

Overview of the Nervous System

Divisions of the Nervous System

Central Nervous System (CNS)	Brain and spinal cord; responsible for processing and coordinating neural functions.
Peripheral Nervous System (PNS)	Nerves and ganglia outside the CNS; connects the CNS to limbs and organs.
Somatic Nervous System	Controls voluntary movements of skeletal muscles.
Autonomic Nervous System (ANS)	Regulates involuntary functions (heart rate, digestion, etc.).
Sympathetic Nervous System	"Fight or flight" response; prepares the body for stress.
Parasympathetic Nervous System	"Rest and digest"; conserves energy and maintains homeostasis.

Key Functions

<ul style="list-style-type: none">Sensory Input: Gathering information from the environment through receptors.
<ul style="list-style-type: none">Integration: Processing sensory information in the brain and spinal cord.
<ul style="list-style-type: none">Motor Output: Responding to processed information via muscle contraction or glandular secretion.
<ul style="list-style-type: none">Homeostasis: Maintaining stable internal conditions.
<ul style="list-style-type: none">Mental Activity: Consciousness, thinking, memory, and emotions.

Cells of the Nervous System

Neurons: Structure and Function

Cell Body (Soma)	Contains the nucleus and other organelles.
Dendrites	Receive signals from other neurons.
Axon	Transmits signals away from the cell body.
Myelin Sheath	Insulates the axon, speeding up signal transmission.
Nodes of Ranvier	Gaps in the myelin sheath where action potentials occur.
Axon Terminal	Releases neurotransmitters to communicate with other neurons or target cells.

Neuroglia (Glial Cells)

Astrocytes: Support neurons, regulate the chemical environment, and form the blood-brain barrier.
Oligodendrocytes: Form the myelin sheath in the CNS.
Schwann Cells: Form the myelin sheath in the PNS.
Microglia: Immune cells of the CNS; phagocytize pathogens and cellular debris.
Ependymal Cells: Line the ventricles of the brain and produce cerebrospinal fluid.

Neural Communication

Action Potential

A rapid, short-lasting change in membrane potential that travels along an axon. It involves depolarization and repolarization.
Resting Membrane Potential: -70mV
Threshold: -55mV
Depolarization: Na ⁺ influx, membrane potential becomes more positive.
Repolarization: K ⁺ efflux, membrane potential returns to resting state.
Hyperpolarization: Brief period when membrane potential is more negative than resting potential.

Synaptic Transmission

Presynaptic Neuron	Neuron that sends the signal.
Postsynaptic Neuron	Neuron that receives the signal.
Synaptic Cleft	Gap between the presynaptic and postsynaptic neurons.
Neurotransmitters	Chemicals that transmit signals across the synaptic cleft.
Receptors	Proteins on the postsynaptic neuron that bind to neurotransmitters.

Brain Structure and Function

Major Brain Regions

Cerebrum	Largest part of the brain; responsible for higher-level functions such as thought, language, and memory.
Cerebellum	Coordinates movement and balance.
Brainstem	Connects the brain to the spinal cord; controls basic life functions such as breathing and heart rate.
Diencephalon	Includes the thalamus and hypothalamus; relays sensory information and regulates homeostasis.

Lobes of the Cerebrum

Frontal Lobe: Responsible for planning, decision-making, and motor control.
Parietal Lobe: Processes sensory information such as touch, temperature, and pain.
Temporal Lobe: Involved in auditory processing, memory, and language comprehension.
Occipital Lobe: Processes visual information.