NEXTGEN ACADEMY
by Suyog Sir

Transportation in Plants

CHAPTER OUTLINE

15.1 Transportation in Plants
15.2 Excretion : Plants, Animals and Humans
15.3 Coordination : Plants and Humans

1. Overview : Transportation in Plants

Transportation in plants is the process of moving substances synthesized or absorbed in one part of the plant to another part with the help of specialized conducting tissues, i.e., xylem and phloem.

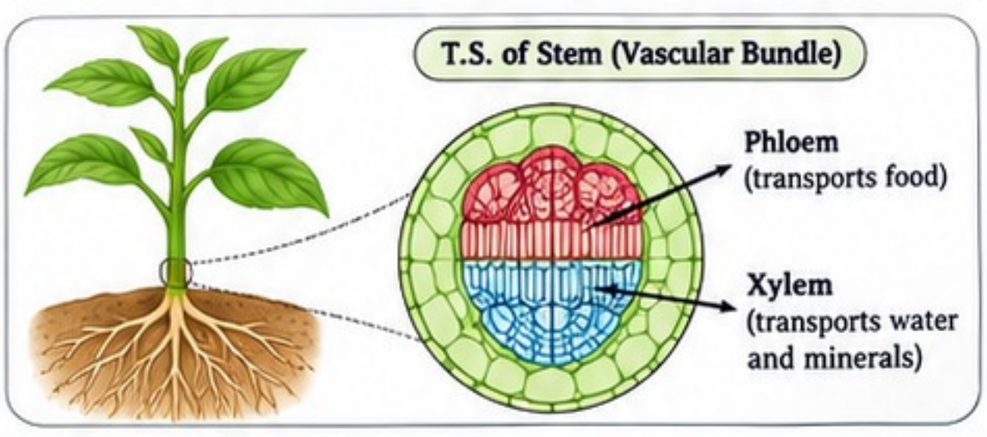
2. Digestive & Respiratory Systems in Context

Q. How do the digestive system and respiratory system work?

Ans. The digestive system breaks down complex food substances into simple, soluble and absorbable nutrients with the help of enzymes. These soluble nutrients are supplied to each cell along with the help of the circulatory system (blood). The lungs, which are important organs of the respiratory system, are the site where oxygen from inhaled air diffuses into the blood. This oxygen is then delivered to every cell with the help of blood circulation. Both the digestive and respiratory systems are under the control of the brain. Their functions are coordinated with each other.

3. Transportation : Meaning

1. **Transportation :** The process of taking a substance made or absorbed in one part of the body to another part with the help of a transportation process.
2. **Transportation in plants :** Plants do not move from their places. Hence, they do not require high energy. They need inorganic substances such as nitrogen, phosphorus, magnesium, manganese, sodium, etc. The absorption of these substances from the soil is done by the roots. After absorption, they are transported to other parts.
3. **Transportation of water in plants :**
   (1) **Root Pressure :** Plants give out excess water in the form of vapour through the stomata present on their leaves. This process is called transpiration.



IMPORTANT POINTS

- Plants require inorganic substances such as nitrogen, phosphorus, magnesium, manganese, sodium, etc.
- These substances are absorbed from the soil by the roots.
- They are then transported to other parts of the plant.
- Specific conducting tissues, xylem and phloem, carry out transportation in plants.
- The xylem is responsible for conduction of water.
- The phloem is responsible for conduction of food.

TRY THIS (Textbook page 163)

Q. A small plant like Balsam or Tuberose, if kept in coloured water and observed after 2 – 3 hours, what happens? Observe.

Ans. Balsam or Tuberose shows that colour water rises due to root pressure.

OBSERVE (Textbook page 164)

Take a transverse section of the stem of a plant and observe the stained xylem under a compound microscope.

- In the observation of the stained xylem, the following facts were observed :
  - Pressure exerted by the roots is called root pressure.
  - Due to root pressure the minerals and water can rise up to the different parts of the plants through xylem and phloem respectively.

(2) TRANSPIRATION PULL

CAN YOU RECALL? (Textbook page 164)

Q. Previously you have performed the activity of observing a branch covered in a plastic bag. What did you observe in that activity?

Ans. When a plastic bag is tied around the living plant, the mixture (water vapour) is seen gathered on the inner side of the bag.

KEY TAKEAWAYS (Exam-Ready)

- Transportation = movement of substances within the plant.
- Roots absorb inorganic substances from the soil.
- Xylem → conducts water.
- Phloem → conducts food.
- Root pressure and transpiration help water to rise in plants.

Translocation and Plant Excretion

1 Translocation in Plants

Translocation is the transport of food made by the plant from the part where it is produced to other parts of the plant through the phloem.

Role and Significance

1. It helps in the distribution of food (sugars) to all plant parts.
2. Transpiration helps in the absorption of water and minerals from the soil.
3. Root pressure assists in pushing water upward during night.

Numerical Facts

- In one year an oak tree releases about 1,51,000 litres of water into the air by transpiration.
- A maize crop in an area of one acre gives out about 11,400 to 15,100 litres of water per day.

2 Transportation of Food and Other Substances in Plants

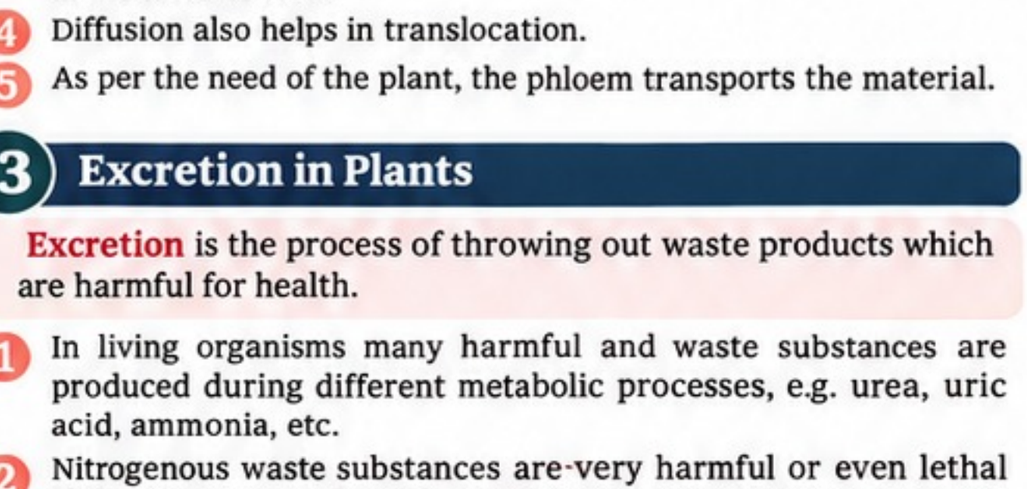
1. Translocation (translocation process) means the movement of the food prepared in the leaves to each cell of the plant body and storage of the extra food (except amino acids) in roots, fruits and seeds.
2. The phloem carries translocated food in both the upward and downward directions.
3. Translocation needs energy. This energy is available to the plant in the form of ATP.
4. Diffusion also helps in translocation.
5. As per the need of the plant, the phloem transports the material.

3 Excretion in Plants

Excretion is the process of throwing out waste products which are harmful for health.

1. In living organisms many harmful and waste substances are produced during different metabolic processes, e.g. urea, uric acid, ammonia, etc.
2. Nitrogenous waste substances are very harmful or even lethal if they are accumulated in the body. Hence, they are removed from the body by the excretory system.
3. There are different methods of excretion.
4. In unicellular organisms, waste materials are directly eliminated across the cell surface by diffusion.
5. The process of excretion in multicellular organisms is complex.

Diagram: Translocation through Phloem



4 Excretion in Plants : Can You Tell?

Q. Why does this happen?

(1) Leaves of plants fall off in a particular season.

(2) Fruits, flowers fall off after a certain period of time.

Ans. Plants do not have excretory system. The excretory matter of the plants is accumulated in the vacuoles, flowers, fruits and barks of the tree. Therefore, in particular season the leaves, flowers and fruits fall off from the tree for disposing these secretions.

(3) Substances like resin, gum, etc. are given out of the plant body.

Ans. Substances like resin and gum are useful to us but they are unwanted for the plants. Since they are not needed by the plants, they are thrown away from the plant bodies.

Important Facts about Plant Excretion

1. Excretion is a simple process in plants.
2. There is no special organ or system for excretion in plants.
3. Diffusion helps in throwing out the gaseous substances.
4. Roots throw some waste materials into the surrounding soil.
5. Waste substances of plants are stored in vacuoles of leaf-cells, in flowers, fruits and in the bark of the stem. These parts laden with waste products fall off intermittently, whereas some waste materials are stored in worn out and old xylem, in the form of resin and gum.
6. In some plants like *Amorphophallus* (Elephant's foot) or Arum leaves, the waste materials are present in the form of raphides which are the crystals of calcium oxalate. Raphides are needle-shaped, they prickle and cause irritation of the skin.

Key Takeaways (Exam Ready)

- Translocation = movement of food from leaves to all parts through phloem.
- Phloem carries food in both upward and downward directions.
- Translocation requires energy (ATP) and is aided by diffusion.
- Excretion = removal of harmful waste produced during metabolism (e.g. urea, uric acid, ammonia).
- Plants do not have a special excretory system.
- Plant waste is stored in vacuoles, flowers, fruits, bark, old xylem (resin, gum) or in the form of raphides (calcium oxalate).

Human Excretion and Urine Formation

7 Excretion in Human Beings

Can you tell? (Textbook page 166)

(1) Which waste materials are produced in our body through metabolic activities?

Ans. In our body, due to metabolic processes (or metabolism), toxic substances such as ammonia, urea, uric acid, creatinine, **etc.** are formed.
Carbon dioxide is given out through the nose.
The excess of vitamins and minerals which find their way into our diet are also thrown out through urine.

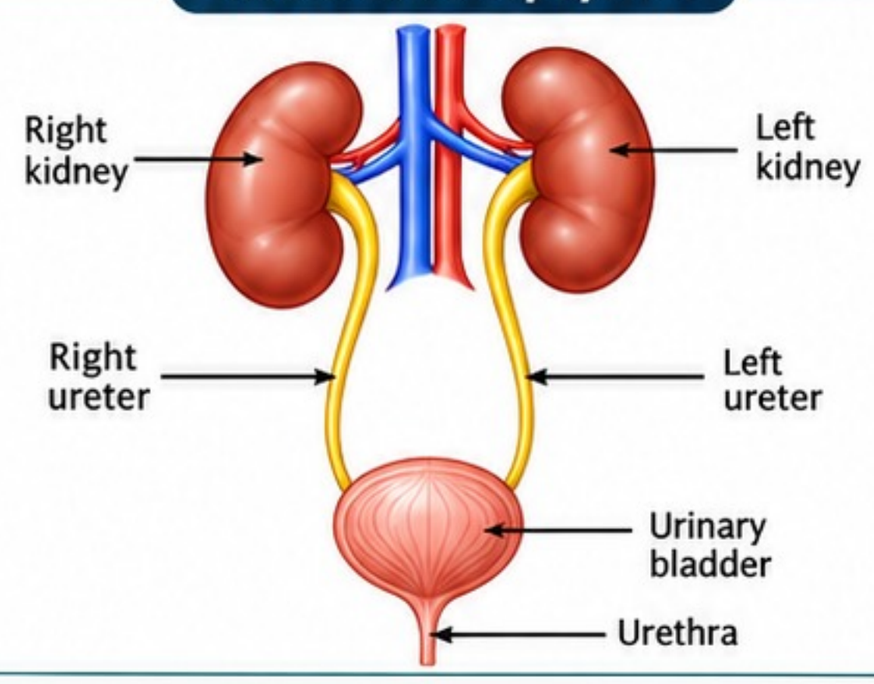
(2) How does the process of excretion take place in humans?

Ans. The blood is filtered through the pair of kidneys. The carbon dioxide escapes out from the lungs. The sweat glands present in the layers of skin also excrete some amount of excretory substances. The undigested and unwanted faecal matter is thrown out through anus in the process of egestion. In this way the excretory substances are thrown out of the body. The excretion in true sense happens only with the help of kidneys where the blood is filtered and the toxic unwanted materials form the urine.

Excretory System in Humans

- (1) **Excretory system** : The excretory system is the system that removes the toxic wastes from the body.
- (2) Following organs form the human excretory system :
  - (i) Pair of kidneys
  - (ii) Pair of ureters
  - (iii) Urinary bladder
  - (iv) Urethra
- (3) **Kidneys** : The two bean-shaped kidneys are situated one on either side of the vertebral column, on the posterior side of abdomen. The right kidney is in a slightly lower position than the left.
- (4) The toxic wastes present in the blood are filtered out by the kidneys.

Human Excretory System



- (5) The functional unit of the kidney that performs the basic function of filtration is called a **nephron**.
- (6) **Bowman's capsule** : Cup-like, thin-walled upper part.
- (7) **Glomerulus** : Network of blood capillaries.
- (8) The urea produced in the liver comes into the blood. When the urea-containing blood comes into the glomerulus, it is filtered through its capillaries and urea and other similar substances are separated from it. The kidneys filter about 190 litres of blood from which about 1 to 1.9 litres of urine is formed.

(9) Formation of Urine

- Bowman's capsule has semi permeable membrane with pores. The molecules of water and some other molecules can pass through these pores. The solution remaining in the Bowman's capsule enters the uriniferous tube or nephron.
- Nephron has four parts, Proximal convoluted tubule, Loop of Henle, Distal convoluted tubule and Collecting duct.
- Water and useful molecules are reabsorbed into the blood whereas remaining toxic substances along with some water is sent ahead for elimination. This solution later forms urine.
- The urine produced in the kidney is then taken through the **ureters** and deposited in urinary bladder.
- The urinary bladder is muscular and it is under the control of voluntary nerves.
- From urinary bladder urine goes out of the body through urethra.
- Kidneys are the main organs of excretion in human beings but the skin and lungs also help in the process of excretion.

Key Facts at a Glance

Functional unit of kidney	Nephron
Bowman's capsule	Cup-like, thin-walled upper part
Glomerulus	Network of blood capillaries
Parts of nephron	Proximal convoluted tubule, Loop of Henle, Distal convoluted tubule, Collecting duct
Blood filtered by kidneys	About 190 litres
Urine formed	About 1 to 1.9 litres

8 Dialysis

- When functioning of the kidneys is affected, the toxic nitrogenous waste products accumulate in the body which may even cause death.

Exam POINTERS

- ✔ Excretion in true sense in humans occurs with the help of **kidneys**.
- ✔ **Main excretory organs** : Kidneys (skin and lungs also help).
- ✔ **Nephron** : functional unit of kidney.
- ✔ **Kidneys** filter ~ 190 litres of blood per day.
- ✔ **Urine formed** : ~ 1 to 1.9 **litres** per day.

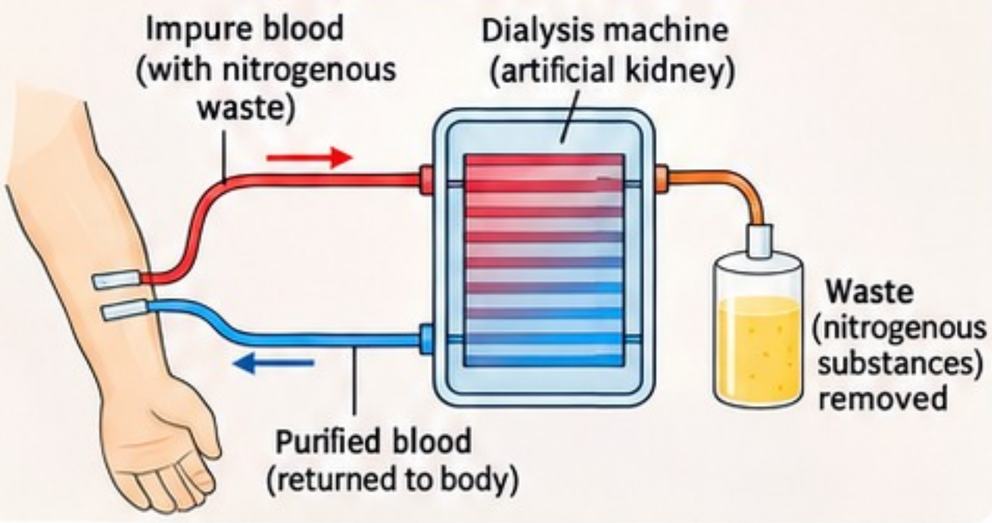
NEXTGEN ACADEMY
by Suyog Sir

Dialysis and Coordination

Dialysis

- In such cases, the filtration of the blood is done by a machine called a dialysis machine.
- About 500 ml of blood is sent at one time through this machine, it is purified and reinfused back into the body of the patient.
- Dialysis is thus the process of separating the nitrogenous waste from blood with the help of this artificial machine.

Dialysis (Artificial Kidney)



Coordination

- **Control :** Systematic regulation of different processes of the body is called control.
- **Coordination :** Bringing about the different processes in the proper sequence can be called coordination.
- There is proper coordination between various systems of the body. At different steps too there is no randomness of any kind.
- **Homeostasis :** Homeostasis is the state of equilibrium which is necessary for the optimal efficiency of the body. This is done by maintaining proper coordination between various systems of the body.
- In plants, there is no nervous system but the responses given to the stimuli shows coordination.

Coordination in Plants

1. Tropism or Tropic Movements

- Movement or growth of any part of the plant in response to an external stimulus is called 'tropism' or 'tropic movement'. These are of the following types :

2 **Phototropic movements or phototropism :** Movements in the direction of light.

3 **Gravitropic movements or gravitropism :** Movements in the direction of gravity.

4 **Hydrotropic movements or hydrotropism :** Movements in the direction of water.

5 **Chemotropic movements or chemotropism :** Movements in the direction of chemical stimuli.

6 **Growth relevant movements :** All the above movements of plants are related with growth so they are called growth relevant movements.

7 **Growth irrelevant movements :** The movements of the plants that do not result into growth are growth irrelevant movements.

8 The technique of plant movements :

- Different hormones are responsible for the movements in the plants. These movements are in response to the environmental stimuli.
- Plants use electrochemical impulses for transfer of information from one place to another.
- Plant cells change their shape by increasing or decreasing their water content. This results into the movements of plants.

Plant Hormones and their Functions

Plant hormones	Function
Auxin	Cell enlargement
Gibberellins	Elongation of stem
Cytokinins	Cell division
Abscisic acid	Prevention and retardation of plant growth, Wilting of leaves

9 Examples of plant movements :

- Venus fly trap and *Drosera* show movements in response to capture insects.
- Movement of leaflets in *Mimosa* (touch-me-not) in response to touch.
- Opening of flowers in lotus (during day-time) and *Polyanthus* i.e. tuberose (at night).
- Dehiscence of fruit for dispersal of seeds as in Balsam.

Coordination in Human Beings

- The two mechanisms in the human body bring about control and coordination. These are :

Nervous Control and Chemical Control

Nervous Control

- **Impulse :** In accordance with the changes in the surroundings, the impulses are generated in the body.

Coordination in Plants

Key Points at a Glance

- **Response :** Responses are given to the respective stimulus by the nervous system.
- The complex and evolved animals have highly developed nervous system. Unicellular animals like the amoeba do not have a nervous system which produces such impulses and response.

The Neuron (Nerve Cell)

- The structural and functional unit of the nervous system is a neuron.
- The nervous system is made up of millions of neurons or nerve cells.
- Neurons conduct impulses from one place to another in the body.
- The largest cell in the human body is neuron.
- A neuron can generate and conduct electrochemical impulses.
- **Neuroglia :** The cells that support the nerve cells and help in their functioning.
- **Nerves :** A bundle of nerve cells and neuroglial cells together form a nerve.

Structure of a Neuron

(1) A neuron has three main parts : (1) Cyton or cell body (2) Dendrites (3) Axon.

(2) The axon is covered by a myelin sheath. It is not continuous but has gaps called Nodes of Ranvier. A Schwann's cell is also present on the axon.

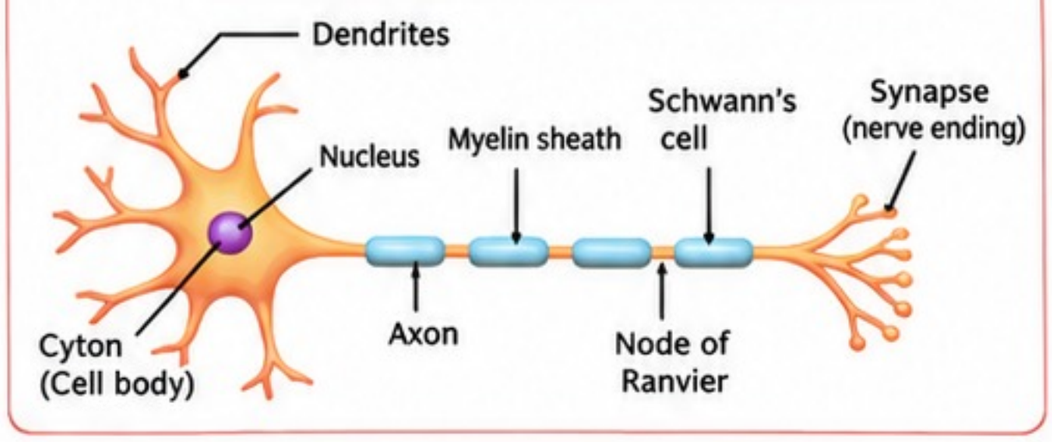
(3) Dendrites have typical processes through which they can collect information from the surroundings. This information is sent to the cyton.

(4) The cyton has a large nucleus which sends the electric impulse to the next neuron with the help of the axon.

(5) There is a minute space, called the synapse, between two adjacent neurons.

(6) In this way, the neural impulse is transmitted from dendrites to the cell body, from cell body to axon and from axon to synapse. Then it passes to the next neuron.

Diagram : Structure of a Neuron



(7) There is secretion of neurotransmitters which are certain chemical substances secreted by the nerve endings near the synapse. Due to these chemical substances, the impulses are transmitted rapidly.

(8) The response is ultimately given by muscle cell or gland.

Can you tell ? (Textbook page 172)

(1) Which are the sensory organs of an organism ? What is their function ?

Ans. Nose, eyes, ears, tongue and skin are the sense organs of human beings. The invertebrates have different types of sense organs as per their body forms. Higher and evolved organisms however possess similar sense organs.

Nose : Olfactory, **Eyes :** Optic, **Ear :** Auditory, **Tongue :** Gustatory, **Skin :** Tactile.

(2) Where are the gustatory and olfactory nerves to be found ?

Ans. Gustatory nerves are found in tongue and olfactory nerves are found in nose.

(3) Types of Nerve Cells / Neurons

Type	Function
Sensory neurons	Conduct impulses from sensory organs to the brain and the spinal cord.
Motor neurons	Conduct impulses from the brain or spinal cord to effector organs like muscles or glands.
Association neurons	Perform the function of integration in the nervous system.

13. The Human Nervous System

- The human nervous system has following three parts :

(A) Central Nervous System

(B) Peripheral Nervous System

(C) Autonomic Nervous System

Central Nervous System

Central Nervous System or CNS

- Central nervous system consists of brain and spinal cord.

1. Brain

- Brain is the main controlling part of the nervous system.
- Its weight is about 1300 – 1400 grams in adult human being.
- It consists of approximately 100 billion neurons.
- It is highly protected in the cranial cavity.
- Spinal cord is protected in the vertebral column.

Key Terms and Their Functions

Meninges	Protective layers in the space between the central nervous system and the bony covering.
Ventricles	Cavities present in various parts of the brain.
Central canal	Long tubular cavity of the spinal cord.
Cerebro-Spinal fluid	Fluid present in the ventricles, central canal and the spaces between the meninges. Function: Supplies nutrients to the central nervous system and protects it from shock.

Control of Brain Sides

- The right side of our body is controlled by the left side of our brain.
- The left side of our body is controlled by the right side of our brain.
- On the left side of the brain there are faculties of analytical thinking, logical thinking, language, science and mathematics.
- On the right side of the brain, there are located: holistic thinking, intuition, creativity, art and music.

2. Structure of Brain

Three main parts :

I. Cerebrum
II. Cerebellum
III. Medulla oblongata

I. Cerebrum

- The largest part of the brain that occupies two-thirds of the brain.
- Consists of two cerebral hemispheres which are joined by a fibres and nerve tracts.
- Surface has deep, irregular ridges and grooves which are called convolutions.
- Convolution increases the surface area of the cerebrum and therefore a large number of nerve cells can be accommodated.

II. Cerebellum

- Smaller part of the brain.
- Situated at the back of the cranial cavity and below the cerebrum.
- Its surface shows shallow grooves instead of deep convolutions.

III. Medulla oblongata

- The hind-most part of the brain.
- Two triangular swollen structures called pyramids are present on the upper side of medulla oblongata.
- The hind part of the medulla oblongata continues as spinal cord.

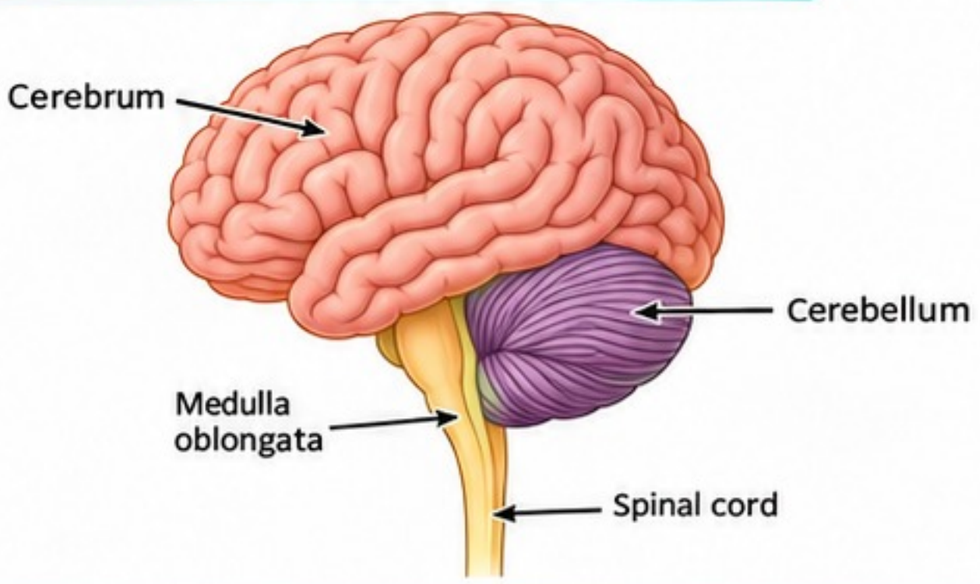
3. Spinal Cord

- Located firmly inside the vertebral column.
- Slightly thick but gradually tapers towards the end.
- Filum terminale is the thread-like fibrous structure at the end of spinal cord.

4. Functions of Brain and the Spinal Cord

Parts of the brain and spinal cord	Functions
Cerebrum	1. Control of voluntary movements. 2. Concentration, planning, decision making, memory, intelligence and intellectual activities. 3. Seat of mind.
Cerebellum	1. Coordination of voluntary movements. 2. Maintaining the body's posture.

Diagram: Human Brain (Lateral View)



Question Bank

1. What are the main parts of the brain?
2. Write the functions of cerebro-spinal fluid.
3. Which part of the brain is the seat of mind?
4. What is filum terminale?
5. State two functions of cerebellum.

Answers

1. Cerebrum, cerebellum and medulla oblongata.
2. It supplies nutrients to the central nervous system and protects it from shock.
3. Cerebrum.
4. Filum terminale is the thread-like fibrous structure at the end of spinal cord.
5. (i) Coordination of voluntary movements. (ii) Maintaining the body's posture.

NEXTGEN ACADEMY
by Suyog Sir

Grade 9 • Science

Nervous Control and Chemical Control

Key Terms and Their Meanings

Medulla oblongata	Control of all involuntary activities such as breathing, sneezing, coughing, salivation, beating of heart and blood circulation.
Spinal cord	1. Conduction of impulses from the skin to the brain. 2. Conduction of impulses from the brain to the muscles or glands. 3. Functioning as the centre of coordination of reflex actions.

Peripheral Nervous System (PNS)

Consists of the nerves origintating from the central nervous system and connecting with all the body parts. It has the following two types :

I. **Cranial nerves :** There are 12 pairs of cranial nerves. They originate from the brain and are associated with various parts in the head, thorax and abdomen.

II. **Spinal nerves :** There are 31 pairs of spinal nerves which originate from the spinal cord.

Autonomic Nervous System (ANS)

- This system works on involuntary control and is not under the control of our will.
- Examples of involuntary organs: heart, lungs, stomach, etc.
- These are associated with arms, legs, skin and some other parts of the body.

Location of Endocrine Glands, Hormones and Their Functions

Glands	Location	Hormones	Functions
Hypothalamus	The floor of the forebrain just above the pituitary gland.	Secretes the controlling hormones which regulate the activity of the secretory cells of the pituitary gland.	Controls the pituitary gland, secretion of some hormones.
Pituitary	Hanging from the lower side of brain.	1. Growth Hormone	– Stimulates growth of bones
		2. Adrenocorticotropic hormone	– Stimulates adrenal gland
		3. Thyroid stimulating hormone	– Stimulates thyroid gland
		4. Prolactin	– Stimulates milk production
		5. Follicle stimulating hormone	– Controls growth of gonads

Reflex Action

- Reflex action is an immediate and involuntary response given to a stimulus from the environment.
- We do not have any control over reflex actions.
- Most reflex actions are without intervention of the brain.

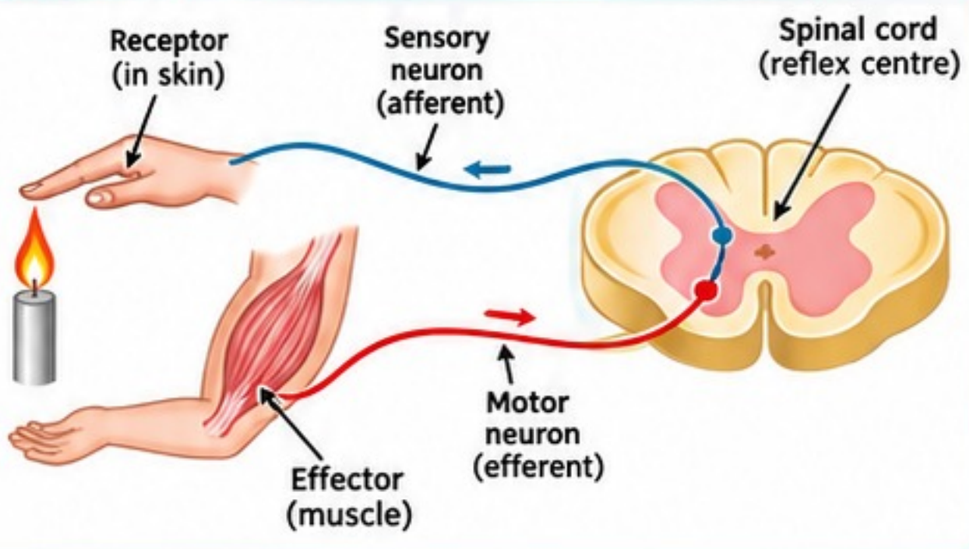
14. Chemical Control

- Chemical control is done by hormones and neurotransmitters.
- Endocrine glands are ductless glands whose secretion mixes in the blood circulation directly.
- Through the blood circulation, they reach the entire body.
- Nerve impulses are fast but short lived, whereas the action of hormones is very slow but long lasting.
- There is a special mechanism which controls the quantity and timing of hormone secretion.

Summary (Exam-Ready)

- **Medulla oblongata** controls involuntary actions (breathing, sneezing, coughing, salivation, heart beat, blood circulation).
- **Spinal cord :** conducts impulses (skin → brain, brain → muscles/ glands) and acts as the centre of reflex actions.
- **PNS :** cranial nerves (12 pairs) and spinal nerves (31 pairs).
- **ANS :** involuntary control of organs (e.g., heart, lungs, stomach).
- **Reflex action :** immediate, involuntary and without brain directly.
- **Chemical control :** by hormones and neurotransmitters from endocrine glands; slow but long-lasting action.

Diagram : Reflex Action (Reflex Arc)



Question Bank

Q1. What is reflex action?

A. Reflex action is an immediate and involuntary response given to a stimulus from the environment.

Q2. Write the number of pairs of cranial and spinal nerves.

A. Cranial nerves – 12 pairs; Spinal nerves – 31 pairs.

Q3. Name two hormones secreted by the pituitary gland.

A. Growth hormone and prolactin.

NEXTGEN ACADEMY
by Suyog Sir

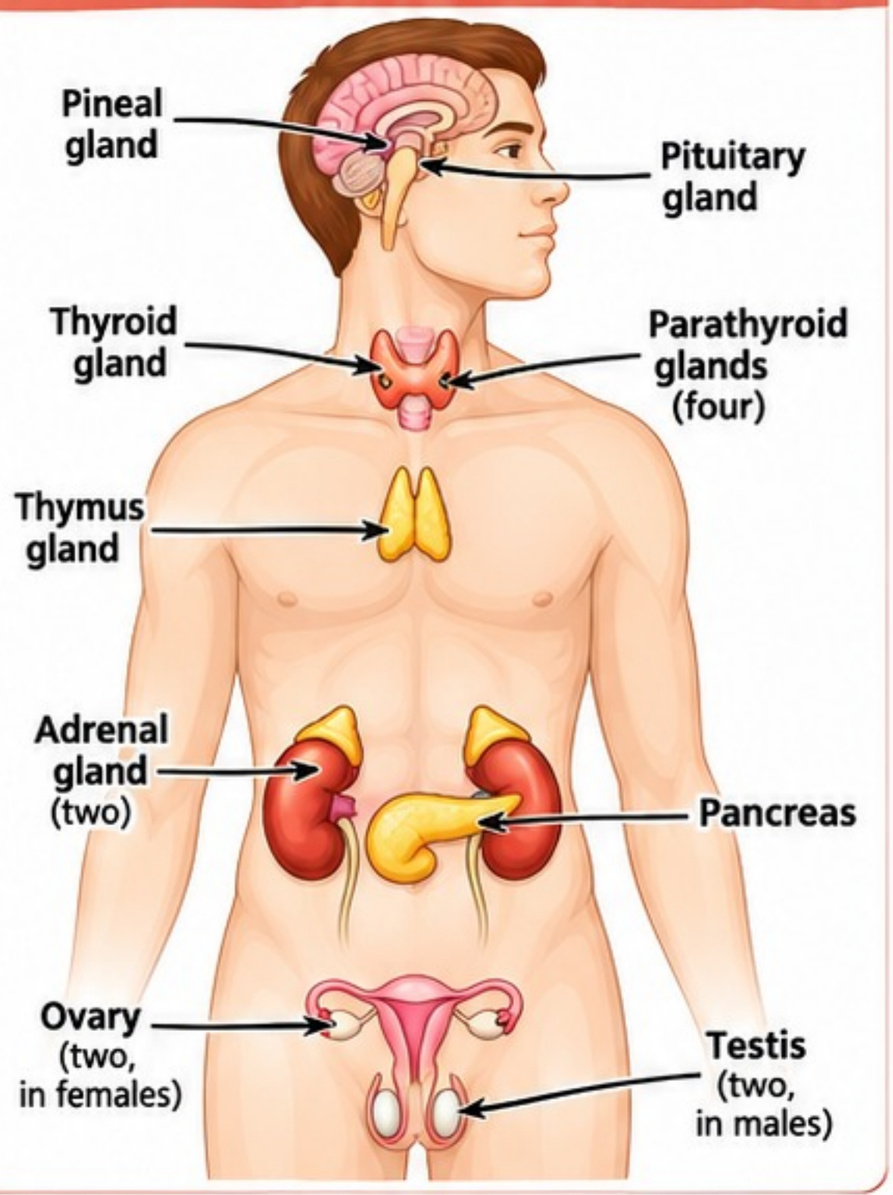
Grade 9 • Science
Notes-and-Question Bank

Endocrine Glands and Hormones

Key Concepts

- **Endocrine glands** (ductless glands) release hormones directly into the blood.
- **Hormones** are chemical messengers that **regulate** growth, metabolism, reproduction and other body activities.
- Each hormone has a **specific target organ** and function.
- The major endocrine glands in humans are: thyroid, parathyroid, pancreas, adrenal gland, thymus, testis and ovary.

Human Endocrine System (Location)



Exam-Ready Summary

- **Thyroid** – Secretes thyroxine; controls growth and metabolic activities.
- **Parathyroid** – Secretes parathormone; regulates calcium and phosphorus metabolism.
- **Pancreas** – Secretes glucagon, insulin, somatostatin and pancreatic polypeptide; regulates glucose level and pancreatic functions.
- **Adrenal gland** – Secretes adrenaline, nor-adrenaline and corticosteroid; helps in crisis (fight or flight), maintains Na^+/K^+ balance and metabolism.
- **Thymus** – Secretes thymosin; controls immune cells.
- **Testis** – Secretes testosterone; develops male secondary sexual characters.
- **Ovary** – Secretes oestrogen and progesterone; brings about endometrial growth, female secondary sexual characters and prepares uterus for pregnancy.

Endocrine Glands, Hormones and Their Functions

Gland	Location	Hormone(s)	Main Function(s)
		6. Luteinizing hormone	– Controls menstrual cycle and ovulation
		7. Oxytocin	– Contracts uterus during parturition
		8. Antidiuretic hormone	– Regulates water level in the body
Thyroid	Antero-lateral sides of trachea in neck region	**1. Thyroxine**	– Controls growth of body and metabolic activities
Parathyroid	Four glands behind thyroid gland	**Parathormone**	Controls metabolism of calcium and phosphorus
Pancreas	Behind the stomach		
	Four types of cells Alpha cells (20%)	**Glucagon**	– Stimulates liver to convert glycogen into glucose
	Beta cells (70%)	**Insulin**	– Stimulates liver to convert excess blood-glucose into glycogen
	Delta cells (5%)	**Somatostatin**	– Controls levels of insulin and glucagon
	P.P. cells or F cells (5%)	**Pancreatic polypeptide**	– Controls movements of intestine and thereby glucose absorption – Controls secretion of pancreatic juice
Adrenal Gland	Anterior end of each kidney	Adrenaline and Nor-adrenaline	– Controls behaviour during crisis and emotional situations – Stimulates heart and its conducting tissue and metabolic processes
		Corticosteroid	– Maintains balance of Na^+ and K^+ and stimulates metabolism
Thymus	In thoracic cage, near the heart	**Thymosin**	Controls the cells which give rise to immunity
Testis	In scrotum	**Testosterone**	Stimulates growth of secondary sexual characteristics like beard, moustache, hoarse voice, etc. in men
Ovary	On either side of uterus in women	**Oestrogen**	– Stimulates growth of endometrium – Stimulates growth of secondary sexual characteristics in women
		Progesterone	– Prepares the endometrium for conception and maintains the pregnancy

Question Bank (Grade 9)

Q1 **State the location of the thyroid gland.**
Ans. Antero-lateral sides of trachea in neck region.

Q2 **Which hormone is produced by beta cells of the pancreas?**
Ans. Insulin.

Q3 **Name the hormones secreted by the adrenal gland.**
Ans. Adrenaline, nor-adrenaline and corticosteroid.

Q4 **What is the function of thymosin?**
Ans. It controls the cells which give rise to immunity.

Q5 **Which hormone prepares the endometrium for conception and maintains pregnancy?**
Ans. Progesterone.

NEXTGEN ACADEMY

by Suyog Sir

Multiple-Choice Questions with Answer Key

Q.1 Choose the correct alternative and write it along with its allotted alphabet:

(1) By the process of _____, a substance either synthesized or absorbed in one part of the body reaches another.
(a) transportation *(b) transcription*
(c) translation *(d) transduction*

(2) All parts of the plant are connected with the _____ tissues.
(a) epithelial *(b) connective*
(c) conducting *(d) nervous*

(3) _____ cells control the opening and closing of stomata.
(a) Stomatal *(b) Guard*
(c) Protective *(d) Security*

(4) Waste materials present in the form of crystals of calcium oxalate are called _____.
(a) graphides *(b) oxalates*
(c) crystallates *(d) raphides*

(5) The functional unit of the kidney that performs the basic function of filtration is called a _____.
(a) nephron *(b) neuron*
(c) cyton *(d) excron*

(6) The network of capillaries in Bowman's capsule is called a _____.
(a) Malpighian body *(b) Cup*
(c) Henle's loop *(d) glomerulus*

(7) Proper coordination between various systems of an organism helps to maintain a state of equilibrium called _____.
(a) homeostasis *(b) statism*
(c) balance *(d) perfection*

(8) The _____ _____ of any plant shows positive phototropic movement.
(a) root system *(b) shoot system*
(c) tissue system *(d) conducting tissues*

(9) There is minute space between two adjacent neurons which is called the _____.
(a) synapse *(b) synapsis*
(c) synergy *(d) spacing*

(10) The long tubular cavity of the spinal cord is called the _____ canal.
(a) spinal *(b) nerve*
(c) central *(d) middle*

(11) _____ _____ supplies nutrients to the central nervous system and protects it from shock.
(a) Blood cells *(b) Cerebrospinal fluid*
(c) Muscular system *(d) Lymphatic circulation*

(12) The _____ continues downwards as the spinal cord.
(a) cerebral hemispheres *(b) medulla oblongata*
(c) corpora quadrigemina *(d) crura cerebri*

(13) _____ glands along with the nervous system are responsible for the control and coordination in our body.
(a) Sweat *(b) Exocrine*
(c) Endocrine *(d) Blood*

(14) _____ contracts uterus during parturition.
(a) ADH *(b) Vasopressin*
(c) Oxytocin *(d) Thyroxin*

(15) _____ maintains balance of Na^+ and K^+ and stimulates metabolism.
(a) Insulin *(b) Thyroxin*
(c) Glucagon *(d) Corticosteroid*

Answer Key

Q. No.	1	2	3	4	5	6	7	8
Answer	(a)	(c)	(b)	(d)	(a)	(d)	(a)	(b)

Q. No.	9	10	11	12	13	14	15
Answer	(a)	(c)	(b)	(b)	(c)	(c)	(d)

True or False and Match the Pairs

Q. 1 State whether the following statements are True or False :

Note : Students should write whether the given statement is true or false. There is no need to correct a false statement and rewrite it.

(1) Water and minerals enter the cells on the root surface due to differences in concentration.

(2) In the process of transportation, excess food, except amino acids, is stored in roots, fruits and seeds.

(3) Latex of rubber is useful substance for the plants.

(4) Kidneys in the human beings is the only excretory organ in the body.

(5) The right kidney is on the upper side than the left kidney.

(6) Movement shown by plants in response to specific chemicals is called 'Gravitopic movement'.

(7) Flower of Tuberose opens in the morning while the lotus opens at night.

(8) Control of voluntary movements is done by cerebrum.

(9) There are 12 pairs of cranial nerves and 31 pairs of spinal nerves.

(10) Beta cells in pancreas are same as F cells.

Ans.

(1) True (2) False (3) False (4) False (5) False
(6) False (7) False (8) True (9) True (10) False

Q. 2 (A) Match the pairs and explain :

Column 'A'	Column 'B'
(1) Growth of pollen tube towards ovule	(a) Gravitropic movement
(2) Growth of shoot system	(b) Chemotropic movement
(3) Growth of root system	(c) Phototropic movement
(4) Growth towards water	(d) Growth – irrelevant movement
	(e) Hydrotropic movement

Ans.

1. Growth of pollen tube towards ovule – Chemotropic movement
2. Growth of shoot system – Phototropic movement
3. Growth of root system – Gravitropic movement
4. Growth towards water – Hydrotropic movement

Explanation of the pairs :

(1) Growth of pollen tube towards ovule – Chemotropic movement.

Ans. Movement shown by plants in response to specific chemicals is called 'chemotropic movement'. For example, the growth of the pollen tube towards the ovule is due to chemotropism.

(2) Growth of shoot system – Phototropic movement.

Ans. The shoot system of a plant grows towards the source of light. This is called phototropic movement.

(3) Growth of root system – Gravitropic movement.

Ans. The root system of plants responds to stimuli of gravitation. Therefore, it is a gravitropic movement.

(4) Growth towards water – Hydrotropic movement.

Ans. Growing towards water means hydrotropic movement. Roots of all plants show hydrotropic movement.

(B) Match the columns :

(1)

Plant hormones	Function
(1) Auxin	(A) Retardation of growth
(2) Gibberellins	(B) Cell division
	(C) Enlargement of cells
	(D) Stem elongation

Ans.

(1) Auxin – Enlargement of cells
(2) Gibberellins – Stem elongation

Complete the Paragraph and Name the Following

(2) Comparison of Cells and Their Hormones

Cells	Percentage	Hormones
Alpha cells	5%	Pancreatic polypeptide
Beta cells	5%	Somatostatin
Delta cells	20%	Insulin
P.P. cells	70%	Glucagon

Ans.

Cells	Percentage	Hormones
Alpha cells	20%	Glucagon
Beta cells	70%	Insulin
Delta cells	5%	Somatostatin
P.P. cells	5%	Pancreatic polypeptide

Q. 4 Complete the paragraph using the words given in bracket :

(nerve, nerve cells, muscle cell, impulses, dendrites, synapse, axon, reflex action, cell body)

The milk was on the stove. Rasika was engrossed watching television. She smelled something burning. She ran towards the kitchen. The milk was boiling over. She held the vessel with her bare hands but, screaming, she let it go at once. This activity was controlled by ..... cells. Special ends of ..... in these cells collected the information, from where it was transferred to the ..... and then towards the terminal end of the ..... . The chemicals produced at the terminal end passed through the minute space i.e. ..... . In this way, ... were conducted in the body and the process of ..... was completed by conducting the impulses from ..... to ..... .

Ans. The milk was on the stove. Rasika was engrossed watching television. She smelled something burning. She ran towards the kitchen. The milk was boiling over. She held the vessel with her bare hands but, screaming, she let it go at once. This activity was controlled by **nerve cells**. Special ends of **dendrites** in these cells collected the information, from where it was transferred to the **cell body** and then towards the terminal end of the **axon**. The chemicals produced at the terminal end passed through the minute space i.e. **synapse**. In this way, **impulses** were conducted in the body and the process of **reflex action** was completed by conducting the impulses from **nerve cells** to **muscle cell**.

Q. 5 Name the following :

(1) The neurons that perform the function of integration in the nervous system.

Ans. Association neuron.

(2) The part of the brain that occupies two-thirds of the area.

Ans. Cerebrum.

(3) The thread-like fibrous structure at the end of the spinal cord.

Ans. Filum terminale.

(4) Centre of coordination of reflex actions.

Ans. Spinal cord.

(5) Part of the brain that controls the pituitary gland.

Ans. Hypothalamus.

(6) Hormone of parathyroid gland.

Ans. Parathormone.

(7) Hormones of pancreas.

Ans. Glucagon, Insulin, Somatostatin, Pancreatic polypeptide.

(8) Endocrine gland in the thoracic cage.

Ans. Thymus.

(9) Four endocrine cells in the pancreas.

Ans. Alpha cells, beta cells, delta cells and P.P. cells or F cells.

(10) Controlling centre of involuntary activities.

Ans. Medulla oblongata.

(11) Three parts of nervous system.

Ans. (1) Central nervous system
(2) Peripheral nervous system
(3) Autonomic nervous system.

Distinguish Between

A. Short Answer Questions

(12) Parts of excretory system in human beings.

Ans. (1) Paired kidneys
(2) Paired ureters
(3) Urinary bladder
(4) Urethra.

(13) Plant hormone secreted at shoot system.

Ans. Auxin.

(14) Hormone controlling metabolism of calcium and phosphorus.

Ans. Parathormone from parathyroid glands.

(15) Hormone maintaining pregnancy.

Ans. Progesterone.

B. Distinguish Between (Theory and Comparison)

***(1) Excretory system of humans and plants.**

Ans.

Excretory System of Humans	Excretory System of Plants
1. The excretory products of humans are toxic. They are harmful if stored in the body. Thus, they are thrown out of the body regularly.	1. Plants store their excretory products in their barks or in other plant parts.
2. Urea, uric acid and ammonia are the main nitrogenous waste products in human beings.	2. Raphides, resins, gum, latex, etc. are the excretory products of plants.
3. Excretion in human beings is a complex process and thus it requires a well-formed system.	3. Excretion in plants is a relatively easier task. They do not have specialised excretory system or organs for the same.
4. Blood is filtered to separate the excretory products.	4. A simple process of diffusion is used to remove the excretory products out of the plant body.

(2) Nervous control and chemical control.

Ans.

Nervous control	Chemical control
1. Nervous control is done by the various neurons and different nerves.	1. Various endocrine glands and the hormones secreted by them bring about chemical control in the body.
2. Nervous stimuli travel with a great speed in the body.	2. The action of hormones is very slow and gradual.
3. Nervous control is short lived.	3. Chemical control lasts longer.

(3) Cerebrum and cerebellum.

Ans.

Cerebrum	Cerebellum
1. Cerebrum occupies two-third part of the brain.	1. Cerebellum occupies less than one-third part of the brain.
2. Cerebrum is the largest part of the brain.	2. Cerebellum is the second largest part of the brain.
3. The voluntary actions are controlled by cerebrum.	3. Cerebellum brings about coordination in the movement of the body and also maintains the equilibrium of the body.
4. There are convolutions on the surface of the cerebrum which are very deep.	4. There are shallow groves on the surface of the cerebellum.

Endocrine Glands: Hormones and Functions

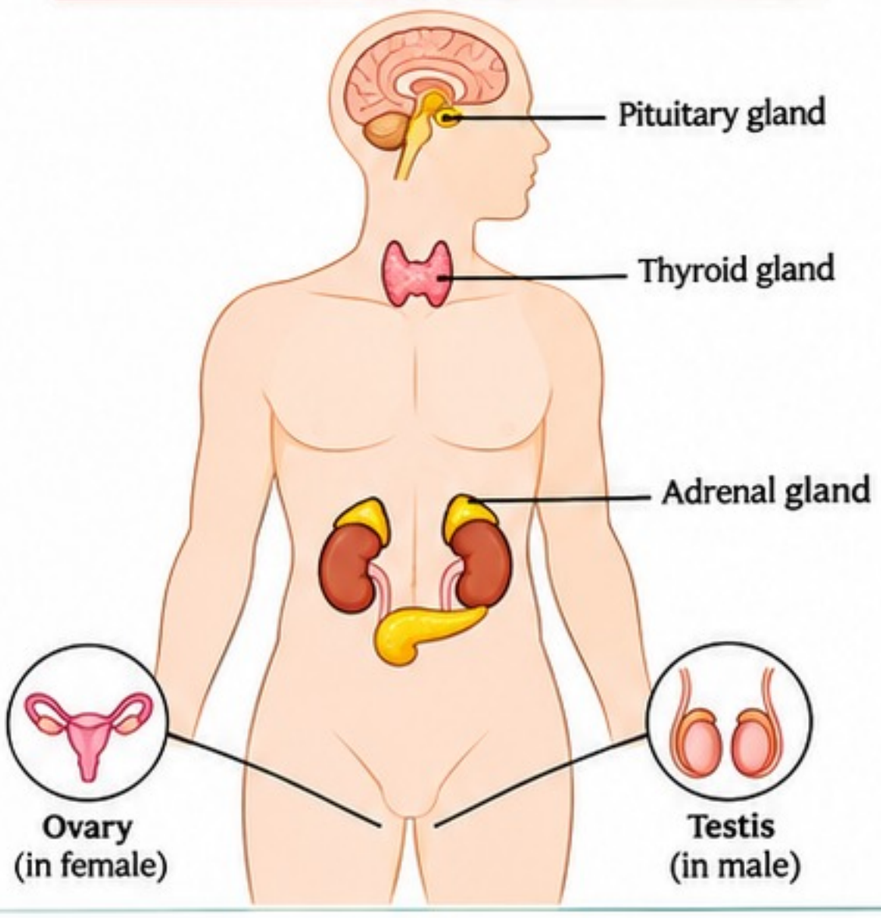
Endocrine System – Overview

- Endocrine glands are ductless glands that release hormones directly into the bloodstream.
- Hormones are chemical messengers that regulate growth, metabolism, reproduction and other body functions.

Key Endocrine Glands and Their Hormones

Gland	Hormone(s)	Main Function(s)
Pituitary	Growth hormone	Body growth, especially bones; converts child to adult.
	Adrenocorticotropic hormone (ACTH)	Stimulates adrenal cortex to secrete its hormones.
Thyroid	Thyroid-stimulating hormone (TSH)	Stimulates thyroid gland to secrete its hormones.
Prolactin	Prolactin	Promotes milk (lactation) production in mothers.
Follicle stimulating hormone (FSH)	FSH	Helps in the growth and control of gonads.
Luteinizing hormone (LH)	LH	Maturnizion of ovum and its release (ovulation); controls menstrual cycle.
Antidiuretic hormone (ADH)	ADH	Regulates water and sodium levels in the body.
Oxytocin	Oxytocin	Aids in child birth and parturition.

Major Endocrine Glands in Human Body



Key Takeaways

- Hormones are secreted by ductless (endocrine) glands.
- They control growth, metabolism, reproduction and response to stress.
- Important endocrine glands: pituitary, thyroid, adrenal, thymus, testis and ovary.

Q. 7 Name the hormones of the following endocrine glands and the function of each :

Pituitary, Thyroid, Adrenal, Thymus, Testis, Ovary

Ans. **(1) Pituitary :** It is the most important endocrine gland. It secretes the following hormones.

(i) **Growth hormone :** Brings about the growth of the body, especially of bones; converts a child into an adult.

(ii) **Adrenocorticotropic hormone (ACTH) :** Helps the adrenal cortex to secrete its own hormones.

(iii) **Thyroid-stimulating hormone (TSH) :** Stimulates the thyroid gland to secrete its own hormones.

(iv) **Prolactin :** Helps in the production of milk (lactation) in mothers.

(v) **Follicle stimulating hormone (FSH) :** Helps in the growth and control of gonads.

(vi) **Luteinizing hormone (LH) :** Causes maturation of the ovum in the ovary and its release (ovulation); also helps in the control of the menstrual cycle.

(vii) **Antidiuretic hormone (ADH) :** Regulates the water and sodium level in the body.

(viii) **Oxytocin :** Helps in child birth or parturition.

(2) Thyroid : Secretes two hormones—thyroxine and calcitonin. Thyroxine controls growth of the body and the basal metabolic rate. Calcitonin controls calcium metabolism and calcium level in the blood.

(3) Adrenal : The cortex (outer part) of the adrenal gland produces corticosteroid. The inner part or medulla secretes adrenaline and noradrenaline. Corticosteroids regulate and balance the levels of sodium and potassium (Na and K) and stimulate metabolism. They also take part in glucose metabolism. Adrenaline and noradrenaline control behaviour during crisis and emotional situations. They also stimulate heart and its conducting tissue and metabolic processes.

(4) Thymus : Controls the cells which give rise to immunity with the help of its hormone called thymosin.

(5) Testis : Male gonads that secrete testosterone, which is a very important hormone in males. It brings about secondary sexual characters in males. The transformation of a boy into a man is due to testosterone. Male characteristics such as beard, moustache, hoarse voice, etc., are developed due to testosterone. They also help in the formation of sperms.

(6) Ovary : Female gonads that produce two hormones—oestrogen and progesterone. Oestrogen transforms a girl into a woman by developing secondary sexual characters. It stimulates the inner lining of the uterus called endometrium to grow. The other hormone, progesterone, is a pregnancy-stabilizing hormone; it prepares the endometrium for implantation of the fertilized ovum and also helps in the maintenance of pregnancy.

Q. 8 Give meanings of the following terms :

(1) Transportation in living organisms

Ans. By the process of transportation, a substance either synthesised or absorbed in one part of the body reaches another.

(2) Translocation of substances

Ans. Translocation is the process in which the food produced by photosynthesis in every leaf of a plant is transported to each plant cell and except for the amino acids it is stored in roots, stem, fruits, seeds, in buds, in other parts of the plant and in pollen grains.

Q. 9 (1) Explain the role of phloem in plants.

Ans. **(1) Phloem :** Phloem is the tissues in plants that help in the transportation of the food (sugars) prepared by the leaves to other parts of the plant.

Coordination in Plants and Haemodialysis

1. Coordination in Plants

- Plants do not have a nervous or muscular system like animals.
- When an external stimulus acts on a plant, it shows movements or growth as a response.
- Plant movements are of two kinds: growth-relevant movements and growth-irrelevant movements.
- Such movements are brought about by coordination in plants and are also called tropic movements or tropisms.

2. Types of Movements in Plants

Type	Meaning (with direction)
Phototropic movement	Growth of the shoot system towards the light.
Gravitropic movement	Growth of the root system in the direction of gravity.
Hydrotropic movement	Growth of the root system towards water.
Chemotropic movement	Growth of the pollen tube towards the ovule in response to specific chemicals.

3. Growth-Relevant vs Growth-Irrelevant Movements

Growth-Relevant Movements	Growth-Irrelevant Movements
• Movements linked with the growth of a plant. • They are associated with **tropisms.** • **Examples:** photo-, gravito-, hydro- and chemotropic movements.	• Movements not concerned with growth. • They occur due to changes in turgidity or activity of certain plant hormones. • **Examples:** leaf movement in *Mimosa*, trap closure in Venus fly trap, flower blooming and fruit dehiscence.

4. Some Growth-Irrelevant Movements (Details & Examples)

1 **Mimosa (touch-me-not)**	Shows movement when touched, brought about by electro-chemical impulses that transfer information from one part to another.
2 **Venus fly trap**	An insectivorous plant with a trap that appears and smells like flowers. When an insect visits, the trap closes; the movement is for feeding and not due to growth.
3 **Drosera**	An insectivorous plant with fibrils on the leaves that bend inwards as soon as an insect lands. The prey is surrounded from all sides and is captured.
4 **Flower blooming**	Flowers bloom at a particular time of the day. Example: Lotus flower opens during daytime, while the tuberose (*Polyanthus*) opens at night.
5 **Fruit dehiscence**	Ripe fruits split open at the right time to disperse seeds. Example: Balsam.

5. Role of Plant Hormones

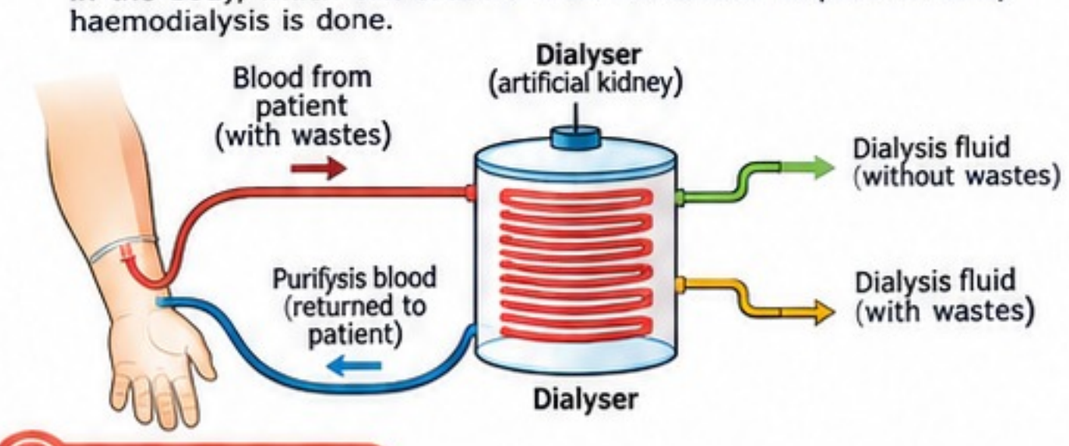
- Plant hormones are responsible for various movements in plants as a response to changes in the surroundings.

Key Points to Remember

- ✔ Plants show coordinated responses without a nervous system.
- ✔ Movements are of two types: growth-relevant and growth-irrelevant.
- ✔ Growth-relevant movements are tropic movements (tropisms).
- ✔ Examples of growth-irrelevant movements: Mimosa, Venus fly trap, Drosera, flowering, and fruit dehiscence.
- ✔ Plant movements are influenced by plant hormones.

6. Haemodialysis

- **Meaning:** The process of separating nitrogenous waste from blood with the help of a dialyser is called haemodialysis.
- **Why it is done:** Due to some reasons, the efficiency of kidneys can be adversely affected by injury, infection or decreased blood supply. In such cases, an excess of toxic substances accumulates in the body, which can cause a fatal condition. To prevent this, haemodialysis is done.



Question Bank

Q.9 Answer the following:

(1) Explain coordination in plants with the help of suitable examples.

Ans. (1) Plant do not have nervous system or muscular system like that of the animals. In response to an external stimulus, they respond with the movement or growth. These two types of movements are growth relevant movements and growth irrelevant movements. Such movements bring about coordination in plants. They are also called tropic movements or tropism.

(2) Tropism is of the following types:

I. **Phototropic movement:** The shoot system of the plants gives positive response to the light. Shoot system grows towards the light and is called phototropic movement.

II. **Gravitropic movement:** The root system of the plant grows towards the direction of gravity. This is called gravitropic movement.

III. **Hydrotropic movement:** The root system of the plant grows towards the direction of water. This is called hydrotropic movement.

IV. **Chemotropic movement:** Some parts of the plant show response to specific chemicals, these are called chemotropic movements. The growth of the pollen tube towards the ovule is a chemotropic movement.

Since all the above movements are related with growth, they are called growth-relevant movements.

(3) The growth-irrelevant movements are not concerned with the growth of a plant. Plant hormones bring about various movements in plants as a response to changes in the surroundings.

(4) Plants like *Mimosa* or 'touch-me-not' use electro-chemical impulses for transfer of information from one place to another.

(5) Some plant cells can change their shapes by increasing or decreasing the water content present in them and hence show movements.

(2) Give some examples of growth irrelevant movements.

Ans. (1) In the insectivorous plant of 'Venus fly trap', there is a trap that appears and smells like flowers. The approaching insects are thus deceived. When an insect visits that flower-like trap, the trap closes up and the insect is captured. These movements are for feeding and are not causing growth. Thus they are growth irrelevant movements.

(2) In another insectivorous plant, Drosera, the fibrils present on the leaves bend inwards as soon as an insect lands on the leaves. The prey insect is surrounded from all sides and thus is captured.

(3) The flowers bloom at a particular time of the day. E.g. The lotus flower opens during day-time while that of the tuberose (*Polyanthus*) opens at night.

(4) Dehiscence of the ripe fruits to disperse seeds at a right time is also a growth-irrelevant movement. E.g. as in Balsam.

(3) When and how is haemodialysis done?

Ans. (1) Due to some reasons, the efficiency of kidneys can be adversely affected by injury, infection or decreased blood supply.

(2) In such cases, an excess of toxic substances accumulates in the body which can cause fatal condition. To prevent this dialysis or haemodialysis is done.

(3) The urea, uric acid, ammonia, creatinine, etc. which are formed due to metabolism are removed from the blood by filtration through a machine called dialyser. The task which is otherwise done by kidneys is artificially done by dialyser.

Types of Neurons and Their Functions

Learning Goals

- Identify the types of neurons and their functions.
- Understand how nerve impulse travels and is transmitted.
- Know the structure and role of the nervous system.
- Recall key terms, examples and important scientific points.

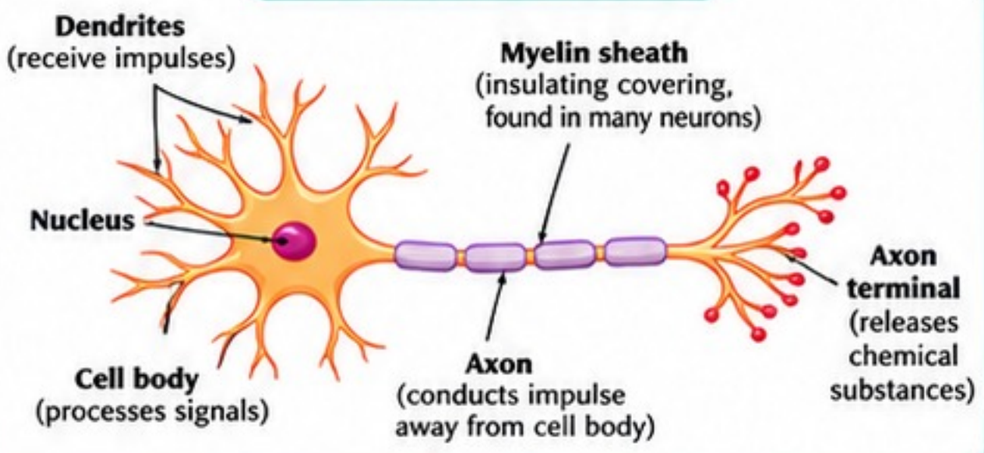
1. Fundamentals of the Nervous System

- The **nervous system** is the body's communication and control system. It receives information from different parts of the body, processes it and sends appropriate orders.
- It consists mainly of brain, spinal cord and a network of nerves spread throughout the body.

2. Neuron: Defintion and Structure

- **Neuron (nerve cell):** A specialised cell of the nervous system that receives, conducts and transmits nerve impulses.
- **Main parts:** dendrites, cell body (cyton) and axon.

Structure of a Neuron



Important Points

- Information is collected by the ends of the dendrites.
- The nerve impulse (electrical signal) starts at these ends.
- Electrical impulses are generated when certain chemicals stimulate the nerve cell.
- These chemicals are **neurotransmitters**.
- A synapse is the small gap between two adjacent neurons.
- Chemical substances at the synapse generate the impulse in the dendrites of the next neuron.
- When the impulse reaches the axon terminal, it stimulates the next neuron.
- The nerve impulse travels from one neuron to the next neuron.

3. Conduction and Transmission of Nerve Impulse

- **Conduction:** The generation and movement of electrical impulses along a neuron.
- **Transmission:** Transfer of the impulse from the axon terminal of one neuron to the dendrites of the next neuron, across a synapse, with the help of chemical substances (neurotransmitters).

4. Types of Neurons

- Neurons are classified according to their function into three types: sensory neurons, motor neurons and association neurons.

Type of neuron	Role (Function)	Example / Connection
Sensory neuron	Carries impulses from sensory organs to the brain and spinal cord.	From sensory organs (e.g., skin, eyes, ears) to the brain/spinal cord.
Motor neuron	Carries impulses from the brain or spinal cord to effector organs.	From the brain/spinal cord to muscles or glands.
Association neuron	Connects sensory and motor neurons and performs integration.	Present in the brain and spinal cord (interneurons).

Summary: Types, Structure and Function

Neuron type	Direction of impulse	Main function	Location
Sensory	Sensory organ → CNS (brain/spinal cord)	Carries sensory information.	In nerve pathways
Motor	CNS → effector (muscle/gland)	Sends commands to effectors.	In nerve pathways
Association (Interneuron)	Within CNS (between neurons)	Links sensory and motor neurons (integration).	Brain and spinal cord

Key Scientific Facts (from the source)

- Nerves are elongated nerve fibres that originate from the brain and spinal cord.
- They are of two types: cranial nerves and spinal nerves.
- Cranial nerves arise from the brain; they are associated with various parts of the head.
- Spinal nerves arise from the spinal cord; they are found in pairs and are distributed to the arms, legs, skin and other parts of the body.
- The autonomic nervous system is not under the control of our will. It regulates the functions of internal organs such as the heart, lungs, stomach, etc.

Functions of the Nervous System

1. **Analytical thinking** – processing of information.
2. **Logical thinking** – reasoning and decision-making.
3. **Holistic thinking** – looking at the whole situation.
4. **Intuition** – quick, immediate understanding.

Also Involves

Language, Science and Mathematics; Art and Music; Creativity.

Question Bank

(A) Short Answer Questions

1. About 500 ml of blood is sent at one time through this system. Purified blood is returned into the body of the patient. (**Ans.** The statement is related to an artificial (autonomic) nervous system.)
2. From central nervous system they connect to the different parts of the body through two types of nerves. (**Ans.** (A) Cranial nerves (B) Spinal nerves.)
3. How is nerve impulse transmitted? (**Ans.** At the synapse between two neurons, the impulse is carried by chemical substances (neurotransmitters).)
4. What are the different types of neurons? (**Ans.** Sensory neurons, motor neurons and association neurons.)
5. How is the nervous system classified? (**Ans.** According to function into sensory neurons, motor neurons and association neurons.)
6. What are their functions? (**Ans.** (i) Sensory neurons: conduct impulses from sensory organs to the brain and spinal cord. (ii) Motor neurons: conduct impulses from the brain or spinal cord to effector organs such as muscles or glands. (iii) Association neurons: connect sensory and motor neurons and perform the function of integration in the nervous system.)
7. What are their functions – the autonomic nervous system? (**Ans.** It regulates the activities of internal organs such as the heart, lungs, stomach, etc.)
8. Finally, the impulses are conveyed by nerve cells to muscle cells or glands. (**Ans.** The nerves originating from the central nervous system form the peripheral nervous system.)

(B) Open-ended Question

- You may have seen how a drunken person struggles to maintain his body balance, exerts excess alcohol in the body causes one to lose control over it. Why does this happen? Find out the reason with the help of the internet. (Textbook page 174)

Chemical Coordination and Homeostasis

1. Introduction

- Living organisms must carry out various functions in a controlled and coordinated way to keep the body in proper balance (**homeostasis**).
- This coordination and control are achieved by two systems: (1) the nervous system and (2) the endocrine system (chemical coordination).

2. Chemical Coordination

- Chemical coordination is the control and regulation of body functions by chemical messengers called **hormones**.
- **Hormones** are secreted by endocrine glands and are released into the blood.
- Through the blood, they reach specific target sites where they bring about particular effects.
- Both the endocrine glands and the nervous system work together to control and coordinate the physiological functions of the body.
- Thus, there is a special mechanism for the quantity (amount) and timing of hormone release.

3. Endocrine Glands and Their Secretions

- **Endocrine glands** are ductless and release their secretions (hormones) directly into the bloodstream.
- They are located at specific places in the body.
- The secretions of these glands are called **hormones**.
- Some important endocrine glands and their secretions are:

Endocrine gland	Main hormone(s)	Major function(s)
Pancreas	Insulin, glucagon	Maintain the blood glucose level.
Thyroid	Thyroxine, calcitonin	Regulate metabolic rate and calcium level of the body.
Adrenal	Corticosteroid, adrenaline, noradrenaline	Help the body during crisis and emotional situations; stimulate heart and its conducting tissue; speed up metabolic processes; maintain body balance.

4. Role of Hormonal Coordination

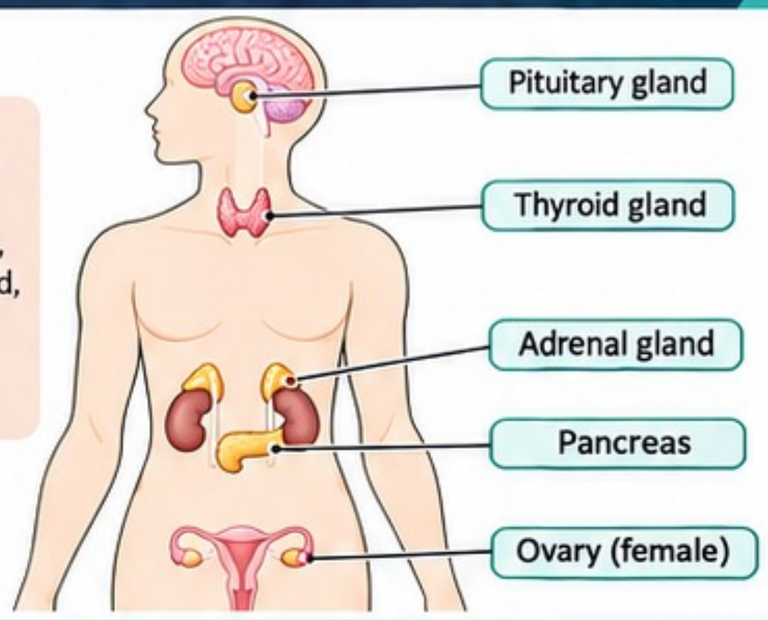
Hormonal coordination keeps the different organ systems functioning smoothly so that the various processes in the body occur in the proper sequence and at the right time.

5. Homeostasis

- Homeostasis is the state of equilibrium or proper coordination between the activities of different systems of an organism.
- It is maintained by the coordinated functioning of various systems.
- For successful completion of any body activity, a proper coordination among different organs and systems is necessary.
- If coordination is lost due to some cause, confusion at different steps occurs, resulting in the failure of that activity.

6. Major Endocrine Glands in Humans (Diagram)

Note: Other endocrine glands include the pineal gland, parathyroid gland, thymus, gonads (testes and ovaries), etc.



7. Key Endocrine Glands and Functions

Gland	Hormone(s)	Function / Importance
Pituitary	Many (growth hormone, etc.)	Controls the activity of almost all other endocrine glands, but it is under the control of the hypothalamus.
Hypothalamus	Releasing and inhibiting hormones	Controls the secretion of pituitary hormones.
Adrenocortical cortex	Adrenocorticotropic hormone (ACTH)	Regulates the secretion of hormones from the adrenal cortex.
Thyroid	Thyroid stimulating hormone (TSH)	Stimulates the thyroid gland.
Luteinizing hormone (LH)	LH	Stimulates the reproductive glands (gonads).
Follicle stimulating hormone (FSH)	FSH	Stimulates the gonads.
Growth hormone (GH)	GH	Responsible for the growth of the body.
Prolactin	Prolactin	Concerned with womanhood and reproduction.
Oestrogen	Oestrogen	A hormone of the female gonad (ovary).
Progesterone	Progesterone	A hormone of the female gonad (ovary).
Testosterone	Testosterone	A hormone of the male gonad (testis).

In Short: All these hormones are essential for sexual development and maturation—oestrogen and progesterone in females; testosterone in males.

8. Question Bank (with Answers)

Q1 What is meant by coordination?

Ans. The different processes in the body always occur in the proper sequence, which is called coordination. In multicellular organisms several different organ systems function simultaneously.

Q2 What is homeostasis?

Ans. Proper coordination between various systems of an organism keeps the state of equilibrium, which is called homeostasis.

Q3 Explain the names and functions of some hormones.

Ans. Some important hormones and their functions are:

- **Insulin and glucagon:** secreted by pancreatic cells; essential for maintaining the blood glucose level.
- **Thyroxine and calcitonin:** produced by the thyroid; regulate the metabolic rate of the body and calcium level.
- **Corticosteroid, adrenaline and noradrenaline:** hormones of the adrenal; help during crisis and emotional situations, stimulate the heart and its conducting tissue, speed up metabolic processes, and maintain balance of chemical coordination in the body.

Formation of Urine and Plant Transportation

A. Formation of Urine (Excretion in Humans)

(3) Q. E.g. Proper coordination exists between internal activities of the body and both temperature, water-level, enzyme-level, or stimuli arising in the external environment.

Ans. **(3) How does excretion occur in human beings?**
OR Describe the process of urine formation.

Ans. The excretory system of the human body consists of two kidneys, two ureters, one urinary bladder and a single urethra.

(2) Q. Kidneys filter out nitrogenous waste products and other unwanted substances from the blood and form the urine.

Ans. (a) The function of the kidney is nephron.

(3) Q. **Process of formation of urine:**

Ans. The functional unit of the kidney is nephron. Urine is produced due to filtration of blood in the nephron.

(b) There is a cup-like, thin-walled upper part of a nephron that is called the Bowman's capsule. It has a network of capillaries inside which is called a glomerulus.

(c) The urine produced in the liver comes into the blood. When the urea-containing blood comes into the glomerulus, it is filtered through its capillaries of glomerulus for separating urea and other similar substances.

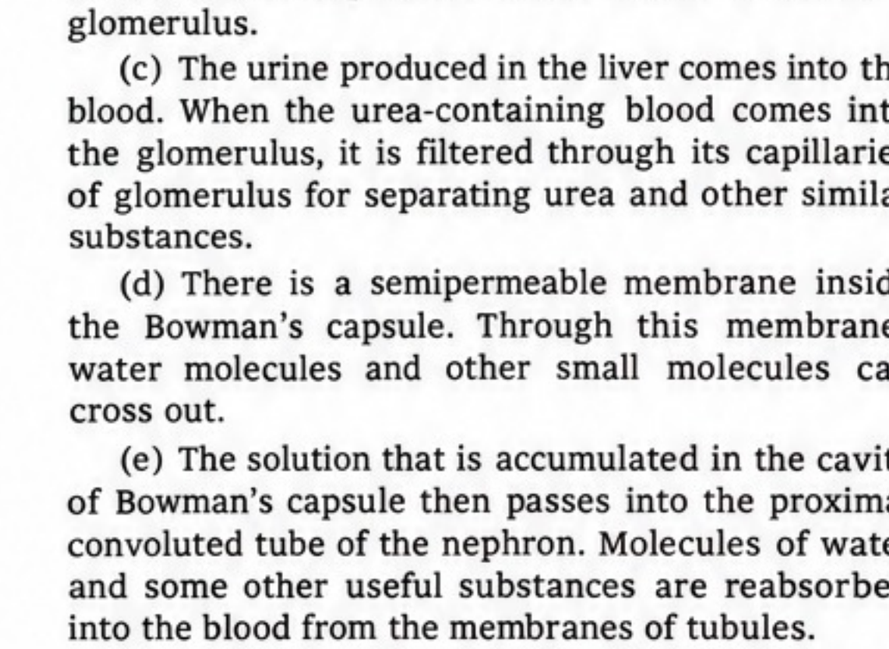
(d) There is a semipermeable membrane inside the Bowman's capsule. Through this membrane, water molecules and other small molecules can cross out.

(e) The solution that is accumulated in the cavity of Bowman's capsule then passes into the proximal convoluted tube of the nephron. Molecules of water and some other useful substances are reabsorbed into the blood from the membranes of tubules.

(f) All the substances which are not needed for the body are separated out and this together forms the urine.

(g) The urine that is formed is carried by the ureters to the urinary bladder and is stored for some time.

Diagram: Bowman's Capsule (Part of a Nephron)



B. Transportation in Plants

(4) Q. How is excretion in plants useful to human beings?

Ans. (1) The waste products which are not useful for the tree can be very useful for the human beings.
(2) The latex of rubber gives various rubber products.
(3) Gum, resin are waste materials for plants but they have various uses for man.
(4) The waste substances of plants are also stored in vacuoles of the cells and in various plant's parts.

(5) Q. **Describe the transportation system in plants.**

Ans. The transportation in case of plants occurs due to two main processes, such as root pressure and transpiration. Similarly, due to translocation of and photosynthesis, the food is carried to the food as required in the plant. The conducting system of the plants such as xylem and phloem help in the transport of water and food respectively.

(6) Q. **All the plant parts are connected with the conducting tissues.**

Ans. Roots of the plants absorb water and minerals from the soil. These substances are transported to all the leaves. In the leaves the process of photosynthesis take place and glucose is produced. This glucose produced by leaves is transported to different parts of the plant either for the generation of energy or for storage in the plant. Both these transports are done by the conducting tissues like xylem and phloem. Xylem carries water while phloem can take place through the urethra by one's own voluntary control of nerves. Therefore, urination can take place through the urethra.

Q. 11 Give scientific reasons :

(1) Q. **All the plant parts are connected with the conducting tissues.**

Ans. Roots of the plants absorb water and minerals from the soil. These substances are transported to all the leaves. In the leaves the process of photosynthesis take place and glucose is produced. This glucose produced by leaves is transported to different parts of the plant either for the generation of energy or for storage in the plant. Both these transports are done by the conducting tissues like xylem and phloem. Xylem carries water while phloem can take place through the urethra by one's own voluntary control of nerves. Therefore, urination can take place through the urethra.

(2) Q. **The muscular urinary bladder is under the voluntary control of nerves.**

Ans. The latex of rubber gives various rubber products.

The urine that is formed is carried by the ureters to the urinary bladder. The urinary bladder is under the voluntary control of nerves. Therefore, urination can take place through the urethra by one's own voluntary control of nerves.

Scientific Reasons and Short Notes

Subject: Life Processes in Living Organisms

Topic: Plant Physiology (Transpiration, Chemotropism, Movement, etc.)

Scientific Reasons (Ans. with Explanations)

(1) The cells around the stomata are called guard cells.

Ans. The cells surrounding each stoma are called guard cells. They regulate the opening and closing of the stomata. These cells remain under control; hence, they are called guard cells.

(2) The cells around the stomata are called gas cells (air cells).

Ans. The cells in the leaf throw out excess water in the form of water vapour by the process of transpiration. These are called gas cells because they are involved in the exchange of gases around the stomata.

(3) Dialysis is done if the kidneys are not functioning well.

Ans. Many harmful products such as urea, uric acid and ammonia are produced during metabolic activities. If these waste substances are not removed from the body, they can cause toxicity. It can also be harmful to life. If kidneys do not function properly (e.g., due to kidney disease), dialysis is performed. Dialysis purifies the blood by filtration. Thus, it helps to remove urea and other harmful substances and saves life.

(4) There should not be harmful substances at any step of reactions in human body.

Ans. For the successful completion of any bodily activity, proper coordination between various processes is essential. All body activities should occur in an orderly and coordinated manner. If at any step of a reaction there is a lack of coordination, or if harmful substances are produced or remain, then the normal physiological reactions may not take place. This can lead to various health problems. Therefore, such harmful substances should not be present at any step of reactions in the body.

(5) Chemotropism is called growth relevant movement.

Ans. Movement shown by plants in response to specific chemicals is called chemotropism. For example, the growth of the pollen tube towards the ovule is called chemotropism. These movements will further lead to the development and growth of the plants.

(6) Muscle cells become able to respond to electrical impulses of nerves.

Ans. When an action or movement is to be brought about in the body, the work of the muscular tissue comes last in the sequence. Movement of muscle cells is essential to bring about any activity. When cells contract or change shape (e.g., become turgid), the cells have the ability to respond to electrical impulses of nerves. Besides, due to these same proteins, cells become able to respond to electrical impulses of nerves.

(5) Therefore, the chemotropism is called growth relevant movement.

Therefore, the chemotropism is called growth relevant movement.

Steps of Transpiration

The process of transpiration takes place in the following sequence:

(1) There are stomata on the leaves of the plants.

There are openings on the leaves of the plants called stomata.

(2) Transpiration.

Through these openings the excess water is thrown out of the leaves in the form of water vapours. This process is called transpiration.

(3) Due to this, the root cells become turgid and exert pressure on the adjacent cells.

Due to transpiration, the root cells become turgid and exert pressure on the adjacent cells.

(4) Due to root pressure, the water and minerals enter the xylem present in the roots.

Due to root pressure, the water and minerals enter the xylem present in the roots. To reduce this difference in concentration they are continuously pushed forward.

(5) The pressure exerted by the root cells thus is sufficient to lift the water up in small shrubs and trees.

The pressure exerted by the root cells thus is sufficient to lift the water up in small shrubs and trees.

Q. 12 Write short notes :

Ans. (1) Root pressure.

(1) The pressure created in the root cells is called a root pressure. Root cells are in contact with water and minerals in the soil. But the concentration inside the cells and the concentration in the surrounding soil is different from the concentration in the water and minerals. Thus there is a concentration gradient created. The water and minerals from the surrounding areas enter in the root cells.

(2) Due to this, the root cells become turgid and exert pressure on the adjacent cells.

(3) Due to root pressure, the water and minerals enter the xylem present in the roots.

(4) Due to root pressure, the water and minerals enter the xylem present in the roots. To reduce this difference in concentration they are continuously pushed forward.

(5) The pressure exerted by the root cells thus is sufficient to lift the water up in small shrubs and trees.

Transport, Neuron and Human Brain

1 Transport in Plants (Continued)

(2) There are two guard cells around the opening of stomata. They have an external membrane. They control the opening and closing of the stomata.

(3) Also some amount of water is lost due to evaporation from the leaves.

(4) As a result, water level in the epidermal layer of the leaf decreases.

(5) To compensate this loss, more water is brought to the leaves through the xylem.

(6) Transpiration thus helps in absorption of water and minerals and their distribution to all parts of the plant.

(7) Root pressure pushes the water up during the night time.

2 Transport of Food and Other Substances in Plants

Q3 Explain transport of food and other substances in plants.

Ans. (1) Translocation is the process of transporting. The food produced in leaves is transported to each cell in the plant body. Excess food except amino acids is stored in roots, fruits, seeds, etc.

(2) Translocation is carried out in both upward and downward directions by phloem.

(3) Translocation is an energy requiring process which consumes ATP.

(4) When sucrose is transported via phloem towards a part of a plant the water concentration decreases in that part resulting into entry of water in the cell by diffusion.

(5) The cellular contents increase and create a pressure on the cell wall. Due to this pressure, the food is pushed into the neighbouring cells having lesser pressure.

(6) In this way, the phloem transports the materials in the plant as and when needed. E.g. The sugar produced by the plant is transported towards buds so that they can bloom into a flower.

3 Neuron

Q4 Define neuron.

Ans. (1) Neurons or nerve cells are structural and functional units of the nervous system that carry impulses from one place to other.

(2) Neuron is the largest cell of the body which measures to about few metres in length.

(3) Neuron has the ability to generate and conduct electrochemical impulses.

(4) Every neuron has three main parts, viz. cyton or cell body, axon and dendrites. Dendrites pick up the electrochemical signals produced.

(5) These signals are transferred to cyton and from cyton they are sent to axons. From axon of one neuron, the impulse is then given to dendrites of next neuron.

(6) The cells called neuroglia support the nerve cells and help in their functioning. Nerve is formed of neurons and neuroglial cells together.

4 Human Brain

Q5 Write about the human brain.

Ans. (1) Human brain is highly evolved organ. It is the main controlling centre of nervous system. It is the part of the central nervous system. It is very well protected inside the cranium or cranial cavity.

(2) The brain is enclosed by meninges which are protective coverings. There are hollow ventricles inside the brain which are filled up with cerebrospinal fluid. This fluid is protective and nourishing in function.

(3) The average weight of adult human brain is about 1300 – 1400 grams and there are approximately 100 billion neurons in the brain.

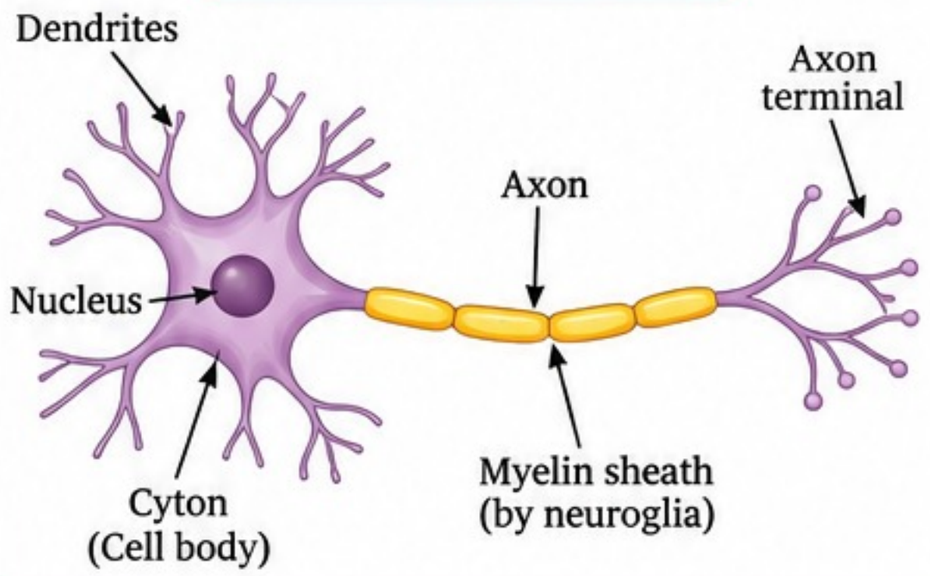
(4) There are three main parts of the brain, viz. Cerebrum, cerebellum and medulla oblongata.

(4) **Cerebrum :** It is the largest part of the brain occupying two-third area of brain. It consists of two cerebral hemispheres. The two hemispheres are joined with each other by tough nerve fibres.

Cerebral surface has deep, irregular ridges and grooves called convolutions due to which the surface area of the cerebrum is increased. Large number of neurons are accommodated in cerebrum due to convolution.

(5) **Functions of cerebrum :** Controlling all the voluntary movements. Mental faculties such as

Structure of a Neuron



Brain, Reflex Action and Spinal Cord

A. Parts of the Brain and Their Functions

- The brain performs higher functions such as concentration, planning, decision making, intelligence and intellectual activities.

(6) Cerebellum

- This is the smaller part of the brain situated below the cerebrum at the back of the cranial cavity.
- Its surface shows shallow grooves instead of deep convolutions.

(7) Functions of cerebellum

- Coordination of voluntary movements and maintaining the balance of the body.

(8) Medulla oblongata

- Hind-most part of the brain consisting of two triangular swollen structures called pyramids on the upper side.
- The medulla oblongata extends downwards as the spinal cord.

(9) Functions of medulla oblongata

- It controls all the vital and involuntary activities like beating of the heart, blood circulation, breathing, sneezing, coughing, salivation, etc.

B. Reflex Action

Ans. (1) Reflex action is an immediate and involuntary response given to a stimulus from the environment.

- (2) The reflex action is so spontaneous that it does not require thinking or control by our brain.
- (3) Reflex actions are not controlled by brain. But the control and coordination is maintained by the reflex actions by which the load on the brain is reduced.
- They are of survival value as a person is saved from a dangerous situations due to reflex actions.
- (4) The path of reflex action is as follows:

Sense organs → Sensory neurons → Towards the spinal cord → Coordination neuron → Motor neuron → Muscle or gland.

C. Spinal Cord

Ans. (1) Spinal cord is the part of central nervous system.

- (2) It is well-protected in the vertebral column.
- (3) It starts from medulla oblongata and continues throughout the back of the body. It is thicker in the initial parts and later goes on tapering.
- (4) The end of the spinal cord is called a *filum terminale*. It is thread-like fibrous structure.
- (5) There are 31 pairs of spinal nerves that arise from spinal cord and come out of the vertebral column.
- (6) Spinal cord controls the reflex actions.
- (7) The spinal cord is important in the working of peripheral nervous system.

Q. 13 Discuss :

(Textbook page 163)

(1) Why do we eat fruits and vegetables? Do the plants also need minerals like we do?

Ans. In order to obtain vitamins and minerals, we take fruits and minerals in our diet. They also provide us with roughage. Plants also need minerals just like we do. Nitrogen, phosphorus and potassium are very important minerals for the growth of the plants.

(2) From where do the plants get inorganic substances other than carbon dioxide and oxygen?

Ans. Plants obtain inorganic substances from soil. Some plants which are heterotropic obtain it by devouring insects.

Q. 14 Use your brain power! / Think about it :

(1) Which types of plant tissues are xylem and phloem? (Textbook page 163)

Ans. Xylem and phloem are the conducting tissues of the plants. They are complex and permanent tissues of the plants.

(2) At least a small quantity of garbage or waste is produced every day in each house. What will happen if you keep this garbage for many days in your house? (Textbook page 165)

Ans. The garbage if biodegradable will start decomposing resulting into foul odour. Houseflies will hover around it and the entire place will become unhygienic. The germs of infective diseases will spread causing illness.

Reasoning and Application Questions

(3) Observe your mother while she cuts Elephant's foot (*Amorphophallus*) or arum leaves. Your hands may also begin to itch if you try to cut those leaves. Why does this happen? Try to find out. Ask your mother what she does to prevent the itching?

Ans. In Elephant's foot (*Amorphophallus*) or arum leaves there are calcium oxalate crystals. They are called raphides. Since they are needle-shaped, they prick the skin and cause itching. To prevent the itching, these leaves are usually cooked, and the first water containing the irritant (oxalic acid/tartaric acid) is discarded. Later, the chopped pieces are washed with tamarind water. Tamarind contains tartaric acid, which dissolves the raphide crystals. Even lemon juice can be squeezed to reduce the effect of raphides, as it also contains ascorbic acid (vitamin C) and citric acid.

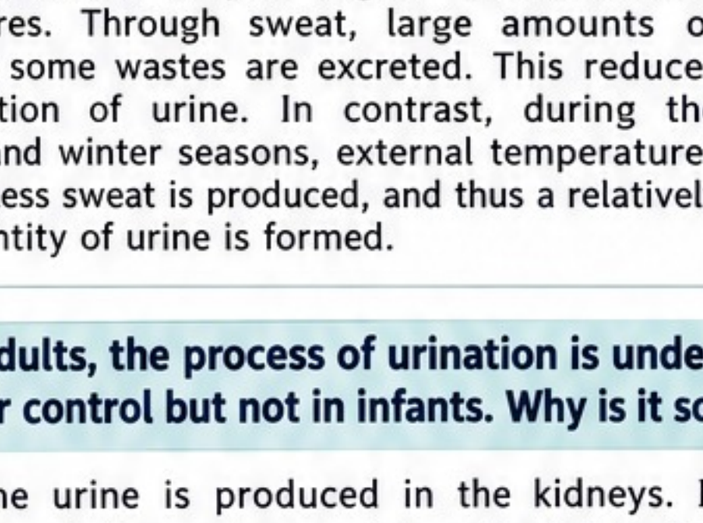
(4) As compared to the monsoons and winter a very small quantity of urine is produced in the summer season. Why is it so?

Ans. Due to higher ambient temperature in summer months, we sweat a lot. Sweating is a thermoregulatory mechanism that helps maintain body temperature despite higher environmental temperatures. Through sweat, large amounts of water and some wastes are excreted. This reduces the formation of urine. In contrast, during the monsoon and winter seasons, external temperatures are lower, less sweat is produced, and thus a relatively larger quantity of urine is formed.

(5) In adults, the process of urination is under their control but not in infants. Why is it so?

Ans. The urine is produced in the kidneys. It passes through the ureters and is collected in the urinary bladder, which stores it. The bladder is muscular, and its urination (emptying) is under voluntary control in adults. In infants, the nervous mechanism that controls the act of urination is not fully developed and functional; hence, urination in infants occurs involuntarily, without control.

Human Urinary System



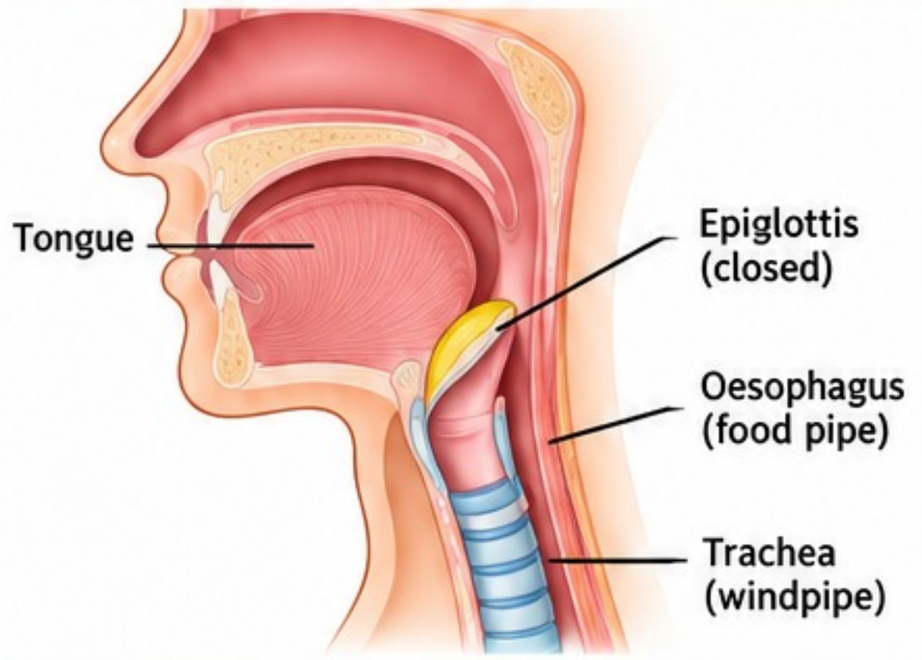
(6) Sometimes, while eating we bite our own finger or tongue by mistake.

Ans. When we are hurriedly gulping food or are not concentrating on eating, the coordination between our movements is disturbed. This can cause us to bite our own finger or tongue by mistake. Such an action produces a painful impulse, which is transmitted to the brain through the sensory nerves. We then feel pain for that action and start eating more carefully.

(7) Sometimes, we choke while eating in a hurry.

Ans. Choking at the time of eating in a hurry is a reflex action. There is a small flap called epiglottis between the openings of the trachea and oesophagus. This flap is present in the pharyngeal region. When food or water is entering the oesophagus, the epiglottis closes the opening of the trachea tightly. If, due to hurried swallowing, food particles or water enter the trachea by mistake, it produces instant choking. This is a protective reflex action that keeps the respiratory passage free of any food or water.

Position of Epiglottis during Swallowing



(8) An injury to the medulla oblongata can lead to death. Why?

Ans. Medulla oblongata controls all the involuntary and vital activities of the body. It regulates essential functions such as breathing (respiration), heartbeat and blood circulation. An injury to the medulla can therefore disrupt these vital functions and may result in death.

NEXTGEN ACADEMY

by Suyog Sir

Reflex Arc and Human Excretory System

Key Note

The heart keeps beating and breathing goes on rhythmically. If this rhythmic activity is interrupted, sudden death can occur.

Q. 15 **Observe the figure given below carefully and as per the numbers in that figure, answer the following questions :**

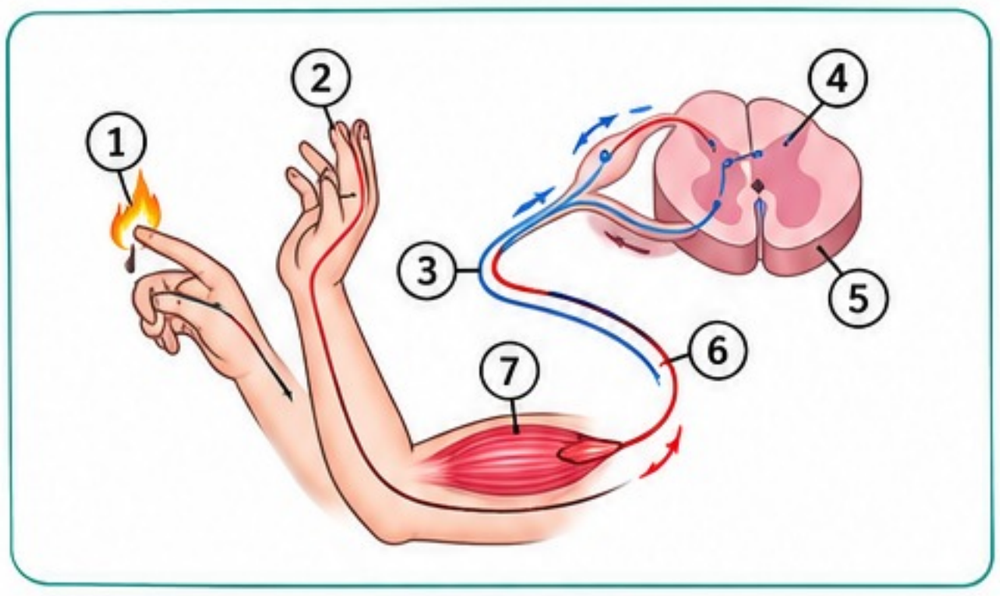


Fig. 15.1

(i) What is happening at 1 and 2?

Ans. A burning flame is felt at 1 (finger). The hand is instantly withdrawn at 2. Sensory neurons in the fingers send information to the spinal cord. The return message comes back in a fraction of a second, and the hand is pulled back.

(ii) Which nerve carried the impulse to the point marked 3? In which direction is it conducting the impulse?

Ans. The impulse is carried to point 3 by a sensory nerve (sensory neuron). It conducts the impulse from the skin of the finger towards the spinal cord.

(iii) Which is the nerve shown by 4?

Ans. Nerve marked 4 is an association nerve (interneuron). It transfers the impulse from the sensory neuron to a motor neuron.

(iv) Which is the organ marked as 5?

Ans. The organ marked as 5 is the spinal cord.

(v) At 6, which nerve is conducting the response impulse?

Ans. At 6, the response impulse is carried by a motor nerve (motor neuron) from the spinal cord to the muscle cells.

(vi) At 7, where has the impulse reached? What is its effect?

Ans. At 7, the impulse reaches the muscles of the forearm. The muscle cells receive the impulse, contract rapidly, and the hand is withdrawn away from the flame of a burning candle.

Q. 16 **Draw well-labelled and neat diagrams :**

***(1) Human excretory system :**

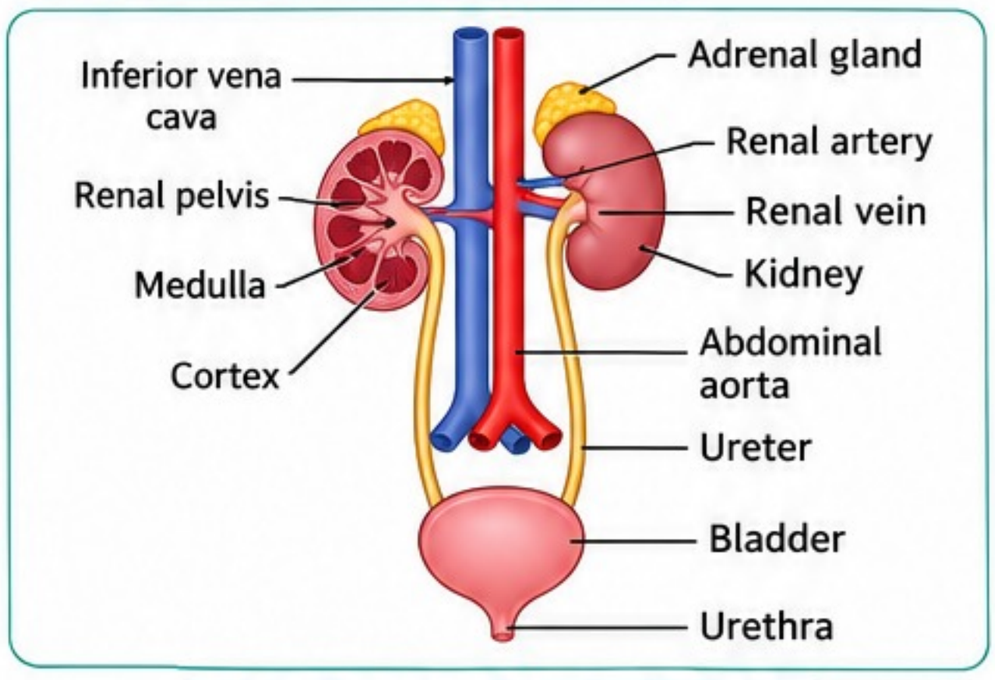


Fig. 15.2 : Human excretory system

***(2) Structure of nephron :**

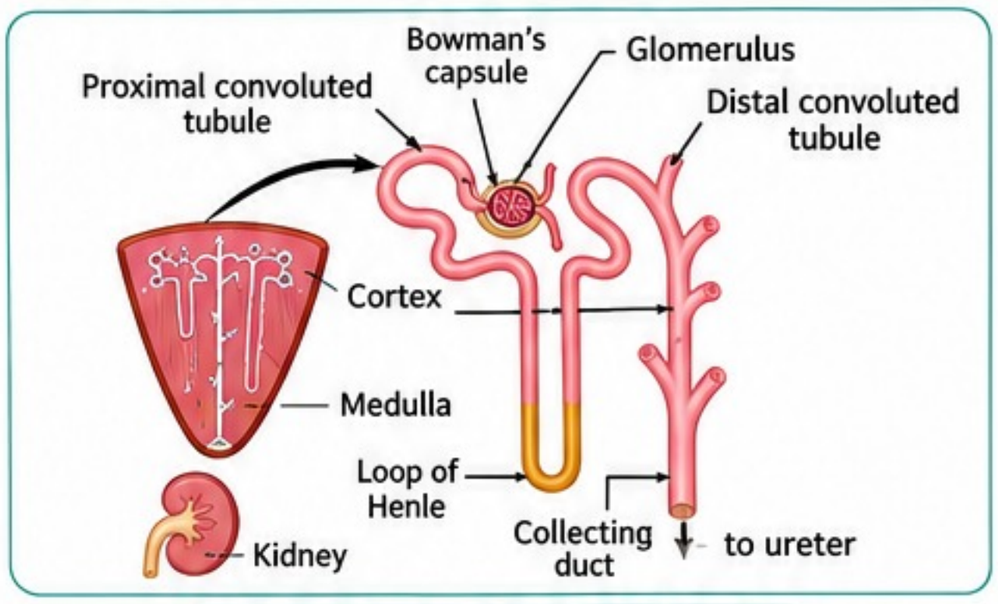


Fig. 15.3 : Structure of nephron

(3) V.S. of kidney :

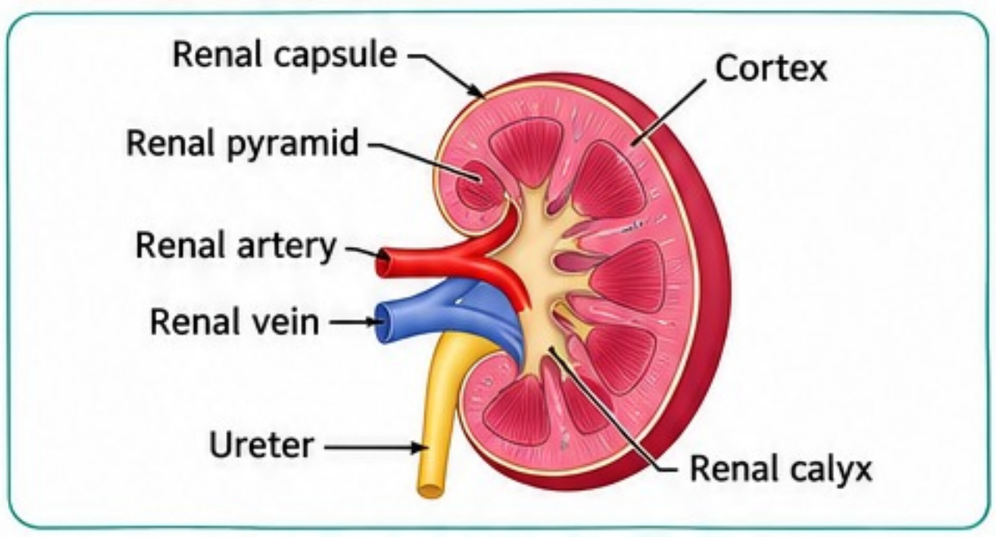


Fig. 15.4 : V.S. of kidney

NEXTGEN ACADEMY

by Suyog Sir

Essential Biological Diagrams

(4) Dialysis of blood

Hemodialysis (artificial kidney): purification of blood using a dialysis machine.

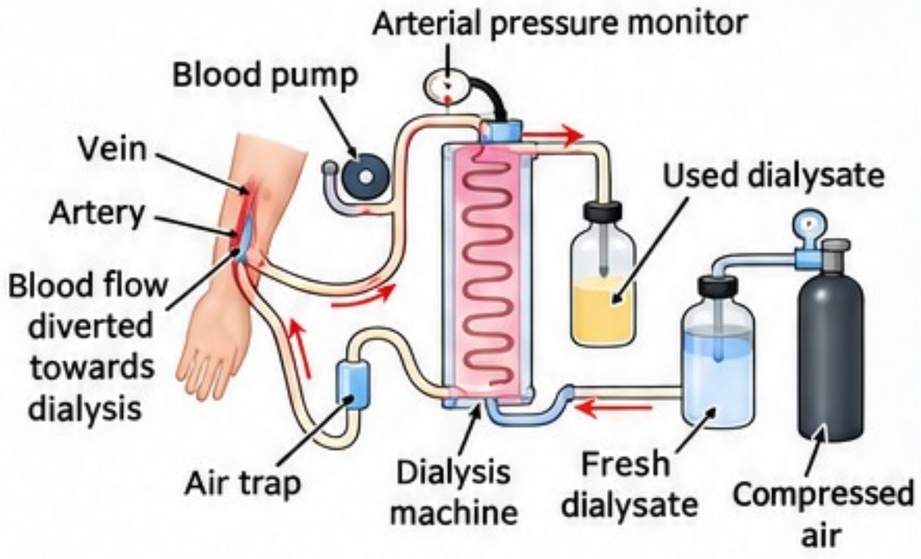


Fig. 15.5 : **Dialysis of blood**

(5) Human brain

Major parts of the human brain.

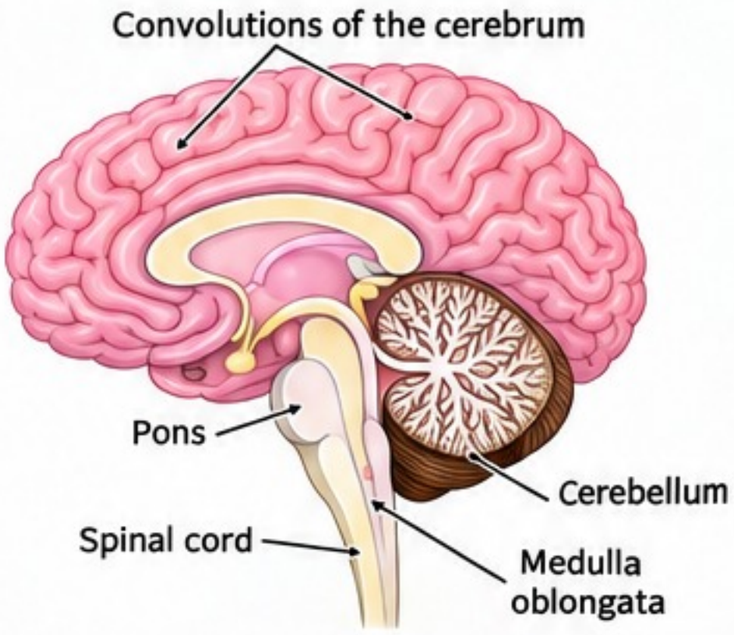


Fig. 15.6 : **Human brain**

(6) Nerve cell or neuron

Structural parts of a neuron (nerve cell).

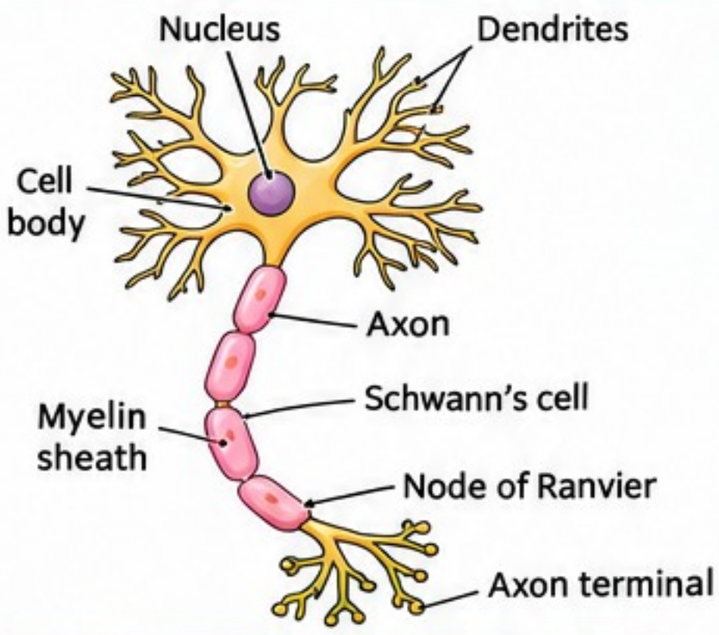


Fig. 15.7 : **Nerve cell or Neuron**

(7) Neuro-muscular junction

Junction between a nerve and a muscle fibre that transmits a nerve impulse to initiate muscle contraction.

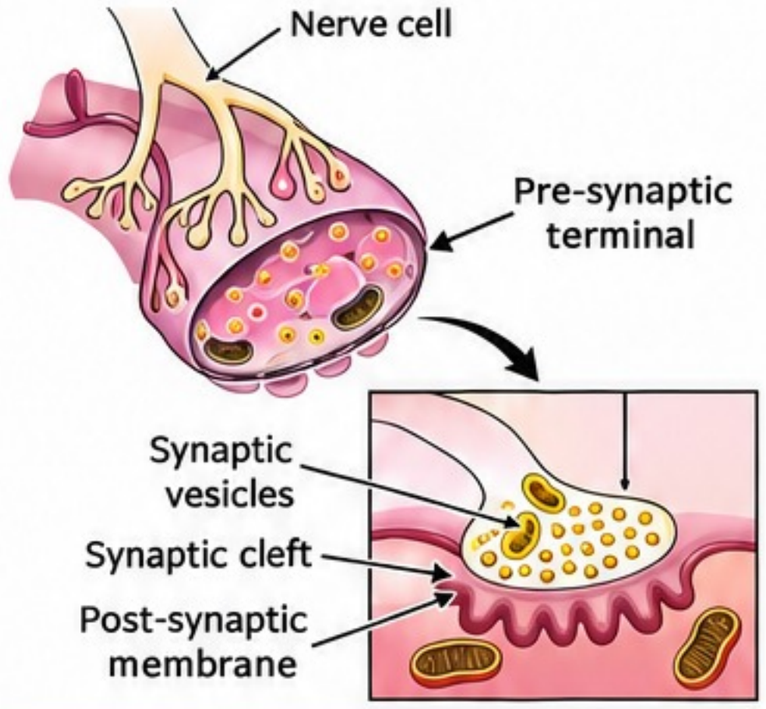


Fig. 15.8 : **Neuro-muscular junction**

(8) Human endocrine glands

Major endocrine glands and their positions in the human body.

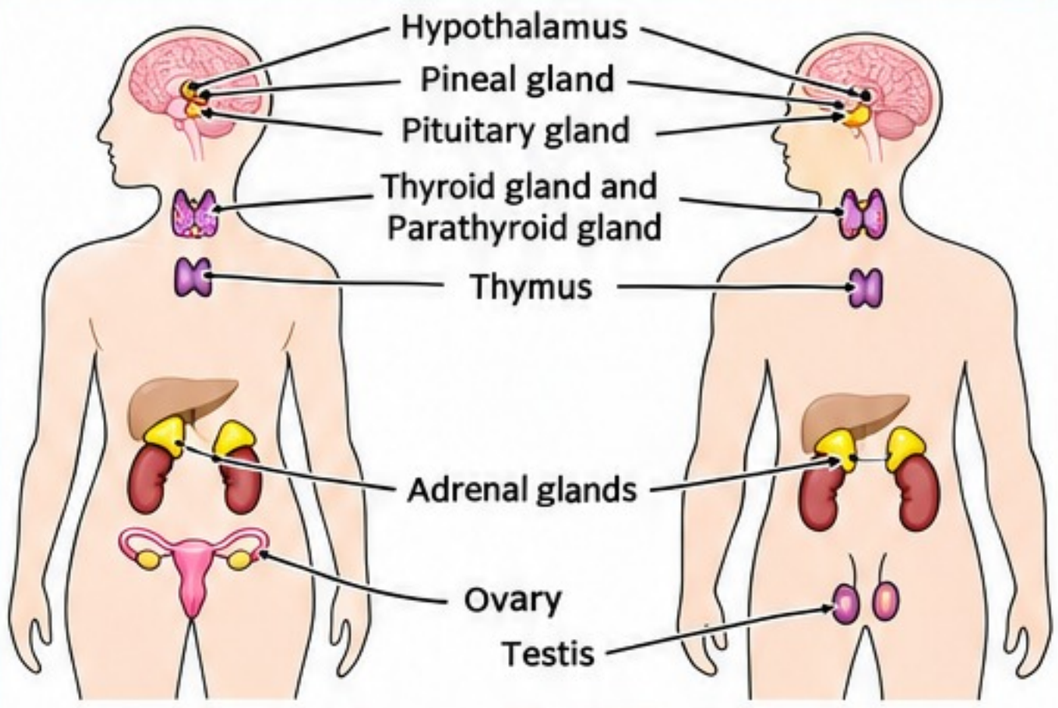
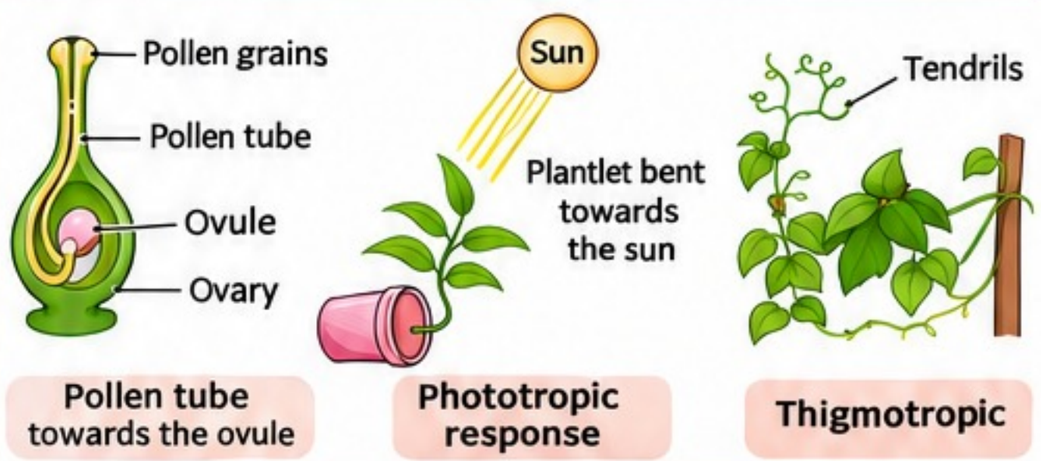


Fig. 15.9 : **Human endocrine glands**

Q. 17 Activity Based Questions

(1) Observe : (Textbook page 169)



Pollen tube towards the ovule | **Phototropic response** | **Thigmotropic**

Fig. 15.9 : **Coordination in plants**