

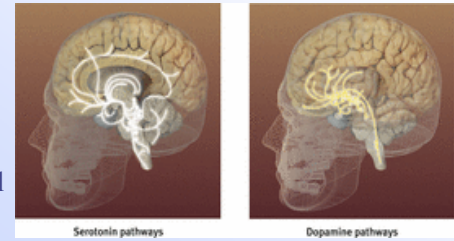
CNS Tour (Lecture 12)

IV. CNS TOUR

A. Introduction

- There are to a chemical pathways in the nervous system.

These pathways also form different neurological structures



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B. Spinal Cord

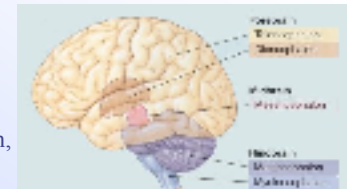
- Receives sensory neurons from skin and sends out motor neurons to the muscles and glands.
- Controls simple, fast, and reflective actions of the body, and communicates with the body and brain.
 - Higher-ordered thinking is controlled by higher cortical regions.
 - A topological relation between regions of the spinal cord and body parts it controls. The upper parts of the body are controlled by upper parts of the spinal cord etc.



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C. Basic divisions of the Brain

Neuro-anatomists distinguish between three parts of the brain: The Hindbrain, Midbrain, and Forebrain.



Hindbrain: Sections of Brain Stem & Cerebellum

Midbrain: The top of the Brain Stem

Forebrain: The Cerebral Hemispheres and the Limbic Structure. Forms a barrier between the evolutionarily older Hindbrain and Midbrain and the evolutionarily newer Forebrain.

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D. The Hindbrain

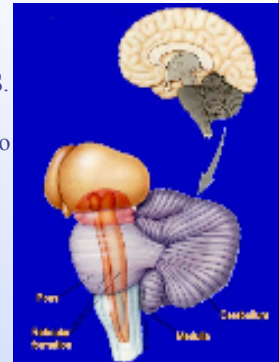
- The hindbrain is involved in basic regulation and arousal. It has 4 structures of interest:
 - **Pons:** Associated with sleeping, waking, and dreaming.
 - **Medulla:** Responsible for bodily functions that are not consciously controlled (heart rate).



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D. The Hindbrain

- **Reticular Formation:**
 - Site of the Reticular Activating System RAS.
 - Dense network of neurons which project to higher cortical sites.
 - Screens incoming information and if needed jolts the brain into intense awareness
 - Driving monotonously, you suddenly see a deer crossing the road.



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D. The Hindbrain

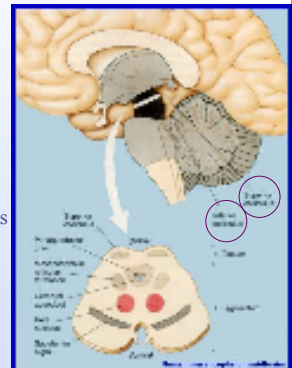
- **Cerebellum**
 - Highly convoluted and densely packed neurons
 - Central for skilled actions and balance; without it you would be clumsy and uncoordinated.
 - Skilled actions (of musicians, athletes, and everyday folks) are first processed consciously, but become *compiled* and stored in the cerebellum.



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E. The Midbrain

- The Midbrain has two structures: Superior and Inferior Colliculi.
 - **Superior Colliculi:**
 - Processes visual info.
 - Mammalian Superior Colliculi is primarily involved in visual reflexes and reactions to moving stimuli.
 - **Inferior Colliculi**
 - Processes acoustic information



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F. The Forebrain

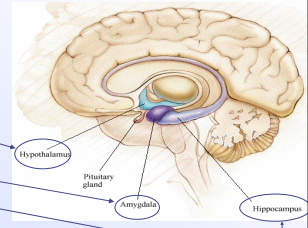
- The Forebrain includes the **Thalamus**, which is walnut shaped.
- The Thalamus is a relay station.
 - Sends in-coming information from eyes, ears, skin, and some motor centers, to higher regions of the brain.
 - Also receives outgoing information from these higher cortical regions and distributes them.



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F. The Forebrain (Limbic System)

- The **Limbic System** had 3 interesting structures:
 - Hypothalamus
 - Amygdala
 - Hippocampus



Hypothalamus: The hypothalamus exerts a powerful control over the body in part by exerting an influence over the pituitary gland. By working with the pituitary, the hypothalamus maintains **homeostasis** in the body.

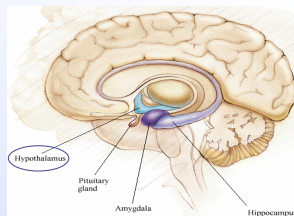
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F. The Forebrain (Limbic System)

The **Hypothalamus** also regulates emotions!

Stimulating certain regions produce range of emotions: From rage to pleasure.

Given a chance to bar press for stimulation of its “pleasure” center, rats will bar press for days, without eating.



The hypothalamus controls behavior that stems from basic biological urges (feeding, drinking, sex maintaining temperature).

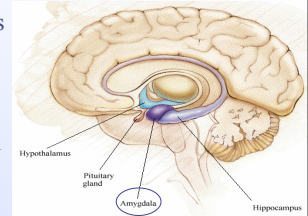
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F. The Forebrain (Limbic System)

The **Amygdala** processes sensory stimuli (particularly olfactory).

Modulates hypothalamic mechanism of aggression and defensive behavior.

Implicated in attack behavior: Animals will continue fighting against opponents who defeated them, if a region of the Amygdala is destroyed.



Males without an Amygdala fearlessly confront others who may dominate.

Its central in learning about the odor of harmful stimuli.

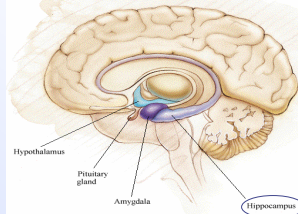
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F. The Forebrain (Limbic System)

The **Hippocampus** plays a pivotal role in learning and memory.

What is first known first came from H.M. who had his hippocampus removed

He could recall events that occurred 3 months before the operation, but could not form new memories.

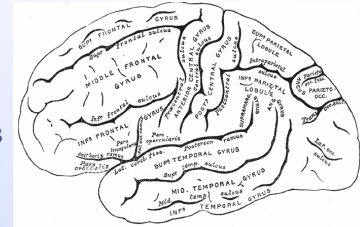


H.M. has normal short-term memory (repeat phone numbers) and memory for actions (learning tennis), but lacked an ability to place info into long-term memory.

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F. The Forebrain

The **Cortex** is between the skull and other parts of the brain. Its folds make it look wrinkly.



The cortex is divided into sections by various **sulci** and **gyri**. The sulci (or fissures) are the "grooves" and the gyri are the "bumps" that can be seen on the surface of the brain, increases the amount of cerebral cortex that can fit in the skull.

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F. The Forebrain

The **Cortex** is the functional summit of the brain

The cortex carries out high-level functions: Attention, language, and memory, as well as mediating some bodily sensations and movements.

Its cells are densely packed, intricately connected, and capable of complex synaptic interconnections.



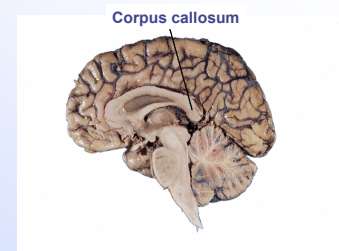
The cortex has two halves or hemispheres.

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F. The Forebrain

The **Corpus Callosum** connects the two hemispheres of the cortex.

The two halves are connected to each other by a large flat mass of fibers.

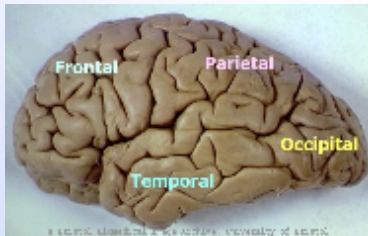


Gender differences in size and efficiency of the CC

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G. Lobes of the Cortex

- The cortex is divided into four lobes
 - Occipital
 - Parietal
 - Temporal
 - Frontal



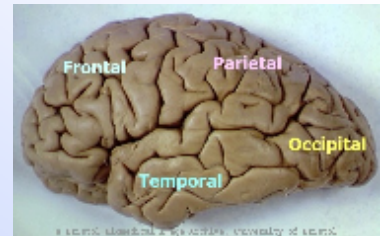
Occipital: Contains the visual cortex to process vision info.

Parietal: Contains the somatosensory cortex, which processes info about pain, pressure, touch and temperature.

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G. Lobes of the Cortex

Temporal: Contains the auditory cortex and is involved in memory, emotion, perception, & comprehension

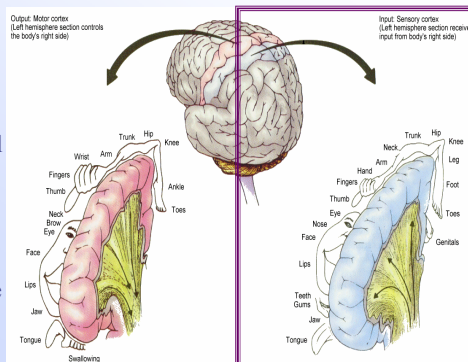


Frontal: Important in motor control (motor cortex), language production, making plans, thinking creatively, taking the initiative

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G. The Forebrain

The **Somato-sensory cortex**, in the Parietal Cortex, maps sensory info from all over the body.



IV. CNS TOUR

F. The Forebrain

The **Motor Cortex**, in the Frontal cortex, is a region which controls muscles for motor output.

