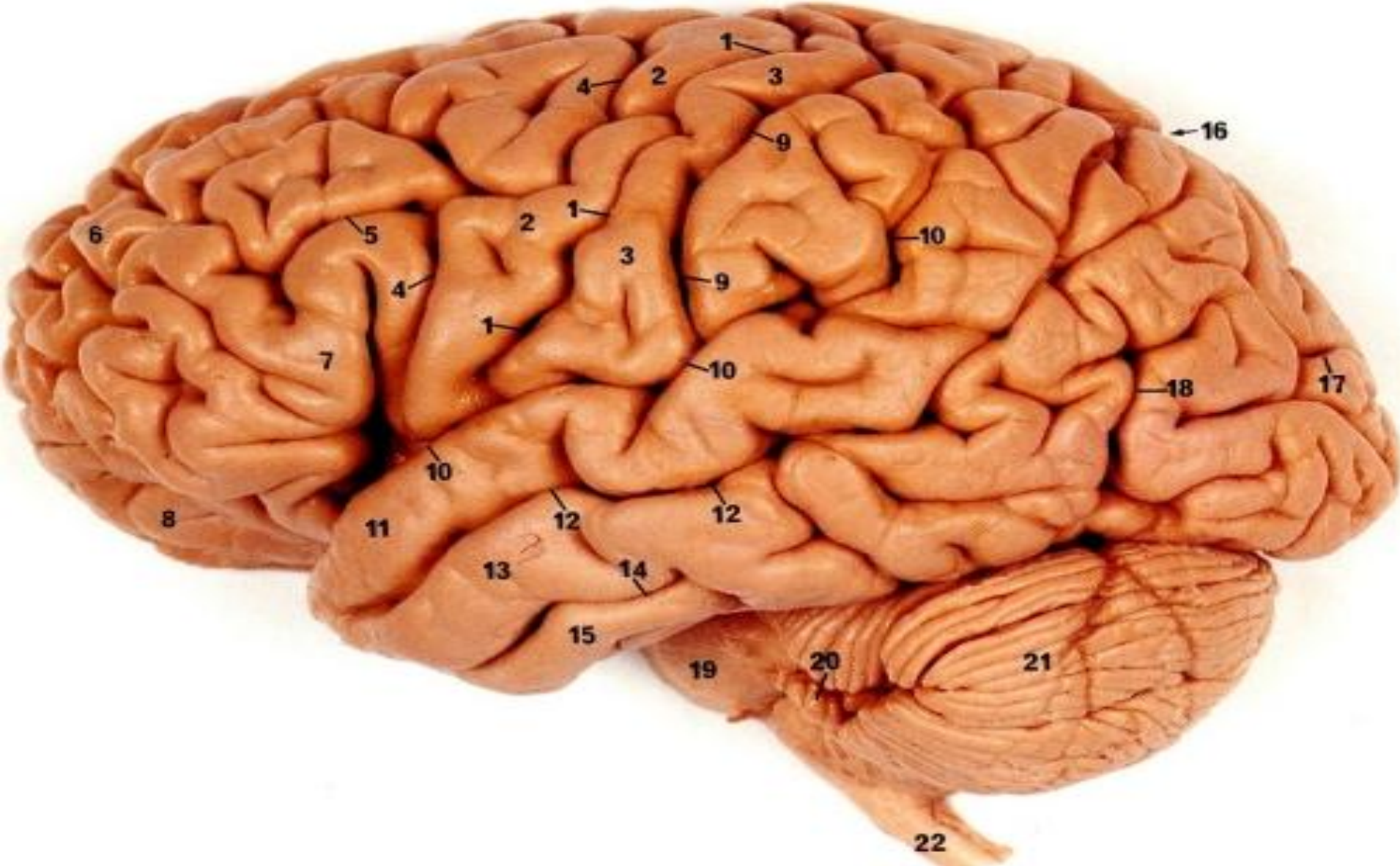


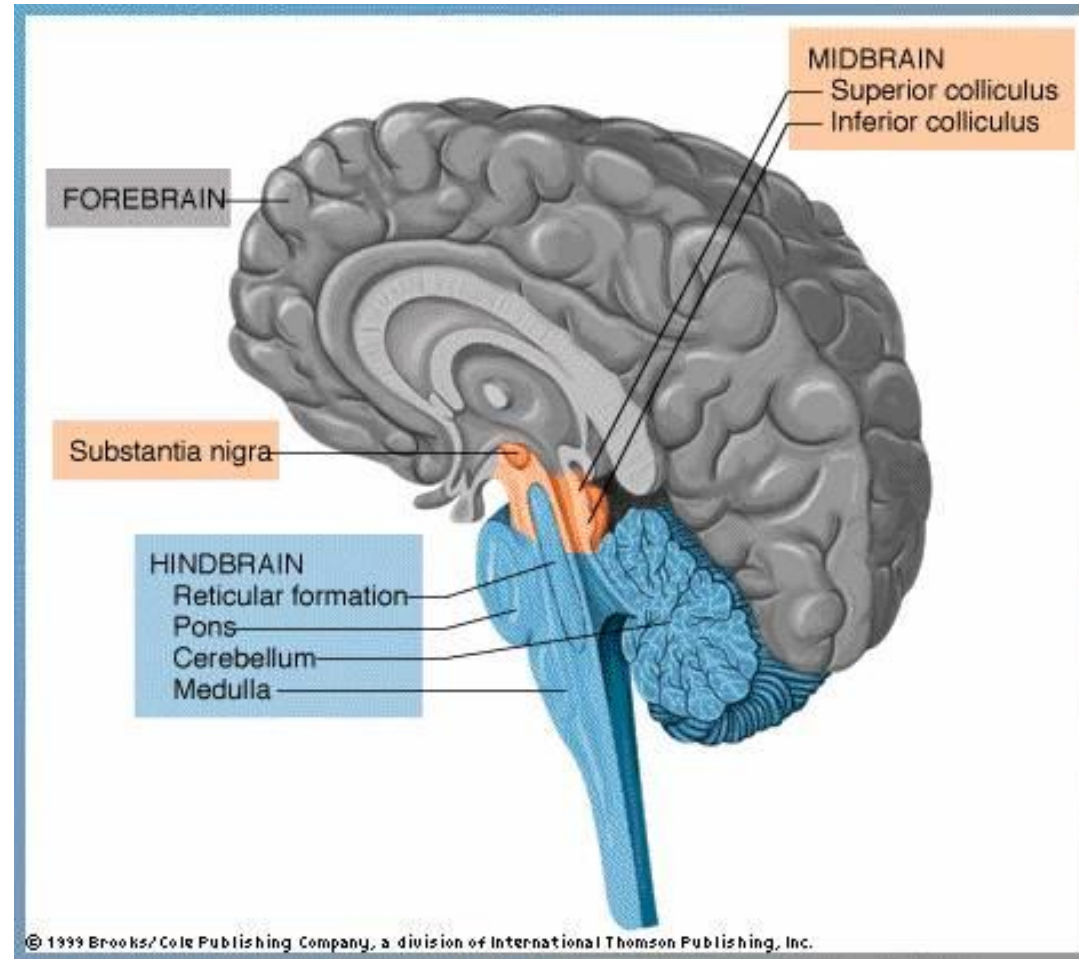
Da Brain



Regions of the Brain

Hindbrain:

- ▶ medulla
- ▶ pons
- ▶ reticular formation
- ▶ cerebellum

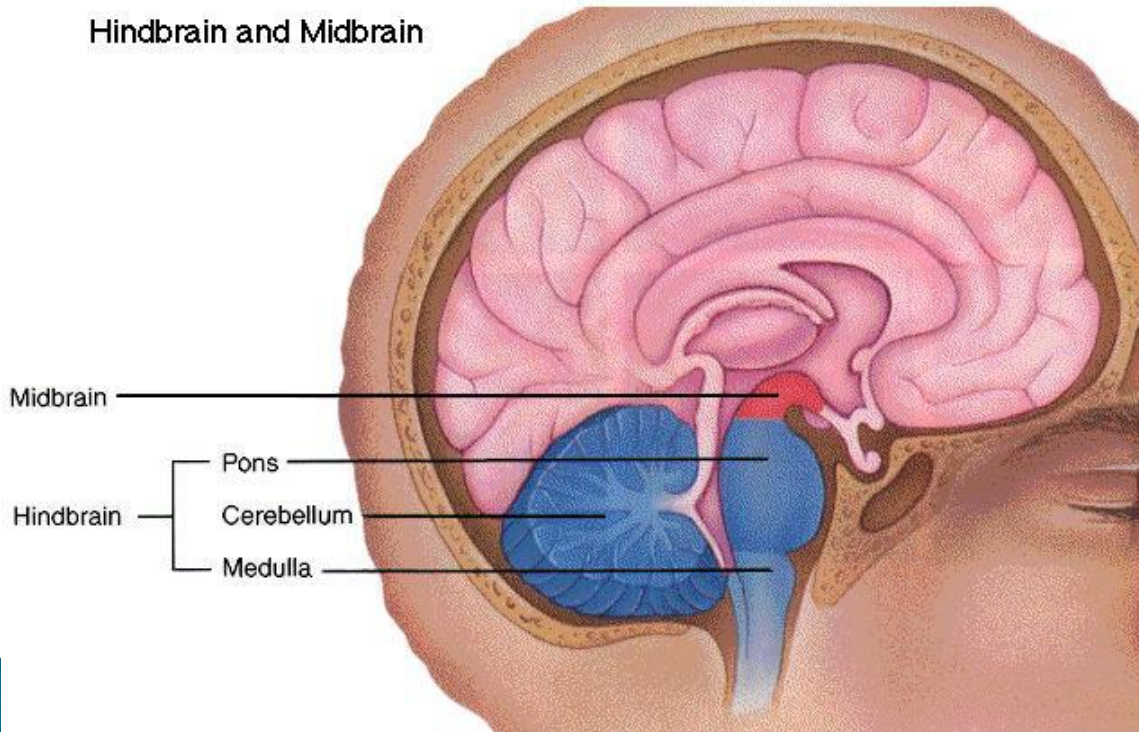


The Hindbrain

- ▶ **Brainstem**: lower base which connects the spinal cord to the brain; is the oldest part of the brain responsible for automatic survival functions.

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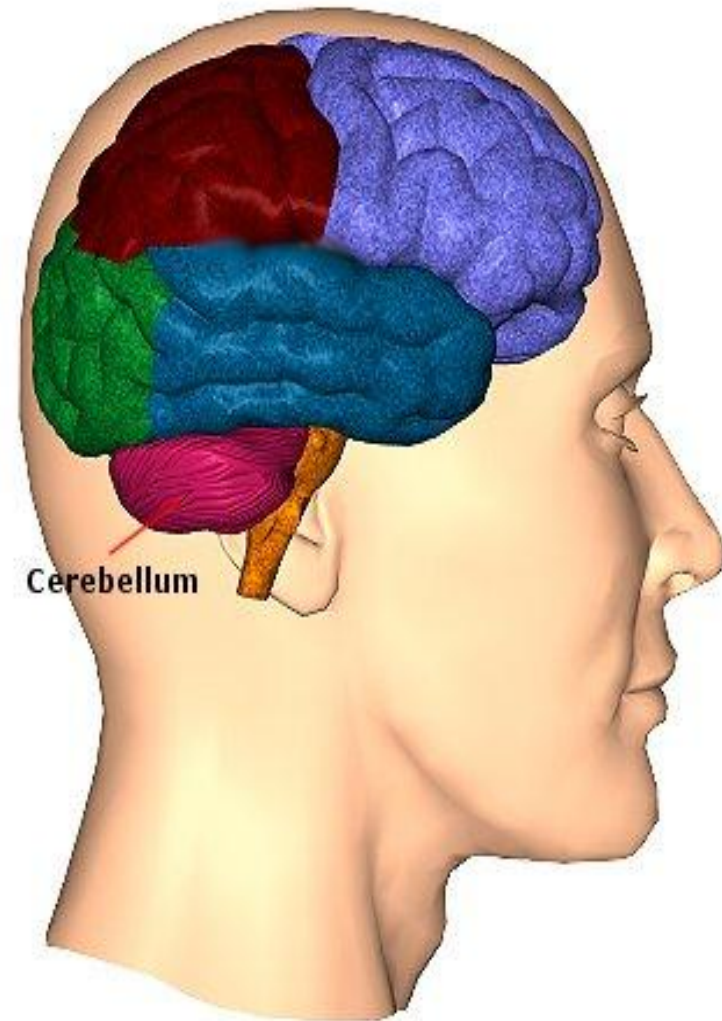
Hindbrain and Midbrain



Medulla:
controls
heartbeat and
breathing

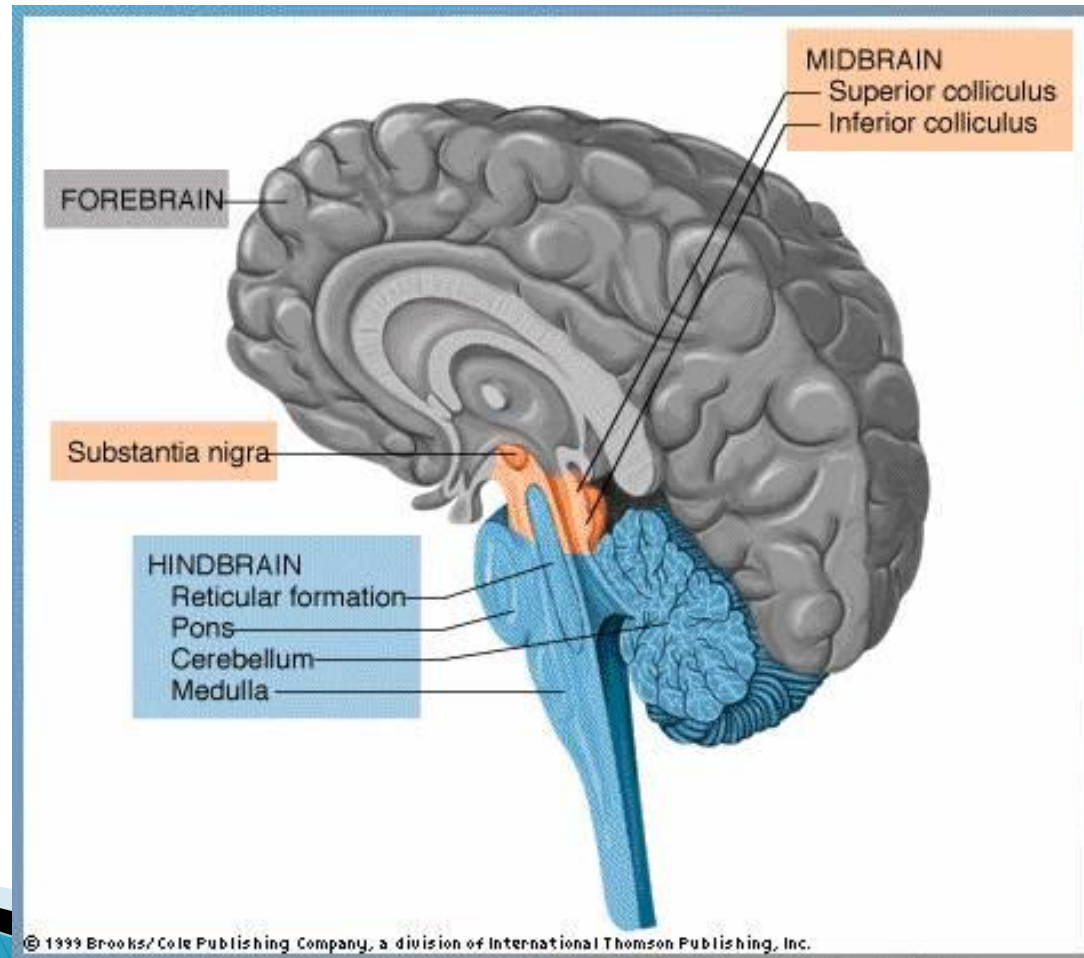
The Hindbrain

- ▶ **Cerebellum**: responsible for balance and movement; referred to as the “little brain” attached to the rear of the brainstem.
- ▶ **Pons**: connects the lower and mid brain regions; regulates brain during sleep and dreaming.
- ▶ **Reticular Formation**: plays a role in controlling arousal.



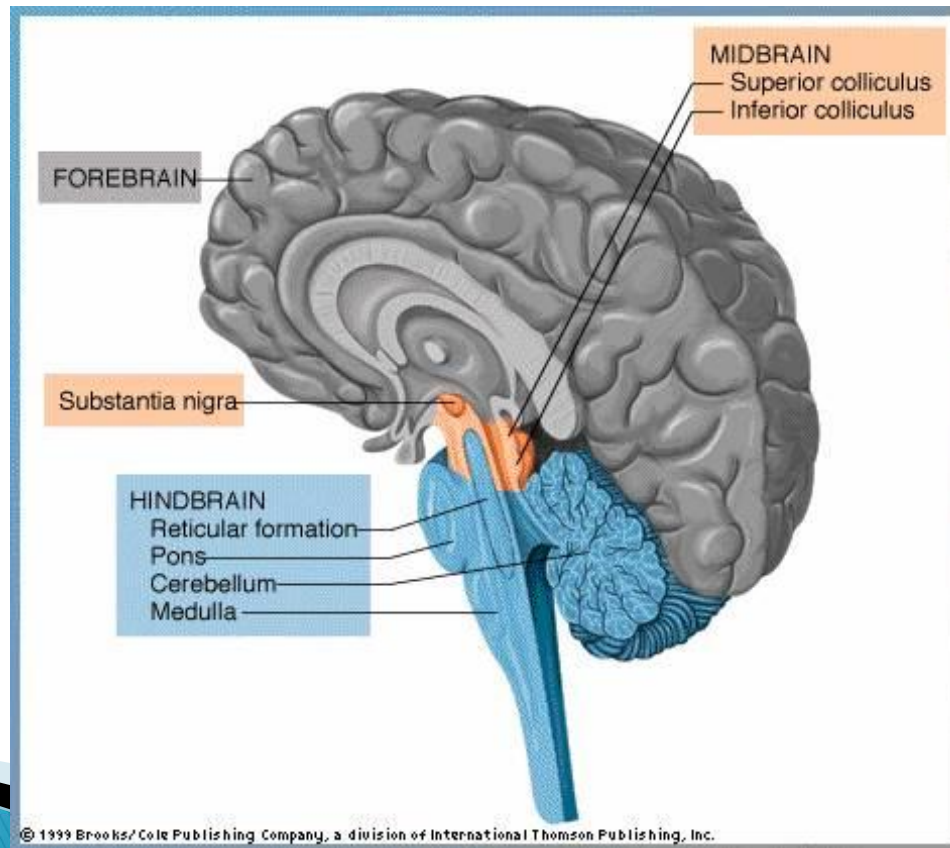
Regions of the Brain

• Midbrain: contains clusters of nerve cells.



Regions of the Brain

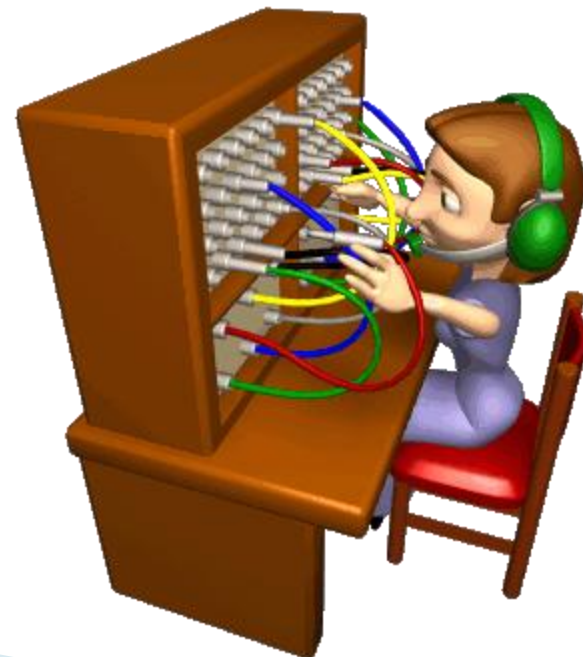
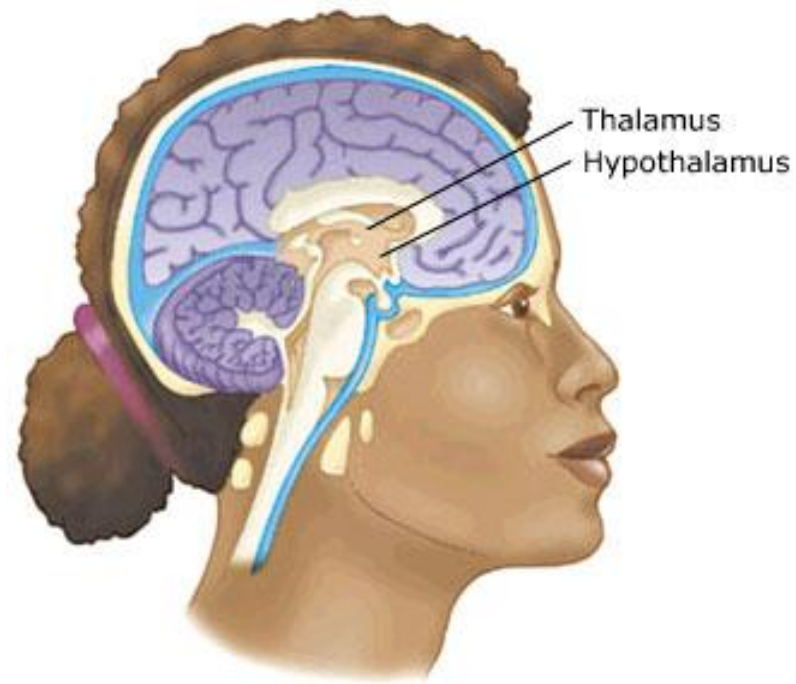
- ▶ **Forebrain**: is the most important part of the brain consisting of the thalamus, limbic system, hypothalamus, and cerebral cortex which contains the lobes of the brain.



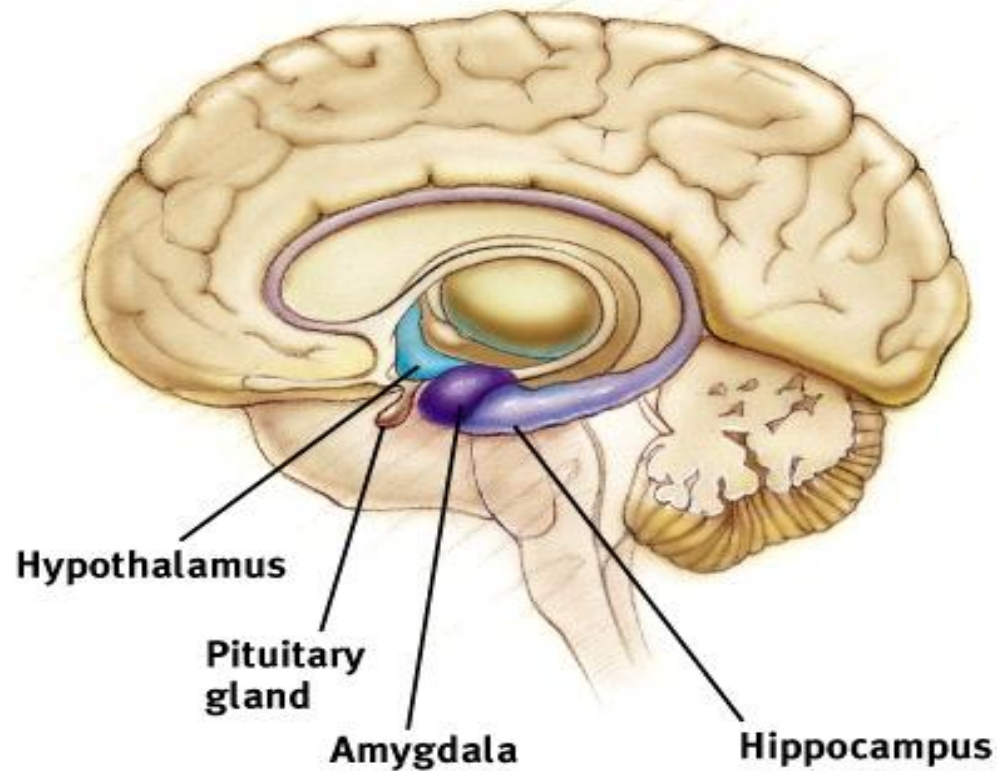
Forebrain

Thalamus

- ▶ Switchboard “relay station” of the brain.
- ▶ Receives sensory signals from the spinal cord and sends them to other parts of the forebrain.
- ▶ Every sense except smell.



The Limbic System deals with memory, emotions, and drives (sex, hunger, etc.)



The Limbic System

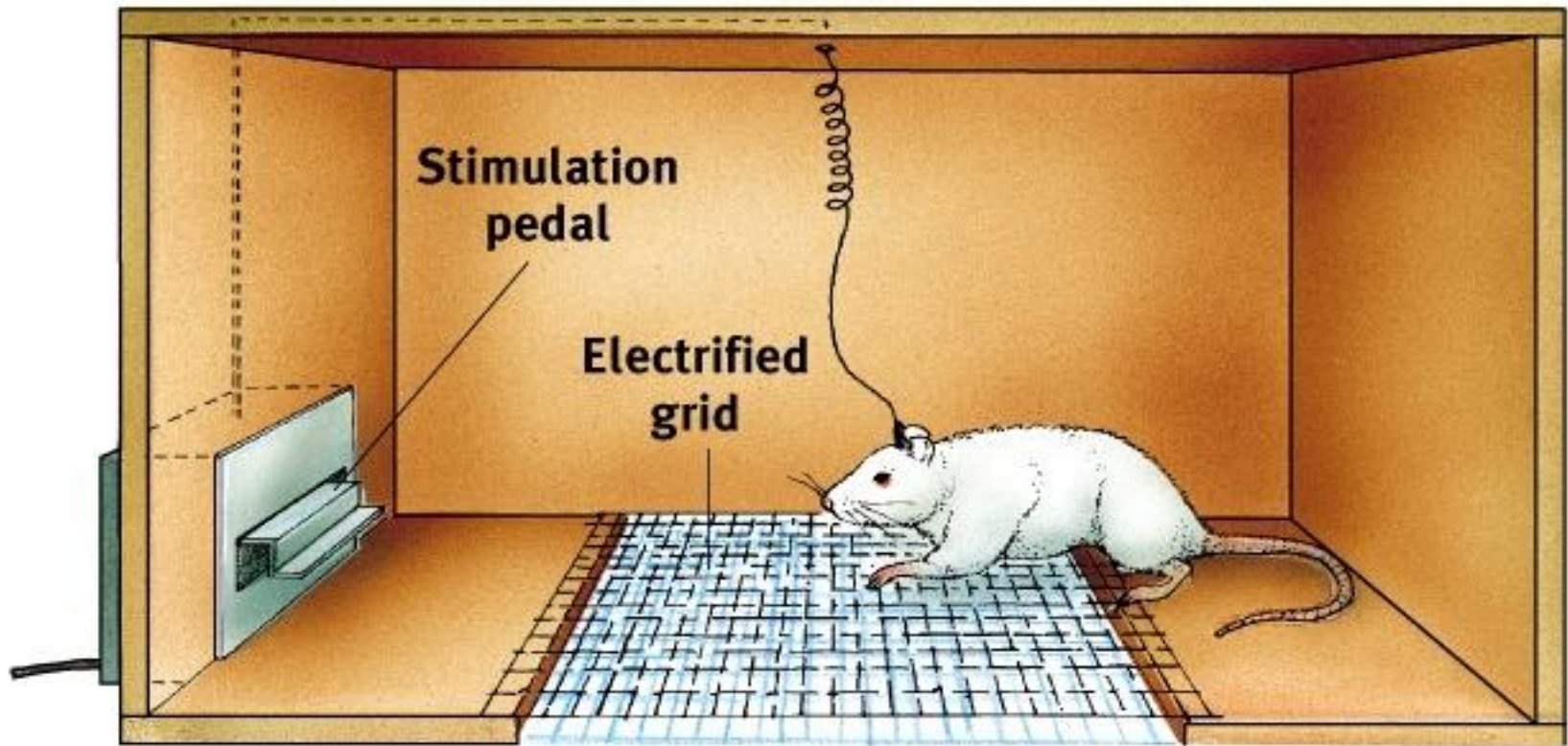


The most powerful structure in the brain.

Hypothalamus

- ▶ Maybe most important structure in the brain. Controls and regulates the 2 F's
Feeding
An ahmm . . . Mating
Controls the endocrine system.
The "reward system"

Rat with an Implanted Electrode in pleasure center of Hypothalamus



The Limbic System

Hippocampus



- ▶ Involved in the processing and storage of memories.
- ▶ Its proximity to your emotional centers explains why memories and emotions are so linked!

The Limbic System

Amygdala

- ▶ Brain part involved in telling your body to produce norepinephrine (adrenaline)
- ▶ More involved in volatile emotions like anger.

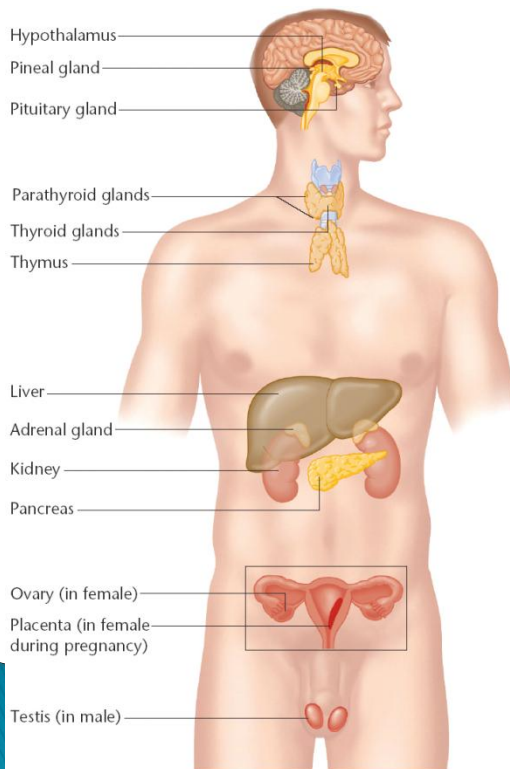


The emotion of anger has not changed much throughout evolution.

The Limbic System

Pituitary Gland

- ▶ **Pituitary Gland:** controlled by the hypothalamus; it regulates growth and other glands in the endocrine system. It is often referred to as the “master gland.”



The Limbic System

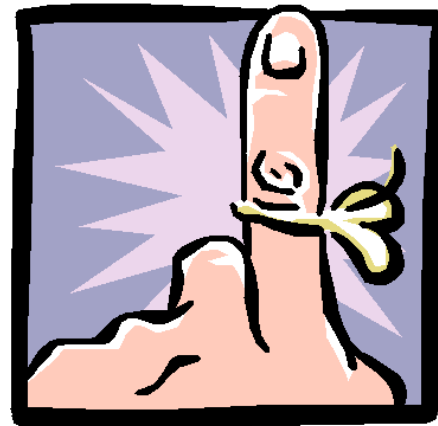
Match the picture with the part of the limbic system that is related to it.



amygdala



hypothalamus



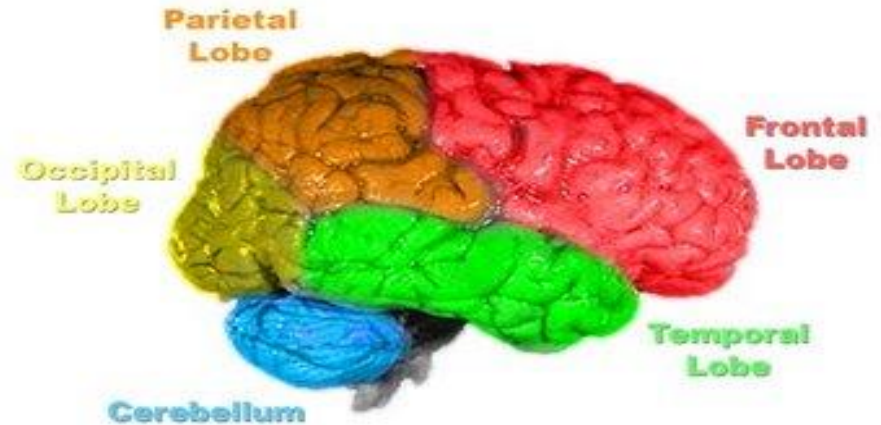
hippocampus



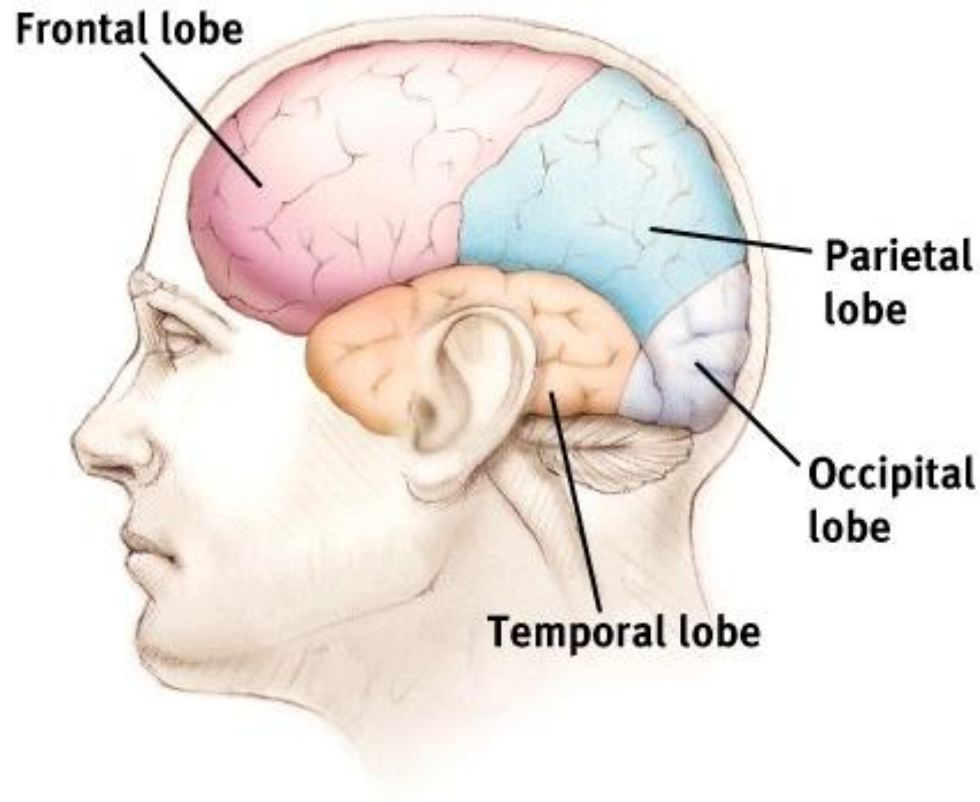
pituitary gland

The Cerebral Cortex

- ▶ Made up of densely packed neurons we call “gray matter”
- ▶ Brain's ultimate control and information center
- ▶ If you lay brain out it would be as big as a large pizza.
- ▶ It's divided into 2 hemispheres and 4 lobes!



The Cerebral Cortex is made up of four lobes.



What is the Frontal Lobe?

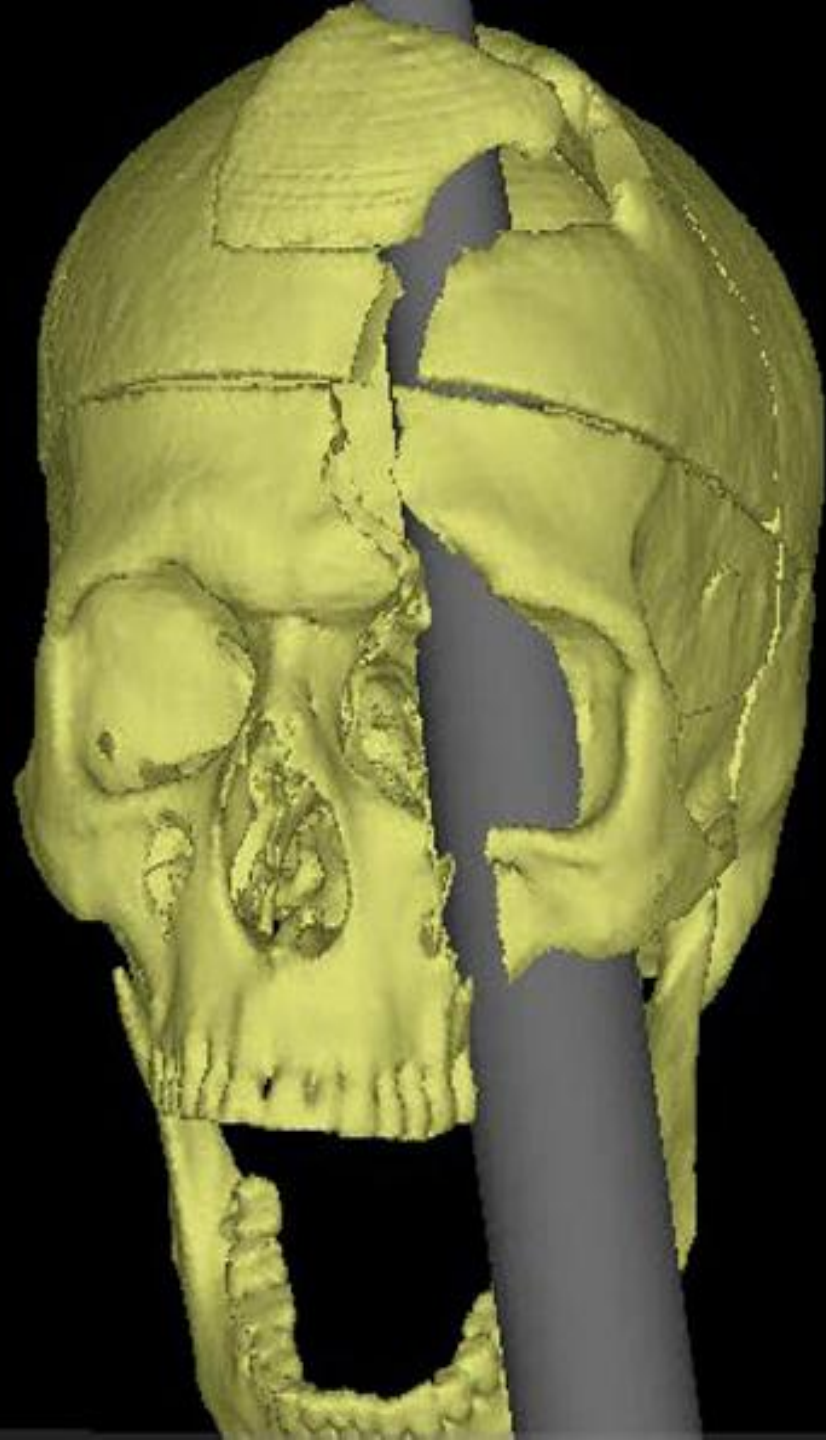
- ▶ Abstract thought and emotional control and planning.
- ▶ Speaking, muscle movement
- ▶ Contains *Motor Cortex*, *Broca's area (speech)*
- ▶ *Lobotomies damage this.*
- ▶ *Suppresses the Amygdala.*



Frontal Lobe and Phineas Gage

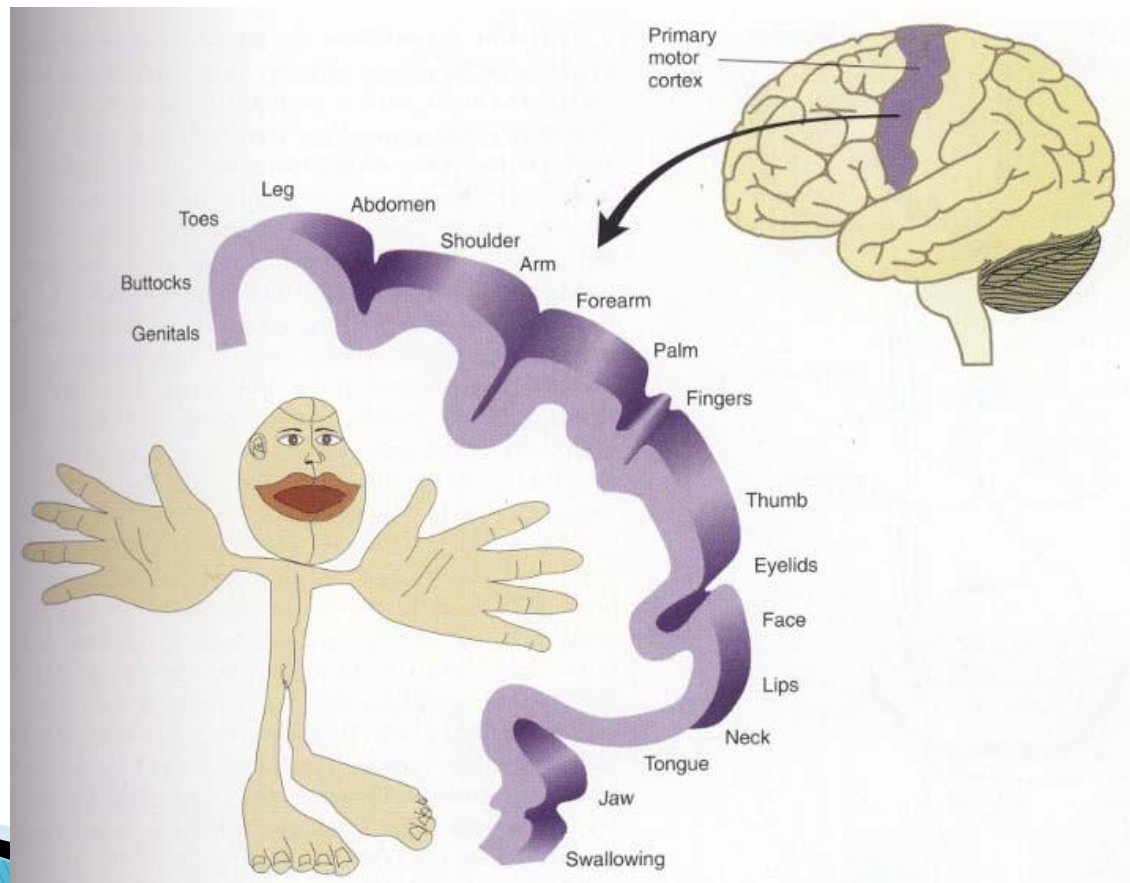
- ▶ How did Gage's accident affect him?
- ▶ Why do we care about Phineas Gage?





What is the motor cortex?

- Part of the brain in the frontal lobe that tells my body how to move (like typing this).

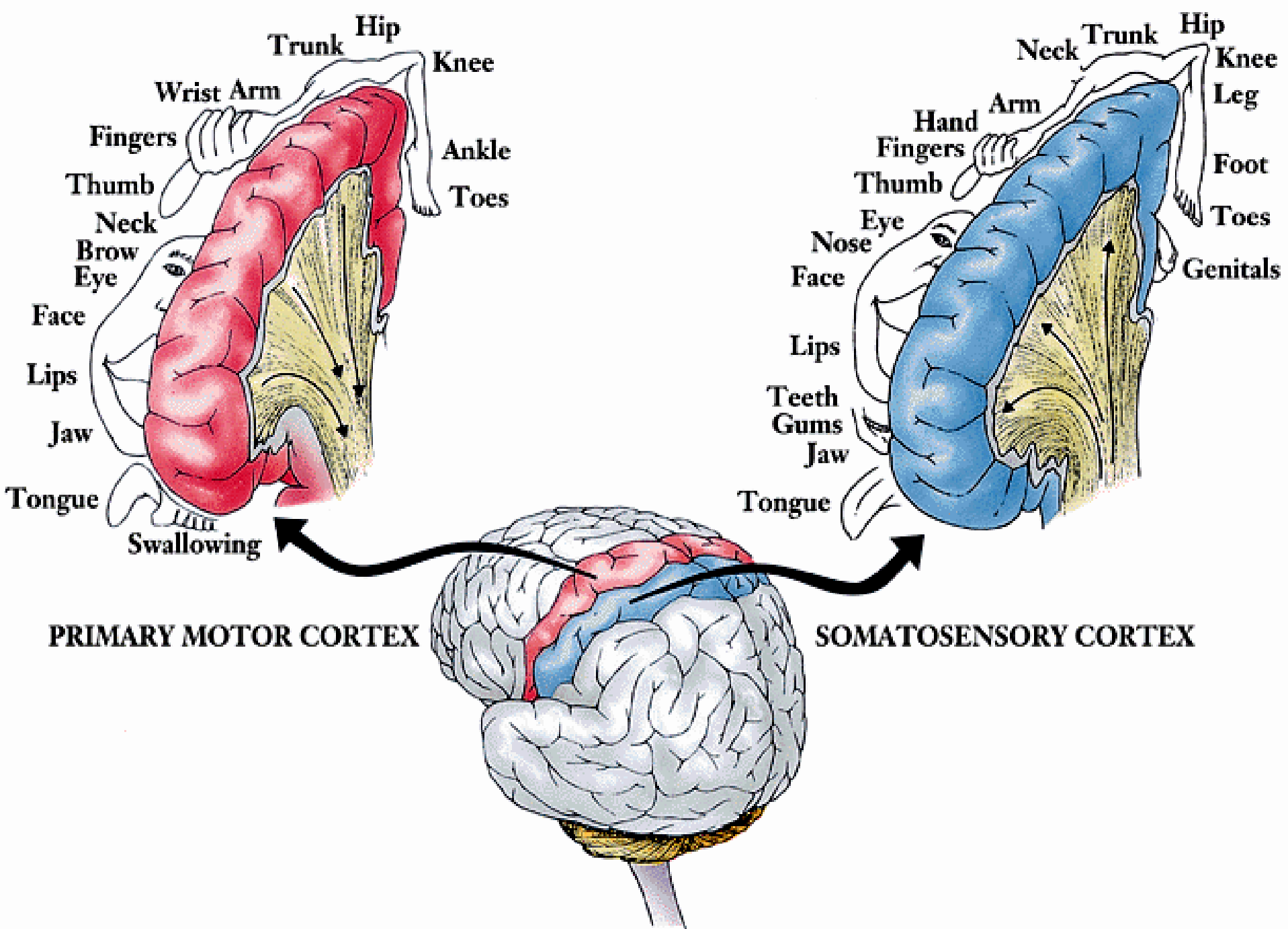


Parietal Lobes



Where would this girl feel the most pain from her sunburn?

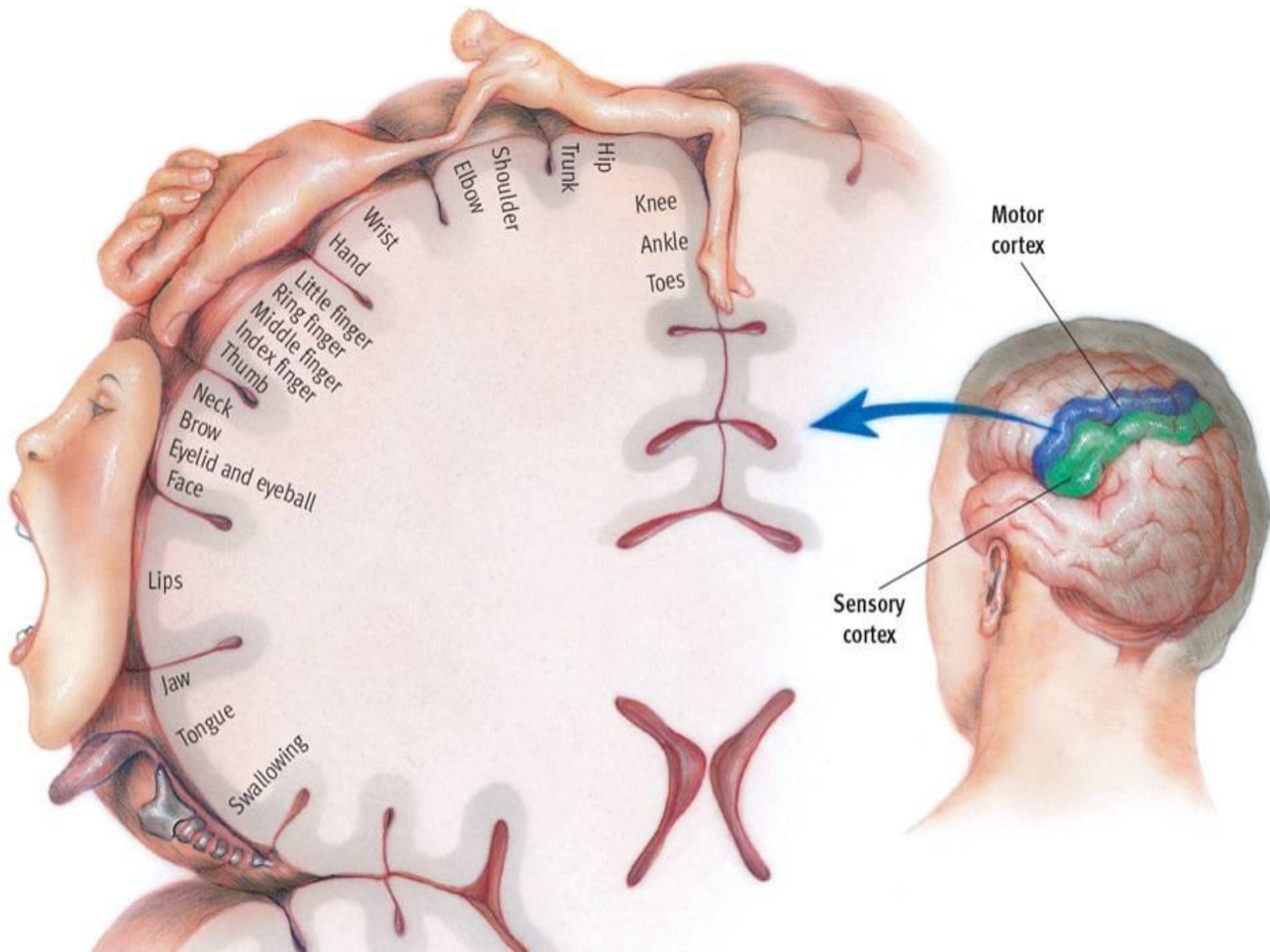
- ▶ Contain *Sensory Cortex*: receives incoming touch sensations from rest of the body.
- ▶ Most of the Parietal Lobes are made up of *Association Areas*.



Sensory homunculus

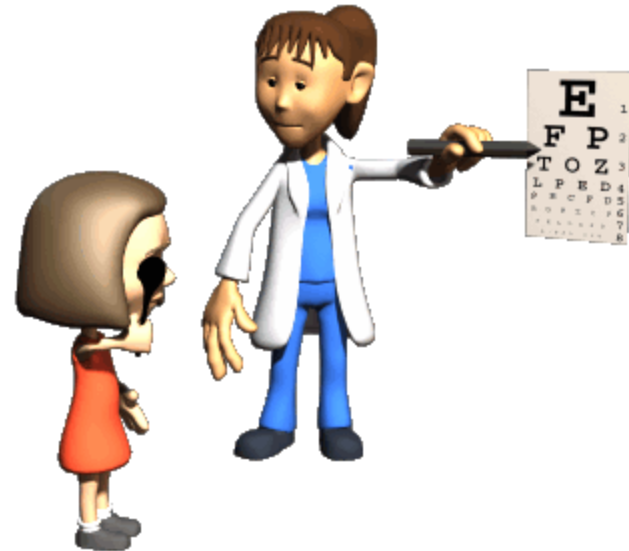


A visual representation of how much space your brain needs to operate parts of your body. Notice how big the face and hands are. How small everything else is!



Occipital Lobe

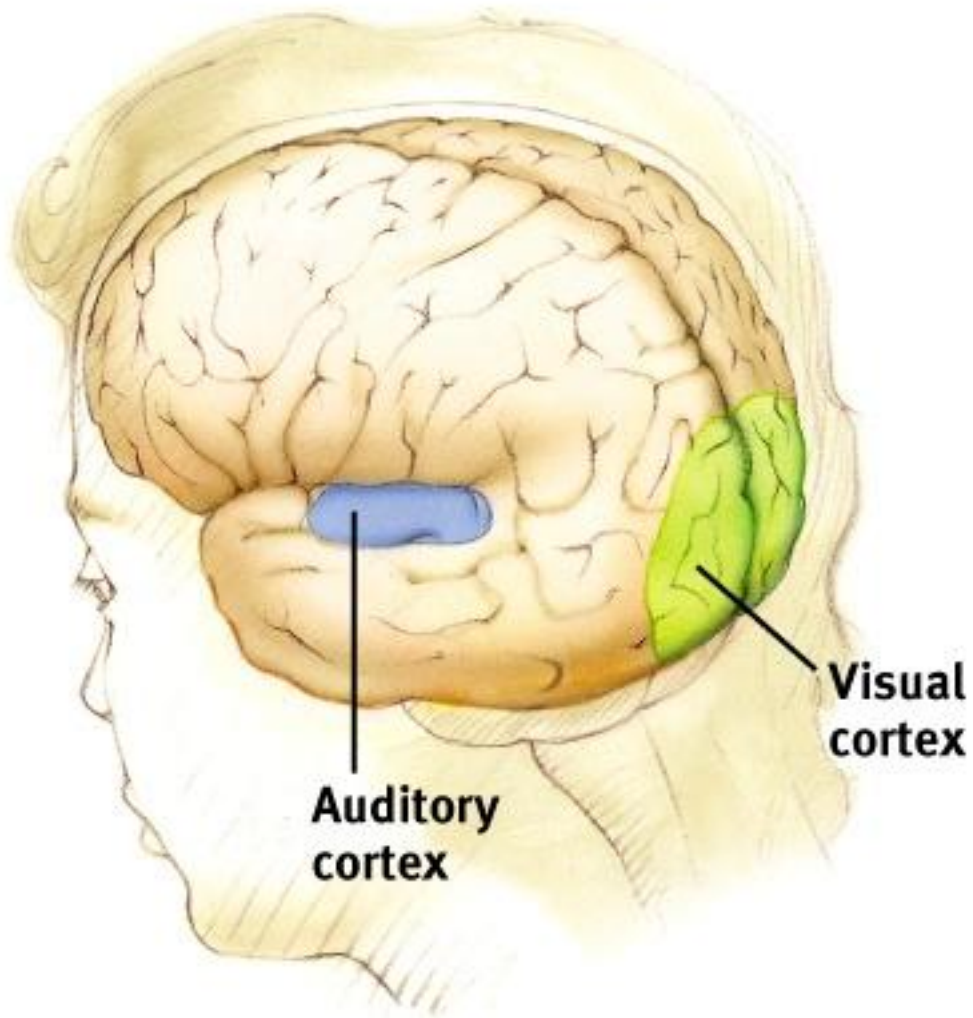
- ▶ Think “optical”.
- ▶ Contains *Visual Cortex*: interprets messages from our eyes into images we can understand.



Temporal Lobes



- Process sound sensed by our ears.
- Interpreted in Auditory Cortex.
- Contains *Wernike's Area*: interprets written and spoken speech.



Notice how close the auditory cortex is to the ears.

We Only Use 10% of Our Brains...JUST KIDDING!!!

- ▶ **Association Areas:** areas of cerebral cortex not involved in motor or sensory processes. Makes up largest portion of cortex which is involved in higher mental functions such as learning, memory, thinking, and speaking.

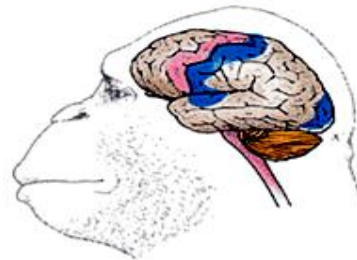
Primary motor area
Primary sensory areas
Association areas



Rat



Cat



Chimpanzee



Human



Primary motor area



Primary sensory areas



Association areas



Rat



Cat



Chimpanzee



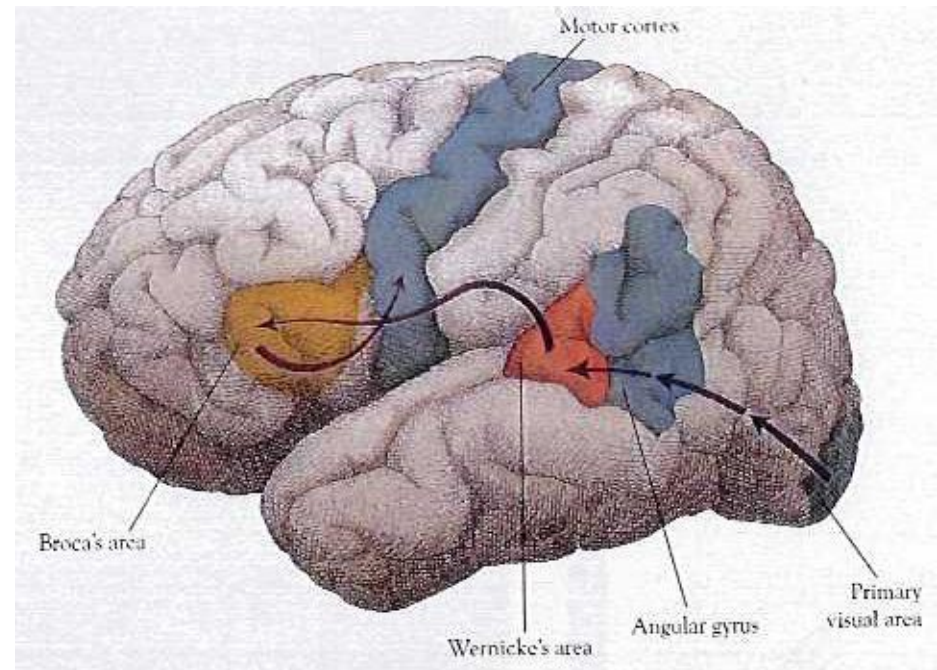
Human

Cerebral Cortex and Language

- ▶ **Aphasia**: impairment of language, usually caused by damage to the left hemisphere to the brain either in Broca's or Wernicke's area:

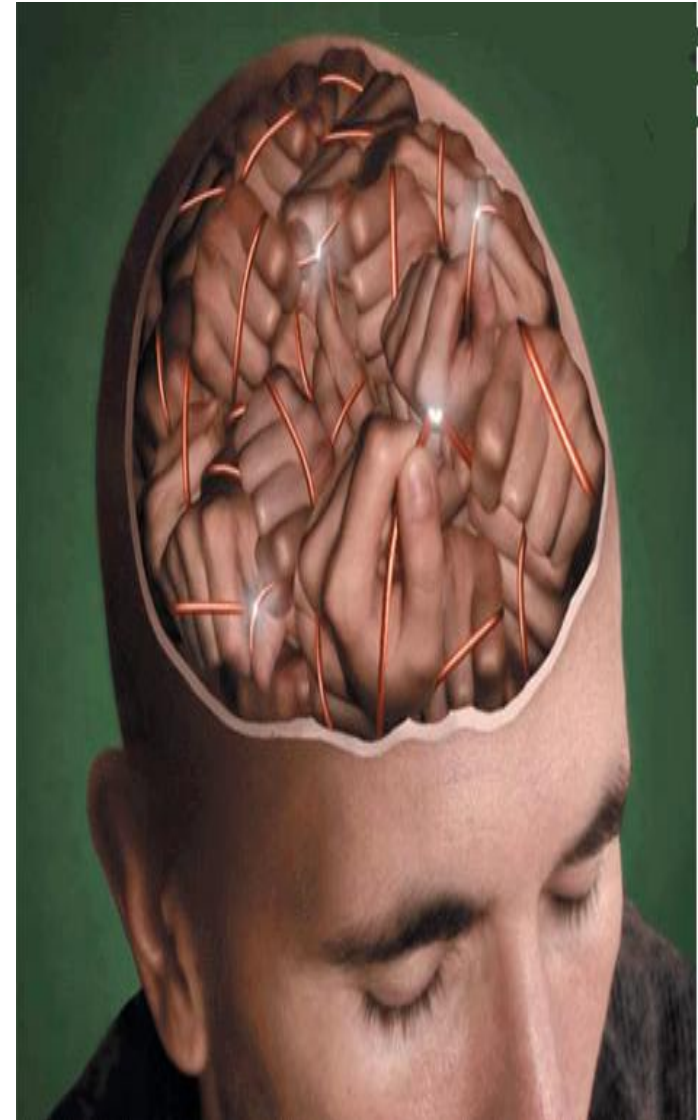
Broca's Area: an area of the left frontal lobe that directs the muscle movements involved in speech

Wernicke's Area: an area of the left temporal lobe involved in language comprehension



Brain Reorganization

- ▶ **Plasticity**: the brain's capacity for modification as evident in brain reorganization following damage (especially in children) and in experiments on the effects of experience on brain development



KEY NAMES

Unit 2: Biological Bases of Behavior

Paul BROCA



1824-1880

- ▶ Discovered that a structure in the left frontal lobe controls language production.

This structure is now known as “Broca’s” area

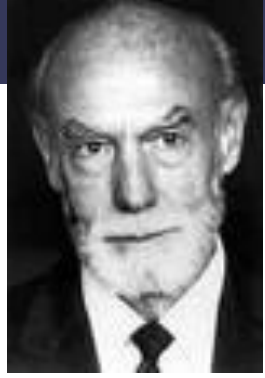
Carl WERNICKE



1848-1905

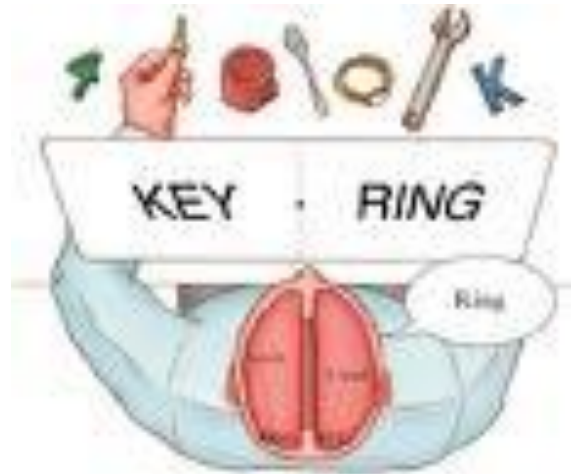
- ▶ Discovered that a structure in the left temporal lobe controls language comprehension.

This structure is now known as “Wernicke’s” area

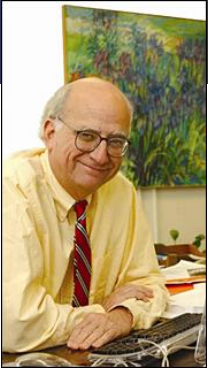


Roger SPERRY

- ▶ 1981 Nobel Prize Winner (medicine) for **split-brain research**



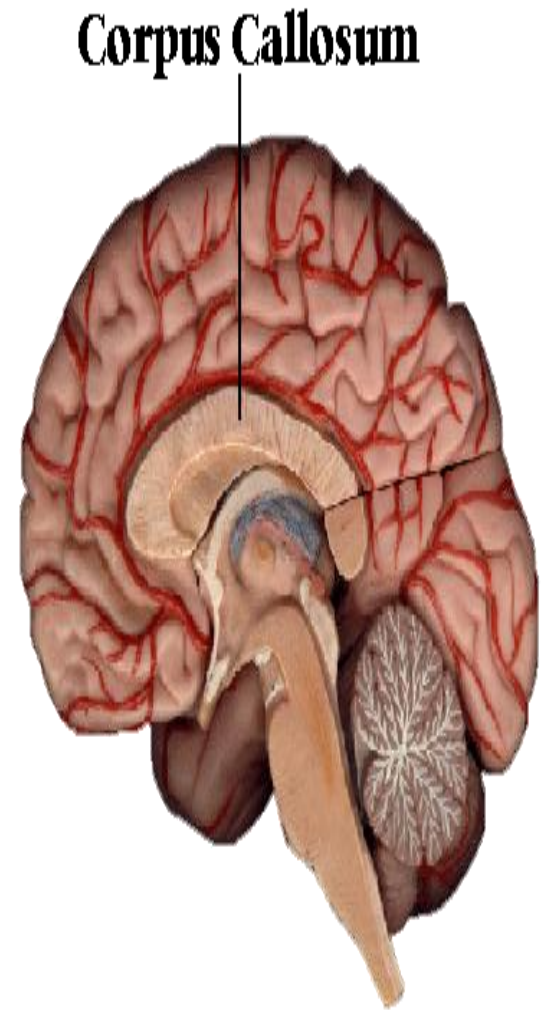
Michael Gazzaniga



- ▶ Worked under Roger Sperry
- ▶ made important advances in our understanding of functional lateralization in the brain and how the cerebral hemispheres communicate with one another

The Divided Brain

- ▶ **Corpus Callosum**: large bundle of neural fibers that allows the two sides of the brain to communicate. Carries messages between the two hemispheres.
- ▶ Cutting it leads to **split brains**.



Split Brain Illustrates Left Brain Used For Language and Right Used For Spatial and Non-Linguistic Functions



“Look at the dot.”



Two words separated by a dot are momentarily projected.

“What word did you see?”



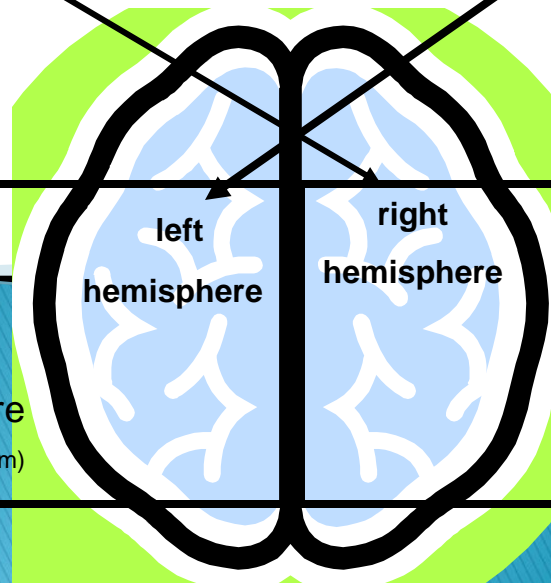
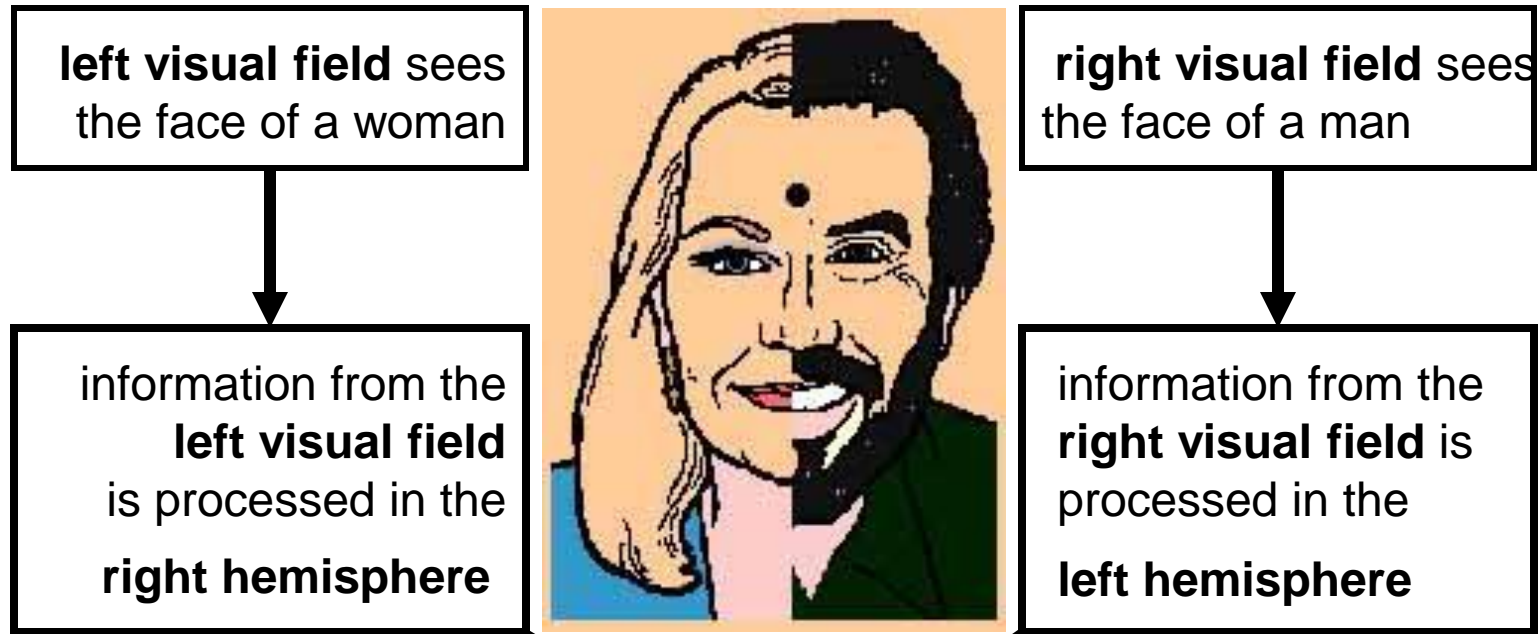
or



“Point with your left hand to the word you saw.”



Another type of experiment performed with split brain patients uses chimeric figures



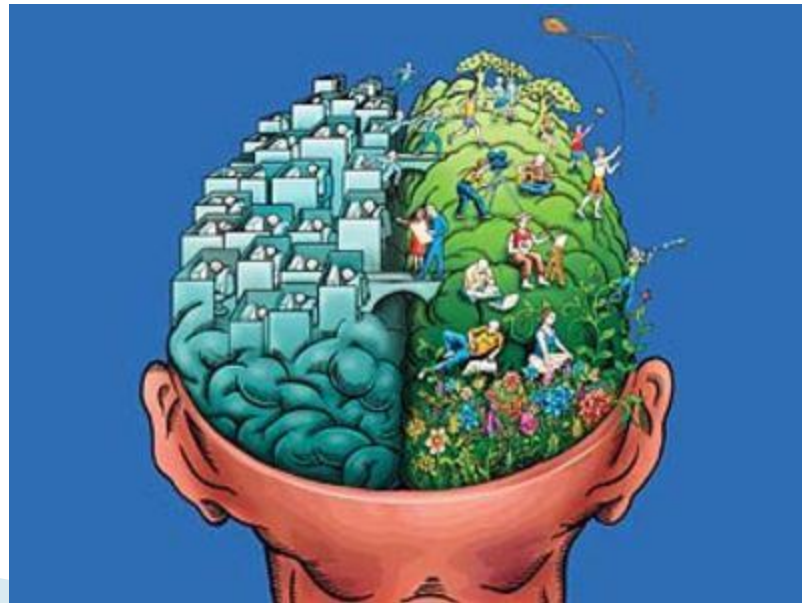
Can point at face of man with **right** hand

Can verbally describe the picture
(Broca's & Wernicke's are in the left hem)

Can point at face of woman with

Right and Left Brain Functions

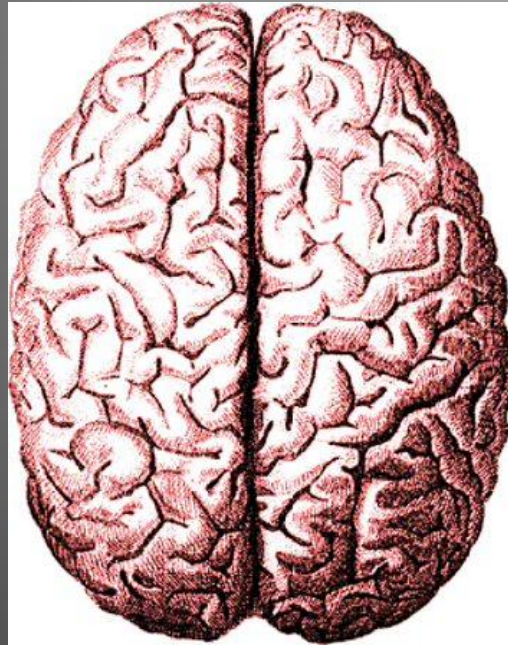
- ▶ **Cerebral dominance** refers to these tendencies for each brain hemisphere to exert control over different functions, such as language (left) or perception of spatial relationships (right).



Specialization of the Cerebral Hemispheres

Left Hemisphere

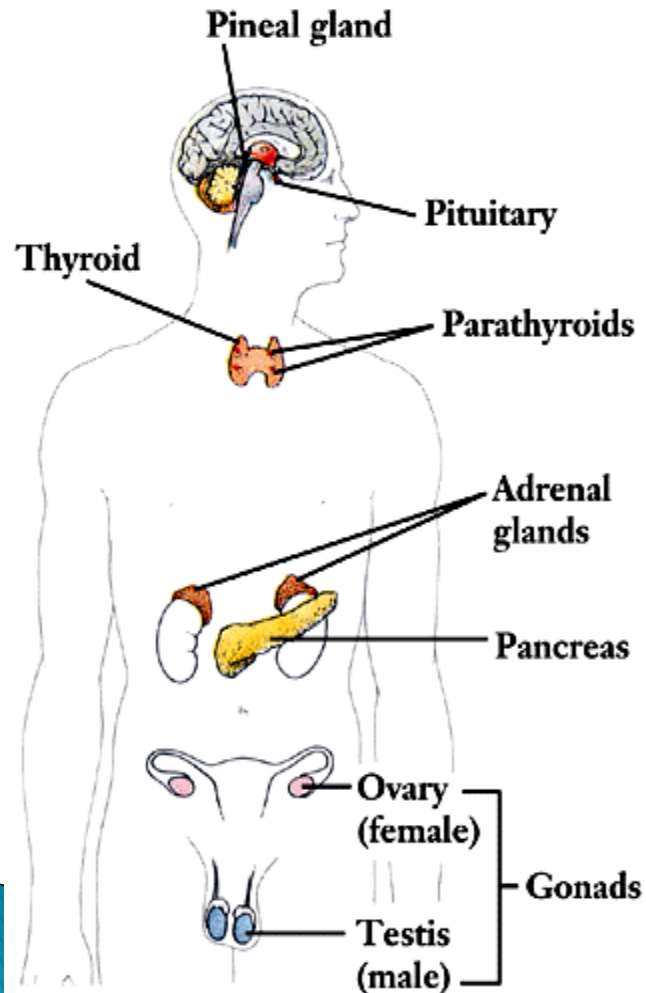
- Spontaneous speaking and writing
- Responses to complex commands
- Word recognition
- Memory for words and numbers
- Sequences of movements
- Feelings of anxiety
- Positive emotion



Right Hemisphere

- Repetitive but not spontaneous speaking
- Responses to simple commands
- Facial recognition
- Memory for shapes and music
- Spatial interpretation
- Emotional responsiveness
- Negative emotion

The Body's Other Communication Network (Slower)



- ▶ **The Endocrine System:** the body's “slow” chemical communication system; secretes hormones into bloodstream.

Endocrine System Components

- ▶ **Hormones:** cousins of neurotransmitters; chemical messengers, mostly those manufactured by the endocrine glands, that are produced in one tissue and affect another.
 - ▶ **Adrenal Glands:** endocrine glands above the kidneys that secrete the hormones epinephrine (adrenaline) and norepinephrine (noradrenaline), which help to arouse the body in times of stress.
- 