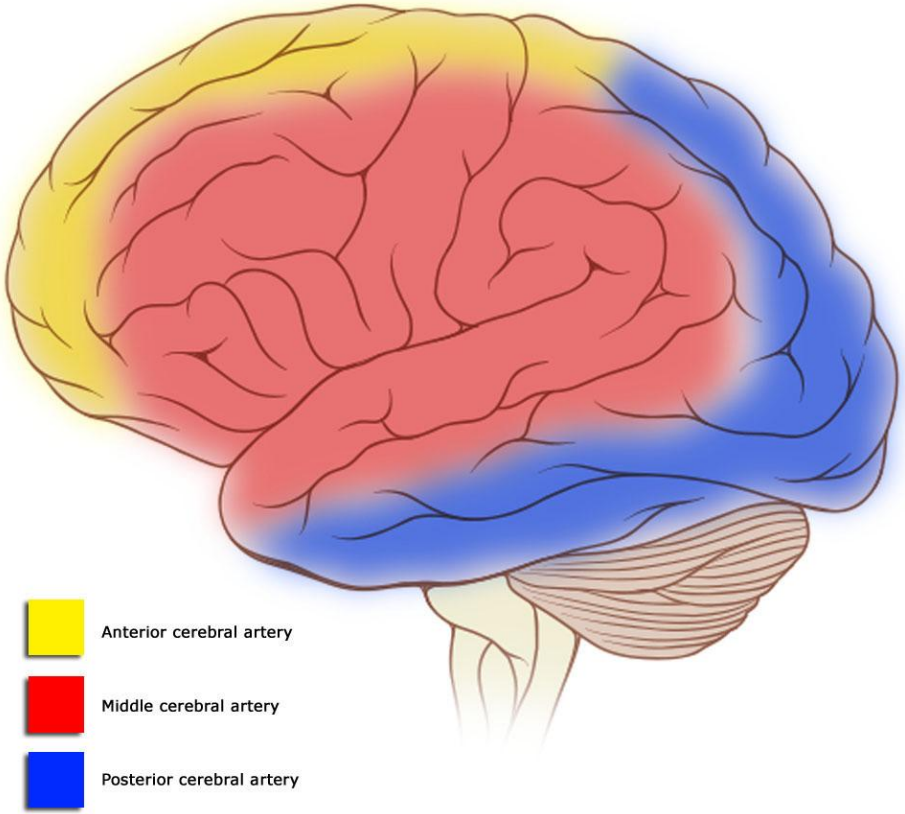


Posterior Circulation



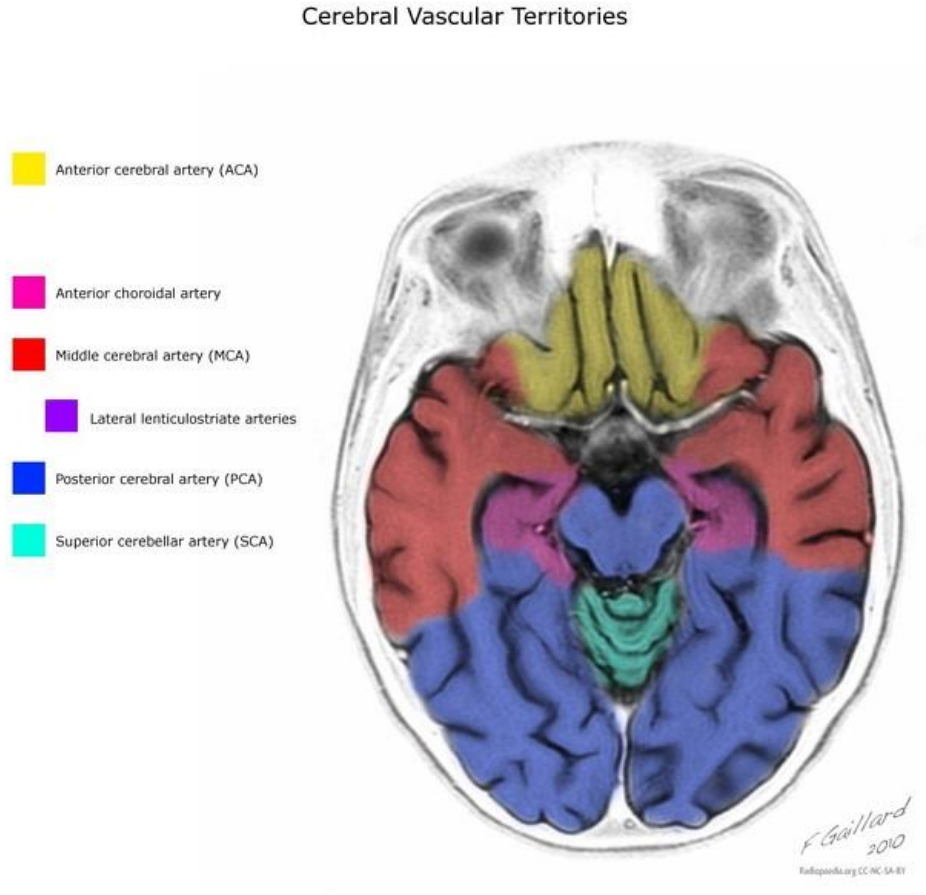


Cortical vascular territories



Posterior Circulation

- PCAs supply the occipital lobes, inferomedial temporal lobes, and portions of the thalamus and midbrain.



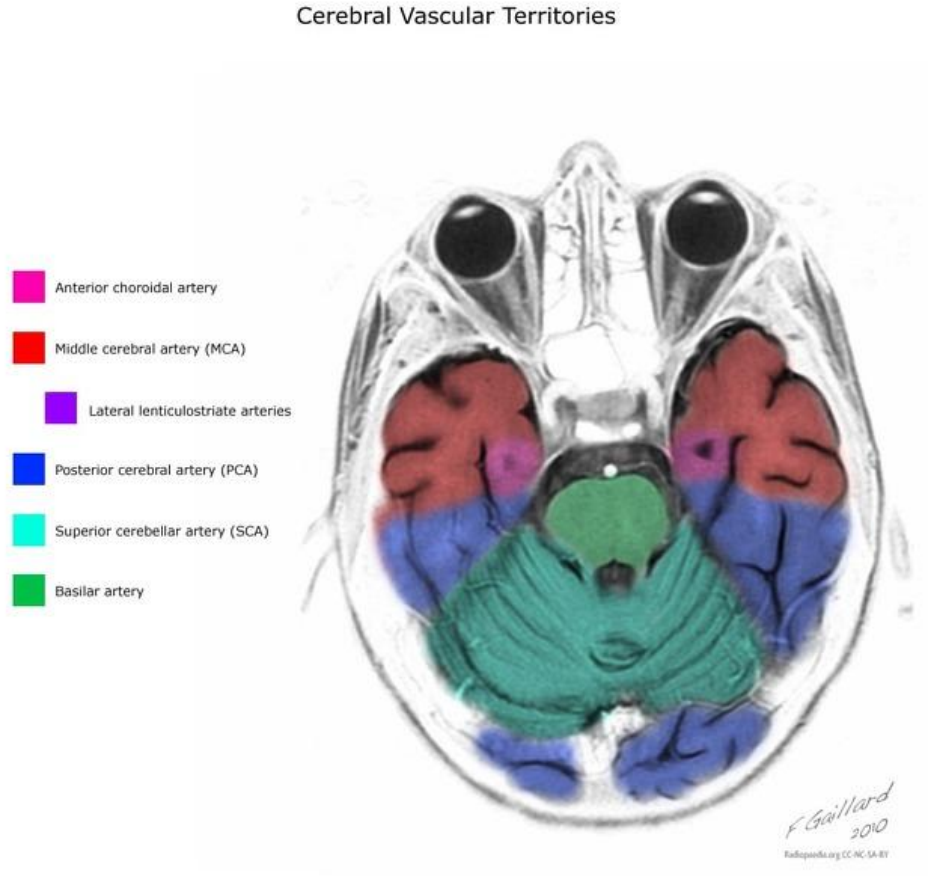
Occipital Lobe

- Visual Cortex
- Visual reception and interpretation



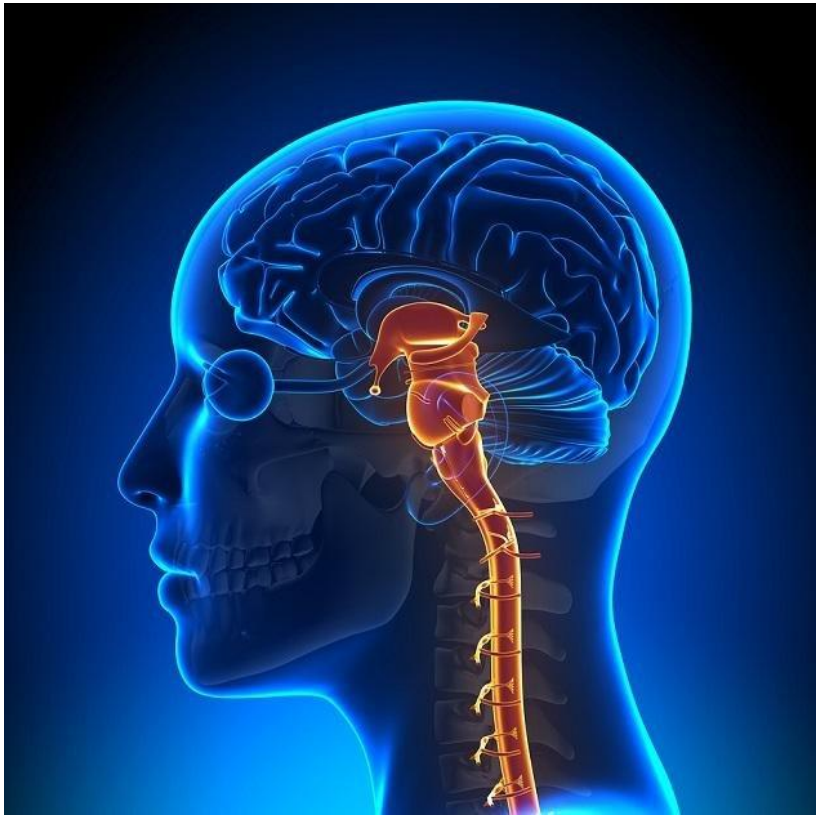
Posterior circulation

- Vertebrobasilar circulation supplies the brainstem

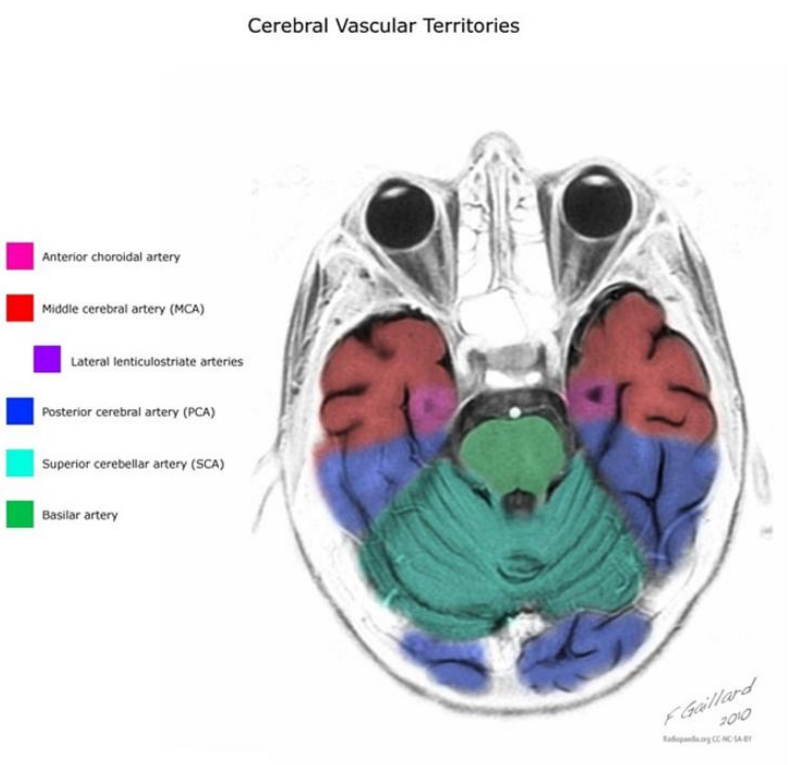


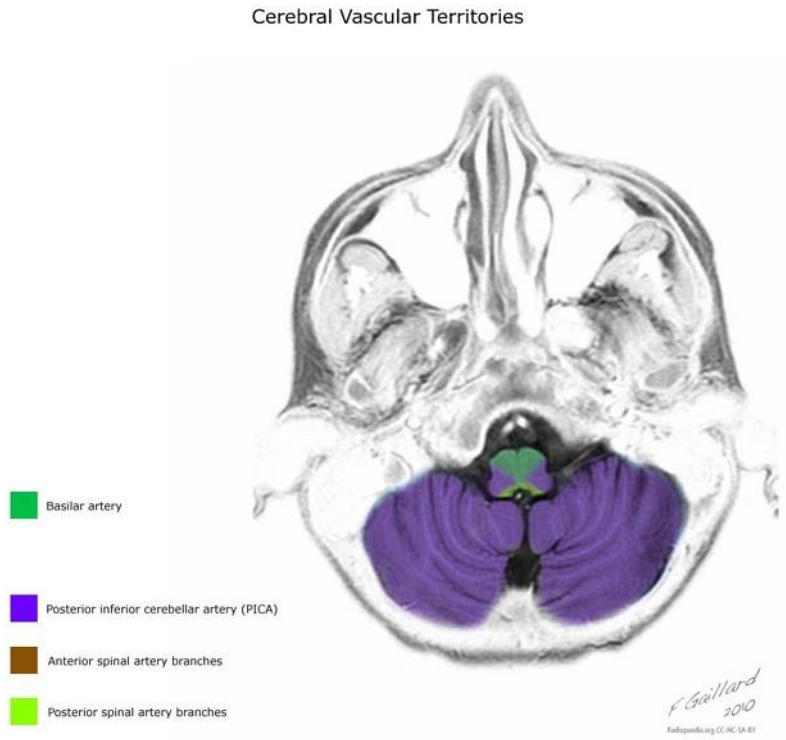
Brainstem

- Involuntary Responses!!
- Parts:
  - Midbrain
  - Pons
  - Medulla

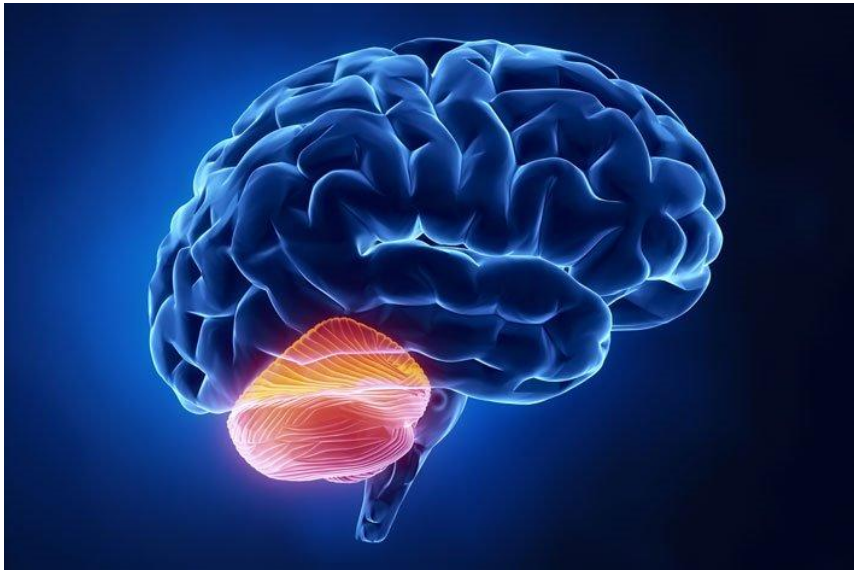


Cerebellar Blood Flow





Cerebellum



- Functions
- Balance
- Equilibrium
- Posture
- Eye Movement
- Coordination of voluntary movement
- Muscle tone

Location, location, location

- Brain in a box
- Cytotoxic edema can cause compression
- Function + Location

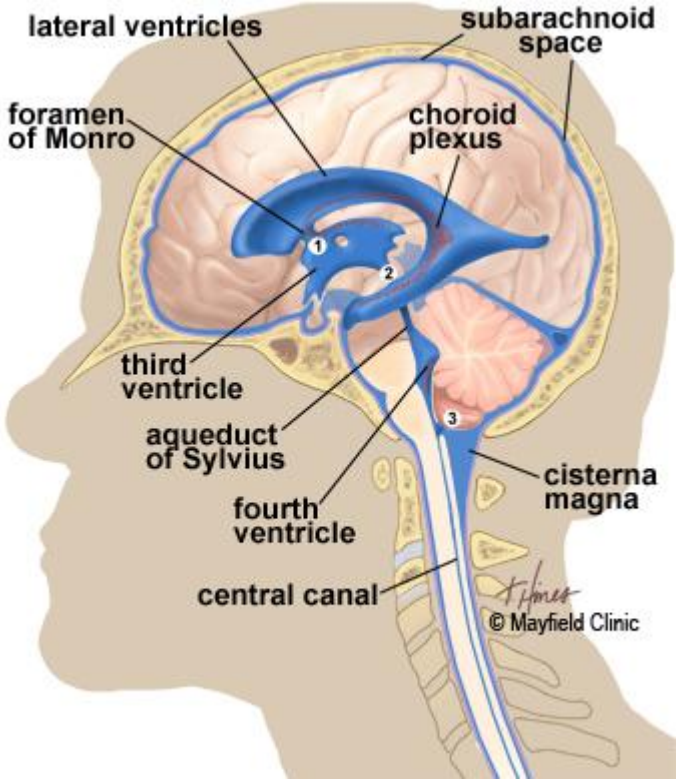
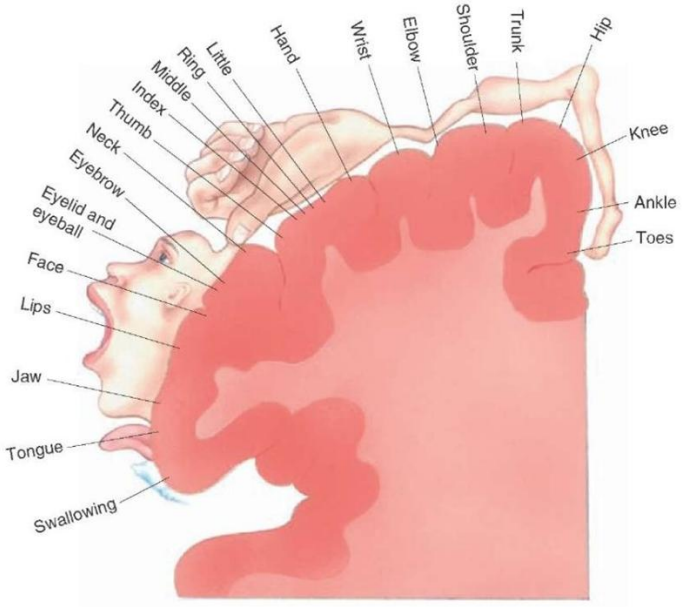


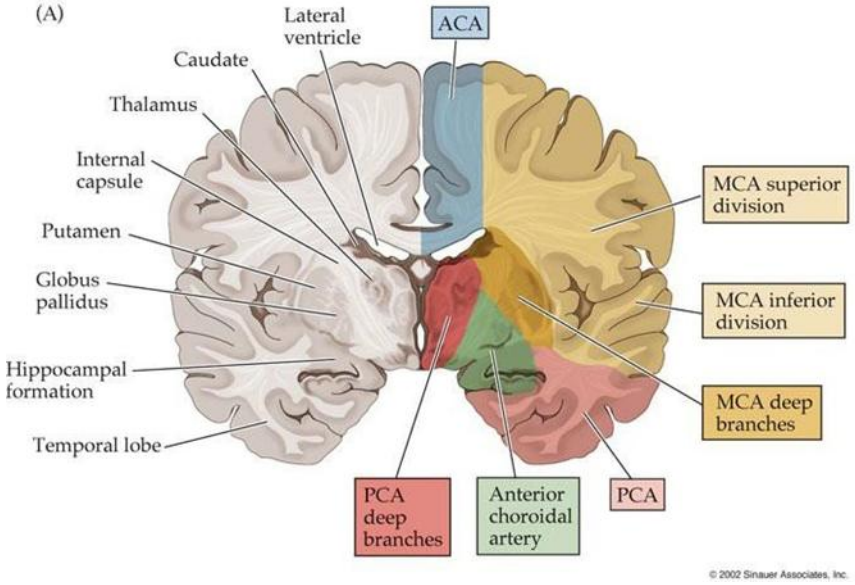
Illustration by Tonya Hines, CMI. © Mayfield Clinic. Source: *Anatomy of the brain*.

Case Review: Where Is the Lesion?

- A 68-year-old right-handed woman suddenly drops her coffee cup and has difficulty speaking. Her husband brings her to the emergency department, where a stroke evaluation is initiated. She is alert and follows simple commands, but her speech is effortful and limited to short phrases. Examination shows right lower facial weakness, significant right arm weakness, and decreased sensation in the right hand. Right leg strength is nearly normal.

Lesion Localization





References

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