

Biology (Class IX)

Chapter - 6 (Tissues)

Introduction

- In unicellular organisms, a single cell performs all basic functions. For example, in Amoeba, a single cell carries out movement, intake of food and respiratory gases, respiration and excretion.
- In multi-cellular organisms there are millions of cells. These cells are specialised to carry out a few functions.

Q) What is a tissue?

Tissue is a group of similar cells which perform the same functions and have a common origin.

This cluster of cells, called a tissue, is arranged and designed so as to give the highest possible efficiency of function. Blood, phloem and muscle are all examples of tissues.

Q) What is the utility of tissues in multicellular organisms?

Tissues are made up of groups of cells carrying a specialised function. Each specialised function is taken up by a different tissue. Since these cells of a tissue carry out only a particular function, they do it very efficiently. For example, in human beings, muscle cells contract or relax to cause movement, nerve cells carry messages, and blood flows to transport gases, food, hormones and wastes material and so on.

Likewise, in plants, vascular tissues (xylem, phloem) conduct water and food from one part of the plant to other parts. So, multicellular organisms show division of labour through tissues.

Are plants and animals made of same type of tissues?

<u>PLANT TISSUES</u>	<u>ANIMAL TISSUES</u>
(1) Plants are stationary or fixed. They contain dead tissues since dead cells can provide mechanical strength and need less maintenance.	(1) Animals are mobile. Most of the tissues they contain are living.
(2) The growth in plants is limited to certain regions.	(2) Cell growth in animals is more uniform.
(3) The structural organisation is not complex.	(3) The structural organisation is far more specialised and complex.

Q) Why are plants and animals made of different types of tissues?

PLANT TISSUES

Plant tissues are of two main types:

- (i) Meristematic tissue (ii) Permanent tissue.

<u>Meristematic tissue</u>	<u>Permanent tissue</u>
1) The cells divide repeatedly.	1) The cells are derived from meristematic tissue and do not divide.
2) The cells are undifferentiated.	2) The cells are fully differentiated.
3) The cells are small and isodiametric.	3) The cells are variable in shape and size.
4) Inter cellular spaces are generally absent.	4) Visible intercellular spaces are present.
5) Vacuoles are absent.	5) Large vacuoles are present in mature cells.
6) Metabolism occurs at high rate.	6) Metabolism occurs at low rate.
7) The cell walls are thin.	7) Cell walls may be thin or thick.

The permanent tissues are classified as:

- (i) Simple tissue
- (ii) Complex tissue.

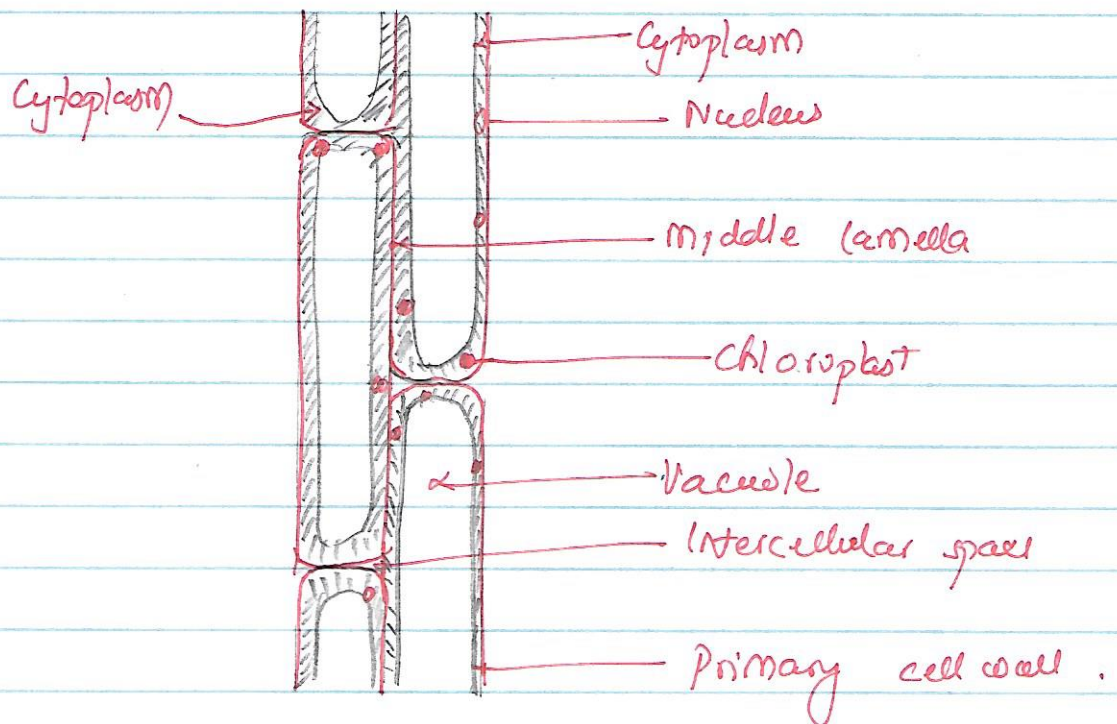
Simple Permanent Tissues:

A tissue with cells of similar structure (one type of cells) and function is called simple tissue. It is of three types:

- 1) Parenchyma
- 2) Collenchyma
- 3) Sclerenchyma.

Parenchyma

- 1) Cells are thin-walled and unspecialised.
- 2) These are living cells.
- 3) Cells are usually loosely packed with large intercellular spaces.
- 4) Store nutrient and water in stem and roots.
- 5) Some cells contain chlorophyll called chlorenchyma and perform photosynthesis. Other cells have large air cavities called aerenchyma which provide buoyancy to the hydrophytic plants.



Collenchyma

- (1) It consists of living cell
- 2) The cells contain cytoplasm
- 3) Its cell wall is cellulose
- 4) The thickening of cell wall is not uniform
- 5) Lumen of cell is wide
- 6) It provides mechanical support and elasticity to the plant body.

Sclerenchyma

- 1) Cells are thick-walled and lignified.
- 2) Tissues are made up of dead cells.
- 3) No intercellular spaces between the cells are found.
- 4) Provides strength to the plant parts.
- 5) The cells are long and narrow, make the plant hard and stiff. The tissue is present in the stem around vascular bundles, in the vein of leaves and the hard covering of seeds and nuts.

Type of Meristematic Tissue

Depending on the region where they are present, meristematic tissues are classified as:

- (i) Apical (ii) Lateral (iii) Intercalary

- (1) Apical Meristem is present at the growing tips of stems and roots and increases the length of the stem and the root.
- (2) The girth of the stem or root increases due to lateral meristem.
- (3) Intercalary meristem is the meristem at the base of the leaves or internodes (on either side of the node) on twigs.

Complex Permanent Tissues.

Xylem: Xylem is mainly concerned with the transport of nutrients, water and minerals upward in the plant body. It forms a continuous tube through the roots, stems, leaves, flower and fruit by the fusion of elongated cells.

It consists of following types of cells:

- 1) Tracheids 2) Xylem vessels 3) Xylem fibres 4) Xylem parenchyma

① Tracheids: Tracheids are elongated, tapering cells with blunt ends. They have lignified secondary wall. They are the chief water conducting elements in Pteridophytes and Gymnosperms.

② Xylem Vessels: Xylem vessels have perforations at the end and are placed one above the other like a long pipe line. They are seen in the xylem of angiosperms. They conduct water, mineral nutrients and also provide mechanical strength to the plant body.

③ Xylem Fibres: The fibres of sclerenchyma associated with the xylem are known as xylem fibres. They give additional mechanical strength to the plant. They are also called wood fibres.

④ Xylem Parenchyma: The parenchyma cells associated with xylem are known as xylem parenchyma. It is the only living tissue among xylem cells. They store food reserves in the form of starch and fat. They also help in condition of water.

PHLOEM

Phloem conducts food material from leaves to the other parts of the plant. It is made up of four types of cells.

- (i) Sieve elements
- (ii) Companion cells
- (iii) Phloem fibres
- (iv) Phloem parenchyma.

① Sieve elements : Sieve elements are the conducting elements of the phloem. Sieve elements are of two types - sieve cells and sieve tubes. Sieve cells are present in Pteridophytes and Gymnosperms where a sieve tube are present in Angiosperm.

② Companion Cells : Companion cells are thin walled elongated specialized Parenchyma cells. They are associated with sieve elements. They have a prominent nucleus and cytoplasm. They help the sieve tube in conduction of the food material in angiosperm.

③ Phloem fibres : The fibres of sclerenchyma associated with phloem are called phloem fibres. They are also called bast-fibres. They give mechanical support to the plant. Among the four types of phloem cells, phloem fibres are the only dead tissues.

④ Phloem parenchyma :

The parenchyma cells associated with phloem are called phloem parenchyma. They store starch and fats.

Q.1) Name the types of simple tissue.

ANS) (i) Parenchyma (ii) Collenchyma (iii) Sclerenchyma.

Q.2) Where is apical meristem found.

ANS) ... in shoot apex and root apex of plants.

3) Which tissues make up the husk of coconut?

ANS) Sclerenchyma tissue.

4) What are the constituents of phloem?

ANS) Phloem is made up of four types of elements:

(i) Sieve tube.

(ii) Companion Cell.

(iii) Phloem fibre.

(iv) Phloem parenchyma.

5) How many types of elements together make up the xylem tissue? Name them.

ANS) Four types of elements make up the xylem tissue.

(i) Tracheids

(ii) Vessels

(iii) Xylem parenchyma

(iv) Xylem Fibres.

6) How are simple tissues different from complex tissues in plants?

ANS) A simple tissue is made up of only one type of cell whereas a complex tissue is made up of different types of cells.

7) Where are the functions of the stomata?

ANS) (i) Exchange of gases with atmosphere.

(ii) Transpiration, i.e., loss of water in the form of water vapour.

8) Name the plant tissue having dead cells.

ANS) Sclerenchyma.

8) Name the water conducting tissue generally present in gymnosperms. (Ans) Tracheids.

9) Which tissues in plants provide them flexibility? Collenchyma.

10) Why is the epidermis present as thick waxy coating of cutin in desert plants?

(Ans) A thick waxy coating of cutin is present in the desert plants to prevent excessive loss of water during transpiration. Due to this, plants can survive in scarcity of water in deserts.

11) Why are xylem and phloem called complex tissues? How are they different from one other?

(Ans) Xylem and phloem are called as complex tissues as they are made up of more than one type of cells.

(Xylem)	(Phloem)
1) Xylem mainly consist of dead cells (except xylem parenchyma)	1) Phloem consists of living cells (except phloem)
2) It conducts water and mineral from roots to aerial parts of the plant	2) It translocates prepared food from leaves to storage organ and growing parts of the body.

12) Write a short note on (i) Xylem (ii) Phloem

13) Why are plants and animals made of different types of tissues?

(14) What is a permanent tissue? Classify permanent tissues and describe them.

ANIMAL TISSUE

Blood and muscles are both examples of tissues found in our body. On the basis of the functions, animal tissues are of four types, viz. epithelial tissue, connective tissue, muscular tissue and nervous tissue.

Blood is a type of connective tissue.
Muscle forms muscular tissue.

Epithelial Tissue

The covering or protective tissue in the animal body are epithelial tissues. Epithelial tissue cells are tightly packed and form a continuous sheet. They have only a small amount of cementing material between them and almost no intercellular spaces.

Epithelium covers most organs and cavities within the body. It forms a barrier to keep different body systems separate. The skin, the lining of the mouth, the lining of blood vessels, lung alveoli and kidney tubules are all made of epithelial tissue.

Functions of epithelial tissue:

- (i) Epithelial cells protect the underlying cells from drying, injury and chemical effects. They also protect the body from viral or bacterial infections.
- (ii) It helps in the absorption of water and nutrients.
- (iii) It performs secretory function by secreting useful chemicals like sweat, saliva, enzymes from the food etc in the body.

Epithelial Tissues are of following types:

(a) Simple squamous epithelium:

They are present in cells lining blood vessels or lung alveoli where transportation of substances occurs through a selectively permeable surface; there is a simple flat kind of epithelium.

(b) Stratified squamous epithelium:

Skin epithelial cells are arranged in many layers to prevent wear and tear. Since, they are arranged in a pattern of layers, the epithelium is called stratified squamous epithelium.

(c) Columnar epithelium:

Where absorption and secretion occur, as in the inner lining of the intestine, these tall epithelial cells are present. This columnar epithelium facilitates movement across the epithelial barrier. In the respiratory tract, the columnar epithelial tissue also has cilia, which are hair-like projection on the outer surface of epithelial cells. These cilia can move and their movement pushes the mucus forward to clear it. This type of epithelium is thus ciliated columnar epithelium.

(d) Cuboidal epithelium:

These form the lining of the kidney tubules and ducts of salivary glands where these provide mechanical support. Sometimes, a portion of the epithelial tissue folds inwards and a multicellular gland is formed. This is glandular epithelium.

Connective Tissue

Blood is a type of connective tissue. The cells of connective tissue are loosely spaced and embedded in an intercellular matrix. The matrix may be jelly like, fluid, dense or rigid.

Blood has a fluid (liquid) matrix called plasma, in which red blood cells (RBCs), white blood cells (WBCs) and platelets are suspended.

There are five types of connective tissues:

(i) Areolar connective tissue:

It is a loose and cellular connective tissue. It joins skin to muscles, fills spaces inside organs, and is found around muscles, blood vessels and nerves.

Function:

- (a) It acts as a supporting and packing tissue between organs lying in the body cavity.
- (b) It helps in repair of tissues after an injury.
- (c) It also helps in combating foreign toxins.
- (d) It fixes skin to underlying muscles.

(ii) Dense regular connective tissue:

It is a fibrous connective tissue, characterised by ordered and densely packed collection of fibres and cells. Dense regular connective tissue is the principal component of tendons and ligaments.

Functions:

- (a) Tendon: Tendons are cord like, strong, inelastic structures that join skeletal muscles to bones.
- (b) Ligament: They are an elastic structure which connects bones to bones.

(iii) Adipose Tissue :

Adipose tissue is basically an aggregation of fat cells. The adipose tissue is abundant below the skin, between the internal organs and in the yellow bone marrow.

Functions :

- (a) It serves as a fat reservoir.
- (b) It provides shape to the limbs and the body.
- (c) It keeps visceral organs in position.
- (d) It forms shock-absorbing cushions around kidneys and eyeballs.
- (e) It acts as an insulator. Being a poor conductor of heat, it reduces heat loss from the body i.e. it regulates body temperature.

(iv) Skeletal tissue :

The skeletal tissue or supporting tissue includes bone and cartilage which form the endoskeleton of vertebrates only.

(a) Cartilage : The cartilage is a specialised connective tissue which is compact and less vascular.

Cartilage can be found in ear pinna, nose tip, epiglottis, intervertebral discs, end of long bones, lower ends of ribs and rings of trachea.

(b) Bone : Bone is a strong and non-flexible tissue. Like cartilage, bone is also a specialised connective tissue.

Functions : (a) Cartilage provides support and flexibility to the body parts. It smoothes the surfaces at joints.

(b) Bone provides shape and skeletal support to body.

(c) Bone protects vital body organs such as brain, lungs etc.

(d) Bone anchors the muscles.

(V) Fluid connective tissue :

Fluid connective tissue links the different parts of the body and maintain continuity in the body. It includes body and lymph.

(a) Blood : In this tissue, cells move in a fluid or liquid matrix or medium called blood plasma.

Blood occurs in blood vessels called arteries, veins and capillaries which are connected together to form the circulatory system.

(b) Lymph : Lymph is a colorless fluid that has been filtered out of the blood capillaries.

Functions :

(a) Blood transports nutrients, hormones and vitamins to the tissues and transport excretory products from tissues to the liver and kidney.

(b) Lymph transports the nutrients (oxygen, glucose) that may have filtered out of the blood capillaries back into the heart to be recirculated in the body.

(c) Lymph brings CO_2 and nitrogenous wastes from tissues to the blood.

Muscular Tissue

Muscular tissue consists of elongated cells, also called muscle fibres. This tissue is responsible for movement in our body. Muscles contain special protein called contractile protein which contract and relax to cause movement.

Voluntary Muscles: (Striated Muscles)

Voluntary muscles can be moved by the conscious will when we want them to move. For example, muscles of limbs or skeletal muscles.

These muscles are also called skeletal muscles as they are mostly attached to bones and help in body movement. These muscles show alternate light and dark bands. As a result they are also called striated muscles. The cells of these tissue are long, cylindrical, unbranched and multinucleate (having many nuclei).

Involuntary Muscles (Smooth Muscles)

The muscles which do not move on our will are called involuntary muscles. The movement of food in the alimentary canal or the contraction and relaxation of blood vessels are involuntary movements. These muscles are also called as smooth muscles. They are also found in the iris of the eye, in arteries and in bronchi of the lungs.

Q) Briefly describe striated and smooth muscles with their functions.

Nervous Tissue

Nervous tissue contains highly specialised units called nerve cells or neurons. Each neuron has the following three parts:

- (i) The cyton or cell body: It contains a central nucleus and cytoplasm with characteristic deeply stained particles, called Nissl granules.
- (ii) The dendrites: These are short processes arising from the cyton.
- (iii) The axon: It is a single, long, cylindrical process of uniform diameter. It carries impulses away from the cell body.

Functions: Neurons have the ability to receive stimuli from within or outside the body and conduct impulses to different parts of the body. The impulses travel from one neuron to another neuron and finally to brain or spinal cord.

Questions:

(1) Name the tissue responsible for movement in our body.

Ans) Muscular tissue.

(2) What does a neuron look like?

Ans) A neuron consists of a cell body with a nucleus and cytoplasm, from which long thin hair-like parts called dendrites arise. Each neuron has a single long part called the axon.

(3) Give three features of the cardiac muscle.

Ans) (i) Cardiac muscle are involuntary

(ii) Cardiac muscle cells are cylindrical, branched and uninucleate.

(iii) Cardiac muscles show rhythmic contraction and relaxation.

(4) What are the functions of areolar tissue?

Ans) Areolar tissue is a connective tissue. It fills the space inside the organ, supports internal organs and helps in repair of tissues.

- (5) (i) Tissue that forms the inner lining of our mouth - Simple squamous epithelium
(ii) Tissue that connects muscle to bone in human - Tendon
(iii) Tissue that transports food in plants - Phloem
(iv) Tissue that stores fat in our body - Adipose tissue
(v) Connective tissue with a fluid matrix - Blood
(vi) Tissue present in the brain - Nervous tissue.

(6) (i) Skin - Epithelial tissue (Squamous epithelium)

(ii) Bark of tree - Cork (protective tissue)

(iii) Bone - Skeletal tissue (connective tissue)

(iv) Lining of kidney tubules - Cuboidal epithelial tissue

(v) Vascular bundles - xylem and phloem.

(7) Name the region in which parenchyma tissue is present.

Ans) Parenchyma is a simple permanent tissue present in the cortex and pith of stem and roots. It is also present in the mesophyll of leaves.

(8) What is the role of epidermis in plants?

Ans) Epidermis is a protective tissue of plants. It provides protection to underlying tissues. Epidermis forms the outer covering of the entire plant surface. Epidermal cells on the aerial parts of the plant often secrete a waxy, water-resistant layer on their outer surface, which provides protection against loss of water, mechanical injury and invasion of parasitic fungi. In the roots, they help in the absorption of water. It also regulates transpiration in plants.

(9) How does the cork act as a protective tissue?

Ans) The cork cells are dead and do not have any intercellular spaces. The cell walls of the cork cells are coated with suberin (a waxy substance). Suberin makes these cells impermeable to water and gases. Thus, it protects underlying tissues from desiccation (loss of water from plant body), infection and mechanical injury.

(10) What is lignin?

Ans) Lignin is a chemical substance present in the cell wall of plants which acts as a cement and hardens it.

(11) What is cutin?

Ans) Cutin is a chemical substance with water proof quality covering the aerial parts of plants.

(12) Differentiate between : (a) Tendons and Ligaments

(b) Apical meristem and lateral meristem.

Ans) (a)

Tendons	Ligament
1) It is an inelastic band	1) It is an elastic band
2) Tendon connects a muscle with bone	2) Ligament connects one bone with another bone.
3) Yellow fibres are absent	3) Yellow fibres are present
4) Bundle of white fibres occur in parallel series	4) Bundles of white fibres run in different direction.

(b) Apical meristem

- 1) Occurs at the tips of roots and shoots.
- 2) Adds vertical growth to roots and shoots (increase length)
- 3) Responsible for primary growth
- 4) Produces new leaves and flowers

Lateral Meristem

- 1) Occurs at the cambium
- 2) Responsible for secondary growth (increase width)
- 3) Responsible for secondary growth
- 4) Produces the bark on trees

(13) Name the tissue which form the lining of blood vessels.

Ans) Epithelial tissue cells.

(14) Explain three functions of epidermis in plants. What changes take place in the epidermis as the plant grows older.

Ans. 1) Protect the plant from water loss in transpiration.

2) It acts as boundary tissue surrounding the plant

3) Exchange of gases through the stomata

4) Storage of water and metabolic products.

As plants grow older, a strip of secondary meristem replaces the epidermis of the stem. Cells on the outside are cut off from this layer. This forms the several-layer thick cork or the bark of the tree. (15)