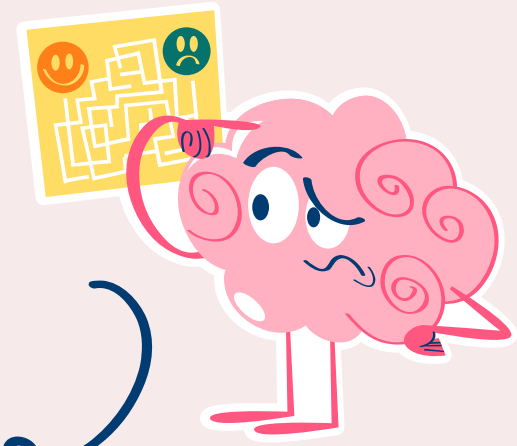
COGS 17

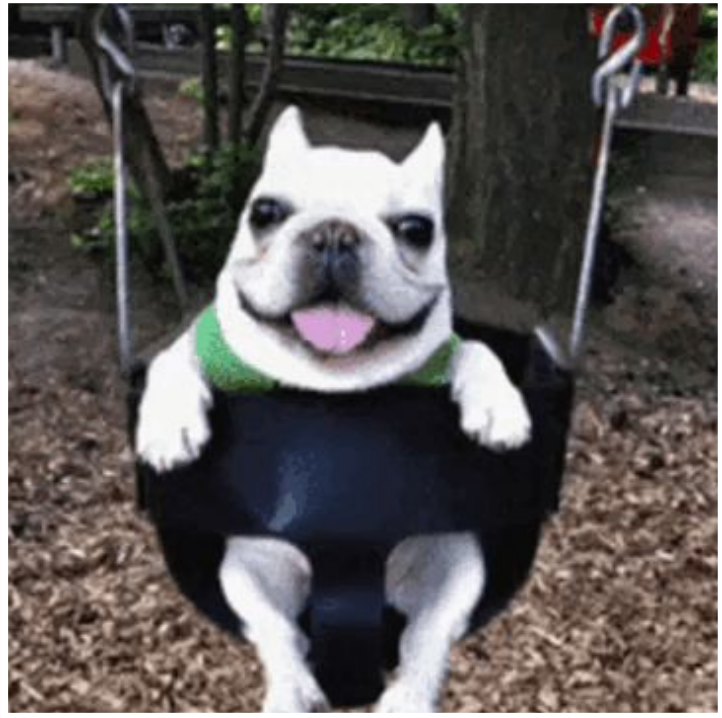
Week 2

Fundamentals of Neuroanatomy!



Introduce yourselves!

1. **What is your name + pronouns?**
2. **What year are you** (ex. freshman, sophomore, transfer, etc) **and what is your major?**
3. **Most exotic food you've tried?**



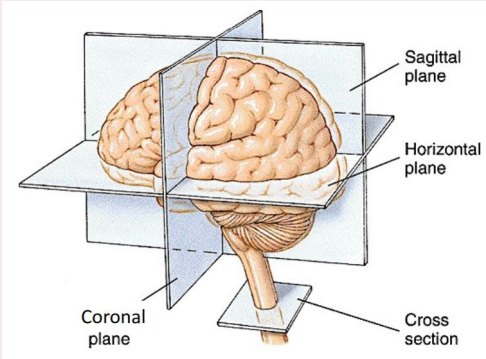
Anatomical Terms

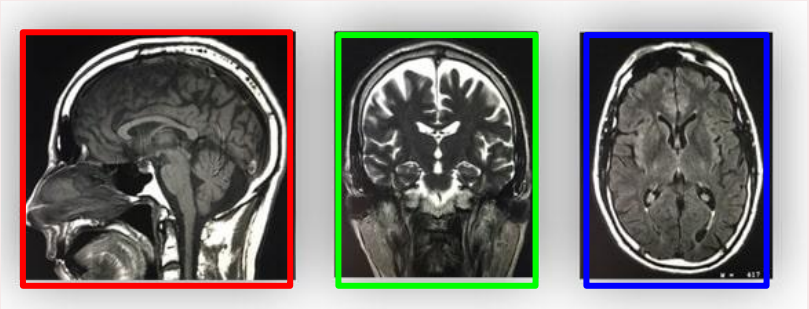
Sagittal: captures lateral and medial (think Sagittarius!)
Horizontal: captures dorsal and ventral
Coronal: captures anterior and posterior (crown)

Medial: towards middle
Lateral: away from midline

Contralateral: opposite side
Ipsilateral: same side

Dorsal: towards back of the body
Ventral: towards front of the body





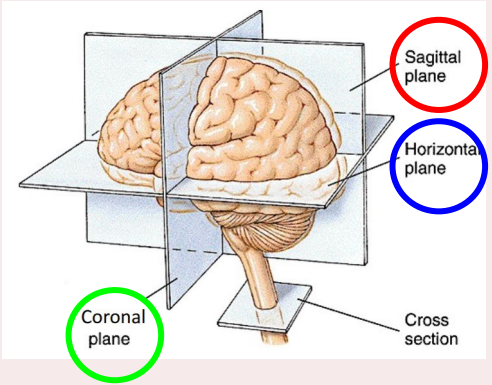
Anatomical Terms

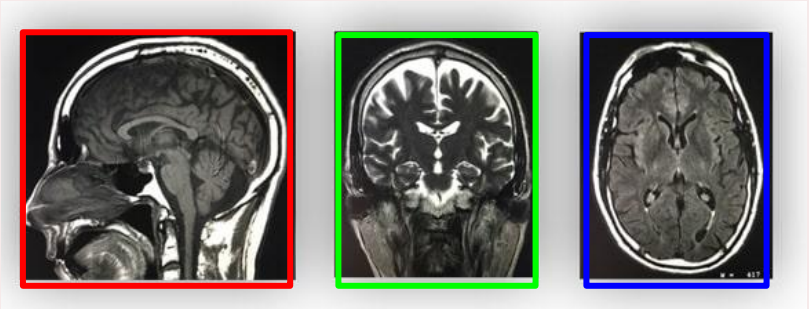
Sagittal: captures lateral and medial (think Sagittarius!)
Horizontal: captures dorsal and ventral
Coronal: captures anterior and posterior (crown)

Medial: towards middle
Lateral: away from midline

Contralateral: opposite side
Ipsilateral: same side

Dorsal: towards back of the body
Ventral: towards front of the body





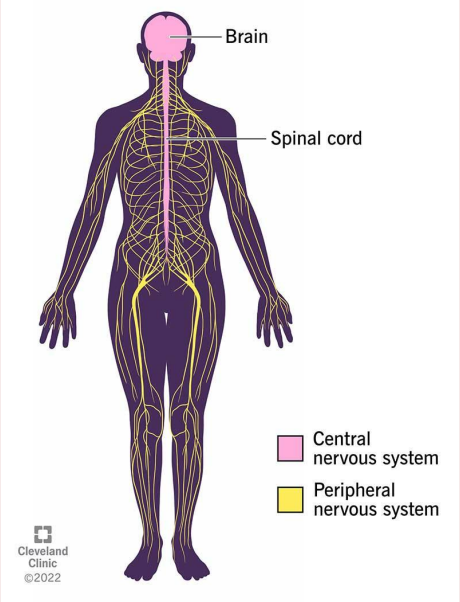
Divisions of Nervous System

Central Nervous System (CNS)

- Contains spinal cord and brain
- Encased by bone and meninges

Peripheral Nervous System (PNS)

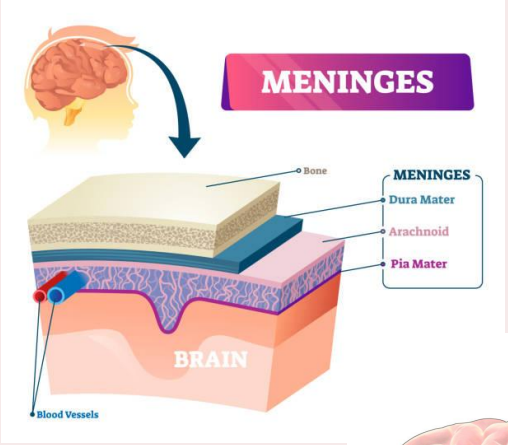
- Nerves outside CNS
- Responsible for Somatic (Sensory/Motor) and Automonic Nervous System (Internal)



Support Structures

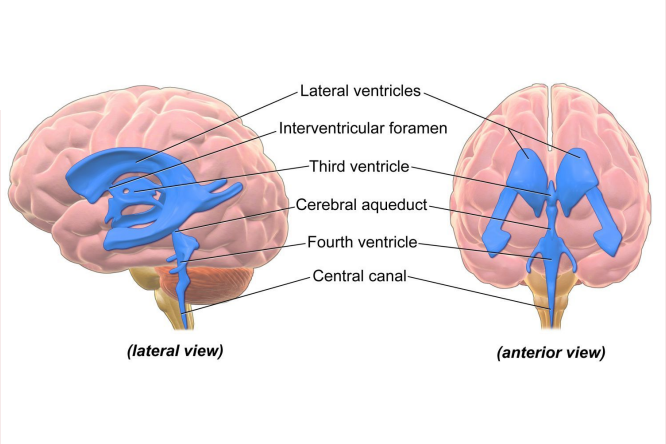
Meninges → composed of PAD!

- Dura Mater: Thick outer layer
- Arachnoid Mater: Spider-web like, spongy layer filled with CSP, shock absorber
- Pia Mater: flexible inner layer that conforms to the brain and spine surfaces



Ventricles

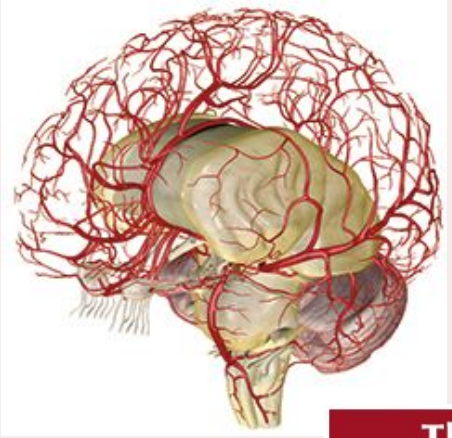
- Hollow, interconnected cavities
- Produce and circulate CSF



Support Structures cont.

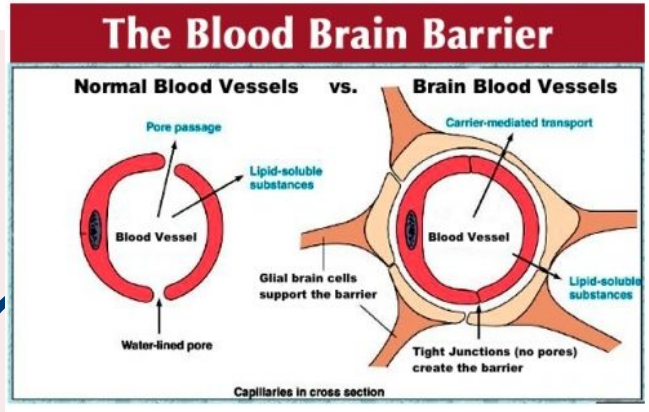
Blood Vessels

- Web of incoming arteries and outgoing veins
- Helps clear out the brain of waste
- Carries out “used” CSF
- 2% of body weight but uses 20% of blood supply



Blood-Brain Barrier (BBB)

- Strict control over chemicals in the brain
- Protects brain from infections
- Only small uncharged particles and fat-soluble molecules can passively cross



The Brain - Hindbrain

Medulla Oblongata

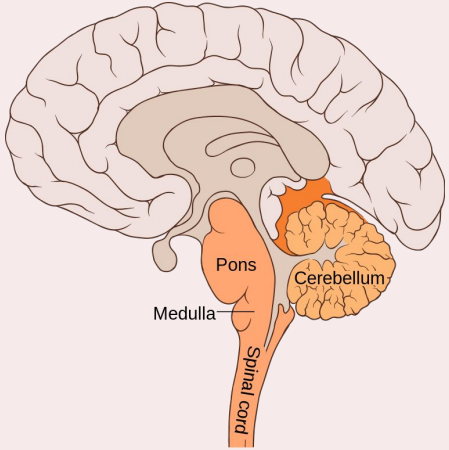
- Controls vital reflexes (i.e. breathing, heart rate)

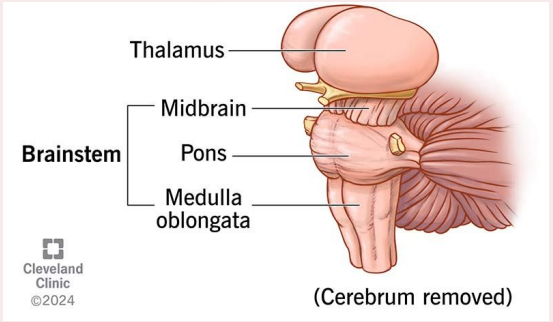
Pons → Latin for “Bridge”

- Relay between cortex and cerebellum / brain and spinal cord
- Includes reticular formation (arousal) and Raphe system (sleep)

Cerebellum (NOT the brain stem!)

- Motor programs with real-time sensory coordination
- Critical in timing actions and shifting attention





The Brain - Midbrain

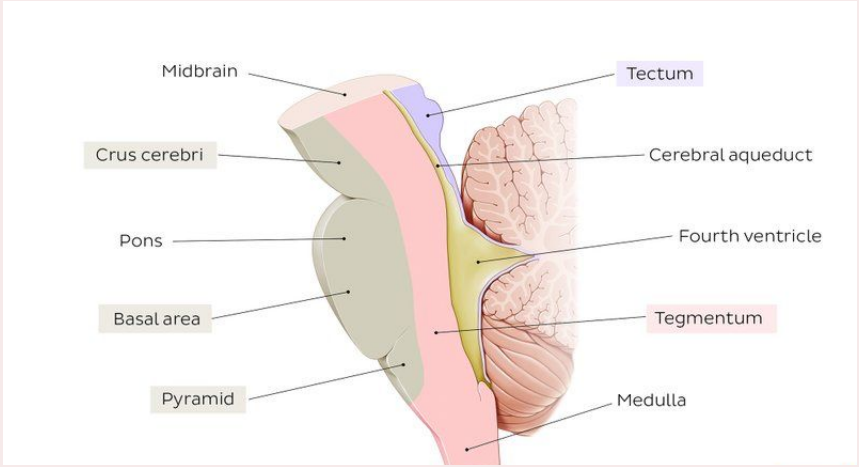
Entirely contained in the brainstem

Tectum → Latin for “Roof”

- Part of sensory pathways to the brain
- Consists of Superior (visual – associated w/ “Blindsight”)) and Inferior (auditory) Colliculus

Tegmentum → Latin for “Covering” or ”Rug”

- Contains major motor pathways and some cranial nerves
- Includes Red Nucleus and Substantia Nigra
- Contains cranial nerves to control eye movements



The Brain - Forebrain (Diencephalon)

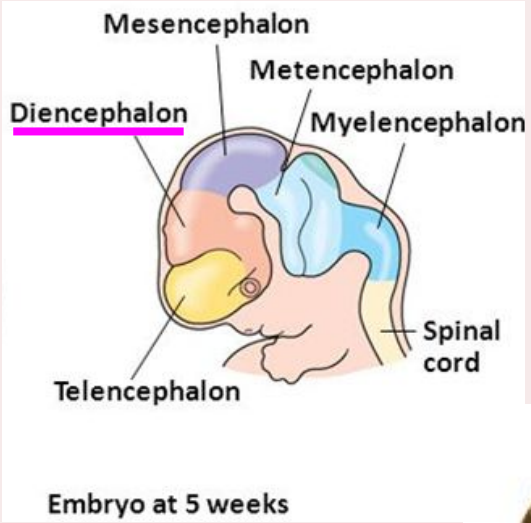
Consists of thalamus and hypothalamus

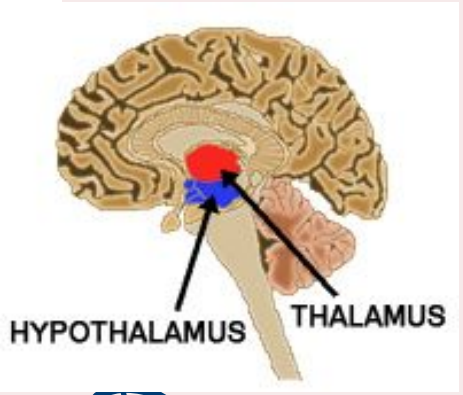
Thalamus

- Primary source of input to cerebral cortex
- Nuclei of many sensory and motor systems
- Involved in critical arousal

Hypothalamus

- Hypo = “below”
- Oversees 4Fs
- Also regulates temperature and internal clock
- Controls endocrine via pituitary gland

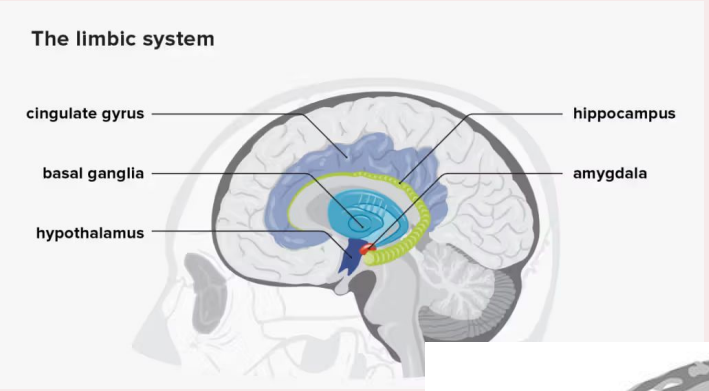




The Brain – Forebrain (Telencephalon)

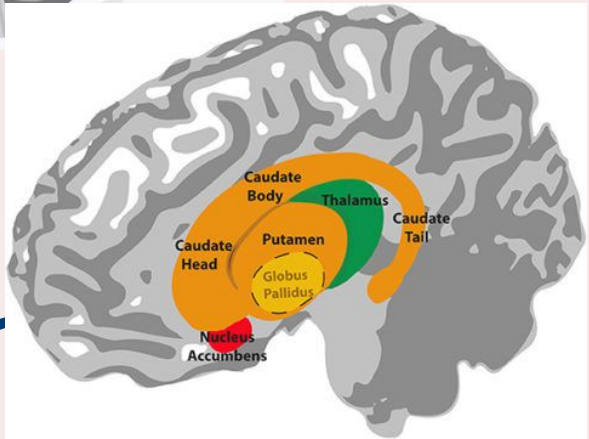
Limbic System

- Emotion, Motivation
- Hippocampus: formation of new memories and spatial mapping
- Amygdala: emotional expression
- Cingulate Gyrus: assess valence +/-
- Olfactory Bulb: exchanges olfactory info with the rest of the limbic system



Basal Ganglion

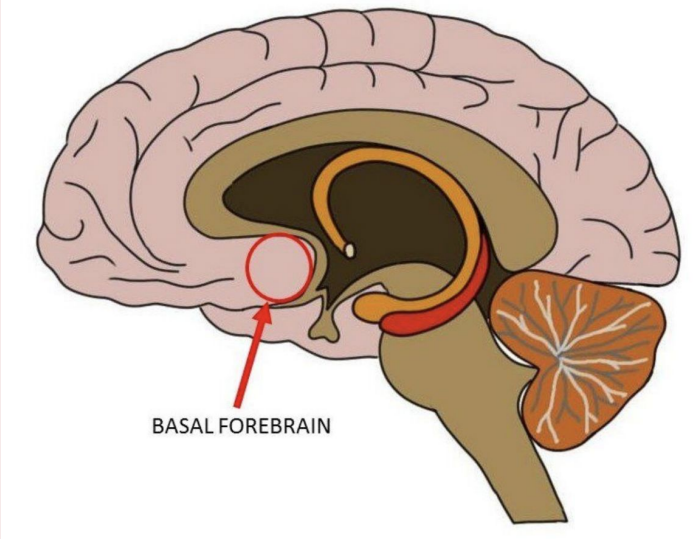
- Control of movement, especially planned sequential behaviors (task setting)
- Includes caudate, putamen, and globus pallidus



The Brain – Forebrain (Telencephalon)

Basal Forebrain

- Attention and cortical arousal
- Main source of ACh and GABA
- Sleep/arousal cycles



The Brain - Cerebral Cortex

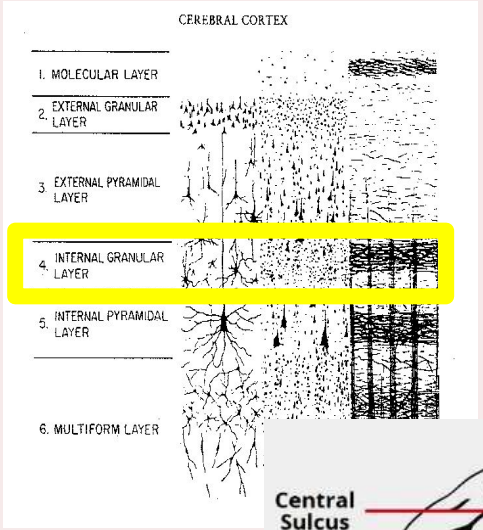
Organized into 6 layers

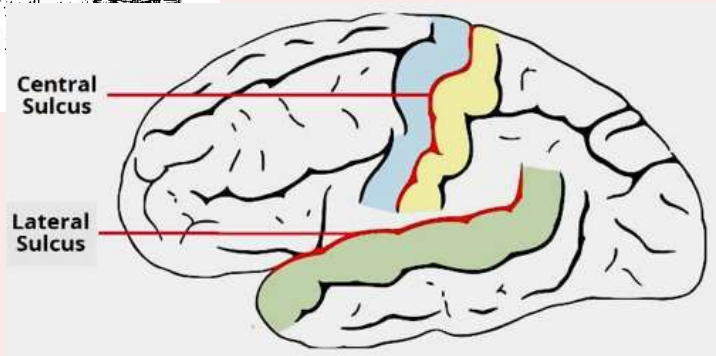
- Information projected in at layer 4

- Bulges = gyri
- Folds = sulci

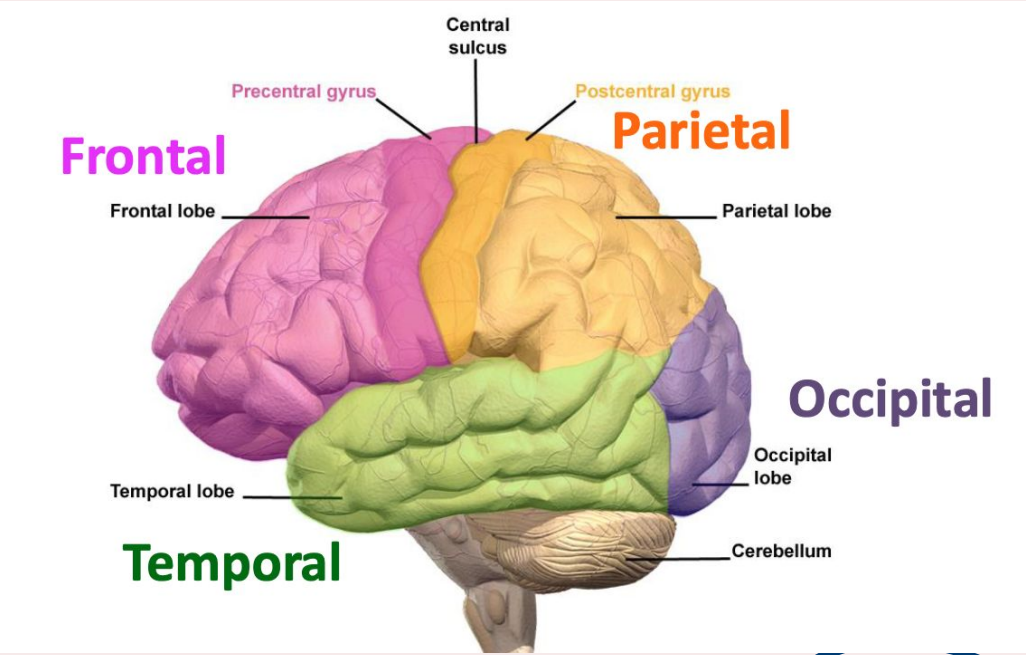
- Central Sulcus divides parietal from frontal lobe

- Lateral Sulcus divides temporal from frontal lobe





The Brain – The "Big 4" Lobes



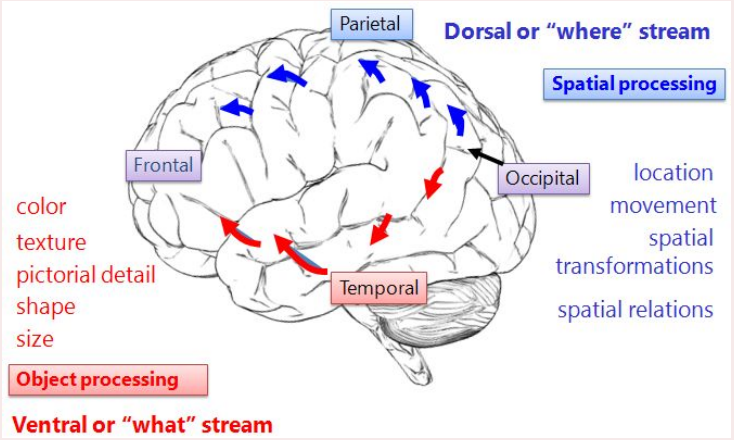
The Brain – The "Big 4" Lobes

Occipital Lobe

- Visual processing
- Contains V1 and receives projections from thalamus & higher visual areas
- Separate pathways for details (e.g., color, depth) that project to other lobes

Temporal Lobe

- Contains auditory areas (including Wernicke's Area)
- Inferior Temporal: ventral "who/what" pathway, specializes for face detection
- Anterior Temporal: emotional expression and interpretation



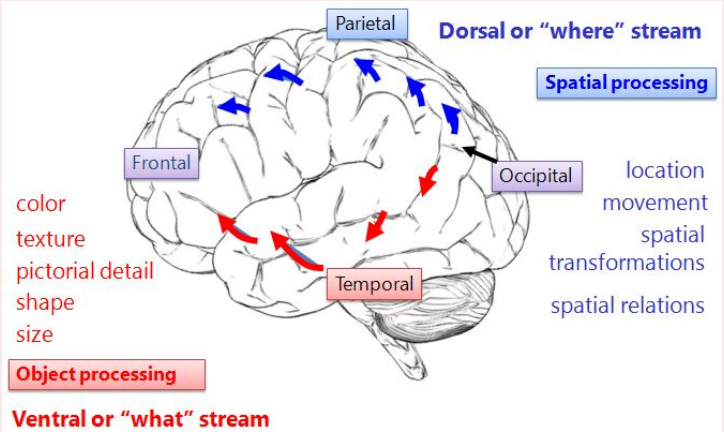
The Brain - The "Big 4" Lobes cont.

Parietal Lobe

- Integrating visual and somatosensory info
- Spatial mapping
- Medial Temporal (MT): dorsal "where/how" pathway
- Includes Canonical and Mirror cells

Frontal Lobe (also contains prefrontal cortex)

- Important for motor movements, language production, and strategy
- Precentral gyrus: motor cortex
- Premotor areas contain mirror cells
- Contain Broca's Area (preparing to speak)



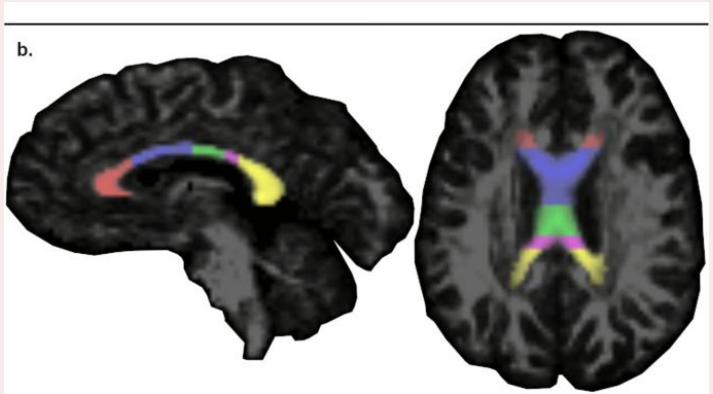
The Brain - Lobes + More Significant Parts

Prefrontal Cortex

- Self-control, delayed gratification
- Culturally appropriate behavior
- Cost/benefit analysis

Corpus Callosum

- Large axonal fibers connecting the two hemispheres
- Part of the “white matter” of the brain
    - Consists of mainly myelinated axons
    - Brain is ~66% white matter



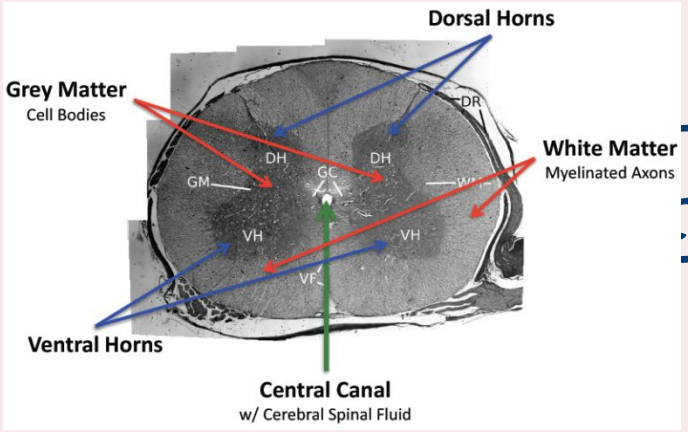
Spinal Cord

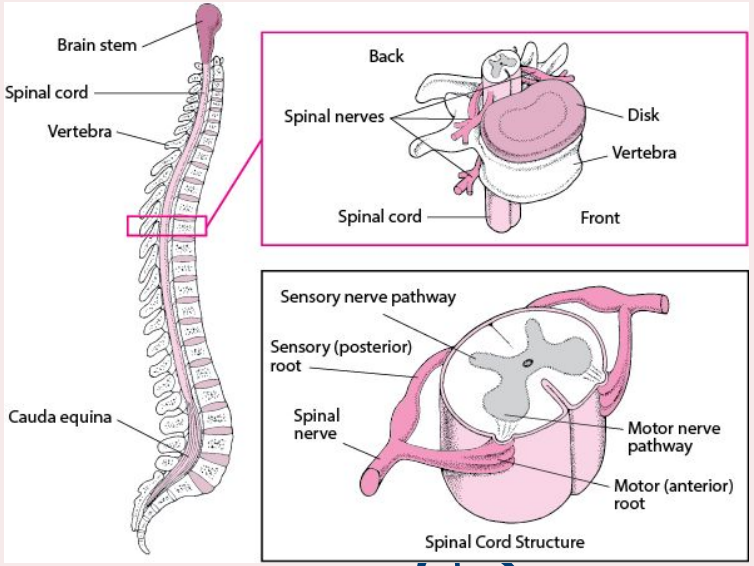
Consists of 31 segments along the spine

Dorsal Root
- Afferent nerves
- Info from body to brain

Ventral Root
- Efferent nerves
- Motor info to muscles and glands

Bell-Magendie Law
- Sensory info goes in via dorsal roots and exits ventral roots





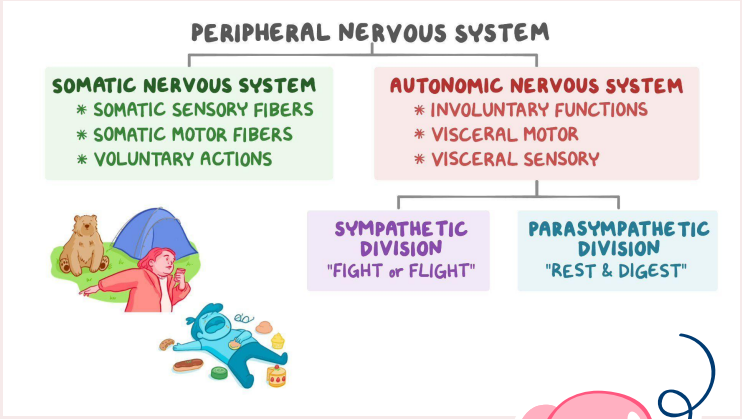
Peripheral Nervous System Cont.

Somatic

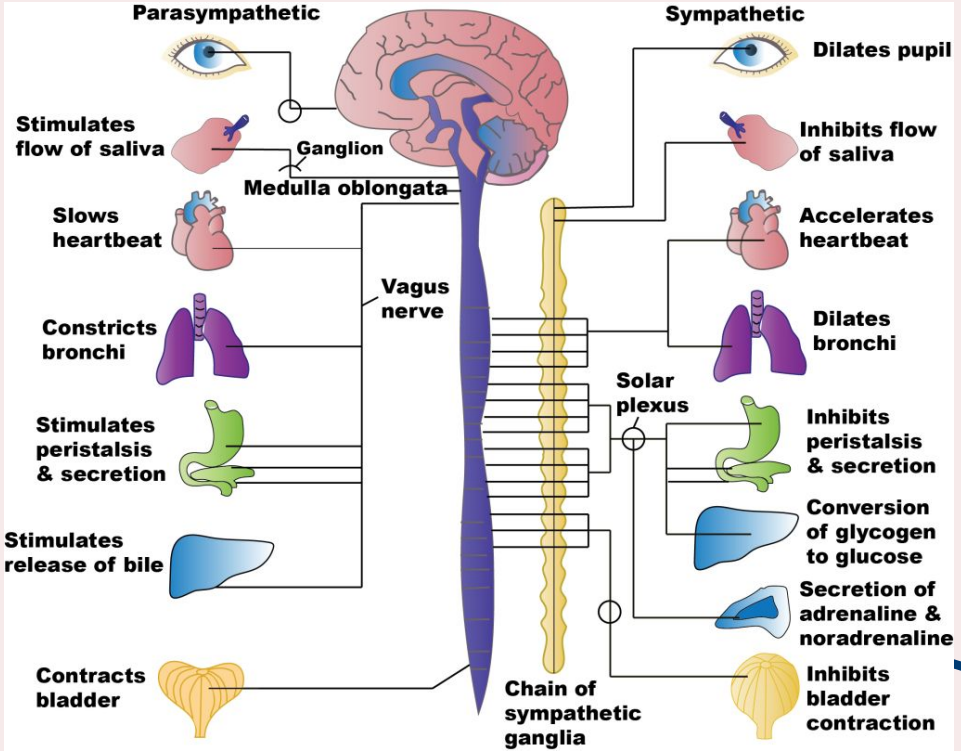
- 31 pairs of spinal nerves: sensory information from body, feedback from skeletal muscles, and motor output to muscles
- 12 cranial nerves: senses, feedback from some organs, motor control of eye movements, and control of facial expressions

Autonomic

- Regulates internal state
- Sympathetic “Fight or Flight”
- Parasympathetic “Rest & Digest”
- Parasympathetic Rebound
    - Excessive, repeated stressors can lead to ulcers; Voodoo death



Autonomic Nervous System cont.



Reminders!

Homework Problem Sets

- Homework #1 is due this WED 11:59 PM!
- No late homeworks accepted

Midterm

- Midterm 1 is Tues, April 22 from 3-30:4:50 PM
- Can be taken online or in class
- Will be proctored in class

Extra Credit

- SONA
- Mnemonics
- Do all HWs → 4 extra credit points