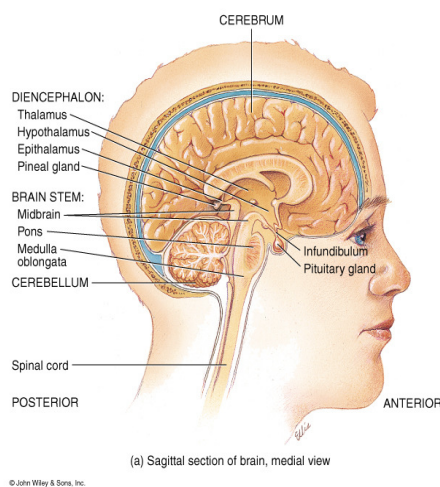


# PTA 106

## Unit 1 Lecture 1B

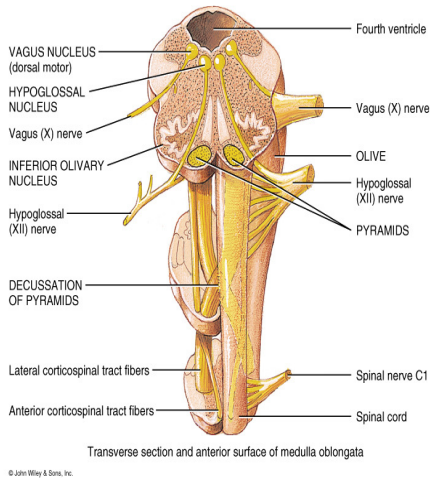


### Structural and Functional areas of the Medulla Oblongata



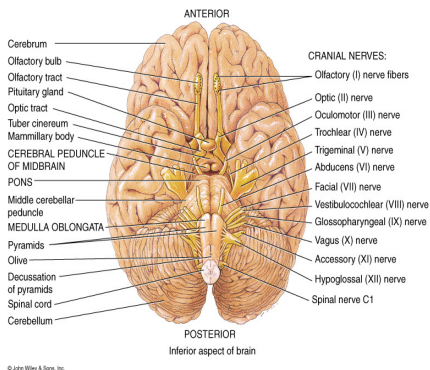
- **Cardiovascular Center:**  
Regulates the rate and force of the heartbeat and the diameter of blood vessels
- **Medullary Rhythmicity Area:**  
adjusts the basic rhythm of breathing via inspiratory and expiratory areas.
- **Other centers for vomiting, coughing, and sneezing**

## Structural and Functional areas of the Medulla Oblongata



- **Pyramids:**  
**Axons from the largest motor tracts from the cerebrum to the Spinal Cord.**
- **Decussation of Pyramids:**  
**Crossing of the motor tracts of the pyramids**
- **Nucleus Gracilis:** Neuron cells bodies of second order neurons (sensory info)
- **Nucleus Cuneatus:** Neuron cells bodies of second order neurons (sensory info)

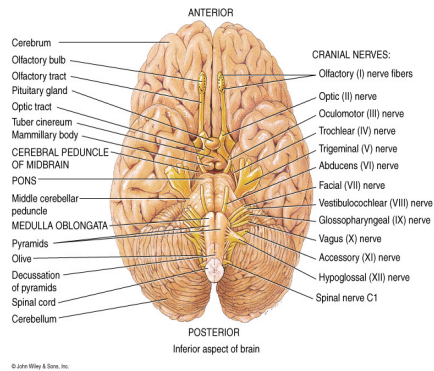
## Structural and Functional areas of the Medulla Oblongata



- **Contains the Nuclei of five cranial nerves:**
1. **Vestibulocochlear**  
**Receive sensory and motor impulses for the cochlea**
  2. **Glossopharyngeal**  
**Relay sensory and motor impulses related to taste, swallowing, and salivation**
  3. **Vagus**  
**Sensory and motor impulses for viscera**

## Structural and Functional areas of the Medulla Oblongata

- Contains the Nuclei of five cranial nerves:



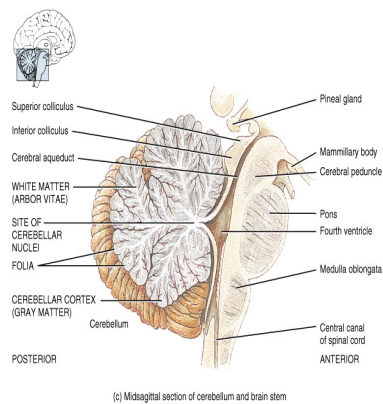
### 4. Spinal Accessory

Origin for nerve impulses that control swallowing.

### 5. Hypoglossal

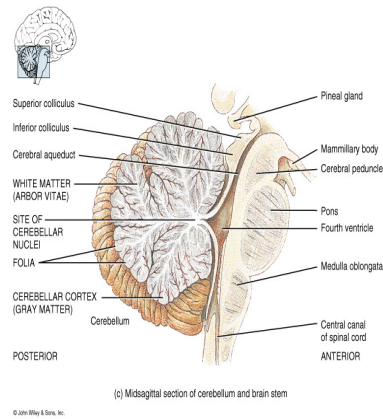
Origin for impulses that control tongue movement for speech and swallowing

## Structural and Functional areas of the Pons



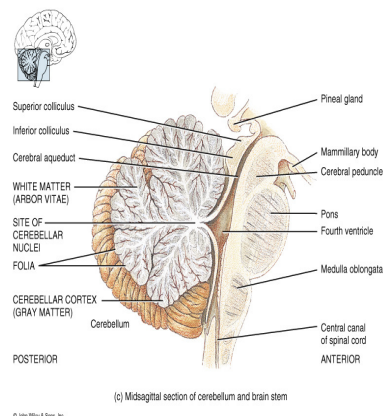
- Bridge the connects medulla and superior brain structures
- Longitudinal axons of ascending sensory and descending motor tracts
- Transverse axons connect the right and left sides of the cerebellum
- **Pneumotaxic Area:** transmits inhibitory impulses to the inspiratory area of the Medullary rhythmicity area

## Structural and Functional areas of the Pons



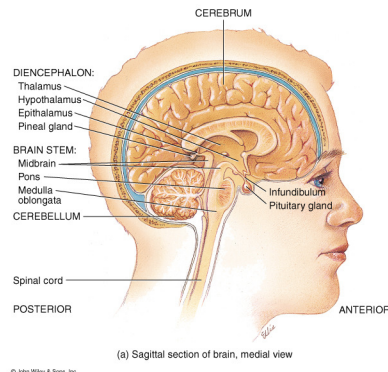
- **Apneustic Area:**  
Transmits stimulatory impulses to the inspiratory area
- **Contains the nuclei of four cranial nerves**
  1. **Trigeminal:**  
receive somatic sensory impulses from the head and face. Motor impulses the control chewing
  2. **Abducens:**  
Motor impulses to the Lateral Rectus muscle.

## Structural and Functional areas of the Pons



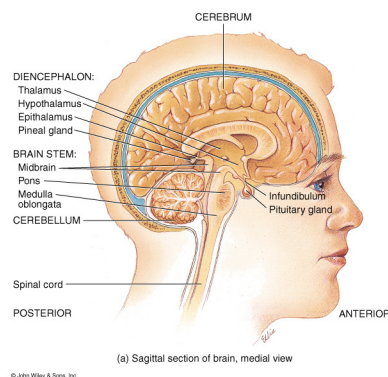
3. **Facial:**  
Receive sensory impulses for taste and provide motor impulses that regulate saliva, tears, and muscle of facial expression
4. **Vestibulocochlear:**  
Sensory impulses related to balance and equilibrium

## Structural and Functional areas of the midbrain or mesencephalon



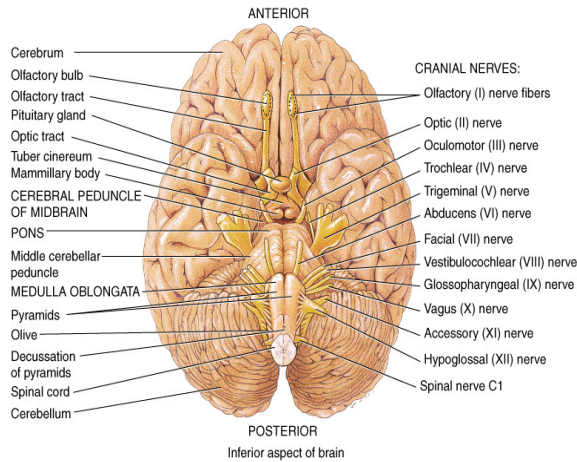
- **Cerebral Peduncles:**  
Tracts that contain axons from the corticospinal and corticobulbar motor neurons  
Sensory tracts from the pons and medulla that extend to the thalamus
- **Corpora Quadrigemina:**  
Superior colliculi: reflex center for movement of the eyes and head in response to visual stimuli.  
Inferior colliculi: reflex center for movement of the head and trunk in response to auditory stimuli.

## Structural and Functional areas of the midbrain or mesencephalon



- **Sustantia nigra:**  
Nuclei that control subconscious muscle activities through the production of dopamine
- **Red Nuclei:** relay area for motor tracts that control coordinated muscular movements
- **Headquarters of the Reticular formation, the reticular activating system (RAS).** Network of interconnected nuclei throughout the brain that produces heightened alertness and excitement or generalized lethargy and sleep

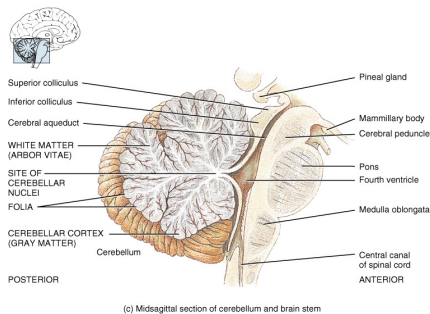
## Structural and Functional areas of the midbrain or mesencephalon



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- **Nuclei associated with two cranial nerves:**
1. **Oculomotor:** controls movement of the eyeballs, constriction of the pupil, and shape of the lens
  2. **Trochlear** controls movement of the eyeballs, specifically the Superior oblique muscle.

## Structural and Functional areas of the Cerebellum



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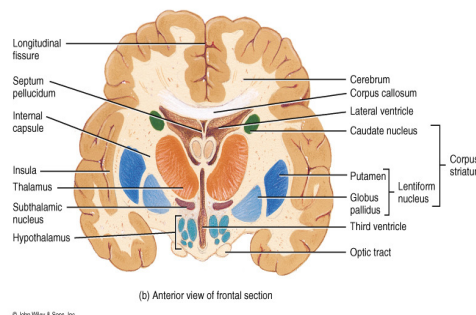
(c) Midsagittal section of cerebellum and brain stem

- **Second-largest part of the brain**
  - **with the motor areas of cerebrum to help provide smooth and coordinated skeletal muscle contractions and movements**
  - **Folia:** leaf like gray matter of the cerebellar cortex
  - **Arbor Vitae:** white matter tracts
  - **Connections:**
1. **Inferior Cerebellar Peduncles**  
Medulla to cerebellum
  2. **Middle Cerebellar Peduncles**  
Pons to cerebellum
  3. **Superior Cerebellar Peduncles**  
Midbrain to cerebellum

## Structural and Functional areas of the Cerebellum

- Responsible for muscle synergy (coordination)
- Coordinates the action of muscle groups
- Is a monitor of other neurological centers, such as those that initiate muscle contractions and auditory and visual centers.
- **Dysfunction:** Viral infections (Epstein-Barr, mycoplasma pneumonia, chickenpox) / lesions
- **Ataxia:** uncoordinated muscle activity
- **Tremor:** particularly intention tremor
- **Nystagmus:** involuntary eye movement

## Structural and Functional areas of the Diencephalon



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### Thalamus:

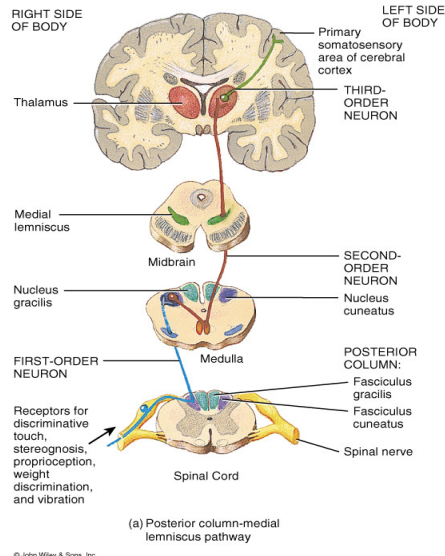
**Masses of gray matter organized into nuclei with interspersed tracts of white matter.**

**Functions as a principal relay station for sensory impulses and cognition**

### Intermediate Mass:

**Bridge of gray matter connecting right and left sides**

## Structural and Functional areas of the Diencephalon



### Thalamus:

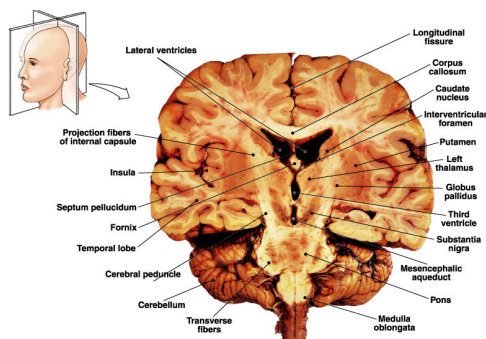
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## Structural and Functional areas of the Diencephalon

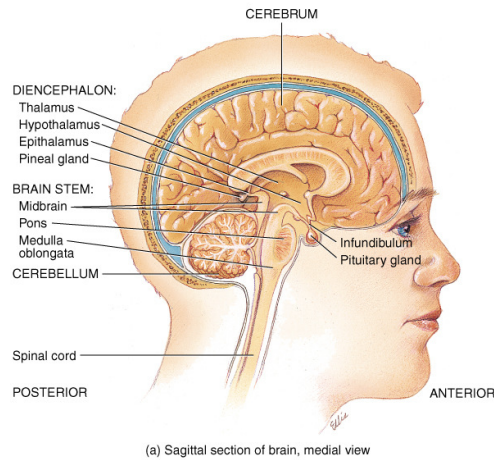


### Nuclei of the Thalamus:

- 1. Medial Geniculate Nucleus:**  
Relays auditory impulses
- 2. Lateral Geniculate Nucleus:**  
Relays visual impulses
- 3. Ventral Geniculate Nucleus:**  
Relays impulses of taste, somatic touch, somatic pressure, somatic temperature, somatic pain



## Structural and Functional areas of the Diencephalon



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### Hypothalamus:

Controls many body activities and is one of the major regulators of homeostasis.

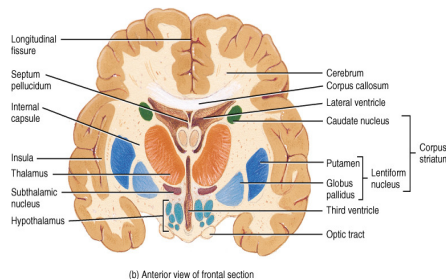
### Mammillary Bodies:

relay center for reflexes related to smell

### Infundibulum:

Connect the hypothalamus to the pituitary gland.

## Structural and Functional areas of the Diencephalon

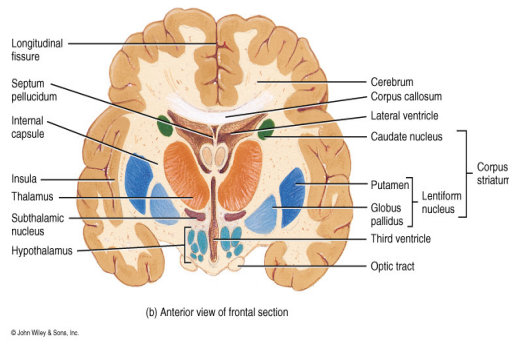


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### Hypothalamus major functions:

1. Controls and integrates activities of the Autonomic nervous system
2. Produces Hormones that control the activity of the pituitary gland
3. Produces hormones that control urine production, labor contractions, and milk let-down
4. Regulation of emotional and behavioral patterns related to rage, aggression, pain, pleasure, and behavioral patterns related to sexual arousal

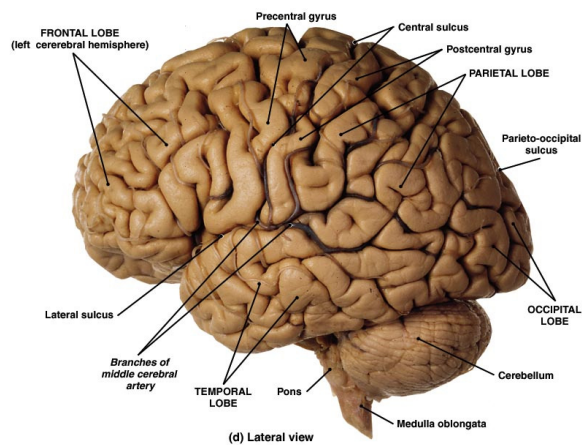
## Structural and Functional areas of the Diencephalon



### Hypothalamus major functions:

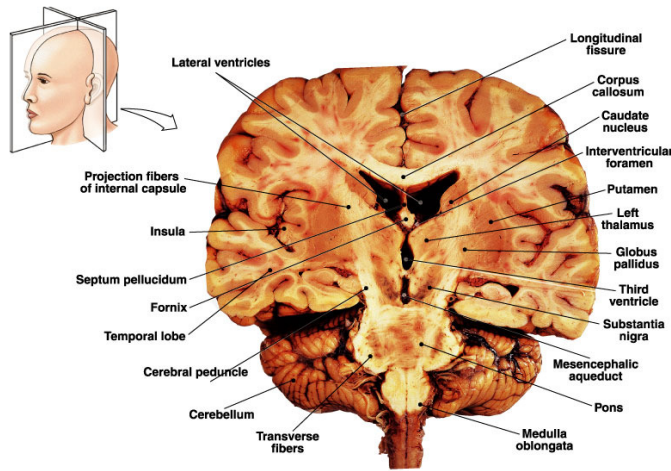
5. Regulation of eating and drinking  
**Feeding center (hunger)**  
**Satiety center (inhibits feeding center)**  
**Thirst Center**
6. Control of body temperature
7. Regulation of circadian rhythms and states of consciousness

## Structural and Functional areas of the of the cerebral hemispheres



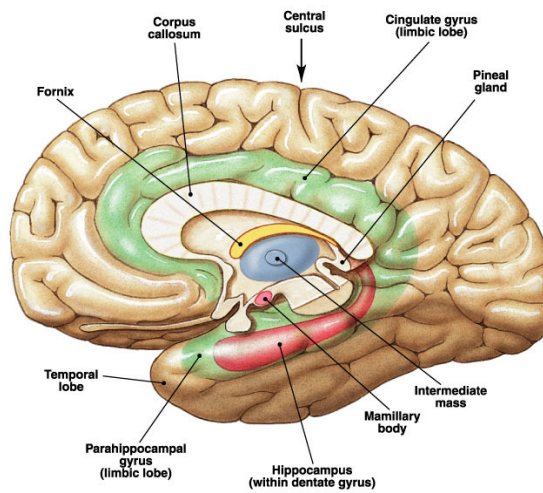
1. Cerebral cortex: Integration and processing of sensory input and initiation of motor activities
  - a. Frontal: voluntary control of skeletal muscles
  - b. Parietal: Sensory perception
  - c. Occipital: visual stimuli
  - d. Temporal: auditory and olfactory stimuli

## Structural and Functional areas of the of the cerebral hemispheres



2. Cerebral Nuclei:  
Subconscious control of skeletal muscle tone and the coordination of learned movement patterns

## Organization of the Limbic System



## Functions of the Limbic System

### Considered the Motivational Brain

- Establish emotional states
  - particularly those essential for self-preservation (feeding, fight, and flight, fear anger)
  - Essential for sex and parenting)
- Links conscious, intellectual functions with unconscious and autonomic functions
- Facilitates memory storage and retrieval

## Functions of the Limbic Nuclei

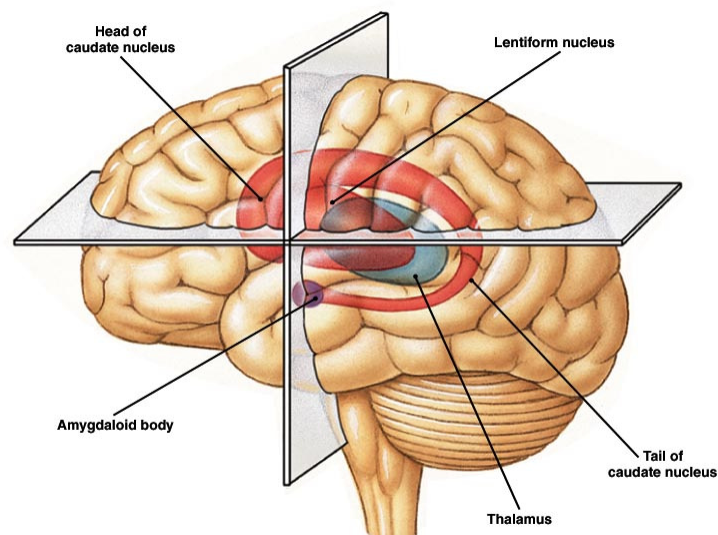
- **Amygdaloid body or Amygdala:** Plays a key role in emotions. Is linked to both fear responses and pleasure. Is responsible for determining what memories are stored and where the memories are stored in the brain. It is thought that this determination is based on how huge an emotional response an event invokes. Believed to act as an interface between limbic system, cerebrum, and other sensory areas.
  - **Clinical concerns:** Autism, Depression, Narcolepsy, Post-traumatic stress disorder, and Phobias are suspected to be related to dysfunction of these nuclei. Dysfunction can occur from damage, developmental problems, and neurotransmitter imbalance.

## Functions of the Limbic Nuclei

**Hippocampus:** Plays a key role in memory and spatial navigation (recording information about one's environment and its spatial orientation). Sends memories out to the appropriate part of the cerebral hemisphere for long-term storage and retrieves them when necessary. Damage to this area of the brain may result in an inability to form new memories (anterograde amnesia) and often also affects memories formed before the damage (retrograde amnesia).

- **Clinical concerns:** Alzheimer's affects this area first. Damage can also result from anoxia and encephalitis.

## Organization of the Basal Nuclei or ganglia



## Primary Function of the Basal Ganglia

- Basal ganglia (nuclei) are involved with the subconscious control of skeletal muscle tone and the coordination of learned patterns
- These nuclei do not initiate movement.
- As you begin a voluntary movement the basal nuclei control and adjust muscle tone of the appendicular muscles

## Functions of Basal Ganglia Nuclei

- **(Striatum) Caudate and Putamen Nuclei:** Best known for a role in the planning and modulation of movement pathways, also involved in a variety of other cognitive processes involving executive functions.
- **Substantia nigra:** Thought to be involved in movement and attention. Consists of two parts, the **pars compacta** and **pars reticulata**.
  - **Pars compacta:** produces and releases the neurotransmitter dopamine
  - **Pars reticulata:** Largely involved with control of eye muscles, coordinates activity with the superior colliculus.

## Functions of Basal Ganglia Nuclei

- Clinical concerns: Age related changes, encephalitis, or toxins such as MPTP from heroin can cause degeneration of the pars compacta. The decreased dopamine levels are associated with Parkinsons disease, Schizophrenia, and psychomotor retardation seen in cliinca drepression.