

Micrograph of nerve axons making contact with muscle fibers at neuromuscular junctions. The neurotransmitter acetylcholine (red) sends the signal for the muscle to contract.

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## Overview of the Nervous System

Center for  
Educational Outreach  
Baylor College of Medicine

### Overview of the Nervous System

#### Image Reference

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#### Key Words

nervous system, central nervous system, spinal cord, cerebellum, brain stem

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## Major Components of the System

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- The nervous system consists of the brain, spinal cord and a network of neurons (nerve cells).
- The system can be divided into two main components, 1) the central nervous system (CNS), comprised of the brain and spinal cord, and 2) the peripheral nervous system (PNS), which serves as the transmission connection between the CNS and the rest of the body.
- The PNS is made up of the autonomic nervous system, which control bodily functions without thought, and the sensory-somatic system, which transmits sensory information to the CNS for it to respond and send commands back to the body.



## Major Components of the System

The main parts of the nervous system are the brain, spinal cord and an extensive network of nerves. The brain and spinal cord comprise what is known as the central nervous system. There also is a peripheral nervous system (PNS), composed of nerves that communicate between the central nervous system and the rest of the body.

The PNS is divided into sensory and motor pathways. Motor pathways give rise to the autonomic nervous system, which is further partitioned into the sympathetic and parasympathetic divisions.

## References

- 1.Campbell, N.A., and Reece, J.B. (2002). *Biology, 6<sup>th</sup> Edition*. San Francisco, CA: Pearson Benjamin Cummings.
- 2.Clark, Joe O.E. (1999). *A Visual Guide to the Human Body*. London: Barnes and Noble, Inc.
- 3.OpenStax College. The Peripheral Nervous System, OpenStax-CNX CC-BY-

3.0. April 10, 2013. <http://cnx.org/content/m44751/1.3/>

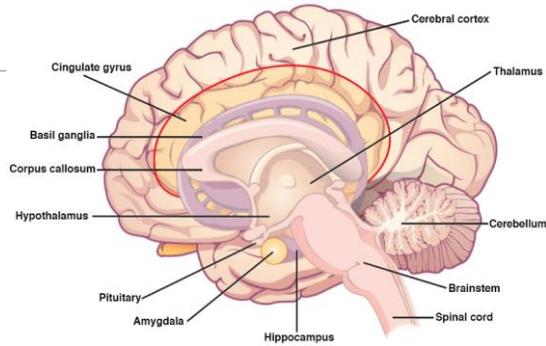
**Key Words**

nervous system, organization, central nervous system, neurons, peripheral nervous system, somatic nervous system, autonomic nervous system

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## The Brain

- The brain is the center of the nervous system in vertebrates.
- The convoluted layer of neural tissue known as the cerebral cortex is what allows higher cognitive functions.



The brain is a highly complex control system that controls virtually all functions of the human body.

- The cerebral cortex handles hearing, speech, vision, decision-making and long-term planning.
- The cerebellum helps us maintain balance and posture, and coordinates our movements, as well as playing an important role in learning and remembering new motor skills.
- The limbic system is comprised of a number of interconnected brain regions (inclusive red line) and is involved with emotions and motivations, such as survival.
- The brainstem is responsible for automatic functions of the body, such as heartbeat and breathing.



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## The Brain

The brain is the site of sense and sensation, and the part of the nervous system where higher functions, such as memory, comparison and decision-making take place. The brain is responsible for learning, feeling emotions, processing sensory information and generating commands. It also is known to control autonomic functions, such as breathing and heart rate.

## References

- 1.Campbell, N.A., and Reece, J.B. (2002). *Biology, 6<sup>th</sup> Edition*. San Francisco, CA: Pearson Benjamin Cummings.
- 2.Clark, Joe O.E. (1999). *A Visual Guide to the Human Body*. London: Barnes and Noble, Inc.
- 3.Moreno, N.P., B.T. Tharp, and T. GrandPré. (2013). *Brain Chemistry Teacher's Guide*. Houston, TX: Baylor College of Medicine.
- 4.OpenStax College. 2014. The Central Nervous system, OpenStax-CNX CC-BY-3.0. May 10, 2013. <http://cnx.org/content/m44749/1.4/>

**Image Reference**

OpenStax College. The Central Nervous System, OpenStax-CNX CC-BY-3.0. May 10, 2013. <http://cnx.org/content/m44749/1.4/>

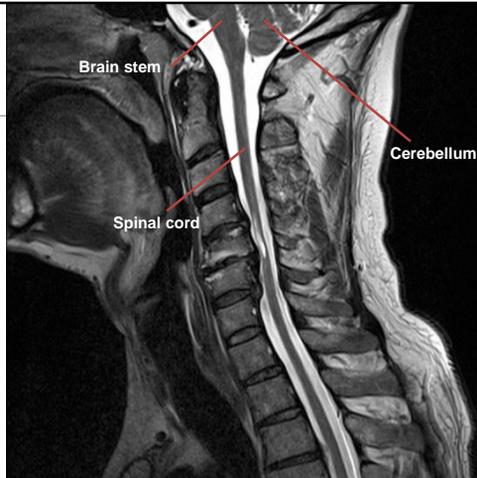
**Key Words**

nervous system, brain, cerebral cortex, cerebellum, brainstem, limbic system

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## Spinal Cord

- The spinal cord and brain make up the central nervous system.
- The spinal cord serves as a conduit for motor and sensory information to and from the brain. It also coordinates certain reflexes.
- The spinal cord is enclosed in a vertebral column of bones, also called the spine.



MRI showing sagittal view of the spinal cord extending from the lower end of the brain stem. The base of the cerebellum is visible just to the right of the brainstem.



MRI © Nuada Medical, Wellcome Images CC-BY-NC-ND 4.0.

## Spinal Cord

The spinal cord is the main trunk of the internal communications system. Roots of the body's branching network of nerves lead into and out of the spinal cord, which is enclosed and protected by the vertebral column. The spinal cord conveys information to and from the brain, and also generates basic patterns of locomotion. It can act independently of the brain to produce reflexes, automatic responses to certain stimuli.

## References

1. Campbell, N.A., and Reece, J.B. (2002). *Biology, 6<sup>th</sup> Edition*. San Francisco, CA: Pearson Benjamin Cummings.
2. Clark, Joe O.E. (1999). *A Visual Guide to the Human Body*. London: Barnes and Noble, Inc.

## Image Reference

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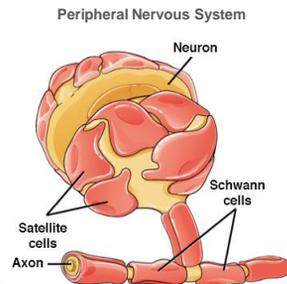
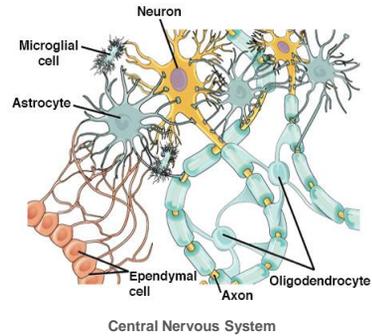
**Key Words**

nervous system, brain, spinal cord, spine, vertebrae, reflexes, sensory system

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## Neurons and Glial Cells

- Neurons are cells that receive and transmit chemical or electrical signals throughout the brain and body. They have specialized functions and come in a variety of shapes and sizes.
- Glial cells are not neurons. They are cells in the nervous system that support the development of neurons and neuron signaling. Some kinds work in the CNS, while others function in the PNS.



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### Neurons and Glial Cells

The human brain contains approximately 86 billion neurons.

### Reference

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### Image Reference

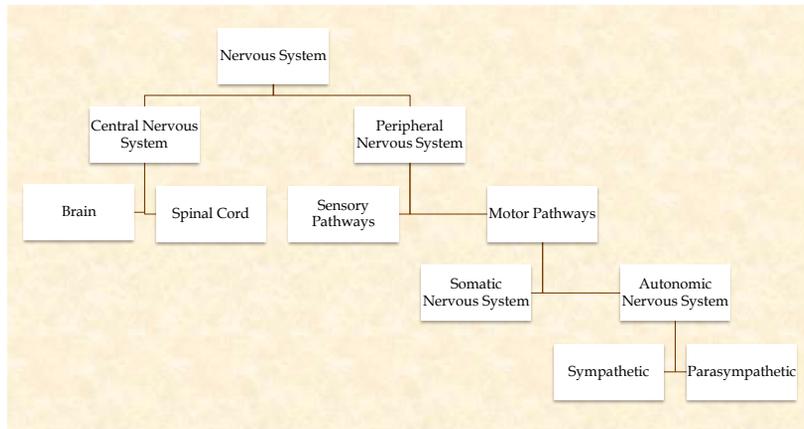
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### Key Words

nervous system, central nervous system, peripheral nervous system, neurons, glia

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# Organization



## Organization

The nervous system can be divided into two main components, the central and peripheral nervous systems. The central nervous system is made up of the brain and spinal cord, which are tightly coordinated and work together to integrate information.

The peripheral nervous system (PNS) is comprised of cranial nerves, spinal nerves and ganglia outside the central nervous system. It serves as a relay that transmits information to and from the central nervous system.

The PNS can be further partitioned into a sensory and motor pathway. The sensory pathway, also called afferent neurons, transfers sensory information to the central nervous system. The central nervous system then processes the information before it travels to muscles, glands and endocrine cells via the motor pathway, or efferent neurons.

Somatic motor neurons, which stimulate skeletal muscles to contract, are under voluntary control. Autonomic motor neurons regulate the activity of involuntary effectors, such as smooth muscles, cardiac muscle and glands.

Autonomic motor neurons are further broken down into sympathetic and parasympathetic divisions, which counterbalance each other. Activation of the sympathetic division corresponds to arousal and energy generation, also known as the “fight-or-flight” response. Activation of the parasympathetic division generally causes promotes calming and a return to self-maintenance, or “rest and digest” functions.

## **References**

- 1.Campbell, N.A., and Reece, J.B. (2002). *Biology, 6<sup>th</sup> Edition*. San Francisco, CA: Pearson Benjamin Cummings.
- 2.Clark, Joe O.E. (1999). *A Visual Guide to the Human Body*. London: Barnes and Noble, Inc.

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## Functions of the System

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- The nervous system performs three overlapping functions: sensory input, integration and motor output.
- Higher functions take place in the brain.
- The rest of the nervous system carries sensory information to, and receives commands from the brain.



## Functions of the System

Stimulation triggers sensory organs and receptors to send messages along nerves to the brain, which interprets this information and sends instructions to organs and tissues along the cranial nerves, or via the spinal cord.

Sensory nerves can end in receptors that respond to touch, temperature or chemical stimuli. The sensory input is conveyed to integration centers in the central nervous system, where it is interpreted. The integration centers then conduct the motor output to muscle or gland cells that carry out the body's responses.

## References

1. Campbell, N.A., and Reece, J.B. (2002). *Biology, 6<sup>th</sup> Edition*. San Francisco, CA: Pearson Benjamin Cummings.
2. Clark, Joe O.E. (1999). *A Visual Guide to the Human Body*. London: Barnes and Noble, Inc.

**Key Words**

nervous system, human, sensory input, motor output, stimulation, receptor, neuron

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