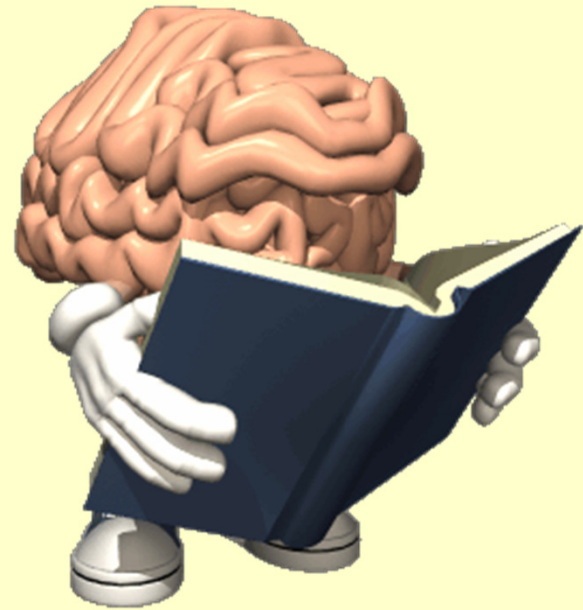


The Brain



Ways we Study the Brain

- Accidents
- Lesions
- CAT Scan
- PET Scan
- MRI
- Functional MRI



Accidents

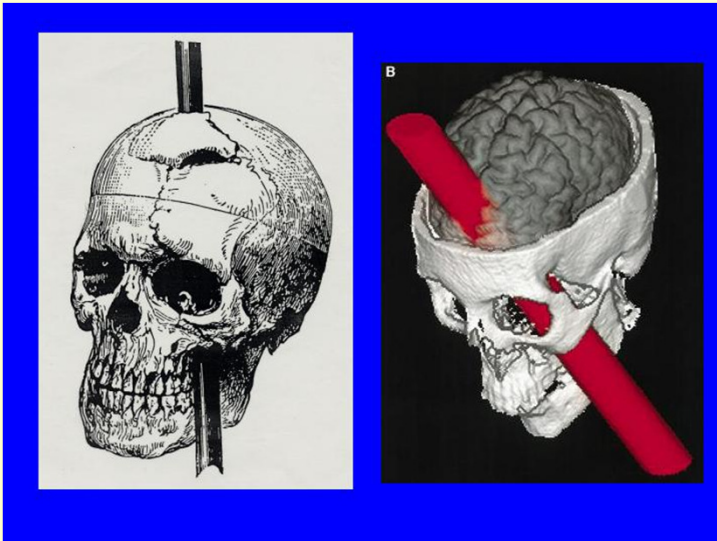


Phineas Gage Story

- Personality changed after the accident.

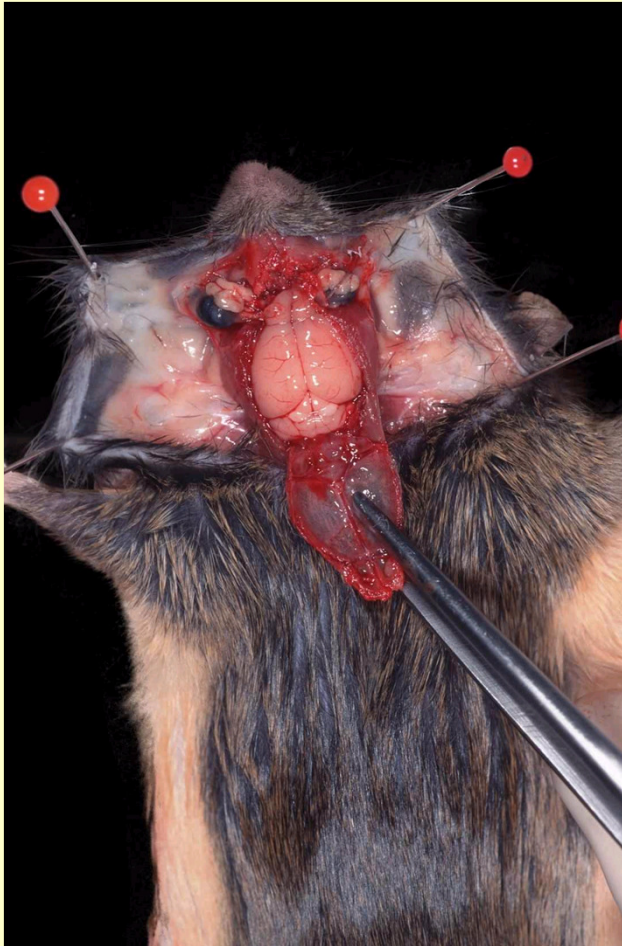
What this this tell us?

- That different part of the brain control different aspects of who we are.

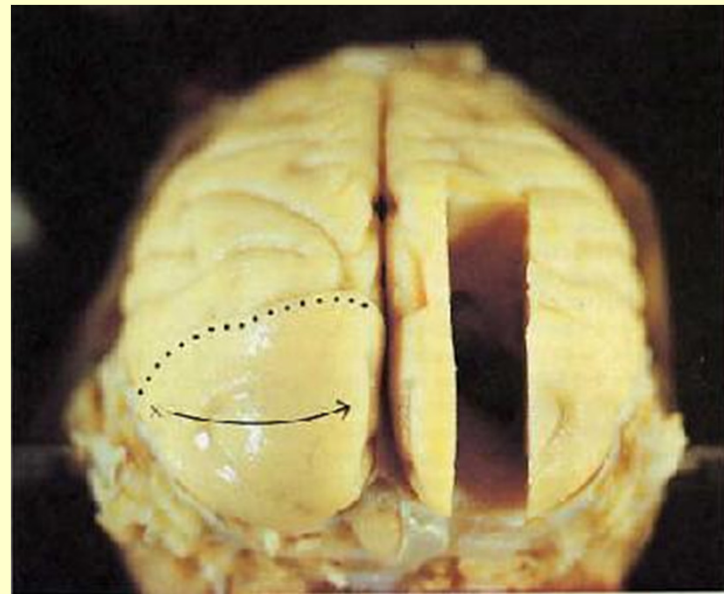




Lesions



- Removal or destruction of some part of the brain.
- Frontal Lobotomy



Clinical Observation

Clinical observations have shed light on a number of brain disorders. Alterations in brain morphology due to neurological and psychiatric diseases are now being catalogued.



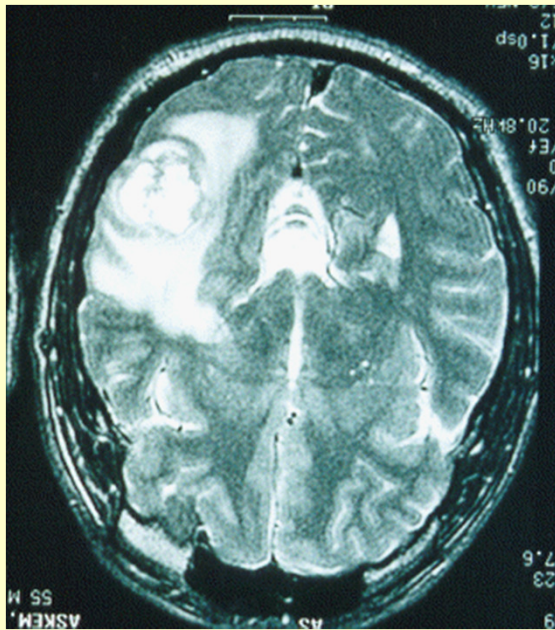
Tom Landers/ Boston Globe

Electroencephalogram

- EEG
- Detects brain waves through their electrical output.
- Used mainly in sleep research.



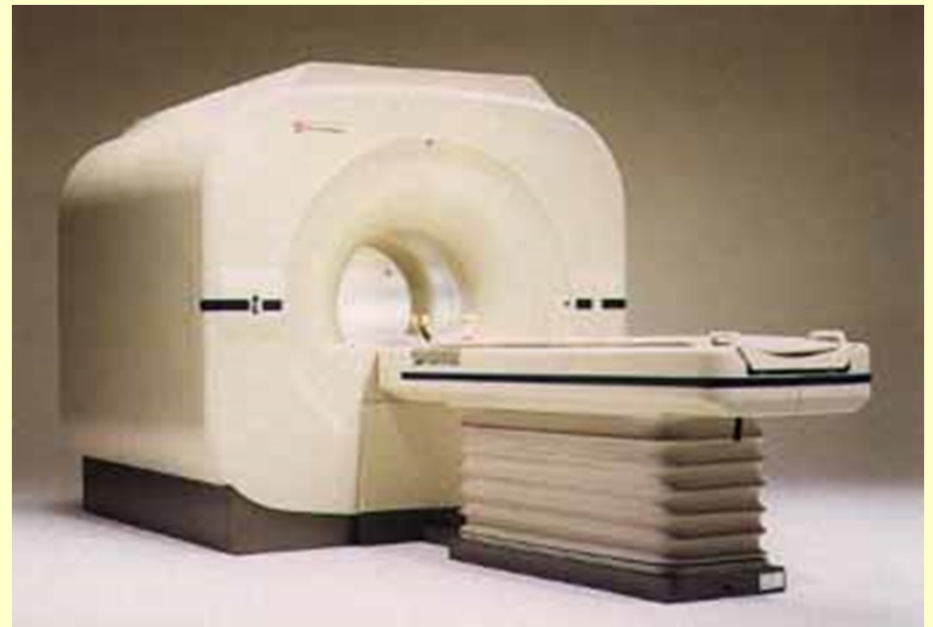
Computerized Axial Tomography



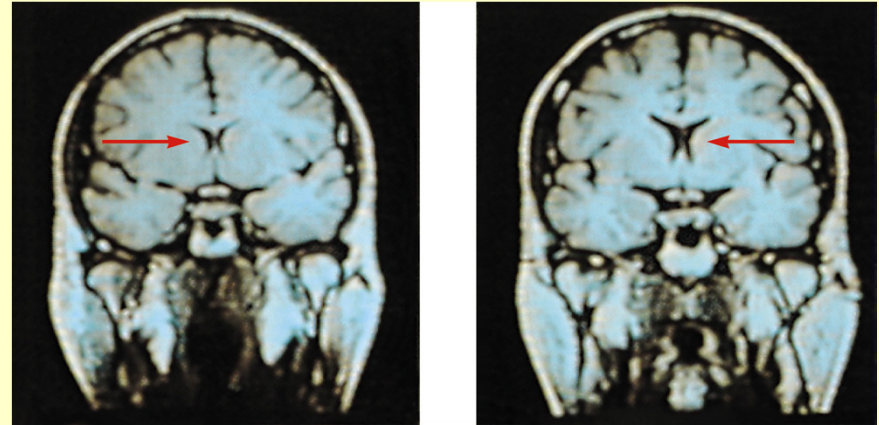
- CAT Scan
- 3D X-Ray of the brain.
- Good for tumor locating, but tells us nothing about function.

Magnetic Resonance Imaging

- MRI
- More detailed picture of brain using magnetic field to knock electrons off axis.
- Takes many still pictures and turns images into a movie like production.



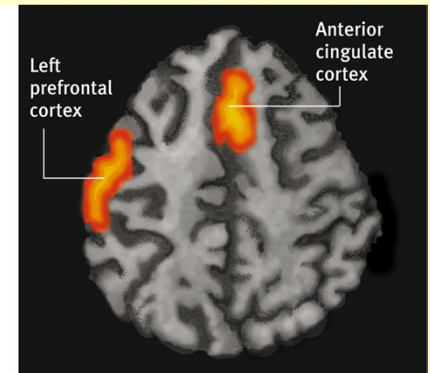
MRI (magnetic resonance imaging) uses magnetic fields and radio waves to produce computer-generated images that distinguish among different types of brain tissue. Top images show ventricular enlargement in a schizophrenic patient. Bottom image shows brain regions when a participant lies.



Both photos from Daniel Weinberger, M.D., CBDB, NIMH



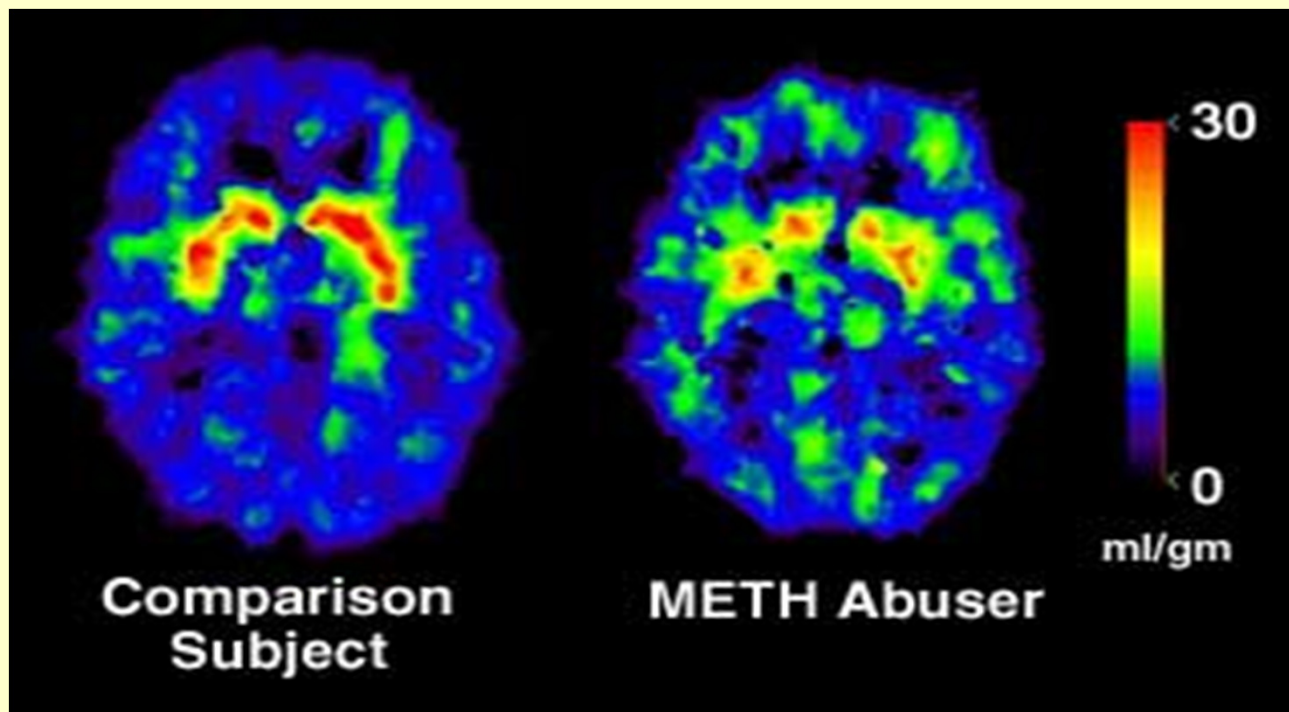
James Salzano/ Salzano Photo



Lucy Reading/ Lucy Illustrations

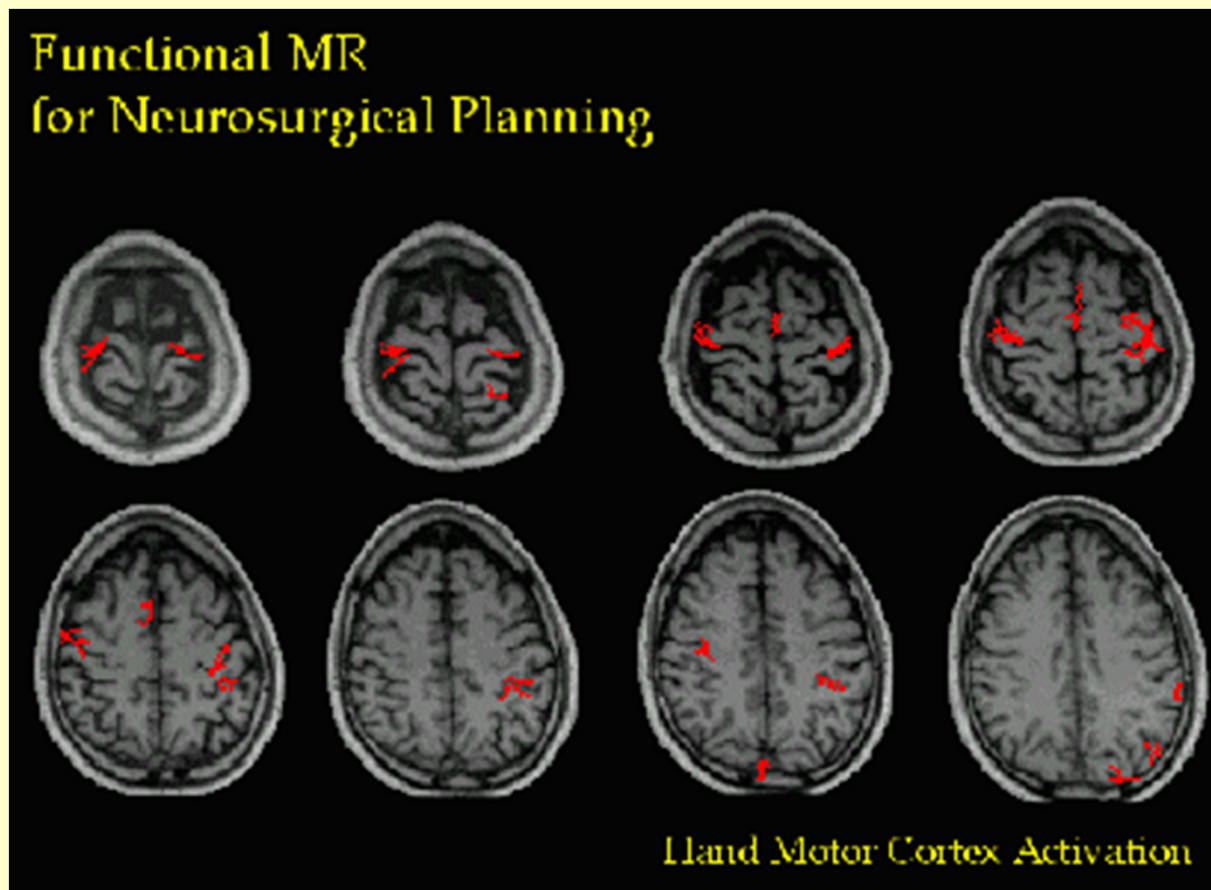
Positron Emission Tomography

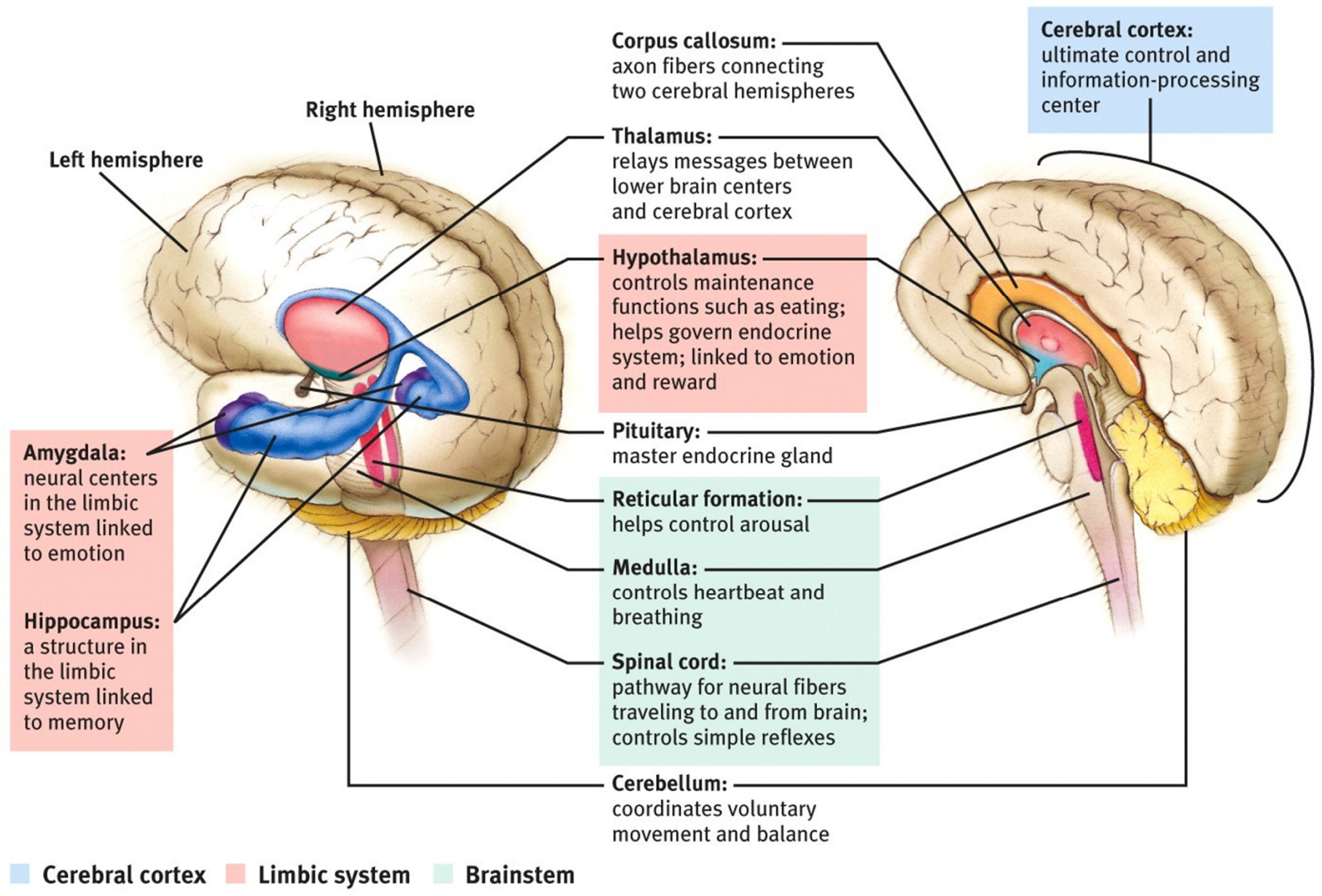
- PET Scan
- Measures how much of a chemical the brain is using (usually glucose consumption).



Functional MRI

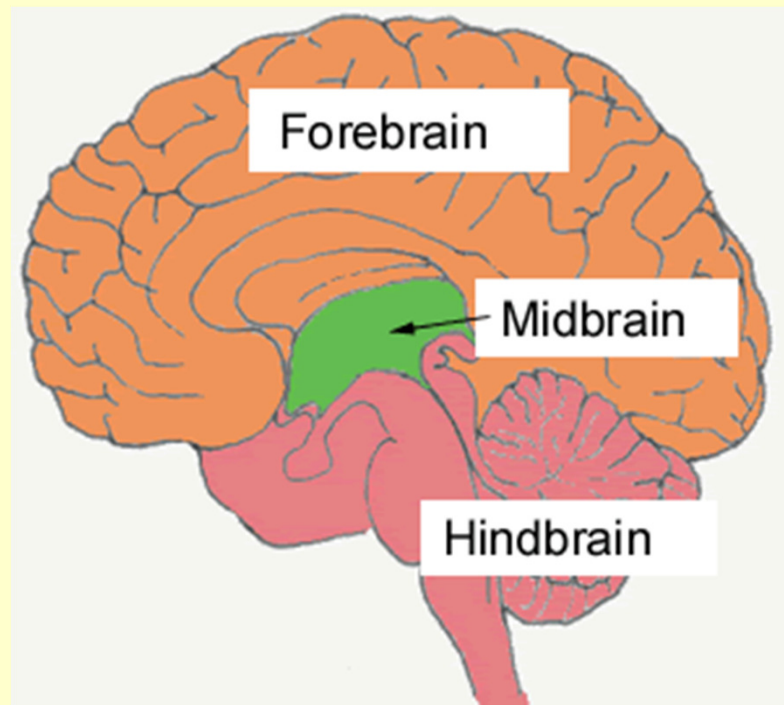
- Combination of PET and MRI





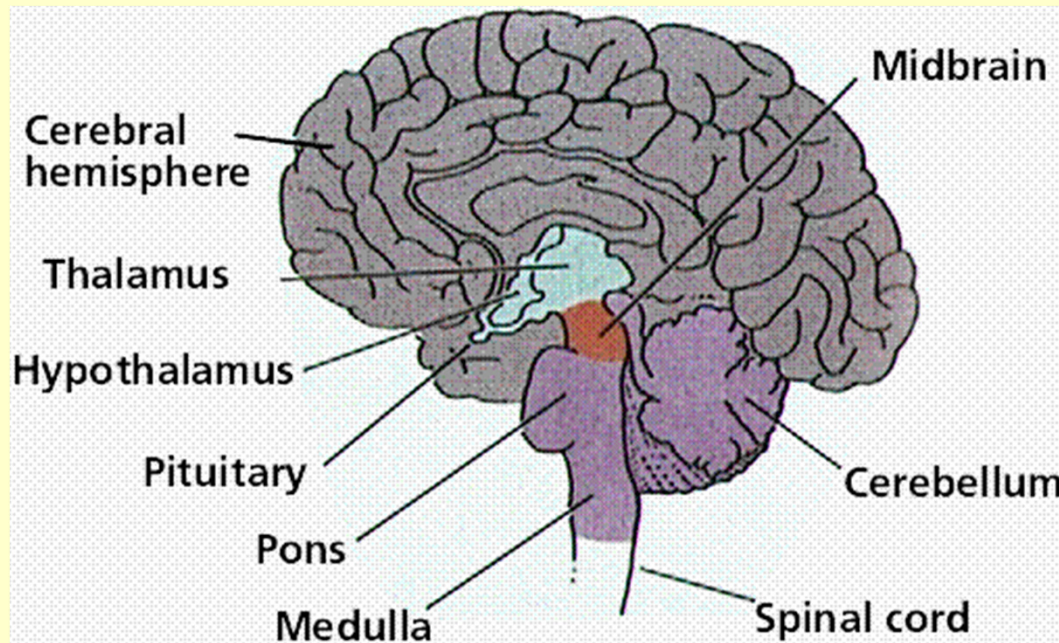
Brain Structures

1. Hindbrain
2. Midbrain
3. Forebrain
4. Cerebral Cortex (part or forebrain)



Hindbrain

- Structures on top of our spinal cord.
- Controls basic biological structures.



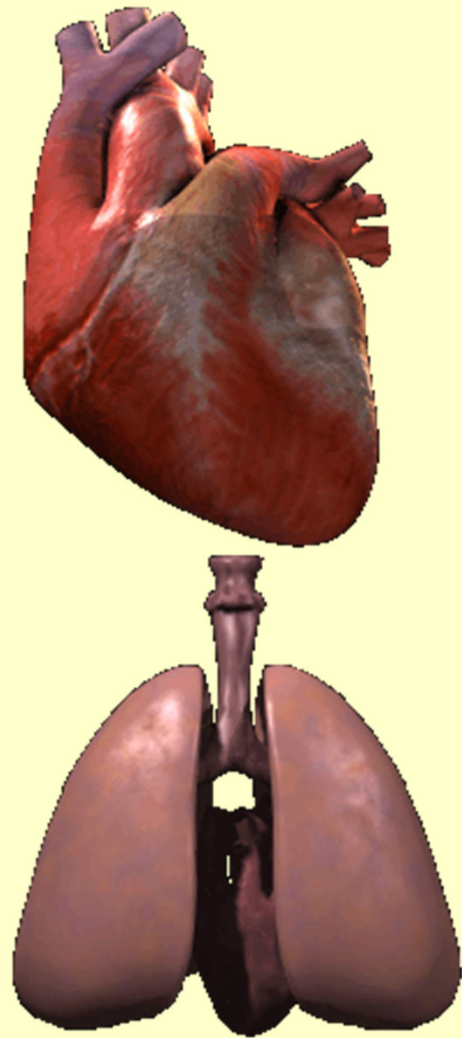
The brain in purple makes up the hindbrain.

Medulla Oblongata

- Located just above the spinal cord.

Involved in control of

- blood pressure
- heart rate
- breathing.



Pons



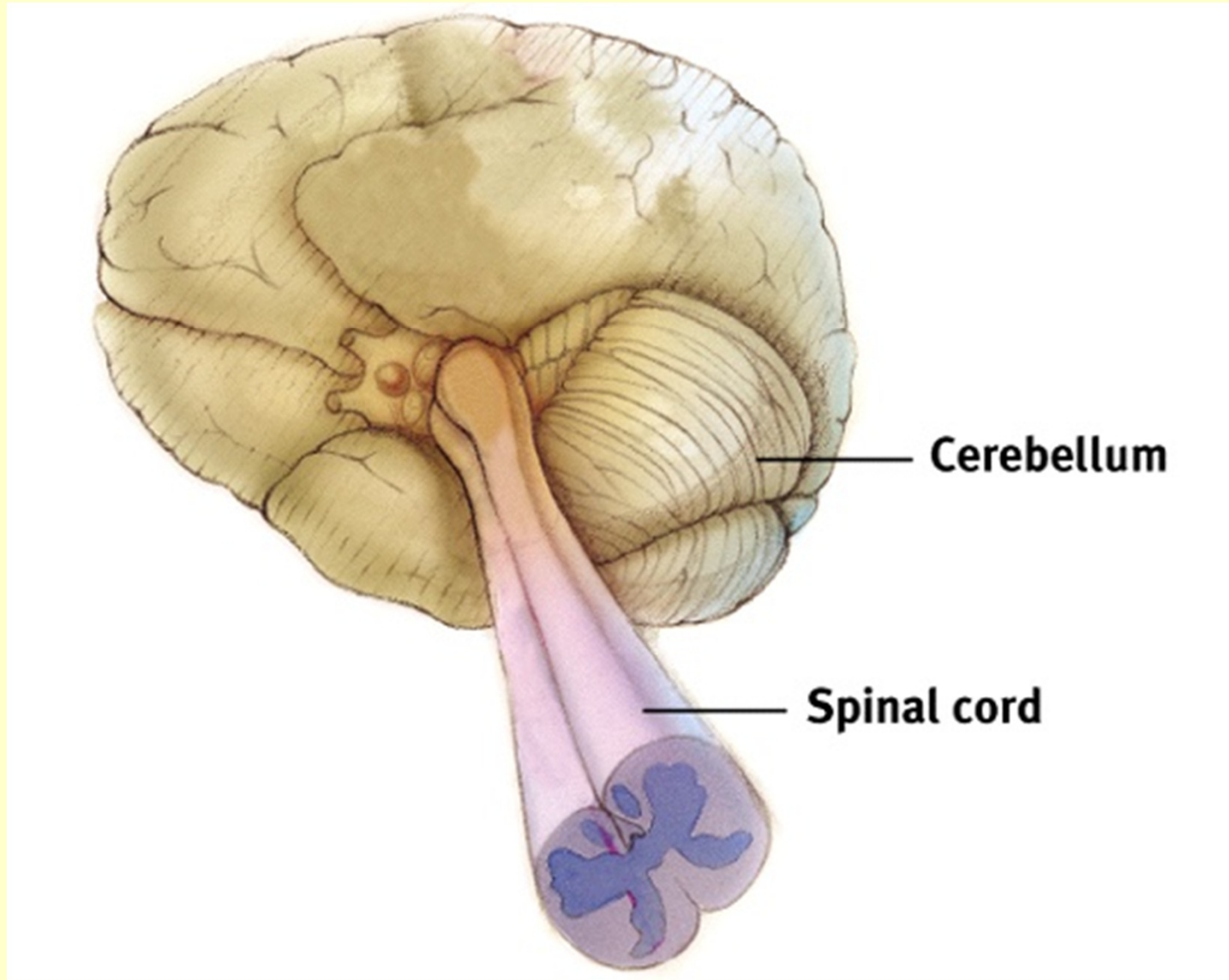
- Located just above the medulla.
- Connects hindbrain with midbrain and forebrain.
- Involved in facial expressions.

Cerebellum

- Bottom rear of the brain.
- Means “little brain”
- Coordinates fine muscle movements.



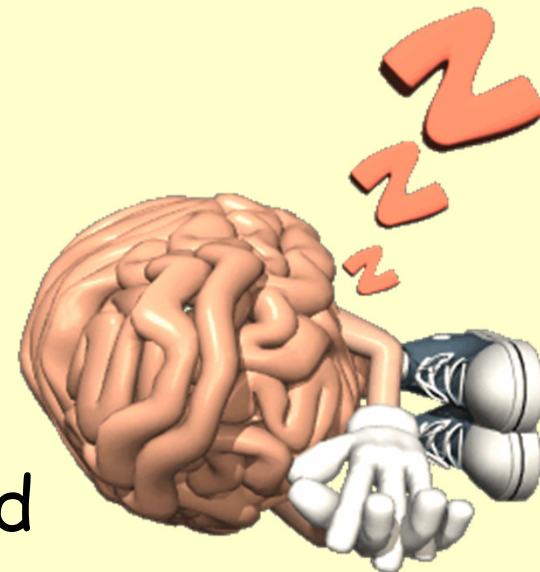
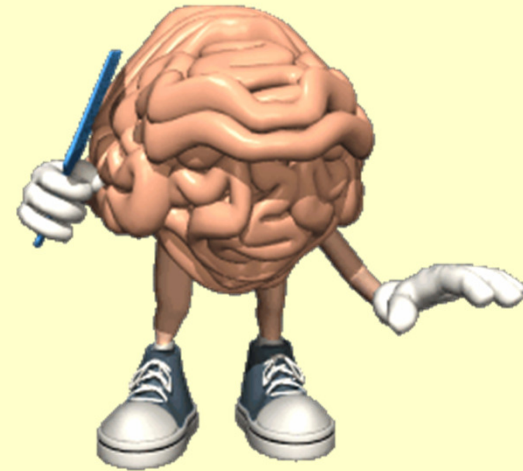
Cerebellum



Midbrain

If stimulated

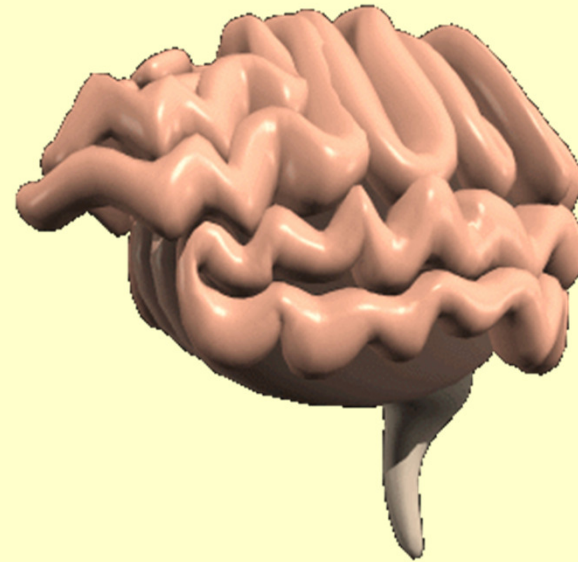
- Coordinates simple movements with sensory information.
- Most important structure in Midbrain is the **Reticular Formation**: controls arousal and ability to focus our attention.



If Destroyed

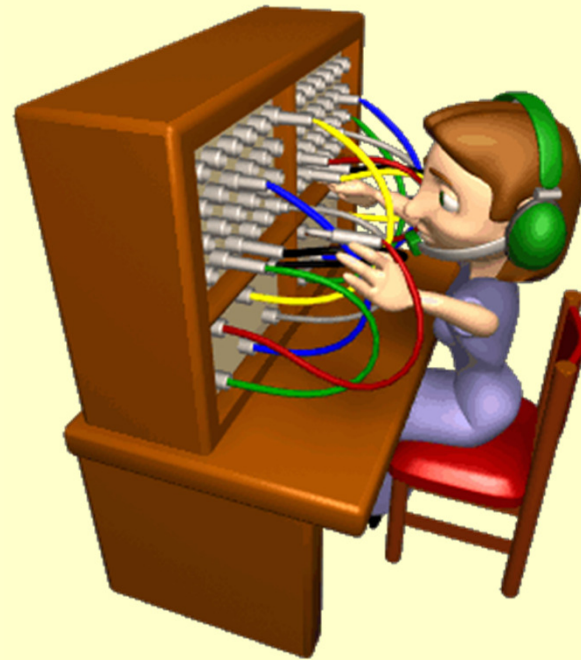
Forebrain

- What makes us human.
- Largest part of the brain.
- Made up of the Thalamus, Limbic System and Cerebral Cortex.

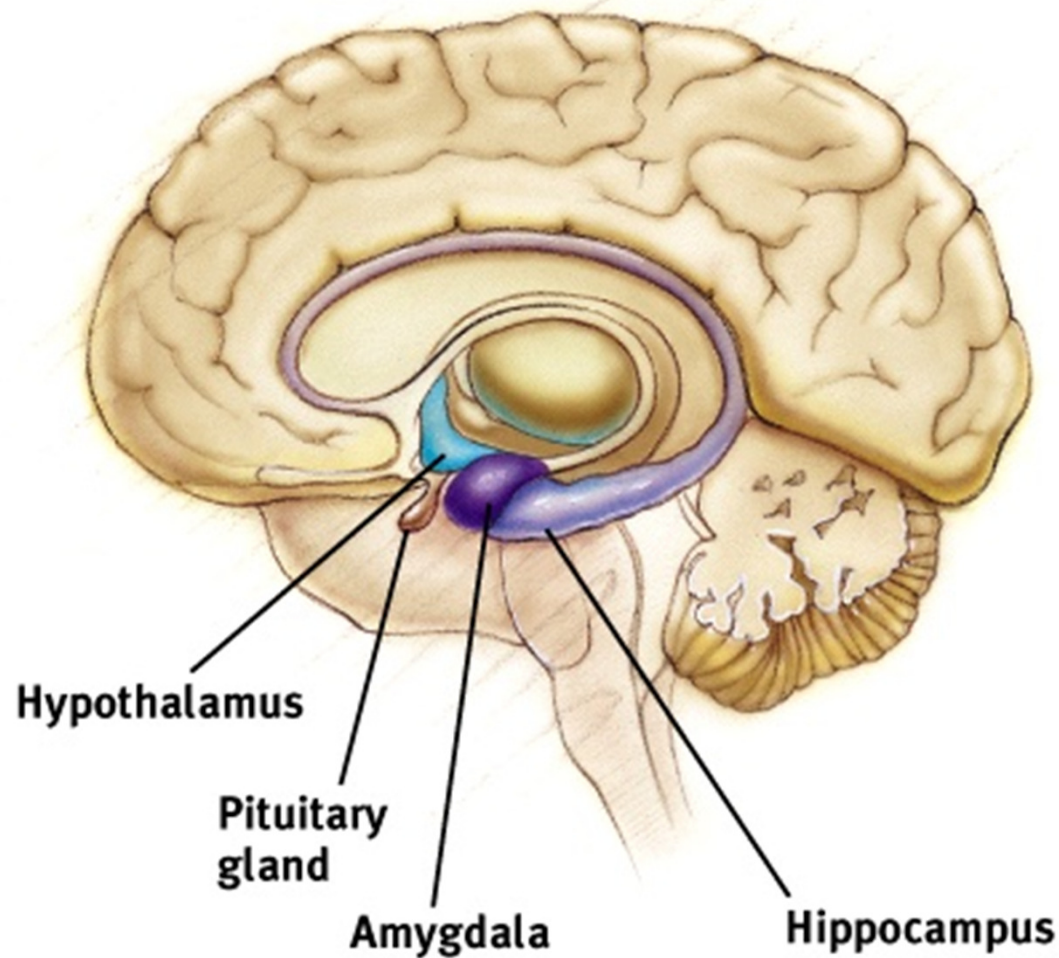


Thalamus

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

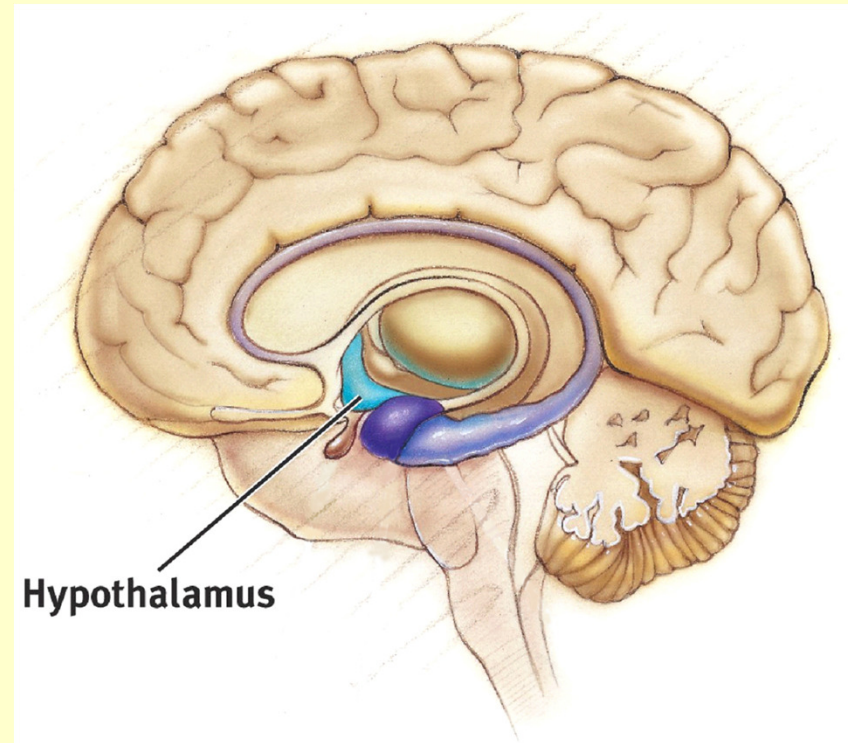


The Limbic System



Hypothalamus

The **Hypothalamus** lies below (*hypo*) the thalamus. It directs several maintenance activities like eating, drinking, body temperature, and control of emotions. It helps govern the endocrine system via the pituitary gland.



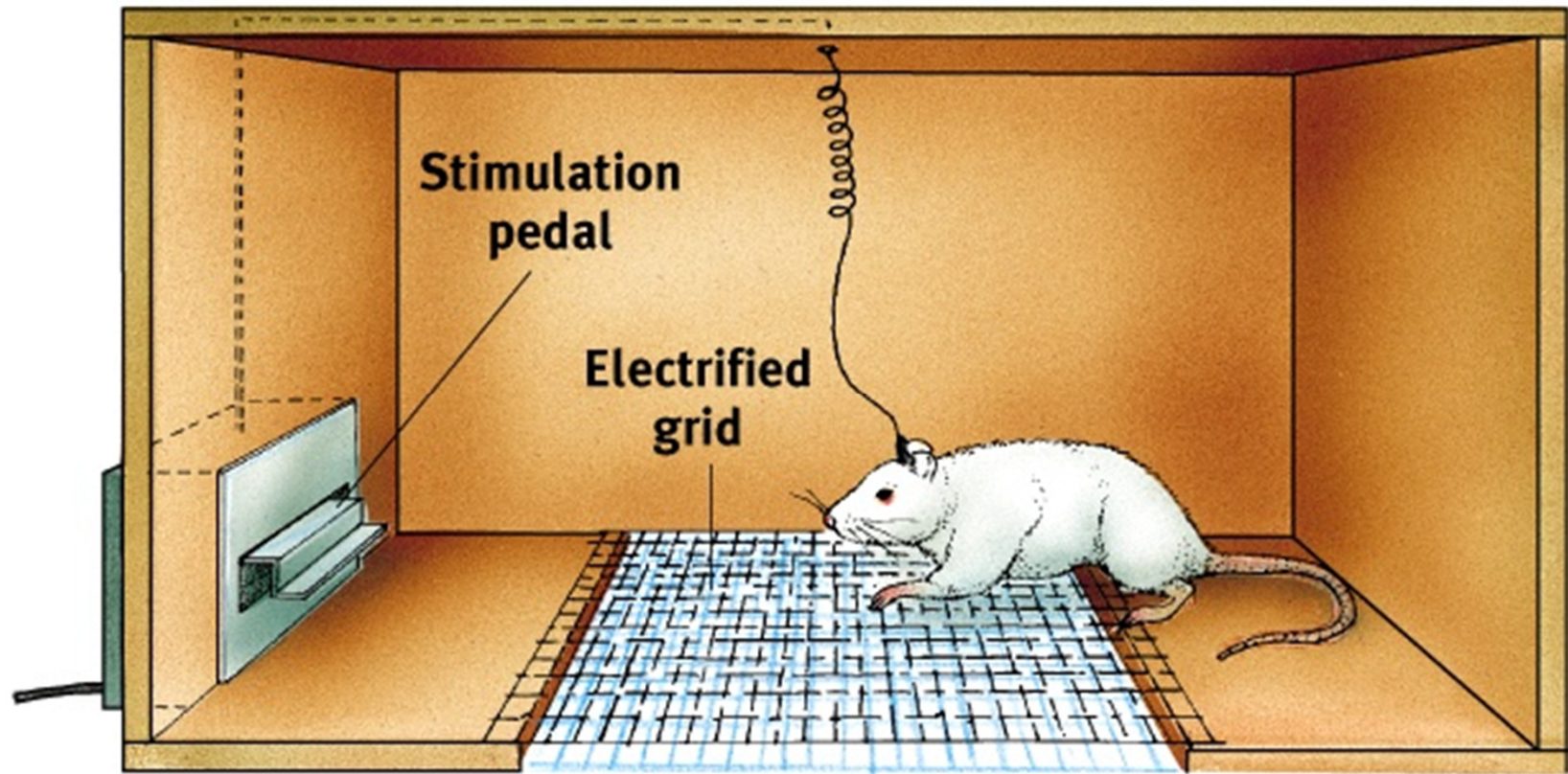
Hypothalamus



The most powerful structure in the brain.

Controls and regulates

- Body temperature
- Sexual Arousal
- Hunger
- Thirst
- Endocrine System



Rats cross an electrified grid for self-stimulation when electrodes are placed in the reward (hypothalamus) center

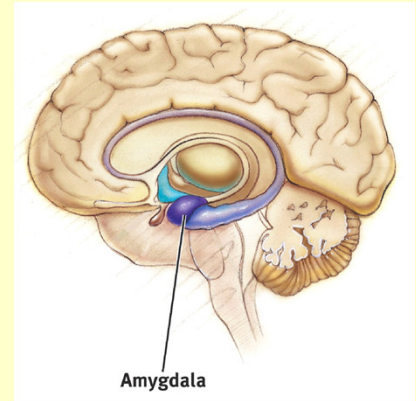
Hippocampus



- Involved in the processing and storage of memories.

Amygdala

- Involved in how we process memory.
- More involved in volatile emotions like anger.



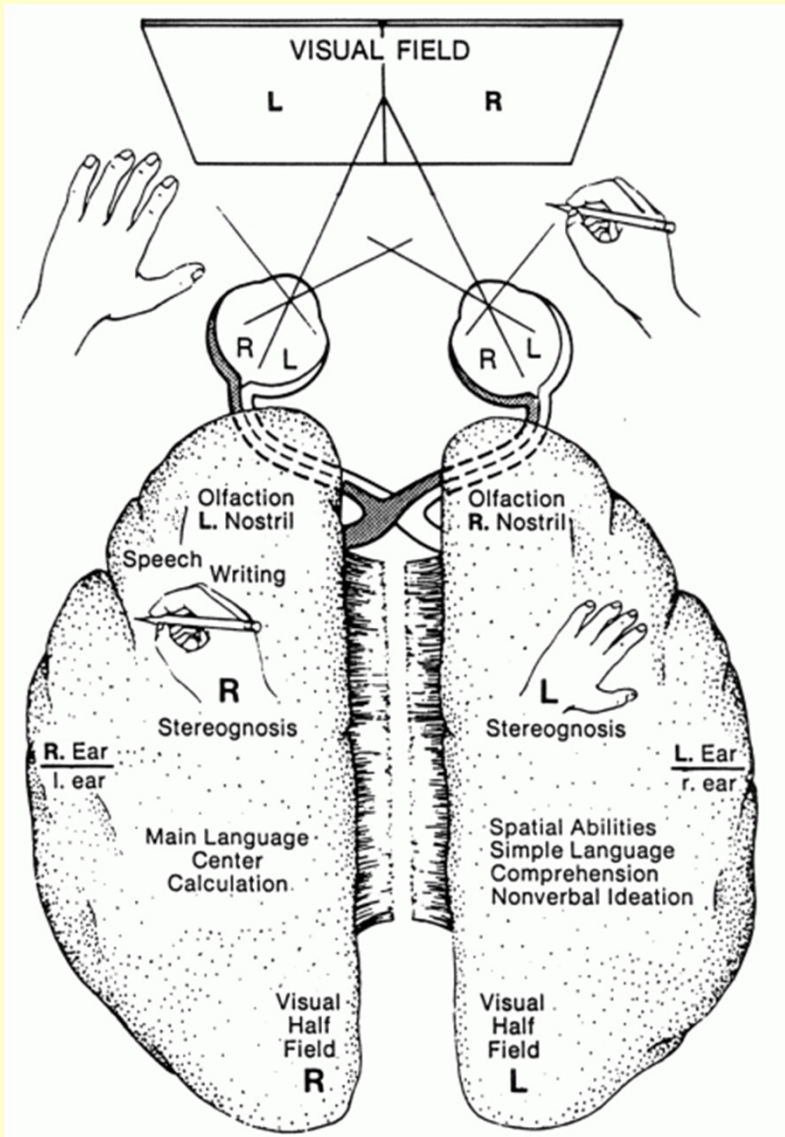
The emotion of anger has not changed much throughout evolution.

The Cerebral Cortex

- Made up of densely packed neurons we call “gray matter”
- Glial Cells: support brain cells.
- Wrinkles are called *fissures*.
- If you lay brain out it would be as big as a large Pizza 2000 pizza.



Hemispheres



Divided into two hemispheres.

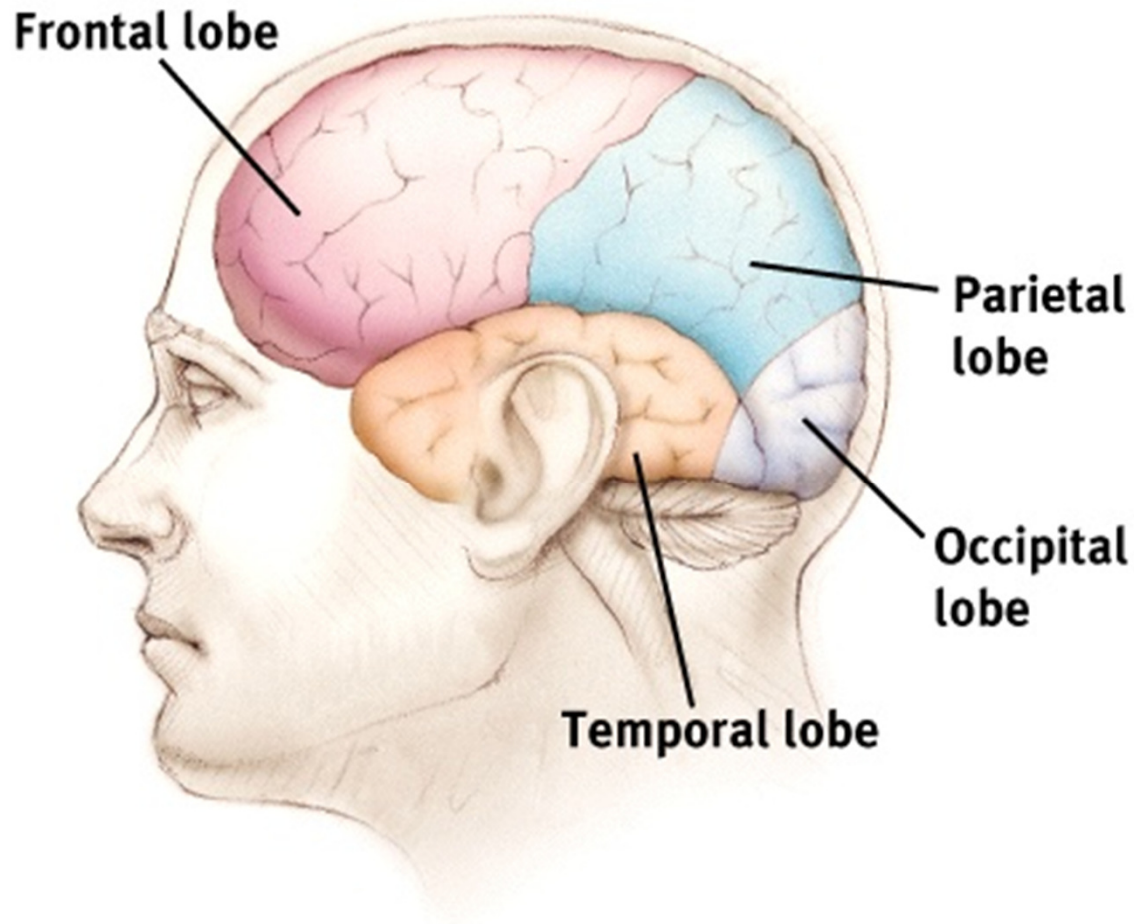
- ***Contralateral control:*** right controls left and vice versa.

In general,

Left Hemisphere: logic and sequential tasks.

Right Hemisphere: spatial and creative tasks.

The Cerebral Cortex is made up of four Lobes.

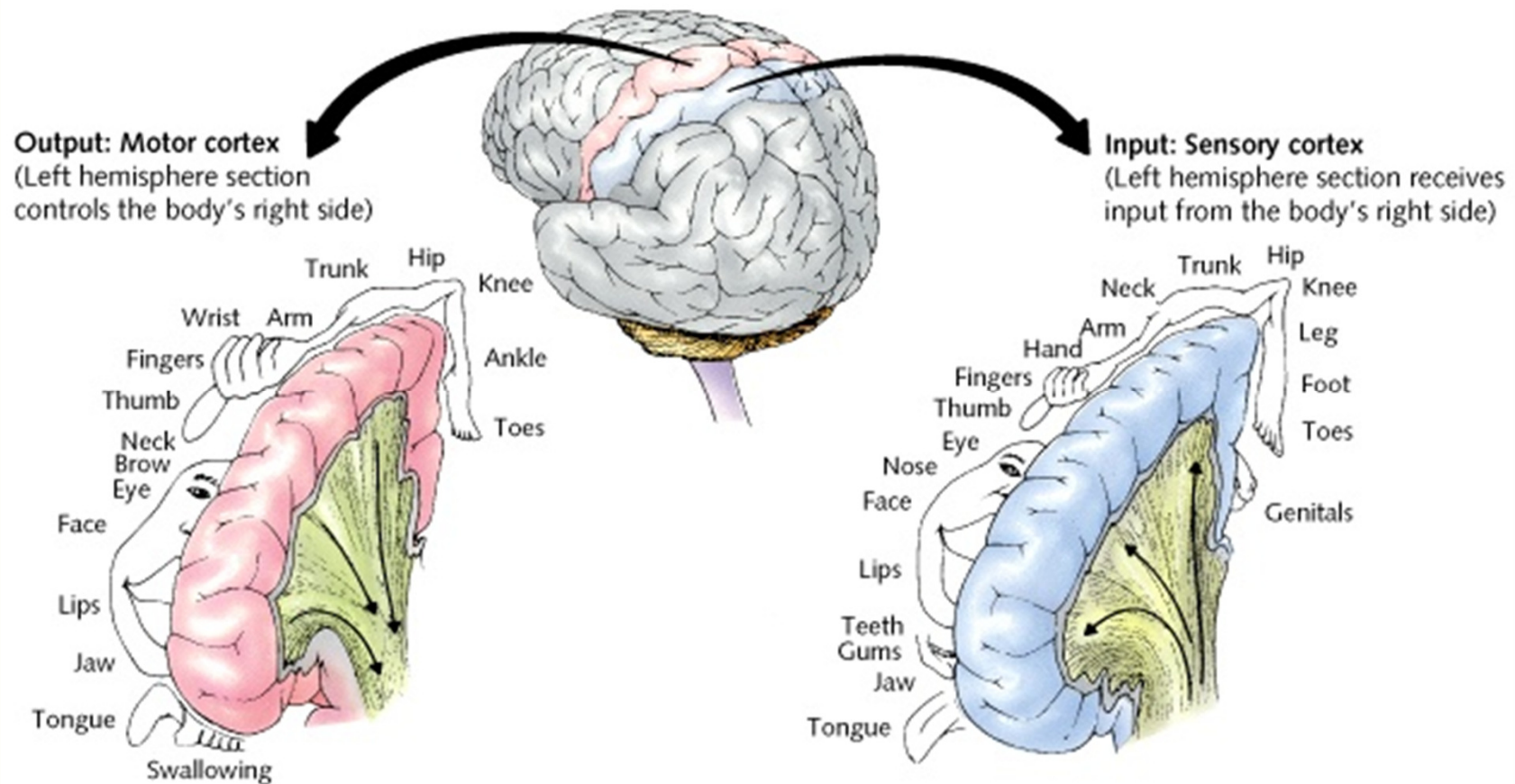


Frontal Lobes

- Abstract thought and emotional control.
- Contains ***Motor Cortex***: sends signals to our body controlling muscle movements.
- Contains ***Broca's Area***: responsible for controlling muscles that produce speech.
- Damage to Broca's Area is called ***Broca's Aphasia***: unable to make movements to talk.



Motor and Sensory Cortexes



Parietal Lobes



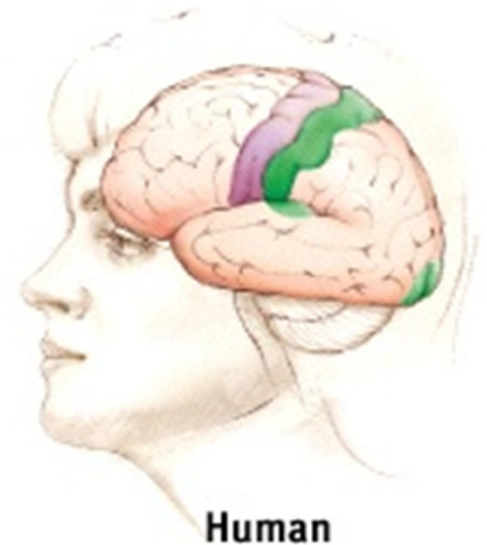
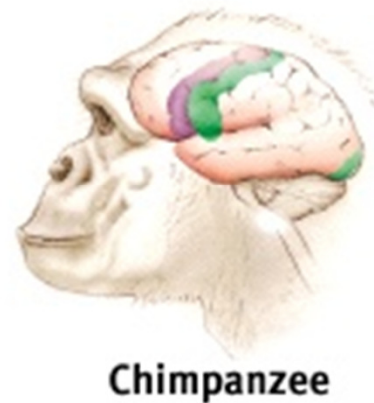
Where would this girl feel the most pain from her sunburn?

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

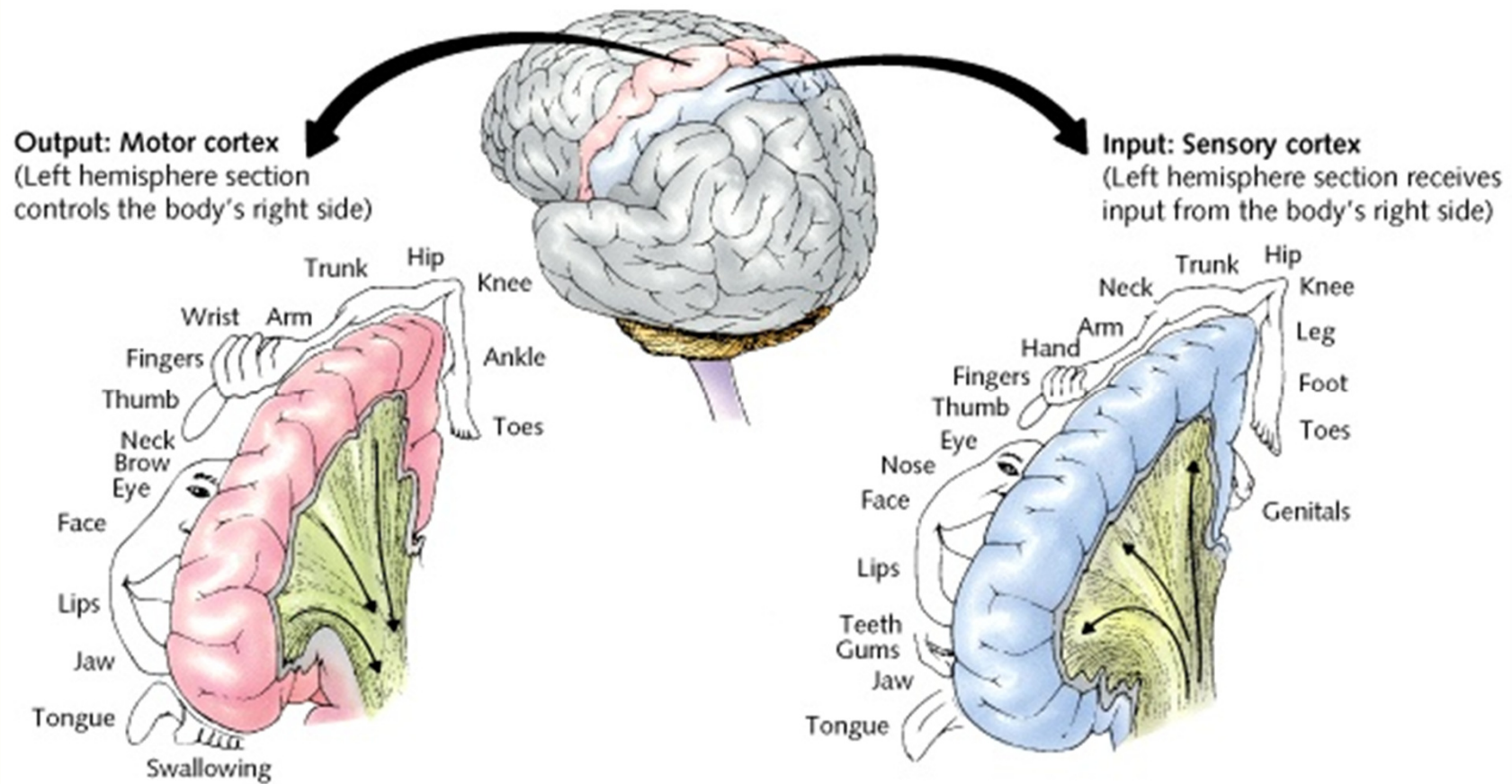
Association Areas

- Any area not associated with receiving sensory information or coordinating muscle movements.

- Motor areas
- Sensory areas
- Association areas

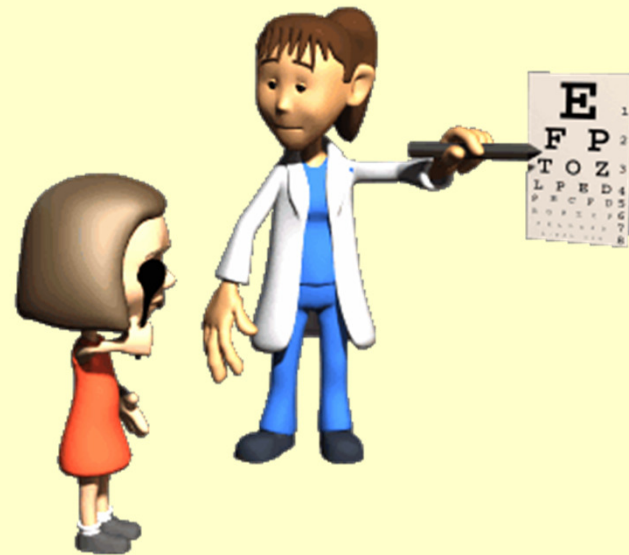


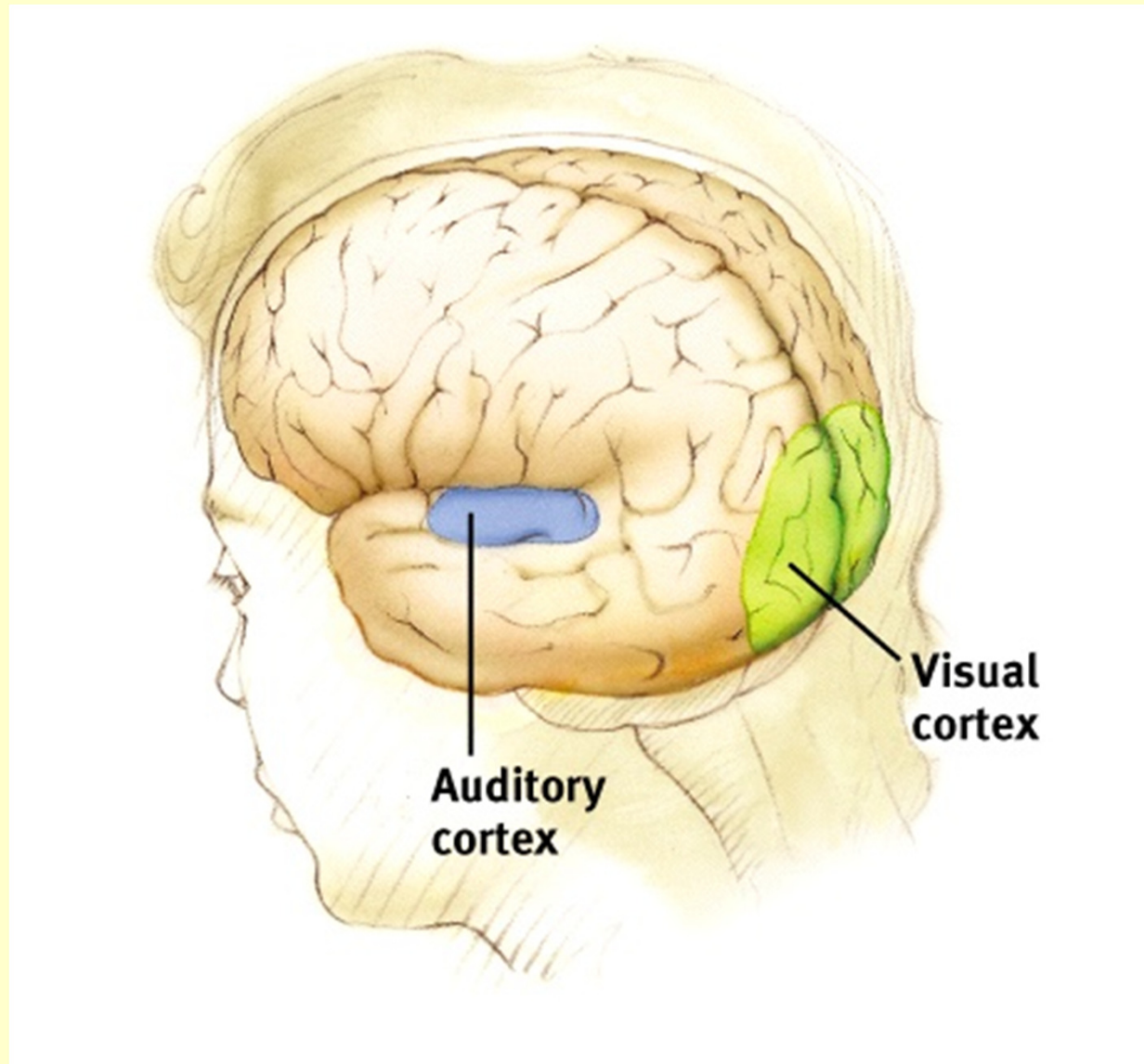
Motor and Sensory Cortexes



Occipital Lobes

- Deals with vision.
- Contains *Visual Cortex*. interprets messages from our eyes into images we can understand.



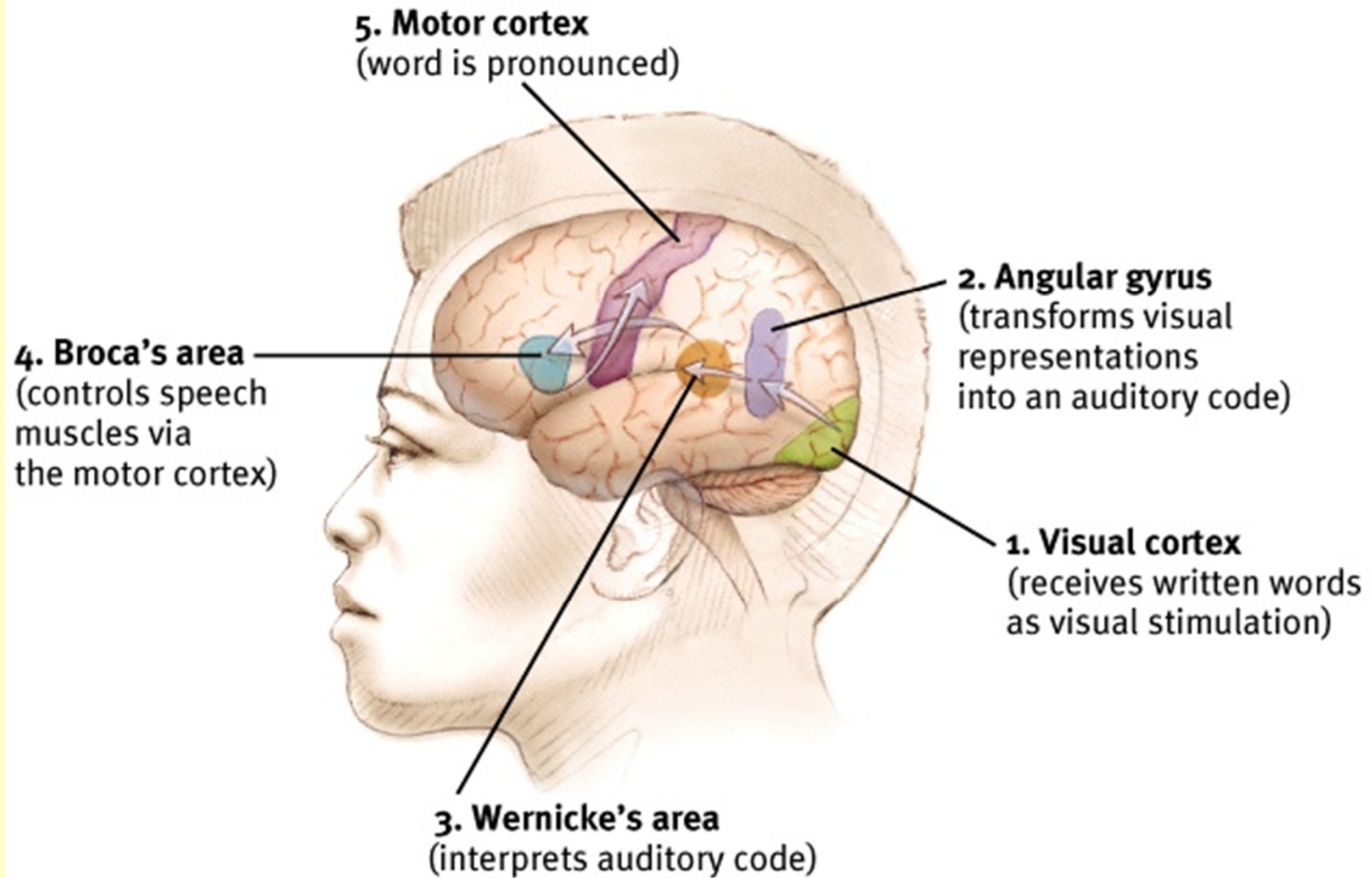


Temporal Lobes

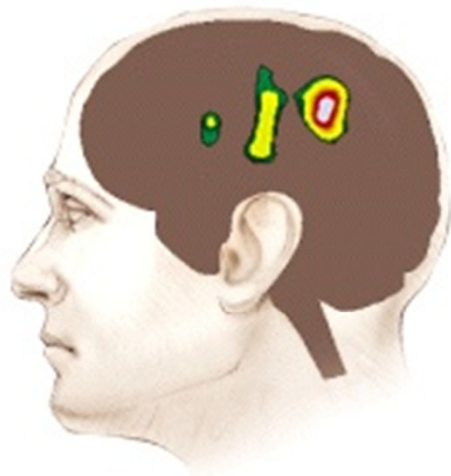


- Process sound sensed by our ears.
- Interpreted in Auditory Cortex.
- NOT LATERALIZED.
- Contains *Wernike's Area*: interprets written and spoken speech.
- *Wernike's Aphasia*: unable to understand language: the syntax and grammar jumbled.

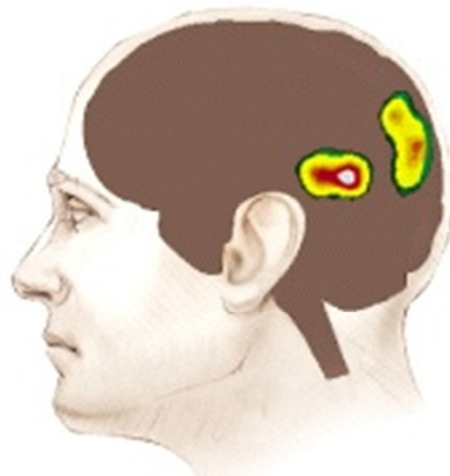
Specialization and Integration in Language



Brain Activity when Hearing, Seeing, and Speaking Words



(a)
Hearing



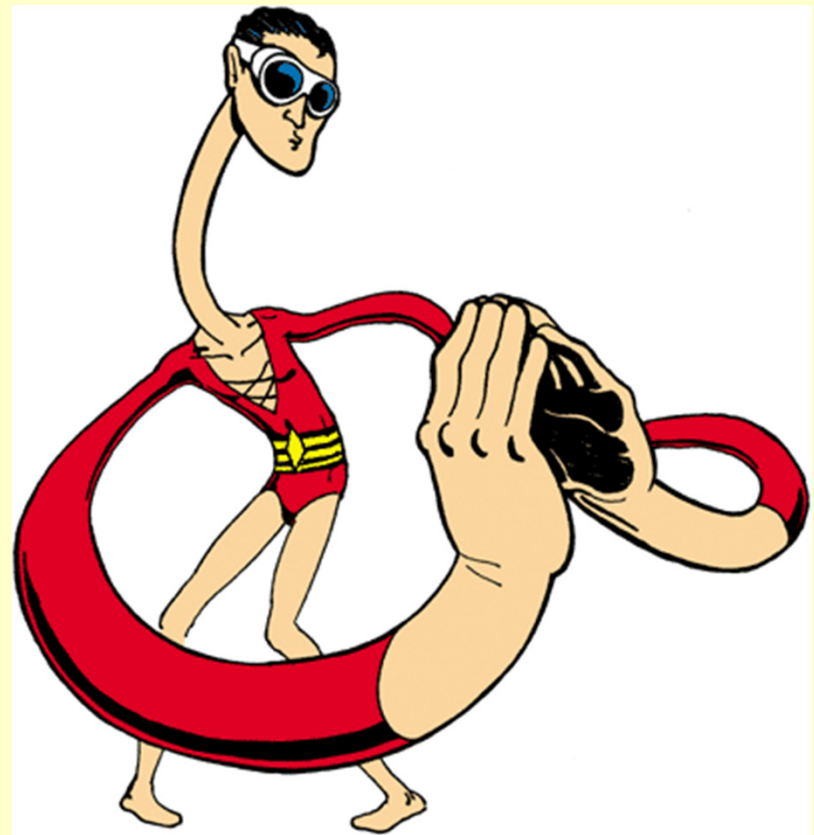
(b)
Seeing



(c)
Speaking

Brain Plasticity

- The idea that the brain, when damaged, will attempt to find new ways to reroute messages.
- Children's brains are more plastic than adults.



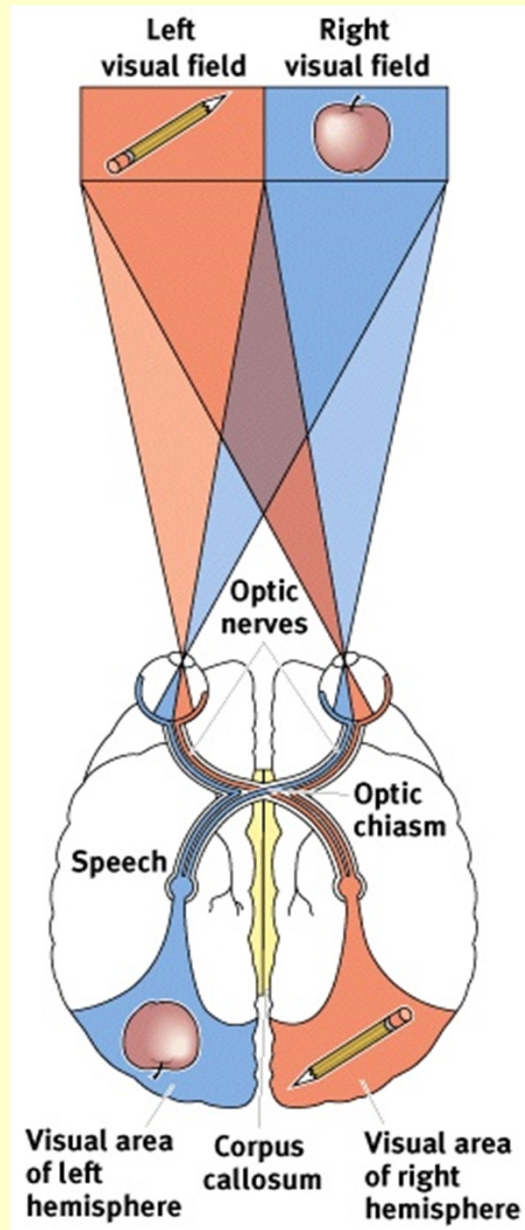
The Corpus Callosum

Corpus callosum

Divides the 2 hemispheres.

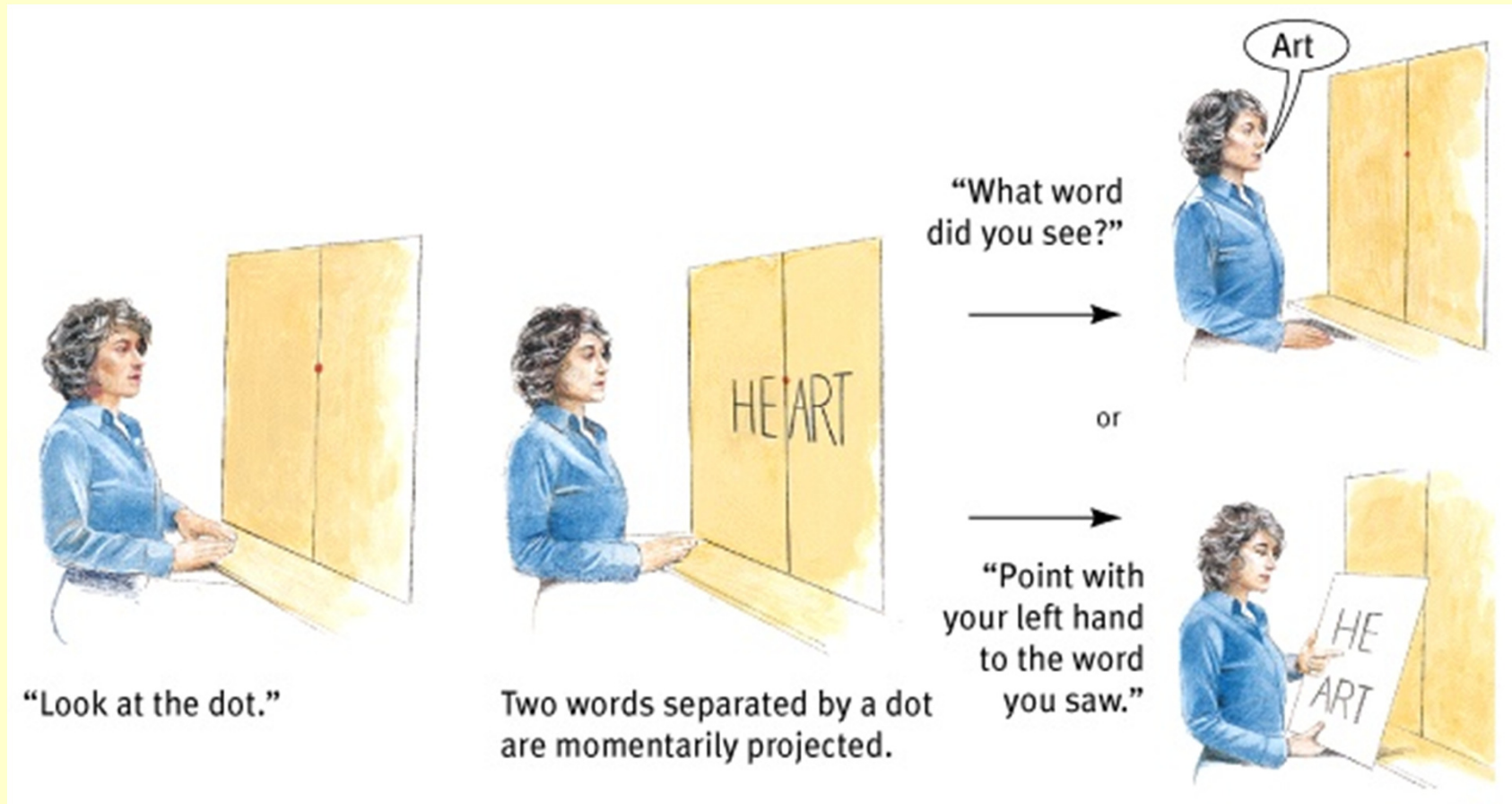


Split Brain Patients



Those who does to epilepsy, have their corpus callosum removed.

Testing the Divided Brain



Decreasing Left-handers

