

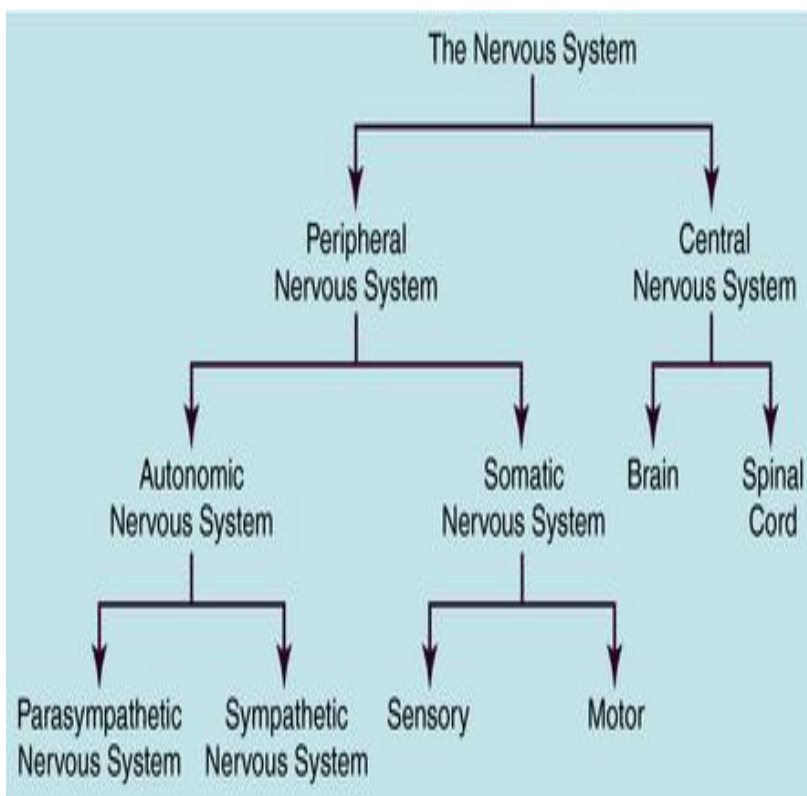
Lecture 4: Nervous system

The nervous system is divided into two main parts: the central nervous system (CNS), which consists of the brain and spinal cord, and the peripheral nervous system (PNS), which consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves and their associated ganglia.

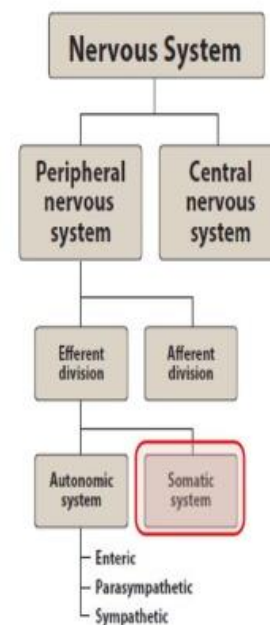
Functionally, the nervous system can be further divided into the:

Somatic nervous system, which controls voluntary activities, and the **Autonomic nervous system**, which controls involuntary activities.

The nervous system, together with the endocrine system, controls and integrates the activities of the different parts of the body.



Revision



Central Nervous System

The central nervous system is composed of large numbers of **nerve cells** and **their processes**, supported by specialized tissue called **neuroglia**.

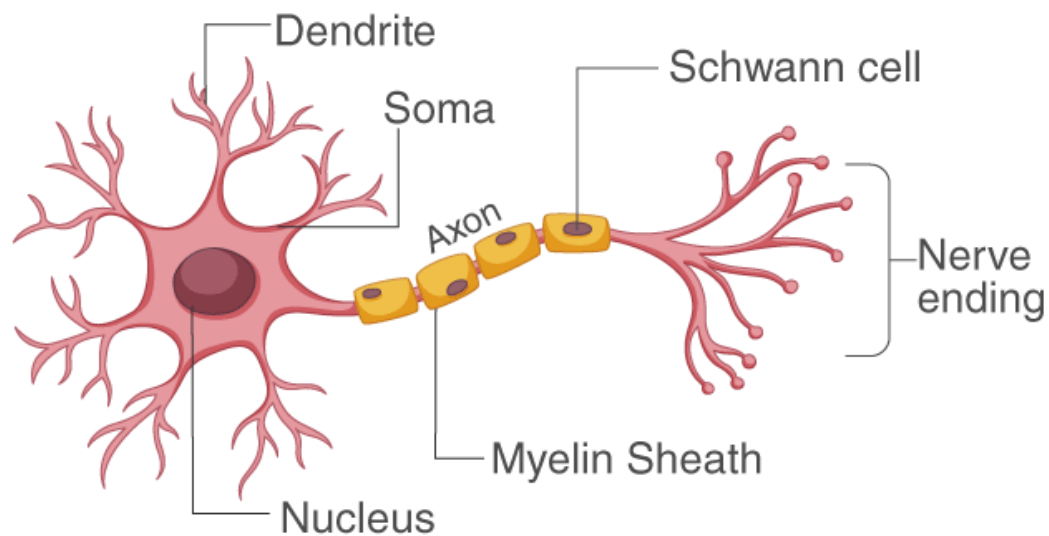
Neuron is the term given to the nerve cell and all its processes. The nerve cell has two types of processes, called dendrites and an axon.

Dendrites are the short processes of the cell body; the **axon** is the longest process of the cell body.

The interior of the central nervous system is organized into gray and white matter. Gray matter consists of nerve cells embedded in neuroglia.

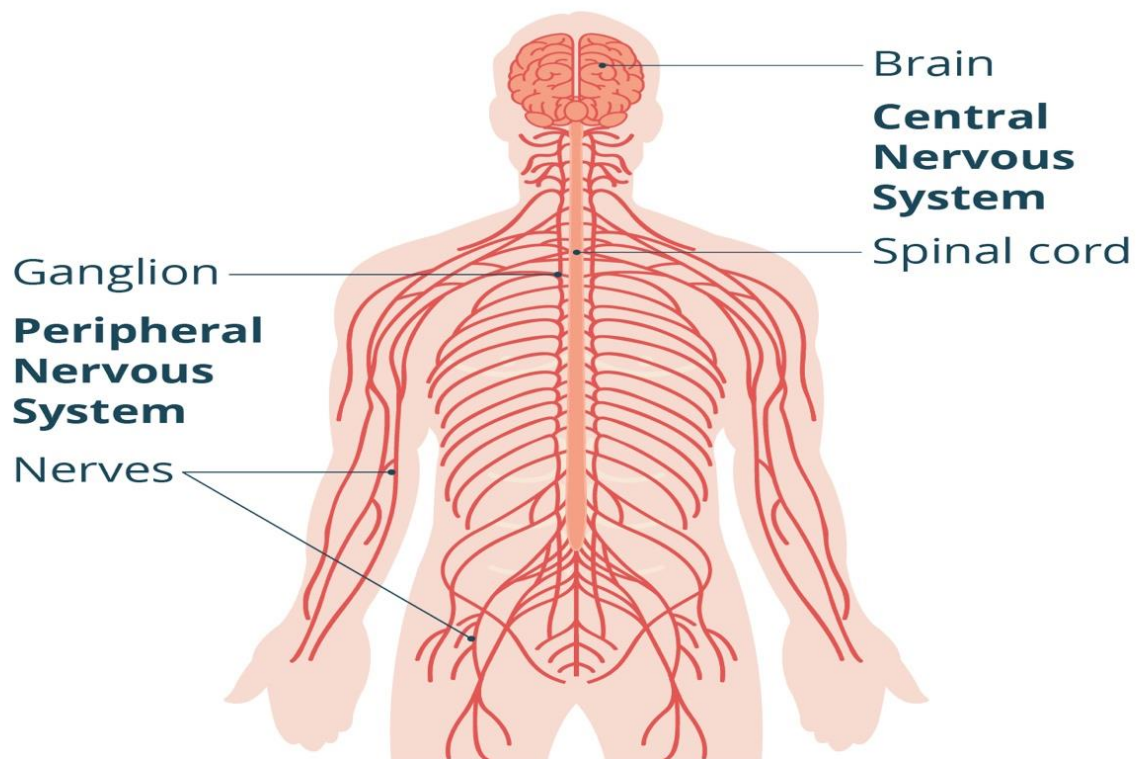
White matter consists of nerve fibers (axons) embedded in neuroglia.

STRUCTURE OF NEURON



Peripheral Nervous System

The peripheral nervous system consists of the cranial and spinal nerves and their associated ganglia. On dissection, the cranial and spinal nerves are seen as grayish white cords. They are made up of bundles of nerve fibers (axons) supported by delicate areolar tissue.



Cranial Nerves

There are 12 pairs of cranial nerves that leave the brain and pass through foramina in the skull. All the nerves are distributed in the head and neck except the Xth (vagus), which also supplies structures in the thorax and abdomen.

Spinal Nerves

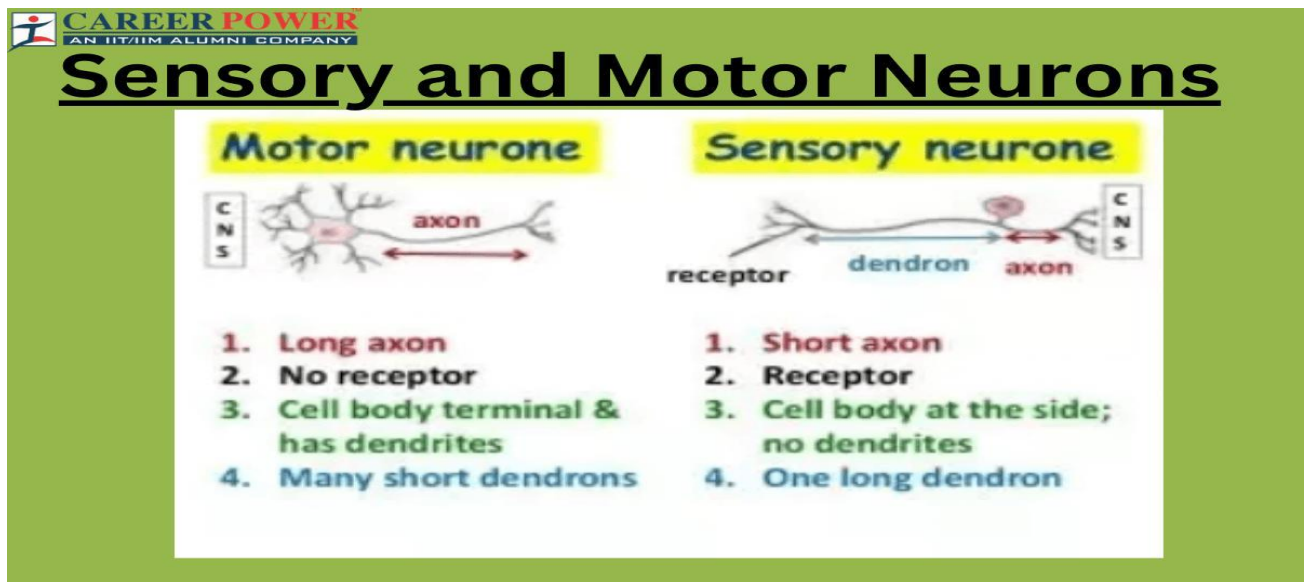
A total of 31 pairs of spinal nerves leave the spinal cord and pass through intervertebral foramina in the vertebral column

The spinal nerves are named according to the region of the vertebral column with which they are associated: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal.

Each spinal nerve is connected to the spinal cord by two roots: the anterior root and the posterior root. The anterior root consists of bundles of nerve fibers carrying nerve impulses away from the central nervous system. Such nerve fibers are called **efferent fibers**. Those efferent fibers that go to skeletal muscle and cause them to contract are called motor fibers.

The posterior root consists of bundles of nerve fibers that carry impulses to the central nervous system and are called **afferent fibers**.

Because these fibers are concerned with conveying information about sensations of touch, pain, temperature, and vibrations, they are called Sensory fibers.



Autonomic Nervous System

The autonomic nervous system is the part of the nervous system concerned with the innervation of involuntary structures such as the heart, smooth muscle, and glands throughout the body and is distributed throughout the central and peripheral nervous system. The autonomic system may be divided into two parts the **sympathetic** and the **parasympathetic** and both parts have afferent and efferent nerve fibers.

Functions of the sympathetic nervous system: Although continually active to some degree (for example, in maintaining the tone of vascular beds), the sympathetic division has the property of adjusting in response to stressful situations, such as trauma, fear, hypoglycemia, cold, and exercise.

Functions of the parasympathetic nervous system: The parasympathetic division is involved with maintaining homeostasis within the body. It is required for life, since it maintains essential bodily functions, such as digestion and elimination of wastes.

The hypothalamus of the brain controls the autonomic nervous system and integrates the activities of the autonomic and neuroendocrine systems, thus preserving homeostasis in the body.

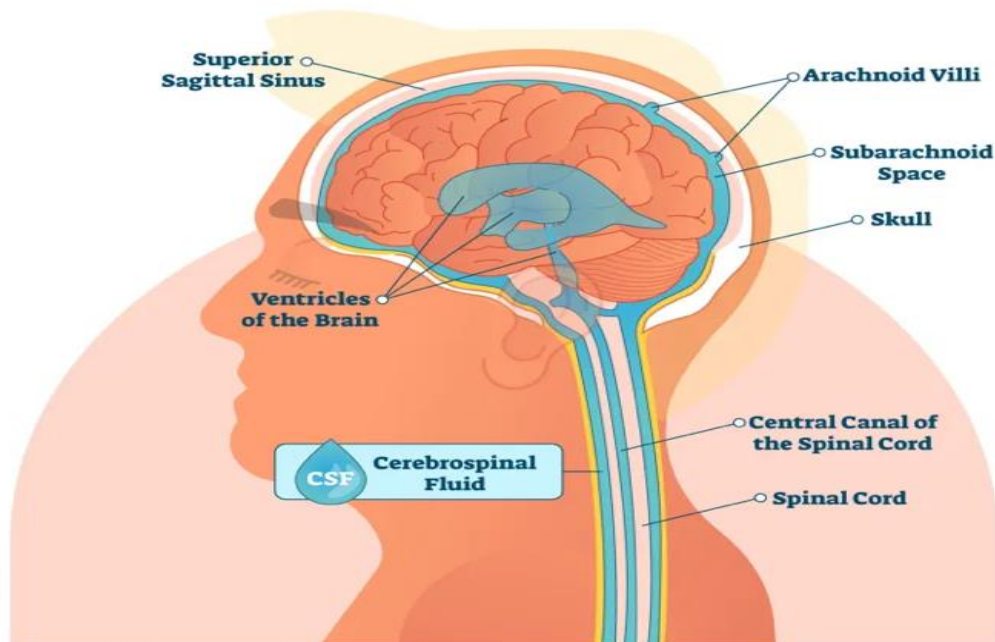
Somatic nervous system: The efferent somatic nervous system differs from the ANS in **that a single myelinated motor neuron, originating in the CNS, travels directly to skeletal muscle without the mediation of ganglia**. As noted earlier, the somatic nervous system is under voluntary control, whereas the ANS is involuntary.

The Meninges

The brain in the skull is surrounded by three protective membranes, or meninges: the dura mater, the arachnoid mater, and the pia mater. (The spinal cord in the vertebral column is also surrounded by three meninges.)

CSF (Cerebrospinal fluid): Cerebrospinal fluid (CSF, shown in blue) is made by tissue that lines the ventricles (hollow spaces) in the brain. It flows in and around the brain and spinal cord **to help cushion them from injury and provide nutrients**.

CEREBROSPINAL FLUID



Cerebrospinal fluid has three main functions:

1. CSF protects brain and spinal cord from trauma.
2. CSF supplies nutrients to nervous system tissue.
3. CSF removes waste products from cerebral metabolism.

Parts of brain

- Forebrain: The forebrain consists of the Cerebrum, Thalamus and Hypothalamus.
- Midbrain: The midbrain connects the forebrain and the hindbrain .
- Hind Brain: The hindbrain has three parts, namely - medulla oblongata, pons and cerebellum.

Cerebrum: The cerebrum is the largest part of the brain, This part ociate with higher brain functions such as thinking and action.

Diencephalon

The diencephalon is almost completely hidden from the surface of the brain. It consists of a **dorsal thalamus** and a **ventral hypothalamus**.

Thalamus: This part is for processing and relaying sensory information selectively to several parts of the cerebral cortex, as one thalamic point may reach one/several regions of the cortex.

It also plays an important part in regulating sleep and wakefulness.

Hypothalamus: This part regulates certain metabolic processes, as well as other activities of the Autonomic Nervous System. It secretes and synthesizes neurohormones (sometimes called hypothalamic-releasing hormones), and they, in turn, stimulate/inhibit the secretions of pituitary hormones. It controls hunger, thirst, anger, temperature, anger, fatigue and circadian cycles.

Mid Brain

The midbrain connects the forebrain and the hindbrain. It acts as a bridge and transmits signals from hindbrain and forebrain. It is associated with motor control, vision, hearing, temperature regulation, alertness.

Hind Brain: this part of the brain plays a role in controlling the heart rate, breathing, blood pressure, sleep and waking up functions.

The cerebellum is responsible for maintaining equilibrium, transfer of information, fine adjustments to motor actions, coordinating eye movements etc.

