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## CONTROL AND COORDINATION

Control and coordination are the functions of the nervous system and hormones in our bodies. The responses of the nervous system can be classified as reflex action, voluntary action or involuntary action.

### Animals – Nervous System

- Nervous tissue is made up of an organized network of nerve cells or neurons and is specialized for conducting information via electrical impulses from one part of the body to another.
- The responses of the nervous system can be classified as reflex action, voluntary action or involuntary action.
- The nervous system gets information from our sense organs and acts through our muscles.
- The nervous system is made up of nervous tissues. It is formed of three distinct components namely the neurons, neuroglia and nerve fibres.
- Nervous system controls and coordinates the activities of our body.
- Nervous tissue is made up of an organised network of nerve cells or neurons, and is specialised for conducting information via electrical impulses from one part of the body to another.
- Neuron is the structural and functional unit of the cell and has three parts- cyton, dendrites and axon.
- A receptor is a cell or group of cells that receives the stimuli. An effector is a part of the body which can respond to a stimulus according to the instructions from the brain or the spinal cord.

### Human Brain

- The brain and spinal cord constitute the central nervous system. They receive information from all parts of the body and integrate it.
- The brain is broadly divided into three regions: forebrain, midbrain and hindbrain.
- The **forebrain** mainly consists of cerebrum. The midbrain does not have any further divisions. The hindbrain consists of three centres called pons, cerebellum and medulla.
- The **fore-brain** is the main thinking part of the brain. It has regions which receive sensory impulses from various receptors. Separate areas of the fore-brain are specialised for hearing, smell, sight and so on.
- Cerebrum is the largest portion forming nearly two-third of the brain.
- **Cerebrum** holds your memories, allows you to plan, enables you to imagine and think.
- The sensation of feeling full is because of a centre associated with hunger, which is in a separate part of the fore-brain.
- Many of these involuntary actions are controlled by the mid-brain and hind-brain.
- All the involuntary actions including blood pressure, salivation and vomiting are controlled by the **medulla** in the hind-brain.

- **Midbrain** connects the forebrain to the hindbrain.
- **Thalamus** present in cerebral medulla is a major conducting centre for sensory and motor signaling. It acts as a relay centre.
- **Hypothalamus** lies at the base of the thalamus. **Hypothalamus** controls sleep and wake cycle of the body. It also controls the urges for eating and drinking. It controls involuntary functions like hunger, sexual desire anger, fear, thirst.
- Think about activities like walking in a straight line, riding a bicycle, picking up a pencil. These are possible due to a part of the hind-brain called the **cerebellum**.
- **Cerebellum** is responsible for precision of voluntary actions and maintaining the posture and balance of the body.
- **Pons** is a bridge of nerve fibre that connects the lobes of cerebellum. It relays signals between the cerebellum, spinal cord, midbrain and cerebrum. It controls respiration and sleep cycle.
- Spinal cord is lower part of brain which control reflex center.
- Spinal cord originates from medulla.
- A delicate organ like the brain, which is so important for a variety of activities, needs to be carefully protected. For this, the body is designed so that the brain sits inside a bony box.

## Coordination in Plants

- Animals have a nervous system for controlling and coordinating the activities of the body. But plants have neither a nervous system nor muscles.
- Coordination is the ability to use different parts of the plant together, smoothly and efficiently. In plants, coordination is due to the result of a chemical system, wherein plant hormones have a major role.
- The control and coordination system in plants is done by plant hormones. They affect the growth of a plant in one or the other aspect. The growth of a plant is divided in three stages:
  - Cell division
  - Cell enlargement
  - Cell differentiation
- Plant hormone not only controls these stages of plant growth but also promotion of breaking of dormancy, falling of leaves, fruit growth, ripening of fruits, ageing of plants etc.

## Plant Hormones

- Chemical coordination is seen in both plants and animals.
- There are five major classes of plant hormones. They are:
  - Auxins
  - Cytokinins
  - Gibberellins
  - Abscisic Acid (ABA)

- o Ethylene
- **Growing plants** detect light a hormone called auxin synthesized at the shoot tip helps the **cells** to grow longer.
- Gibberellins are the most abundantly found plant hormones.
- Gibberellin's example of plant hormones like auxins help in the **growth** of the **stem**

### Cytokinins

- **Cytokinins** promote cell division and it is natural then that they are present in greater concentration in areas of rapid cell division such as in fruits and seeds.
- Cytokinin is found abundantly in liquid endosperm of coconut.
- Cytokinin also causes cell enlargement.

### Ethylene

- **Ethylene** is a gaseous plant hormone. It is a growth inhibitor.
- It is mainly concerned with maturation and ripening of fruits.
- Maximum synthesis of ethylene occurs during ripening of fruits like apples, bananas and melons.
- It is used for ripening of fruits.

### Abscisic Acid

- **Abscisic acid** (ABA) is a growth inhibitor which regulates abscission and dormancy.
- It increases tolerance of plants to various kinds of stress. So, it is also called as stress hormone. It is found in the chloroplast of plants.

### Hormones in Animals

- **Adrenaline hormone** is secreted from the **adrenal glands**.
- Adrenaline is secreted directly into the blood and carried to different parts of the body. The target organs or the specific tissues on which it acts include the heart.
- **Iodine** is necessary for the **thyroid gland** to make **thyroxin hormone**. Thyroxin regulates carbohydrate, protein and fat metabolism in the body so as to provide the best balance for growth.
- In case iodine is deficient in our diet, there is a possibility that we might suffer from goiter. One of the symptoms in this disease is a swollen neck.
- **Growth hormone** is one of the hormones secreted by the **pituitary**. As its name indicates, growth hormone regulates growth and development of the body. If there is a deficiency of this hormone in childhood it leads to dwarfism.
- **Insulin** is a hormone which is produced by the **pancreas** and helps in regulating **blood sugar levels**. If it is not secreted in proper amounts, the sugar level in the blood rises causing. It **leads to diabetes**.
- Testosterone hormone is secreted in males and estrogen in females.

## Important Hormones and Their Functions

S.No.	Hormone	Endocrine Gland	Functions
1	Growth hormone	Pituitary gland	Stimulates growth in all organs
2	Thyroxin	Thyroid gland	Regulates metabolism for body growth
3	Insulin	Pancreas	Regulates blood sugar level
4	Testosterone	Testes	Male sex hormone
5	Estrogen	Ovaries	Development of female sex organs, regulates menstrual cycle, etc.
6	Adrenaline	Adrenal gland	Help regulate your metabolism, immune system, blood pressure, response to stress and other essential functions.
7	Releasing Hormones		Stimulates pituitary gland to release hormones

### Note:

- The pituitary gland regulates and controls other endocrine glands and so is called as the "Master gland".
- The adrenal glands are located above each kidney. They are also called suprarenal glands.



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