

Control and Coordination

Nervous System

Nervous system is the organ system present in the animals to control and coordinate different activities of the body. Nervous system comprises of the brain, the spinal cord, and a huge network of nerves that are spread throughout the body.

The nervous system is responsible for sending, receiving and processing messages in the form of chemical signals called as impulses.

A neuron is the basic unit of the nervous system. Each neuron consists of three parts, namely, the cell body or cyton, branched projections called the dendrites, and the long process from the cell body, called the axon.

Synapse is a gap between two neurons.

Nerves are thread like structures emerging out of the brain and spinal cord. Nerves branch out to all parts of the body and are responsible of carrying messages in the body.

Types of nerves: Different types of nerves present are sensory, motor and mixed.

- Sensory nerves send messages from the sense organs to the brain or spinal cord.
- Motor nerves carry messages back from the brain or spinal cord to all the muscles and glands in the body.
- Mixed nerves carry both sensory and motor nerves.

Reflex action and Reflex arc

Reflex action is an involuntary action by the body. Reflex is an action generated by the body in response to the environment.

Reflex arcs are formed in the spinal cord itself, although the information input goes on to reach the brain.

Types of nervous system

The nervous system is divided into two systems – the central nervous system and the peripheral nervous system.

Central nervous system: It includes the brain and the spinal cord. It receives information from the body and sends out instructions to particular organs.

- The forebrain is the main thinking part of the brain. It consists of the cerebrum and diencephalon. The cerebrum is the seat of memory and intelligence, and of sensory centres like hearing, smell and sight. The diencephalon is the seat for pressure and pain.
- The midbrain connects the forebrain to the hindbrain and controls the reflexes for sight and hearing.
- The hindbrain consists of the cerebellum, pons and medulla. The cerebellum coordinates muscular

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activities and maintains balance and posture. The medulla controls involuntary activities like blood pressure and beating of the heart.

- The spinal cord extends from the medulla of the brain through the whole length of the vertebral column and is protected by the vertebral column or backbone.

Peripheral nervous system: It consists of the cranial and spinal nerves. The peripheral nervous system is divided into autonomic nervous system and somatic nervous system.

- Autonomic nervous system includes motor nerves that control involuntary actions like breathing, beating of the heart, and peristaltic movements of the alimentary canal.
- Somatic nervous system includes voluntary actions like muscle movement and blinking of the eyelids.

Nerves:

- The cranial nerves originate from the brain. Some cranial nerves carry impulses to and from the central nervous system. Some cranial nerves are mixed, while the others are sensory and motor nerves.
- The spinal nerves originate from the spinal cord. All spinal nerves carry impulses to and from the central nervous system. Spinal nerves are mixed nerves.

Hormones in Animals

Endocrine system is the system formed by ductless glands which secrete chemical substances called as hormones. Endocrine glands release hormones directly into the blood.

Hormones are minute, chemical messengers thrown into blood to act on target organs.

Hormones can be steroids, proteins, peptides or amino acid derivatives.

Endocrine glands

Different types of endocrine glands present in our body are the pituitary gland, the pineal gland, the hypothalamus, the thyroid, the parathyroid, the thymus, the adrenal gland, the pancreas, the testes and the ovary.

The pituitary gland:

- It is a pea-shaped gland located at the base of the brain.
- It is considered to be master gland as it secretes many hormones to regulate the organs as well as the other glands.
- Different hormones secreted by this gland include Growth hormone, TSH, FSH, LH, ACTH, MSH, Vasopressin and Oxytocin.

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The hypothalamus:

- It is a neuro-endocrine part of the brain.
- It links the nervous system and the endocrine system through the pituitary gland.
- Different hormones secreted by this gland include TRH, GnRH, GHRH, CRH, Somatostatin, Dopamine.

The thyroid gland:

- It is located in the neck, ventral to the larynx.
- It is the one of the largest endocrine glands.
- The principal hormones produced by this gland are triiodothyronine and thyroxine.
- Thyroxine is a hormone that regulates the metabolism of carbohydrates, proteins and fats in the body. Hyposecretion of thyroxine leads to cretinism in children, and myxoedema in adults. Hypersecretion of thyroxine leads to exophthalmic goitre in adults. Goitre is caused due to deficiency of iodine in food. Iodine is essential for the synthesis of thyroxine.

Parathyroid glands:

- These are two pairs of small, oval-shaped glands embedded on the dorsal surface of the thyroid gland present in the neck.
- They secrete parathormone. Parathormone helps in regulation of calcium and phosphate ions in the bones and blood.
- Hyposecretion leads to parathyroid tetany and hypersecretion causes osteoporosis.

The adrenal glands:

- These are located above the kidneys and hence are called as suprarenal glands.
 - Two regions of the adrenal gland are adrenal cortex and adrenal medulla.
 - Adrenal cortex secretes the hormones like cortisol, aldosterone and androgens.
- Adrenal medulla secretes the hormones like adrenaline and noradrenaline. Adrenaline is also called the "hormone of fight or flight," or the emergency hormone. It prepares the body to face an emergency condition of physical stress, like danger, anger and excitement.

The pancreas:

- It is located just below the stomach within the curve of the duodenum. It is both exocrine and endocrine in function.
- It secretes hormones such as insulin, glucagon, somatostatin and pancreatic polypeptide.
- Insulin regulates the sugar level in our blood. Insulin secreted in small amounts increases the sugar level in our blood which in turn causes a disease called diabetes mellitus.

Gonads:

Two types of gonads present in human beings are female gonads and male gonads.

Female gonads

- A pair of ovaries forms the gonads in female.
- Ovaries are the female sex organs that lie one on either side of the abdominal cavity. Ovaries

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produce two hormones, namely, oestrogen and progesterone.

- Oestrogen controls the changes that occur during puberty, like feminine voice, soft skin and development in mammary glands.
- Progesterone controls the uterine changes in the menstrual cycle, and helps in the maintenance of pregnancy.

Male gonads

- A pair of testes forms the gonads in males.
- A pair of testes is the male sex organ located in the scrotum, which is outside the abdomen.
 - Testes produce the hormone testosterone.
- Testosterone controls the changes, which occur during puberty, like deeper voice, development of penis, facial and body hair.

The pineal gland:

- It is located near the centre of the brain, dorsal to the diencephalon.
 - It produces the hormone melatonin.
- Melatonin affects reproductive development, modulation of wake and sleep patterns, and seasonal functions.

The thymus gland:

- It is located in front of the heart, in the upper part of the sternum.
 - It produces the hormone thymosine.
- It helps in the maturation of T-lymphocytes.

Coordination in Plants

All living things respond to environmental stimuli. Plants also respond to stimuli with the help of chemical compounds secreted by the cells. Plants being living organisms, exhibit some movements.

Types of movements

The movement of a plant during its growth can be directional or non-directional.

Directional movements: These are also called as tropic movements. Tropic movements are the movements which occur in the direction of the stimulus.

- Positive phototropism is seen in shoots which respond by bending towards light. Negative geotropism is seen in shoots by growing away from the ground.
- Roots bend away from light exhibiting negative phototropism. They grow towards the ground exhibiting positive geotropism.

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- Thigmotropism is the directional growth of a plant part in response to the touch stimulus of an object.
- Hydrotropism is a growth response in which the direction is determined by the stimuli of water.
- Chemotropism is a growth movement of a plant part in response to chemical stimulus. e.g. Growth of pollen tubes towards ovules.

Non- directional movements: These are also called as nastic responses. These are exactly the movement of plant parts.

- These movements are independent of growth.
- Plant cells must change their shape for this movement to happen.
- The movement in plants occurs in the direction opposite to the stimulus.

Plant hormones

Plants have various hormones, which help to coordinate growth, development and response to the environment. Hormones are the chemical compounds released by stimulated cells. Hormones diffuse all around the cell. Different hormones secreted by the plant are auxins, gibberellins, cytokinins, abscisic acid.

- Auxins are the hormones synthesised at the tip of the stem. These help the plant in growth by cell elongation.
- Gibberellins are hormones that help in the growth of the stem, seed germination, bolting, and flowering.
- Cytokinins are hormones present in the areas of rapid cell division, such as fruits and seeds. They also promote the opening of the stomata.
- Abscisic acid is a hormone that inhibits the growth in various parts. It is also responsible for the closure of stomata.