

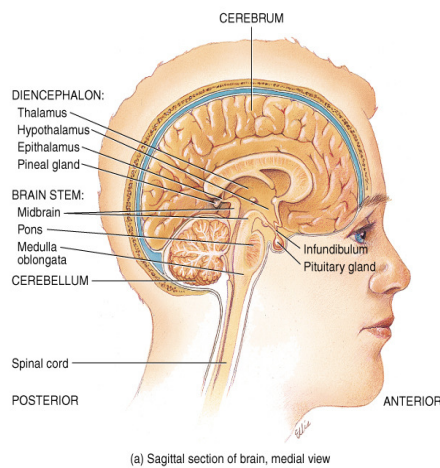
Bio& 241 A&P

Unit 4 Lecture 3



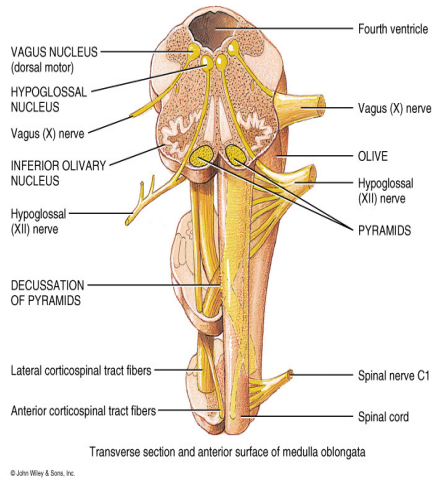
Granule Cell

Structural and Functional Areas of the Medulla Oblongata



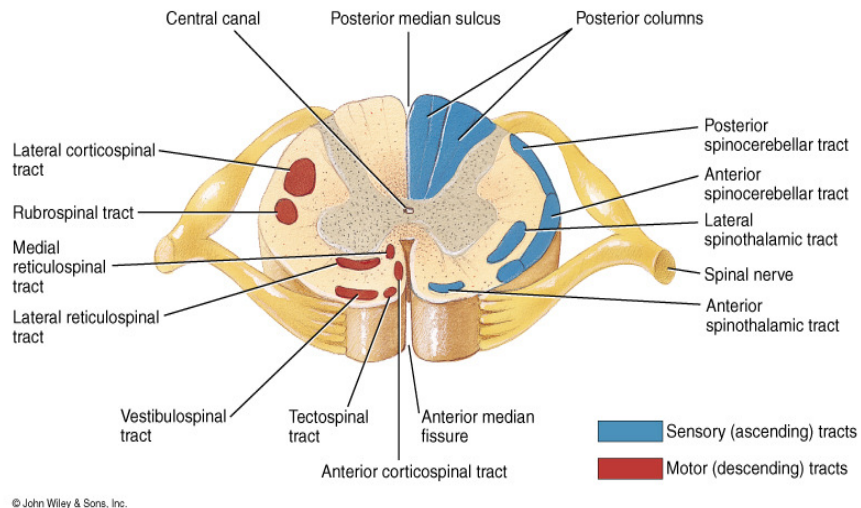
- **Cardiovascular Center:**
Regulates the rate and force of the heartbeat and the diameter of blood vessels
- **Medullary Rhythmicity Area:**
adjusts the basic rhythm of breathing via inspiratory and expiratory areas.
- **Other centers for vomiting, coughing, and sneezing**

Structural and Functional Areas of the Medulla Oblongata

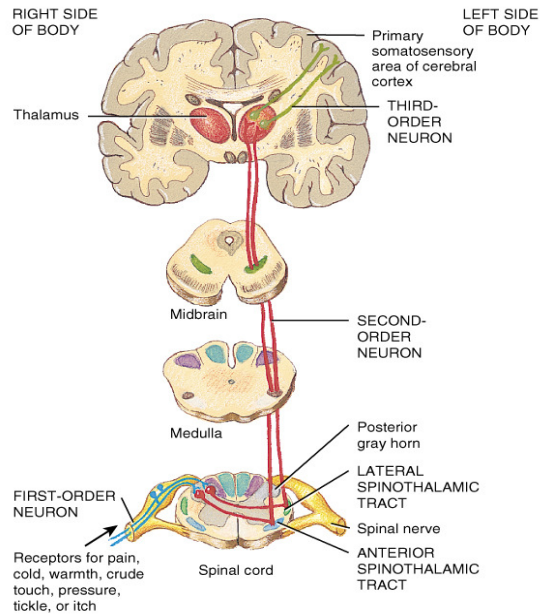


- **Pyramids:**
Axons from the largest motor tracts from the cerebrum to the Spinal Cord
- **Decussation of Pyramids:**
Crossing of the motor tracts of the pyramids
- **Nucleus Gracilis:** Neuron cells bodies of second order neurons (sensory info)
- **Nucleus Cuneatus:** Neuron cells bodies of second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

Ascending and Descending Tracts of the Spinal Cord

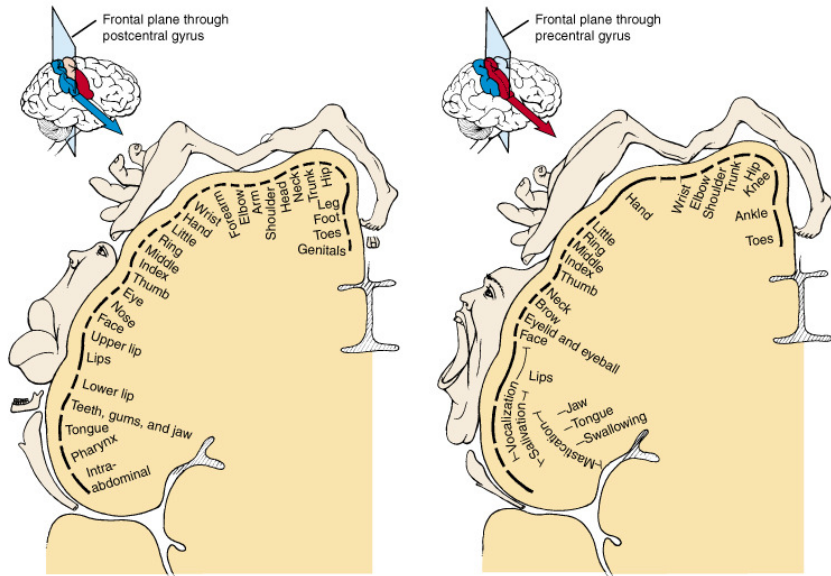


Organization of Sensory or Ascending Pathways



(b) Anterolateral (spinothalamic) pathways

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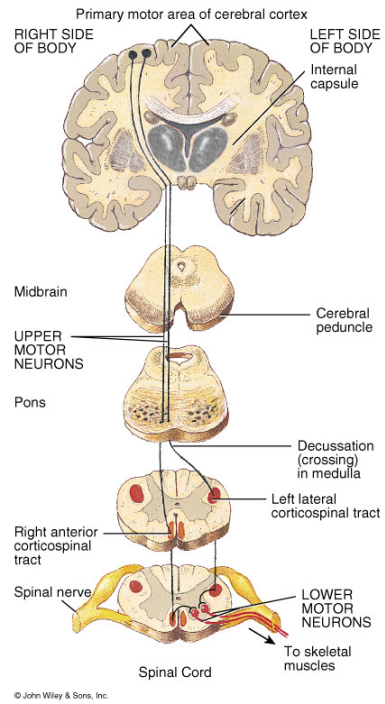


(a) Frontal section of primary somatosensory area in right cerebral hemisphere

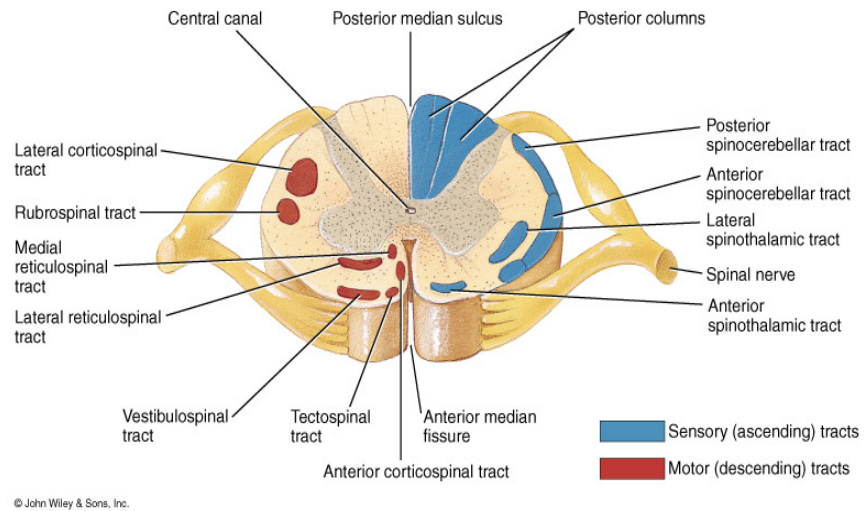
(b) Frontal section of primary motor area in right cerebral hemisphere

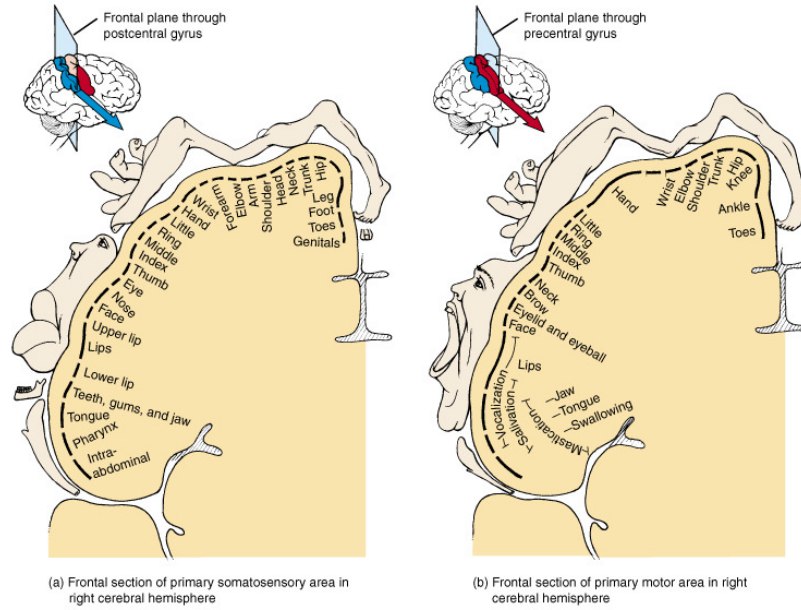
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Organization of Motor or descending Pathways



Ascending and Descending Tracts of the Spinal Cord



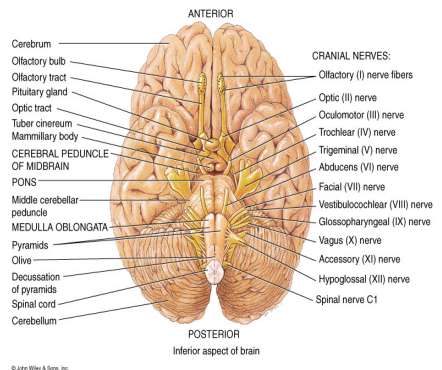


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Structural and Functional Areas of the Medulla Oblongata

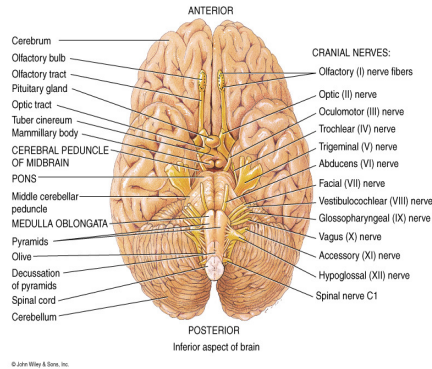
- Contains the Nuclei of five cranial nerves:

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:**



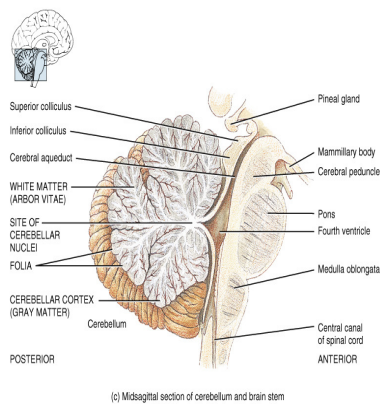
4. Spinal Accessory

Origin for nerve impulses that control swallowing.

5. Hypoglossal

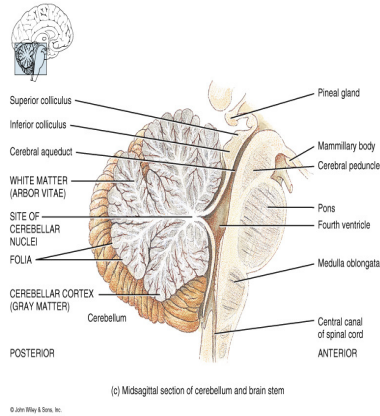
Origin for impulses that control tongue movement for speech and swallowing

Structural and Functional Areas of the Pons



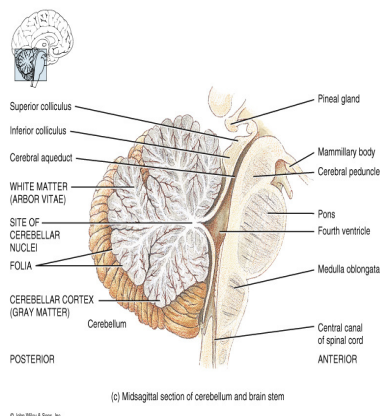
- **Bridge that connects medulla and superior brain structures**
- **Longitudinal axons of ascending sensory and descending motor tracts**
- **Transverse axons connect the right and left sides of the cerebellum**
- **Pneumotaxic Area: transmits inhibitory impulses to the inspiratory area of the medullary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

Structural and Functional Areas of the Pons



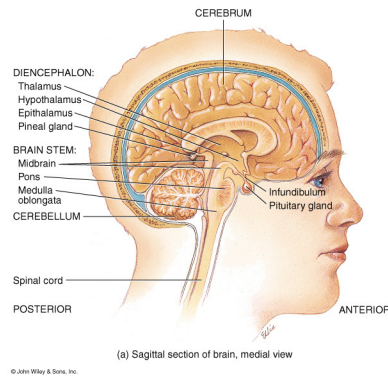
- **Apneustic Area:**
Transmits stimulatory impulses to the inspiratory area
 - **Contains the nuclei of four cranial nerves**
1. **Trigeminal:**
receive somatic sensory impulses from the head and face. Motor impulses the control chewing
 2. **Abducens:**
Motor impulses to the Lateral Rectus muscle.

Structural and Functional Areas of the Pons



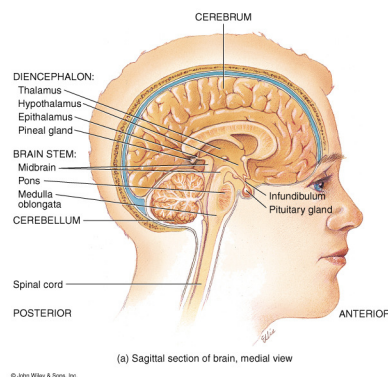
3. **Facial:**
Receive sensory impulses for taste and provide motor impulses that regulate saliva, tears, and muscle of facial expression
4. **Vestibulocochlear:**
Sensory impulses related to balance and equilibrium

Structural and Functional Areas of the midbrain or Mesencephalon



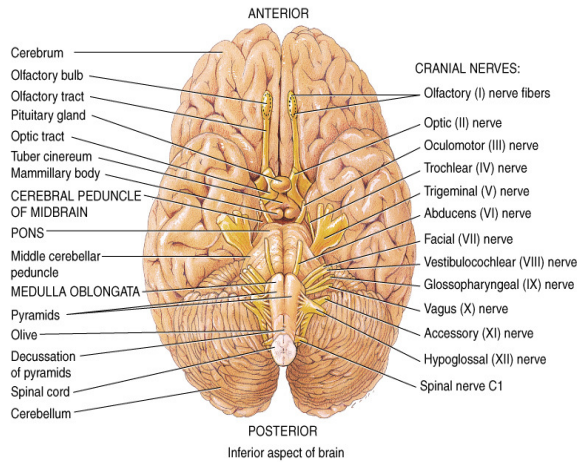
- **Cerebral Peduncles:**
Tracts that contain axons from the corticospinal and corticobulbar motor neurons
Sensory tracts from the pons and medulla that extend to the thalamus
- **Corpora Quadrigemina:**
Superior colliculi: reflex center for movement of the eyes and head in response to visual stimuli.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



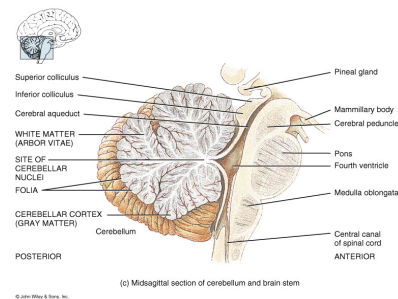
- **Sustantia nigra:**
Nuclei that control subconscious muscle activities through the production of dopamine
- **Red Nuclei:** relay area for motor tracts that control coordinated muscular movements
- **Headquarters of the Reticular formation, the reticular activating system (RAS).** Network of interconnected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

Structural and Functional Areas of the midbrain or Mesencephalon



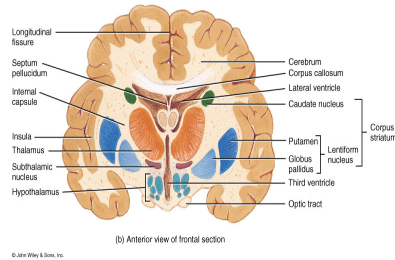
- **Nuclei associated with two cranial nerves:**
1. **Oculomotor:** controls movement of the eyeballs, constriction of the pupil, and shape of the lens
 2. **Trochlear:** controls movement of the eyeballs, specifically the Superior Oblique muscle.

Structural and Functional areas of the Cerebellum



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

Structural and Functional Areas of the Diencephalon



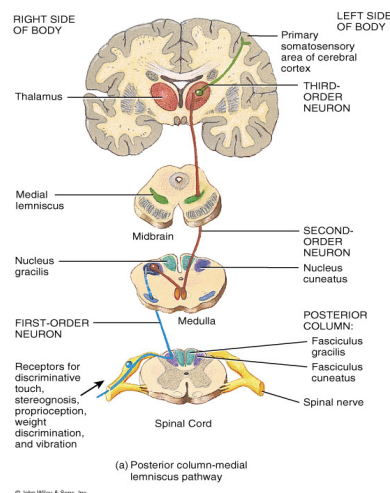
Thalamus:

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:

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

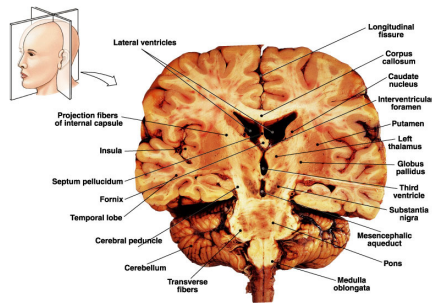
Functions as a principal relay station for sensory impulses and cognition

- **Intermediate Mass:**
Bridge of gray matter connecting right and left sides

Structural and Functional Areas of the Diencephalon

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

Hypothalamus:

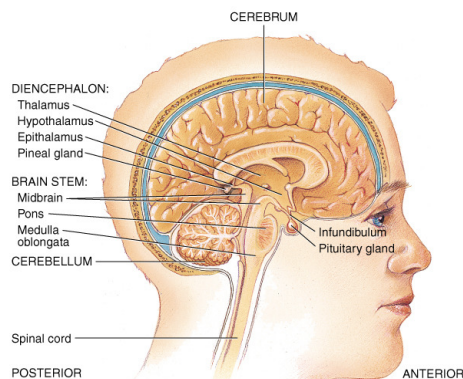
Controls many body activities and is one of the major regulators of homeostasis.

Mammillary Bodies:

relay center for reflexes related to smell

Infundibulum:

Connect the hypothalamus to the pituitary gland.



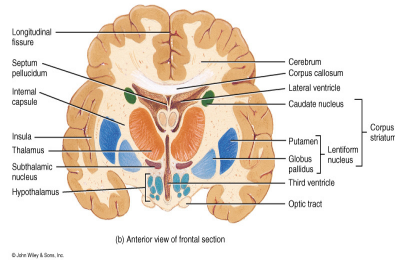
(a) Sagittal section of brain, medial view

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Structural and Functional Areas of the Diencephalon

Hypothalamus major functions:

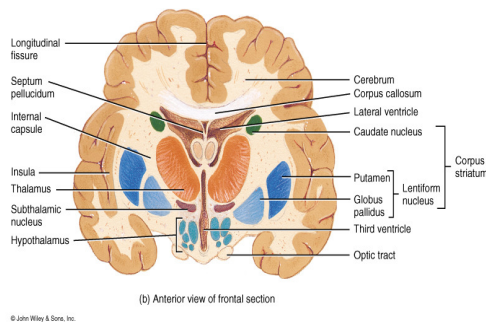
1. Controls and integrates activities of the Autonomic Nervous System
2. Produces hormones that control the activity of the pituitary gland
3. Produces hormones that control urine production, labor contractions, and milk let-down
4. Regulation of emotional and behavioral patterns related to rage, aggression,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



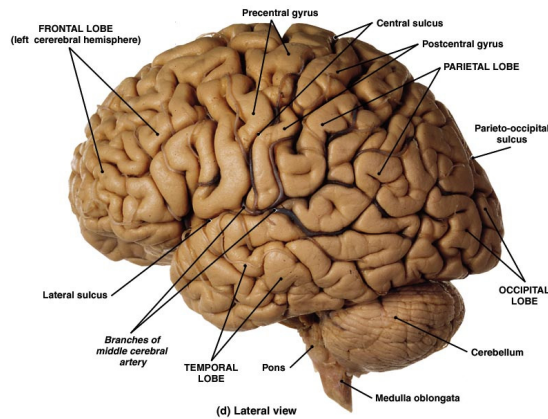
Structural and Functional Areas of the Diencephalon

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



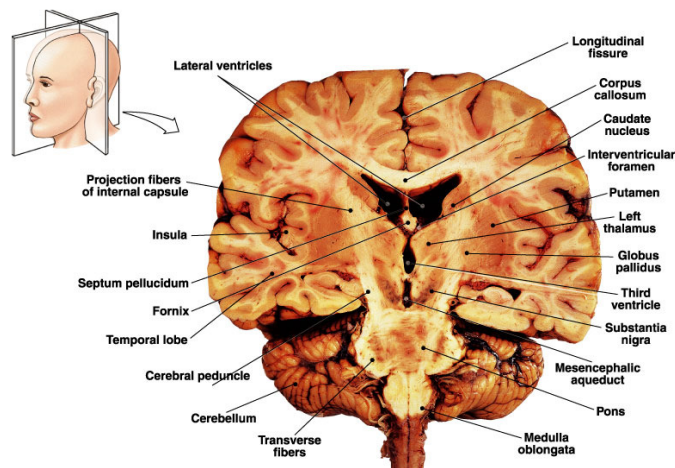
Structural and Functional Areas of the of the cerebral hemispheres



1. Cerebral cortex: Integration and processing of sensory input and initiation of motor activities

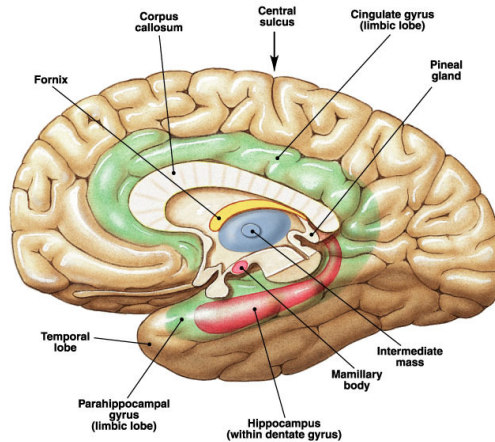
- a. Frontal: voluntary control of skeletal muscles
- b. Parietal: Sensory perception
- c. Occipital: visual stimuli
- d. Temporal: auditory and olfactory stimuli

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

Structural and Functional Areas of the of the cerebral hemispheres



3. Limbic System:

- a. establishing emotional states
- b. linking conscious intellectual functions with the unconscious autonomic functions
- c. Facilitating memory storage and retrieval

Memory and Synaptic Plasticity

Memory trace: a pathway of neurons that form synapses.

Synaptic Plasticity: Through learning and experience we have the ability to form new synapses, to remove, or modify existing synapses to make transmission easier.

Facilitation: Rapid arrival of repeated signals at the synapse that make it easier for the postsynaptic neuron to create an EPSP. Involves the build up of Ca^{2+} through tetanic stimulation.

Posttetanic Potentiation: Facilitates memories that last for a few hours. Involves long term build up of Ca^{2+} in the presynaptic terminal, which allows increased release of neurotransmitters and the excitation of the postsynaptic neuron.

Memory and Synaptic Plasticity

Immediate Memory: The ability to hold something in memory for just a few seconds. Very important to reading.

Short-Term Memory (STM): Last for a few seconds to a few hours. Quickly forgotten if it's not reinforced.

Working Memory: a form of STM we use frequently such as in looking up a phone number and remembering it long enough to dial the phone

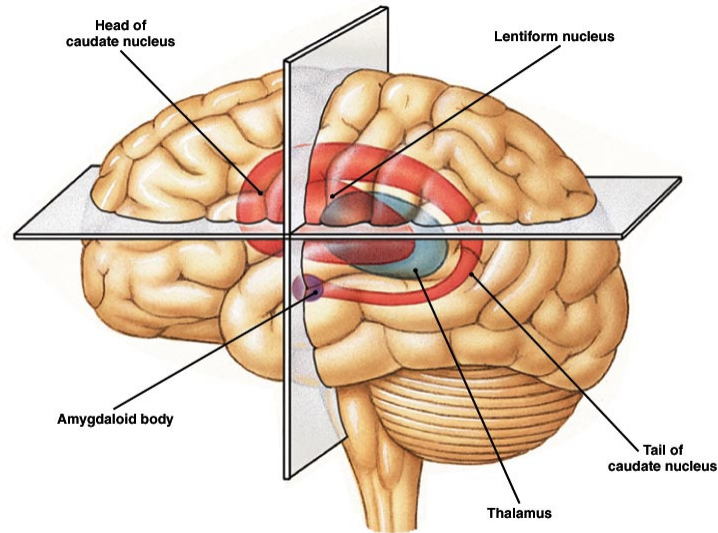
Memory and Synaptic Plasticity

Long-Term Memory (LTM) Last a lifetime and is less limited. Involves the remodeling of synapses or the formation of new synapses through the growth and branching of axon terminals and/or dendrites. Believed to involve pyramidal cells.

Declarative Memory: Retention of events and facts that you can put into words, numbers, names, and dates

Procedural Memory: Retention of motor skills; how to tie your shoes, play a musical instrument, or type on a keyboard.

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**