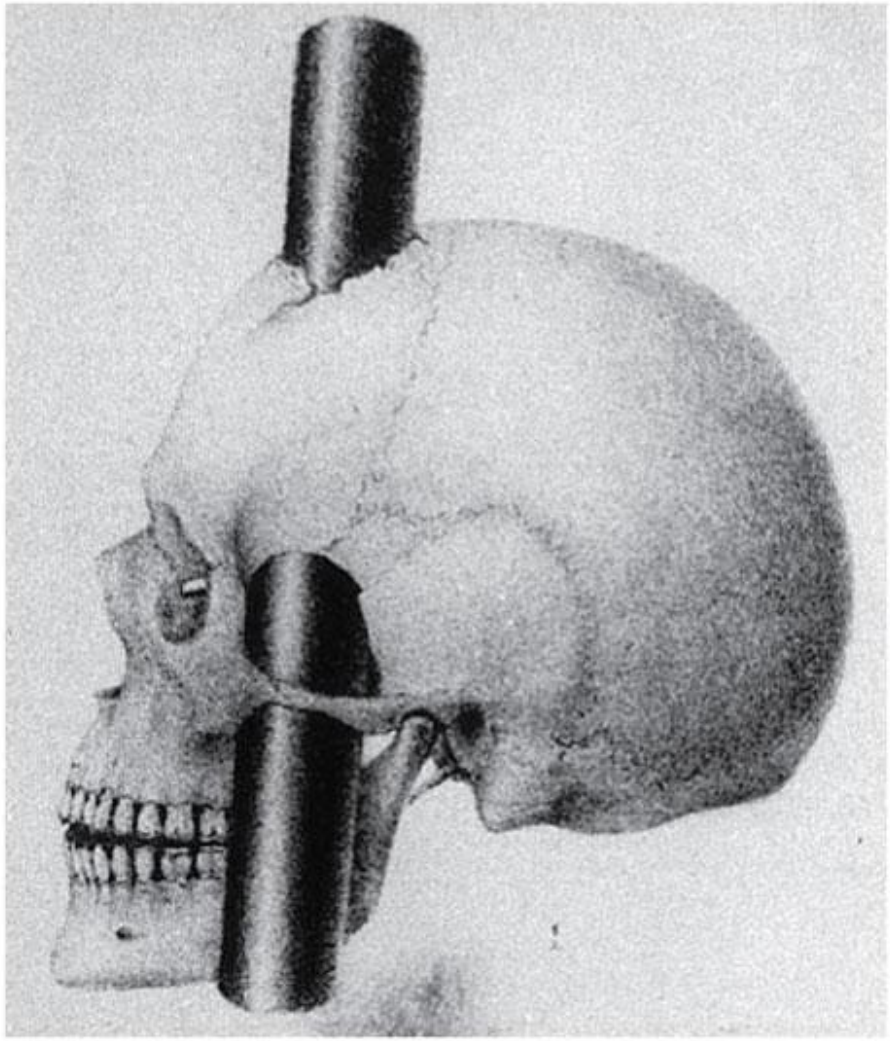
Nervous System: Part IV
The Central Nervous System
The Brain

NATIONAL MATH + SCIENCE INITIATIVE

Can you survive when part of your brain is destroyed?



Essential Knowledge 3.D.2

2. Cells communicate with each other through direct contact with other cells *or* from a distance via chemical signaling.

Sensory receptor

Sensory input

Integration

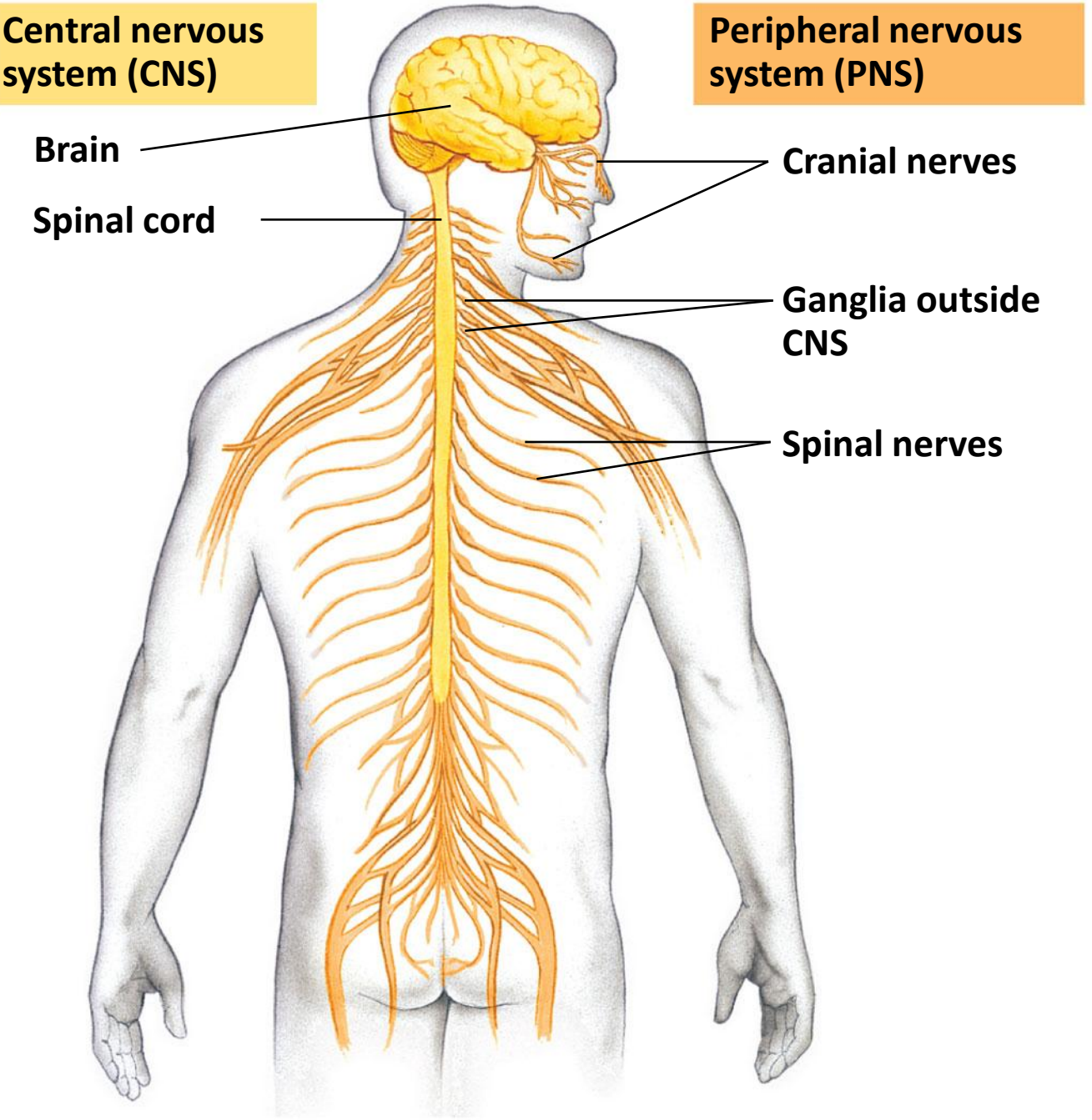
Effector

Motor output

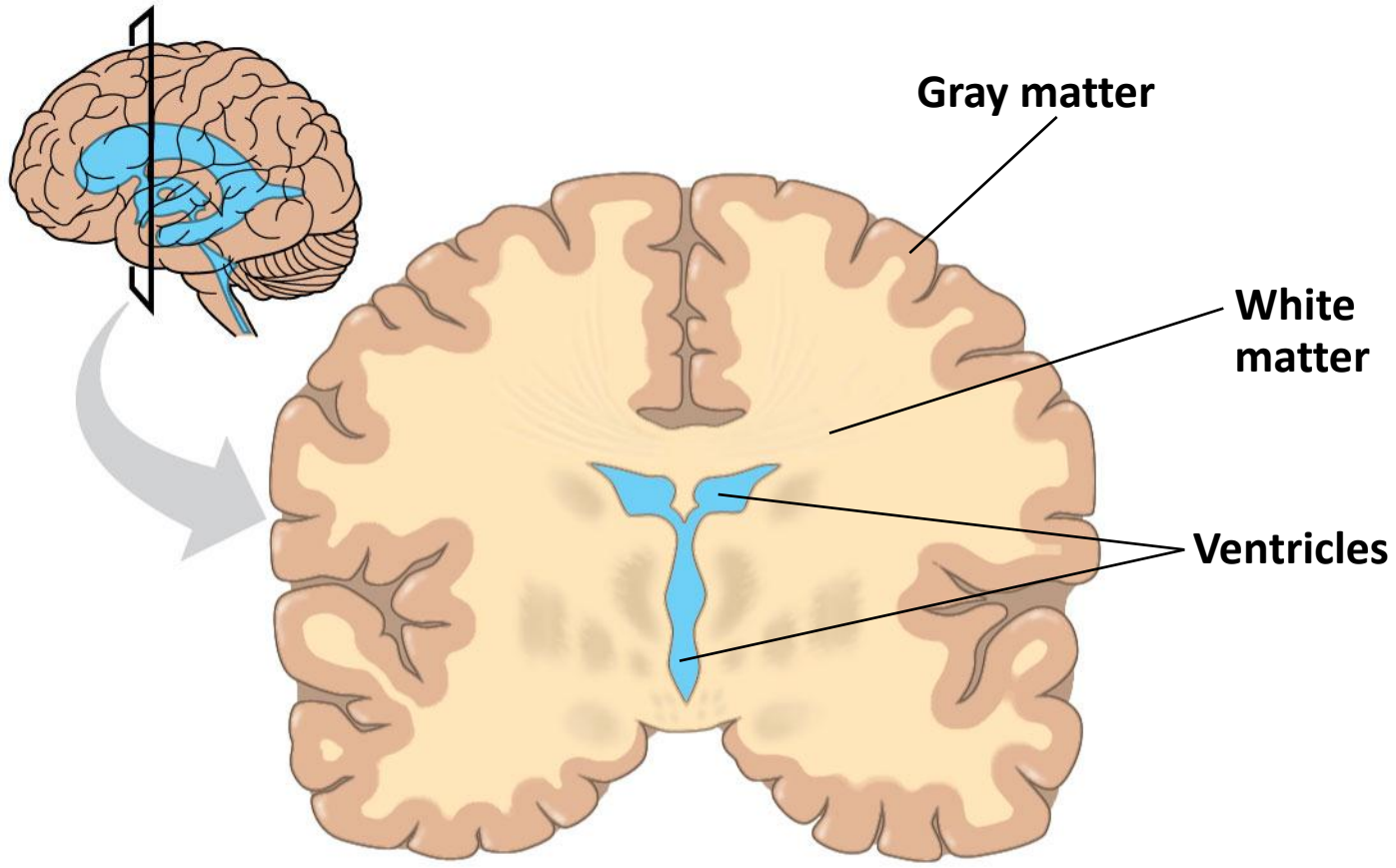
Brain and spinal cord

Peripheral nervous system (PNS)

Central nervous system (CNS)

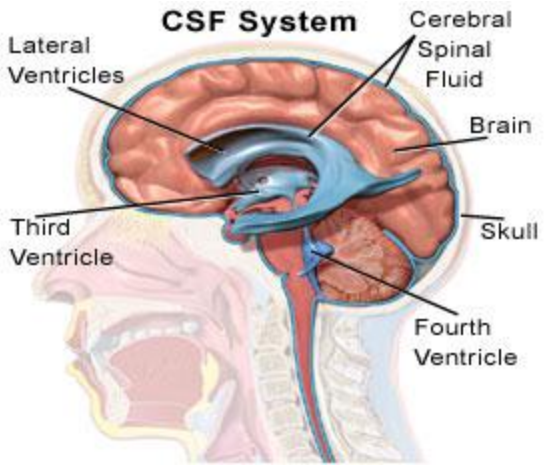


What accounts for the difference between white and gray matter?



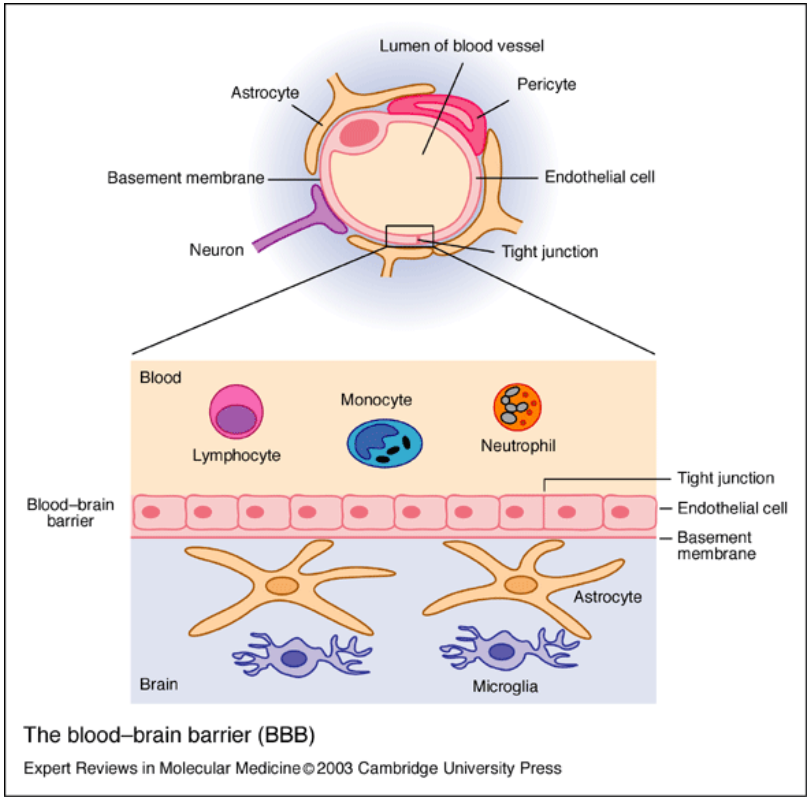
Cerebrospinal Fluid

- The central canal of the spinal cord and the ventricles of the brain are hollow and filled with **cerebrospinal fluid**
- The cerebrospinal fluid is filtered from blood and functions to cushion the brain and spinal cord as well as to provide nutrients and remove wastes

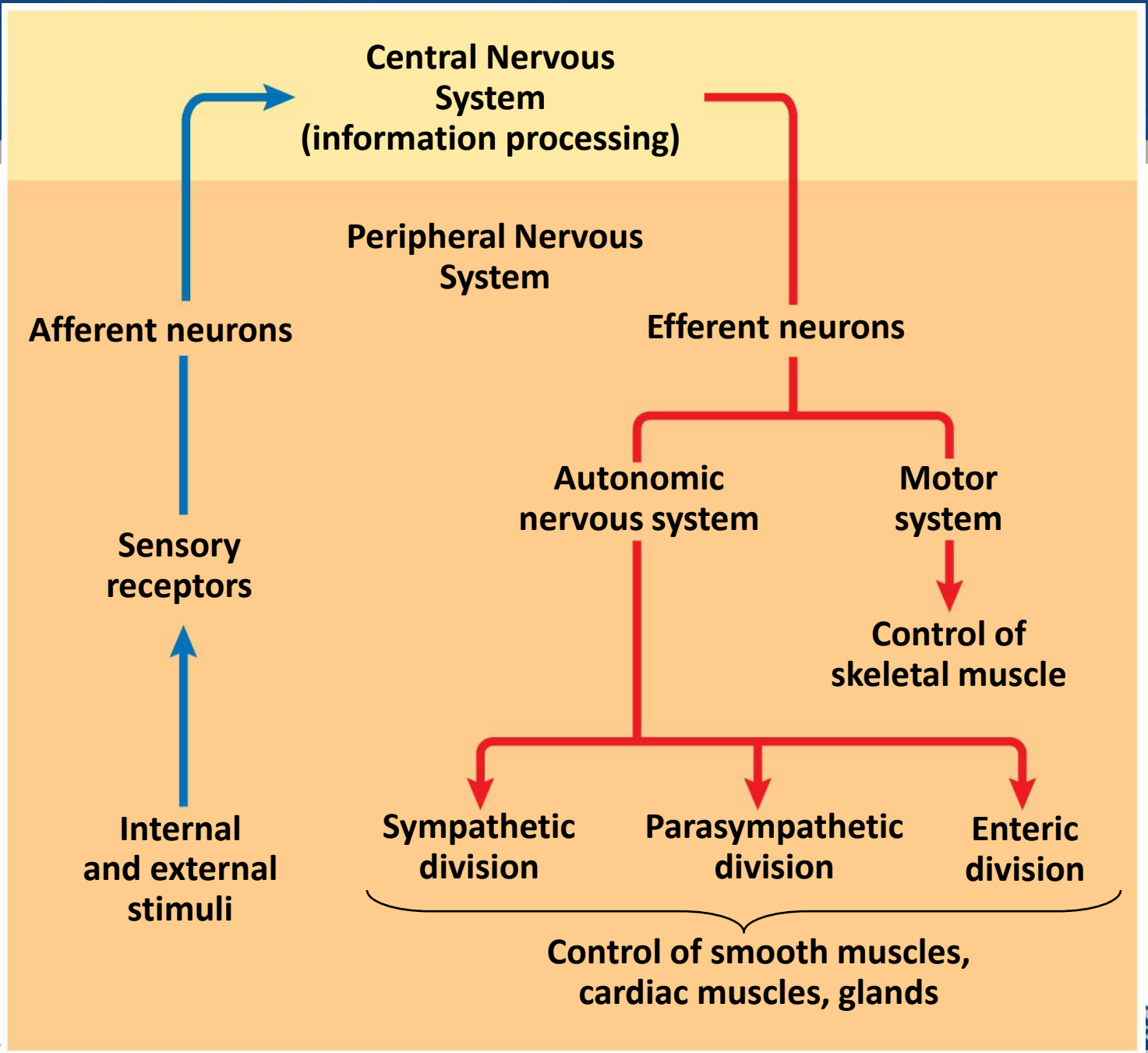


Glia

- Glia have numerous functions including to nourish, support, and regulate neurons
  - Embryonic radial glia form tracks along which newly formed neurons migrate
  - Astrocytes induce cells lining capillaries in the CNS to form tight junctions, resulting in a blood-brain barrier and restricting the entry of most substances into the brain



The blood–brain barrier (BBB)



Sensory receptor

Sensory input

Integration

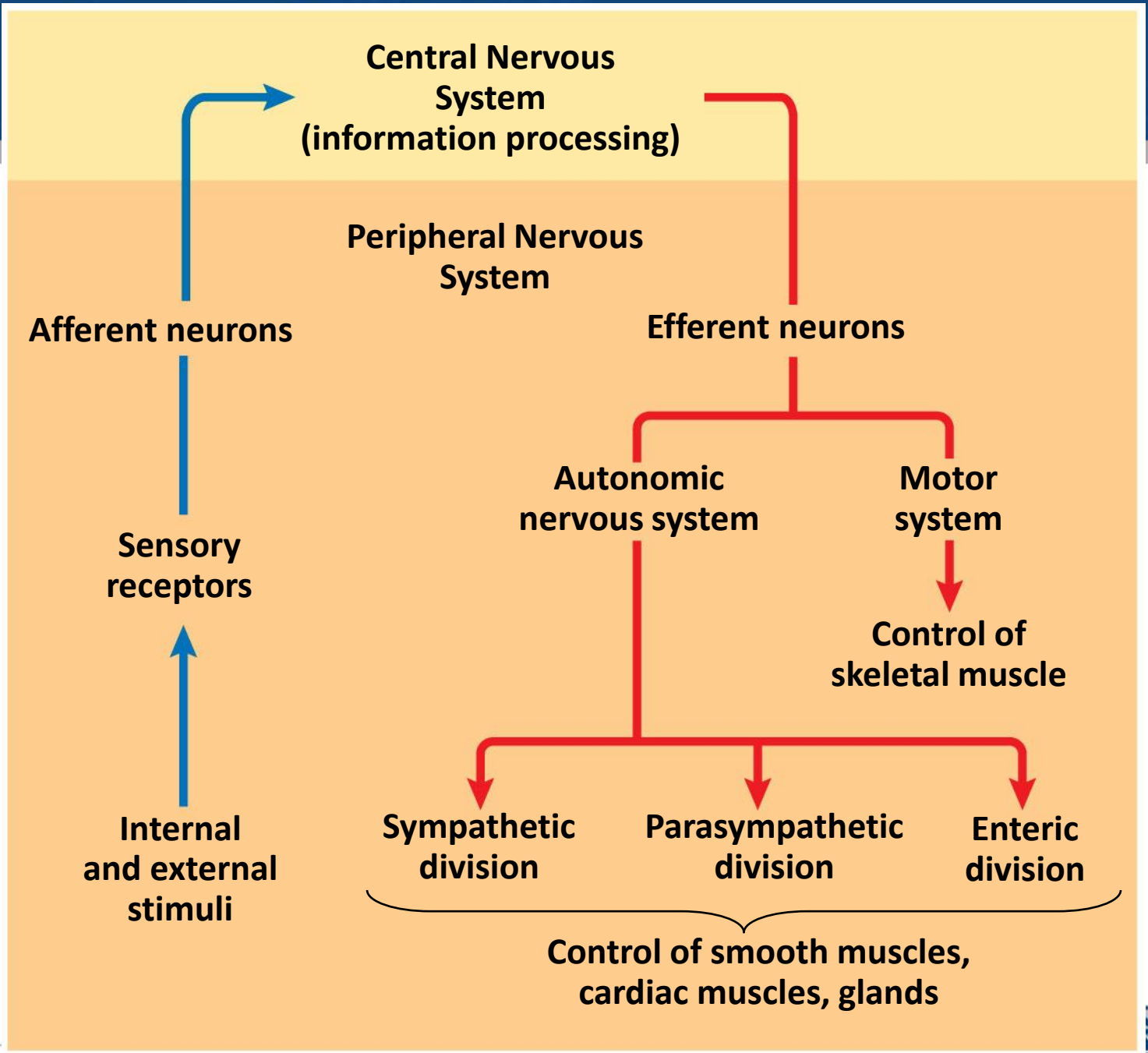
Effector

Motor output

Brain and spinal cord

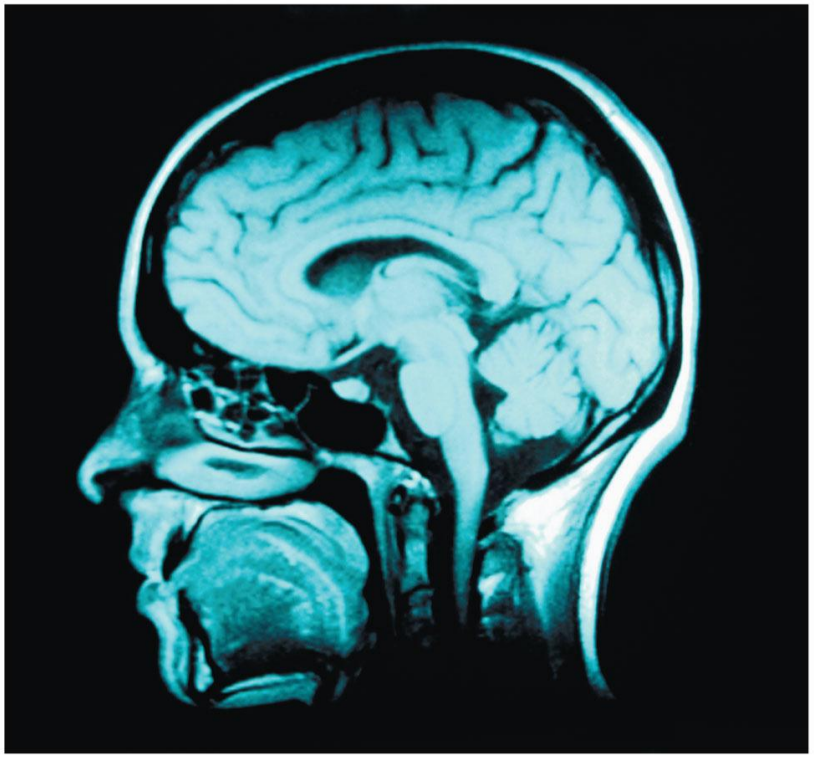
Peripheral nervous system (PNS)

Central nervous system (CNS)



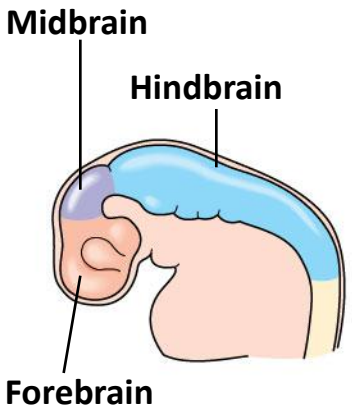
The Vertebrate Brain Is Regionally Specialized

- Specific brain structures are particularly specialized for diverse functions
- These structures arise during embryonic development

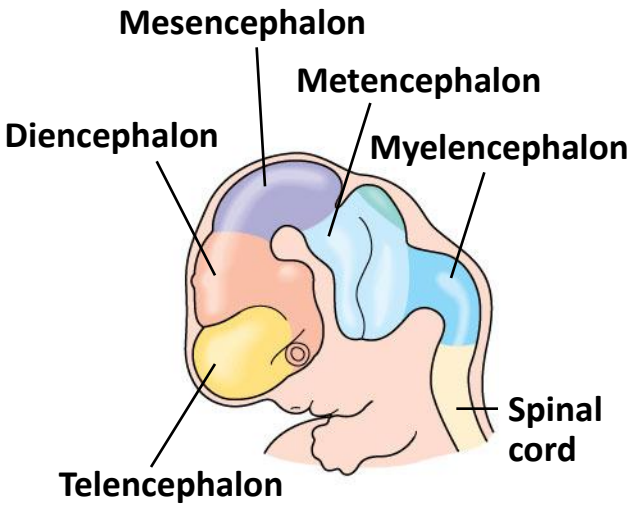


Human Embryonic Brain Development

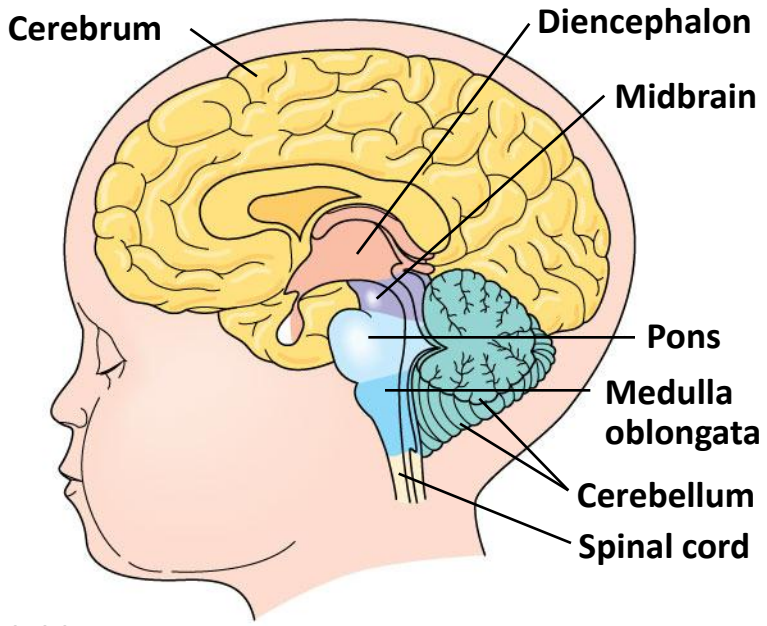
Embryonic brain regions		Brain structures in child and adult
Forebrain	Telencephalon	Cerebrum (includes cerebral cortex, white matter, basal nuclei)
	Diencephalon	Diencephalon (thalamus, hypothalamus, epithalamus)
Midbrain	Mesencephalon	Midbrain (part of brainstem)
Hindbrain	Metencephalon	Pons (part of brainstem), cerebellum
	Myelencephalon	Medulla oblongata (part of brainstem)



Embryo at 1 month



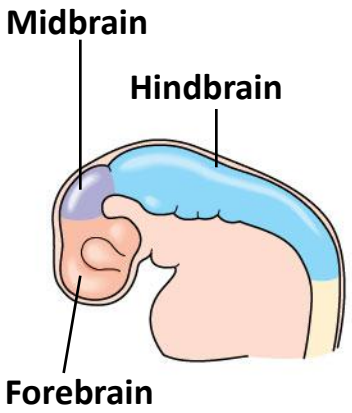
Embryo at 5 weeks



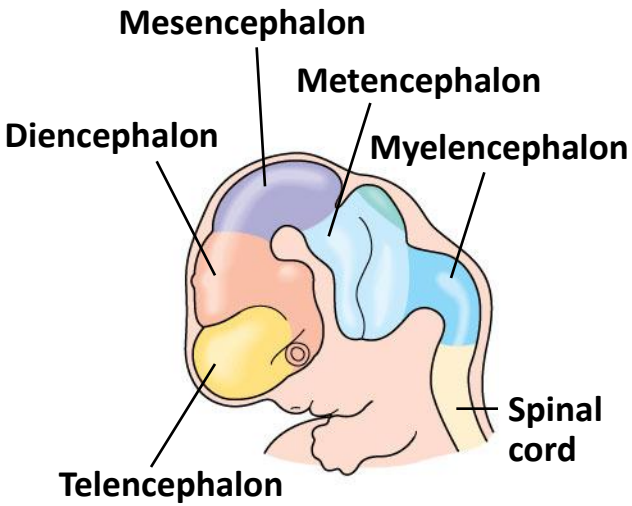
Child

Brain structures in child and adult

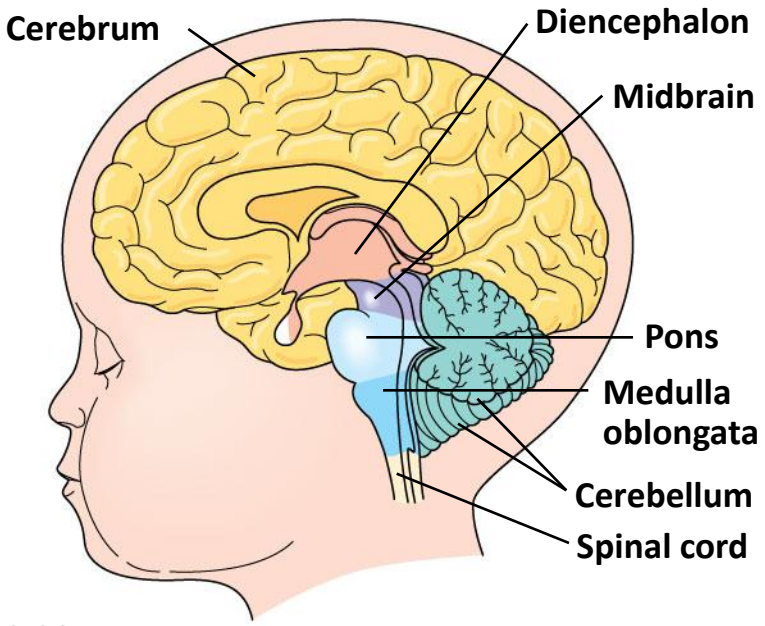
Forebrain		Cerebrum (includes cerebral cortex, white matter, basal nuclei)
		Diencephalon (thalamus, hypothalamus, epithalamus)
Midbrain		Midbrain (part of brainstem)
Hindbrain		Pons (part of brainstem), cerebellum
	Myelencephalon	Medulla oblongata (part of brainstem)



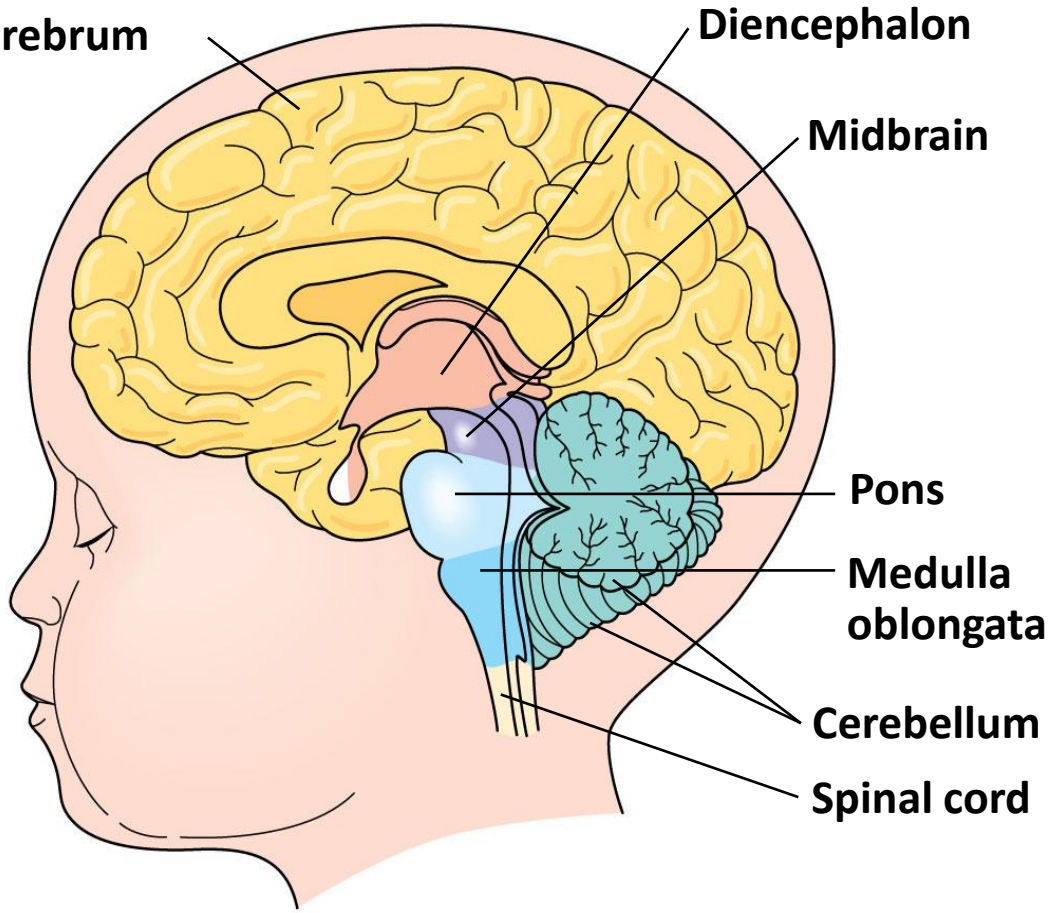
Embryo at 1 month



Embryo at 5 weeks



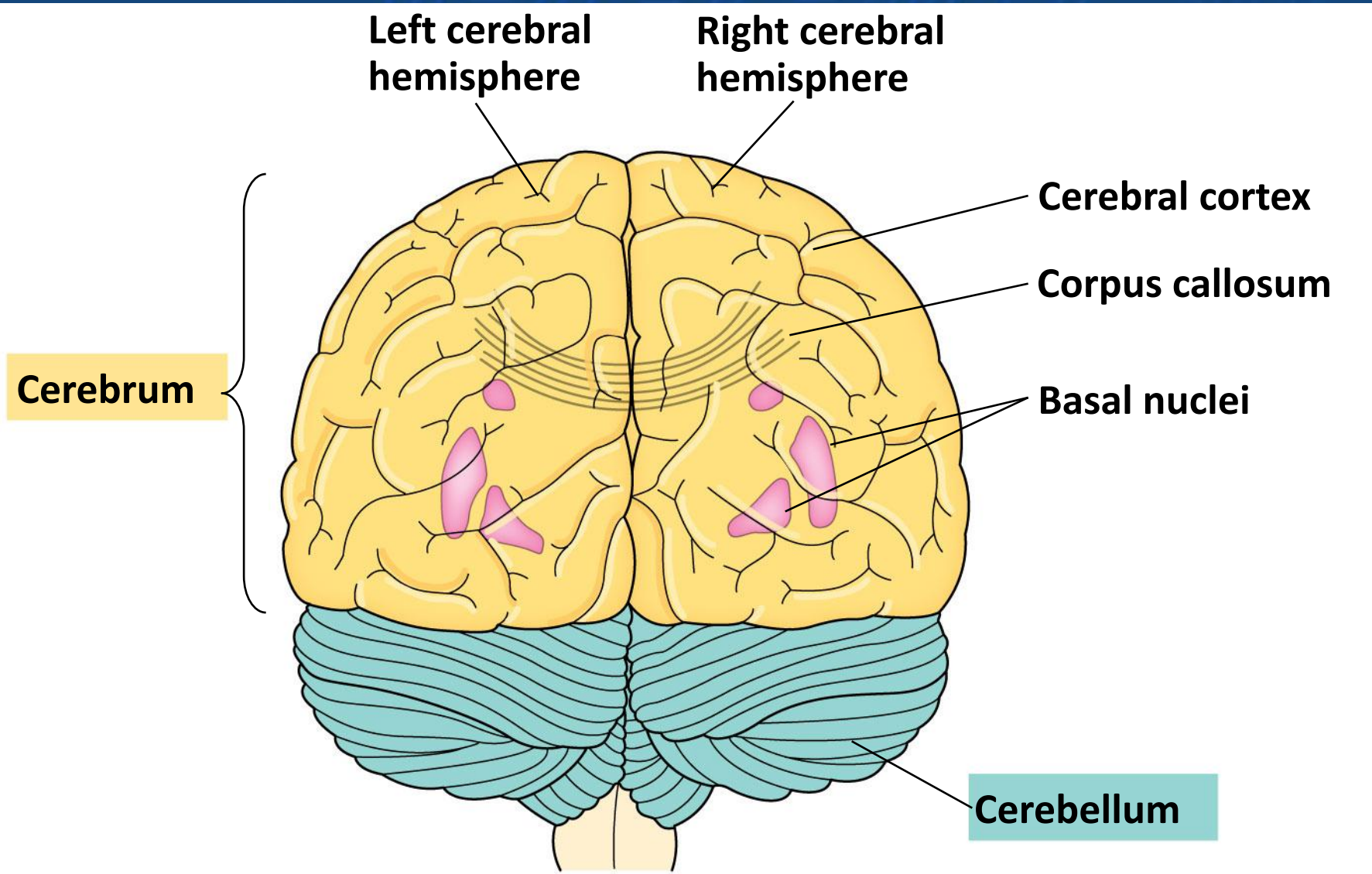
Child



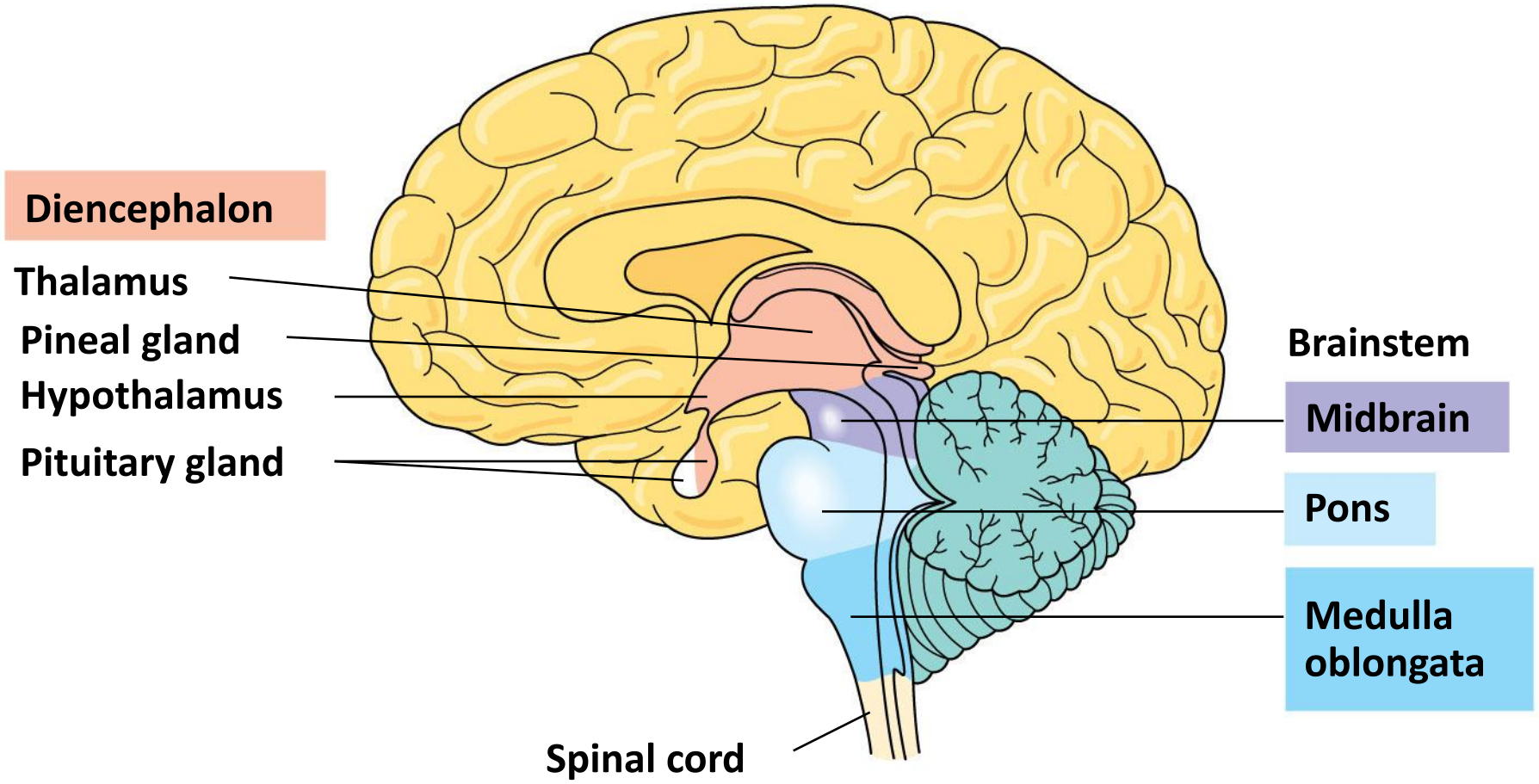
Child

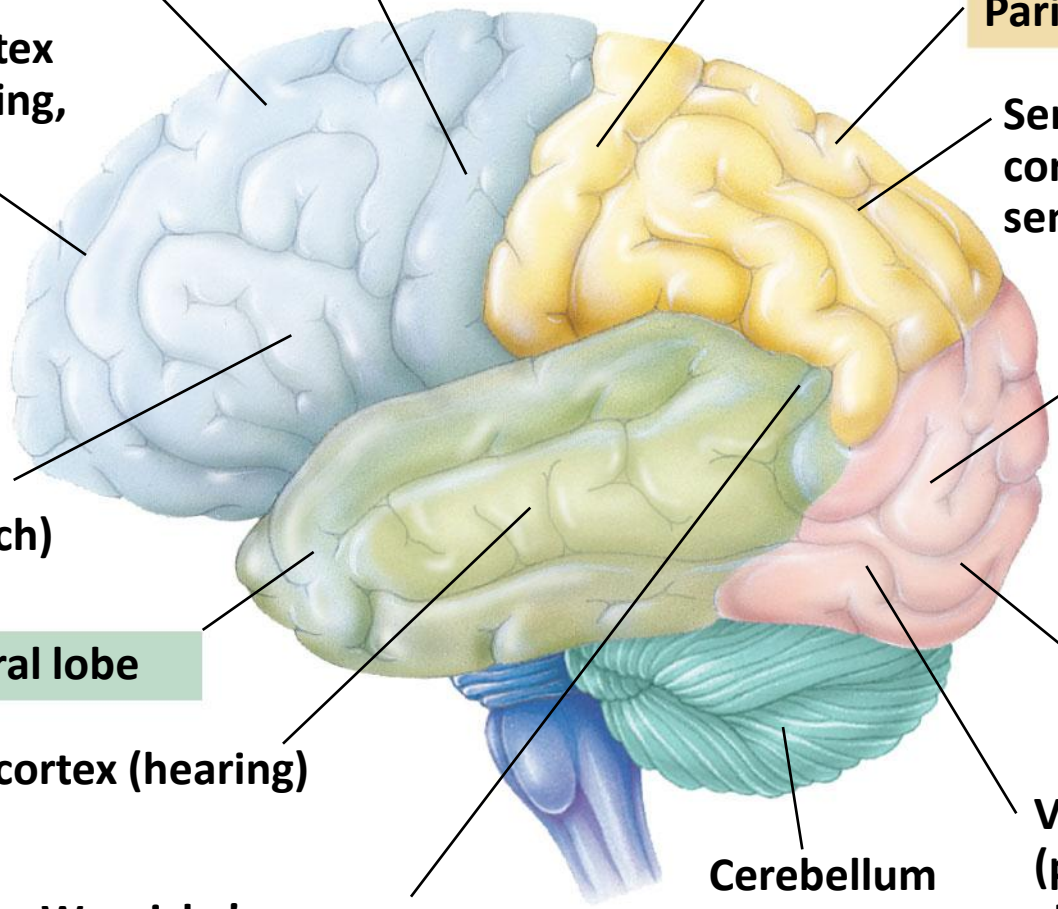
Brain structures in child and adult

- Cerebrum (includes cerebral cortex, white matter, basal nuclei)
- Diencephalon (thalamus, hypothalamus, epithalamus)
- Midbrain (part of brainstem)
- Pons (part of brainstem), cerebellum
- Medulla oblongata (part of brainstem)



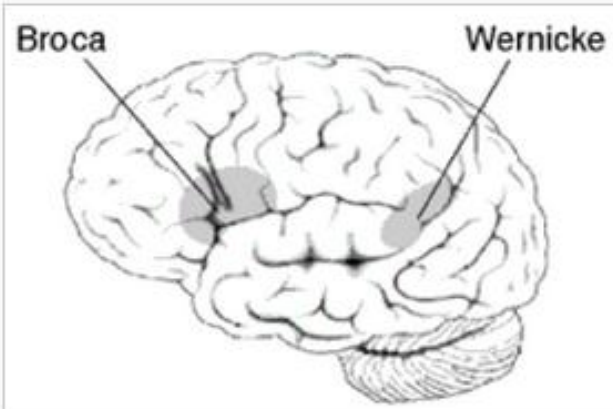
Adult brain viewed from the rear





Language and Speech

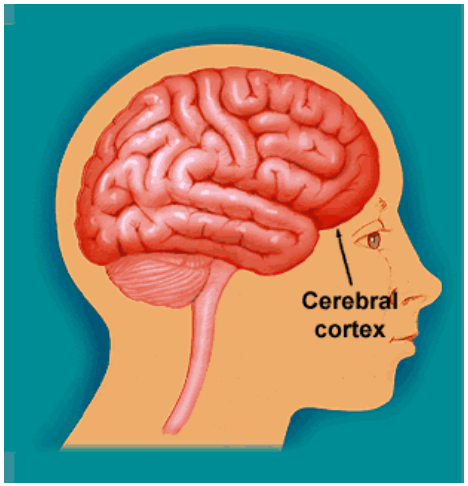
- Studies of brain activity have mapped areas responsible for language and speech
- Broca's area in the frontal lobe is active when speech is generated
- Wernicke's area in the temporal lobe is active when speech is heard
- These areas belong to a larger network of regions involved in language

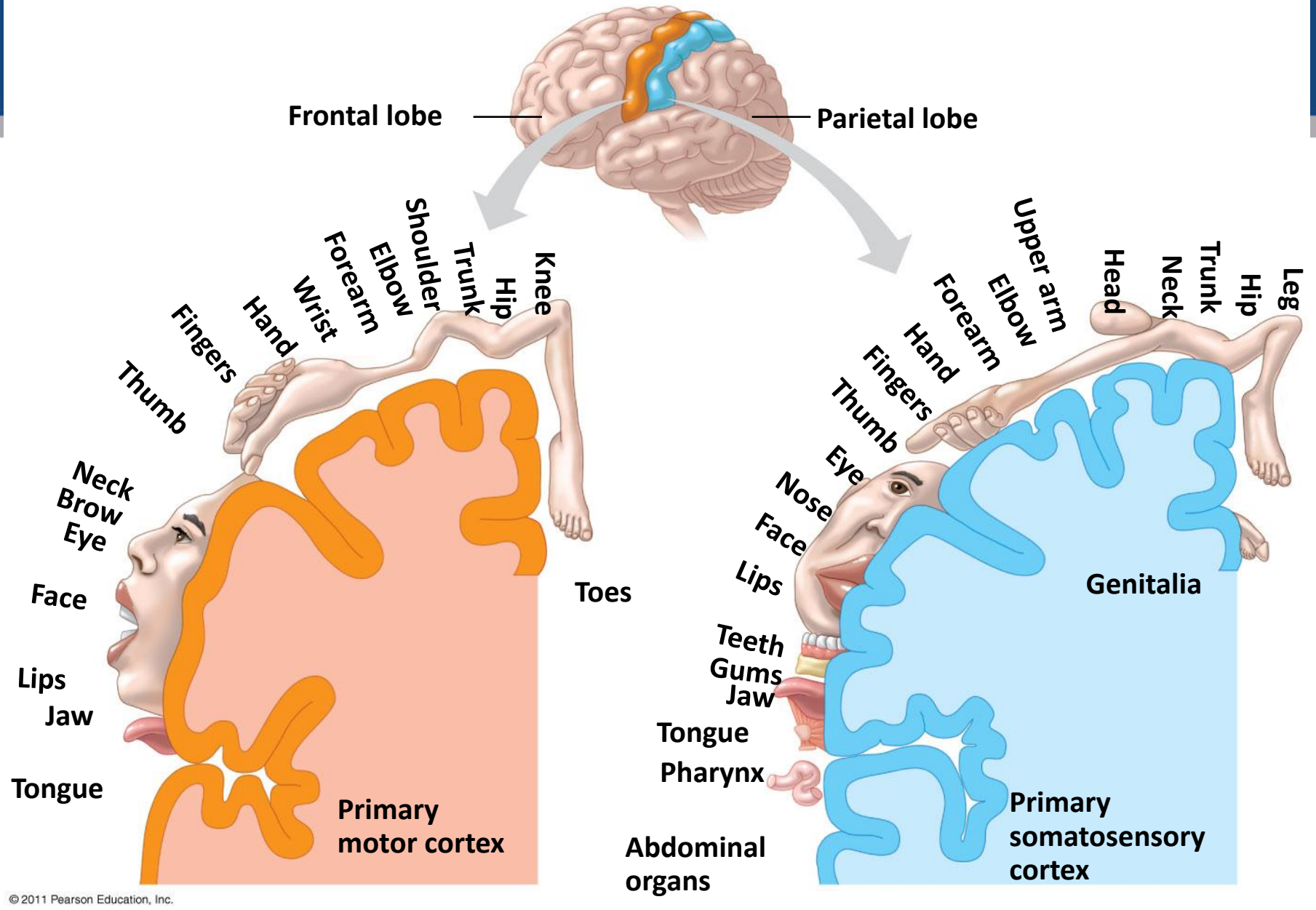


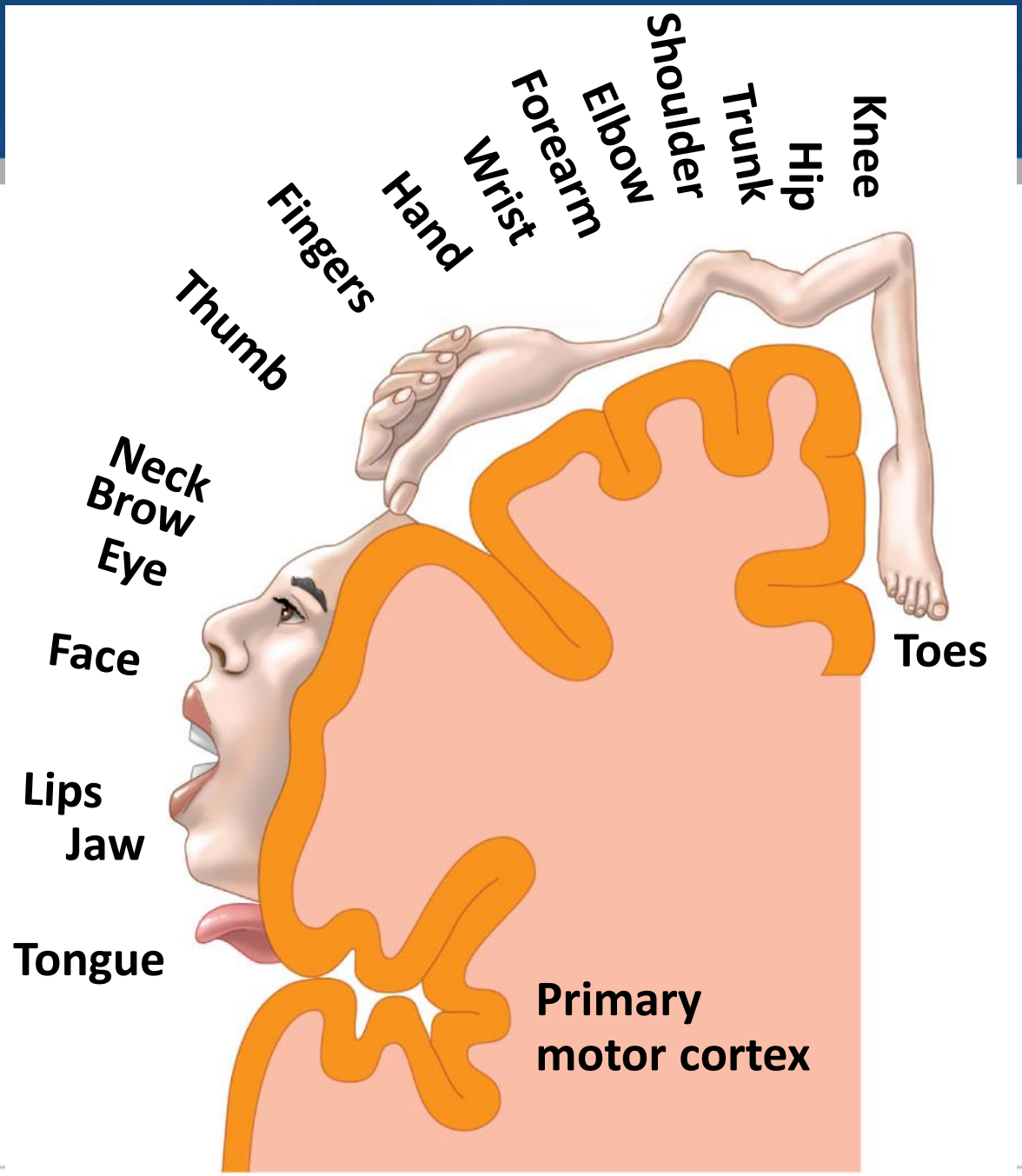
Location of two brain areas that play a critical role in language, Broca's area and Wernicke's area

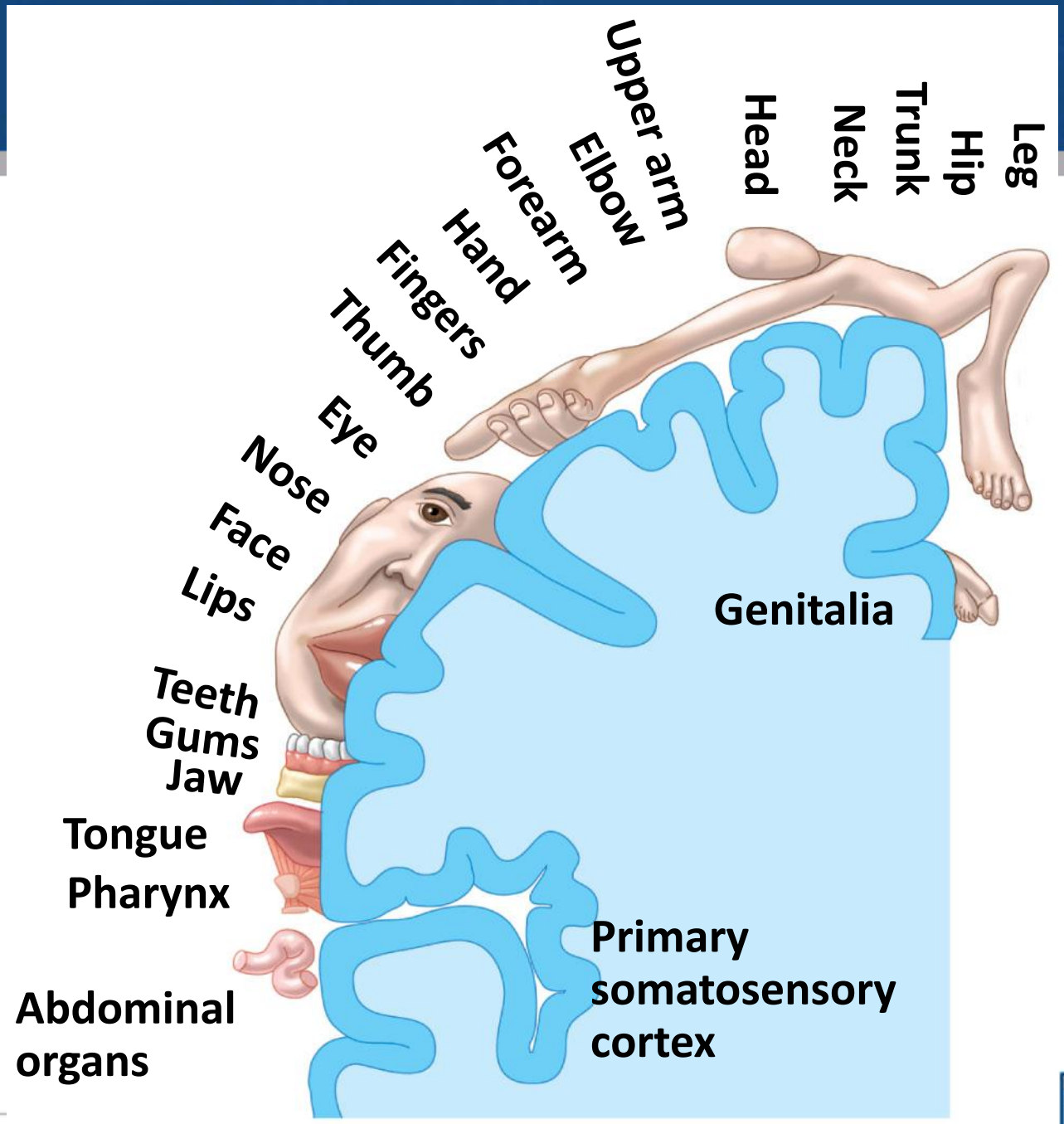
Information Processing

- The cerebral cortex receives input from sensory organs and somatosensory receptors
- Somatosensory receptors provide information about touch, pain, pressure, temperature, and the position of muscles and limbs
- The thalamus directs different types of input to distinct locations



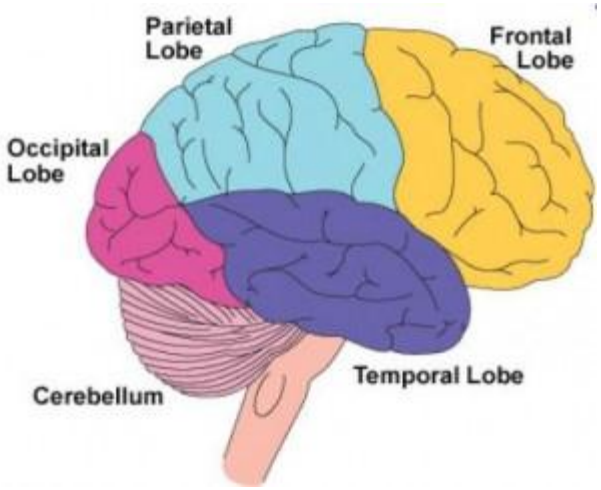






Frontal Lobe Function

- Frontal lobe damage may impair decision making and emotional responses but leave intellect and memory intact
- The frontal lobes have a substantial effect on “executive functions” of thinking making decisions.



Created by:

Debra Richards
Coordinator of Secondary Science Programs
Bryan ISD
Bryan, TX