



PHARMACOLEARN

It's Important to Know!

BP201T — Human Anatomy and Physiology II

B.Pharm Semester 2 · Unit 1 — Nervous System

Unit I: Nervous System

The nervous system receives information, processes it and coordinates responses. Study it through organisation, cells, electrical signals, synapses and the central nervous system.

Organisation of the nervous system

The central nervous system consists of the brain and spinal cord. The peripheral nervous system consists of nerves and ganglia outside the central nervous system. The peripheral system includes sensory pathways that carry information toward the central nervous system and motor pathways that carry commands away from it.

The somatic motor system controls skeletal muscle. The autonomic nervous system regulates smooth muscle, cardiac muscle and glands. The autonomic system is divided into sympathetic and parasympathetic divisions. The enteric nervous system coordinates much of the activity of the gastrointestinal tract.

Neurons and neuroglia

A neuron has a cell body, dendrites and an axon. Dendrites usually receive signals, while an axon conducts signals away from the cell body. Axons may be myelinated or unmyelinated. Myelin increases conduction speed, and gaps in myelin are called nodes of Ranvier.

Neuroglia support neurons. Astrocytes help maintain the chemical environment and contribute to the blood-brain barrier. Oligodendrocytes form myelin in the central nervous system, while Schwann cells form myelin in the peripheral nervous system. Microglia have immune functions in the central nervous system. Ependymal cells line ventricles and are associated with cerebrospinal fluid.

Nerve fibres and electrophysiology

The resting membrane potential results from ion concentration gradients and selective membrane permeability. A stimulus that reaches threshold can generate an action potential. Depolarisation is followed by repolarisation and a brief period of altered excitability called the refractory period.

A nerve impulse propagates along the axon. Myelinated fibres conduct by saltatory conduction, in which the impulse appears to jump between nodes of Ranvier. The action potential follows the

all-or-none principle in a single axon, while stimulus intensity can be represented by recruitment of more fibres.

Receptors, synapses and neurotransmitters

Receptors detect changes in the internal or external environment. Mechanoreceptors detect mechanical deformation, thermoreceptors detect temperature, chemoreceptors detect chemical stimuli, photoreceptors detect light and nociceptors respond to potentially damaging stimuli.

A synapse is a junction where a neuron communicates with another neuron, muscle cell or gland cell. At a chemical synapse, an action potential opens calcium channels, vesicles release neurotransmitter and the neurotransmitter binds postsynaptic receptors. Signal termination occurs by enzymatic breakdown, reuptake or diffusion.

Brain, meninges and cerebrospinal fluid

The meninges are dura mater, arachnoid mater and pia mater. The ventricles are connected cavities containing cerebrospinal fluid. Cerebrospinal fluid cushions the central nervous system, supports the chemical environment and helps remove waste. Excess accumulation can increase intracranial pressure.

The cerebrum supports conscious perception, voluntary movement, language and higher cognitive functions. The brain stem contains pathways and centres important for vital functions. The cerebellum coordinates movement, posture and balance.

Spinal cord and reflex activity

The spinal cord carries ascending sensory and descending motor pathways. A reflex arc includes a receptor, sensory neuron, central synapse or processing region, motor neuron and effector. Reflex activity can occur rapidly because the response does not require conscious processing before the initial action.

Unit I: Frequently asked questions

Q: What is the difference between the central and peripheral nervous systems?

A: The central nervous system consists of the brain and spinal cord. The peripheral nervous system consists of nerves and ganglia outside them.

Q: What is saltatory conduction?

A: Saltatory conduction is rapid impulse transmission along a myelinated axon in which depolarisation is regenerated at the nodes of Ranvier.

Q: What are the three meninges?

A: The meninges are dura mater, arachnoid mater and pia mater.

Unit I: Key takeaways

- The central nervous system is the brain and spinal cord.
- Neurons conduct signals and neuroglia support neural function.
- Action potentials depend on membrane ion gradients and threshold.
- Synapses transfer signals to neurons, muscles or glands.

- Reflex arcs provide rapid patterned responses.

Unit I: Clinical correlation

Clinical correlation: reflex testing. A reflex examination tests the integrity of sensory receptors, peripheral nerves, spinal segments, motor pathways and muscles.