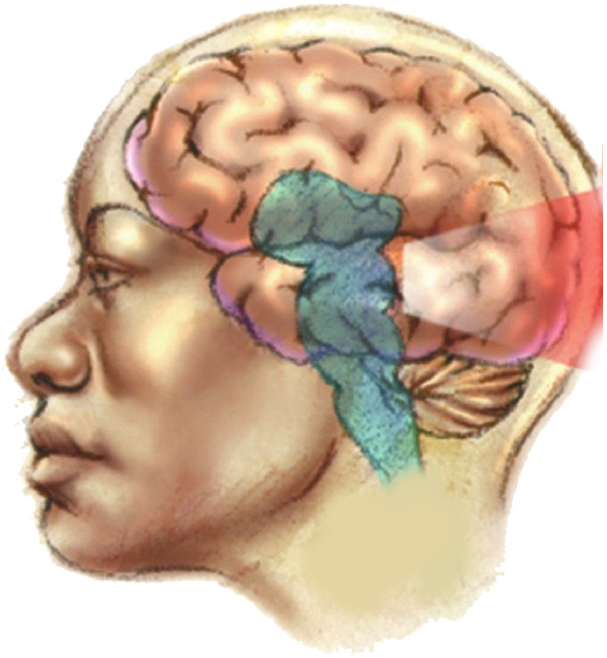
Older Brain Structures

The Brainstem is the oldest part of the brain, beginning where the spinal cord swells and enters the skull. It is responsible for automatic survival functions.

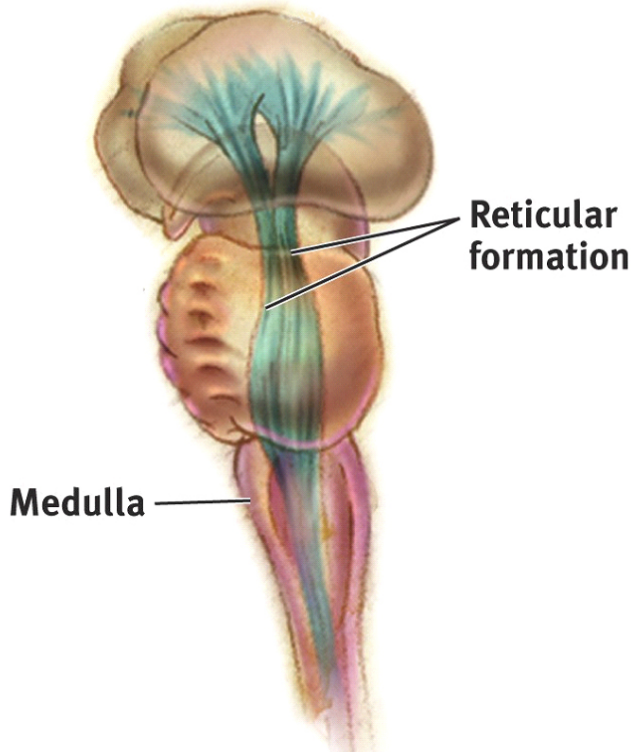


Brain Stem

The Medulla [muh-DUL-uh] is the base of the brainstem

It controls autonomic functions and relays nerve signals between the brain and spinal cord.

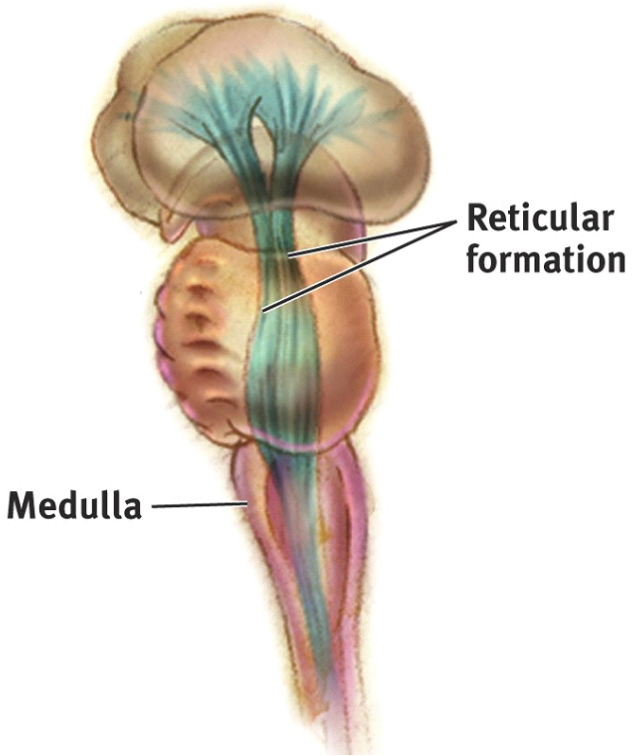
- respiration
- blood pressure
- heart rate
- reflex arcs
- vomiting



Brain Stem

Pons and inside that the (Reticular Formation) is a nerve network in the brainstem that plays an important role in controlling arousal.

•It is involved in motor control and sensory analysis... for example, information from the ear first enters the brain in the pons. It has parts that are important for the level of consciousness and for sleep.



The Reticular Formation controls:

•Attention

•Cardiac Reflexes

•Motor Functions

•Regulates Awareness

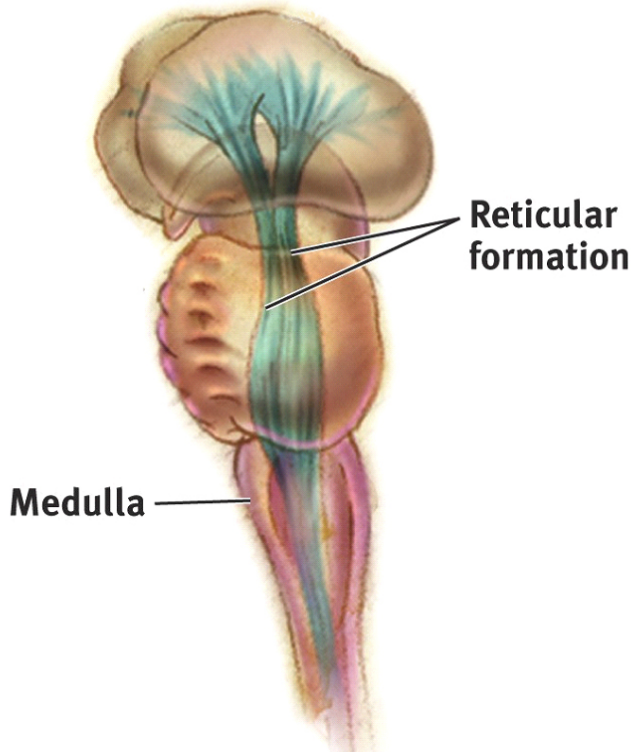
•Relays Nerve Signals to the Cerebral Cortex

•Sleep

Brain Stem

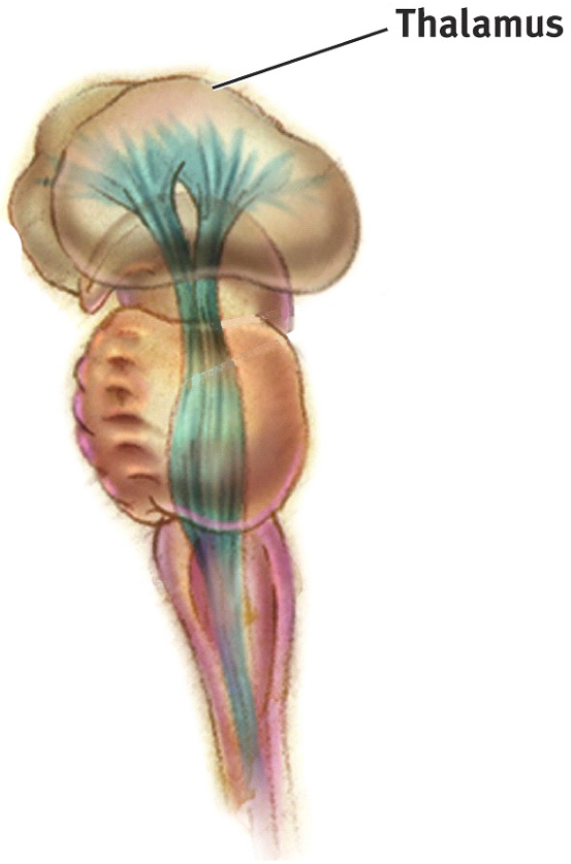
The Medulla [muh-DUL-uh] is the base of the brainstem that controls heartbeat and breathing.

Reticular Formation is a nerve network in the brainstem that plays an important role in controlling arousal.



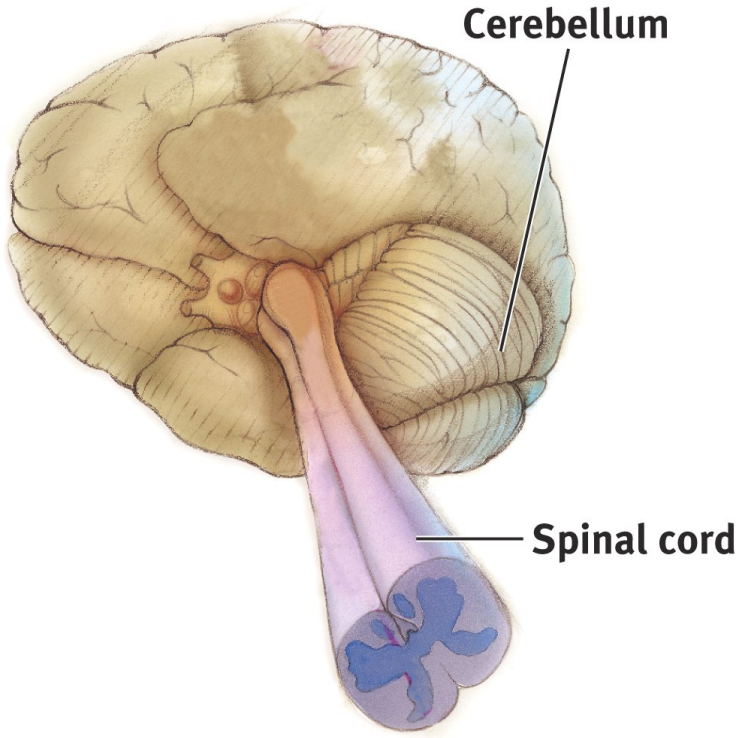
Brain Stem

The Thalamus [THAL-uh-muss] is the brain's sensory switchboard, located on top of the brainstem. It directs messages to the sensory areas in the cortex and transmits replies to the cerebellum and medulla.



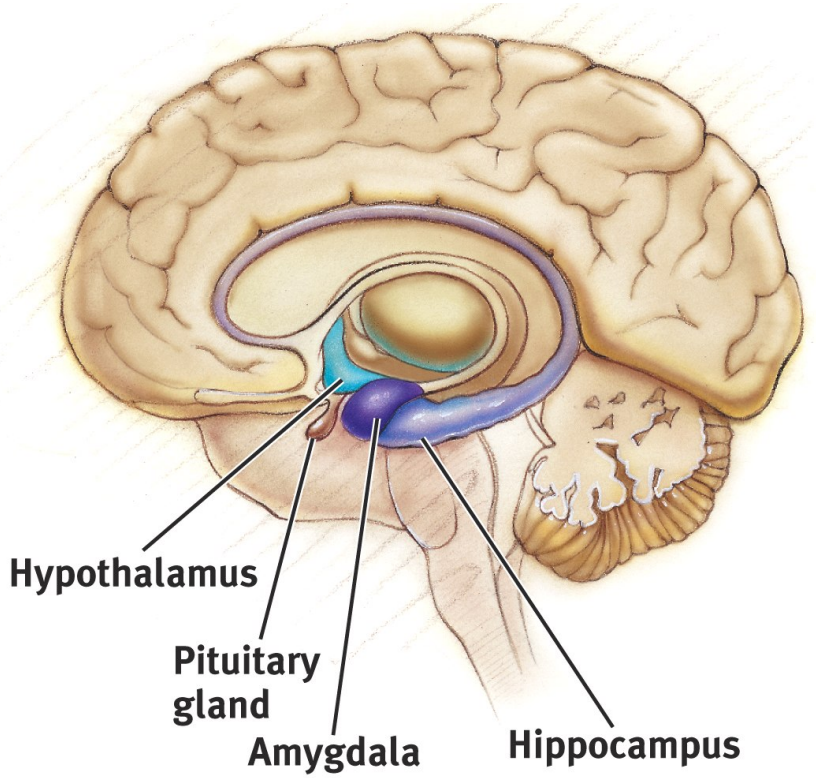
Cerebellum

The “little brain” attached to the rear of the brainstem. It helps coordinate voluntary movements and balance.



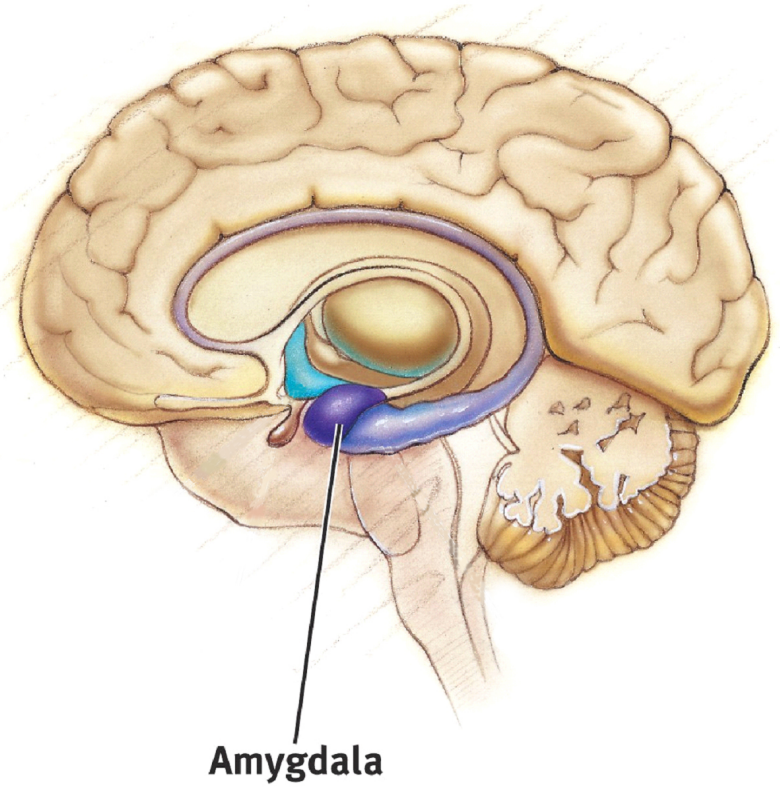
The Limbic System

The Limbic System is a doughnut-shaped system of neural structures at the border of the brainstem and cerebrum, associated with emotions such as fear, aggression and drives for food and sex. It includes the hippocampus, amygdala, and hypothalamus.



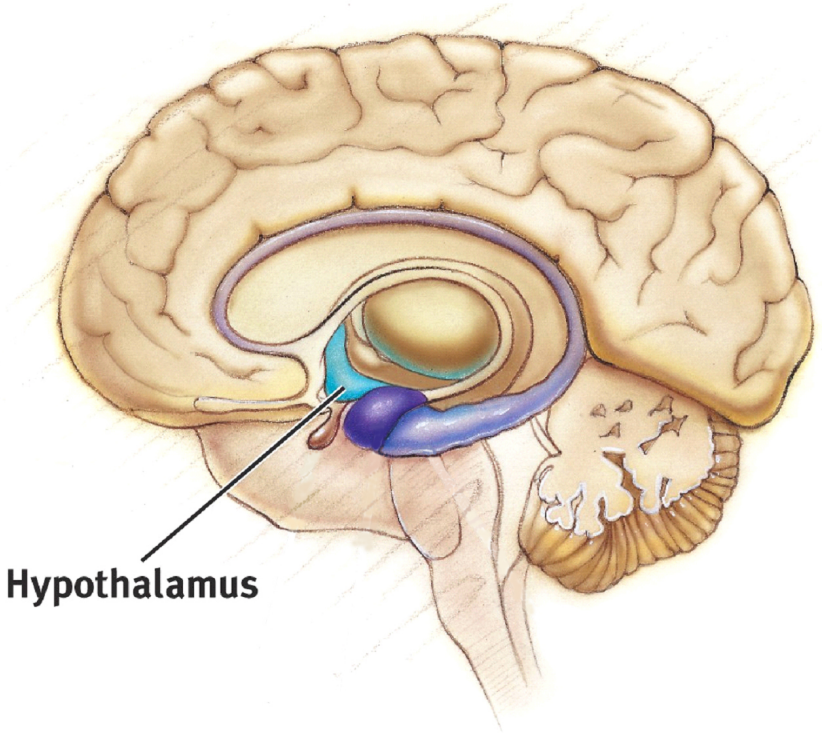
Amygdala

The Amygdala [ah-MIG-dah-la] consists of two almond-shaped neural clusters linked to the emotions of fear and anger.



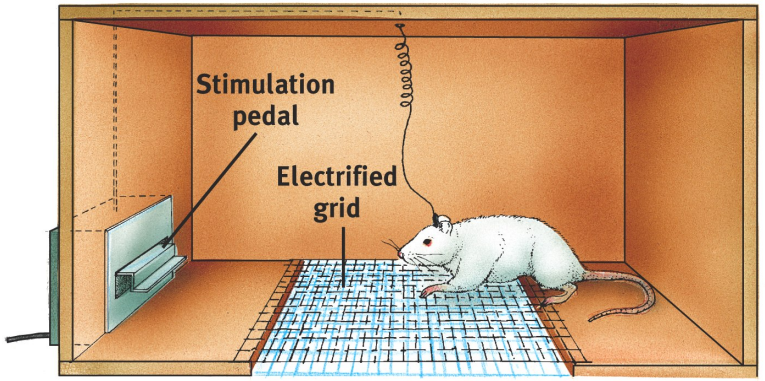
Hypothalamus

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.



Reward Center

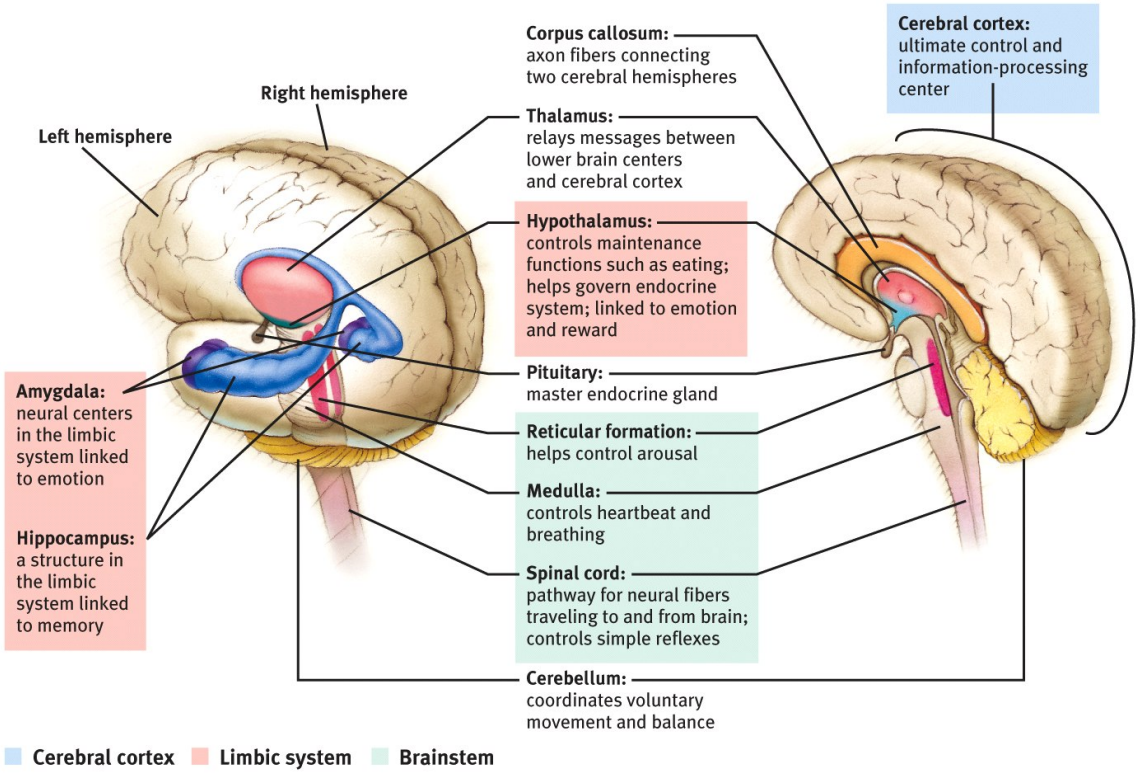
Rats cross an electrified grid for self-stimulation when electrodes are placed in the reward (hypothalamus) center (top picture). When the limbic system is manipulated, a rat will navigate fields or climb up a tree (bottom picture).



Sanjiv Talwar, SUNY Downstate

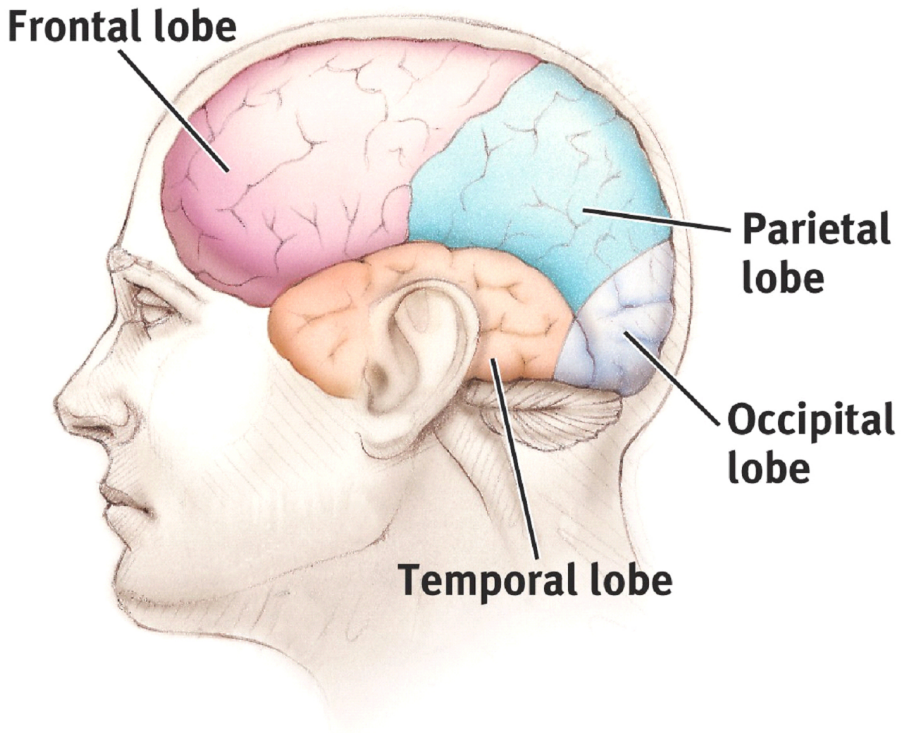
The Cerebral Cortex

The intricate fabric of interconnected neural cells that covers the cerebral hemispheres. It is the body's ultimate control and information processing center.



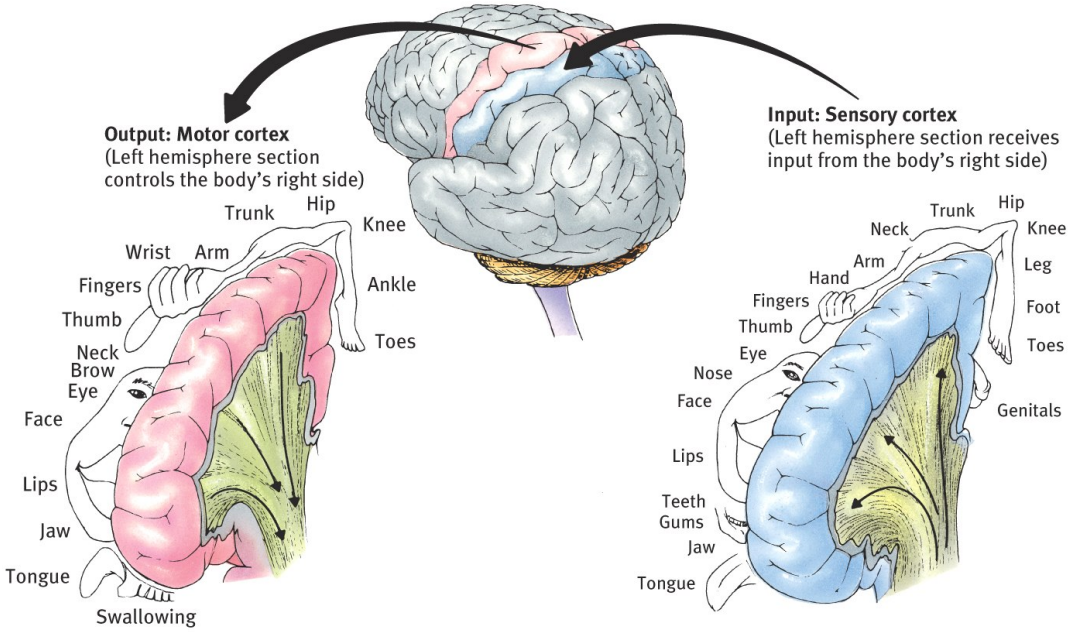
Structure of the Cortex

Each brain hemisphere is divided into four lobes that are separated by prominent fissures. These lobes are the frontal lobe (forehead), parietal lobe (top to rear head), occipital lobe (back head) and temporal lobe (side of head).



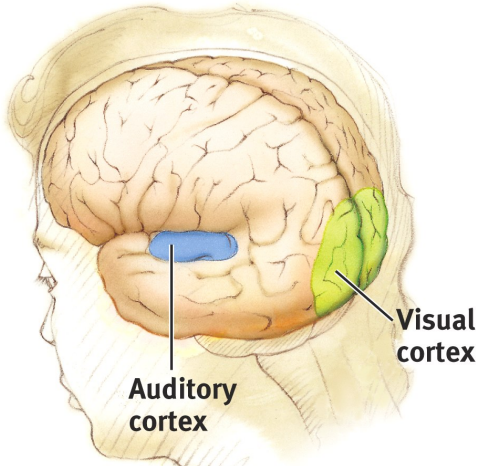
Functions of the Cortex

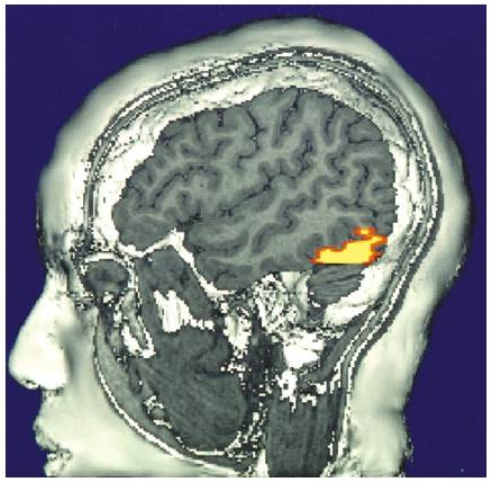
The Motor Cortex is the area at the rear of the frontal lobes that control voluntary movements. The Sensory Cortex (parietal cortex) receives information from skin surface and sense organs.



Visual Function

The functional MRI scan shows the visual cortex is active as the subject looks at faces.

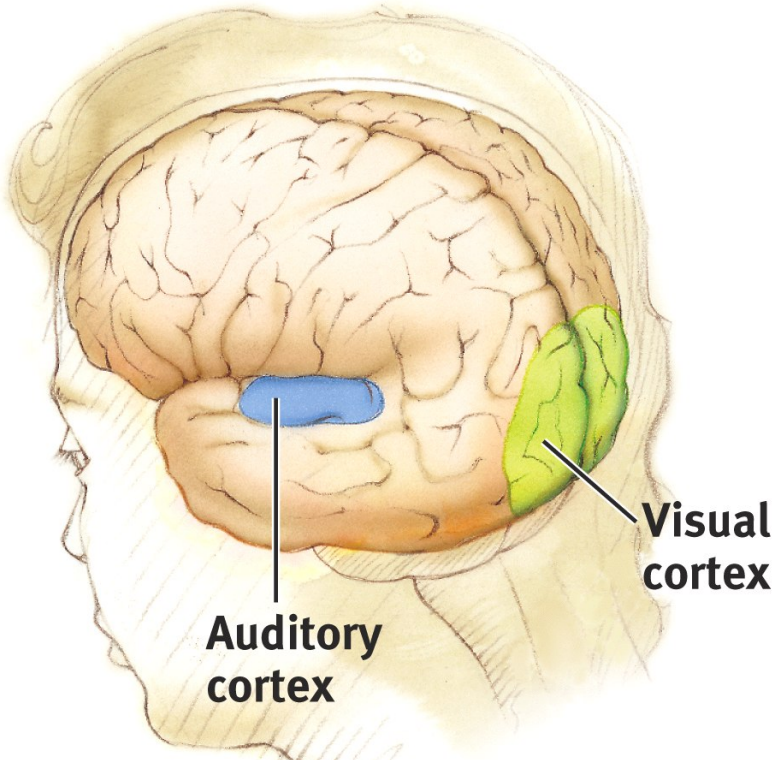




Courtesy of V.P. Clark, K. Keill, J. Ma. Maisog, S. Courtney, L.G. Ungerleider, and J.V. Haxby, National Institute of Mental Health

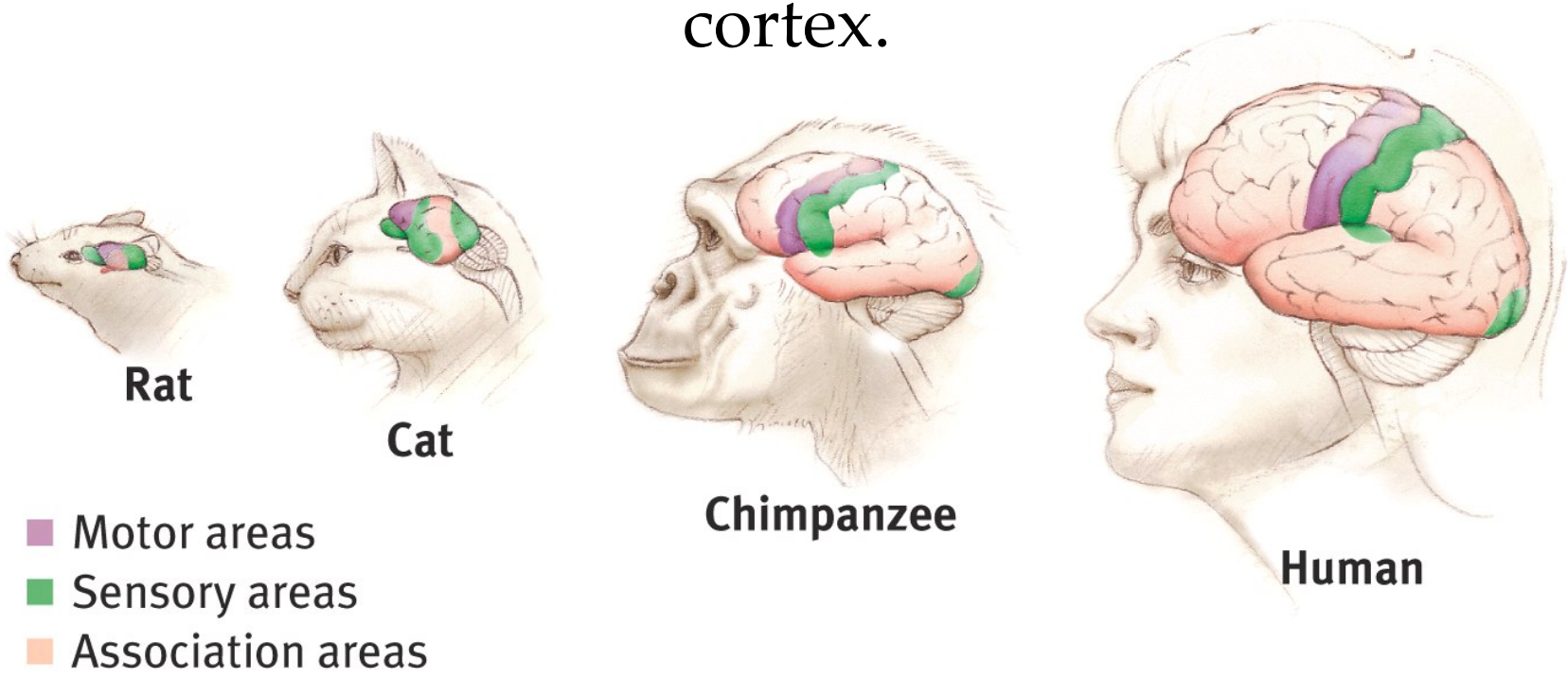
Auditory Function

The functional MRI scan shows the auditory cortex is active in patients who hallucinate.



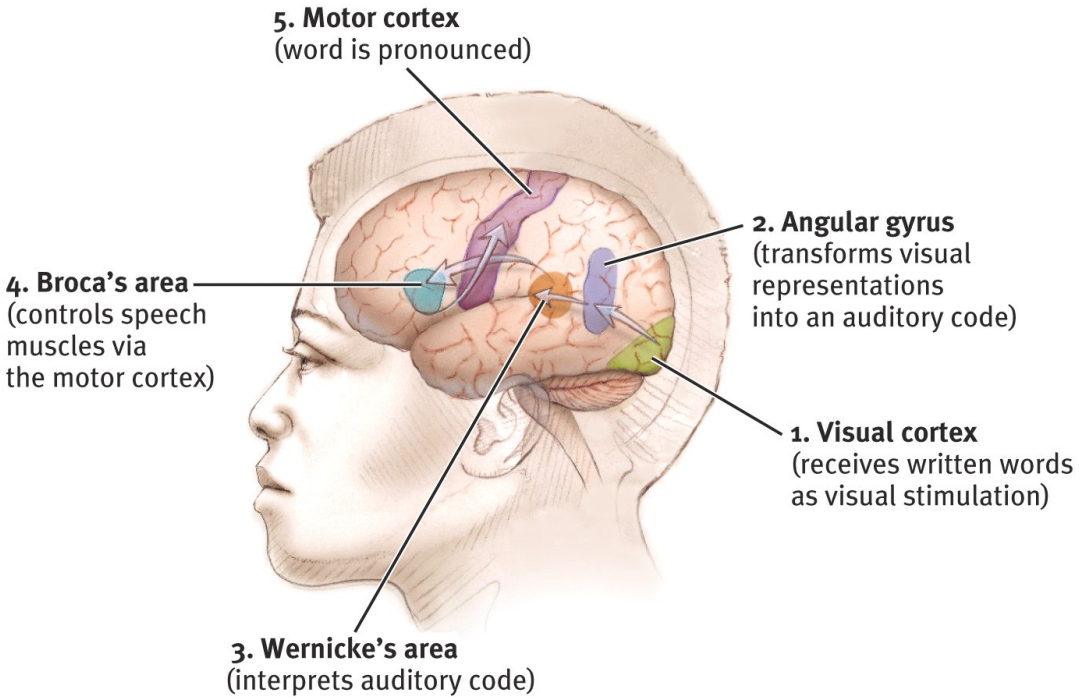
Association Areas

More intelligent animals have increased "uncommitted" or association areas of the cortex.



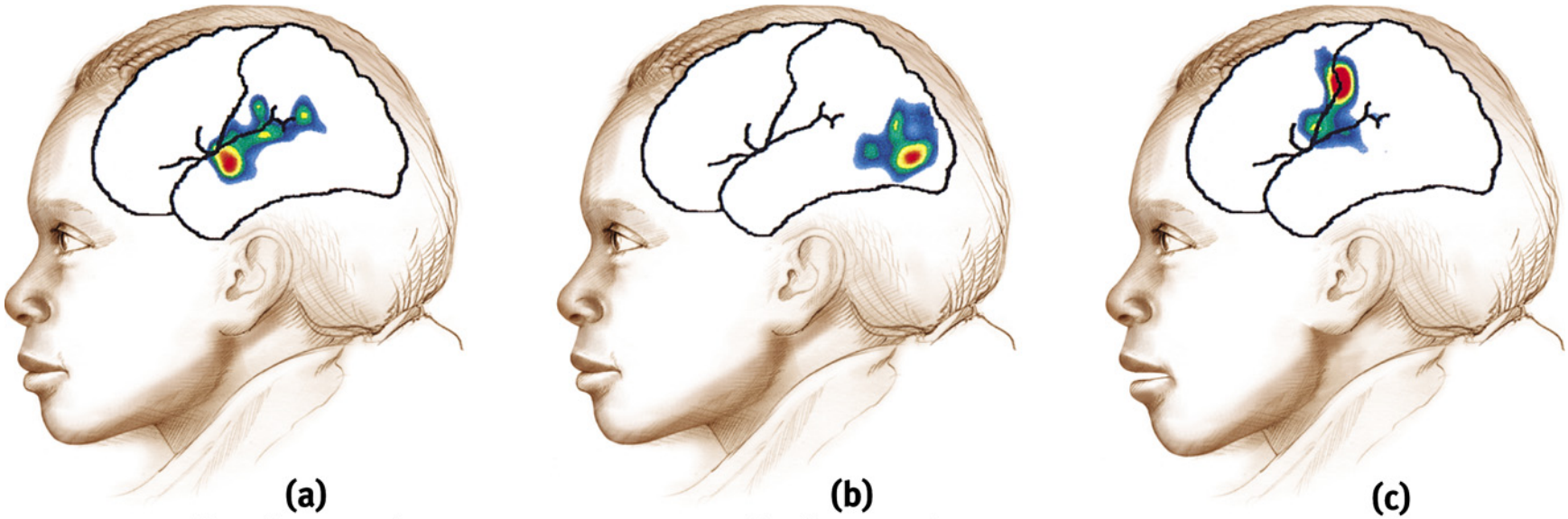
Language

Aphasia is an impairment of language, usually caused by left hemisphere damage either to Broca's area (impaired speaking) or to Wernicke's area (impaired understanding).



Specialization & Integration

Brain activity when hearing, seeing, and speaking words



(a) Hearing words (auditory cortex and Wernicke's area)

(b) Seeing words (visual cortex and angular gyrus)

(c) Speaking words (Broca's, area and the motor cortex)