Control & Co-ordination

Living organisms respond and react to various stimuli like heat, light, cold, touch, pressure etc.

For example -

Take off the hand on touching a hot object.

Catching a ball by a fielder.

The response which a living being makes in relation to external stimuli is called control and coordination.

It is Nervous System which is mainly responsible for control and coordination in complex animals.

Nervous System

Nervous system is mainly composed of brain, spinal cord and nerves. Though five sense organs (nose, eyes, ears, tongue and skin) are also a part of nervous system and play a very important role in nervous system.

Functions of Nervous System

Receive the information from environment by sense organs.

Transportation of information to brain through spinal cord and nerves.

After analyzing the information, it reacts accordingly through muscles and glands.

For example when we touch a hot object, our skin helps us to sense the heat, the nerves carry the impulse to the brain through spinal cord, and then the brain sends impulse to the muscles to contract and take off the hands.

Receptors

Receptors are group of cells present in sense organs which are sensitive to change in environment.

There are five types of receptors which are responsible for sensing the change in environment.

Gustatory Receptors: Responsible for taste detection.

Phono Receptors: Responsible for hearing.

Olfactory Receptors: Responsible for smell detection.

Photo Receptors: Responsible for detecting light.

Thermo Receptors: Responsible for feeling the touch of external stimuli.

Neuron

Neurons are specialized cells which are combined to form nerves of the nervous system. As nerves are emerged from brain and spinal cord and branch out to almost all parts of the body, so neuron is also called unit of nervous system.

The neuron consists of the following parts:

Cell Body: This main part has all of the necessary components of the cell, such as the nucleus, endoplasmic reticulum, ribosome and mitochondria. If the cell body dies, the neuron dies.

Axon: This is a long cable like projection of the cell along the length of the cell. It ends in several hair-like structures; called axon terminals/ axon endings. The axon terminals relay nerve impulses.

Dendrites: These small branch-like projections of the cell make connections to other neuron and receive the nerve impulses.

Synapse: The point of contact between the terminal branches of axon of one neuron with the dendrite of another neuron is called synapse.

Working of Neuron:

Neurons are responsible for transmitting message from brain to body parts and vice versa.

When receptors sense anything, a chemical reaction is triggered. This chemical reaction causes an electrical impulse in dendrites. This impulse travels through the body of neuron to axon endings. Tiny amount of chemical is released in synapse by axon endings when impulse reaches there. This chemical crosses the synapse and reach to tip of dendrites where it again produces electrical impulse. And then this impulse travels along neuron.

Types of Neuron:

Sensory Neurons: These neurons transmit message from body parts to central nervous system (which is composed of the brain and the spinal cord).

Motor Neurons: These neurons transmit message from central nervous system to body parts.

Relay Neurons: These neurons relay the signals within the central nervous system.

Nervous System in Humans

The nervous system in humans can be divided into two main parts,

Peripheral nervous system 2. Central nervous system

Peripheral Nervous System (PNS):

The peripheral nervous system is composed of the Cranial nerves, Spinal nerves and Visceral nerves.

Cranial Nerves: There are 12 pairs of cranial nerves. The cranial nerves come out of the brain and go to the sense organs and muscles in the head region.

Spinal Nerves: There are 31 pairs of spinal nerves. The spinal nerves come out of the spinal cord and go to the sense organs and muscles which are below the head region. These nerves carry message to brain through spinal cord.

Visceral Nerves: The visceral nerves come out of the brain and spinal cord and go to the internal organs (like heart, kidney etc.)

Voluntary and Involuntary Actions

Voluntary actions are actions which we do in conscious control of brain. For example: Writing, speaking, walking, kicking a ball, lifting an object etc.

Involuntary actions are those which occur without the conscious control of organisms or we can say they are not under the control of will. For example: beating of heart, breathing, sweating, working of kidney, digestion of food.

Reflex action: It is a quick, automatic response to the change in environment (stimulus) that involves only spinal cord. Reflex actions occur within fractions of seconds.

Reflex arc: It is the pathway through which reflex action occurs.

Types of Reflexes / Reflex actions

Cerebral Reflex: A cerebral / cranial reflex is one that is controlled by one of the cranial nerves and tends to take place in the facial or head area. For ex. Change in size of pupil in bright light etc.

Spinal Reflex: A spinal reflex is a reflex that involves only the spinal nerves and spinal cord and is not processed by the brain. For ex. take off the hand on touching a hot object.

How Muscles (Effectors) cause Movement?

Muscles are made up of muscle cells which have special proteins. These proteins can change their arrangement on receiving message from brain. When they do so, shape of muscle changes. They can contract or expand. This contraction and expansion can cause movement in body parts.

Central Nervous System (CNS):

The central nervous system is composed of the brain and the spinal cord.

Brain

Brain controls all the functions in the human body. It is surrounded by a skull/ cranium. Cerebrospinal fluid is filled between the skull and the brain. Cranium and cerebrospinal fluid protect the brain from external shocks.

Human brain has three parts -

Forebrain (Cerebrum) b. Mid brain c. Hind brain

Forebrain/ Cerebrum: It is the most complex part of brain.

Functions -

Thinking part of the brain.

Memory (Store information).

Sensation.

Movement.

Feelings.

Thus cerebrum controls all the voluntary actions. Different parts of cerebrum are responsible for different jobs.

Mid brain: It controls cerebral reflexes like change in size of pupil, blinking of eye.

Hind brain: It controls all involuntary actions (beating of heart, breathing, sweating etc). Hind brain is mainly composed of three parts -

Pons - Regulate respiratory system.

Cerebellum - Controls posture, balance, motion, picking an object.

Medulla - Controls involuntary actions ex. digestion, heartbeat, blood pressure, vomiting, saliva in mouth, swallowing.

Spinal Cord

Spinal cord is started at medulla (Hind brain) and extends to downward. It is enclosed by a bony structure called Vertebral column at back centre of body.

Function -

It carries message between brain and nerves.

It controls spinal reflexes.

Endocrine System

The endocrine system is composed of several endocrine glands.

What are Glands?

Glands are organs in our body which excrete a liquid substance having some different chemicals. This liquid is called secretion of the gland.

Glands are of two types -

Exocrine Glands

Glands that have ducts are called exocrine glands. The secretions of exocrine glands reach their target by traveling through a duct (tube). Some examples of exocrine glands are sweat glands and salivary glands.

Endocrine Glands

The endocrine glands do not have ducts to carry their product to a surface. They are called ductless glands.

Hormones are the chemical substances produced by endocrine glands. These glands secrete their hormones directly into the blood vessels. Blood carries the secretion to different parts.

Thus Endocrine System is the system of endocrine glands in our body which secretes chemical substances called “Hormones”. This system controls various activities of our body for example growth of body.