

# Round 19: Anatomy Review

4/22/2021

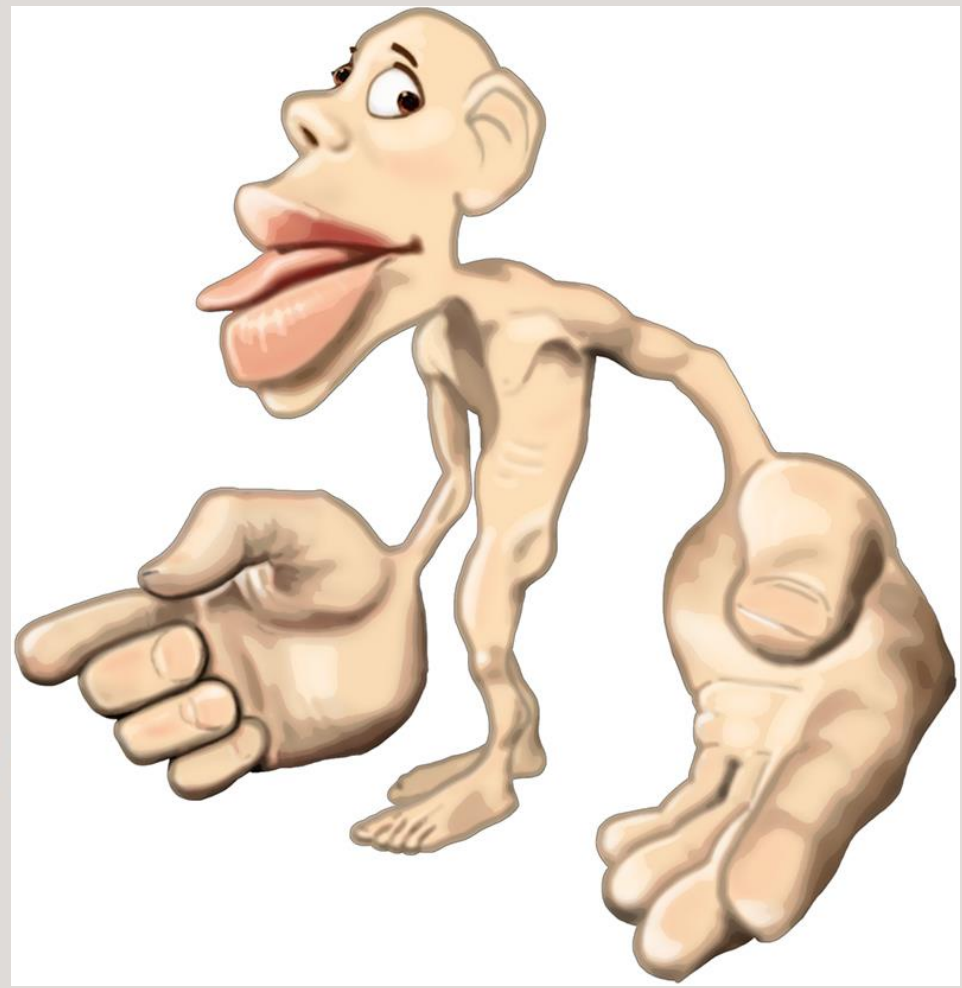
Kristy Snyder Colling, PhD

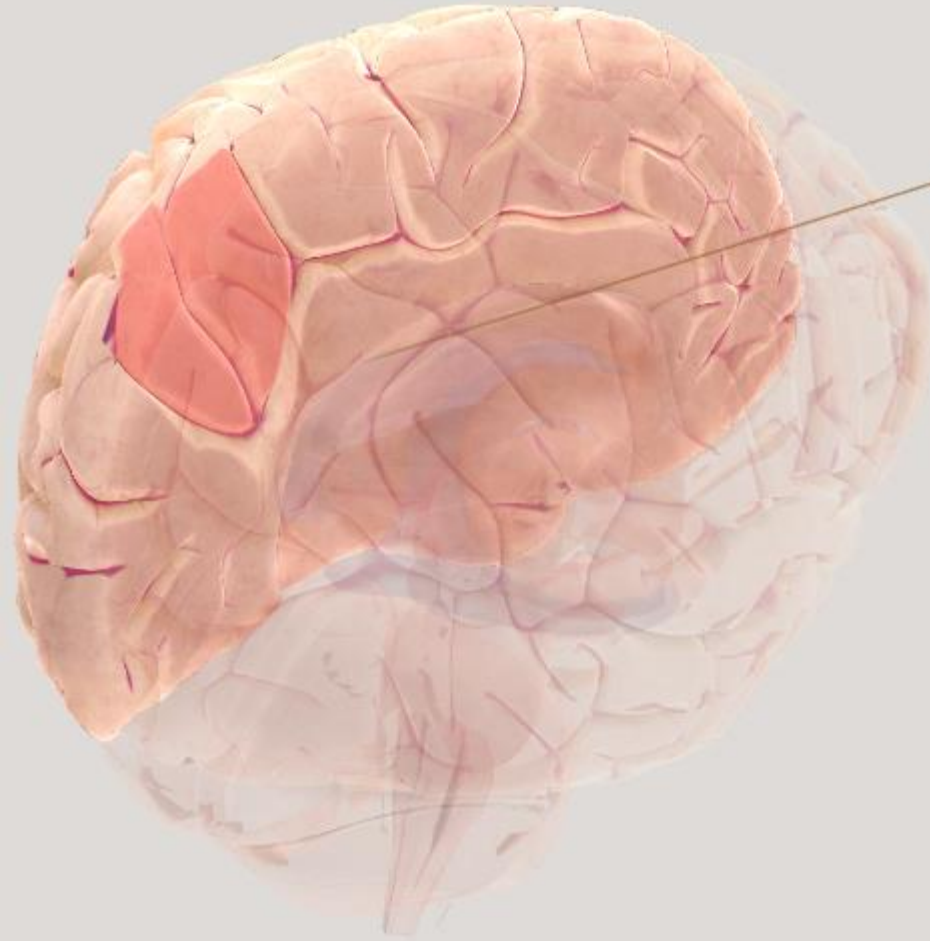
## Parietal Lobe



- Somatosensory areas
- Prosody processing
- Association cortices
- Spatial Attention
  - Navigation
  - Symbolic manipulation (math/calculation)
- Precuneus

Somatosensory Cortex





## Precuneus

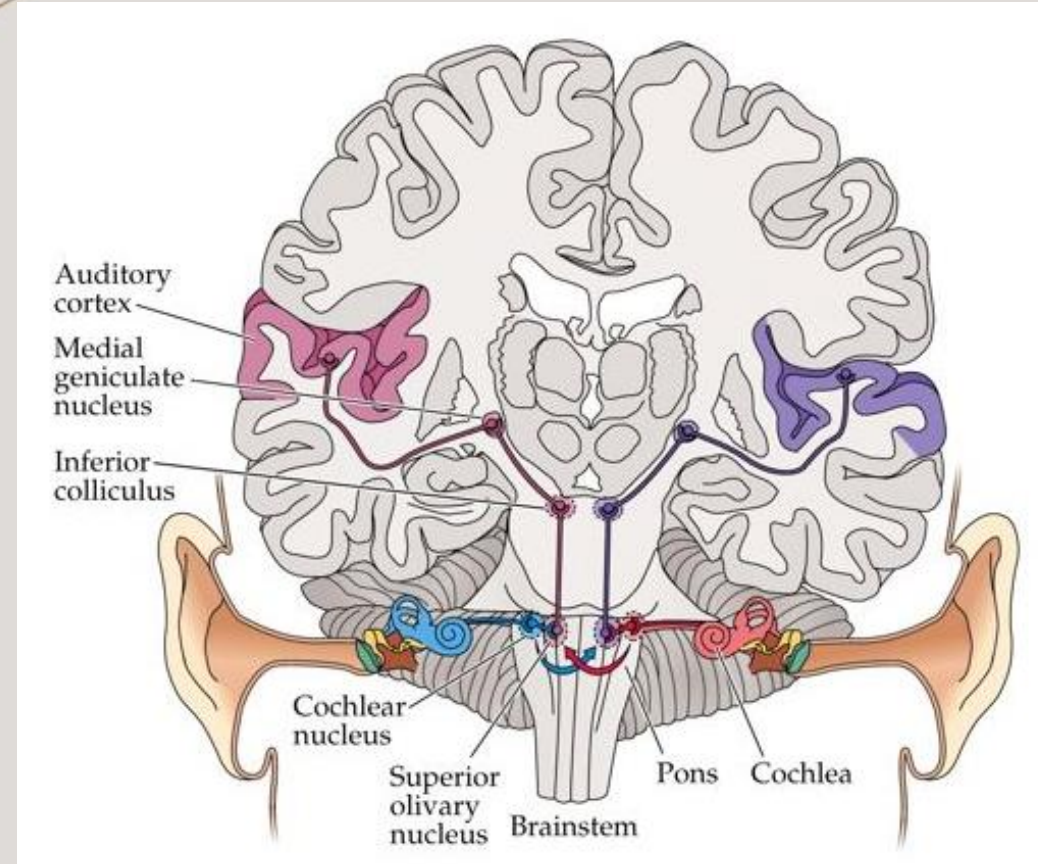
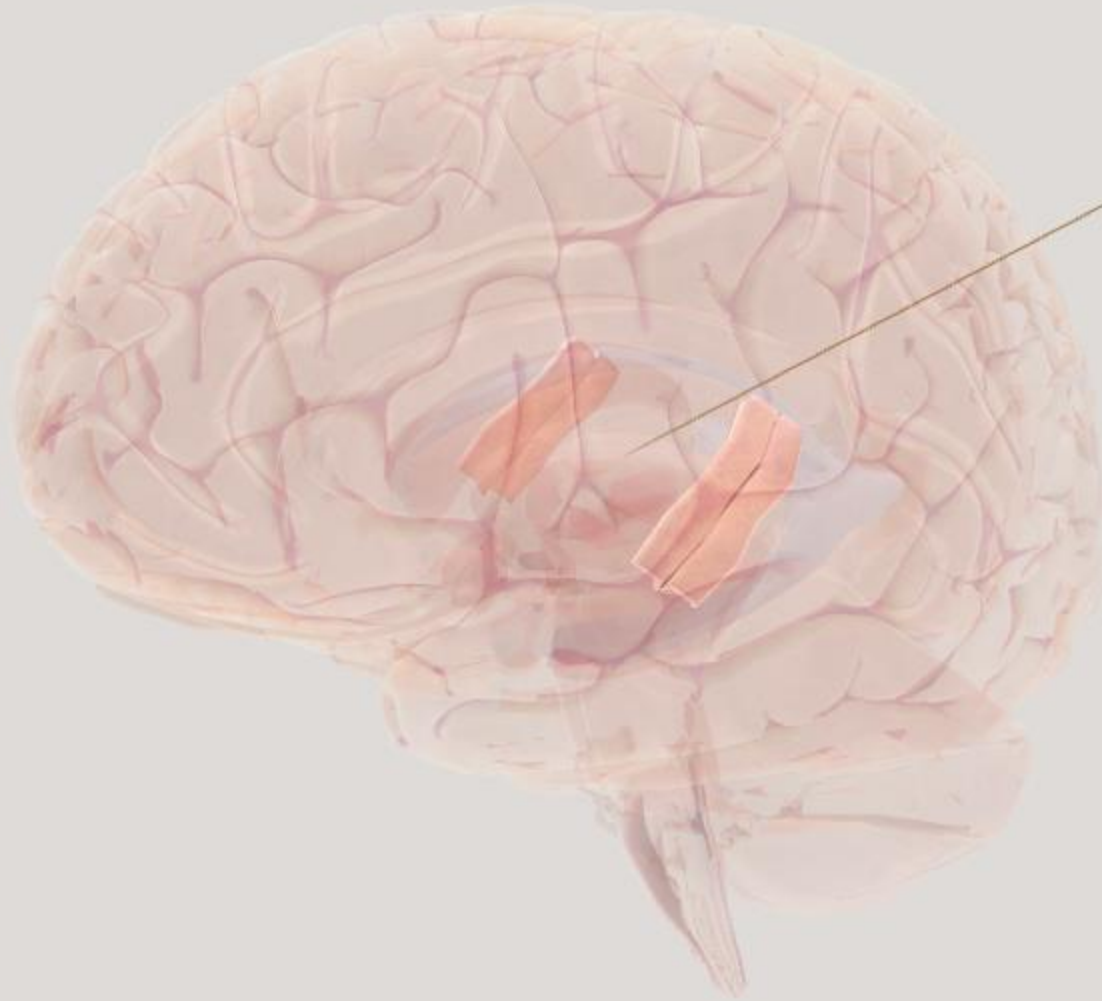
- Imagination
- Self-consciousness
- Reflecting on past memories
- Personality
- PTSD

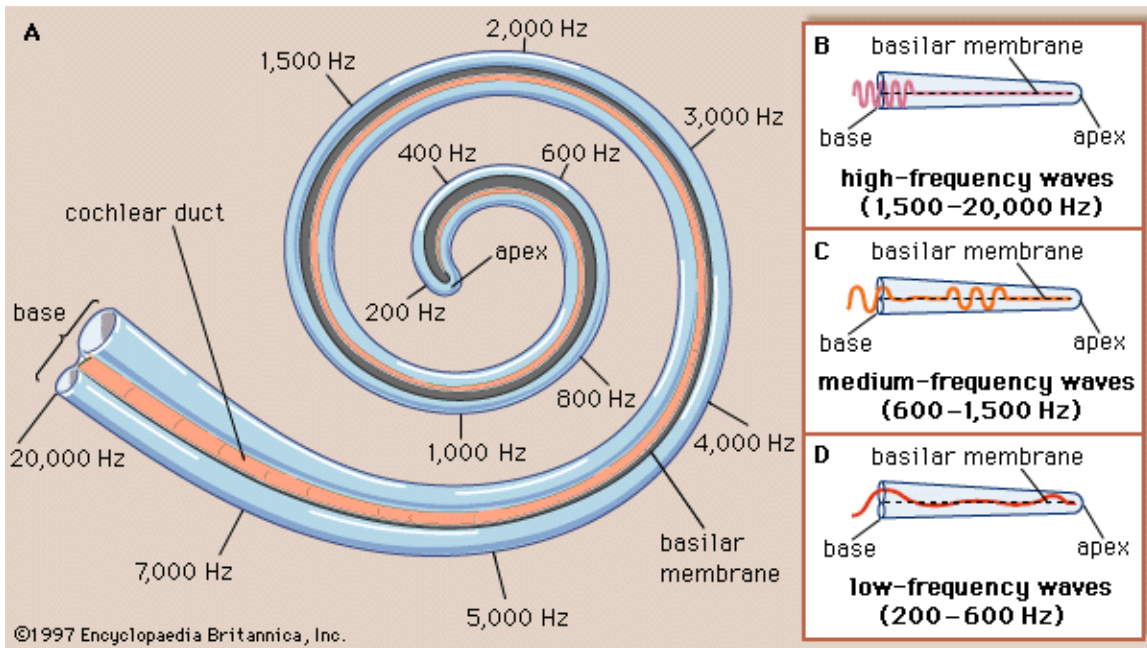
## Temporal Lobe



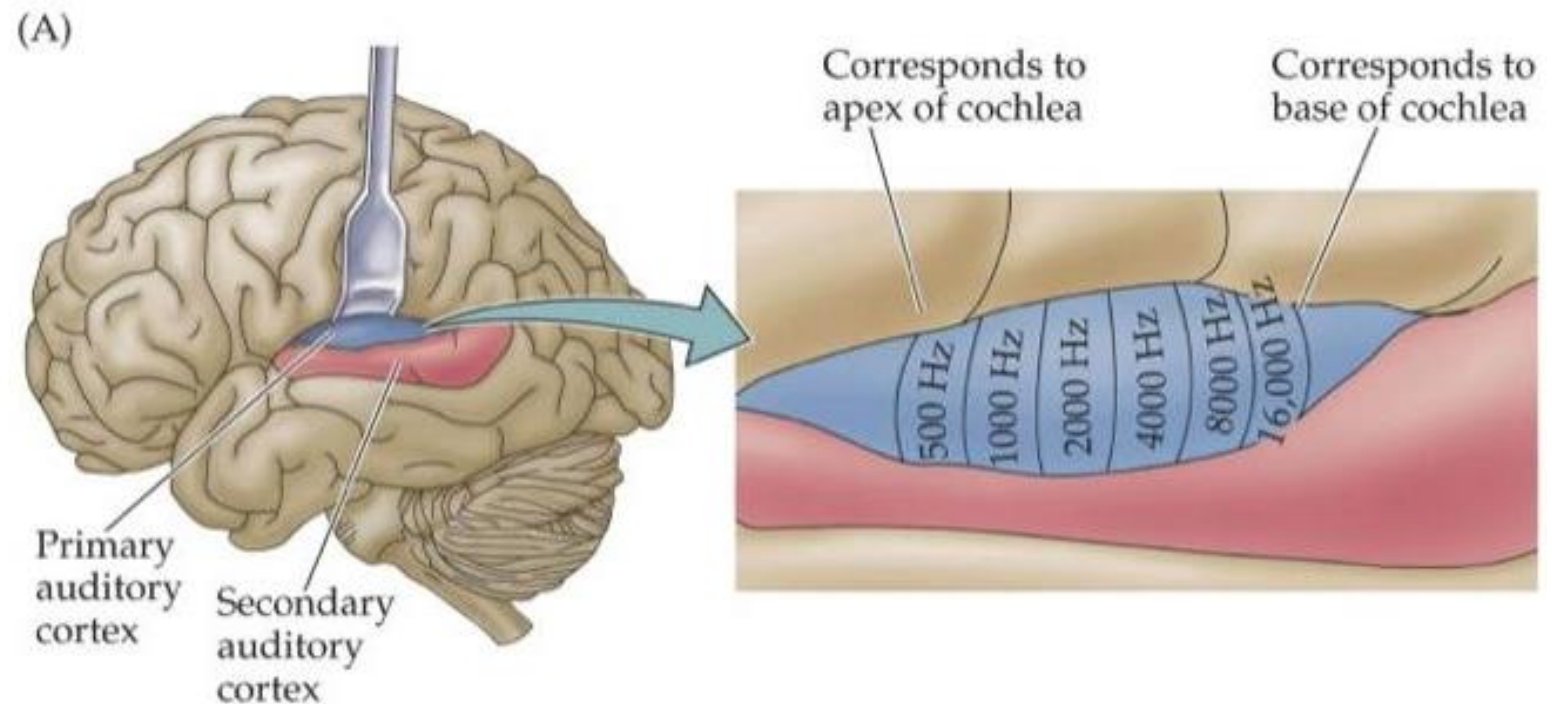
- Primary functions include memory, emotions, and language comprehension
- Contains auditory cortex, hippocampus, & Wernicke's area
  - Links words, written or spoken, to their semantic meanings
- "Hotspot" for epilepsy

## Auditory Cortex





- **Secondary Auditory Cortex** –
  - Sound localization & analysis of complex sounds





## Wernicke's Area

- Language comprehension
- Wernicke's (Receptive) Aphasia
  - Fluent but nonsensical speech
  - "word salad"





## Limbic System

- Group of structures responsible for motivation, emotion, learning, and memory
  - Olfactory bulb (smell)
  - Hippocampus (memory)
  - Amygdala (fear/reward)
  - Basal Ganglia (Motivation & Voluntary movement)
  - Cingulate gyrus



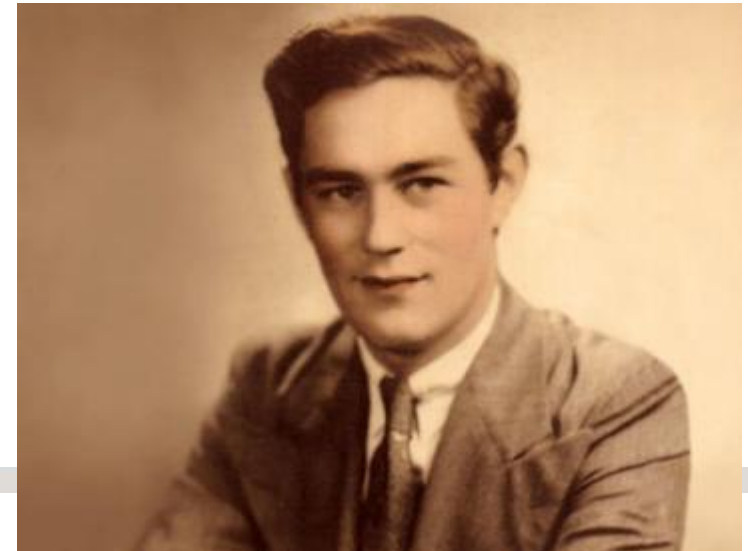
## Entorhinal Cortex

- Links cerebral cortex to hippocampus
  - Funnels sensations (e.g., hearing, sight) to hippocampus to be consolidated
- Establishes a directory for binding & searching distributed information (engram)
- Plays a role in spatial knowledge, relating our location in space to external environment



## Hippocampus

- Functions:
  - Memory encoding
  - Memory consolidation
  - Learning
  - Neurogenesis
  - Spatial navigation



Let's remember the periodic table of elements:

- 1.
- 2.
- 3.
- 4.



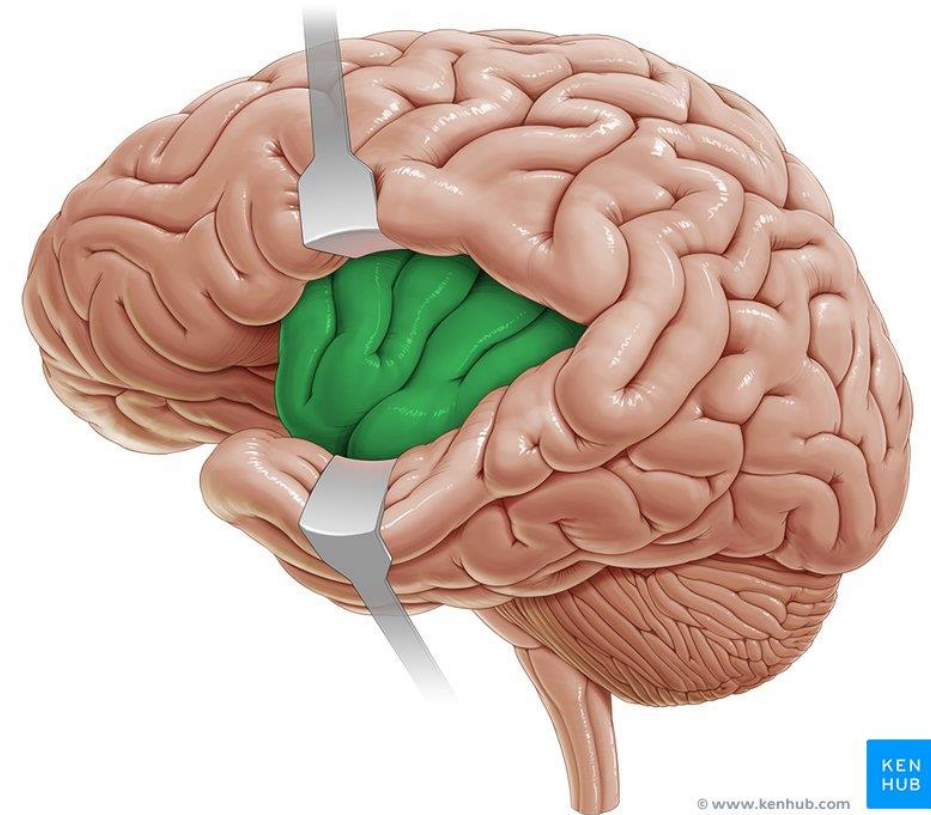


## Amygdala

- Fear, anger, rage, sadness
- Learning
  - Integrates information from different sensory modalities
  - Links stimuli to emotional responses
  - Associates fear, aggression, anxiety to people or places
  - Recognition & avoidance of threats
- Feeding
- Autonomic functions

# Insula

- Compassion, empathy, self awareness, interpersonal experience
- Pain sensation
- Sense of agency
- Major role in disgust
  - Also, sadness, anger, fear, happiness
- Social experience -> norm violations, emotional processing, empathy, social decision making
- Left insula activation correlated with Emotional Intelligence
  - Ability to identify, regulate, and process emotions of self and others





## Basal Ganglia

- Control voluntary movements, habitual behaviors, and emotions
- Intermediary between higher thoughts and sensations & reflexes
- Damage
  - Parkinson's
  - Tourette's
  - Huntington's



## Caudate Nucleus

- Integrates spatial information and motor behavior
- Part of the reward system -> helps select actions based on changing values of goals
  - Motivation & decision making
- Helps to refine movements & reduce unnecessary movement



An anatomical illustration of the human brain, viewed from a slightly elevated lateral perspective. The brain is rendered in a light, translucent pinkish-orange color, showing the gyri and sulci of the cerebral cortex. Two prominent, darker orange, bean-shaped structures are highlighted, representing the putamen. A thin, dark line extends from the top of the text box to the right putamen, indicating its location. The background is a solid, light gray color.

## Putamen

- Transfers information from frontal cortex to globus pallidus
- Involved in initiation & learning of motor movements
- Refines extent & amplitude information



## Globus Pallidus

- Communicates with cerebral cortex about motor control via thalamus
- Inhibits unnecessary muscle contractions, so movements are smooth and intentional
  - Reduces tremors & jerk



## Nucleus Accumbens

- Part of the reward network
  - Controls motivation and plays a role in addiction
- Releases Dopamine upon completion of a satisfying or rewarding behavior



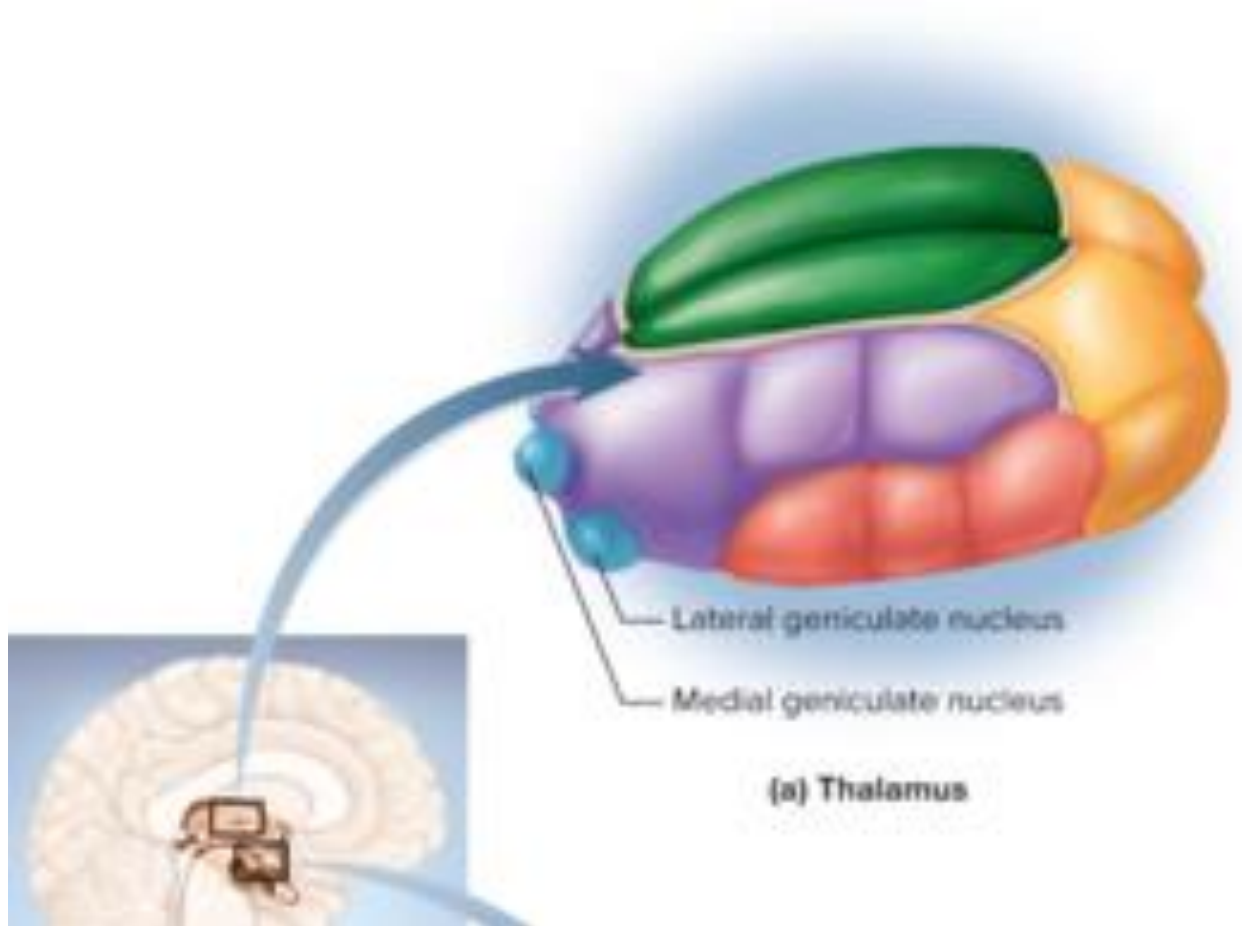
## Substantia Nigra

- Part of GABA & Dopaminergic pathways
- Movement initiation & timing
- Neuronal loss in Parkinson's
  - Problems initiating & maintaining intentional movement
- Plays a role in space localization (spatial learning)



## Thalamus

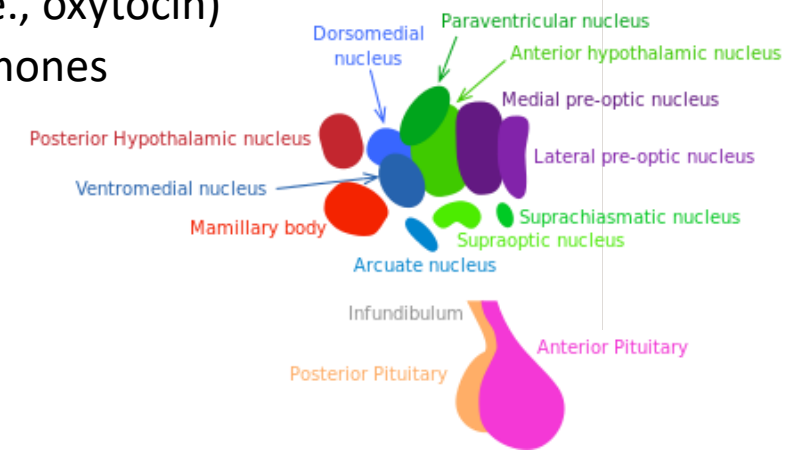
- Regulates awareness and emotional aspects of sensory experiences
- Relay station
  - Processes and distributes sensory and motor information going to the cerebral cortex
  - Except smell



- **Anterior**
  - Part of limbic system; memory & emotion
- **Medial**
  - Emotional output to prefrontal cortex.  
Awareness of emotions
- **Ventral**
  - Signals from cerebellum and basal nuclei to motor areas of cortex
- **Lateral**
  - Contributes to emotional function of limbic system
- **Posterior**
  - Relay of visual signals to occipital lobe (via lateral geniculate nucleus) and auditory signals to temporal lobe (via medial geniculate nucleus)

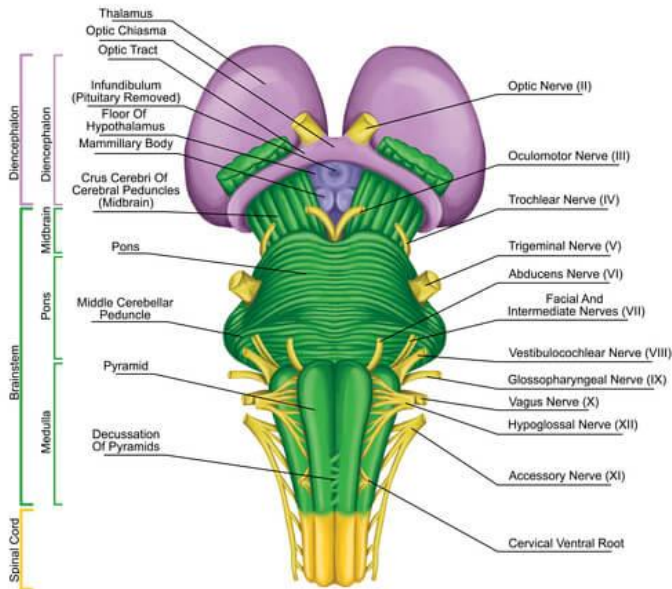
## Hypothalamus

- Link between central nervous system and the endocrine system
- Governs the secretion of various hormones that play roles in:
  - Maintaining homeostasis (i.e., body temperature)
  - Regulating hunger & thirst
  - Circadian rhythms
  - Bonding (i.e., oxytocin)
  - Sexual hormones



## Brain Stem

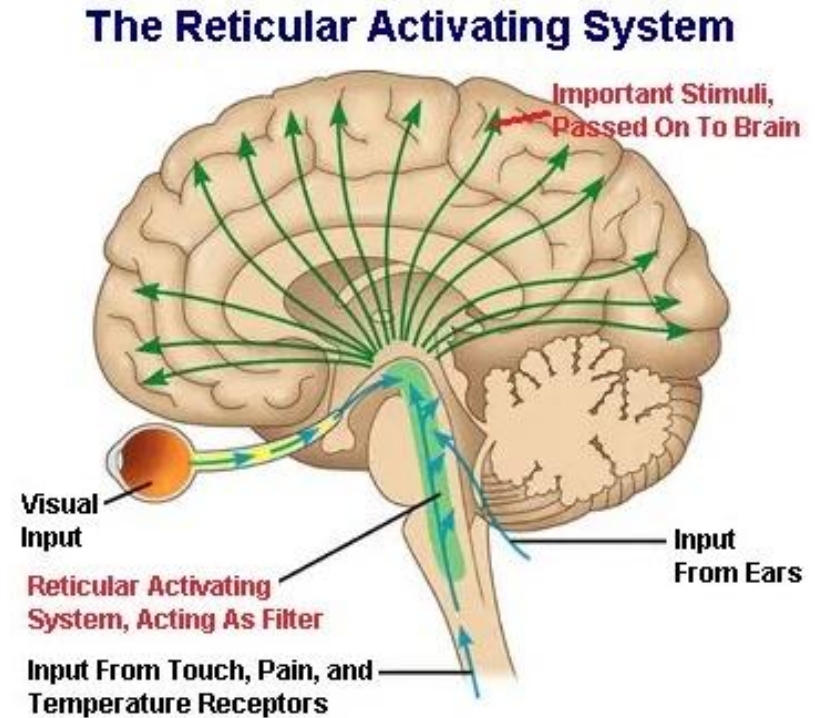
- Contains:
  - Medulla, Pons, and Midbrain
  - Nuclear groups & nerve fibers of the Cranial Nerves
  - Ascending Sensory tracts from spinal cord to thalamus to cortex
  - Descending Motor pathways from cortex, subcortical nuclei to brain stem to spinal cord
  - Reticular Formation
  - Passage for Aqueduct of Sylvius - circulation of cerebrospinal fluid





# The Reticular Activating System

- Regulates arousal/Attentional Filter
  - Ascends to the cortex to enhance attentive state and facilitate conscious perception of sensory stimuli
  - Inhibitory – if weak then pt will have symptoms of ADHD
  - Excitatory - if weak pt will appear passive and fatigued
- Participates in fight or flight responses
  - Over-reactive in PTSD
    - Exaggerated startle reflex
    - Decrease in habituation to repeated sensory stimuli
    - Dysregulated sleep – insomnia, nightmares, frequent awakenings



## Frontal Lobe



- Personality
- Decision making
- Motor control
- Memory
- Executive function

## Orbitofrontal



- Process consequences of complex behaviors
- Adjust behaviors to reach specific, desired outcome
- Social behavior & decision making
- Linked to depression

## Inferior Frontal



- Response inhibition

## Middle Frontal



- Goal-directed behaviors
- Reactions to external events

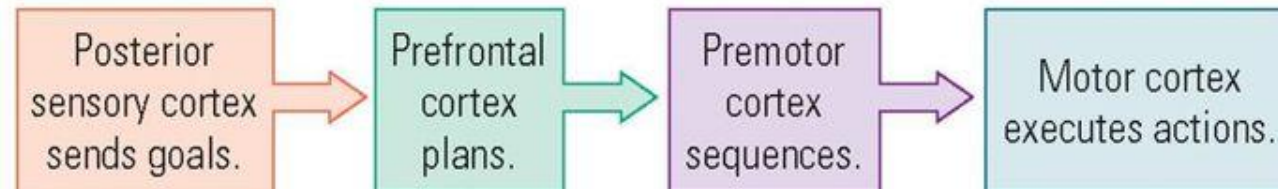
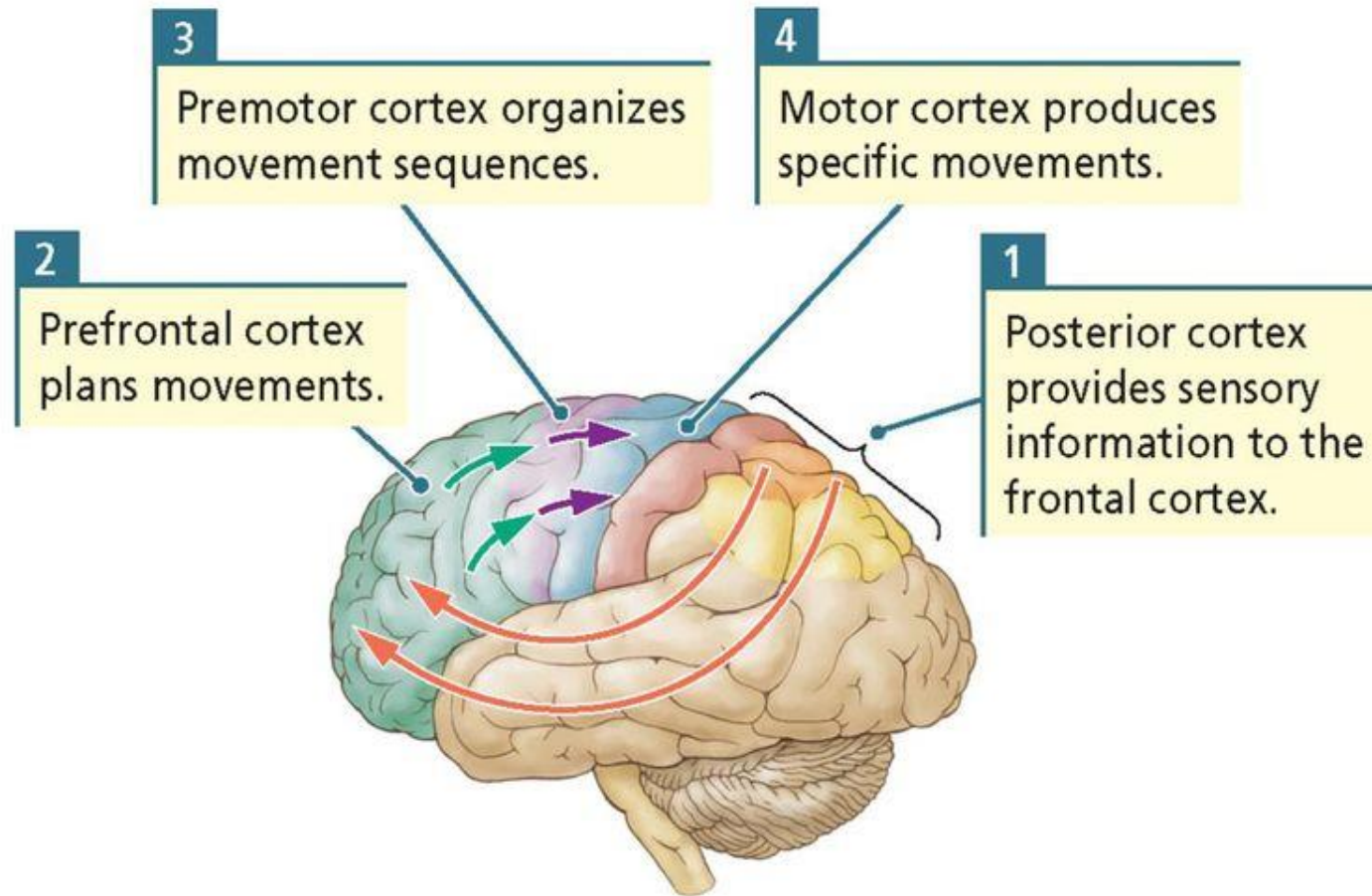
## Broca's Area



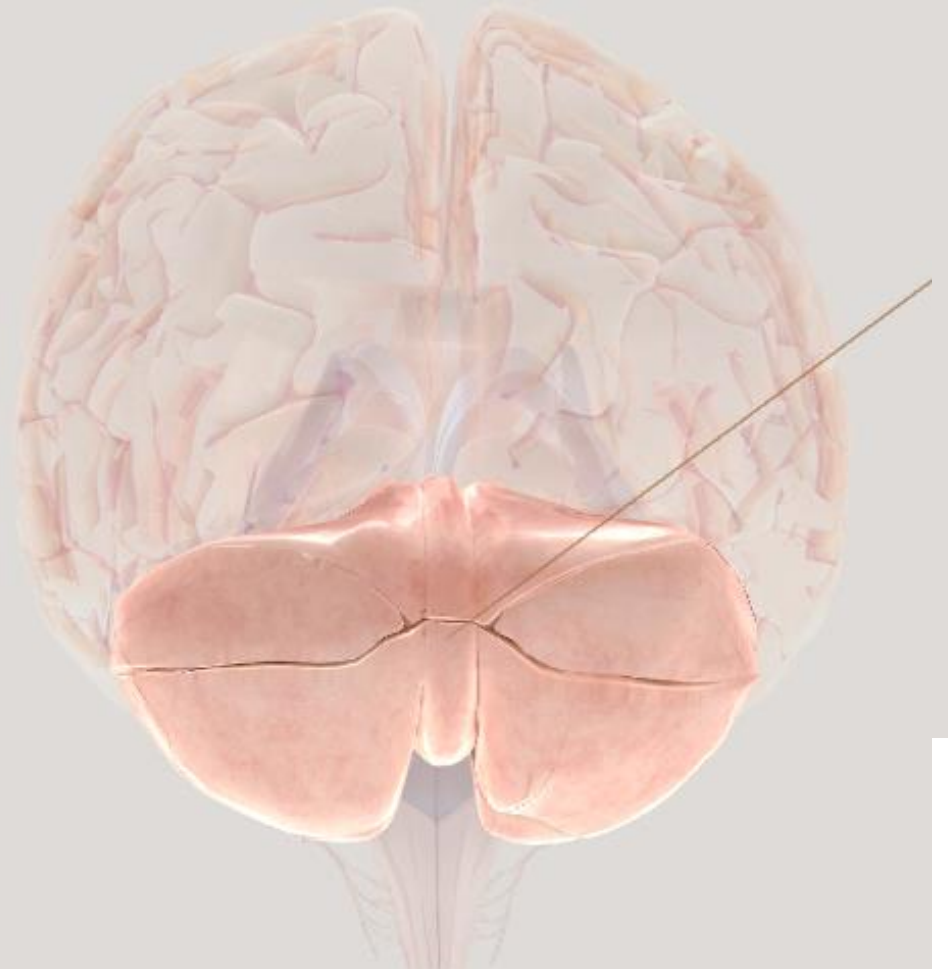
- Expressive Aphasia

Motor Cortex

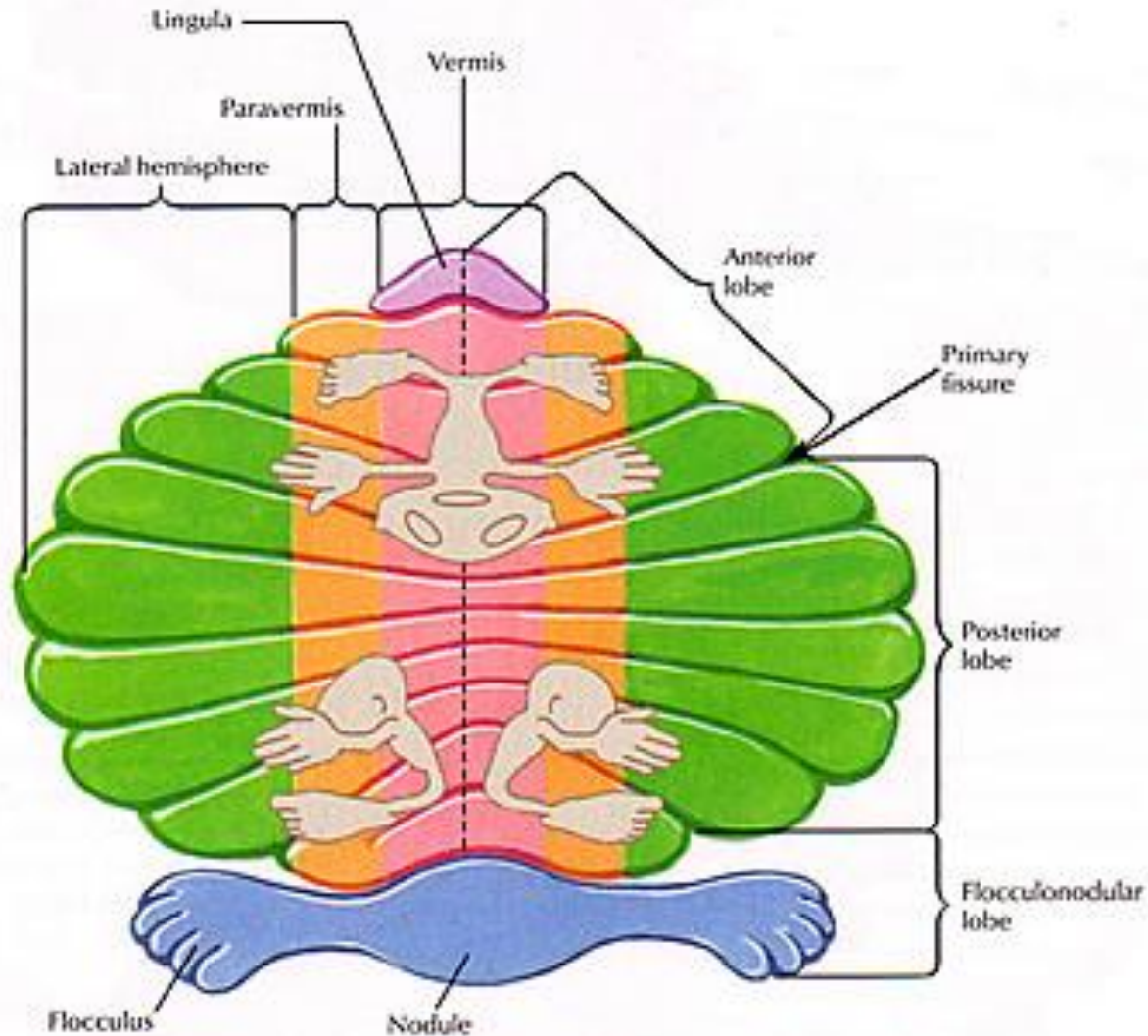




Cerebellum

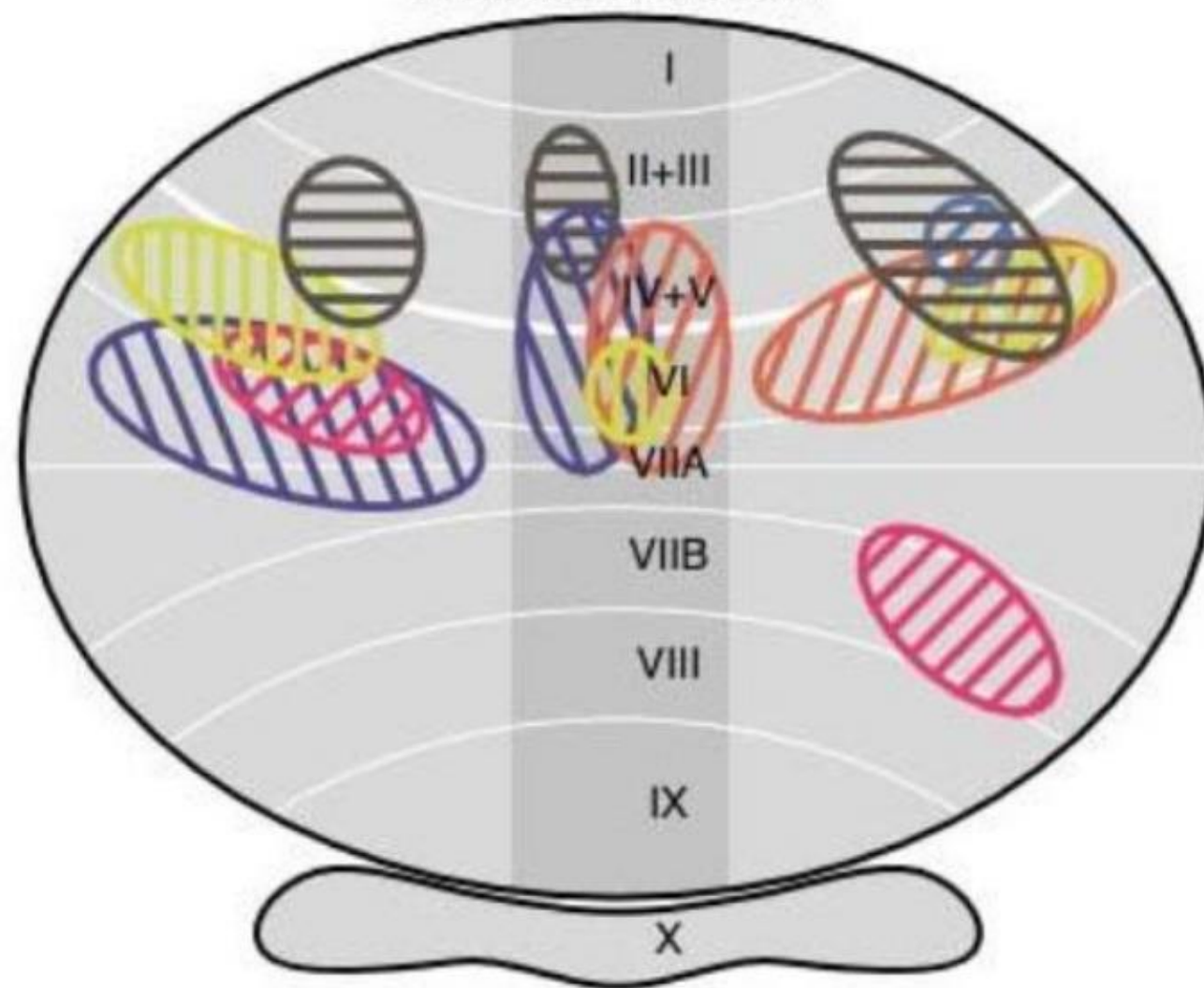






# The Cerebellum



- Regulates movement by monitoring and compensating for errors (i.e., if actual movement deviates from intended movement).
- Calculates specific motor plans re: precision control of rapid limb movements & tasks that require fine dexterity
- Important for procedural memory
  - Ataxia –
    - delay in initiating responses, errors in range, force, rate & regularity
    - cannot sustain rhythm in alternate tapping
    - don't brace against forces generated by movement

# Cerebellar activations



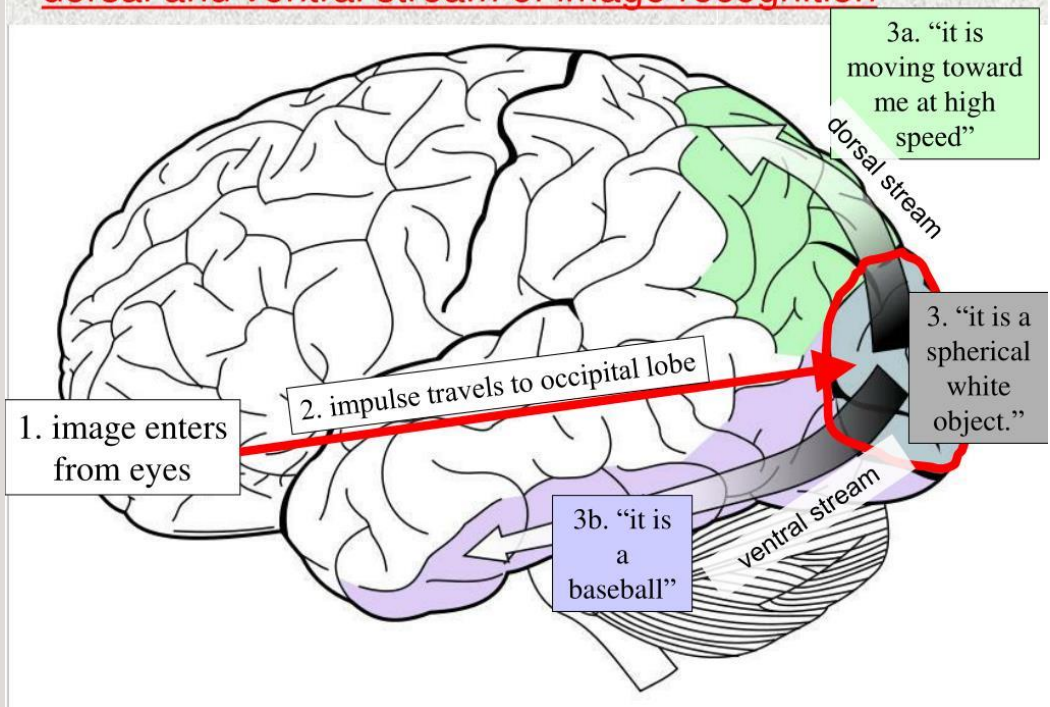
- |  |   |
|--|---|
|  Explicit memory retrieval      |  Sequence learning                 |
|  Language/Verbal working memory |  Trajectory/Rotor pursuit learning |
|  Verbal working memory          |  Classical conditioning            |



# Occipital Lobe



## dorsal and ventral stream of image recognition



Thank You

# Gustatory Pathway

