Control and Coordination

Control and Coordination in Humans

In human beings, the control and coordination take place through the nervous system and the endocrine system that produce and secrete hormones. The five sense organs in our body, eyes, ears, nose, tongue and skin are called receptors and these organs functions by receiving information from the environment around us. Therefore, the response and coordination in both humans and animals involve the sense organs, the nervous system and hormones.

What is the Nervous system?

The nervous system consists of nerve fibres and nerve cells which transmit impulses of the nerve between different parts of the body.

It is a system found in animals that synchronizes its functions by passing signals to and from different parts of the body.

It is brought about by the nervous system after it detects any physical response on any part of the body due to various changes such as temperature, pressure, light, etc.

Furthermore, the nervous system coordinates with the endocrine system to react accordingly. This system of control and coordination is brought about after the involvement of various internal systems working in sync to respond in accordance.

The neuron is the structural and functional unit of the nervous system. It receives and transmits electrical nerve impulses. A neuron comprises of :

- cell body
- dendrites
- axon

The cell body consists of a nucleus and granular cytoplasm called Nissl's granules.

Dendrites are several branched, finger-like projections that transmit nerve impulse towards the cell body.

The axon arises from the cell body which is branched at the distal end. The cells of the axon are called Schwann cells which are covered by a myelin sheath. The space between the myelin sheath is known as Nodes of Ranvier. The end of the axon contains bulb-like structures called the Synaptic Knob.

Parts of the Nervous System

Vertebrates have a distinct nervous system, which is divided into two main parts:

- Central Nervous System (CNS)
- Peripheral Nervous System (PNS)

Central Nervous System

It consists of the brain and spinal cord. Generation of sensory emotions takes place here. Thoughts and emotions are produced, leading to the formation of memories. It gathers information from all over the body and syncs its activity accordingly. Apart from sensory motions, it also controls the rate at which we breathe, heart rate, the temperature of the body, etc.

Peripheral Nervous System

Everything apart from the brain and spinal cord constitutes the PNS. It includes nerves and everything that goes down the spinal cord. It is responsible for bringing information from all parts of the body to the brain. The nerves in the PNS are known as peripheral nerves, and these nerves connect our sense organs and all other organs, blood vessels, etc., to the CNS.

Organs of the Human Nervous System

The human nervous system consists of the following organs:

- Brain
- Spinal cord
- Nerves

Brain

Our brain controls all the actions of the body. It receives the signals from the sensory organs It comprises of three parts:

- Forebrain
- Midbrain
- Hindbrain

Forebrain helps in the control and coordination of all the voluntary functions and is the thinking part of the brain.

Midbrain transmits signals from the hindbrain and forebrain.

It helps in controlling the vision, hearing, temperature, etc.

The hindbrain controls and coordinates the heart rate, blood pressure, breathing, walking, sleeping, etc.

Spinal Cord
The spinal cord is a thick nerve located in the cavity of the backbone. Its upper end is connected to the brain. It is connected to all the parts of the body through nerves and controls all the functions of the body by transmitting the information received through the sensory organs to the brain.

Nerves
The nerves connect the brain and spinal cord to all parts of the body. There are three types of nerves in our body:

- Cranial Nerves connect all parts of the head to the brain.
- Spinal Nerves connect all parts of the body to the spinal cord.
- Visceral Nerves connect the spinal cord to the internal organs.

Functions of the Nervous System
The main function of a nervous system is the conduction and transmission of the nerve impulse.

Conduction and Transmission of Nerve Impulse
The information is carried in the form of a nerve impulse. It refers to any electrical, chemical, or mechanical disturbances created by a stimulus in a neuron. A nerve impulse is conducted across the synapse with the help of neurotransmitters.

A neuron is non-conducting. Its membrane is positive on the outside and negative on the inside. The resting potential of a neuron is 70 to 90. The membrane is thus said to be polarized.

Sodium-potassium pump operates to maintain the resting potential. The axon which is filled with axoplasm is immersed in the extracellular fluid. The sodium-potassium pump located on the membrane of the axon pumps 3 sodium ions from axoplasm to extracellular fluid and 2 potassium ions from extracellular fluid to axoplasm. The conduction is mediated by the enzyme Sodium-potassium ATPase.

When a stimulus is applied, the sodium ions start rushing inside and the potassium ions start rushing outside. This changes the permeability of the axon membrane and the pump stops operating. The resting potential inside the membrane is -70mV and the

action potential is +30mV and the membrane is said to be depolarized. The action potential travels along the membrane and this is known as a nerve impulse.

After a certain time of action potential, the sodium-potassium pump operates again and the membrane of the axon gets repolarized by the resting potential.

Reflex Action and Reflex Arcs

Reflex action includes all the actions that are not under the control of our will. That means these actions are voluntary. For eg., sneezing, coughing, blinking, etc. It is an automatic response to a stimulus.

Reflex arc refers to the pathways taken by nerve impulses in a reflex action. There are two types of reflexes- spinal reflexes that involve only the spinal cord, and the cerebral reflexes that involve only the brain.

The sensory neurons transmit signals from the sensory organ to the relay neuron present in the spinal cord. These signals are sent back to the muscles through the motor neuron. The muscles attached to the sense organ move the organ away from danger.

Hormones in Animals

The endocrine system in animals consists of endocrine glands and hormones. Hormones are chemical substances that are produced in the endocrine system and are responsible for passing signals/messages to different parts as a result of an occurrence in the body, which results in different parts reacting differently to the message from hormones. Not all cells in the body react to hormones, the cells who react are called target cells.

Functions of hormones in Animals

- Ensures proper growth
- Responsible to look after the maturing and development in a proper time frame
- Makes sure reproduction happens at the right time
- For instance, Thyroid secretes two hormones: Thyroxine (T4) and Thyronine (T3) which affects everyday metabolism.

Plants don’t possess the same organs and organ systems found in animals. However, they do have comparable systems to bring similar functions. Continue reading to know more about how plants bring about control and coordination in their systems.

Control and Coordination in Plants

Plants do coordinate, but in a different way than animals. Some plants are short, some are tall, some dense and some scanty. All these parameters are influenced by the presence of hormones called plant hormones. These hormones are also called phytohormones or Plant growth regulators. Phytohormones are responsible for control and coordination in plants. This movement is always in a controlled and organized environment.