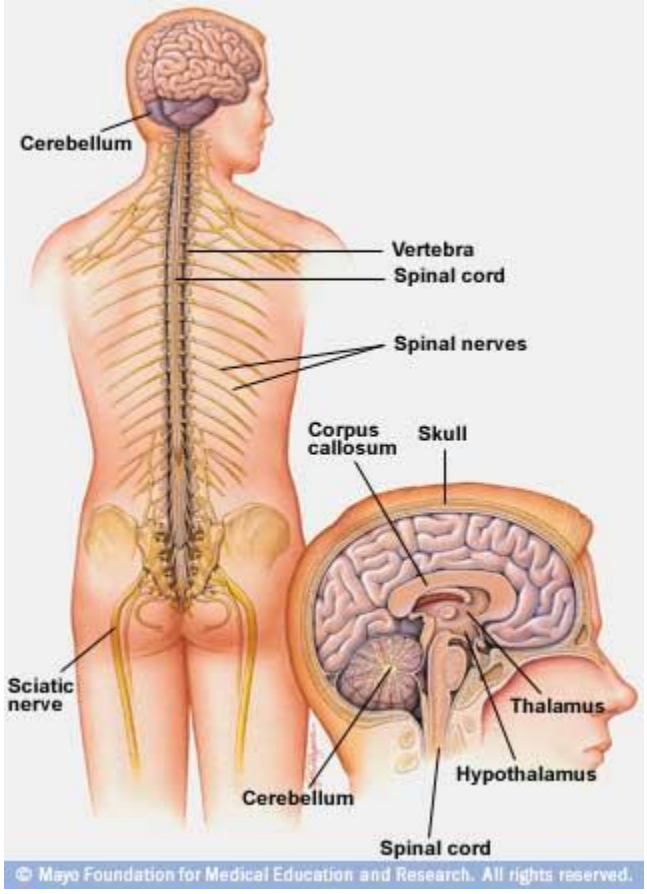
Brain Anatomy

Brain and nervous system

Your brain contains billions of nerve cells arranged in patterns that coordinate thought, emotion, behavior, movement and sensation. A complicated highway system of nerves connects your brain to the rest of your body, so communication can occur in split seconds. Think about how fast you pull your hand back from a hot stove. While all the parts of your brain work together, each part is responsible for a specific function — controlling everything from your heart rate to your mood.



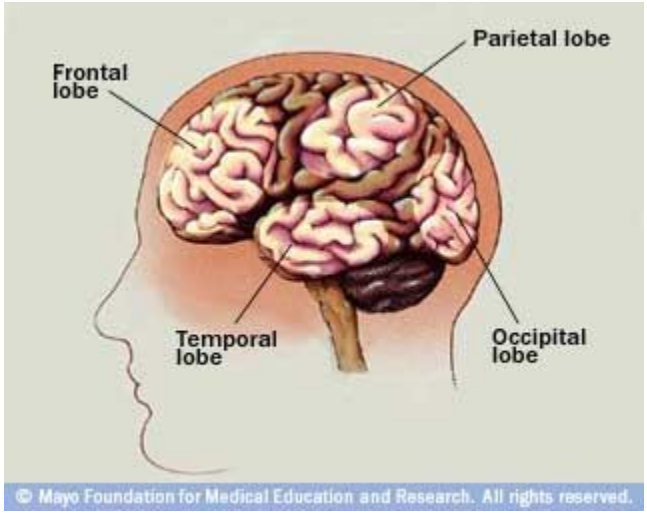
Cerebrum

The cerebrum is the largest part of your brain. It's what you probably visualize when you think of brains in general. The outermost layer of the cerebrum is the cerebral cortex, the "gray matter" of the brain. Deep folds and wrinkles in the brain increase the surface area of the gray matter, so more information can be processed.

The cerebrum is divided into two halves (hemispheres) by a deep fissure. The hemispheres communicate with each other through a thick tract of nerves, called the corpus callosum, at the base of the fissure. In fact, messages to and from one side of the body are usually handled by the opposite side of the brain.

Lobes of the brain

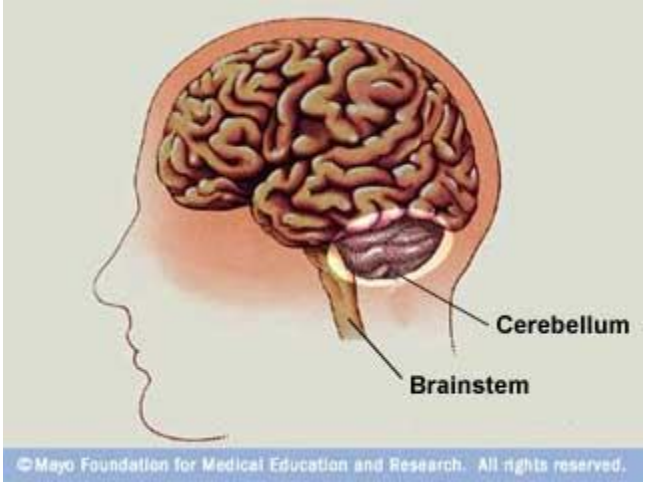
Each of your brain's hemispheres is divided into four lobes. The two frontal lobes act as short-term storage sites for ideas, allowing you to consider more than one idea at a time. One section of the frontal lobes helps control voluntary movement, while a place in the left frontal lobe allows thoughts to be transformed into words. The parietal lobes interpret sensory information, such as taste, temperature and touch; they also help with reading and math. Occipital lobes process images from the eyes and link that information with images stored in memory. The temporal lobes translate information from the ears, including music. The underside of the temporal lobe plays a crucial role in memory.



Cerebellum and brainstem

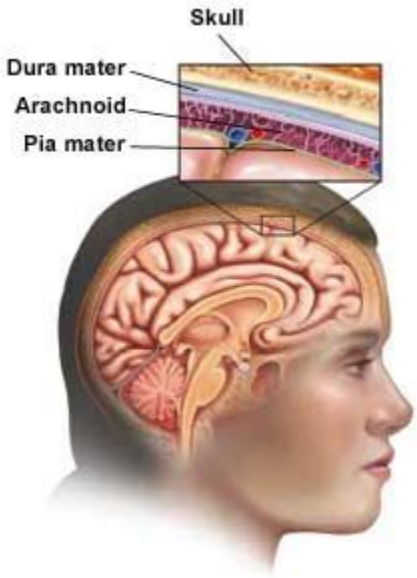
The cerebellum is a wrinkled ball of tissue below and behind the rest of your brain. It works to combine sensory information from the eyes, ears and muscles to help coordinate movement. Damage to the cerebellum can cause "intention tremor," which is trembling of part of your body — for example, your hand — occurring only when you try to move it.

The brainstem links the brain to the spinal cord. It controls many functions vital to life, such as heart rate, blood pressure and breathing. This area is also important for sleep.



Layers of protection

The brain is protected by three layers of membrane, called meninges, lying just under the skull. The tough outer layer is called the dura mater, and the delicate inner layer is the pia mater. The middle layer is the arachnoid, a web-like structure filled with fluid that cushions the brain.

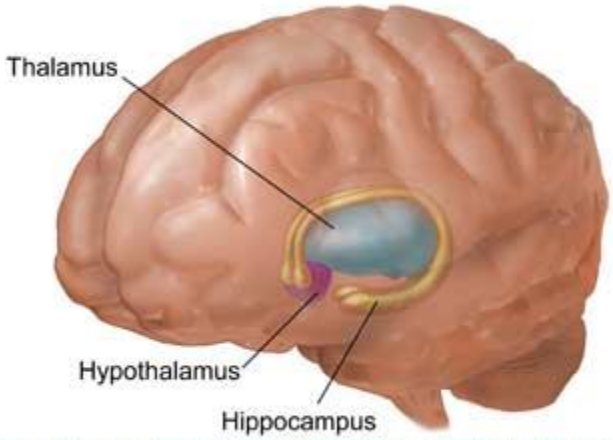


The inner brain

Structures deep within the brain control your emotions and memories. Known collectively as the limbic system, these structures come in pairs, just like the lobes in the brain's cerebrum. Each part of the limbic system is duplicated in the opposite half of the brain.

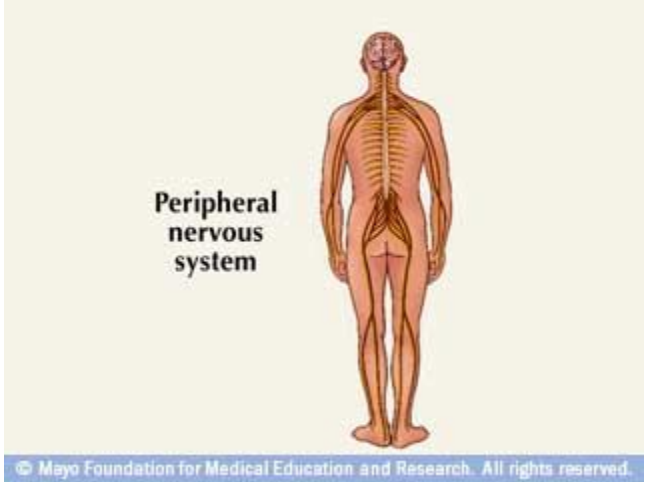
The thalamus acts as a gatekeeper for messages passed between the spinal cord and the cerebral hemispheres. The pea-sized hypothalamus controls emotions such as exhilaration and anger. It also regulates your body's temperature and is responsible for crucial urges — such as eating, sleeping and sexual behavior.

The hippocampus is a memory indexer, sending memories to be stored in appropriate sections of the cerebrum and then recalling them when necessary.



Peripheral nervous system

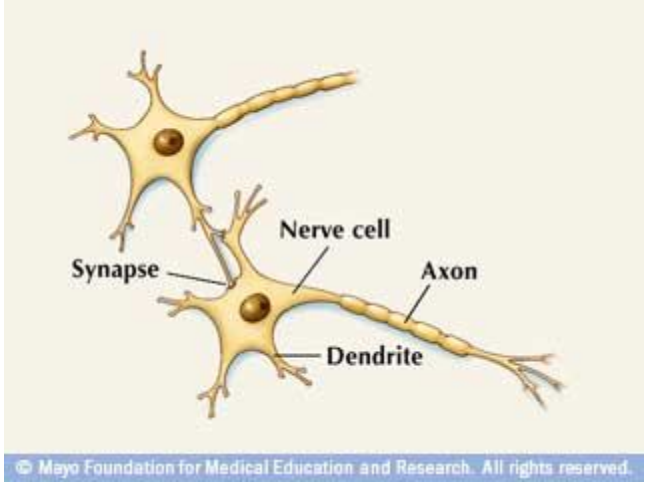
The peripheral nervous system is all the nerves in your body, aside from the ones in your brain and spinal cord. It acts as a communication relay between your brain and your extremities. For example, if you touch a hot stove, the pain signals travel from your finger to your brain in a split second. In just as short a time, your brain tells the muscles in your arm and hand to snatch your finger off the hot stove.



Nerve cells

Nerve cells (neurons) have two main types of branches coming off their cell bodies. Dendrites receive incoming messages from other nerve cells. Axons carry outgoing signals from the cell body to other cells — such as a nearby neuron or muscle cell.

Interconnected with each other, neurons are able to provide efficient, lightning-fast communication.



Neurotransmitters

A neuron communicates with other cells through electrical impulses, which occur when the nerve cell is stimulated. Within a neuron, the impulse moves to the tip of an axon and causes the release of neurotransmitters, chemicals that act as messengers.

These neurotransmitters pass through the synapse, the tiny gap between two nerve cells, and attach to receptors on the receiving cell. This process is repeated from neuron to neuron, as the impulse travels to its destination — an intricate web of communication that allows you to move, think, feel and communicate.