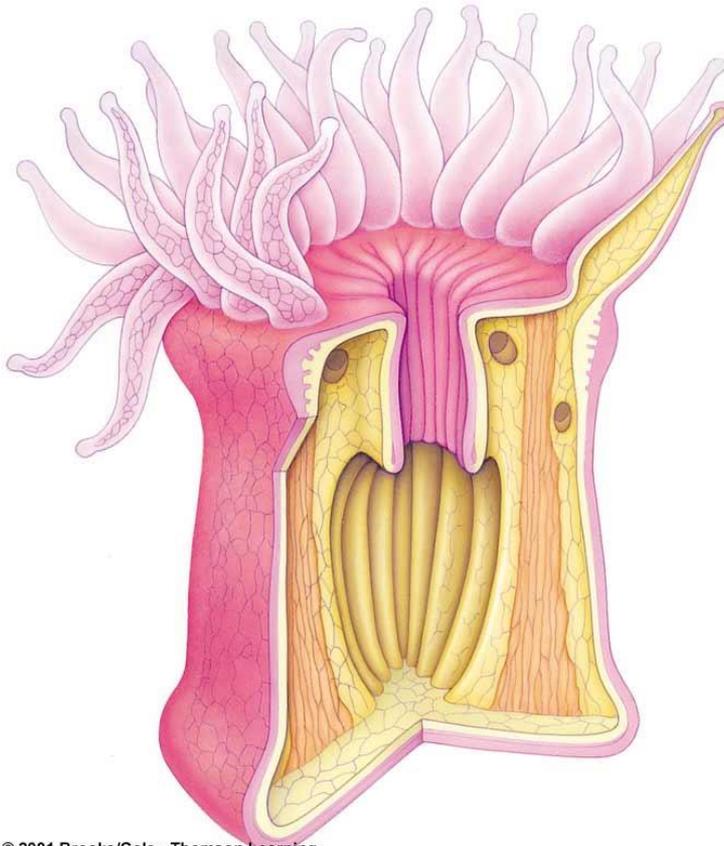


# The Human Brain

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I Think Therefore I am

# The Beginning

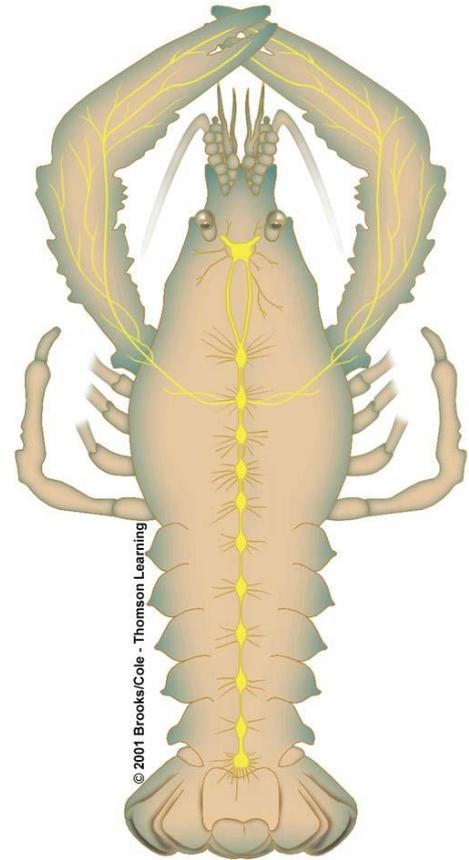


© 2001 Brooks/Cole - Thomson Learning

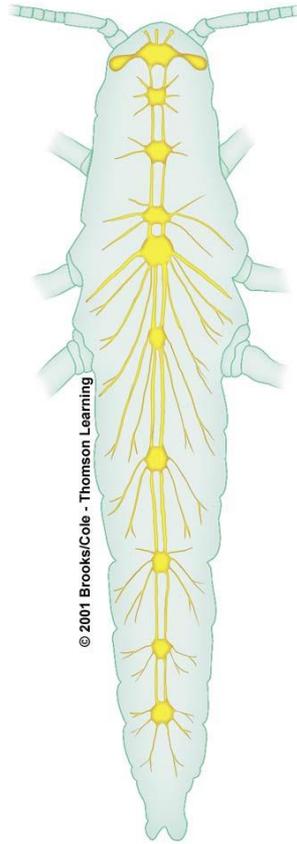
- The simplest creatures have very simple nervous systems made up of nothing but a bunch of nerve cells
- They have **neural nets**, individual neurons linked together that form a net around the entire animal
- Examples: jelly fish, sea anemone

# Ganglions

- Most invertebrates (such as the crayfish) have simple "brains" that consist of localized collections of neuronal cell bodies called **ganglia**



# Invertebrate Brains



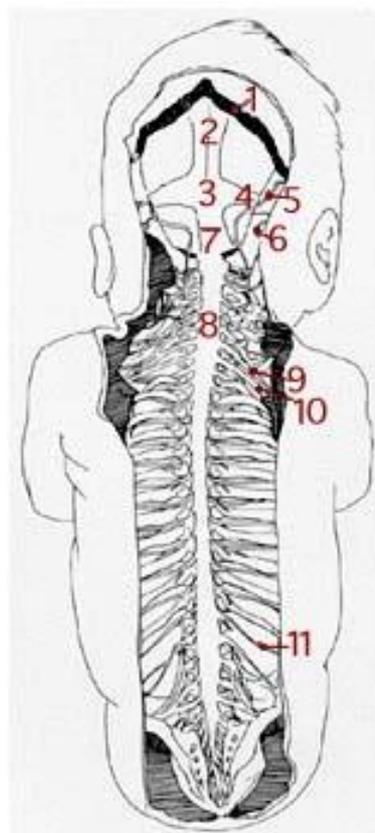
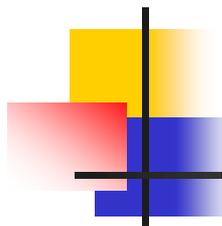
- As nervous systems evolved, chains of ganglia evolved into more centralized simple brains
- Brains evolved from ganglia of invertebrates



# Major Divisions of the Brain

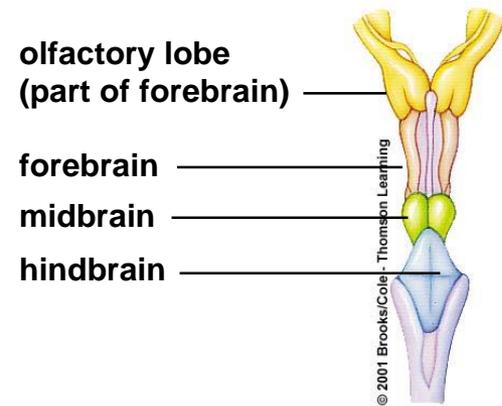
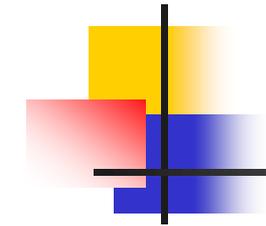
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- **Major Divisions of the Brain**
- **Spinal cord**
- **Brainstem**
- **Cerebellum**
- **Forebrain**
  - **Diencephalon** - thalamus, hypothalamus
  - **Cerebral cortex**

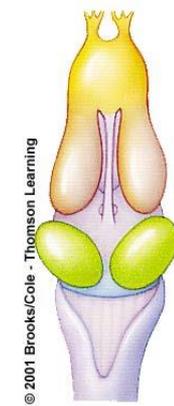


1. Posterior margin of parietal bone
2. Superior sagittal sinus
3. Confluence of sinuses
4. Transverse sinus
5. Greater occipital nerve
6. Lesser occipital nerve
7. Occipital sinus
8. Spinal dura mater
9. Superior trunk of brachial plexus\*

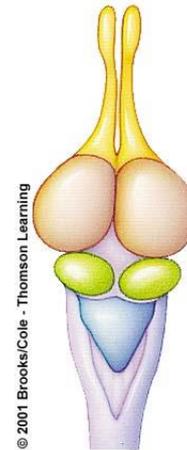
# Evolutionary Trend in Brains



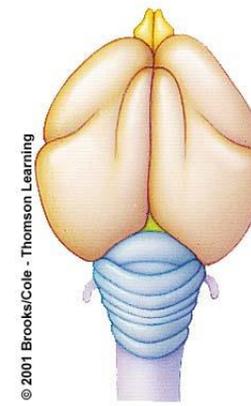
**FISH**  
(shark)



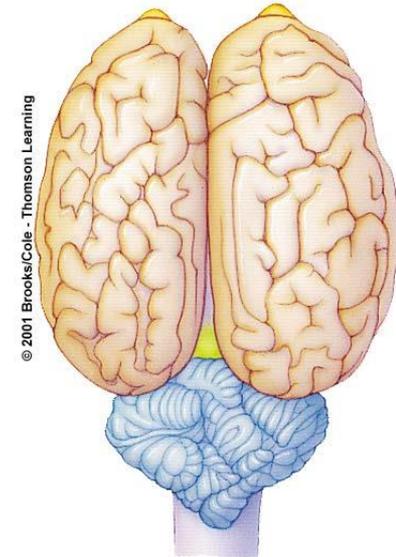
**AMPHIBIAN**  
(frog)



**REPTILE**  
(alligator)



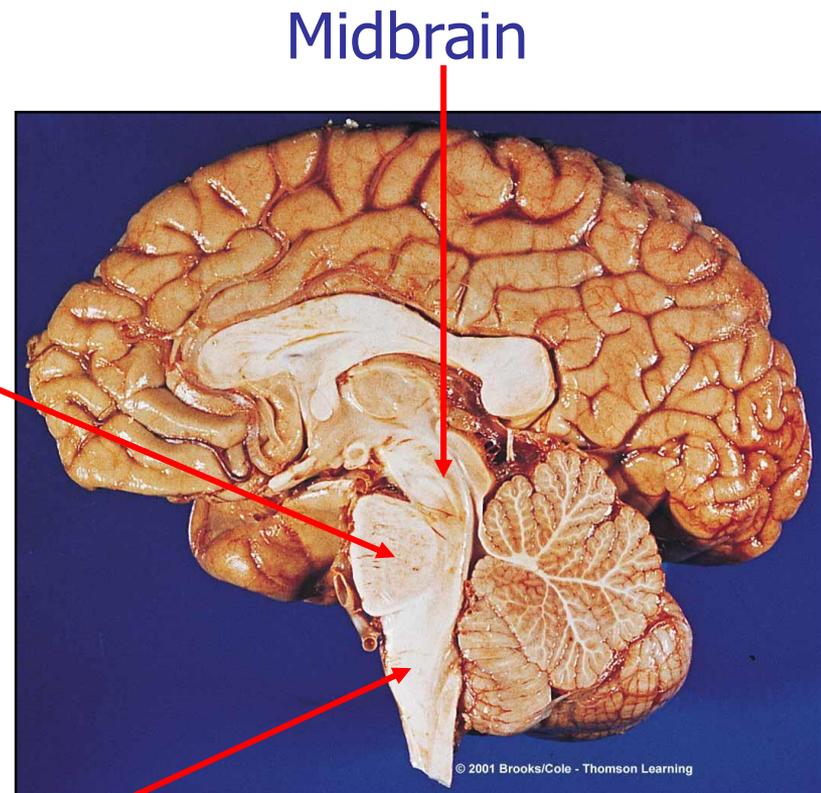
**BIRD**  
(goose)



**MAMMAL**  
(horse)

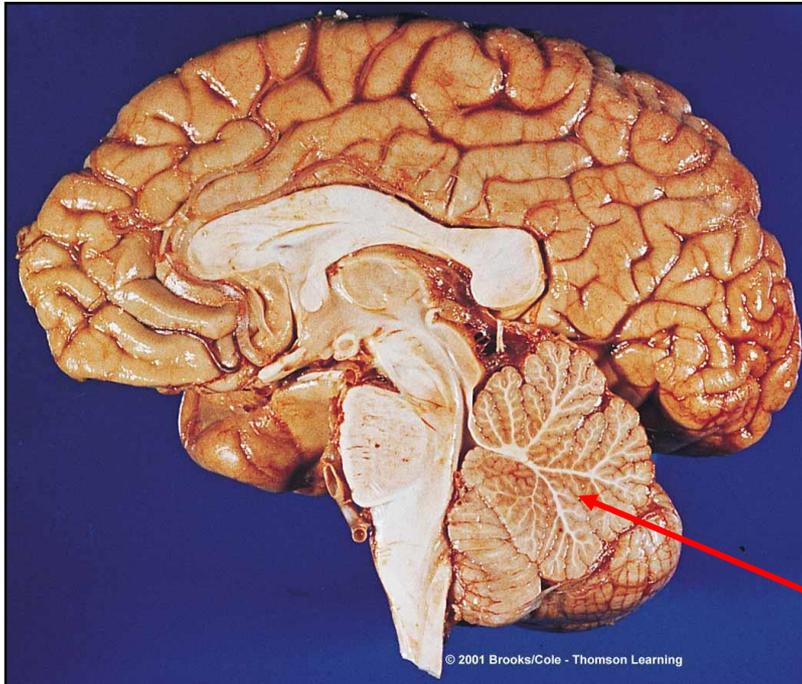
# Main Brain Parts

- **Brainstem** - The brainstem consists of the **medulla** (an enlarged portion of the upper spinal cord), **pons** and **midbrain**
- The brainstem controls the reflexes and automatic functions (heart rate, blood pressure), limb movements and visceral functions (digestion, urination)



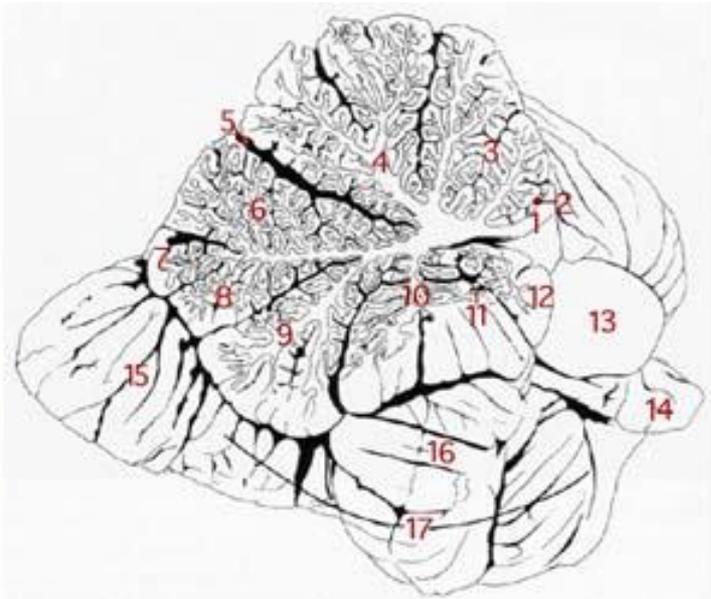
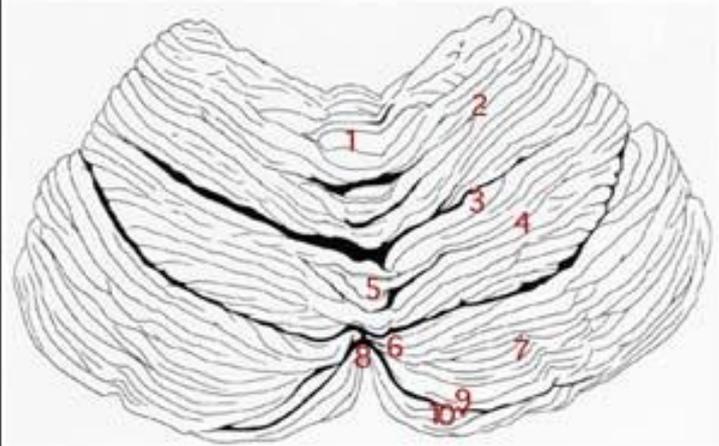
Medulla

# Main Brain Parts



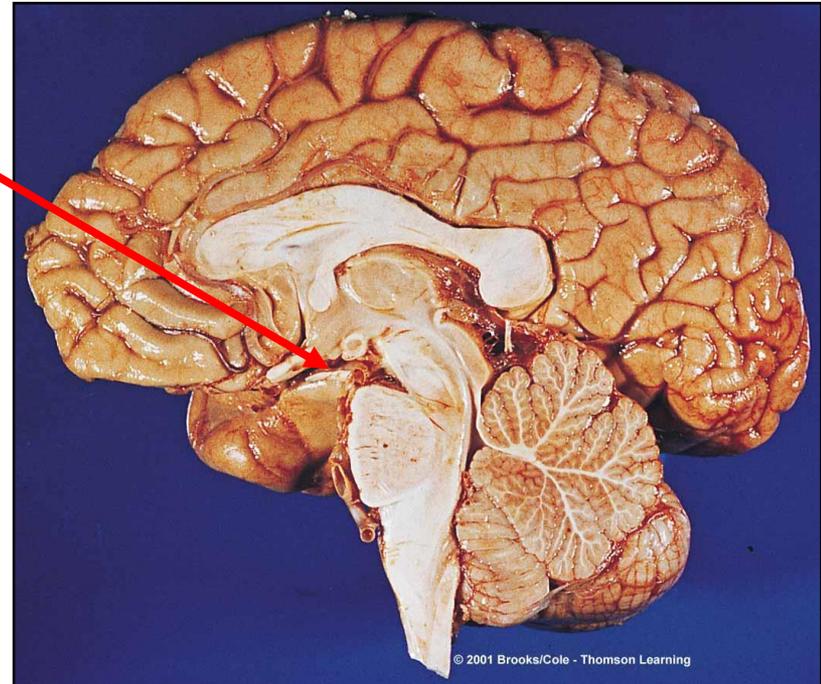
- **Cerebellum** - The cerebellum integrates information from the vestibular system that indicates position and movement and uses this information to coordinate limb movements

● Cerebellum

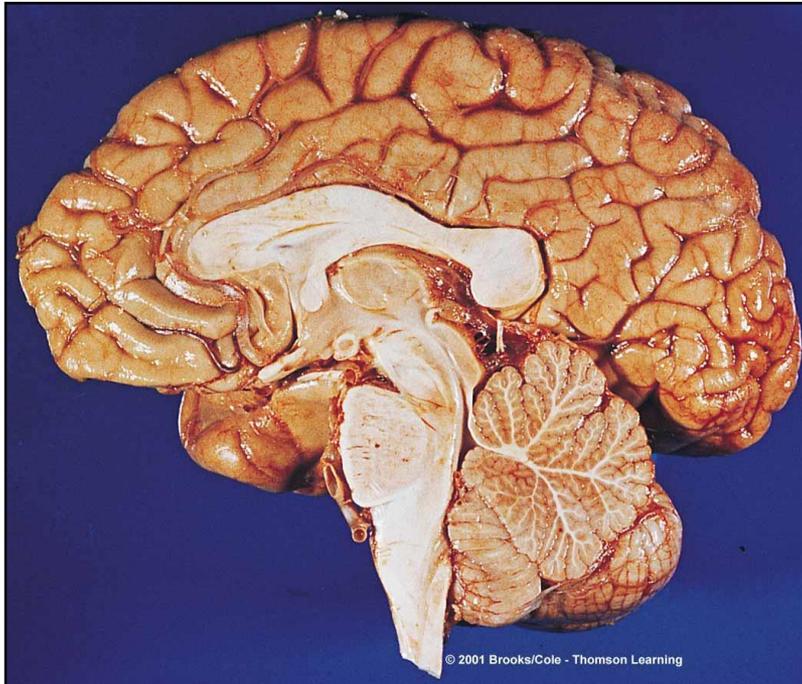


# Main Brain Parts

- **Hypothalamus** and **pituitary gland** - These control visceral functions, body temperature and behavioral responses such as feeding, drinking, sexual response, aggression and pleasure



# Main Brain Parts



- **Cerebrum** (also called the **cerebral cortex** or just the **cortex**)

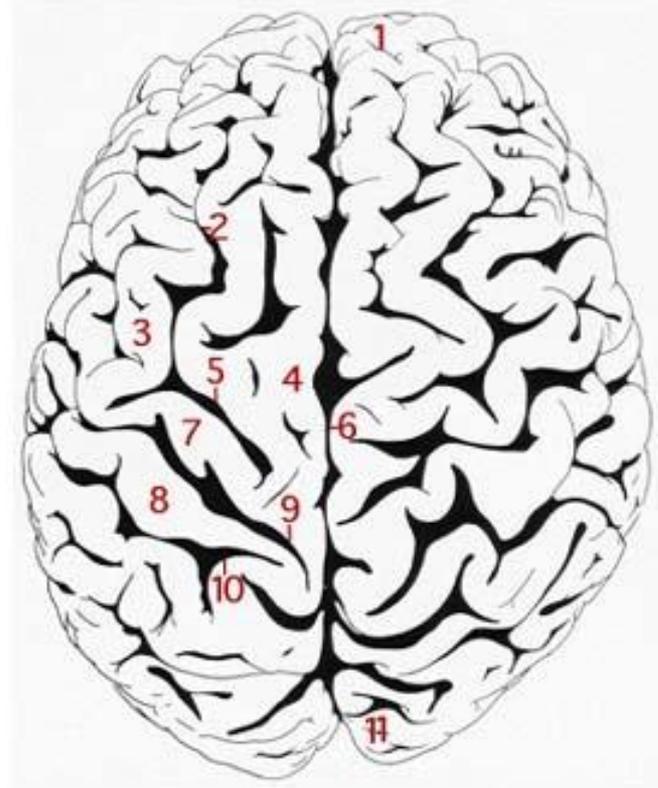


# The Cerebrum

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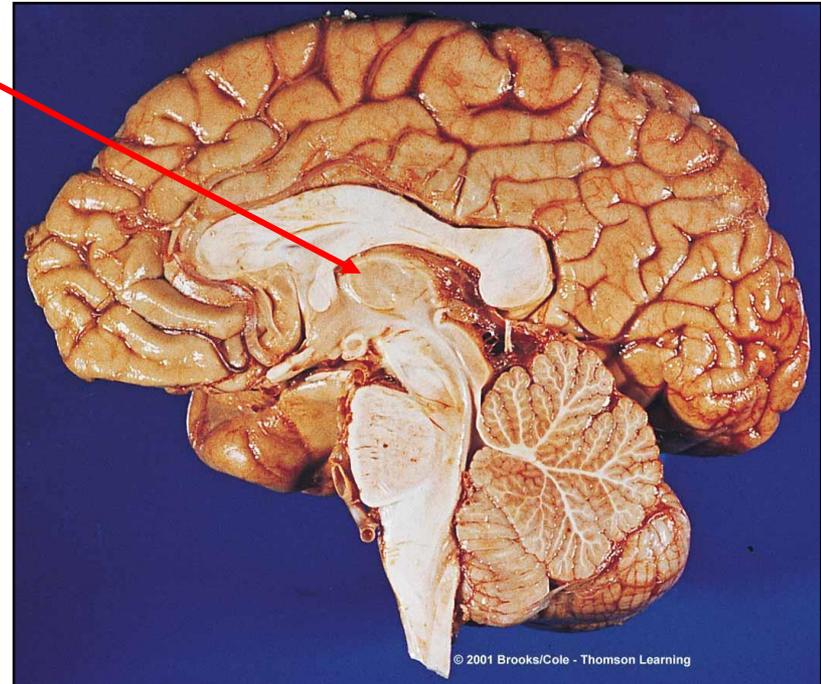
- The cerebrum consists of the cortex, large fiber tracts (corpus callosum) and some deeper structures (basal ganglia, amygdala, hippocampus)
- It integrates information from all of the sense organs, initiates motor functions, controls emotions and holds memory and thought processes

# The Cerebrum



# Main Brain Parts

- **The thalamus** relays information from the brainstem and spinal cord to the cerebral cortex



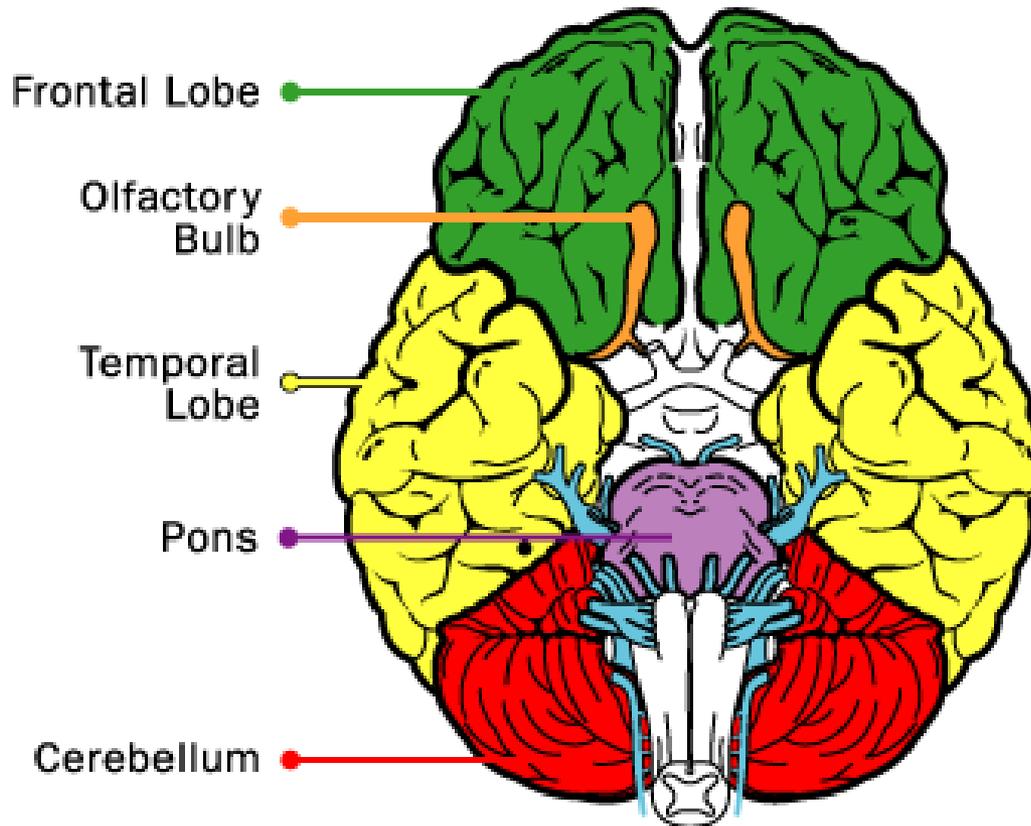


# The Lower “Lizard” Brain

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- Lower animals (fish, amphibians, reptiles, birds) do not do much "thinking," but instead concern themselves with the everyday business of gathering food, eating, drinking, sleeping, reproducing and defending themselves
- We perform these functions as well, and so have a “lizard” brain built into us too

## Major External Parts of the Human Brain (Underside View)



Frontal Lobe

Olfactory  
Bulb

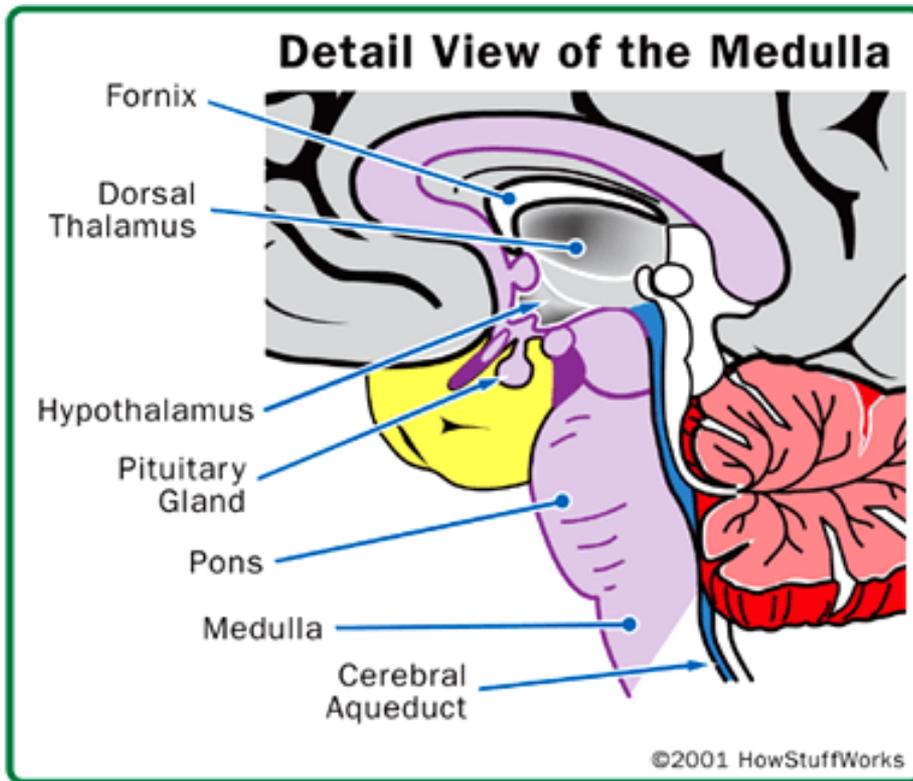
Temporal  
Lobe

Pons

Cerebellum

Cranial Nerves Shown in **BLUE**

# The Lower or “Lizard” Brain



- The basic **lower brain** consists of the **spinal cord, brainstem** and **diencephalon**
- Within each of these structures are centers of neuronal cell bodies, called nuclei, that are specialized for particular functions (breathing, heart-rate regulation, sleep)



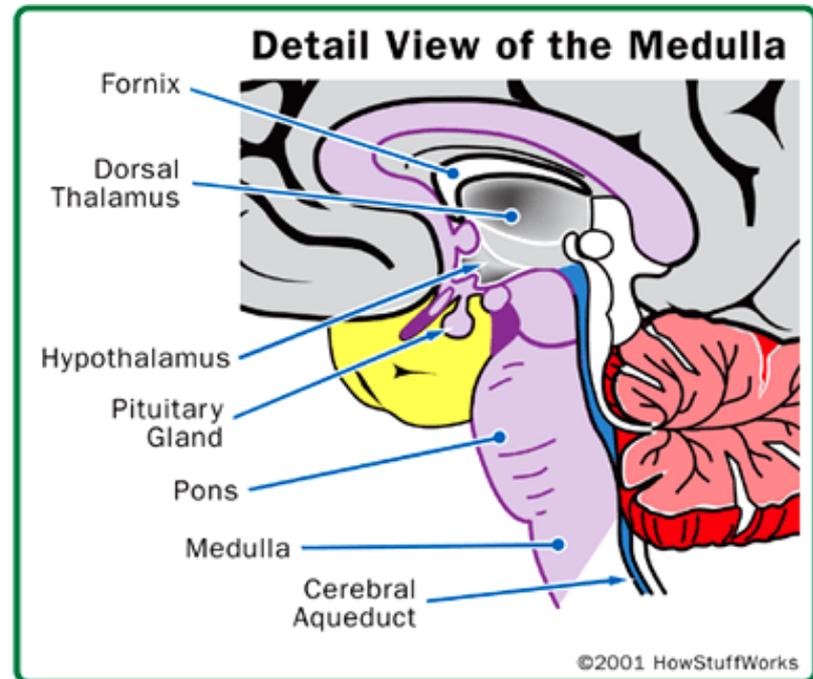
# The Medulla

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- The medulla contains nuclei for regulating blood pressure and breathing, as well as nuclei for relaying information from the sense organs that comes in from the cranial nerves.

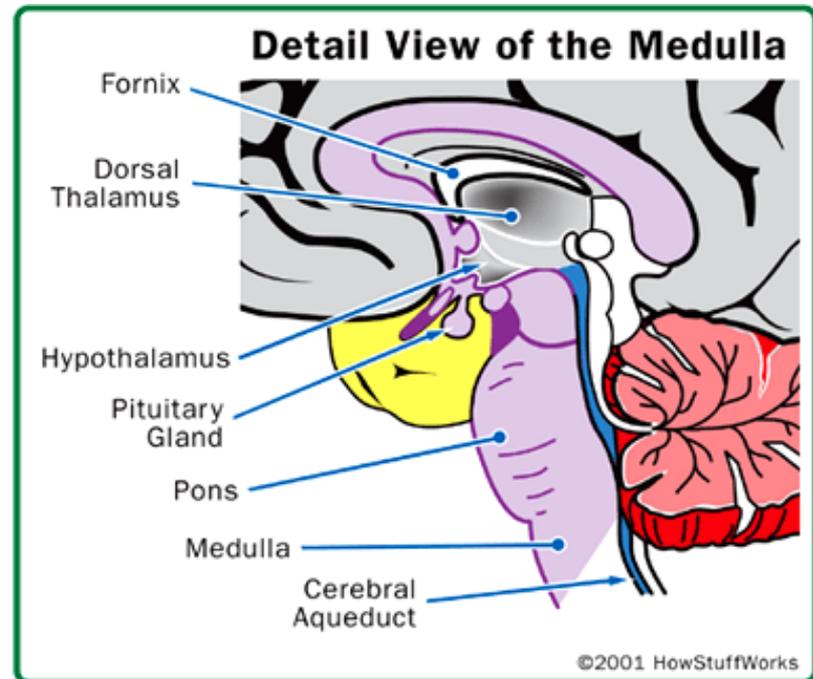
# The Pons

- The pons contains nuclei that relay movement and position information from the cerebellum to the cortex. It also contains nuclei that are involved in breathing, taste and sleep



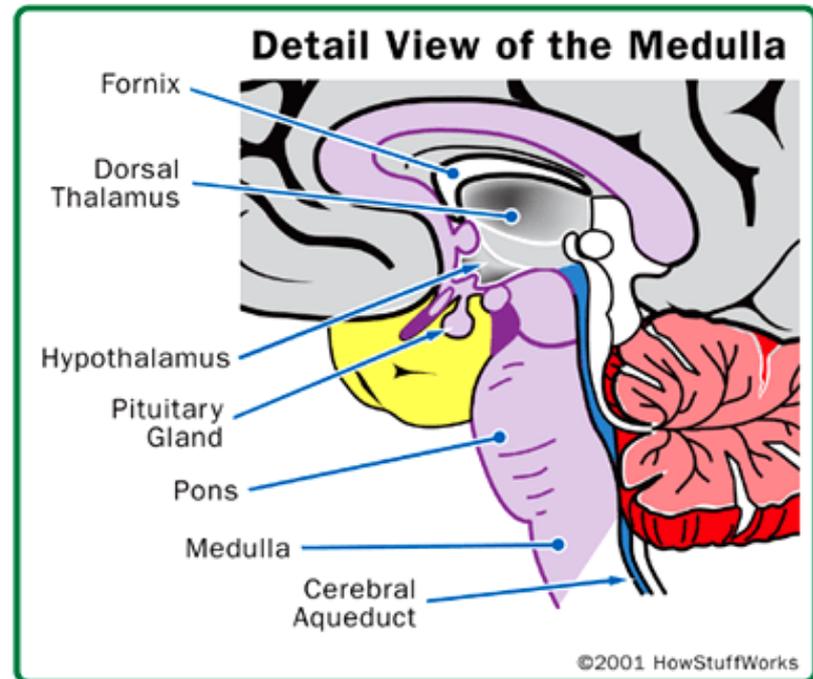
# The Midbrain

- The midbrain contains nuclei that link the various sections of the brain involved in motor functions (cerebellum, basal ganglia, cerebral cortex), eye movements and auditory control. One portion, called the **substantia nigra**, is involved in voluntary movements; when it does not function, you have the tremored movements of Parkinson's disease



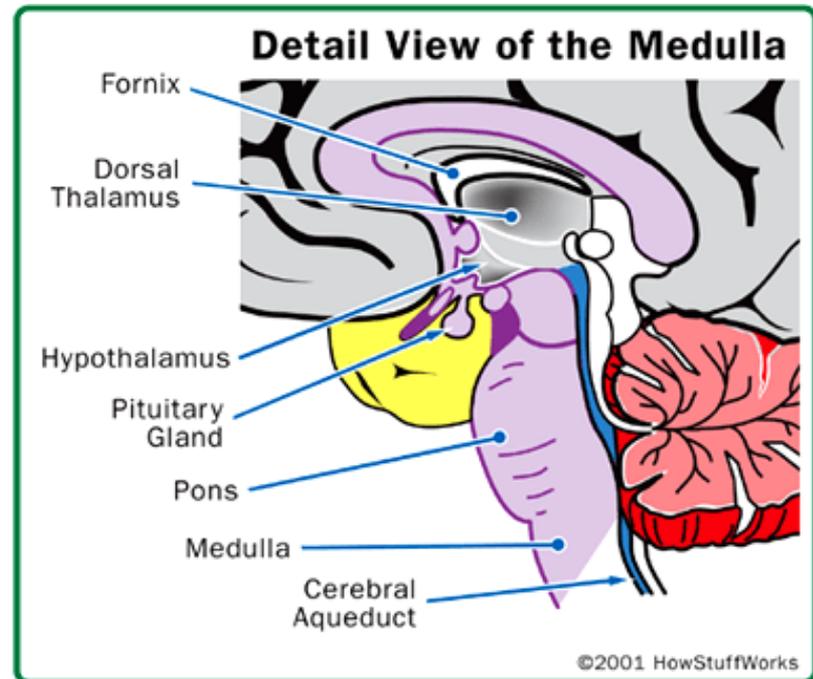
# The Thalamus

- The thalamus relays incoming sensory pathways to appropriate areas of the cortex, determines which sensory information actually reaches consciousness and participates in motor-information exchange between the cerebellum, basal ganglia and cortex.

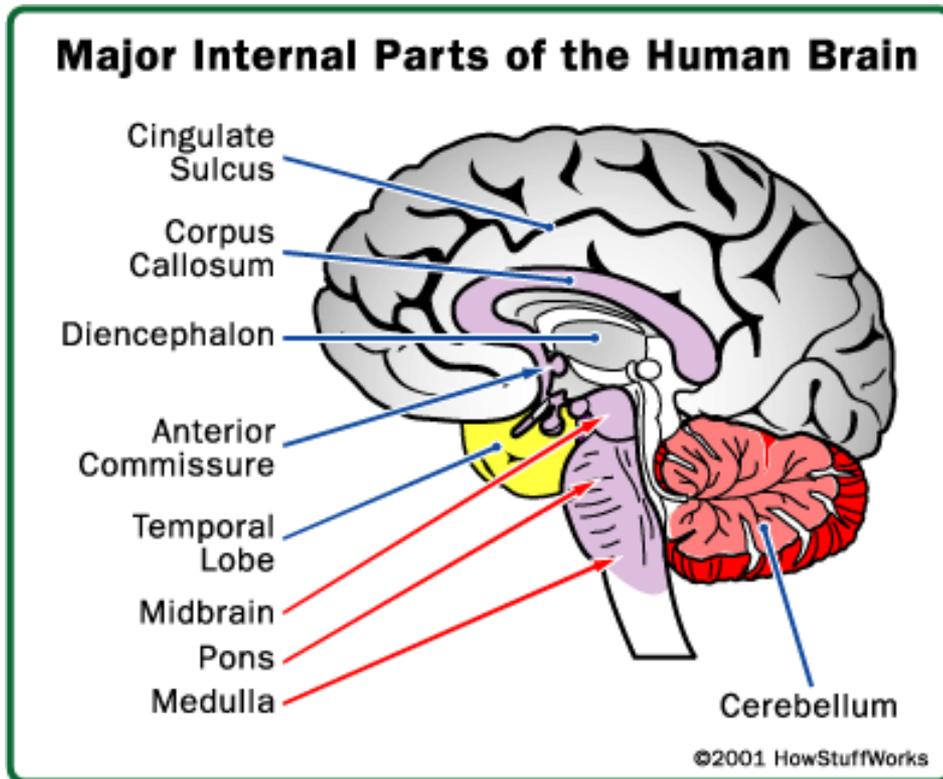


# The Hypothalamus

- The hypothalamus contains nuclei that control hormonal secretions from the pituitary gland. These centers govern sexual reproduction, eating, drinking, growth, and maternal behavior such as lactation (milk-production in mammals). The hypothalamus is also involved in almost all aspects of behavior, including your biological "clock," which is linked to the daily light-dark cycle (**circadian rhythms**).

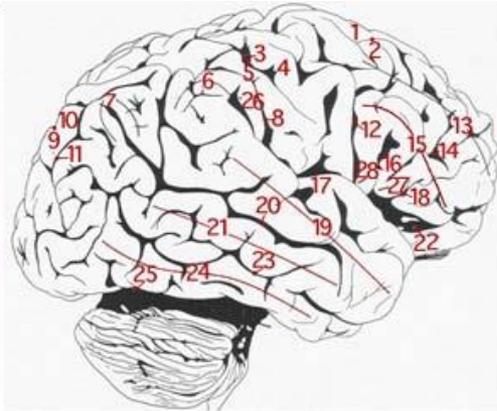


# The Cerebellum



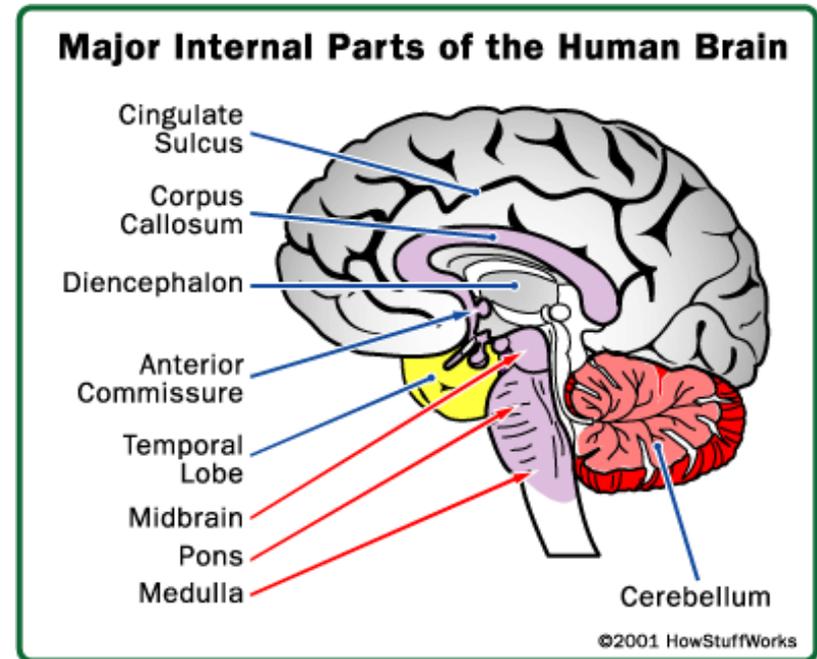
- The cerebellum is folded into many lobes and lies above and behind the pons and handles motor functions
- To demonstrate this, reach out and touch a point in front of you, such as the computer monitor -- your hand makes one smooth motion. If your cerebellum were damaged, that same motion would be very jerky as your cortex initiated a series of small muscle contractions to home in on the target point

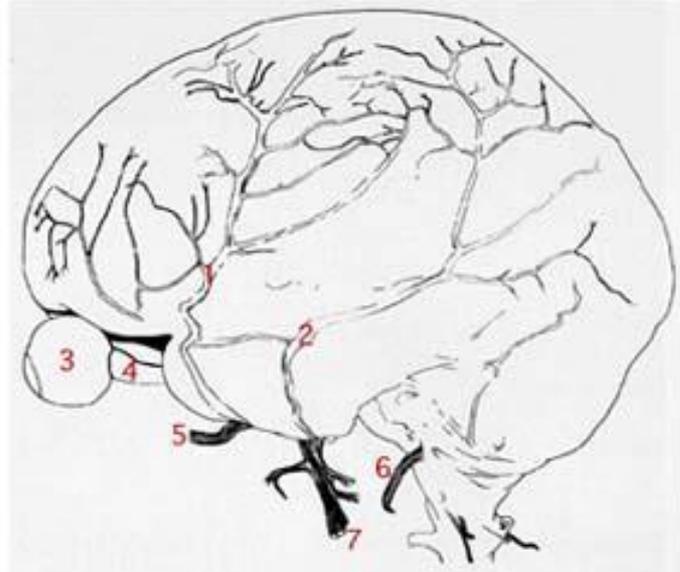
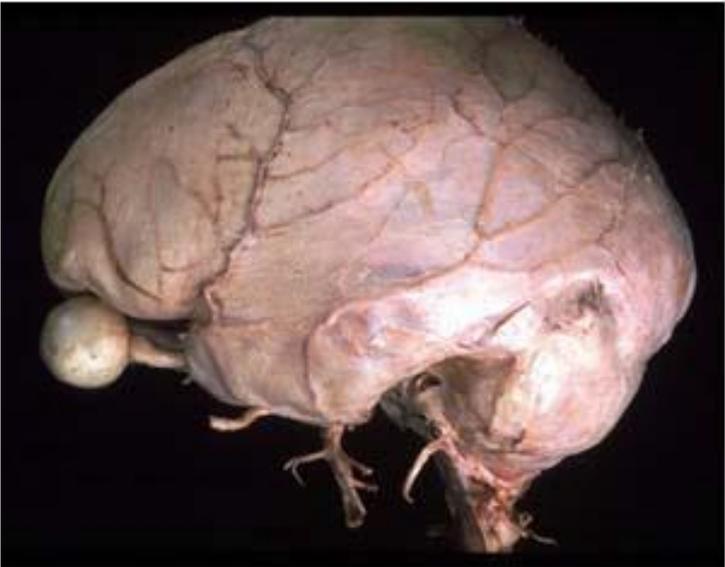
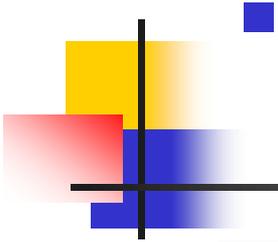
# The Mighty Cerebrum



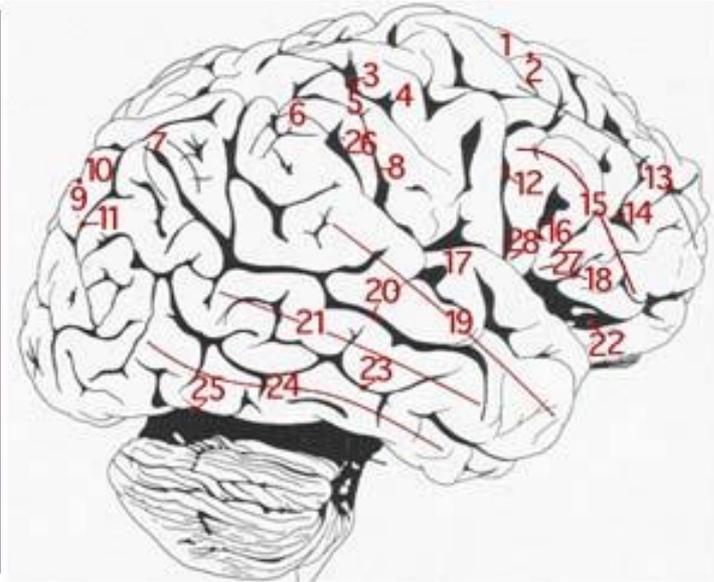
# The “Higher” Brain

- The cerebrum is the largest part of the human brain
- The cortex contains all of the centers that receive and interpret sensory information, initiate movement, analyze information, reason and experience emotions



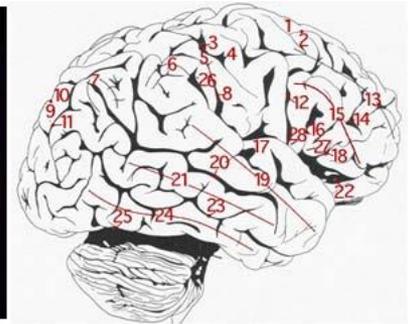


# The Cerebrum

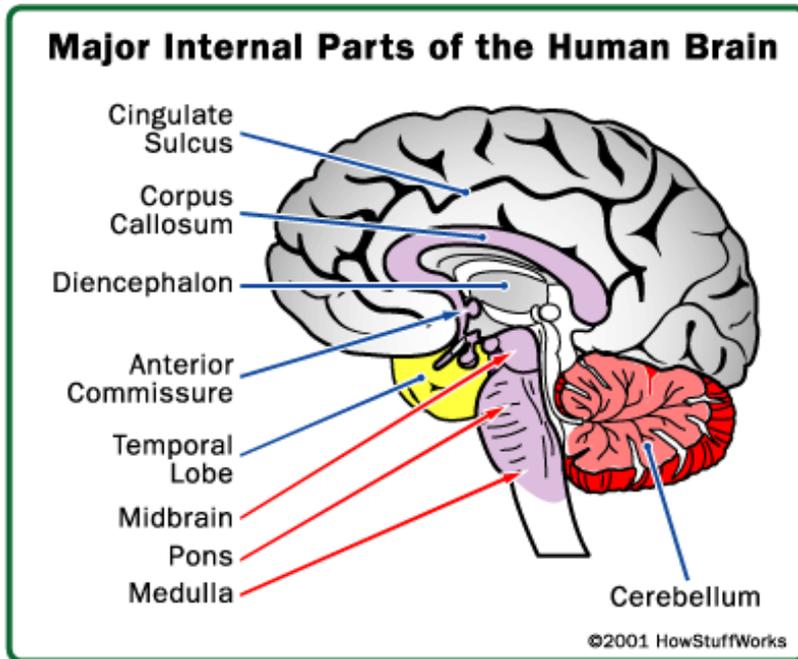


# The Cerebrum

- The cortex is folded, forming folds (**gyri**) and grooves (**sulci**)
- Several large sulci divide the cortex into various lobes: the **frontal lobe**, **parietal lobe**, **occipital lobe** and **temporal lobe**



# The Cerebrum



- When viewed from above, a large groove (**interhemispheric fissure**) separates the brain into left and right halves
- The halves talk to each other through a tract of white-matter fibers called the **corpus callosum**

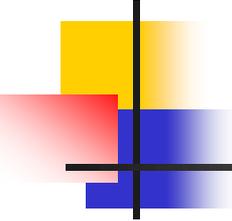


# Specialized Cerebrum Structures – CW Assignment

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- **Parietal lobe**
- **Frontal lobe**
- **Broca's area**
- **Occipital lobe**
- **Temporal lobe**
- **Basal ganglia**
- **Limbic system**
- **Amygdala**
- **Insula**
- **Hippocampus**

Describe each one of the structures above.



# Floating in Water

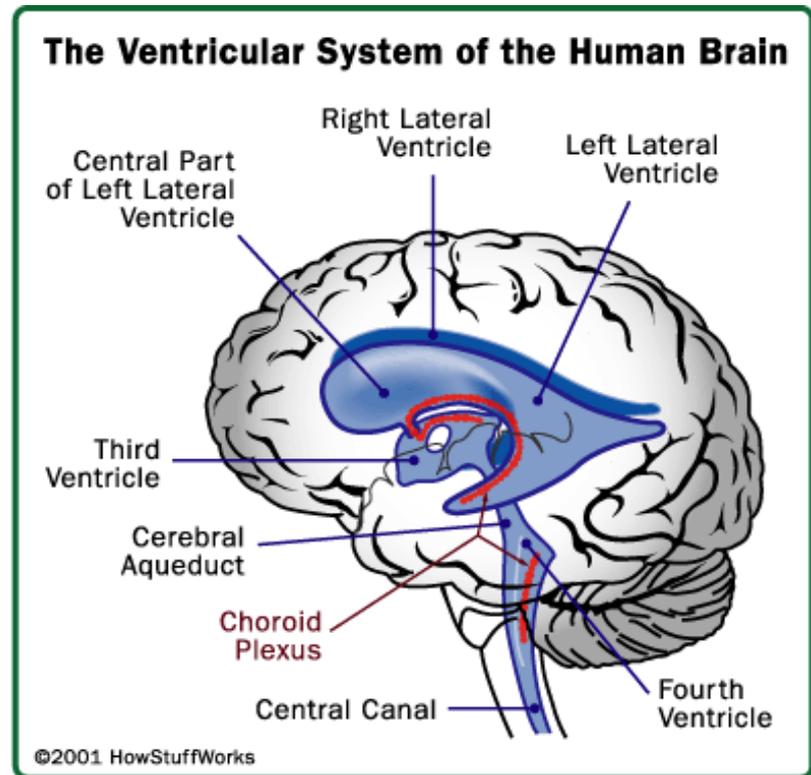
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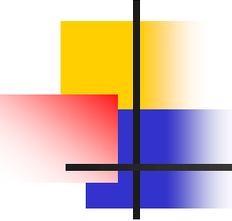
- Your brain and spinal cord are covered by a series of tough membranes called **meninges**, which protect these organs from rubbing against the bones of the skull and spine
- For further protection, the brain and spinal cord float in a sea of **cerebrospinal fluid** within the skull and spine

# The Ventricles

- This cushioning fluid is produced by the **choroid plexus** tissue, which is located within the brain, and flows through a series of cavities (**ventricles**) out of the brain and down along the spinal cord

Ventricle system of the brain





Credit to...

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- **How Your Brain Works @**

<http://www.howstuffworks.com/brain1.htm>