

CONTROL AND COORDINATION

Gist of the Lesson:

- The working together of various organs of the body of an organism in a proper manner to produce appropriate reaction to a stimulus is called **Coordination**.
- The changes in the environment to which an organism responds and reacts is called **Stimulus**.
- **Control & Coordination in Animals**- takes place by
 - (i) Nervous system & (ii) Endocrine system
- **Nervous system**- Stimulus → Receptor organ → Sensory nerve → Brain/Spinal cord
↓
Response ← Effector organ ← Motor nerve
- **Endocrine system**- Stimulus → Endocrine organ → Secrete hormone → Hormone in blood
↓
Response ← Target organ

Parts of the Nervous System-

(i) Brain (ii) Spinal cord (iii) Nerves (Neurons)

Parts of a Neuron-

(i) Dendrons (ii) Cell body (iii) Axon

Synapse- Space/junction between two adjacent nerves is called **Synapse**.

Passing of information takes place-

- (i) By Electric impulse (inside the neuron) and
- (ii) In the form of chemicals (At synapse) as Neurotransmitter.

Reflex Action- Spontaneous, involuntary and automatic response to a stimulus to protect us from harmful situations.

Eg. On touching a hot object unknowingly we instantly withdraw our hand.

Reflex Arc- The pathway of the reflex action is called Reflex arc.

Stimulus → Receptor organ → Sensory nerve → Spinal cord → Effector organ → Response.

Nervous System-

(1) Central Nervous system (CNS)

(2) Peripheral Nervous system (PNS)

(i) Brain

(i) Autonomic Nervous system

(ii) Spinal cord

(ii) Voluntary Nervous system

Brain-

- (i) Centre of coordination of all activities.
- (ii) Thinking is involved.
- (iii) Complex process.

Fore Brain	Mid Brain	Hind Brain
<ul style="list-style-type: none"> (i) Cerebrum (ii) Thalamus (iii) Hypothalamus 	-----	<ul style="list-style-type: none"> (i) Cerebellum (ii) Pons (iii) Medulla oblongata

For brain Cerebrum-

- (i) Main thinking and largest part of the brain.
- (ii) It has 3 main areas.
 - a. Sensory area- to receive impulses from sense organs via Receptors
 - b. Motor area- control voluntary movements.
 - c. Association areas- Reasoning, learning & intelligence.

Thalamus - It relays sensory information to the Cerebrum

Hypothalamus- It forms the link between Nervous system & Endocrine system

Mid brain- It connects Fore brain and Hind brain. Controls reflex of eyes & ears

Hind brain- Connects the Fore brain & Hind brain

- Cerebellum - Controls & coordinates muscular movements, maintaining body posture and equilibrium.
- Pons- Acts as a bridge between brain & spinal cord
- Medulla oblongata- Controls involuntary actions like blood pressure, salivation, vomiting, etc.

Spinal Cord- Cylindrical or tubular structure extending downwards from the Medulla oblongata.

Protection of the brain & the spinal cord-

- (i) Bony outer covering: skull for the brain & vertebral column for the spinal cord.
- (ii) Cerebrospinal fluid present in between the three membranes (Meninges).

Action caused by Nervous tissue-

Information → Nervous tissue → Brain Muscles → Causes action

Path or Action-

Nerve impulse → Muscle cell → Changes shape due to special proteins

↓

Action caused ← Shorter form of muscles ← Change shape & arrangement of cell

Chemical communication by hormones- (advantages)

- (i) Electrical impulses have their limitations because they reach only those cells connect to the nervous tissue.
- (ii) Also the nerve cells cannot generate & transmit impulses continuously.
- (iii) Electrical communication is slower.

Hormones-

- (i) are chemical messengers secreted by endocrine glands
- (ii) Are secreted in small amounts & may act in nearby places or distant places.
- (iii) Do not take part in the reaction & are destroyed immediately.

Hormones are secreted by- Endocrine Glands & Exocrine glands

S. No.	Endocrine Glands	Exocrine Glands
1.	Ducts absent	Ducts present
2	Secrete hormones	Secrete enzymes
3	Secreted in blood	Secreted in ducts of glands
4	Situated away from the site of action	Situated near the site of action
Gland	Endocrine function	Exocrine function
Pancreas	Produces insulin & Glucagon hormone.	Produces digestive enzyme (pancreatic amylase)
Testes	Produces hormone Testosterone	Produces male gametes (reproductive cells)
Ovaries	Produces hormone Oestrogen	Produces female gametes (reproductive cells)
Endocrine Gland	Hormone	Function
Pituitary gland	Growth hormone	Body growth, development of bones & muscles (If excess- Gigantism) (If less- Dwarfism)
Thyroid gland	Thyroxine /TRI IODO THYRO GLOBULIN	Regulates carbohydrate, protein & fat metabolism (If less- Goitre)
Pancreas	Produces insulin & Glucagon hormone	Regulates blood sugar levels (if less diabetes is caused)
Testes in males	Produces hormone	Development of secondary

		Testosterone	male characters like deep voice, beard. etc.
Ovaries females	in	Produces hormone Oestrogen/ Progesterone	Development of secondary female characters like mammary glands, menstrual cycle, maintenance of pregnancy.

Coordination in plants- Only chemical coordination is present in plants.

Tropic movements- The movements of plants in the direction of stimulus (positive) or away from it (negative) are called tropic movements.

E.g. Phototropism, Geotropism. Chemotropism.

Nastic Movements- The movements of plants independent of stimuli are called Nastic Movements.

E.g- Touch me not plant leaves close when touched.

Plant Hormones (Phytohormones) Examples-

1. Auxins- Help in growth of root & shoot tips.
2. Gibberellins- Help in vegetative growth
3. Cytokinins- Promote cell division
4. Absciscic acid - Inhibits growth & causes wilting (falling) of leaves

Important Diagrams

1. Structure of neuron (nerve cell)
2. Reflex arc
3. Human brain
4. Endocrine glands.

One Mark Questions (One word or one sentence)

1. Name the fundamental unit of nervous system?

A. Neuron

2. What are photoreceptors?

A. The sense organs which receive the light are called photoreceptors.

3. What are olfactoreceptors?

A. Olfactoreceptors are the sense organs which receive the smell.

4. What is a neuron?

A. The structural and functional unit of the nervous system is called neuron or the nerve cell. They help in the responding to stimuli.

5. What are the various types of nervous system?

A. There are two types of nervous system:
(i) Central nervous system.
(ii) Peripheral nervous system.

6. What is a reflex action?

A. An action (response) which is immediate and which does not need processing by the brain is called reflex action.

7. Which part of the brain is the centre of intelligence?

A. Cerebral hemisphere.

8. In what form information is passed through neurons?

A. The information passing through neurons are in the form of chemical and electrical signals called nerve impulse.

9. How many types of coordination?

A. There are two types of coordination:
(i) Chemical coordination in both plants and animals;
(ii) Nervous coordination in animals only.

10. Write names of four plant growth regulators?

A. Four plant growth regulators are: auxins, cytokinins, gibberellins and abscisic acid.

11. Name a growth regulator found in plants?

A. Auxins.

12. What is phototropism?

A. The bending of plants towards the light is called phototropism.

13. What is geotropism?

A. Downward movement in response to gravitational force is called geotropism.

14. What are phytochrome?

A. Plants respond to photoperiodic stimulus by a specialised pigment which is called phytochrome.

15. What are hormones?

A. The chemical substances secreted by certain glands are called hormones.

16. Name any one sex hormone?

A. Estrogen or testosterone.

Two Marks Questions (30 words)

1. What is the structure of neuron?

A. Cells of nervous tissues are called neurons. Each neuron cell consists of a irregular cell body. From the surface of cell body fine processes arise called dendrites. A long process called axon also arises from the cell body. Sometimes axon is covered by one or two sheath. Then it is called medullated nerve fiber.

The dendrites receive the message or impulses from other neuron or organs. The axon conducts the impulses. The axon also form synapse junction with the dendrites of other neurons.

2. What are the overall functions of the human brain?

A. The various overall function of human brain are:

- (i) To receive impulses from all the sensory organs like eye, ear, nose, tongue, skin.
- (ii) Sending of responses to muscles and glands for proper actions.
- (iii) Control and coordination of body activities.
- (iv) Thinking, storage of past knowledge and experiences, feeling of consciousness and modification of behaviour according to situation and experience.

3. Write the functions of any one part of hind-brain?

A. There are following parts of hind-brain:

- (i) Cerebellum. (ii) Pons. (iii) Medulla.

Functions of cerebellum: It regulates and coordinates movements and posture of the body. It helps in adjustment of the body balance.

4. What is the autonomic nervous system?

A. The specific set of nerves that mainly controls and integrates the functions of internal organs is called autonomic nervous system. It controls the body organs, such as heart, blood vessel, glands, smooth muscles and uterus in the body; that are not directly under control of our will. Autonomic nervous system consists of: (i) Sympathetic and (ii) Para-sympathetic systems. They have opposite effects on the organ i.e., if one stimulates the organ the other inhibits its action.

5. What are hormones?

A. Hormones are chemical substances which are transported from the site of synthesis to the place of action or Hormones are chemical substances which are synthesized at one region of the body of organism and are transported to the site of action. They are needed in a very small amount.

6. Differentiate between estrogen and testosterone?

A. Estrogen is a female hormone and is secreted by the ovary. It causes development of secondary female sex features such as development of breasts. Testosterone is a male hormone and is secreted by the testis. It causes development of secondary male features such as the growth of moustaches and beard.

7. Which hormones regulate the following functions in the human body?

(i) The rate of metabolism

(ii) Sugar metabolism

(iii) Conversion of proteins into sugars

(iv) The amount of water reabsorption by the kidney

(v) Development of breast in females.

A. (i) Thyroxine (ii) Insulin (iii) Cortisone (iv) Antidiuretic hormone (ADH)
(v) Estrogen.

8. Why is pituitary gland called master gland?

- A. Pituitary gland controls the working of majority of endocrine glands by secreting stimulating hormones. For example, pituitary secretes TSH hormone which controls the secretion of thyroxine by the thyroid. For the same reason pituitary is called master gland.

Three Marks Questions (50 words)

1. Trace the path of reflex action with the help of a diagram?

- A. Pathway of the reflex action: Suppose a pin is pricked suddenly in the foot. This stimulus received by the receptor organs (skin of the foot) stimulates and sensory fiber (afferent fiber) of the area. The nerve fiber carries the stimulus to the spinal cord through the dorsal root of a spinal nerve. Now from the spinal cord the impulse is passed to one or more motor (efferent) nerve fibers through the ventral root of the spinal cord. The motor nerve fibers stimulate the effector organ (muscles of the foot) or organs to an activity so as to deal suitably with the stimulus. In this case pin pricking the portion of the body i.e., foot is immediately lifted.

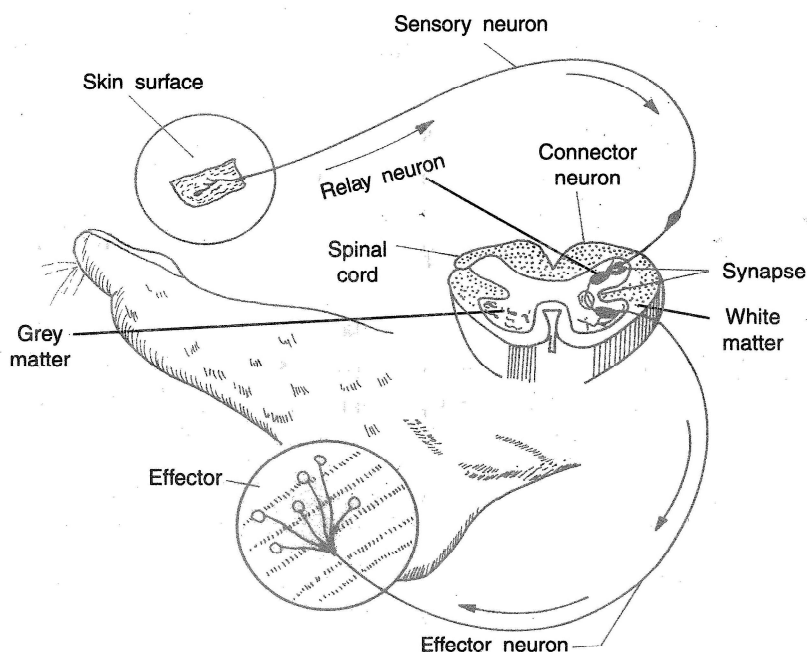
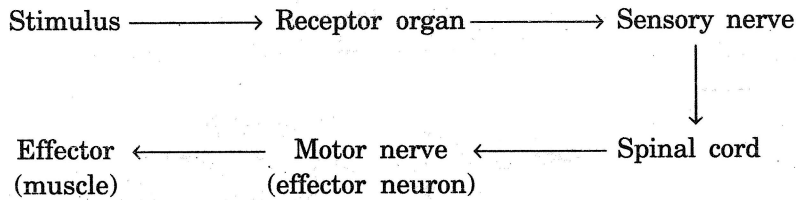


Fig. 7.6. A typical reflex reaction, stepping on a nail initiates a three neuron reflex

A typical reflex action has the following pathway.



2. (i) Compare voluntary and involuntary actions? Or (ii) Differentiate between reflex actions and voluntary actions?

A.

Voluntary Actions	Involuntary/Reflex Actions
1. The actions are under the will or conscious of the individual.	1. Actions occur without consulting the will.
2. They may or may not involve information from receptors or sense organs.	2. Involuntary actions always occur in response to stimuli picked up by receptors.
3. Impulses originate in the brain.	3. Impulses originate in the region of receptors.
4. Every voluntary action occurs under conscious directions from brain.	4. Brain is seldom consulted consciously though an involuntary action always involves spinal cord or brain for transfer of information from afferent neurons to efferent neurons.
5. The actions employ voluntary muscles,	5. The actions employ involuntary muscles but occasionally voluntary muscles also get involved.
6. Voluntary actions do not occur in the form of an arc. Mainly three parts are involved— brain (CNS), efferent neuron and effector organ.	6. They occur in the form of a reflex arc. A reflex arc consists of five parts—receptors, afferent neurons interneuron in CNS, efferent neuron and effector organ.

Five Marks Questions (70 words)

1. List the major endocrine glands found in human body. Write their functions?

A. The major endocrine glands in the body of man are given below:

(i) Hypothalamus and Pituitary Gland: The hypothalamus is located at the base of the brain. Its secretion controls the functioning of the pituitary. Its secretions are called releasing hormones. The pituitary gland is suspended from the hypothalamus. It is a small gland but produces a number of hormones. These hormones control the activities of other endocrine glands. So it has been known as the Master Gland.

(ii) Thyroid Gland: It is a two lobed gland and lies in front of the trachea. It produces hormone thyroxine which contains iodine and regulates general metabolism. It maintains the calcium level in the blood and bones. Deficiency of iodine in hormone causes swelling in the neck known as goitre.

(iii) Parathyroid Gland: These are four small glands two on each side of the thyroid in the neck region. They produce Parathormone (calcitonin). The proper development of bones depends upon this hormone.

(iv) Thymus Gland: This is large bilobed gland near the heart or in the upper part of the thorax. It is fully developed in young ones but as the animal grows it is vanished. It accelerates metabolism and speeds up growth i.e., hastens sexual maturity.

(v) Pineal Body: It is located in the roof of the brain. Its removal retards the growth.

(vi) Adrenal Gland: They are two in number situated on the anterior end of each kidney. Each adrenal has two parts. The outer part is cortex and the inner is medulla. Cortex secretes a number of hormones which are divided into three groups.

Medulla of adrenal gland secretes two hormones-adrenalin or epinephrine and nor-adrenaline or norepinephrine. These two hormones help the body to face and prepare emergency situation such as extreme danger or .fright, by increasing the blood 'Pressure, heart beat and glucose level of the blood.

(vii)Pancreas Islets of Langerhans: Pancreas is a double gland i.e., it is both an exocrine and endocrine gland. The endocrine part of pancreas is called islets of langerhans. The cells of islets of langerhans secrete two hormones Insulin and glucagon. The two hormones maintain the proper blood sugar level.

(viii) Gonads: Both male and female organs testes and ovary constitute the gonads and secrete male and female hormones respectively.

Testes: Testes secrete a hormone testosterone from the interstitial cells (leydig cells). Testosterone regulates the development of secondary male sexual characters like pubis hair, deep voice, beard etc.

Ovary: Ovaries produces estrogen and progesterone. These hormones stimulate the growth of female sex organs like uterus and ovaries. They are responsible for the secondary female sexual characters like development of mammary glands, onset of menstrual cycle etc.

For endocrine glands, their hormones and functions see table.

Gland	Hormone	Function / Action
1. Hypothalamus	Releasing hormones	Regulation of the secretion of hormones from pituitary gland.
2. Pituitary (the master gland)	Growth hormone antidiuretic hormone (ADH) ACTH FSH TSH Prolactin Vasopressin Oxytocin	Regulates tissue and bone growth, controls the amount of water reabsorbed by the kidney. Stimulates adrenal cortex to make cortisone. Stimulates the ovary to produce estrogen. Stimulates thyroids to make thyroxine. Regulation of function of mammary gland. Regulation of water and electrolyte balance. Regulation of the ejection of milk during lactation.
3. Thyroid	Thyroxine	Regulates the rate of growth and metabolism. Too little of this hormone causes over weight and sluggishness, Too much of it leads to thinness and over activity.
4. Parathyroid	Calcitonin	Regulation of blood calcium and phosphate.
5. Adrenal (cortex)	Cortisone	Produced by the outside parts (cortex) of this gland. Aids conversion of proteins to sugar.

6. Adrenal (medulla) (Cortex)	Adrenaline (epinephrine) and Nor- adrenaline (norepinephrine) Corticoids	Adrenaline (epinephrine) is released in case of anger, fear of depression (<i>i.e.</i> , emotional stress). It increases heart beat. Nor- adrenaline causes reduction of cardiac output as well as heart rate. Corticoids regulate salt-water balance, carbohydrate, protein and lipid metabolism.
7. Pancreas	Insulin Glucagon	Regulates sugar metabolism. Too little of insulin leads to high sugar level in the blood and weakness—a condition called diabetes. Increase of blood sugars.
8. Ovary	Estrogen Progesterone	Many functions and features such as development of breasts. Maintenance of pregnancy.
9. Testis	Testosterone	Many masculine features such as the growth of mustaches and beard.

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