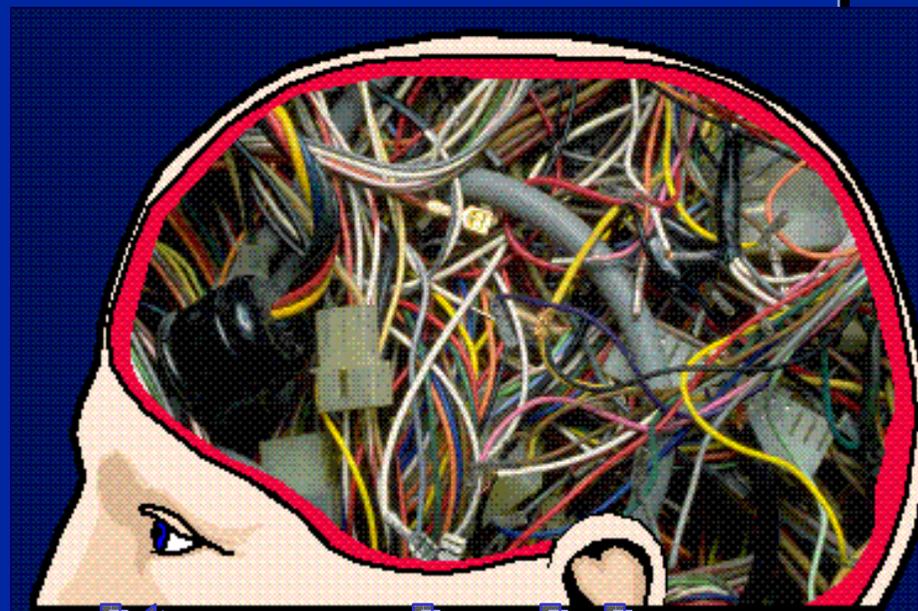


# Central Nervous System

## Part 1: The Brain

- Discuss the organization of the brain, including the major structures and how they relate to one another
- Review the meninges of the spinal cord and brain, and integrate the formation and flow of CSF with this information.



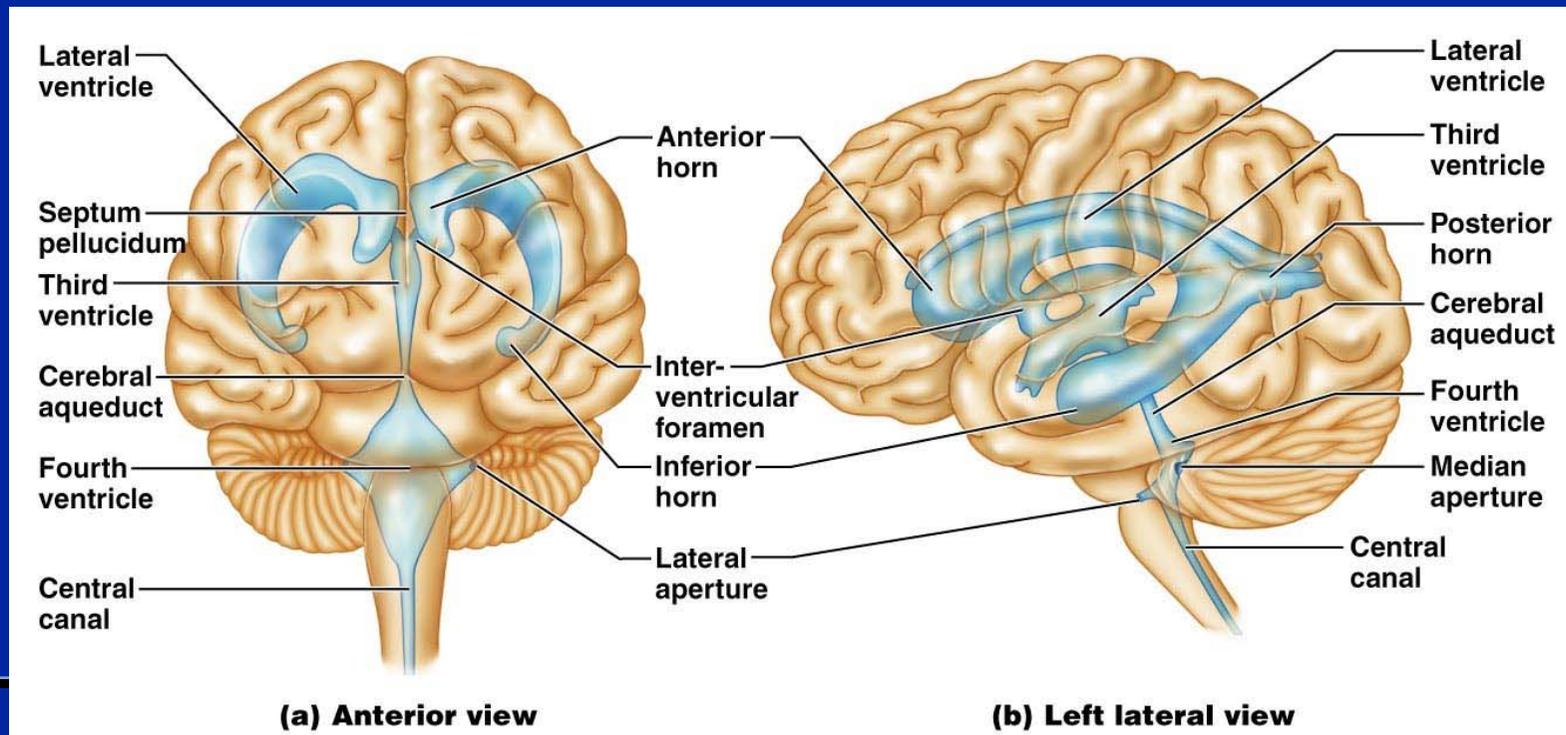
# Ventricles of the Brain

CSF filled chambers

Communicating with central canal of spinal cord

Lined by ependymal cells

Central Canal of Spinal Cord



# Four Major Brain Subdivisions

1. **Brain Stem**
  - a. Midbrain
  - b. Pons
  - c. Medulla oblongata
2. **Cerebellum**
3. **Diencephalon**  
Thalamus and Hypothalamus
4. **Cerebral Hemispheres**
  1. AKA Cerebrum

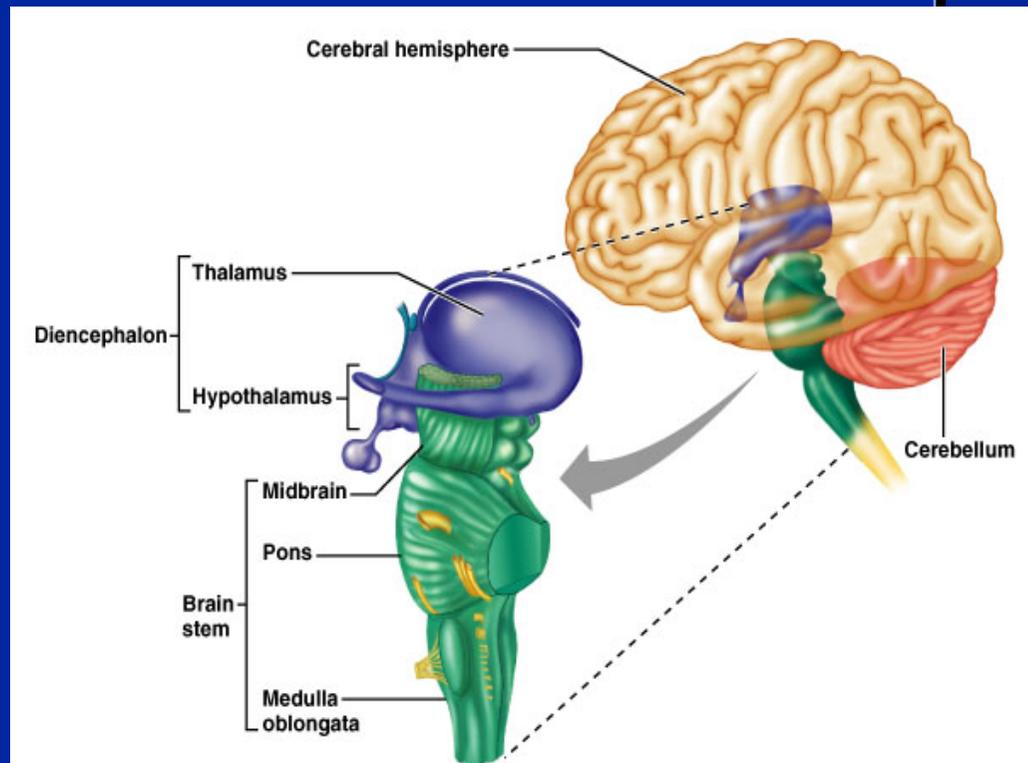


Fig 13.9

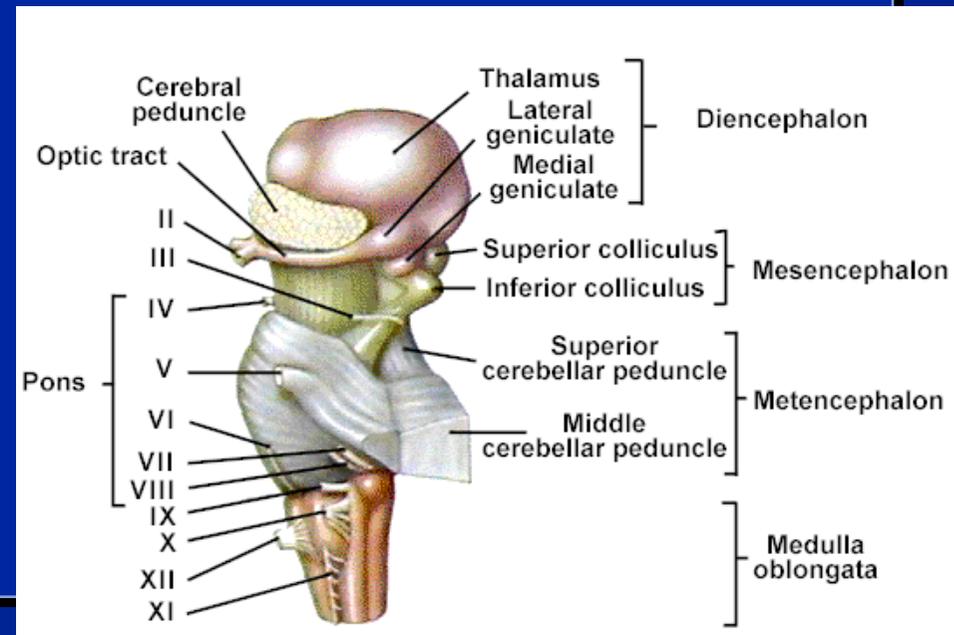
# 1) Brain stem

a. Medulla oblongata

b. Pons

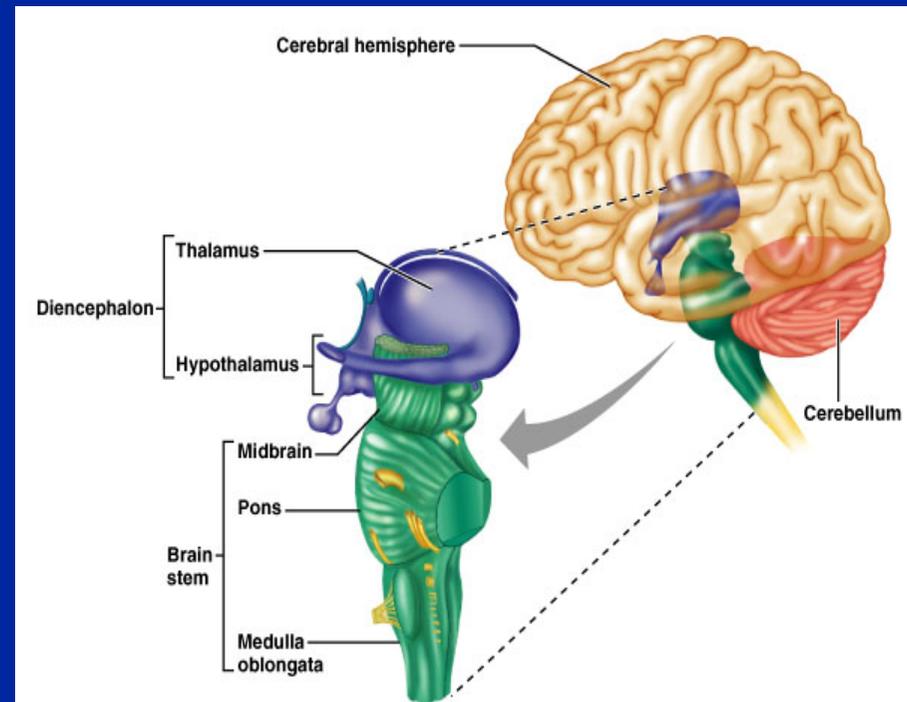
c. Midbrain

- Location of autonomic nuclei involved in respiratory and cardiovascular control
- Relay stations for sensory and motor neurons
- **Decussation**



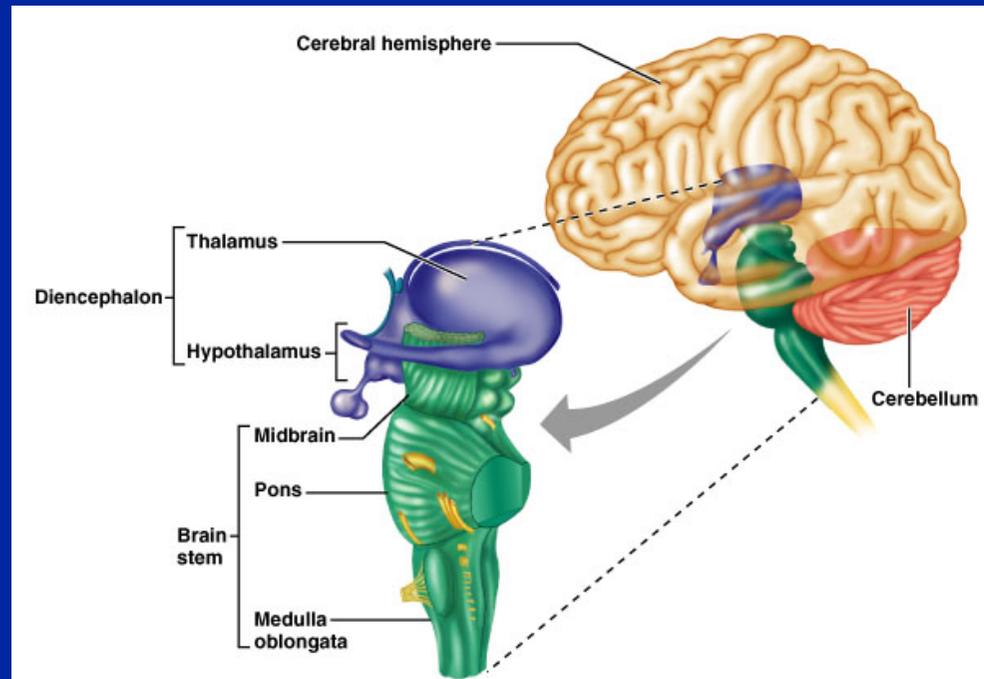
# 1a) Medulla oblongata

- Pyramids
  - Motor output
  - Decussation
- Reticular formation
  - Lower functions
  - Respiration, sleep, etc.
- Cranial nerves
  - VIII, IX, X, XI, XII



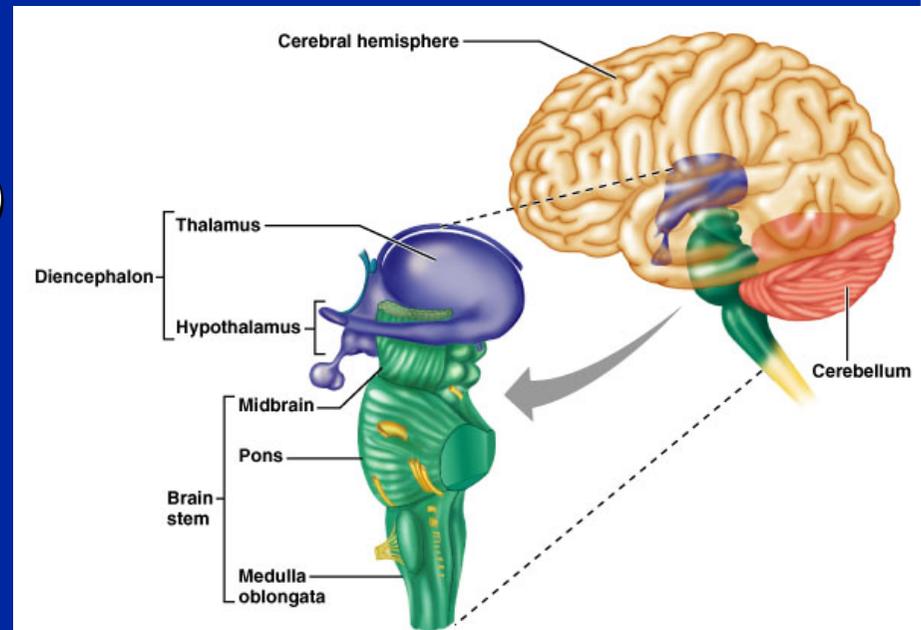
# 1b) Pons

- Pons = bridge
- Connects to cerebellum
- Cranial Nerves  
– V, VI, VII



# 1c) Midbrain

- Cerebral aqueduct
  - Old term: Aqueduct of Sylvius
- Several nuclei (ganglia)
- Sensory reflexes
  - Aural, visual



## 2) Cerebellum

- Dorsal to the Pons
- Two hemispheres
  - Connected by the vermis
- Maintains posture and equilibrium
  - Smooths motor activities
- **Cortex - gray surface**
  - Purkinje cells (not in book), axons of which become arbor vitae (white matter) in center
    - » Large cell bodies visible in gray matter of cerebellum
- White matter: **Arbor Vitae**

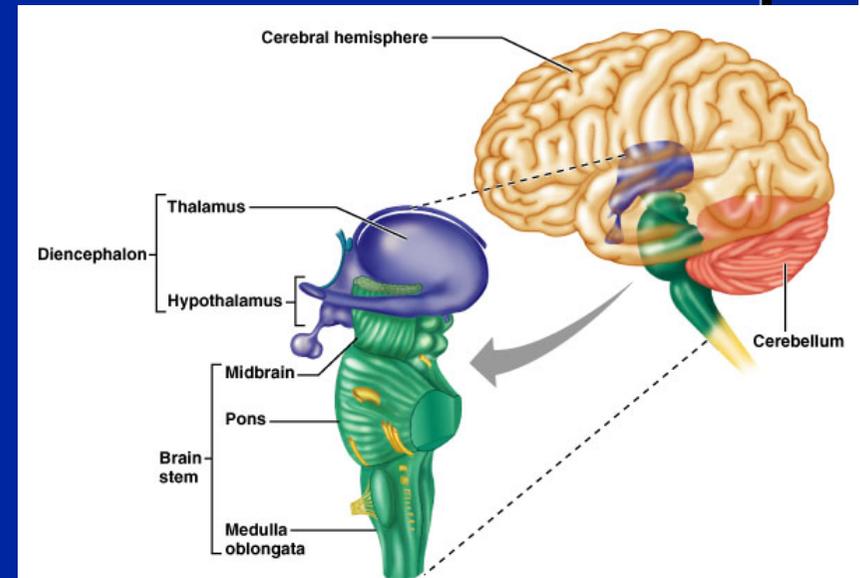


# 3) Diencephalon

3a. Epithalamus

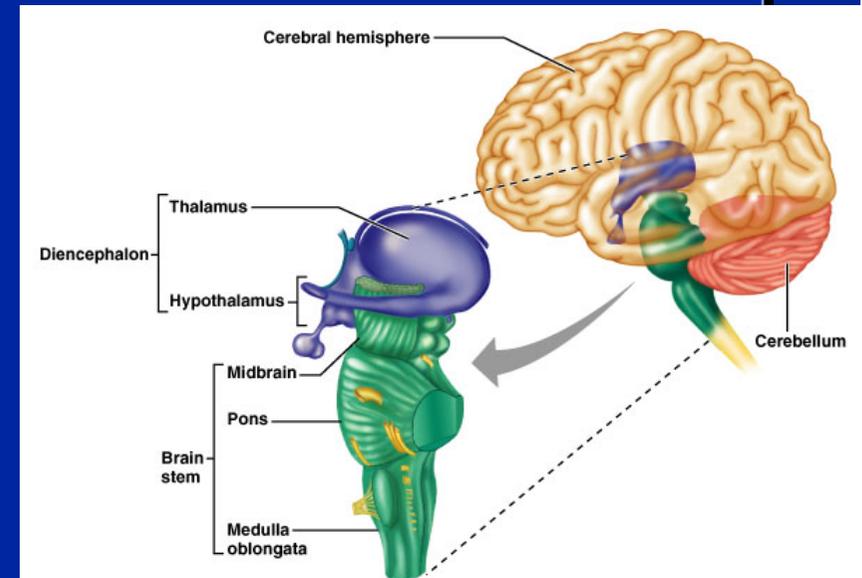
3b. Thalamus

3c. Hypothalamus



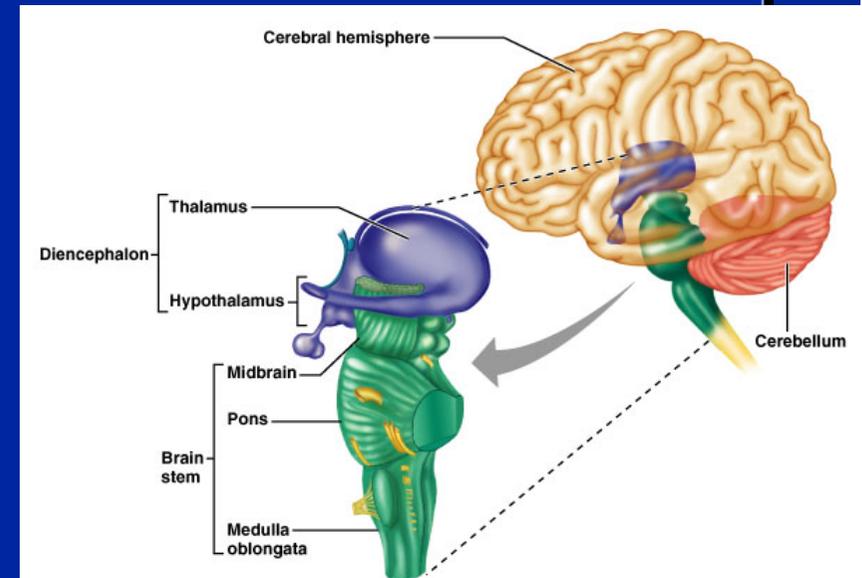
## 3a. Epithalamus

- Pineal gland - produces melatonin,
- sets diurnal cycles
- Choroid Plexus – produces CSF



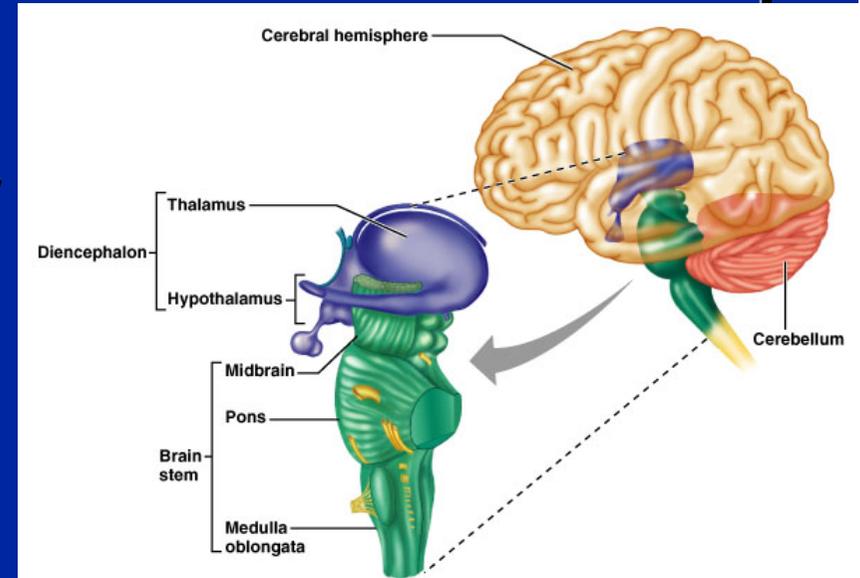
## 3b. Thalamus

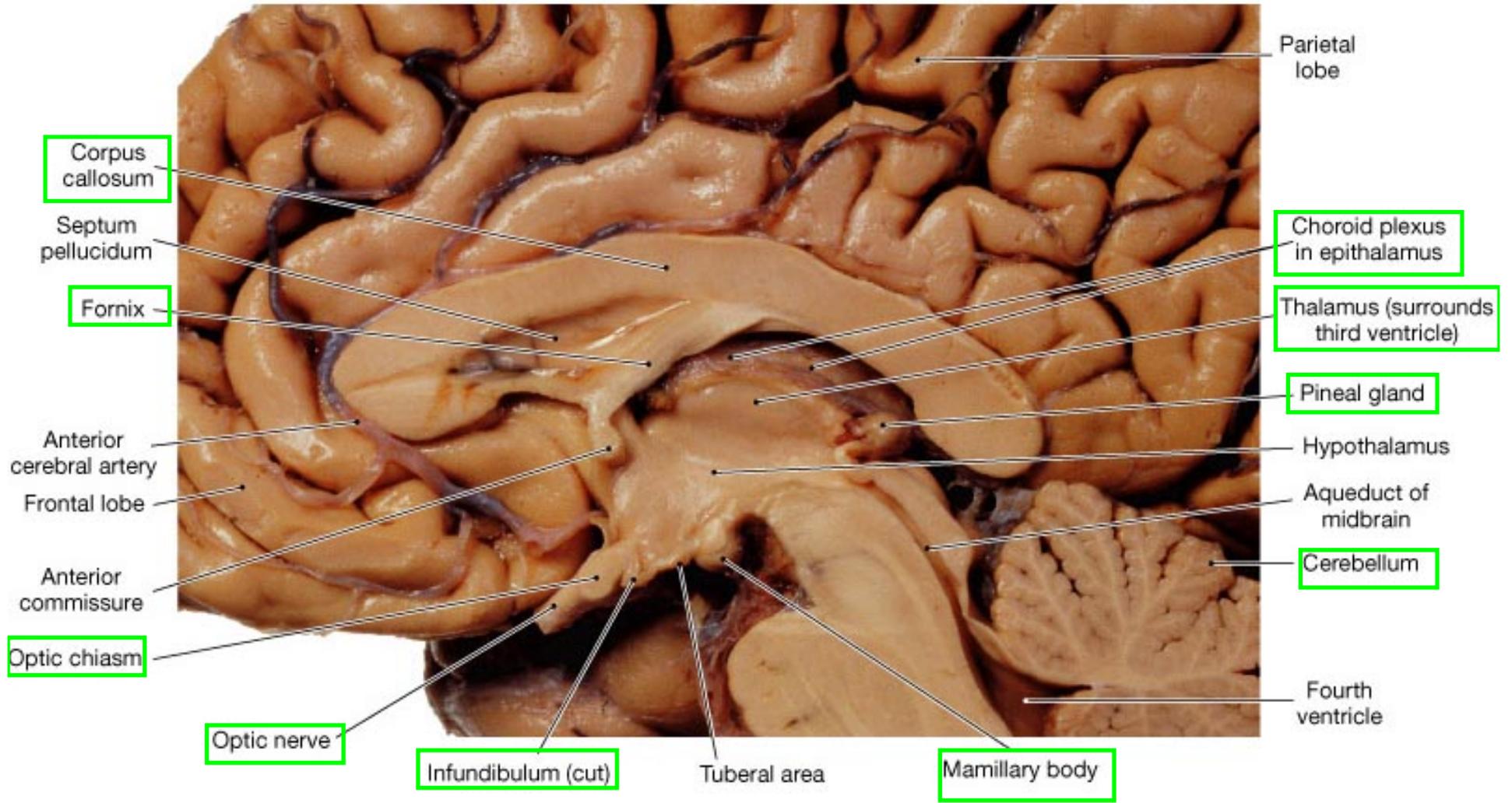
- (80% of diencephalon)
- Next to 3<sup>rd</sup> ventricle
- Communication with hemispheres



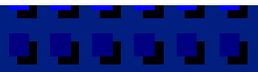
## 3c. Hypothalamus

- Just superior to optic chiasma
- Infundibulum - connects to pituitary gland
- *Some functions:*
  - Control of autonomic nervous system
  - Coordination of nervous and endocrine systems
- Secretion of hormones - ADH and oxytocin



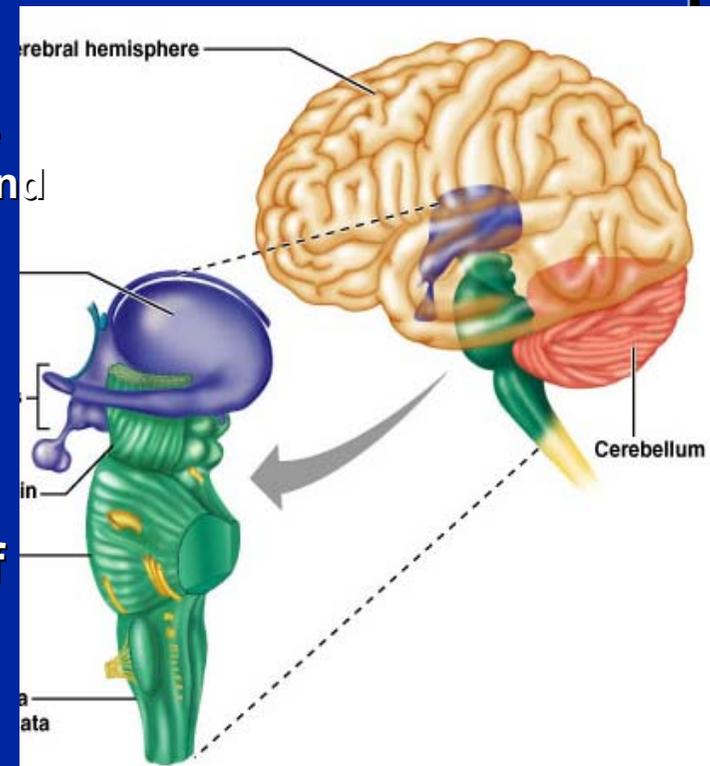


(a) Midsagittal section



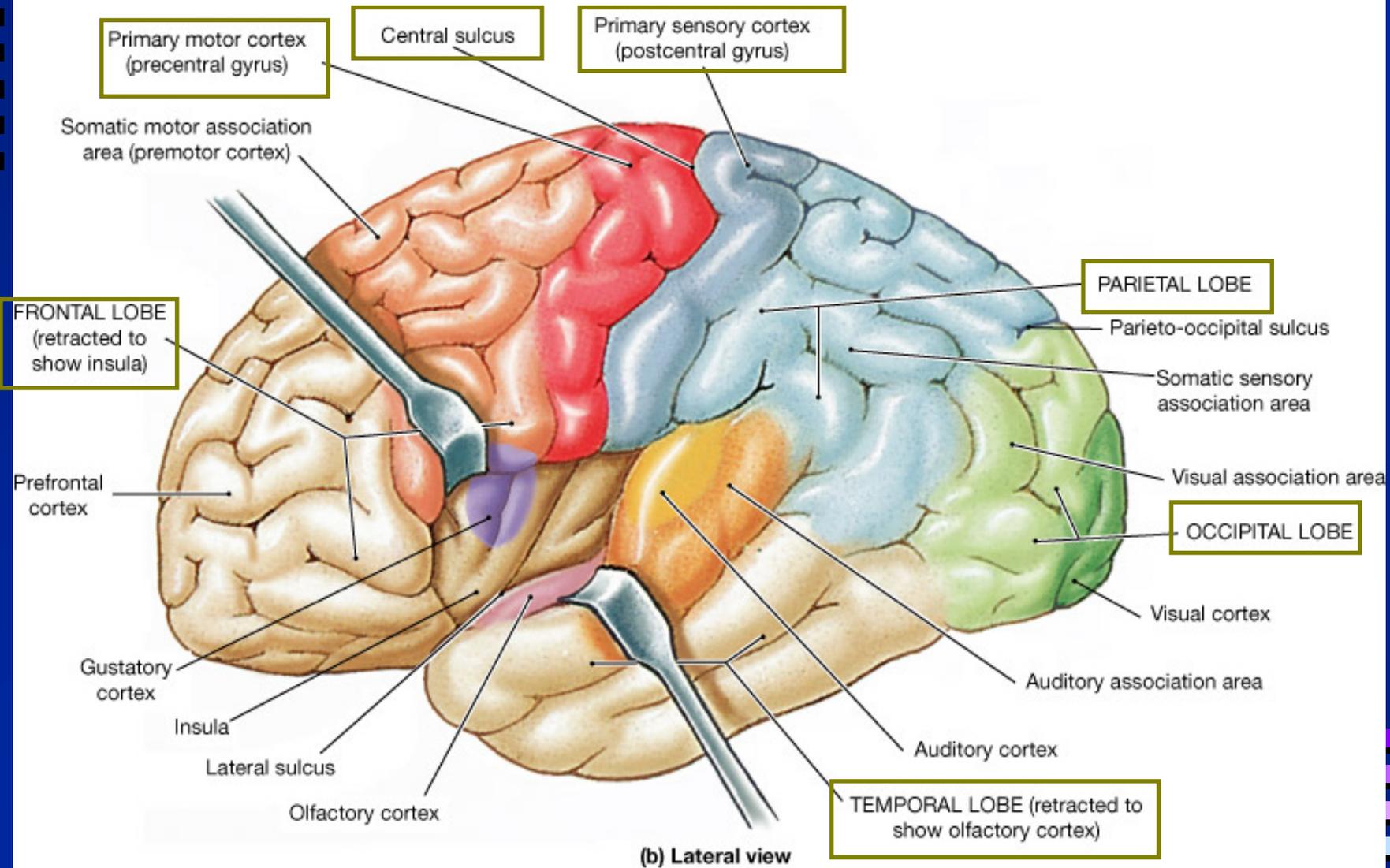
## 4) Cerebrum (Telencephalon)

- 83% of total brain mass
- The right and left halves (cerebral hemispheres)
  - are separated by the **Longitudinal Fissure**
  - and connected by the **Corpus Callosum** and **Anterior Commissure**
  - are separated from the cerebellum by the transverse fissure
- **Sulcus and Gyrus**
  - **Central Sulcus**
- **Gray Matter vs. White Matter**
- The **cortex** (gray matter) is the site of conscious thought



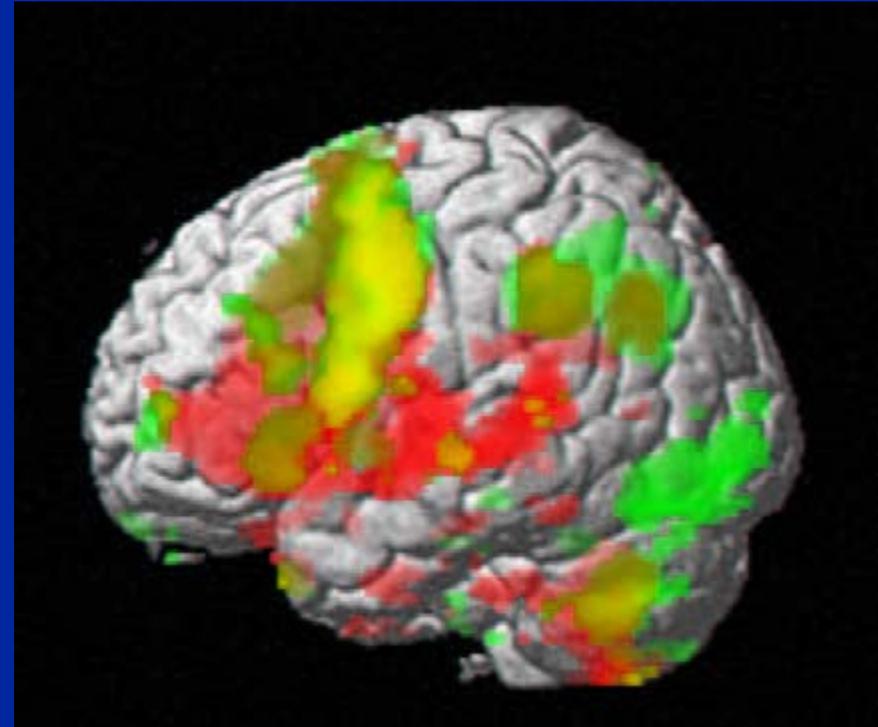
## 4) Cerebral Hemispheres, cont'd

- .. **have functional regions**
  - Sensory and motor areas
    - » e.g. Broca's area (speech)
  - Prefrontal Cortex (Cognitive functions)
- ... **have some functional differences** (in spite of anatomical resemblance) → **Lateralization of cortical functioning**
  - **Right brain: artistic skill**
  - **Left Brain: math, logic**
- ... **receive sensory information and generate commands for opposite side of body**
  - **Decussation of sensory input is in the spinal cord**
  - **Decussation of motor output is in the pyramids**



# fMRI

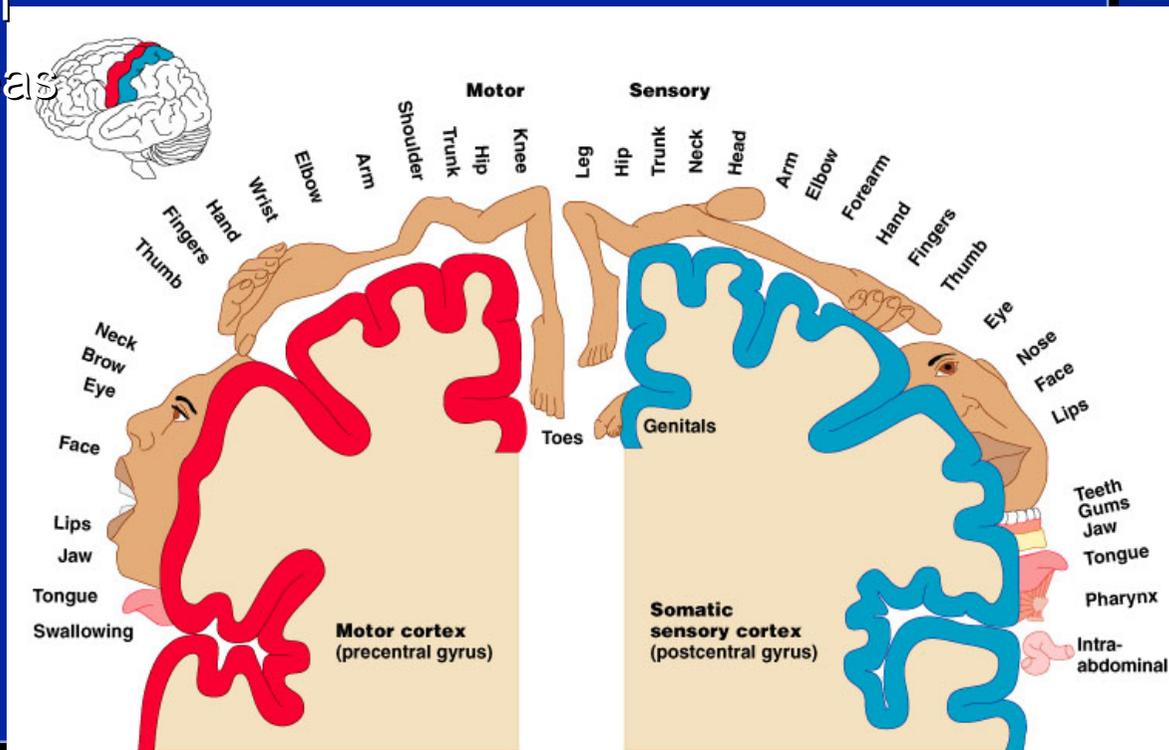
- An fMRI of the brain. Green areas were active while subjects remembered information presented visually. Red areas were active while they remembered information presented aurally. Yellow areas were active for both types.



# 4) Cerebrum, cont'd

## Regions of the Cortex

- Lobes named after the bones of the calvarium
- Sensory vs. Motor Areas
  - Homunculus
- Gyrus and Sulcus
  - Central Sulcus

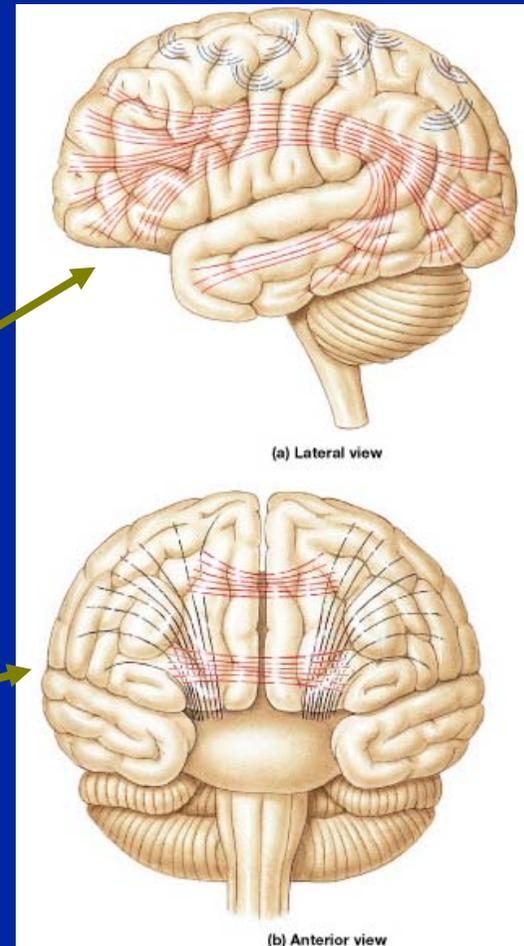


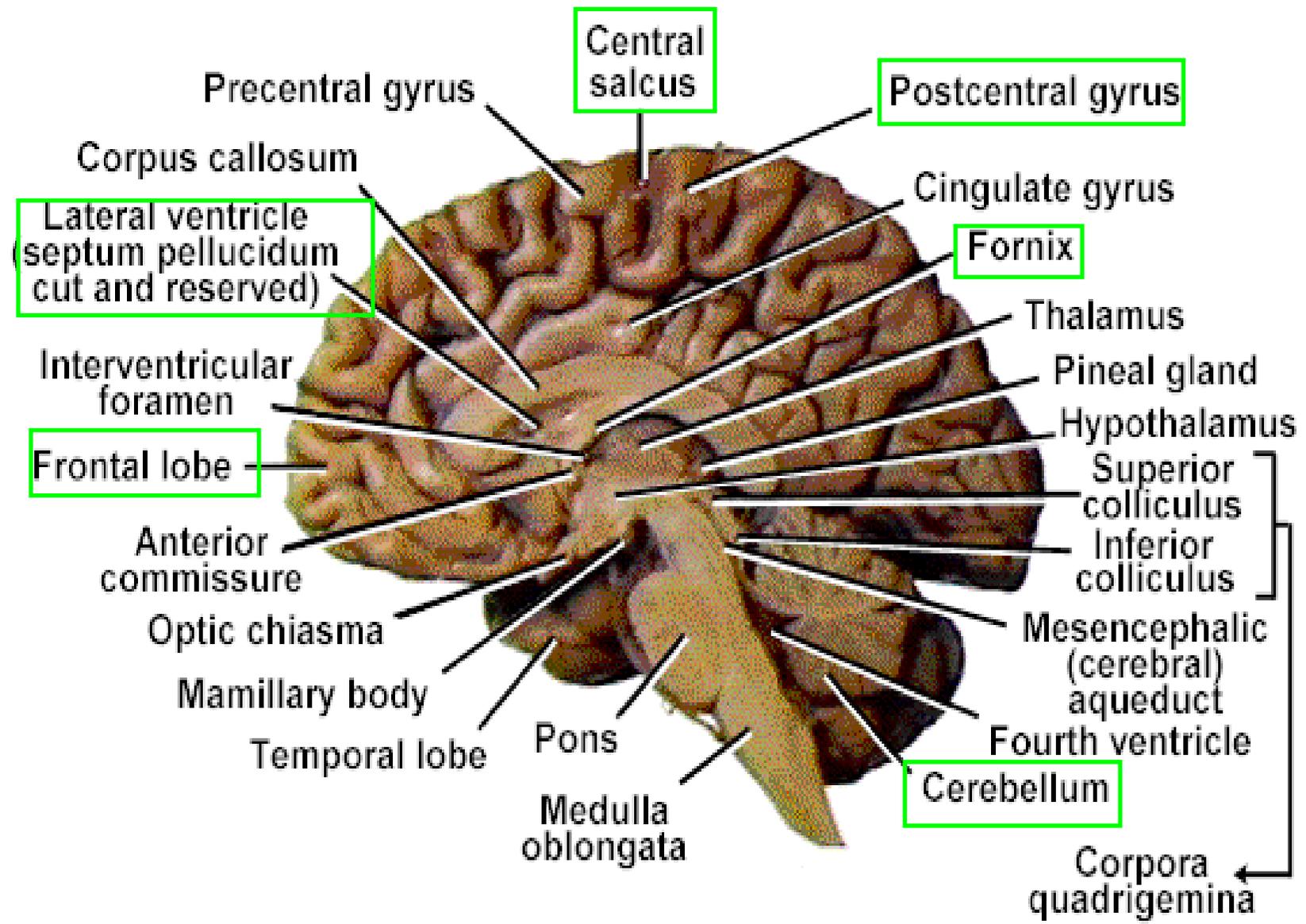
## 4) Cerebral Cortex and Central White Matter

Gray surface (cortex), 2-4 mm thick, is mostly neuron cell bodies with white tracts internally

**Projection tracts (fibers)** – connect more or less vertically

**Association tracts (fibers)** – connect one gyrus to another in the same hemisphere





# Basal Ganglia p 402

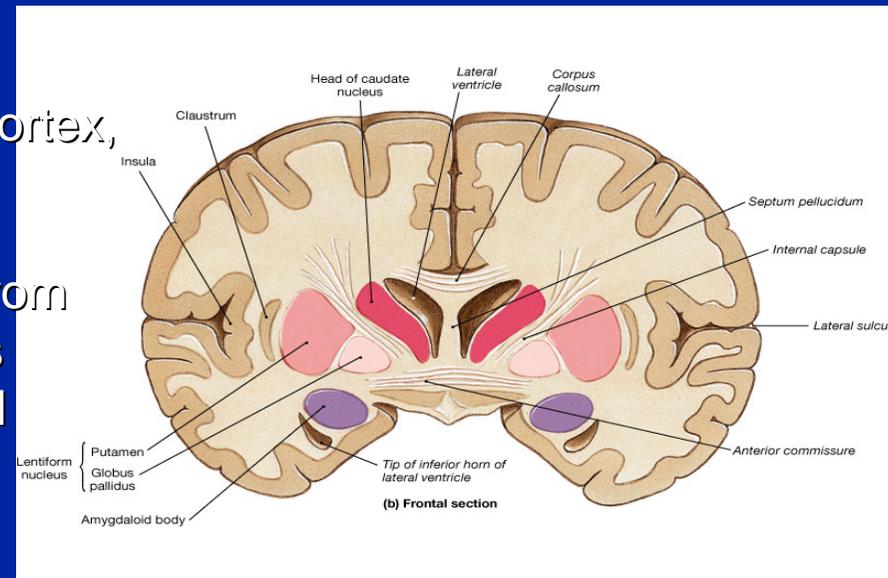
More proper term: **basal nuclei**

A collection of several nuclei

Gray matter deep to the cerebral cortex,  
below floor of lateral ventricles.

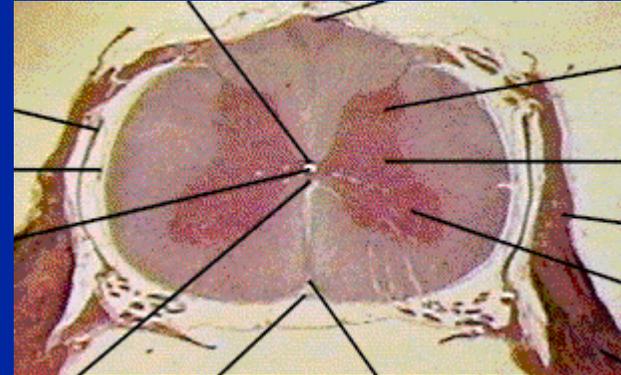
*Function:* modulate motor output from  
the cerebral cortex. Subconscious  
control of skeletal muscle tone and  
coordination of learned movement  
patterns.

Parkinson's disease is caused by the  
loss of at least 80% of the dopaminergic  
neurons in basal nuclei and substantia  
nigra (resting tremor)

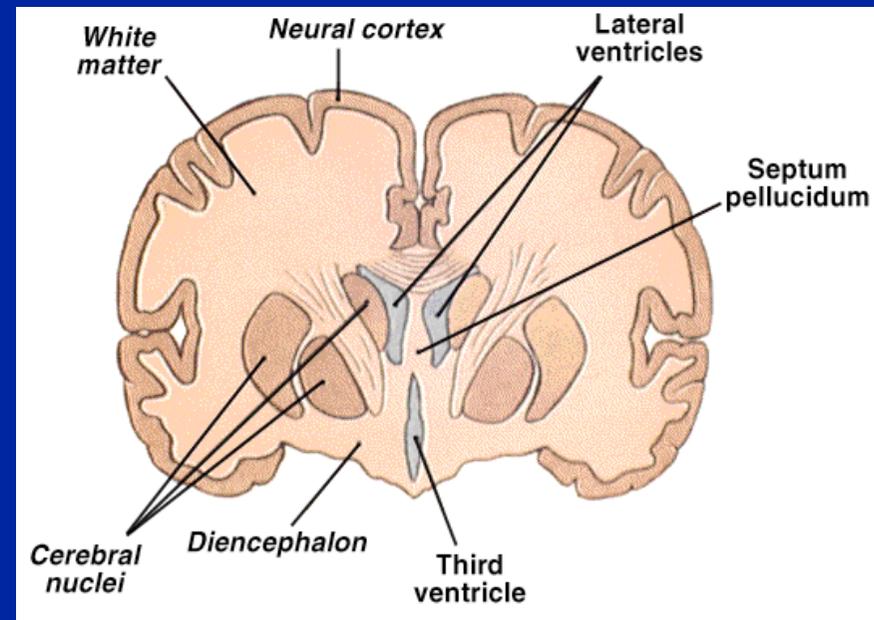


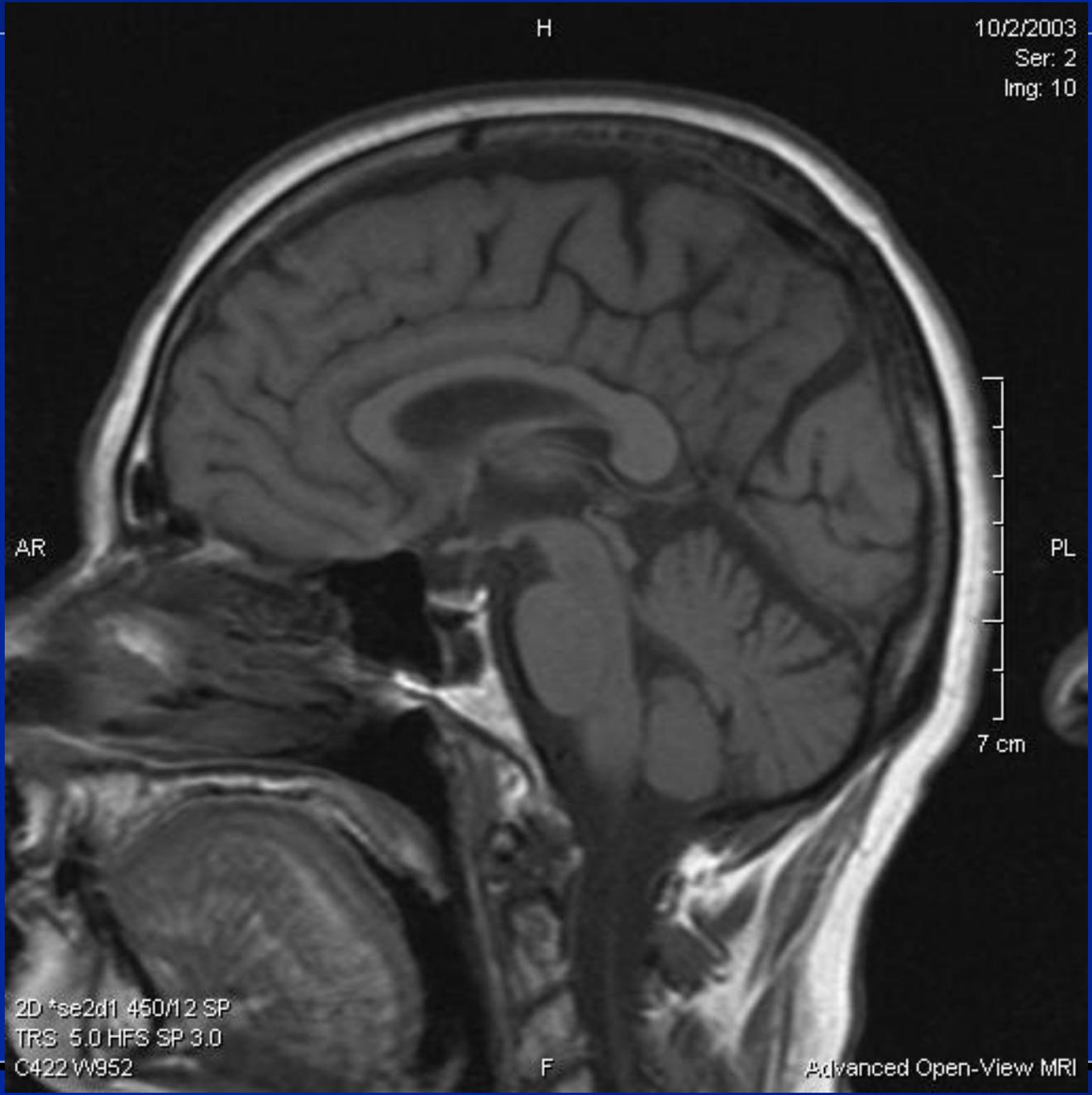
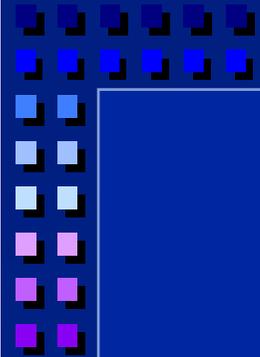
# Gray & White Matter Organization

In **brain stem** similar to spinal cord (nuclei around ventricles, tracts on outside)

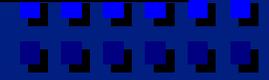


In **cerebrum** and **cerebellum**: white matter covered with layer of neural cortex (grey)





10/2/2003  
Ser: 2  
Img: 10



**Contrast  
enhanced  
MRI**

