

TISSUES

PLANT TISSUES

1. What is a tissue?

A tissue is a group of cells that are similar in structure, function and origin. Various tissues in an organism work in co ordination with each other in order to perform various functions.

The microscopic study of tissues and their functions is known as Histology.

2. What is differentiation?

In a multicellular organism, the cells derived from meristematic tissue become specialized. They take up a permanent shape, size and function, resulting in division of labor. This phenomenon is known as differentiation.

3. What is the utility of tissues in a multicellular organism?

- i) Formation of tissues brings about division of labour in multicellular organisms.
- ii) Tissues become organized to form organs and organs into organ systems.
- iii) Workload of the individual cells gets decreased.
- iv) Due to improved organization and higher efficiency, multicellular organisms have better survival rate.

4. What are the differences between tissues in plants and animals?

| | Plant Tissues | Animal Tissues |
|---|--|---|
| 1 | Tissue organization is towards fixed or stationary habit | Tissue organization is towards active locomotion. |
| 2 | Dead supportive tissues are more abundant. | Living tissues are more common |
| 3 | Plants need less maintenance energy | Animals need more maintenance energy |
| 4 | Tissues are differentiated into meristematic and permanent tissues | Such differentiation is absent |
| 5 | Organization is simple | Organization is complex |
| 6 | Growth is limited to certain regions- root tips and shoot tips. | Growth is internal and not limited to certain regions only. |

5. Classify plant tissues.

Refer notes / Class work

6. What are meristems?

The group of young cells capable of actively dividing, present in the growing parts of the plants such as the root tip and the shoot tip are called meristems or meristematic tissue.

7. What are the characteristics of meristematic tissue?

- i) They are the living cells, actively dividing with very thin cellulose walls.
- ii) They have dense granular cytoplasm.
- iii) Nucleus is large and prominent.
- iv) They are compactly arranged cells without any intercellular spaces or vacuoles.
- v) They do not store reserve food materials.
- vi) They are usually found in the apices of roots and stem.

8. What are the different types of meristems and what is their function?

The three types of meristems are:

Apical meristem: found in the growing tips of the root and shoot. They are also found in the apices of the leaf. They bring about elongation of the root and the stem resulting in the increase in height of the plant.

Intercalary meristem: is found at the base of leaves and internodes resulting in the increase in length.

Lateral meristem: is found beneath the bark and in the vascular bundles they occur in thin layers and is responsible for increase in the girth of the stem.

The main function of meristematic tissue is to divide continuously and produce new cells for the growth of the plant. They are the parent cells from which other types of cells are formed.

9. What are permanent tissues?

The meristematic tissue undergoes differentiation and becomes permanent tissue. They do not divide any more, undergo morphological changes to suit the function they perform.

10. Differentiate between meristematic and permanent tissue.

| | Meristematic tissue | Permanent tissue |
|---|--|---|
| 1 | Cells are small and undifferentiated | Cells are large and differentiated |
| 2 | Cell wall is thin, cells are compactly arranged, without any intercellular spaces. | Cell wall is thick or thin, loosely packed cells with intercellular spaces |
| 3 | Granular, dense cytoplasm with a large nucleus present. | Cytoplasm is less dense, to the periphery of the cell and a less prominent nucleus present. |
| 4 | The cells grow and divide rapidly | The cells are well developed and do not divide. |
| 5 | Vacuoles are absent | A large vacuole is present |
| 6 | Cells are always living | Cells may be living or dead. |
| 7 | It contributes to the growth of the plant | It provides protection, support and carries on photosynthesis and storage functions. |

11. Name the types of simple tissues.

Parenchyma, Collenchyma and Sclerenchyma are the three simple permanent tissues.

12. How are the simple tissues different from the complex tissues?

The simple tissues are made up of only one type of cells whereas the complex tissues are made up of more than one kind of cells.

13. What are the characteristic features of Parenchyma tissue and its function?

- Parenchyma tissues are found in soft parts of the plant and form the basic packing tissue.
- It contains relatively unspecialized cells with thin cell walls.
- The cells are loosely packed with large intercellular spaces.
- The cells may be oval, spherical, elongated or polygonal in shape.
- The cells have a large vacuole in the center with dense peripheral cytoplasm and a nucleus.

They are living cells, still retaining the ability to divide and they form the bulk of the plant body. They are found in all the soft parts of the plants.

Functions:

- i) Parenchyma serves as a packing tissue filling the spaces between other tissues and helps maintain turgidity and rigidity of the cells.
- ii) The main function of the parenchyma tissue is to store and assimilate food. It serves as a food storage tissue.
- iii) Parenchyma cells of the leaf having chloroplasts are called chlorenchyma and carry on photosynthesis.
- iv) Parenchyma tissues of the aquatic plants have large air spaces and are called aerenchyma. They give buoyancy to the plant, and help them to float.
- v) They store waste products such as resin, gum tannin etc

14. Write the characteristic features of Collenchyma tissue and its functions.

- Collenchymas tissues occur in the leaf stalks below the epidermis, midribs and veins and in the herbaceous stems.
- Collenchyma tissue is a living tissue with cells which are oval, spherical or polygonal in shape, found in the peripheral regions of the stem and leaves.
- The cell wall is irregularly thickened at the corners with deposition of extra cellulose and pectin
- There are no intercellular spaces between the cells.

Functions:

- i) Collenchyma is a mechanical tissue providing mechanical support and elasticity to plants.
- ii) It allows easy bending or flexibility in various parts of the plant like stem and leaves without breaking.
- iii) It carries out photosynthesis when they contain chloroplasts.

15. Write the characteristics of Sclerenchyma tissue and its functions.

- This tissue is present in stems, around the vascular bundles and in the hard coverings of seeds and nuts.
- It is composed of long, narrow and thick walled cells, devoid of protoplasm and hence dead cells.
- The walls of the sclerenchyma cells are greatly thickened due to the deposition of lignin (a chemical substance which acts as cement and binds cells together and hardens them.)
- These cells are closely packed with no intercellular spaces.
- Sclerenchyma cells are dead without nucleus and cytoplasm.

Sclerenchyma cells are of two types:

- a) **Fibres:** they are long narrow and pointed at both ends.
- b) **Scleireids:** are shorter isodiametric cells also known as stone cells or grit cells.

Functions:

- i) Sclerenchyma is the chief mechanical tissue of plants which provide strength to the plants. The commercial fibres obtained from plants such as jute, flax, hemp etc are sclerenchyma fibres.
- ii) It forms protective covering around the seeds and nuts.
- iii) It is the tissue which makes the plant hard and stiff.
- iv) Husk of the coconut is made up of sclerenchyma tissue.
- v) It gives rigidity and mechanical strength to plants.

16. What are the conducting tissues present in the plants?

Xylem and phloem are the vascular tissues present in plants.

Xylem is the water conducting tissue and phloem is the food conducting tissue in plants.

17. Differentiate between parenchyma, collenchyma and sclerenchyma cells.

| | Parenchyma | Collenchymas | Sclerenchyma |
|---|--|--|--|
| 1 | It is present in the soft parts of the plant body | It is present in the leaf stalks, midrib, below the epidermis veins and in herbaceous stem | It is present in stems, around the vascular bundles and I hard covering of seeds and nuts. |
| 2 | Living cells | Living cells with thick corners | Dead cells with highly lignified walls. |
| 3 | Cell walls are thin made of cellulose | Cell walls are thick with deposition of cellulose and pectin | Cell walls are thickened due to deposition of lignin |
| 4 | Stores food, waste products and forms packing tissue | Provides mechanical support, elasticity and flexibility to plants | Gives rigidity and mechanical strength to plants |
| 5 | Cells are loosely packed with large intercellular spaces | intercellular spaces are very little | Cells are closely packed without any intercellular spaces. |

18. What is the role of epidermis in plants?

- i) Epidermis is the outermost, uniform single layer of cells acting as a protective tissue covering the plant body. It gives protection against loss of water (desiccation), mechanical injury, and invasions from pathogens.
- ii) It allows exchange of gases and transpiration through stomata.
- iii) In the roots it helps in the absorption of water from soil through root hairs.
- iv) In xerophytic plants, the cuticle of the epidermis has a thick waxy coating of cutin that prevents desiccation. It prevents excessive evaporation of water thro leaves.

19. How does cork act as a protective tissue?

As the plants grow older, the outer protective tissue undergoes certain changes. 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 corks or the bark of the tree. Cells of the cork are dead and compactly arranged without intercellular spaces. They also have a chemical called **suberin** in their walls that makes them impervious to the gases and water. Cork is light and highly compressible and does not catch fire easily due to its suberised walls. For this reason, cork finds the following applications:

- i) as insulation material
- ii) as shock absorbers
- iii) in the manufacture of sports goods
- iv) fire proof material
- v) linoleum sheets.

20. What are stomata? Mention the functions of stomata.

Stomata are the minute openings or pores present in the lower epidermis of leaves and green stems. It is surrounded by a pair of kidney shaped cells called guard cells. The guard cells control the opening and closing of the stomata. They also have chloroplasts and participate in photosynthesis.

Functions:

- i) Stomata help in the exchange of gases like oxygen and carbon di oxide between atmosphere and the plant body.
- ii) They help in transpiration.

21. What is xylem?

Xylem is the water conducting tissue made up of four elements: 1. Xylem vessels

2. Tracheids

3. Xylem Parenchyma and

4. Xylem fibers

They occur in the roots, stems and leaves of higher plants.

i) **Xylem vessels:** are cylindrical, tube like structures. They are formed of a row of cells placed one above the other from which transverse partition walls are absorbed. They are non living cells with thick and lignified walls. The cellulose layer is thinner in some places forming pits, which help the water molecules to move upwards in the vessels.

ii) **Tracheids:** are elongated non living tube like cells. They have hard, thick and lignified walls. At some points the walls are thin and are called pits. Pits of adjacent tracheids help in connecting the cells and create pathway for the movement of water molecules. These cells are spindle shaped and closed at both ends. Vessels and tracheids are the main conducting elements of xylem.

iii) **Xylem parenchyma:** consists of living, thin walled cells that perform the function of storage.

iv) **Xylem fibers:** sclerenchymatous cells associated with xylem are known as xylem fibers. They are non-living tissues.

Functions:

- i) The main function of xylem vessels is conduction of water and minerals from roots to the different parts of the plant body.
- ii) Tracheids and xylem fibers provide mechanical support.
- iii) Xylem parenchyma helps in the storage of food materials it is the only living cell.

22. What is phloem?

Phloem is also a complex permanent tissue like xylem. It conducts the food prepared by the plants in the leaves to different parts of the plant body. Phloem is made up of four elements. They are:

i) Sieve tubes

ii) Companion cells

iii) Phloem parenchyma

iv) Phloem fibers

i) **Sieve tubes:** are the main conducting elements in the phloem. They are elongated cylindrical cells with perforated end walls called sieve plates arranged end to end. The perforated end walls between cells are called sieve plates. Sieve tubes are living cells with cytoplasm, but no nucleus.

ii) **Companion cells:** are always associated with sieve tubes. They are smaller cells having cytoplasm and a prominent nucleus. The companion cells support the sieve tubes in the conduction of food materials.

- iii) **Phloem parenchyma:** are thin walled living cells surrounding the sieve tubes and companion cells mainly concerned with the storage of glucose. They also act as support tissue.
- iv) **Phloem fibers / phloem sclerenchyma:** are thick walled cells, elongated, dead and lignified. They provide mechanical support to the conducting tissues.

23. Differentiate between xylem and phloem.

| | Xylem | Phloem |
|---|---|---|
| 1 | It is a non living or dead tissue | It is a living tissue |
| 2 | The elements forming xylem are tracheids, vessels, xylem parenchyma and xylem fibers. | The elements forming phloem are sieve tubes, companion cells, phloem parenchyma, phloem fibers. |
| 3 | Transports water and minerals from the roots to the leaves and branches – upward and lateral movement of water. | Transports food from the leaves to the stem, roots and branches – downward and lateral movement of food particles dissolved in water. |
| 4 | Xylem contains more dead cells except xylem parenchyma | Phloem contains more living cells – sieve tubes, companion cells and phloem parenchyma. |
| 5 | It provides mechanical strength to the plant body. | Except for phloem fibers, the other components do not provide mechanical support. |

ANIMAL TISSUES

1. Classify the animal tissues.

On the basis of the function they perform, animal tissues are classified into four different types. They are:

- i) Epithelial tissue
- ii) Connective tissue
- iii) Muscular tissue
- iv) Nervous tissue

2. What are epithelial tissues? What are the characteristic features of these tissues?

The covering or protective tissues in the animal body are called epithelial tissues. They also perform the functions of secretion and absorption other than protection.

Characteristics:

- i) It is the simplest tissue made up of a single layer of cells, compactly arranged without any intercellular spaces.
- ii) It forms a protective covering and lines most of the organs and cavities within the body.
- iii) They form a barrier to keep the different body systems separate
- iv) All epithelial tissues are separated from the underlying connective tissues by an extracellular fibrous basement membrane. *- non-cellular material*
- v) Blood vessels are absent in epithelial tissues.

3. What are the functions of epithelial tissues?

Epithelial tissues perform the following functions:

- i) **Protection:** they protect the underlying tissues from drying, injury, infections and from harmful chemicals. Epithelium also produces exoskeletal structures like hair, nails, hoofs, horns, scales etc
- ii) **Absorption:** they form the lining of the intestine and absorb digested food and nutrients and water.
- iii) **Excretion:** they form the lining of kidney tubules and help in the elimination of nitrogenous waste products.
- iv) **Secretion:** epithelial lining of digestive glands and endocrine glands secrete useful enzymes for digestion and other biological processes in our body.
- v) **Respiration:** epithelial cells lining the blood vessels and the alveoli in lungs allow the diffusion of gases between blood and inhaled air.

4. Describe the different types of epithelial tissues.

Based on the shape and function of the cells, the epithelial tissue is of different types. They are:

1. Simple squamous epithelium
2. Cuboidal epithelium
3. Columnar epithelium
4. Glandular epithelium
5. Ciliated epithelium
6. Stratified squamous epithelium

- i) **Simple squamous epithelium:** it consists of an extremely thin layer of flattened cells forming a delicate lining. It lines the blood vessels, oesophagus, lining of mouth, alveoli of lungs etc. It is protective in nature. It protects the underlying tissue from drying, mechanical injury, entry of germs and chemicals.
- ii) **Cuboidal epithelium:** is made up of cup shaped cells, more or less square shaped with a prominent nucleus in the center. It forms the lining of kidney tubules, ducts of the salivary glands, it also lines the sweat and thyroid glands. It provides mechanical strength. It also helps in secretion, absorption and excretory functions.
- iii) **Columnar epithelium:** it consists of tall, pillar like cells with dense cytoplasm and a prominent nucleus at the base. It is present in the inner lining of the intestine, gall bladder and stomach. They perform the function of secretion and absorption.
- iv) **Glandular epithelium:** the columnar and cuboidal epithelial cells intersperse to form the glandular epithelium. The goblet cells are cuboidal and secretory in function. They secrete mucous and certain chemicals. They are found lining the stomach, intestine, glands such as salivary glands, gastric glands. They secrete mucous to protect the inner lining of cells of the stomach.
- v) **Ciliated columnar epithelium:** it is columnar epithelium with cytoplasmic extensions at the free end called cilia. They are found in the respiratory tract like trachea, lungs; these cilia create a wave like motion, helps in the movement of ovum in the oviduct, sperms in the spermduct, filters dust particles in the upper nasal passage, secretes mucous and helps in the removal of certain solid particles by its movement.
- vi) **Stratified squamous epithelium:** is the only epithelium with multiple layers of cells. It is found in the skin. Cells are arranged in many layers. Deeper layers have cuboidal and columnar cells while the upper layers become dense and have squamous layer of cells. The flattened cells have fibrous protein called keratin and become dead cells, which gradually get sloughed off.

5. What are connective tissues? Write their characteristics.

The connective tissue is specialized to connect and anchor various body organs.

Characteristics:

- i) It can connect bones to bones; muscles to bones, bind tissues and give support to various parts of the body.
- ii) It comprises of a homogeneous, gel like intercellular substance called matrix, which may be jelly like, dense, rigid or fluid.
- iii) The nature of the matrix differs with the function of the particular connective tissue.

6. Describe the different types of connective tissues.

Based on the nature of the matrix, connective tissues are classified into four types:

- i) **Fluid connective tissue:** where the matrix is a fluid, which is called plasma. There are two tissues – **Blood and Lymph.**
- ii) **Dense regular connective tissue:** the matrix here is dense, but not rigid. Made up of densely packed fibers and cells that give elasticity. There are two tissues – **Tendons and ligaments.**
- iii) **Skeletal tissue:** made up of rigid connective tissue. There are two tissues – **Bone and cartilage.**
- iv) **Loose connective tissue:** made up of matrix which is gel like and cellular – **Areolar Tissue & Adipose tissue.**

7. Describe the composition and function of the fluid connective tissue.

Blood is a fluid connective tissue. It has a fluid matrix called blood plasma. The blood plasma contains:

RBC's – red blood corpuscles / erythrocytes that are red in colour due to the presence of haemoglobin in them.;

It binds to the oxygen molecules and transports it to all the cells of the body.

WBC's – white blood corpuscles / leucocytes are round or irregular cells that can identify and attack any foreign particle that enters our body' hence protective in function

Platelets or thrombocytes are very tiny cells that help in blood clotting and therefore help in the healing process in case of injuries.

All these cells are suspended in the blood plasma which also carries in it the dissolved salts, nutrients, hormones, enzymes, waste materials and delivers them to the respective organs / cells that are in need of it and can process it further.

Lymph: is the colourless fluid present in the lymph nodes and lymph vessels. It is nothing but blood plasma with WBCs and little proteins. RBC's and platelets are absent in the lymph and therefore no hemoglobin also.

Lymph is a parallel transport system that helps in the transport of larger molecules of proteins and other nutrients to cells.

Lymphocytes produced in the lymph nodes protect the body against infections by engulfing the bacteria and forms the defense / immune system of the body. They also clear the dead cells, thus keeping the body free of wastes.

8. Differentiate between tendons and ligaments.

| | Tendons | Ligaments |
|---|---|--|
| 1 | They connect bones to muscles | They connect bones to bones |
| 2 | They are tough and non elastic | They have considerable strength and is elastic |
| 3 | Composed of white collagen fibers | Composed of yellow elastin fibers |
| 4 | Strengthen the joints and permits normal movement | Has very little matrix, strengthens joints and permits normal movement |

9. What are the characteristic features of skeletal connective tissue? What are its functions?

Bone and cartilage are the two skeletal connective tissues. They are rigid and provide shape and support to the structure of the body.

Bone: it is a very strong and non flexible tissue. The matrix of the bone is in the form of concentric rings called lamellae in which the bone cells called osteocytes are present. The hard matrix is composed of salts of phosphates and carbonates of calcium and magnesium. Hence, bone is hard, mineralized and rigid.

- i) Bones provide shape and skeletal support to the body.
- ii) It anchors the muscles and protects vital body organs such as brain and lungs.
- iii) It is the storage site for calcium and phosphates.

Cartilage: It is a flexible tissue with the matrix made up of proteins, calcium salts and sugar. It is slightly hardened, firm but elastic. The matrix have delicate network of collagen fibers and living cells called chondrocytes. It is present in the nose, external ear / pinna, trachea and larynx.

Cartilage provides flexibility and support to the body parts. It smoothens bone surface at joints.

10. What are the components of loose connective tissue? What are its functions?

Areolar and **Adipose** tissue form the loose connective tissue.

Areolar connective tissue: It is the simplest and most widely distributed connective tissue which is has a matrix made of two kinds of fibers – yellow elastin fibers and white collagen fibers. Scattered in the matrix are found irregular cells called fibroblasts.

- i) It is found between the skin and the muscles, around the blood vessels, nerves and in the bone marrow.
- ii) It fills the space inside the organs, supports internal organs and helps in the repair of tissues.

Adipose tissue: it is an aggregation of fat cells or adipocytes. Each of these cells are filled with fat droplets and arranged into globules. They are separated by collagen and elastin fibers.

- i) They occur abundantly below the skin, around internal organs and kidneys.
- ii) They serve as reservoirs of fat.
- iii) It keeps the visceral organs in position and provides cushioning to organs such as eyeball, kidneys etc.
- iv) They act as insulators and prevent heat loss by the body.

11. Differentiate between bone and cartilage.

| | Bone | Cartilage |
|---|---|---------------------------------------|
| 1 | Hard, strong and inflexible | Tough and elastic |
| 2 | Porous | Non porous |
| 3 | Matrix is made of calcium and phosphorous compounds | Matrix is made of proteins and sugars |
| 4 | Blood vessels present | Blood vessels absent |
| 5 | Bone marrow present | Bone marrow absent |

Muscular Tissue: consists of muscle cells which are also called muscle fibers. It is responsible for movement in our body. Muscles contain special proteins called contractile proteins which contract and relax to cause movement.

12. Describe the structure and function of different types of muscle fibers.

Based on their location, structure and function, muscle cells are of three types. They are:

- i) Striated muscle / skeletal muscle / voluntary muscles.
- ii) Non striated muscles / smooth muscles / involuntary muscles.
- iii) Cardiac muscles.

Striated or skeletal or voluntary muscles:

- i) They are attached to the bones and help in body movement, so they are called skeletal muscles.
- ii) These muscles work according to our will and hence called voluntary muscles.
- iii) Under the microscope, these muscles show alternate light and dark bands or striations, hence they are called striated muscle fibers.
- iv) These muscle cells are long, narrow, cylindrical, unbranched with blunt ends and multinucleate. Their nuclei are peripheral in position.
- v) These muscles are present in the limbs, face and neck.

Non striated / smooth muscles / involuntary muscle fibers:

- i) The cells of this tissue are spindle shaped with pointed ends. They are arranged in bundles and are mono nucleate.
- ii) They do not have any striations, hence called smooth muscle fibers or non striated muscle fibers.
- iii) They are not under the control of our will and hence called involuntary muscles.
- iv) They are found in the iris of the eye, in ureters and in the bronchi of lungs.

Cardiac muscles (Heart muscles):

These muscles are found in the walls of the heart.

These cells are branched, cylindrical and uni nucleate. They work incessantly, rhythmically and tirelessly contracting and relaxing endlessly from early embryonic stage till death.

These muscles do not work according to our will and are therefore involuntary muscles.

13. Differentiate between striated, non-striated and cardiac muscles.

| | Striated muscles | Non striated muscles | Cardiac muscles |
|---|---|---|--|
| 1 | It is also called skeletal muscles | It is called smooth muscles | It is also called heart muscles. |
| 2 | It is present in the limbs, neck, face etc. | It is present in the visceral organs. | It is present in the walls of the heart |
| 3 | Striated | Non striated | Striated |
| 4 | Light and dark bands present | No striations | Faint regular light and dark bands. |
| 5 | Multinucleate | Uni nucleate | Uni nucleate |
| 6 | Long, cylindrical and unbranched cells. | They are long, unbranched, spindle shaped cells | They are cylindrical and branched cells. |
| 7 | Intercalated discs are absent | Intercalated discs are absent | Intercalated discs are present. |

Nervous system: the brain, spinal cord and nerves are all made up of nervous tissue. Cells of this tissue are called nerve cells or neurons. They are highly specialized to respond to stimuli and transmit the stimulus very rapidly from one place to another within the body.

14. Describe the structure of a neuron.

The structural and functional unit of the nervous system is called a neuron. A typical nerve cell has 3 parts. They are: **cyton or cell body, dendrites and axon**

Cyton: It is the cell body of the neuron. It has a large central nucleus and cytoplasm from which long and short, thin nerve fibers arise.

Dendrites: short branched fibers of neuron arise from cyton or cell body. It receives impulses.

Axon: a single, long conducting fiber extending from the cyton, much longer than the other branches of a neuron is the axon. It transmits impulses away from the cell body. It terminates with axon endings

15. What are the functions of the nervous tissue?

- i) It controls all the body activities.
- ii) Dendrites carry the nerve impulses towards the cyton or cell body.
- iii) The axon carries impulses away from the cyton.
- iv) These tissues are highly specialized for being stimulated and the transmitting the stimulus very rapidly from one place to another within the body.

16. What is a nerve?

Many nerve fibers bound together by connective tissue make up a nerve.