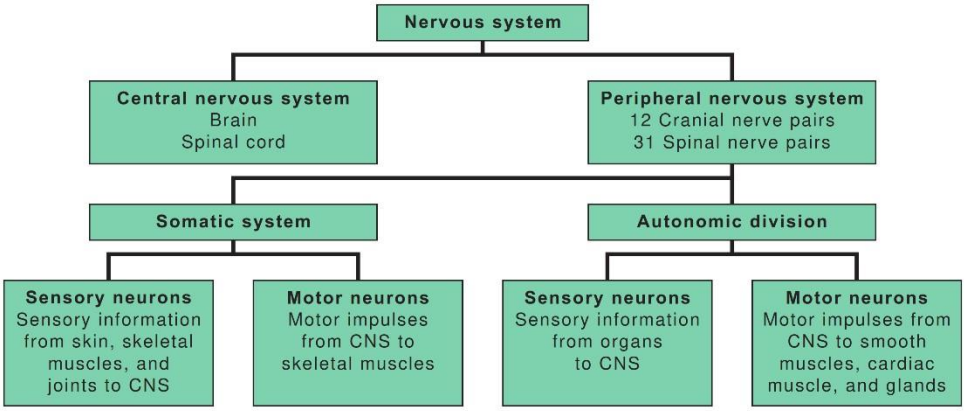
The Nervous System

The nervous system, one of the most complex systems in the body, coordinates the body's involuntary and voluntary actions. The nervous system works in conjunction with the endocrine system to maintain **homeostasis** [from homeo- "similar to" + stasis "a standing still], a term that means "a state of equilibrium." The nervous system has two main divisions: the central nervous system (CNS) and the peripheral nervous system (PNS). The CNS consists of the brain and spinal cord. The PNS, which may be divided into somatic and autonomic nervous subsystems, controls skeletal muscles by means of the cranial and spinal nerves.



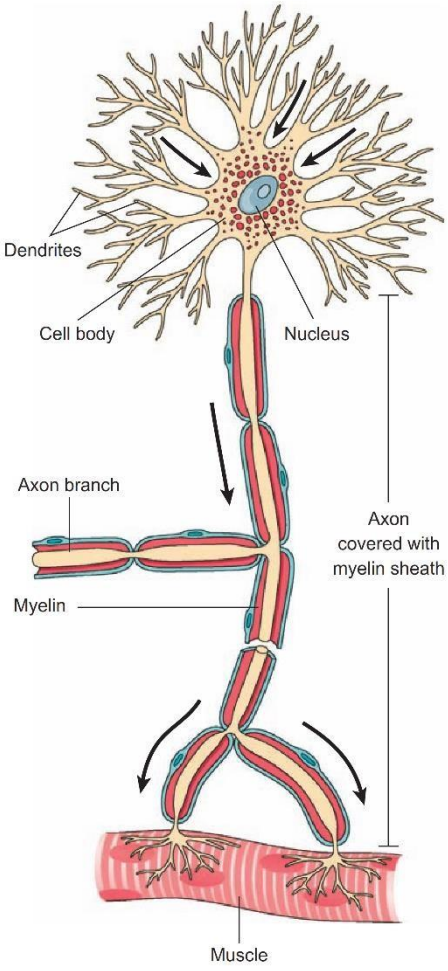
Structure and Function

Nerve tissue is composed of fundamental units called **neurons** [neur/o (nerve); -on (noun suffix)], which are separated, supported, and protected by **neuroglia** [neur/o (nerve); from the Greek glia (glue)]. Neurons carry electrical messages that coordinate the exchange of information between the body's internal and external environments, and the neuroglia offer protection and support to the nerve tissue.

The three principal parts of a neuron cell are its **cell body (soma)**, **dendrites** [from the Greek word (relating to a tree)], and **axon** [axo- (axis); -n noun ending]. The cell body contains the nucleus and receives impulses from other cells

through the dendrites. The cell body passes these messages to the axon, which conducts electrical impulses away from the cell body. The connecting points for these message transfers are called **synapses** [syn- (together); from the Greek word hapto (clasp)].

Synaptic (adjective form of synapse) connections can occur between two nerve cells. The stimulus between the two cells is usually a chemical called a neurotransmitter. Groups of neuron cell bodies within the PNS are called **ganglia** (singular: ganglion [a Greek word meaning "swelling" or "knot"]). Groups of neuron cell bodies within the CNS are called **nuclei** (singular: nucleus [a Latin word meaning "kernel"]). Groupings of axons are called nerves wherever they occur in the body. Axons are covered by the myelin sheath, a white fatty material that provides protection and electrical insulation.



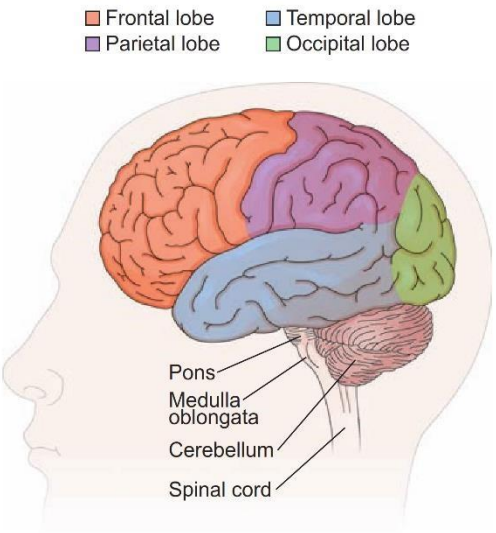
Central Nervous System

The brain is separable into left and right hemispheres each with four lobes: **frontal**, **parietal**, **occipital**, and **temporal**. The names of the lobes relate to their location relative to the skull. The major parts of the brain include the following:

Cerebrum: The cerebrum [cerebr/o (brain)], the largest part of the brain, is where memories and conscious thoughts are stored. It also directs some willed

bodily movements. An outer layer of gray matter called the cerebral cortex protects both hemispheres of the cerebrum.

Cerebellum: The cerebellum [diminutive of cerebrum], like the larger cerebrum situated above it, also inhabits both hemispheres. The cerebellum helps us perform learned body movements smoothly and helps us maintain our equilibrium.



Diencephalon: The diencephalon [di- (two); encephal/o (of or relating to the brain); -on (noun suffix)] contains both the thalamus [from the Greek word thalamus (bed, bedroom)] and the hypothalamus [hypo- (below, deficient); from the Greek word thalamus (a bed, a bedroom)]. The thalamus processes sensory information. The hypothalamus, which is the hormone and emotion center of the brain, controls autonomic functions such as heart rate, dilation of blood vessels, and hormone secretion.

Brain stem: The brain stem contains the midbrain, the pons (which is a Latin word meaning “bridge”), and the **medulla oblongata** [a Latin word (marrow); from the Latin oblongatus (oblong)]. The cavities between the brain stem and the cerebrum are called ventricles [from the Latin word ventriculus, diminutive of venter (belly)].

Peripheral Nervous System

The PNS includes 12 pairs of cranial nerves and 31 pairs of spinal nerves that run along the periphery of the body. The cranial and spinal nerves convey directions from the CNS to the PNS and carry information from the PNS back to the CNS.

Disorders of the Nervous System

Concussion (cerebral concussion: violent shaking of the brain) may result from a fall or blow to the head. A concussion may cause temporary loss of consciousness followed by a short period of **amnesia** [a- (without); -mnesia (memory)].

Cerebrovascular accident: Also known as a stroke, a cerebrovascular accident results from oxygen deprivation caused by a blockage in or rupture of a blood vessel.

Transient ischemic attack: A transient ischemic attack is a temporary interruption in the blood supply to the brain.

Aneurysm: An aneurysm [from the Greek ana (up) and eurys (broad)] is a localized dilation of an artery caused by weakness in the vessel wall or heart chamber.

Multiple sclerosis is a progressive degenerative disease with symptoms caused by demyelination, a patchy loss of the myelin sheath.

Parkinson's disease usually develops after age 60 years and occurs with the loss of the neurotransmitter dopamine, which inhibits transmission of nerve impulses.

Alzheimer's disease is a degenerative, eventually fatal condition involving atrophy of the cerebral cortex, producing a progressive loss of intellectual function.

Epilepsy is a chronic disorder characterized by recurrent seizures that result from the excessive discharge of neurons in the brain.

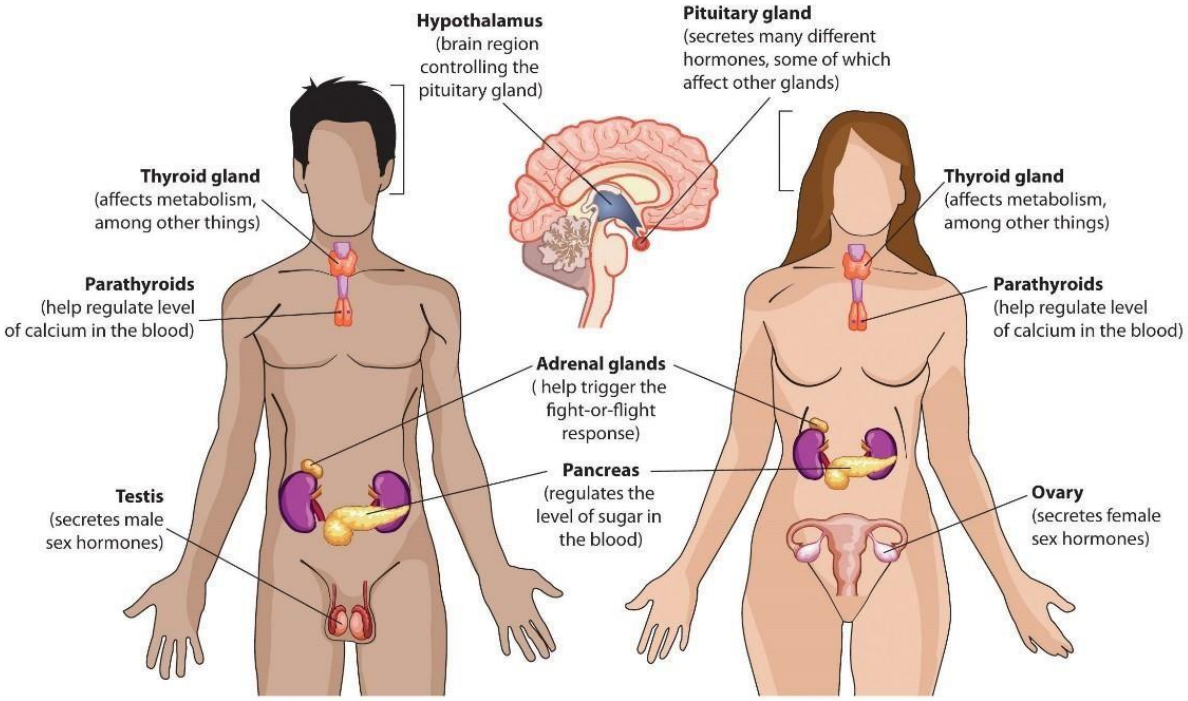
Electroencephalography: The electroencephalogram is a written record of the brain's electrical activity. It is used to document increased electrical events of the brain caused by seizures.

Lumbar puncture requires the insertion of a needle into the subarachnoid space between the third and fourth or fourth and fifth lumbar vertebrae to withdraw cerebrospinal fluid for analysis.

The Endocrine System

The **endocrine system** [endo- (within, inner); from the Greek word krino (to separate)] consists of glands that produce special chemicals called **hormones** [from the Greek word hormao (to rouse or set in motion)]. **Endocrinology** is the medical practice of treating endocrine and hormonal disorders. The practitioner, an **endocrinologist**, specializes in caring for patients with endocrine diseases and hormonal dysfunctions that may involve sexual development, body growth, or other bodily functions.

There are nine primary glands in the endocrine system: pituitary, thyroid, parathyroid, adrenal, pancreas, ovaries, testes, the pineal and thymus glands.



Pituitary Gland

The pituitary gland, also known as the **hypophysis**, is located at the base of the brain below the hypothalamus. It controls the activities of the other endocrine

glands by releasing special hormones that regulate glandular functions. The pituitary gland is divided into an anterior lobe called the **adenohypophysis** and a posterior lobe called the **neurohypophysis**.

Thyroid Gland

The thyroid is a butterfly-shaped gland that wraps around the larynx. Its main jobs are to regulate the body's metabolism and calcium levels. The thyroid produces triiodothyronine, thyroxine, and calcitonin.

Parathyroid Gland

There are four parathyroid glands consisting of a superior and inferior pair, which are located on the posterior surface of the thyroid gland.

Adrenal Glands

The **adrenal glands** consist of two triangular-shaped glands, each one located on the top of a kidney. Their position on top of the kidneys has also earned them the name **suprarenal glands**. Each gland is divided into an outer part called the **adrenal cortex** and an inner part called the **adrenal medulla**.

Pancreas

The pancreas is a feather-shaped organ located behind the stomach. It contains clusters of specialized cells called the **islets of Langerhans**, which produce insulin and glucagon. The function of the islet cells is to control blood sugar levels and glucose metabolism throughout the body.

Gonads

The ovaries and testes are the female and male gonads, respectively.

Disorders and Treatments

Disorders of the endocrine system are almost always the result of an excess or deficit in hormone production. In other words, either too little or too much of a hormone causes a problem.

Benign adenoma that causes too much of a hormone to be secreted. This condition may also destroy pituitary cells and cause too little hormone production.

Gigantism [giant (common English word); -ism (condition)] is an abnormal overgrowth of the body or any of its parts, and **acromegaly** [from the Greek akron (extremity); -megaly (enlargement)] is enlargement of the extremities (mostly hands and feet). Both conditions are caused by excessive secretion of the growth hormone.

Hypothyroidism is characterized by a decrease in thyroid function.

Hyperthyroidism: is characterized by an increase in thyroid function.

Cushing's syndrome is caused by an excessive amount of adrenal hormone secretion or by steroids administered as a treatment for other conditions.

Diabetes mellitus [diabetes, a Greek word meaning "a siphon"; mellitus, a Latin word meaning "sweetened with honey"] is a major health problem that can produce lifelong effects. There are two main types: **Type 1 diabetes mellitus** is a metabolic disorder caused by insufficient production of insulin. **Type 2 diabetes mellitus** is an insulin-resistant disorder that occurs when the pancreas produces insulin, but the body fails to use it effectively.