



## The Central Nervous System <sup>[1]</sup>

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The human body is composed of various systems working together to function as a whole. These body systems are interconnected by one crucial control system – the nervous system. The nervous system is divided into two: the Central Nervous System and the Peripheral Nervous System. In this article, we will focus on the structures and functions of the central nervous system.

The central nervous system or CNS is comprised of two major body organs – the brain and the spinal cord. These two extremely important organs make cognition, sensation, movement and other physiological functions possible.

### **White Matter and Gray Matter**

The brain and the spinal cord possess both white matter and gray matter. White matter involves various bundles of axons. Axons are parts of nerve cells where impulses are conducted away from the cells. They are described as long and threadlike. They are covered by the myelin sheath, which acts as a shock absorber. On the gray matter is comprised of cell bodies and dendrites. It is in the cell bodies that the sensory information is processed, whereas the dendrites function as receivers of the impulses from the synapses to the nerve cells. Dendrites are connected to synapses, which act as junctions between two nerve cells. The gray matter is inside the spinal cord, while the white matter is on the surface. This pattern is reversed in the brain.

### **The Brain**

The human brain is an amazing control center that includes various units where sensory information from the 12 pairs of cranial nerves and the spinal cord are received and processed. The brain does not only function as a data processor; it also initiates coordinated and appropriate motor information as it sends its “feedback” to the spinal cord and the nerves. The brain is divided into regions.

The rhombencephalon (hindbrain) includes the cerebellum, medulla oblongata, pons and reticular formation. The cerebellum serves as a coordinator of body movements. The medulla oblongata is a swollen-tip looking structure that is responsible for breathing, heartbeat regulation, and blood flow regulation. The pons acts as a relay station that transmits signals from the receptors of the eyes, ears and skin to the cerebellum. Finally, the reticular formation

is responsible for sleep, arousal and vomiting.

The mesencephalon (midbrain) includes the reticular formation, the ventral tegmental area (VTA) and the substantia nigra. The VTA has dopamine-release neurons and is involved in pleasure and addiction. On the other hand, the substantia nigra is essential in smoothing the body movements. The term “brainstem” applies to the combination of the midbrain, medulla and pons.

The prosencephalon (forebrain) has two hemispheres named telencephalon. The right telencephalon’s stimulation is reflected at the left side of the body and vice versa. Beneath the cerebrum is the diencephalon, which consists of the thalamus (relay center for all sensory input except smell) the lateral geniculate nucleus (processor of signals from optic nerves), hypothalamus (secretor of stimulating hormones for body chemistry, temperature, etc.), pituitary gland (“master gland” that receives stimulating hormones from the hypothalamus), limbic system (includes hippocampus for long term memory formation and amygdala for emotion regulation).

## The Spinal Cord

The spinal cord has two main functions – (1) conduction of sensory information from the somatic and autonomic peripheral nervous system to the brain, and (2) conduction of motor information from the brain to the effectors, such as the muscles (skeletal, cardiac and smooth) and glands. The spinal cord is also a minor reflex center that performs simple reflexes.

The cerebrospinal fluid or CSF is secreted in the choroid plexus located in each ventricle of the brain. The CSF flows through the CNS <sup>[3]</sup>via the system of four brain ventricles and the central cerebrospinal canal of the spinal cord normally without any interruption.

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