
COGS 17 Week 2

— SPRING 2024, A03 —

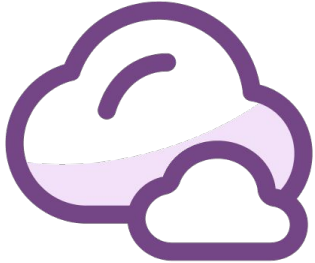
WELCOME TO COGS 17

About Me

- Jason Chen
- MS student in Data Science
- BS in Cognitive Science ML & Neurobiology @ UCSD
- Student researcher in Computational Neural DNA Dynamics Lab
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- Office Hours: Mon 5pm - 6pm over zoom

FEEL FREE TO REACH OUT IF YOU HAVE ANY QUESTIONS!

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What's your major?

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Why do you choose this course?

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How are you feeling about this course so far?

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Section philosophy

- Attendance is not required
- Review terms & topics covered in lectures
- Problem sets to help review
- Section materials will be uploaded to GitHub

Problem Set for Today

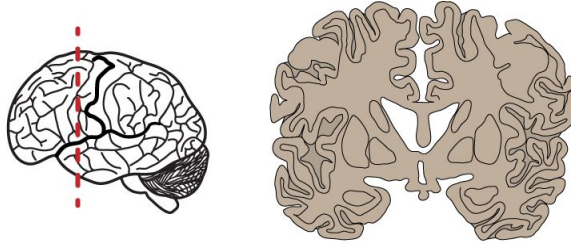
- Link:

<https://docs.google.com/document/d/1whYJuFI7FfIh6MJwatadJ04U3cjBmfpsVsM1AdFZ7DQ/edit?usp=sharing>



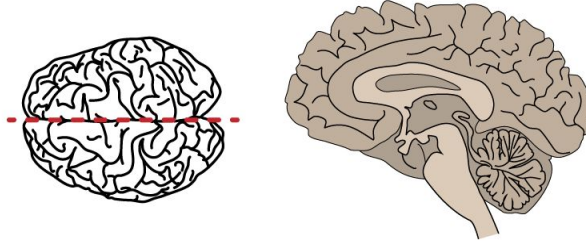
Planar Views of the Brain

Frontal or
coronal plane



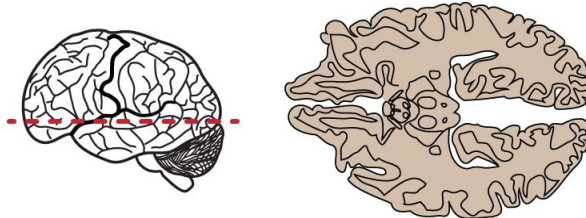
Coronal Plane -- From the **FRONT**

Sagittal plane



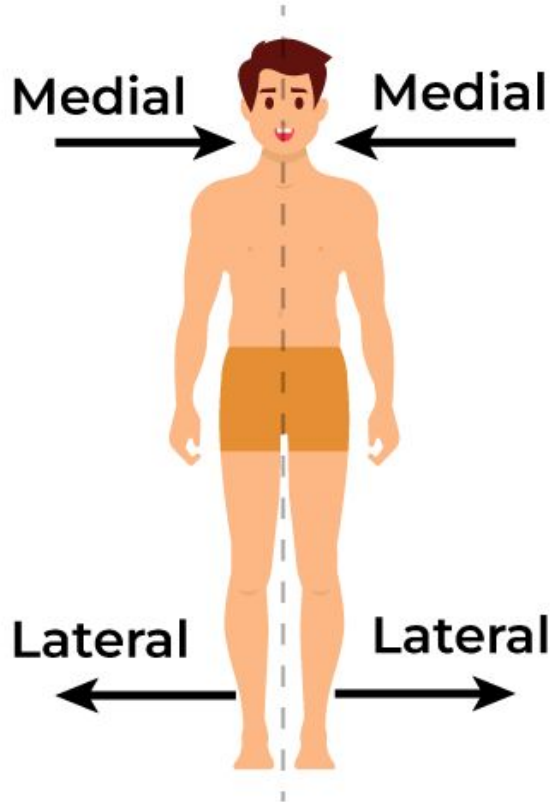
Sagittal Plane -- From the **SIDE**

Horizontal plane



Horizontal Plane -- From the **ABOVE**

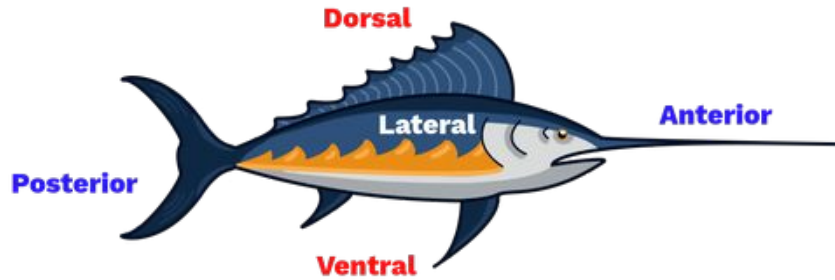
Lateral Vs Medial



Medial: toward midline, away from the sides

Lateral: toward the sides, away from the midline

Dorsal vs ventral



Dorsal: toward the back of the body, for the human head, toward the top

Ventral: toward the stomach, for the human head, toward the bottom

Ipsilateral vs Contralateral

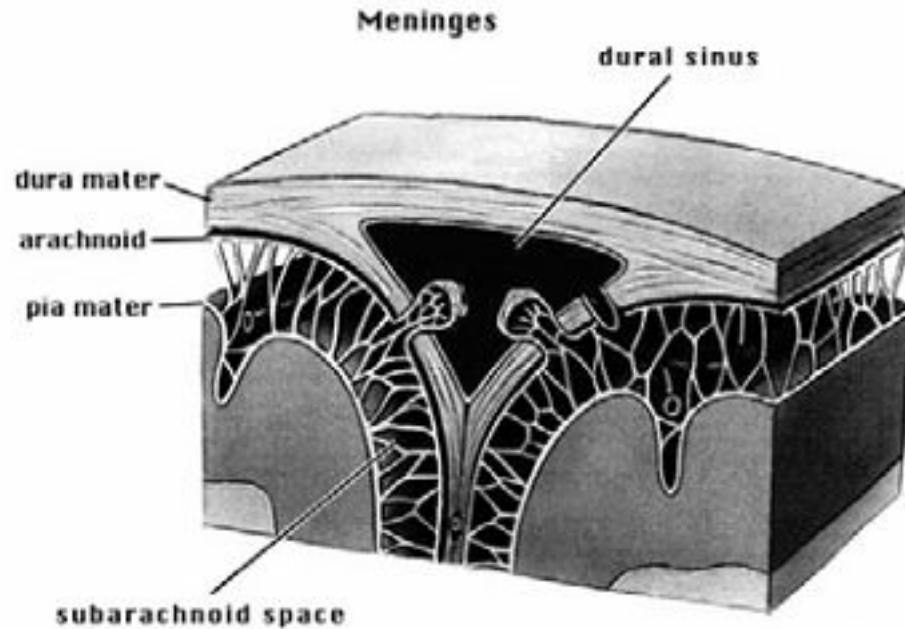


Ipsilateral -- Connection on the **SAME** side of the nervous system



Contralateral -- Connection on the **OPPOSITE** side of the nervous system

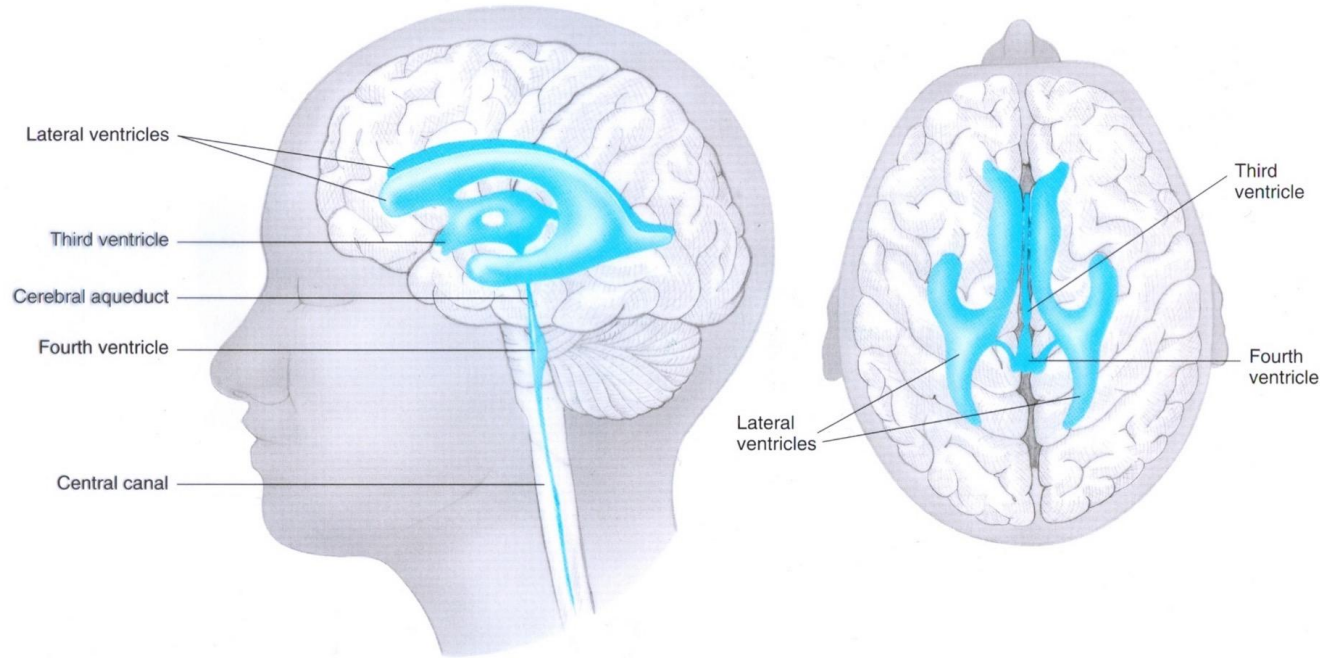
Support Structures: The Meninges



Modified from Prentice Hall: Martini/ Timmons 1997

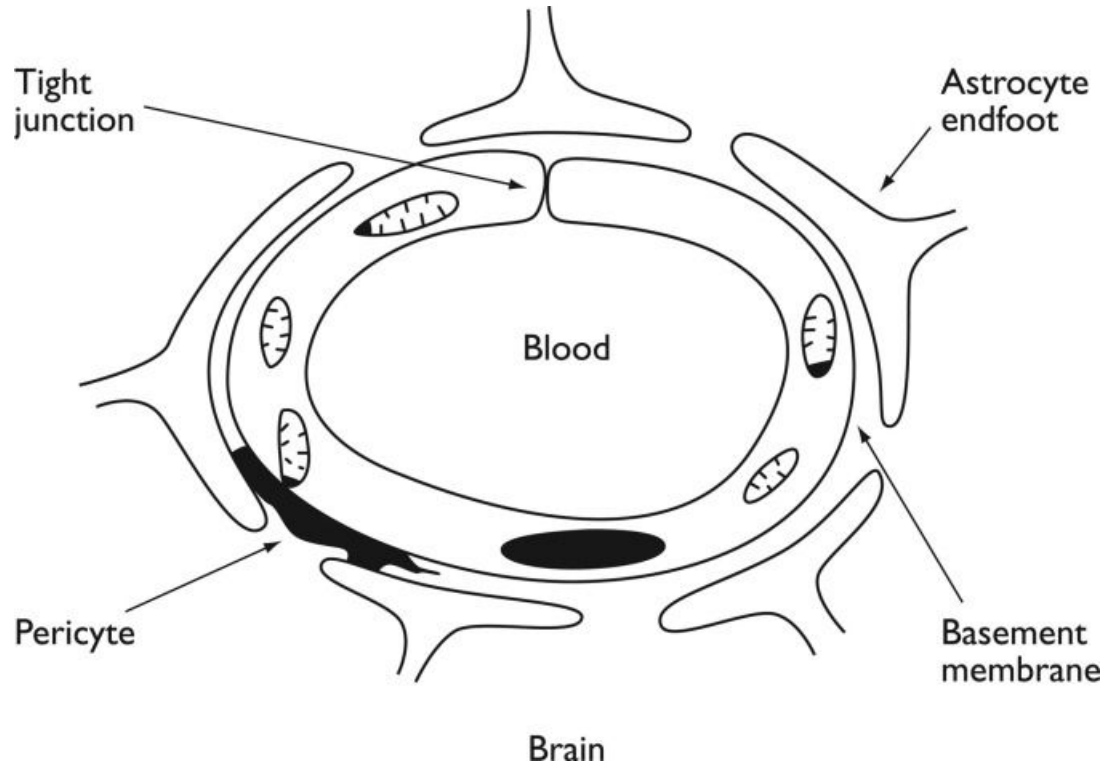
- Dura mater -- Thick outer layer, immediately under bone
- Arachnoid mater -- Spider-web like, filled with cerebrospinal fluid (CSF), absorbs shock
- Pia mater -- Conforms to brain & spine surface, includes blood vessels

Ventricles



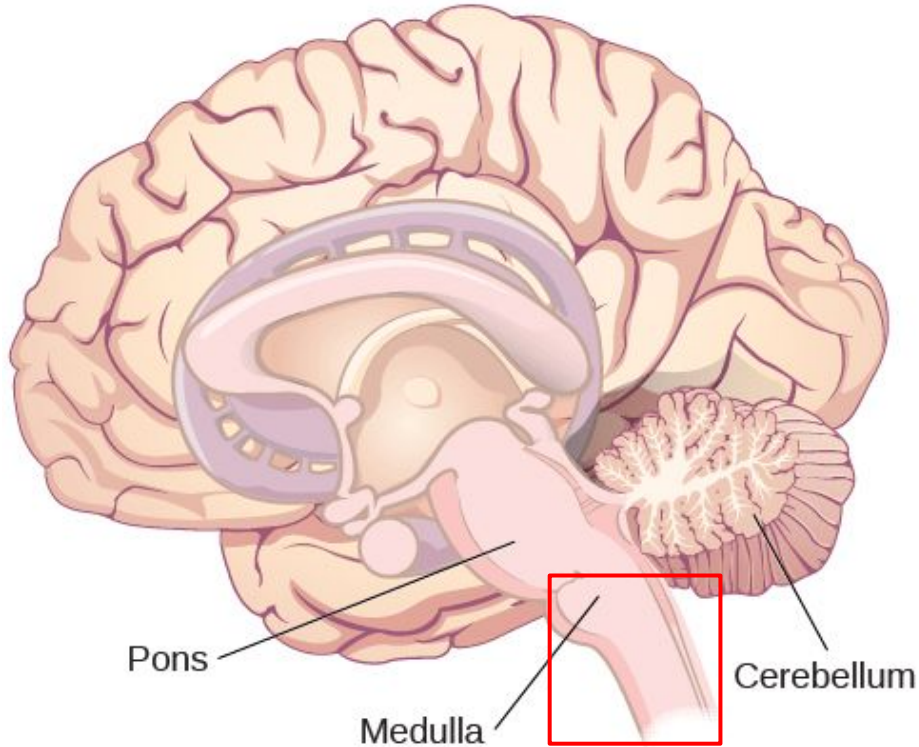
Hollow, interconnected cavities in brain, produce Cerebrospinal Fluid (CSF).

Blood-Brain Barrier



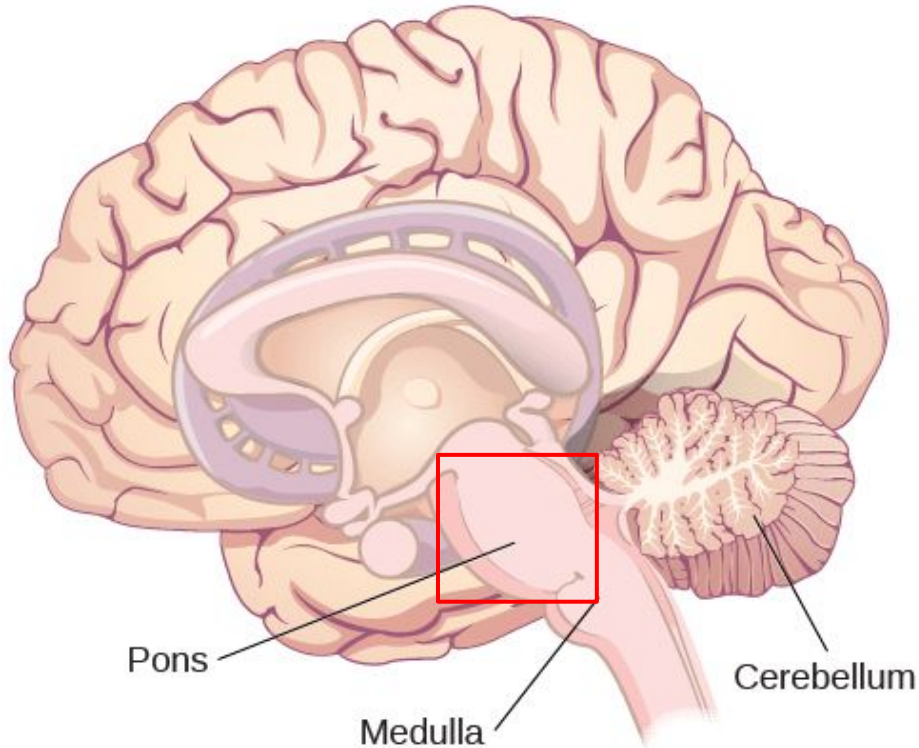
- Strictly control chemical contents of the brain
- Protects brain from infections
- Only small, uncharged particles and fat-soluble molecules can passively cross barrier
- Astrocyte (a kind of glia cell) helps to create barrier

Medulla Oblongata



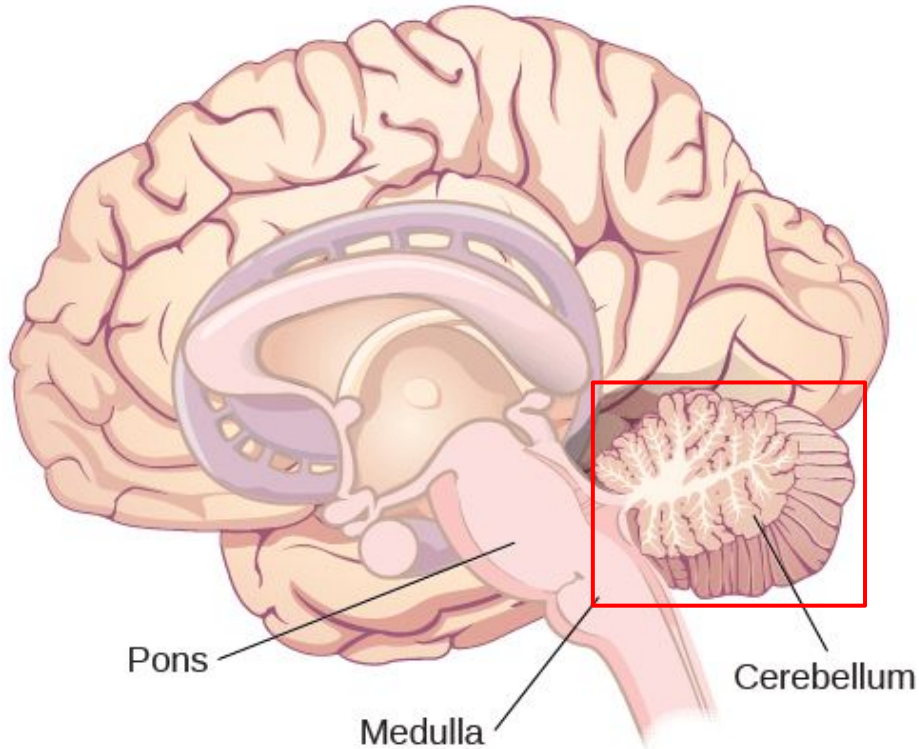
- Controls **VITAL REFLEXES**, including breathing, heart rate, vomiting, coughing, etc.

Pons



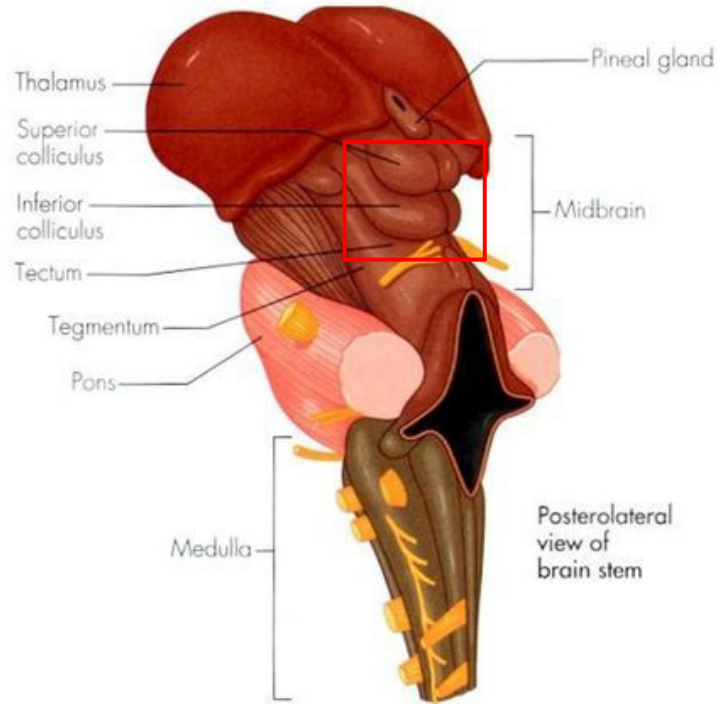
- Latin for “bridge”
- Carry sensory/motor info to/from the head (relay information)
- Include reticular formation and Raphe System

Cerebellum



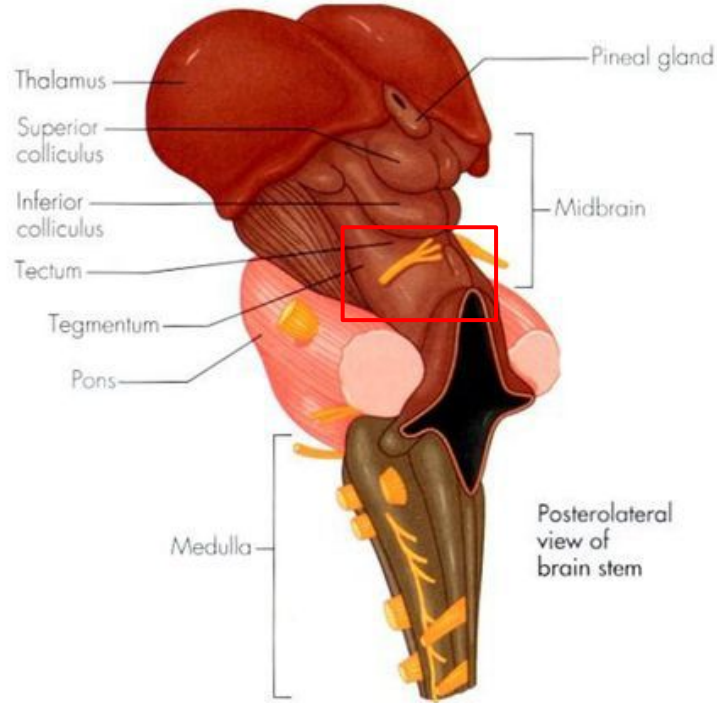
- Guide movements
- Critical in timing actions
- Also important in relevant shifting of attention

Tectum



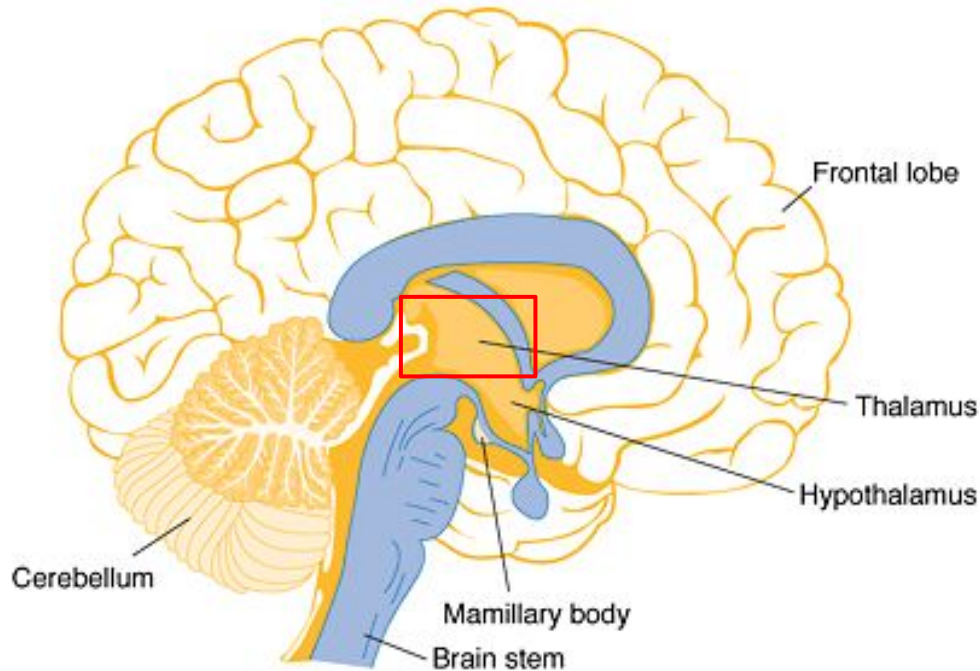
- Means “roof”
- Consists of Superior Colliculus (for visual motion) and Inferior Colliculus (for auditory motion)
- Part of sensory pathways to the brain

Tegmentum



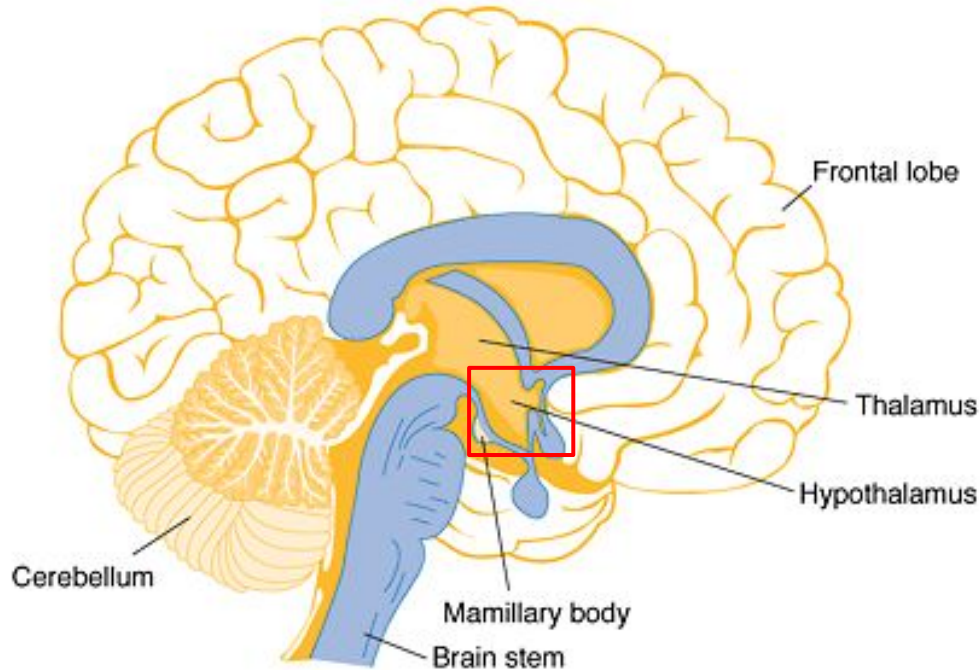
- Means "covering" or "rug"
- Major **MOTOR** pathways
- Part of Reticular Formation for arousal
- Includes Red Nucleus & Substantia Nigra

Thalamus



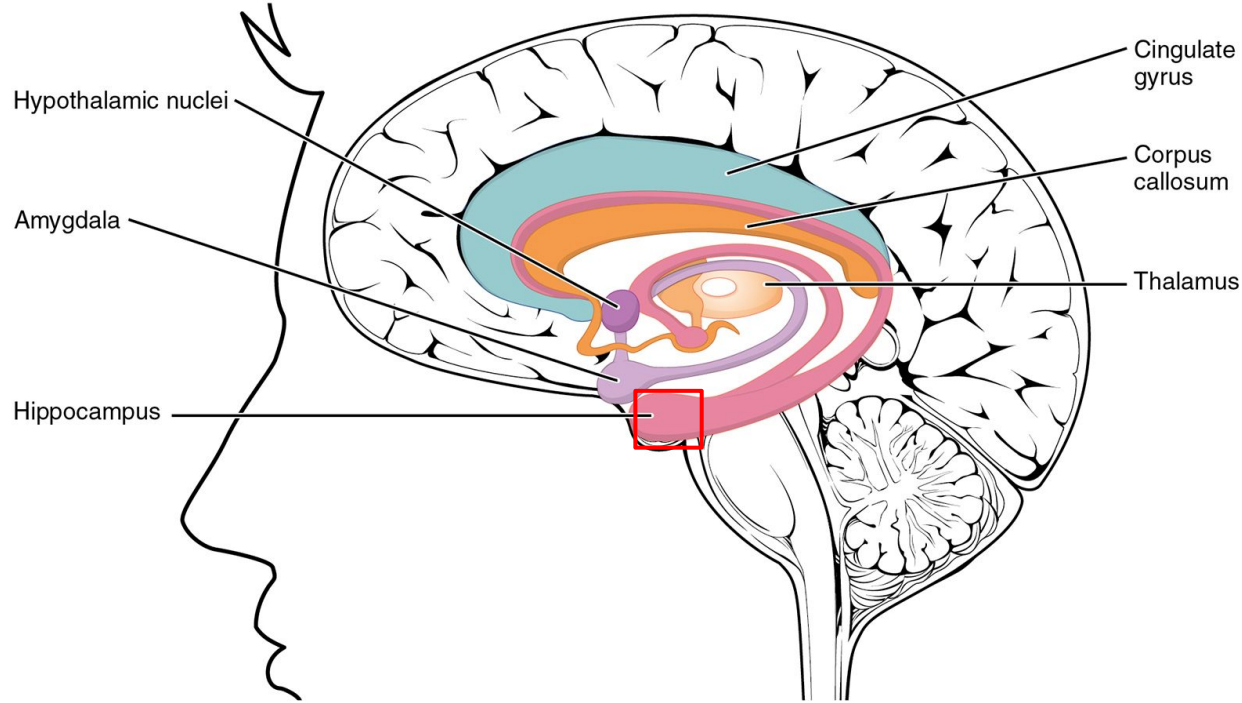
- Primary source of input to Cerebral Cortex
- Also includes intrinsic neurons for information processing within thalamus

Hypothalamus



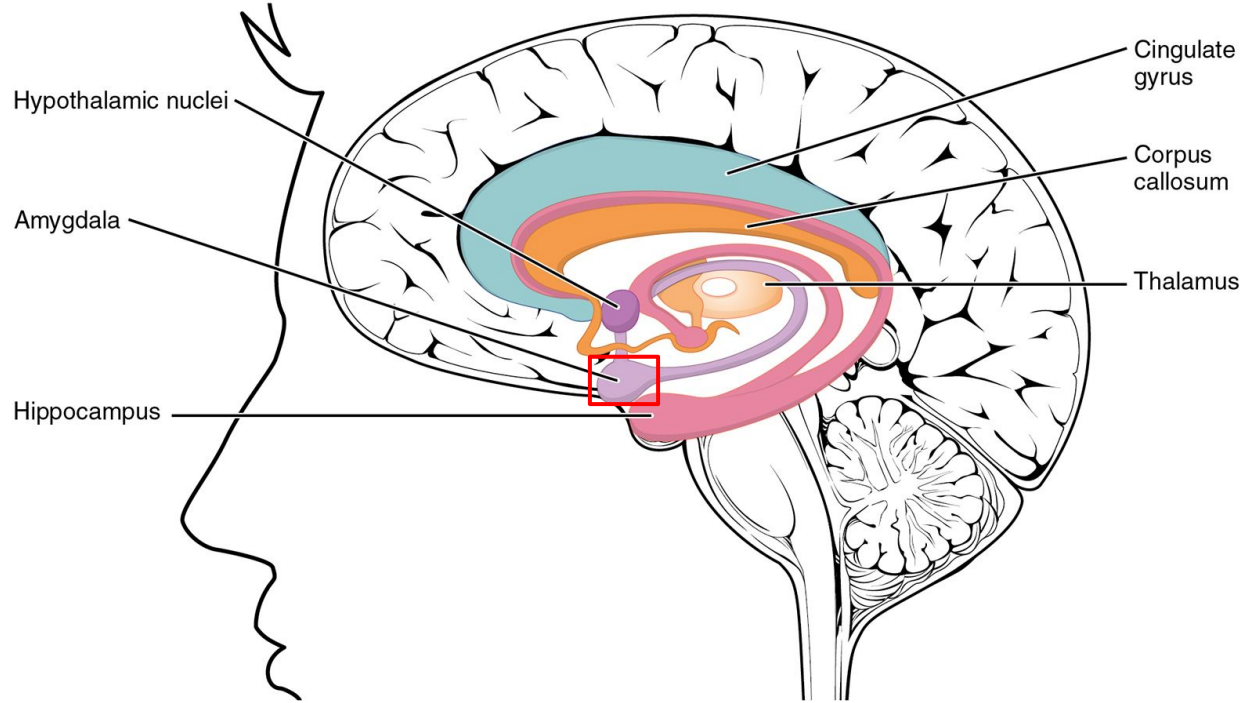
- Controls endocrine systems via affect of pituitary gland
- Oversees “4 Fs” -- Feeding, Fighting, Fleeing, & Sex, and also temperature & clock

Hippocampus



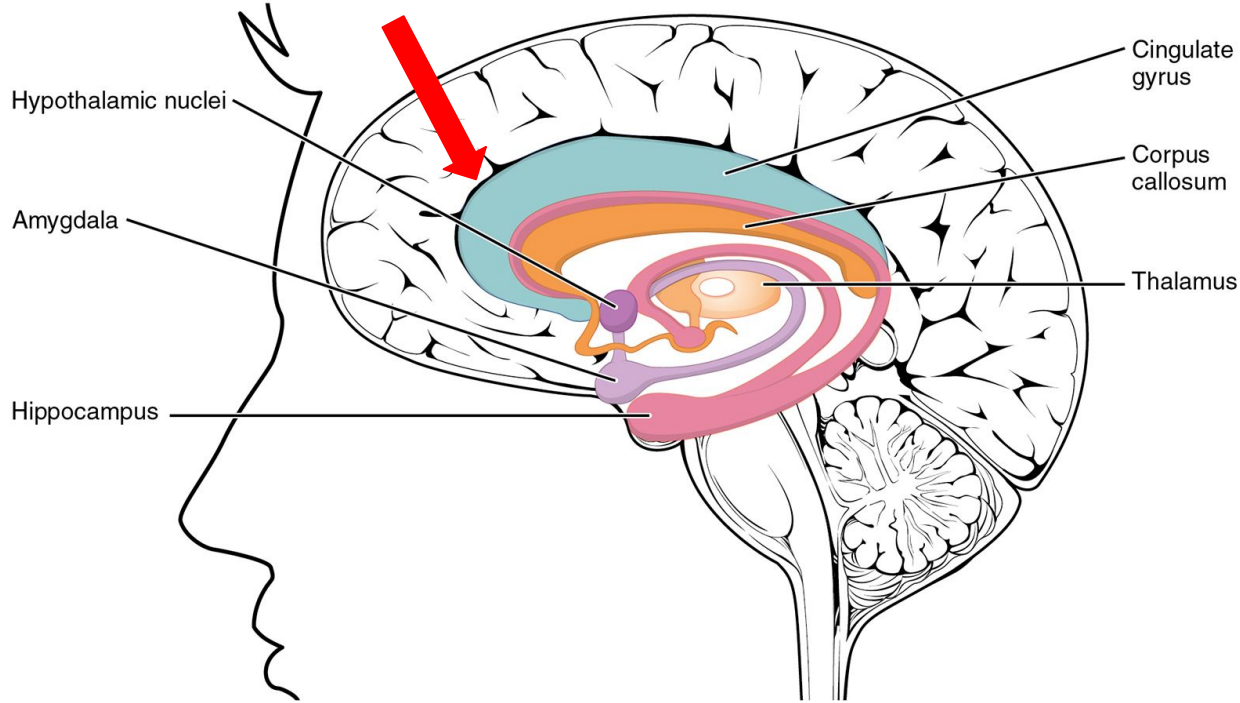
- Important in forming new memories
- Also active in spatial mapping

Amygdala



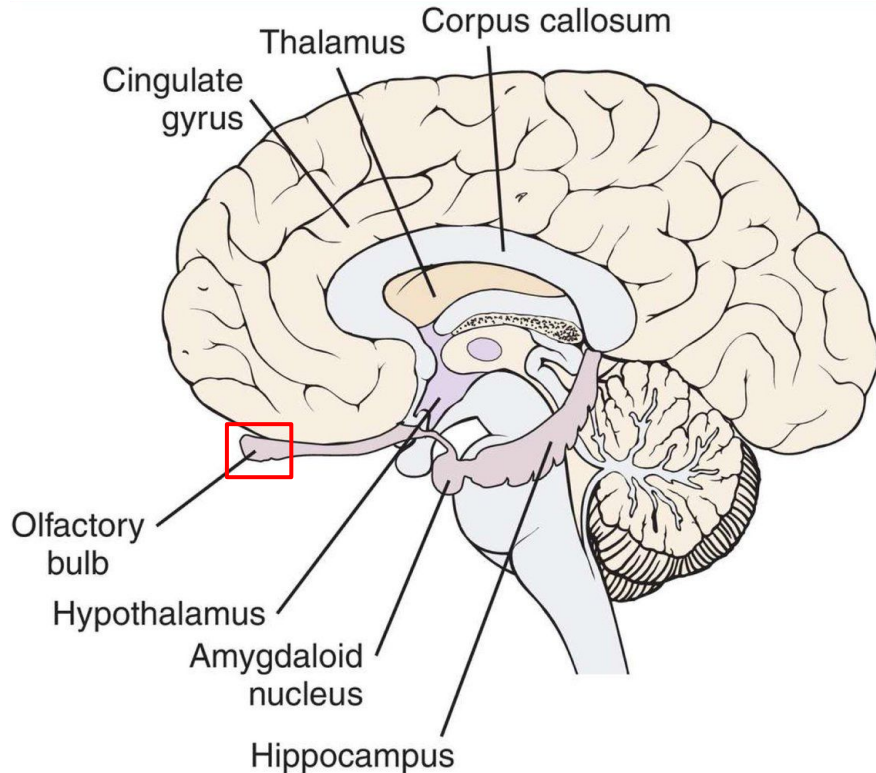
- Important for emotional expression
- Also important in interpreting emotion in others

Cingulate Gyrus



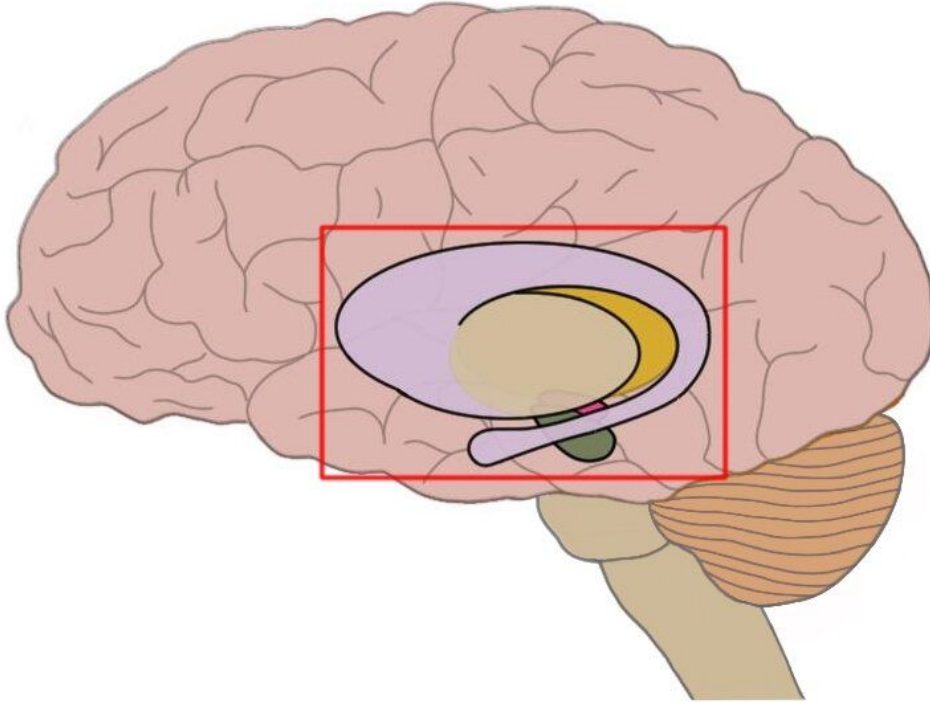
- Interacts with cortex & other limbic structures to access good/bad
- +/- evaluations

Olfactory Bulb



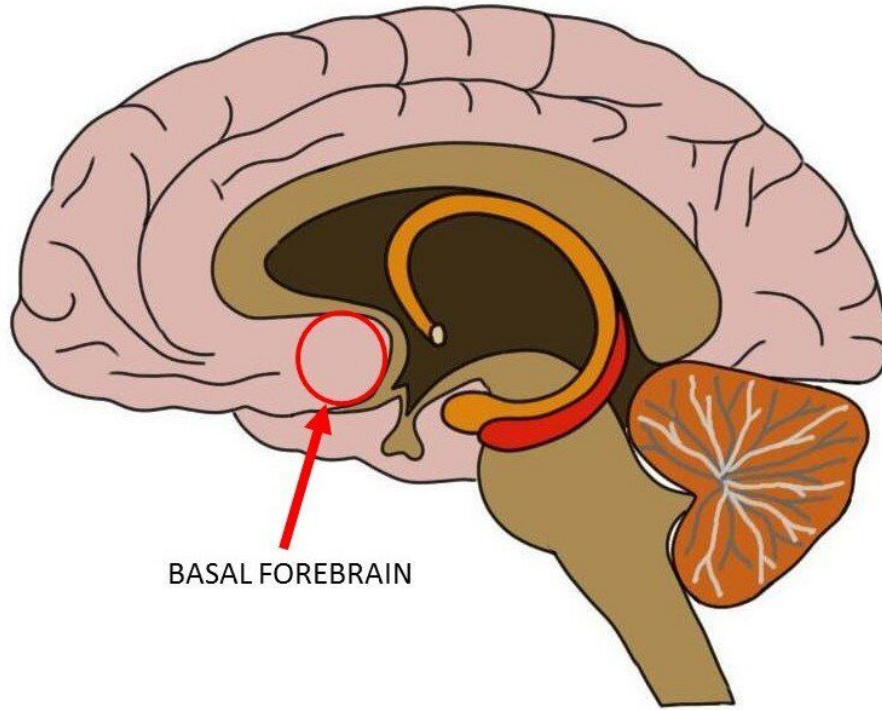
- Receives inputs from olfactory (smell) receptors
- Can exchange with the rest of limbic system responsible for emotional-memory-evoking capacity of smell

Basal Ganglia



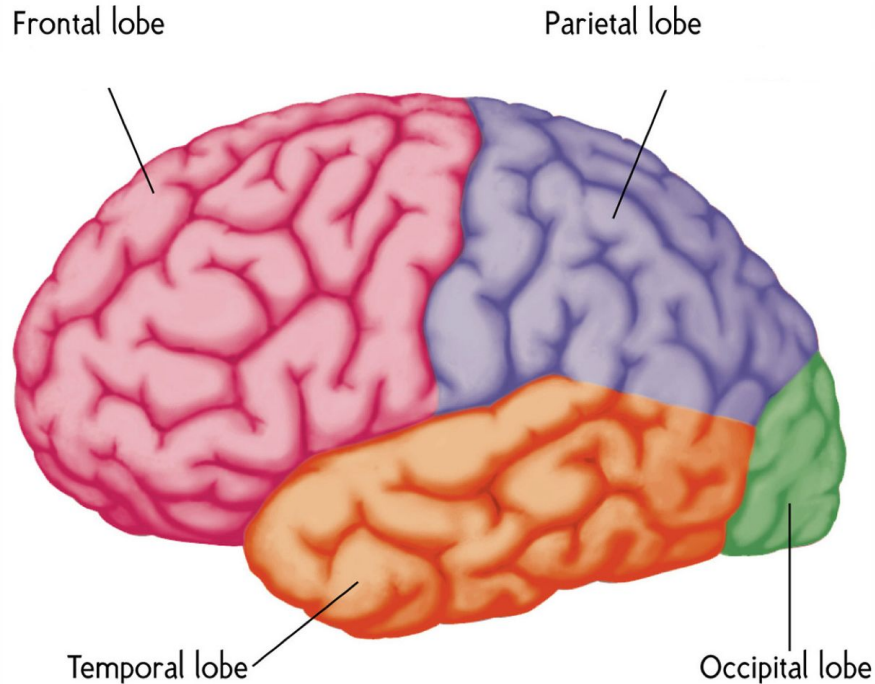
- Involved in the control of movement, especially **PLANNED SEQUENTIAL** behaviors
- Involved in task setting
- Degeneration of this area may cause Parkinson's Disease

Basal Forebrain



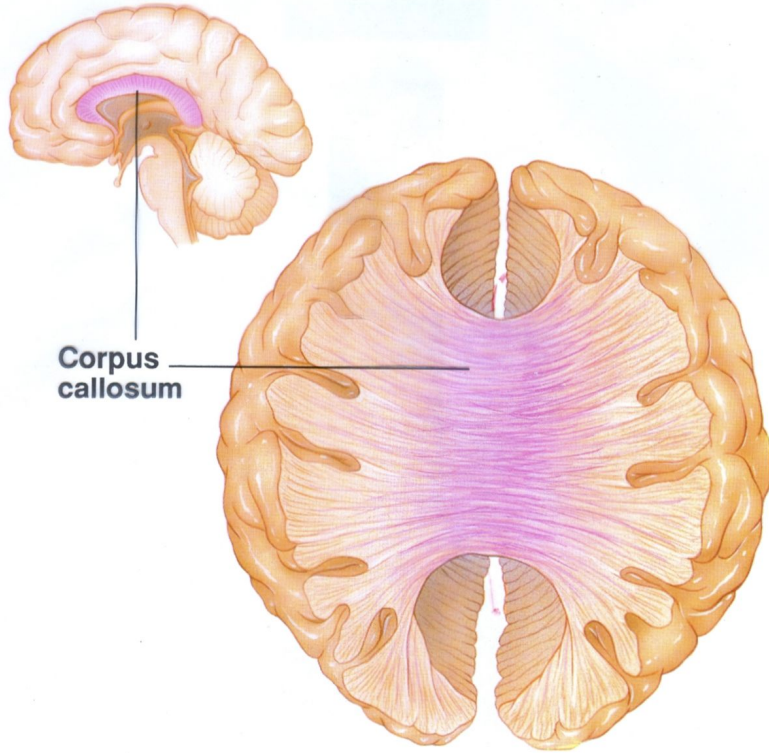
- Includes key structures for attention, especially arousal if cortex
- Main source of ACh (Acetylcholine, excitatory neural transmitter) and GABA (Gamma-Aminobutyric Acid, inhibitory neural transmitter).
- Involved sleep/arousal cycles, arousal of Broca's

Cerebral Cortex



- **Frontal lobe** -- Motor cortex, language production, strategy
- **Parietal lobe** -- Higher somatosensory processing and spatial mapping
- **Temporal lobe** -- Higher visual, audition, emotion & language comprehension
- **Occipital lobe** -- Visual processing

Corpus Callosum



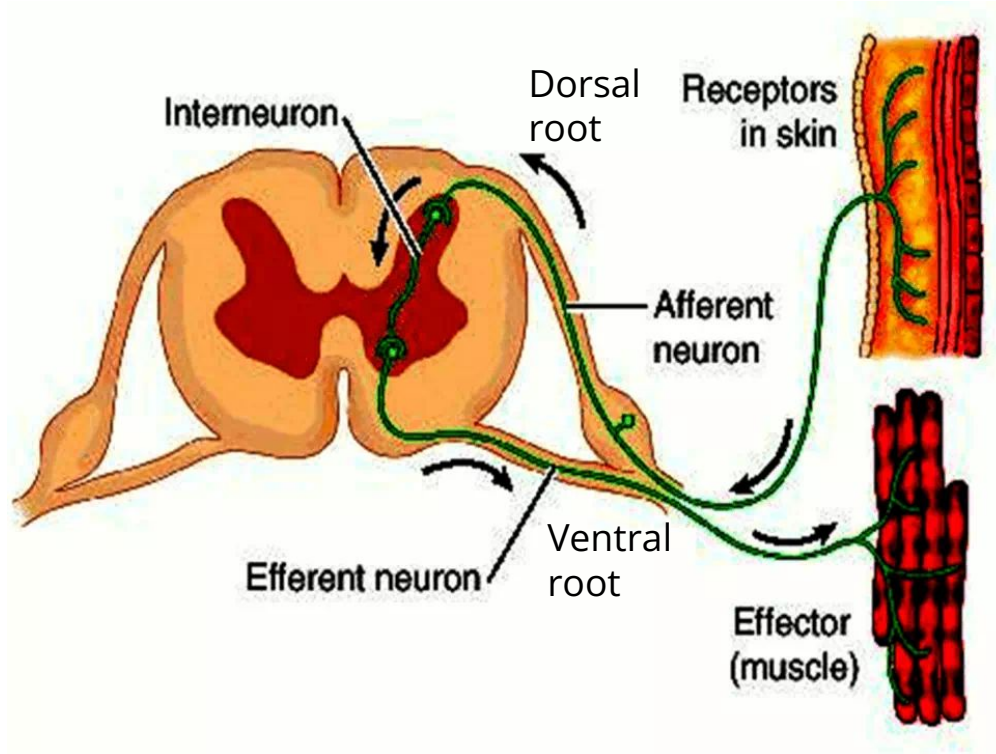
- Connects the two hemispheres of the Cerebral Cortex
- Let both side of the brain communicate and send signals to each other
- Part of “White matter”, the **connection** between “the little grey cells”

The Spinal Cord



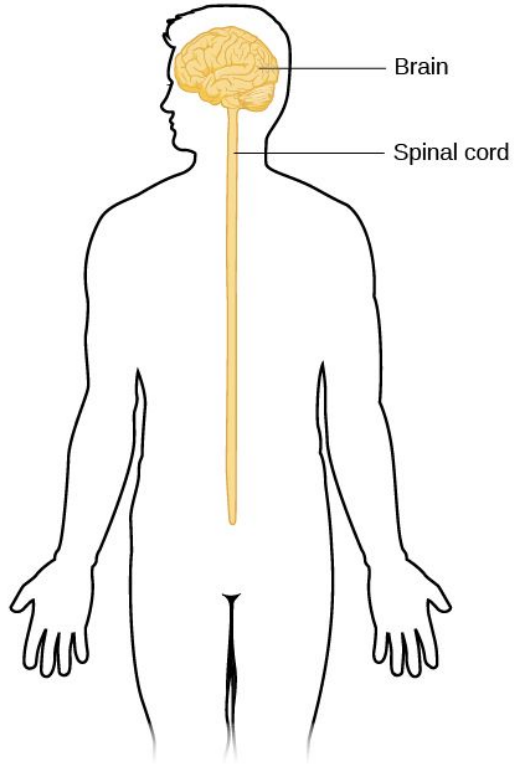
- 31 Segments, each segment has:
- 1 pair **AFFERENT** Dorsal Root nerves that carry sensory info from body to brain
- 1 pair **EFFERENT** Ventral Root nerves that carry motor info to muscles and glands

Bell-Magendie Law



- Sensory info enters dorsal horn via dorsal roots
- Motor info exits ventral horn via ventral roots
- For sense organs and muscles in the head, cranial nerves serve this function
- **“In the door and out the vent”**

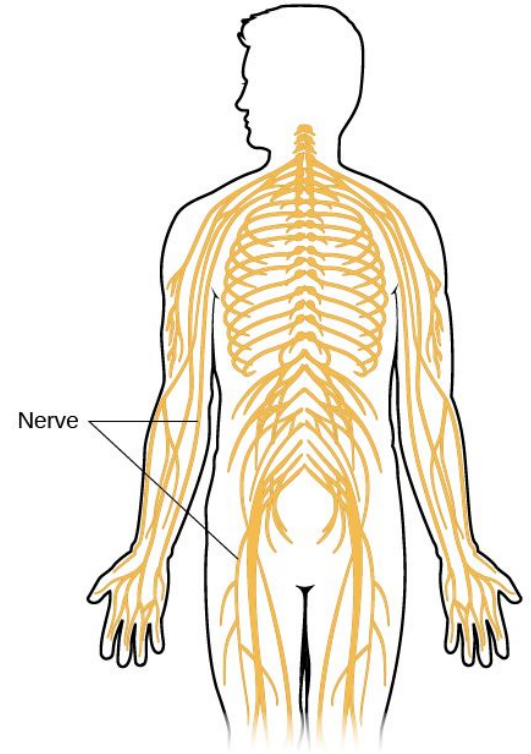
Central Nervous System (CNS)



- Brain & spinal cord
- Surrounded by bones and meninges

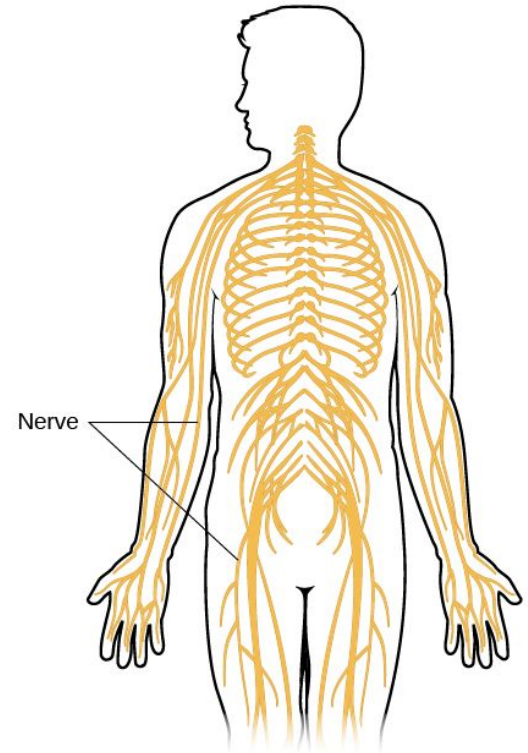
Peripheral Nervous System (PNS)

- Somatic Nervous System: interactions with **EXTERNAL** environments
- Autonomic Nervous System: regulates **INTERNAL** environments
- Also includes cranial nerves, which involves in autonomic nervous system and somatic nervous system



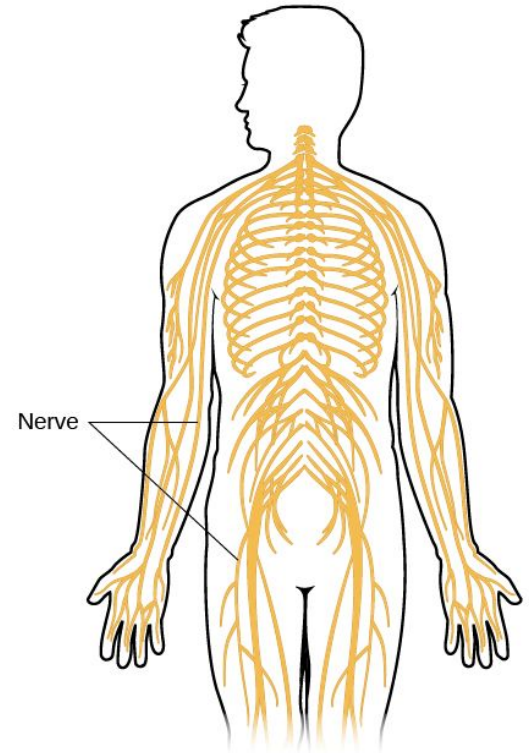
Somatic Nervous System

- 31 pairs of spinal nerves, 12 pairs of cranial nerves
- Spinal: sensory mainly **FROM** body surface & feedback from skeletal muscles; Motor mainly **TO** skeletal muscles
- Cranial: sensory & feedback **FROM** some organs (e.g. heart, lungs); Motor **CONTROL** of eye movement, facial expression, chew & swallow, speech, neck muscles, some organs



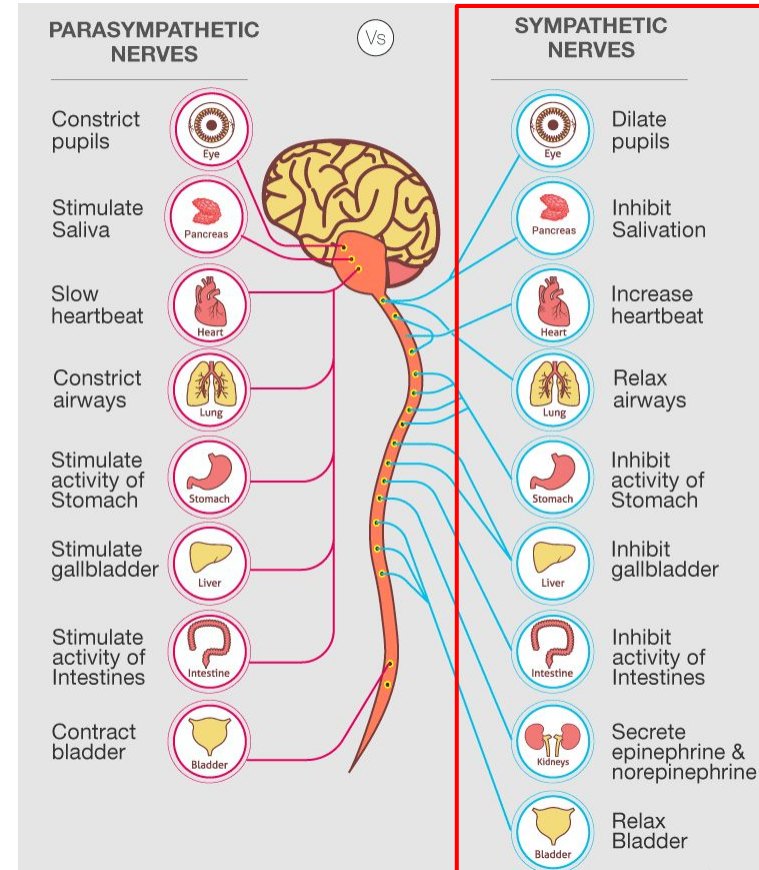
Autonomic Nervous System

- Receives information from organs, send motor commands to control them
- Motor component has 2 divisions: sympathetic nervous system and parasympathetic nervous system



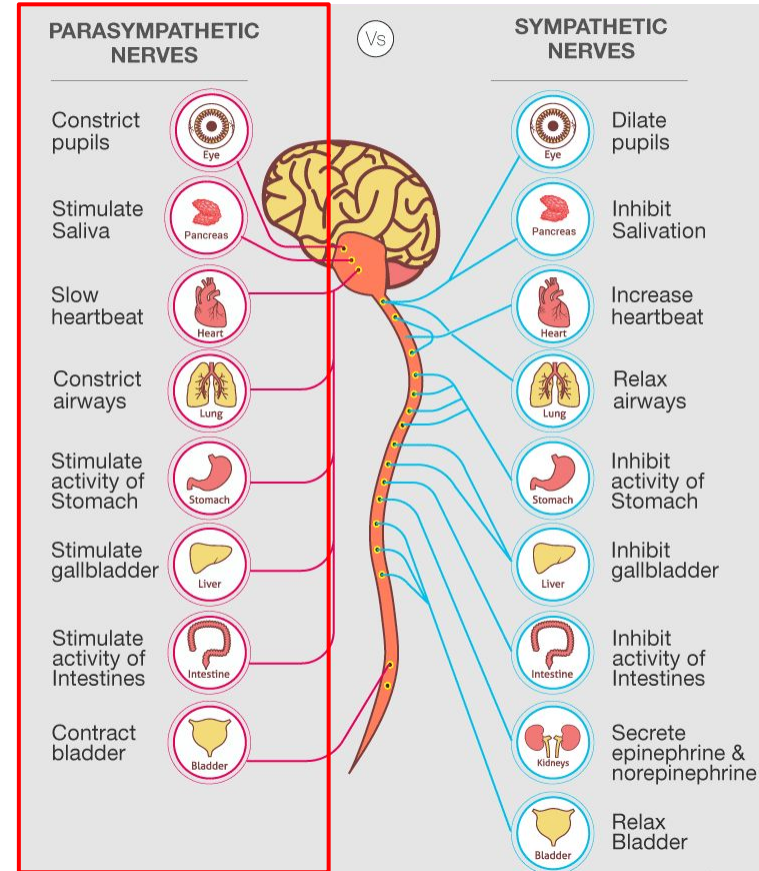
Sympathetic Nervous System

- “Fight or Flight” -- autonomic physiological reaction that triggers acute stress response that will prepare the body for fight, or flee
- Examples: Increase heart rate, hinder sexual arousal, dilate pupils, etc.
- Most reflexive, but sometimes can be influenced by cognition (e.g. Voodoo death)



Parasympathetic Nervous System

- “Rest & Digest” -- the opposite of “fight and flight”, to CALM DOWN
- Examples: Decrease heart rate, facilitate sexual arousal, constrict pupils, etc.
- Parasympathetic rebound: the strong given by parasympathetic nervous system, after a radical sympathetic response
- Examples: Fainting, Ulcers



Questions?

Office Hours: Mon 5-6 pm

To get the section slides: <https://github.com/JasonC1217/COGS17-A03-Sp24>

OR:

