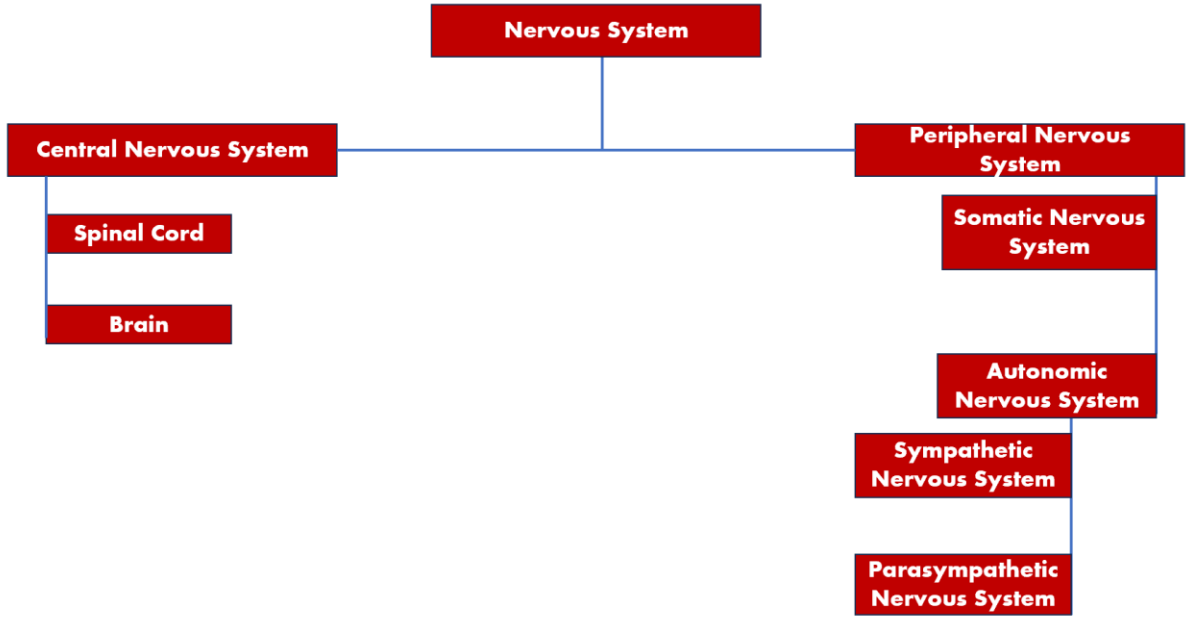
Aim: To study the nervous system using specimen, models, etc

Reference:

1. Waugh Anne and Grant Allison; "Ross and Wilson, Anatomy and Physiology in health and illness" Churchill Livingstone, ninth edition, 2003
2. Tortora G. J., Derrickson B. "Principles of Anatomy and Physiology", John Wiley and Sons, eleventh edition

Theory: The nervous system is a complex network of specialized cells, tissues, and organs that coordinate and regulate the functions of the body. It is divided into two main parts: the central nervous system (CNS) and the peripheral nervous system (PNS).



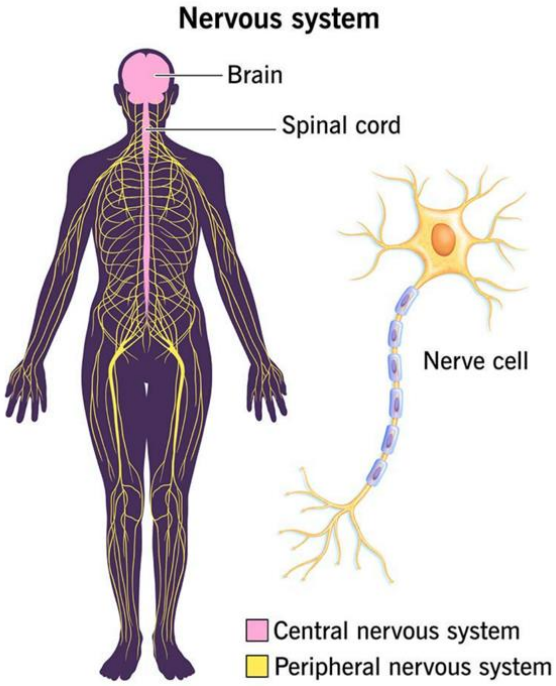
1. Central Nervous System (CNS)

The central nervous system (CNS) is the main control center of the human body, consisting of the brain and spinal cord. It plays a fundamental role in processing sensory information, coordinating responses, and regulating bodily functions.

Types of Central Nervous System:

- Brain:

- The brain is the most complex and vital organ of the CNS, responsible for a wide range of functions including sensory processing, motor control, cognition, emotion, and homeostasis.



- It is divided into several distinct regions, each with specialized functions:

- Cerebrum: Largest part of the brain, divided into left and right hemispheres. It controls conscious thought, voluntary movements, sensory perception, and higher cognitive functions such as memory, language, and problem-solving.

- Cerebellum: Located beneath the cerebrum, the cerebellum coordinates voluntary movements, balance, posture, and motor learning.

- Brainstem: Connects the brain to the spinal cord and consists of the midbrain, pons, and medulla oblongata. It regulates essential functions such as breathing, heart rate, blood pressure, and sleep-wake cycles.

- Limbic System: A group of structures within the cerebrum involved in emotion, behavior, motivation, learning, and memory.

- Spinal Cord:

- The spinal cord is a cylindrical bundle of nerve fibers extending from the brainstem to the lumbar region of the vertebral column.

- It serves as a conduit for nerve impulses traveling to and from the brain and is involved in reflex actions, such as withdrawing a hand from a hot surface or adjusting posture in response to sudden changes in balance.

- The spinal cord also plays a crucial role in transmitting sensory information to the brain and motor commands from the brain to the rest of the body.

Functions of the Central Nervous System:

- Sensory Processing: The CNS receives sensory information from sensory organs (e.g., eyes, ears, skin) and processes it to generate a perception of the external environment.

- Motor Control: It sends signals from the brain to muscles and glands via motor neurons, controlling voluntary movements, involuntary actions (e.g., heartbeat, digestion), and glandular secretion.

- Integration of Information: The CNS integrates sensory input with stored memories, emotions, and learned behaviors to generate appropriate responses to stimuli.

- Homeostasis: It regulates and maintains a stable internal environment by controlling vital functions such as body temperature, blood pressure, fluid balance, and metabolism.

- Higher Cognitive Functions: The CNS is responsible for complex mental processes such as attention, memory, language, problem-solving, decision-making, and emotional regulation.

- Consciousness and Awareness: The CNS enables consciousness, awareness of self and the surrounding environment, and subjective experiences such as thoughts, feelings, and perceptions.

- Emotional Regulation: Brain structures within the CNS, such as the limbic system, play a critical role in processing emotions, mood regulation, and behavioral responses to emotional stimuli.

2. Peripheral Nervous System (PNS)

The peripheral nervous system consists of all nervous tissue outside of the brain and spinal cord. It includes nerves, ganglia (clusters of nerve cell bodies), and sensory receptors located throughout the body. The PNS connects the CNS to sensory organs, muscles, glands, and other tissues, facilitating communication and coordination of bodily functions.

Types of Peripheral Nervous System:

- Somatic Nervous System (SNS):

- The somatic nervous system controls voluntary movements and transmits sensory information from the body's sensory organs to the CNS.

- It consists of sensory neurons that convey information about touch, pain, temperature, and proprioception (awareness of body position) to the CNS.

- Motor neurons of the SNS transmit commands from the CNS to skeletal muscles, enabling voluntary movements and reflex actions.

- Autonomic Nervous System (ANS):

- The autonomic nervous system regulates involuntary bodily functions such as heart rate, digestion, respiratory rate, and glandular secretion.

- It operates largely outside of conscious control and is divided into two branches:

- Sympathetic Nervous System (SNS): Activated during stress or emergencies ("fight or flight" response), it increases heart rate, dilates pupils, and redirects blood flow to muscles.

- Parasympathetic Nervous System (PNS): Counterbalances the sympathetic system, promoting relaxation and digestion, decreasing heart rate, and constricting pupils.

- Enteric Nervous System (ENS):

- The enteric nervous system is a complex network of neurons within the gastrointestinal tract that regulates digestive processes independently of the CNS.

- It controls gut motility, secretion, and blood flow, playing a crucial role in digestion, absorption, and elimination of food.

Functions of the Peripheral Nervous System:

- Sensory Input: The PNS collects sensory information from sensory receptors located throughout the body, including the skin, muscles, joints, organs, and special sensory organs (e.g., eyes, ears).

- Motor Output: It transmits motor commands from the CNS to muscles and glands, controlling voluntary movements, involuntary actions, and glandular secretion.

- Reflex Responses: The PNS coordinates reflex actions, rapid and automatic responses to stimuli that help protect the body from harm (e.g., withdrawing a hand from a hot surface).

- Homeostasis: By regulating autonomic functions such as heart rate, blood pressure, and digestion, the PNS helps maintain internal balance and stability (homeostasis) within the body.

- **Emotional and Physiological Responses:** The autonomic nervous system influences emotional and physiological responses to stress, fear, arousal, and other stimuli, preparing the body for appropriate reactions.

- **Digestive Regulation:** The enteric nervous system controls gastrointestinal motility, secretion, and blood flow, ensuring efficient digestion, absorption, and elimination of nutrients.