

Human body is a complex machine performing tons of functions and processes to maintain and sustain life. Explore how the body controls its movements and coordinates its actions with other parts of the body and the environment by exploring notes for Class 10 chapter 7 Control and Coordination.

Topics Covered in Chapter 7 Control and Coordination:

Animals - Nervous System

What happens in Reflex actions

Human Brain

How are these tissues protected?

How does the Nervous Tissue cause Action?

Coordination in Plants

Immediate response to Stimulus

Movement due to Growth

Hormones in Animals

Introduction to Chapter:

Both plants, animals and other living organisms respond to changes in the environment in a different manner. These detectable changes are called the stimuli, which include light, cold, heat, smell, sound, touch etc.

Control and Coordination in animals

Control and Coordination in animals are conveyed with the help of two main systems.

Nervous system

It is the network of nerve cells and fibers which transfers information via electrical impulses from one part of the body to other parts of the body. The structural and functional unit of the nervous system is the neuron and it includes:

Central Nervous system: It includes the brain and the spinal cord.

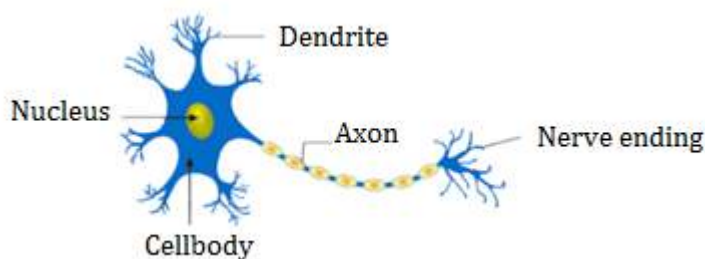
Peripheral Nervous system: It includes nerves and the ganglia.

Receptors

- These are specialized tips of some nerve cells that detect the information from the environment. These are located in our sense organs
 - Ear - it acts as phonoreceptors (receiving sound). It helps in hearing and maintaining the balance of the body
 - Eyes - it acts as photoreceptors (receiving light). It helps in seeing
 - Skin - It acts as thermoreceptors (feels temperature). It helps in feeling heat or cold and touch
 - Nose - it acts as olfactory receptors (sense of smell). It helps in the detection of smell
 - Tongue - it acts as gustatory receptors (sense of taste). It helps in the detection of taste

Neuron

It is the structural and functional unit of nervous system.



Functioning of Neuron

- The information from receptors is acquired at the end of the dendritic tip of a nerve cell as a chemical reaction that creates an electrical impulse
- This impulse travels from the dendrite to the cell body and then at the end of the axon
- Chemicals are released at the end of the axon by the effect of electrical impulse
- These chemicals cross the gap(synapse) and start a similar electrical impulse in a dendrite of the next neuron
- The similar synapse finally allows delivery of such impulses from neurons to other cells, such as muscles cells or gland

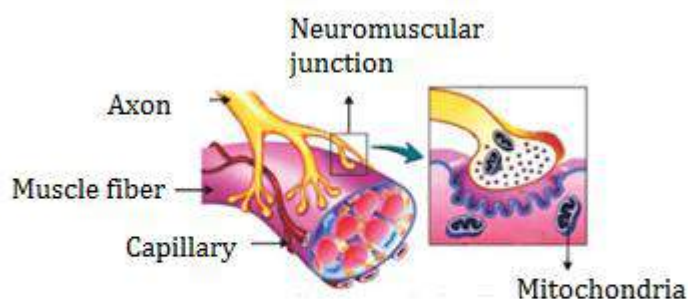


Fig. Neuromuscular junction

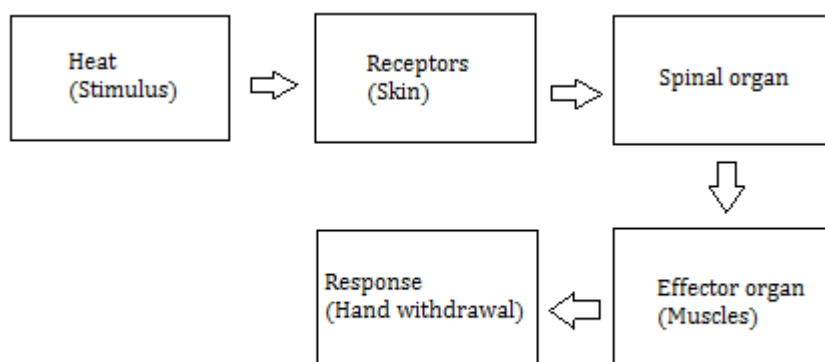
Parts of Neuron

- Dendrite - it acquires information
- Cell body - the information acquired by it travels as an electrical impulse
- Axon - it is the longest fiber on the cell body, known as axon. It transmits electrical impulse from the cell body to dendrite of next neuron

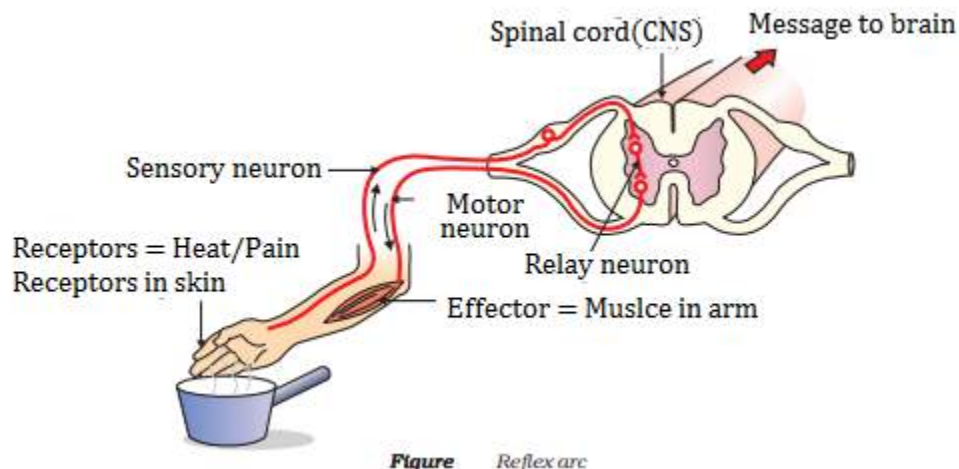
Synapse - It is the gap between the nerve ending of one neuron and dendrite of the other neuron. Here, the electrical signal is converted into a chemical signal for onward transmission

Reflex action

- It is a quick, sudden and immediate response of the body to a stimulus. Example - knee jerk, withdrawal of hand on touching a hot object
- Stimulus - it is an observable or detectable change in the external or internal environment to which an organism reacts
- Reflex arc - the pathway through which nerve impulses pass during reflex action is called reflex arc
- Response - it is the final reaction after the reflex action



Reflex action Pathways



Three types of Responses

- Voluntary - controlled by fore brain. Example - talking, writing
- Involuntary - controlled by mid brain and hind brain. Example - heartbeat, vomiting, respiration
- Reflex action - controlled by spinal cord. Example - withdrawal of hand on touching a hot object

Need for Reflex Actions

In some situations such as touching a hot object, pinching etc. we need to act quickly, otherwise, our body would be harmed. Here the response is generated from spinal cord instead of brain. In this way, time for taking action is reduced which saves us from injury

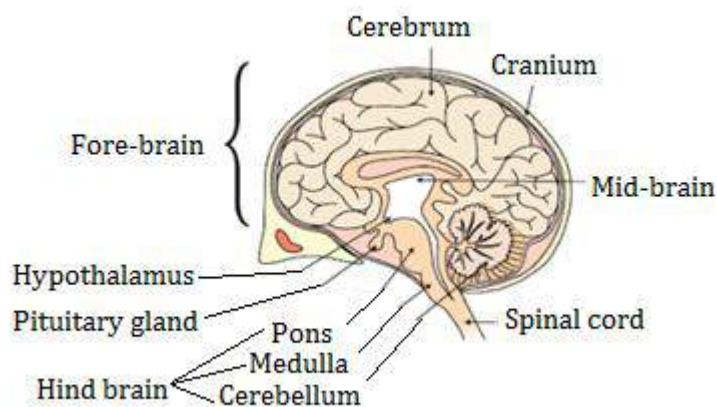
Human nervous System

- The human nervous system consists of two parts, Central Nervous system (CNS) and Peripheral Nervous system (PNS)
- Central nervous system consists of Brain and spinal cord
- Peripheral nervous system consists of cranial nerves which arise from the brain and spinal nerves which arise from the spinal cord

Human Brain

The brain is the most coordinating centre of the body. It has three major parts:

- Forebrain
- Mid brain
- Hind brain



Forebrain

It is the most complex or specialized part of the brain. It consists of the cerebrum.

Functions of Forebrain:

- Thinking part of the brain
- Control the voluntary actions
- Store information (memory)
- Receives sensory impulses from various parts of the body and integrate it
- Centre associated with hunger

Midbrain

Controls involuntary actions such as a change in pupil size and reflex movements of head, neck and trunk.

Hindbrain

It has three parts:

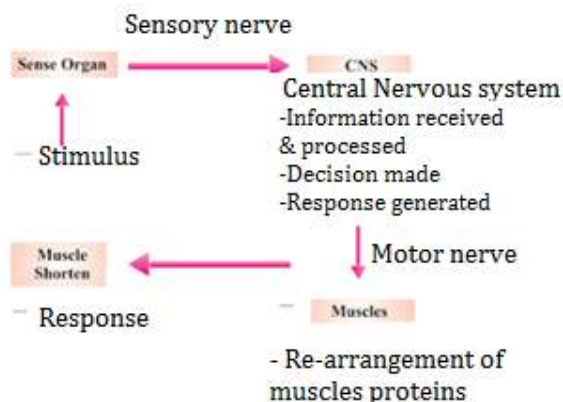
- Cerebellum - controls posture and balance. The precision of voluntary actions. Example - picking pen
- Medulla - controls involuntary actions. Example - blood pressure, salivation, vomiting
- Pons - Involuntary actions, regulation of respiration

Protection of Brain and Spinal cord

- Protection of brain - Brain is protected by a fluid-filled balloon which acts as a shock absorber and is enclosed in the cranium (skull or brain box)
- Protection of spinal cord - Spinal cord is enclosed in the vertebral column

Coordination Between Nervous And Muscular Tissue

- For taking place the voluntary actions, the brain has to send messages to muscles
- The communication between the central nervous system and the other parts of the body is facilitated by the peripheral nervous system consisting of cranial nerves arising from the brain and spinal nerves arising from the spinal cord
- The brain thus allows us to think and take actions based on that thinking. This is accomplished through complex design, with different parts of the brain responsible for integrating different inputs and outputs



Limitations of Electric communication/Nervous system

- Electric impulse will reach only to those cells that are connected by nervous tissue
- After generation and transmission of an electrical impulse, the cell takes some time to reset its mechanism before transmitting another impulse. So cells cannot continually create and transmit the impulse
- Plants do not have any nervous system

Chemical communication

- It helps in overcoming the limitations of electric communication

Control and Coordination in Plants

In plants, the control and coordination are conveyed with the help of plant hormones.

Plant hormones are the organic molecules that affect the physiology of plants and play a major role in the growth and development of the plant cells and tissues. It is also called as the plant growth regulators. The five major types of plant hormones are Auxin, Gibberellin, Cytokinin, Ethylene and Absciscic acid.

Movement in Plants

There are two types of movements in plants

- Independent of growth
- Dependent of growth

Independent of growth

- Independent of growth has immediate response to the stimulus
- Plants use electrical-chemical means to convey information from cell to cell
- For movement to happen, cells change their shape by changing the amount of water in them, resulting in swelling or shrinking of cells

Example - drooping of leaves of 'touch-me-not' plant upon touching it

Dependent of growth

- These movements are tropic movements i.e., directional movements in response to stimulus
- Tendrils - the part of the tendril away from the object grows more rapidly as compared to the part near the object. This causes circulating of tendril around the object
- Phototropism - Movement towards light
- Geotropism - movement towards/away from gravity
- Chemotropism - Growth of pollen tube towards ovule
- Hydrotropism - Movement towards water

Plant hormones

- These are chemical compounds which help to coordinate growth, development and responses to the environment
- Main plant hormones are -

Auxin - synthesized at shoot tips, it helps the cells to grow longer and involved in phototropism (response towards light)

Gibberellin - it helps in the growth of the stem

Cytokinins - It promotes cell division. This is present in greater concentration in seeds and fruits

Absciscic acid - inhibits growth. Causes wilting of leaves and is also known as the stress hormone.

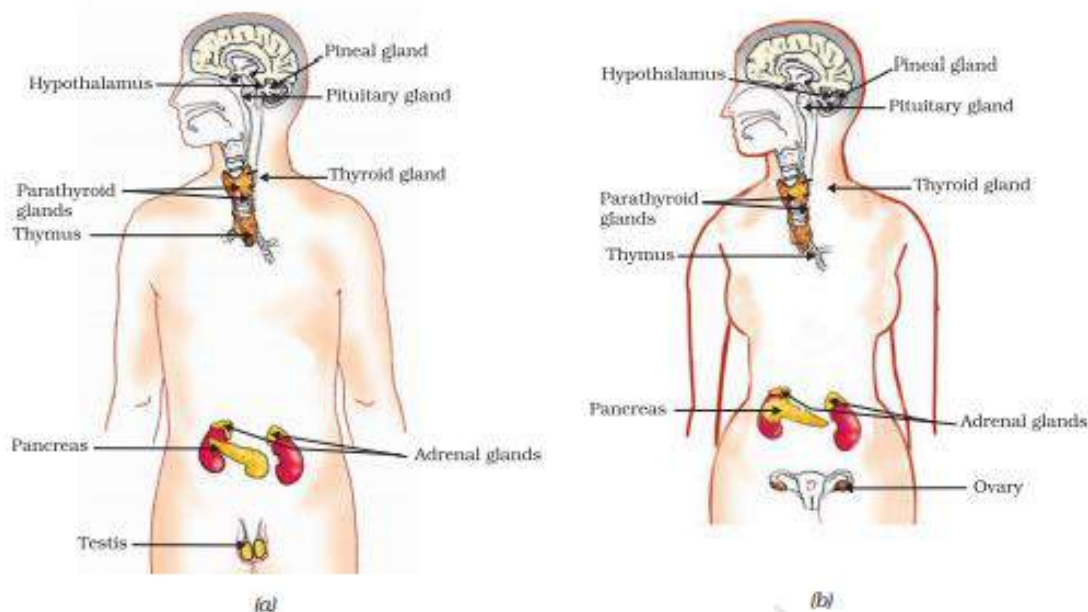
Hormones in Animals

- Hormones are the chemical substances which coordinate the activities of living organisms and also their growth

Endocrine system

It is a series of endocrine glands and the hormones. The endocrine glands are the ductless glands which secrete the hormones directly into the bloodstream.

List of endocrine glands with the hormones names and their functions are given below:



- **Thyroxine** - This hormone is secreted by Thyroid. The thyroid is located in Neck/throat region. It regulates the metabolism of carbohydrates, fats and proteins.
- **Growth hormone** - It is secreted by Pituitary (master gland). This gland is located in Midbrain. It regulates growth and development
- **Adrenaline** - This hormone is secreted by the adrenal. The adrenal gland is located above both kidneys. It regulates blood pressure (increasing), heartbeat, carbohydrate metabolism(during an emergency)
- **Insulin** - it is secreted by the Pancreas. The Pancreas is located below the stomach. It reduces and regulates blood sugar level
- **Sex hormones** -

Testosterone in males - this hormone is secreted by testis. The testis is located in the genital area. Its changes associated with puberty (Sexual maturity)

Estrogen in females - these hormones are secreted by ovaries. The ovaries are located in lower abdomen area. Its changes associated with puberty (sexual maturity)

Importance of Iodine

Iodized salt is necessary because iodine mineral is an essential part of thyroxine hormone secreted by thyroid gland. Thyroxine regulates the metabolism of carbohydrates, fats and

proteins. So, we must consume iodized salt which is necessary for proper working of thyroid gland. Its deficiency causes a disease called goitre (swollen neck)

Diabetes

Diabetes is a disease in which blood sugar level increases

Causes of Diabetes

The disease is caused due to the deficiency of insulin hormone secreted by the pancreas that is responsible to control blood sugar levels

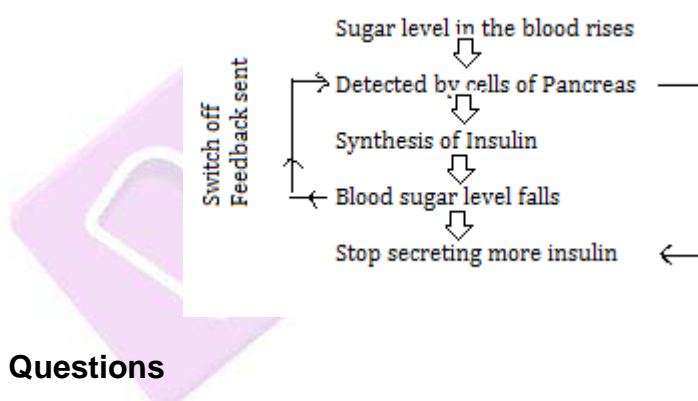
Treatment of Diabetes

Injectations of insulin hormone can help in the treatment of diabetes

Feedback Mechanism

The excess or deficiency of hormones has a harmful effect on our body. Feedback mechanism makes sure that hormones should be secreted in precise quantity and at the right time

Example - Feedback mechanisms to control the sugar level in blood is as follows:



Few Important Questions

1. What are hormones?
2. What is reflex action?
3. What is the role of the central nervous system in control and coordination?
4. What are plant hormones? Explain its types, functions with its examples.
5. List out the functions of Hormones secreted by the Endocrine glands and Exocrine glands.