Nervous Tissue

Nervous tissue is the primary tissue that composes **the central nervous system** and **the peripheral nervous system**. **Neurons** are the basic unit of nervous tissue. They are responsible for sensing stimuli and transmitting signals to and from different parts of an organism. In addition to neurons, specialized cells known as **glial cells** serve to support nerve cells. As structure and function are very much intertwined within biology, the structure of a neuron is uniquely suited to its function within nervous tissue.

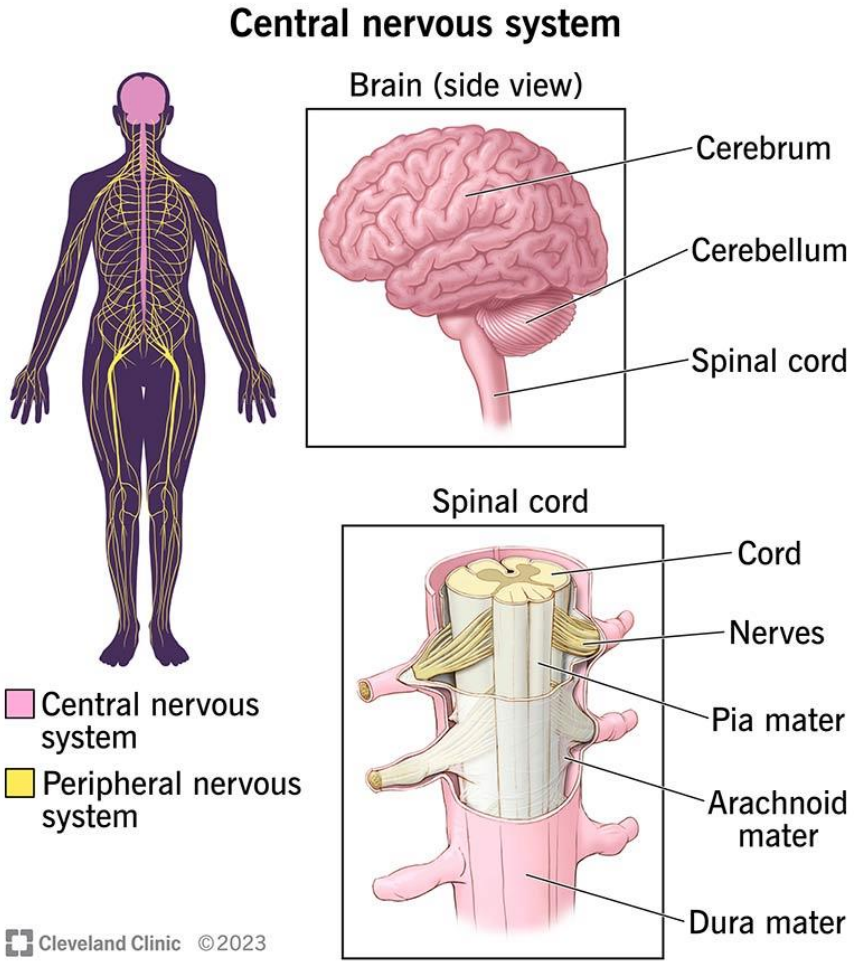
A neuron (nerve cell). The cell body is the central structure with neurites (long and thin structures) radiating outwards from it. A neurite is a general term used for processes connecting nerve cells together to form a network of nervous tissue.

1. The central nervous system

The central nervous system consists of **the brain** and the **spinal cord**. It is part of the overall nervous system that also includes a complex network of neurons, known as the peripheral nervous system. The nervous system is responsible for sending, receiving, and interpreting information from all parts of the body. The nervous system monitors and coordinates internal organ function and responds to changes in the external environment.

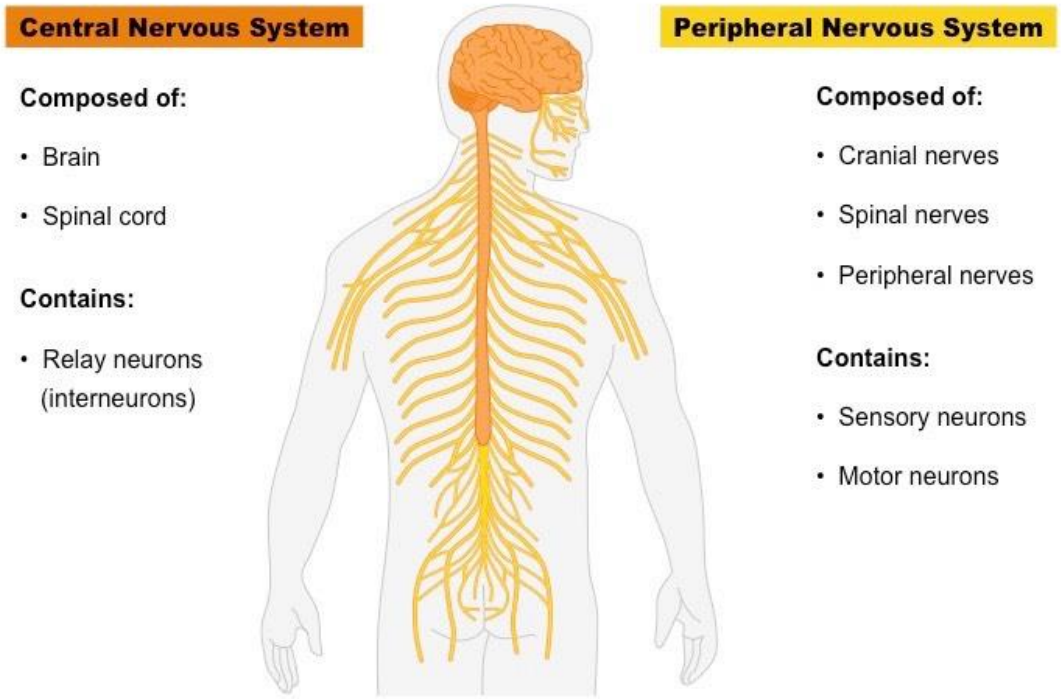
The central nervous system (CNS) functions as the processing center for the nervous system. It receives information from and sends information to the peripheral nervous system. The brain processes and interprets sensory information sent from the spinal cord. Both the brain and spinal cord are protected by a three-layered covering of connective tissue called the meninges.

Within the central nervous system is a system of hollow cavities called **ventricles**. The network of linked cavities in the brain (cerebral ventricles) is continuous with the central canal of the spinal cord. The ventricles are filled with cerebrospinal fluid, which is produced by specialized epithelium located within the ventricles called **the choroid plexus**. Cerebrospinal fluid surrounds, cushions, and protects the brain and spinal cord from trauma. It also assists in the circulation of nutrients to the brain.



2. The peripheral nervous system

There are two types of cells in the peripheral nervous system. These cells carry information to (**sensory nervous cells**) and from (**motor nervous cells**) the central nervous system. Cells of the sensory nervous system send information to the CNS from internal organs or from external stimuli. Motor nervous system cells carry information from the CNS to organs, muscles, and glands.



Somatic and Autonomic Systems

The **motor nervous system** is divided into the somatic nervous system and the autonomic nervous system. The **somatic nervous system** controls skeletal muscle, as well as external sensory organs, such as the skin. This system is said to be voluntary because the responses can be controlled consciously. Reflex reactions of skeletal muscle, however, are an **exception**. These are involuntary reactions to external stimuli.

The **autonomic nervous system** controls involuntary muscles, such as smooth and cardiac muscle. This system is also called the involuntary nervous system. The

autonomic nervous system can further be divided into parasympathetic, sympathetic, enteric divisions.

The **parasympathetic division** functions to inhibit or slow down autonomic activities such as heart rate, pupil constriction, and bladder contraction. The nerves of the **sympathetic division** often have an opposite effect when they are located within the same organs as parasympathetic nerves. Nerves of the sympathetic division speed up heart rate, dilate pupils and relax the bladder. The sympathetic system is also involved in the flight or fight response. This is a response to potential danger that results in accelerated heart rate and an increase in metabolic rate.

The **enteric division** of the autonomic nervous system controls the gastrointestinal system. It is composed of two sets of neural networks located within the walls of the digestive tract. These neurons control activities such as digestive motility and blood flow within the digestive system. While the enteric nervous system can function **independently**, it also has connections with CNS allowing for the transfer of sensory information between the two systems.

Division

The peripheral nervous system is divided into the following sections:

- **Sensory Nervous System**—sends information to the CNS from internal organs or from external stimuli.
- **Motor Nervous System**—carries information from the CNS to organs, muscles, and glands.
    - **Somatic Nervous System**—controls skeletal muscle as well as external sensory organs.
    - **Autonomic Nervous System**—controls involuntary muscles, such as smooth and cardiac muscle.

- **Sympathetic**—controls activities that increase energy expenditures.
- **Parasympathetic**—controls activities that conserve energy expenditures.
- **Enteric**—controls digestive system activity.

Connections

Peripheral nervous system connections with various organs and structures of the body are established through **cranial nerves** and **spinal nerves**. There are **12 pairs** of cranial nerves in the brain that establish connections in the head and upper body, while **31 pairs** of spinal nerves do the same for the rest of the body. While some cranial nerves contain only sensory neurons, most cranial nerves and all spinal nerves contain both motor and sensory neurons.