Tissues

CHAPTER COVERAGE

Tissues; organs, organ systems, organism.
Structure and functions of animal and plant tissues (four types in animals; meristematic and permanent tissues in plants).

INTRODUCTION

A group of cells that are similar in structure and work together to achieve a particular function forms a **tissue**. In unicellular organism, all the life processes such as digestion, respiration, excretion, reproduction, etc. are performed by the single cell, but in a multicellular organism, different groups of cells perform different functions. Thus, there is division of labour in cells and each tissue is composed of cells that originate from common parent cells and have characteristic shape, size and arrangement. There are different types of tissues in plants and animals. Plant tissues are mainly of two types based on their power of division— these are meristematic and permanent tissues. Meristems may be primary or secondary meristems and permanent tissues are classified into simple and complex or compound permanent tissues.

Animal tissues are of four types on the basis of their functions – Epithelial, Connective, Muscular and Nervous tissue.

IMPORTANT TERMS AND CONCEPTS

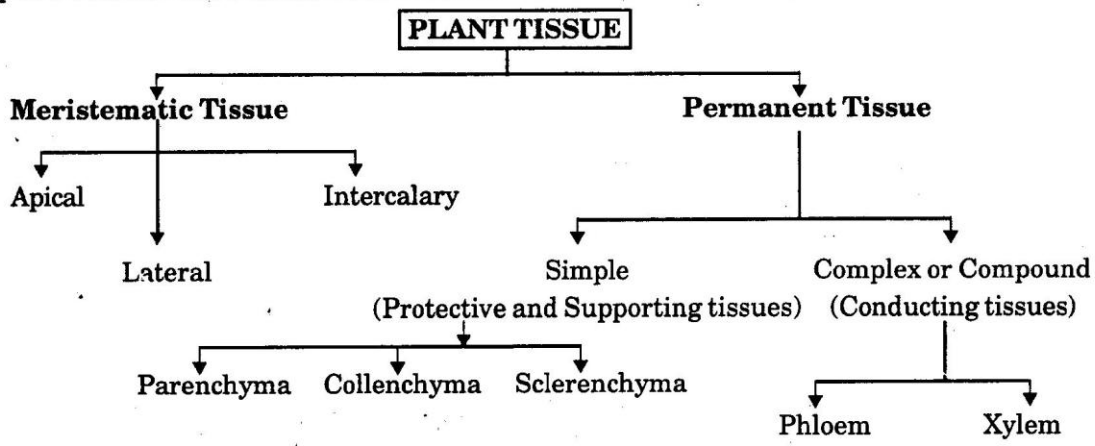
1. Importance of Tissues :

(*i*) Formation of tissues has brought about division of labour in multicellular organisms.
(*ii*) Tissues become organised to form organs and organs into organ systems.
(*iii*) Workload of individual cell has decreased.
(*iv*) Due to improved organisation and higher efficiency, multicellular organisms have higher survival.

2. Differences between :

Plant Tissues	Animal Tissues
(*i*) Tissue organisation is towards stationary or fixed habit.	(*i*) Tissue organisation is towards active locomotion.
(*ii*) Dead supportive tissues are more abundant.	(*ii*) Living tissues are more common.
(*iii*) Plants need less maintenance energy.	(*iii*) Animals need more maintenance energy.
(*iv*) There is differentiation of meristematic and permanent tissues.	(*iv*) Such a differentiation is absent.
(*v*) Organisation is simple.	(*v*) Organisation is complex.
(*vi*) Growth is limited to certain regions.	(*vi*) Growth is not limited in animals.

3. Classification of Plant Tissues : Based on the dividing capacity of the tissues, various plant tissues can be classified as follows :



4. Meristematic Tissue (Meristems) : It consists of undifferentiated, actively dividing cells. Meristematic tissues are growth tissues and are found in those regions of the plant that grows, for example, the root tip, shoot tip and cambium. These tissues are living and bring about an increase in the length and girth (thickness) of the plant. According to their position in the plant, meristems are apical, lateral and intercalary.

5. Characteristics of Meristematic Tissue :

(*i*) The cells of meristematic tissue are similar in structure and have thin cellulose cell walls.

(*ii*) The meristematic cells may be spherical, oval, polygonal or rectangular in shape.

(*iii*) Each meristematic cell contains dense or abundant cytoplasm and a single large nucleus.

(*iv*) The meristematic cells are compactly arranged and do not contain any intercellular space between them.

(*v*) The meristematic cells may or may not contain vacuoles.

6. Functions of Meristematic Tissue :

(*i*) Meristematic tissues have the ability to divide, hence they continuously produce new cells which keep differentiating to form specialised cells of the plant.

(*ii*) The cells of the root tip and shoot tip bring about an increase in length of the plant.

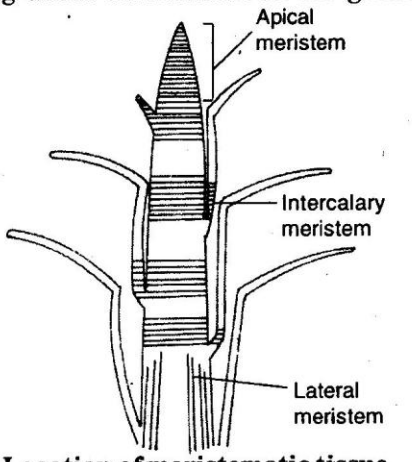
(*iii*) The cells in the lateral region, *i.e.*, cambium bring about an increase in the girth (thickness) of the plant.

7. Types of Meristems :

(*i*) **Apical meristems :** They are present at the growth tips of stems and roots. They act as pro-meristems from which other meristems are derived and help in increasing the length of the stem and the root.

(*ii*) **Lateral meristems (cambium) :** They lie on the lateral sides of stem and root and help in increasing the girth of the stem or root. They act as secondary meristems.

(*iii*) **Intercalary meristems :** They lie at the base of the leaves or internodes on twigs, and help in longitudinal growth of plants by adding primary tissues.



Location of meristematic tissue in plant body

8. Permanent Tissues : These tissues are derived from the meristematic tissues. Different types of permanent tissues are formed by the differentiation of the cells of meristematic tissue.

9. Characteristics of Permanent Tissues :

(*i*) Permanent tissues do not divide as they have lost the power of division.

(*ii*) They have a definite form and size.

(*iii*) They are differentiated cells and carry out specific functions.

(*iv*) They may be living or dead cells.

(*v*) They may have thin or thick cell walls.

(*vi*) The cells are large with vacuolated cytoplasm.

10. Differences between :

Meristematic Tissue	Permanent Tissue
(*i*) Cells divide repeatedly.	(*i*) Cells are derived from the meristematic tissue and normally do not divide.
(*ii*) Cells are undifferentiated.	(*ii*) Cells are fully differentiated.
(*iii*) Cells are small or isodiametric.	(*iii*) Cells are large with definite shape and size.
(*iv*) Intercellular spaces are absent.	(*iv*) Intercellular spaces are often present.
(*v*) Vacuoles are absent.	(*v*) Large vacuoles are present.
(*vi*) Cells have dense cytoplasm.	(*vi*) Cells have thin layered cytoplasm around the vacuoles.
(*vii*) Metabolism occurs at high rate.	(*vii*) Metabolism occurs at low rate.
(*viii*) Cell walls are thin.	(*viii*) Cell walls may be thin or thick.
(*ix*) The inorganic inclusions are absent.	(*ix*) The crystals and other inorganic inclusions are often present.
(*x*) It is a simple tissue.	(*x*) It may be simple or complex tissue.
(*xi*) It helps in growth.	(*xi*) It helps in protection, photosynthesis, conduction, support, etc.
(*xii*) Cells are always living.	(*xii*) Cells may be living or dead.

11. Classification of Permanent Tissues. The permanent tissues are classified into two groups—simple and complex which are further divided into various types as given below :

(*i*) Simple tissues are of three types—Parenchyma, Collenchyma and Sclerenchyma.

(*ii*) Complex tissues are of two types—Xylem and Phloem.

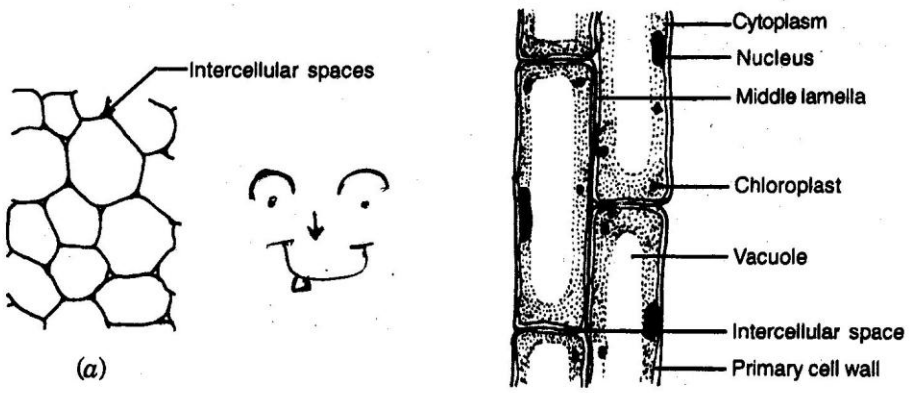
12. Simple Permanent Tissues. These tissues are composed of one type of cells only. The cells are structurally and functionally similar.

On the basis of nature of cells they are of three types : Parenchyma, Collenchyma and Sclerenchyma.

13. Parenchyma :

- It is the most common simple tissue in plants with relatively little specialisation.
- They are living cells which form the bulk of the plant body and possess the power of division.
- The cells are isodiametric in shape.

- The cell wall is thin and made up of cellulose.
- The cells are loosely packed with large intercellular spaces occurring in-between cells.
- The parenchyma tissues are found in soft parts of the plant such as cortex of roots, ground tissues in stems and mesophyll of leaves.
- There is a large central vacuole and dense peripheral cytoplasm containing a distinct nucleus.
- The cells may be oval, round, polygonal or elongated in shape.



(*a*) (*b*)

Parenchyma (*a*) Transverse section, (*b*) Longitudinal section

Functions of Parenchyma :

(*i*) The main function of parenchyma is to store and assimilate food and serve as **food storage tissue.**

(*ii*) Due to turgidity property, parenchyma forms the means of **support** to the stem of herbaceous plants.

(*iii*) Parenchyma cells of leaves containing chlorophyll are called **chlorenchyma.** They carry out photosynthesis.

(*iv*) Parenchyma cells of aquatic plants containing large air cavities are called **aerenchyma,** which give buoyancy to plants to help them float.

(*v*) Parenchyma serves as a **packing tissue** to fill the spaces between other tissues and maintain the shape and firmness of the plant.

(*vi*) Transport of materials occur through cells or cell walls of parenchyma cells.

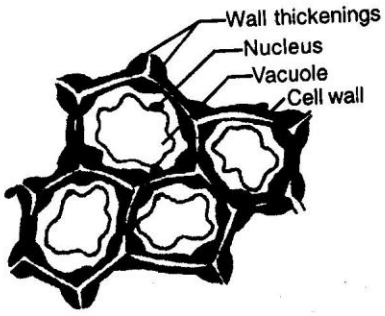
(*vii*) Presence of intercellular air spaces in-between parenchyma cells allows gaseous exchange.

(*viii*) Certain parenchyma cells store waste products of plants such as tannin, gum, crystals, resins of inorganic waste, etc.

(*ix*) The parenchyma of stems and roots also store nutrients and water.

Collenchyma :

- The cells of this tissue are living, elongated and irregularly thickened at the corners.
- Intercellular space is very little.
- Collenchyma occurs below the epidermis in leaf stalks, leaf mid-ribs and herbaceous dicot stems.
- Parenchyma is characterised by the deposition of extra cellulose and pectin.
- Collenchyma cells appear to be circular, oval or polygonal in cross-section.
- Their cell walls have simple pits.
- They often contain chloroplasts.



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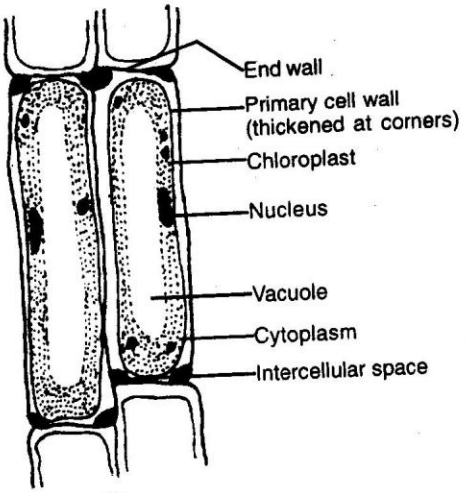


(b)

Collenchyma (*a*) Transverse section, (*b*) Longitudinal section

16. Functions of collenchyma :

(*i*) Collenchyma is a mechanical tissue. It provides mechanical support and elasticity to plants.

(*ii*) It provides tensile strength and flexibility to the organ in which they occur.

(*iii*) It allows easy bending in various parts of a plant (leaf, stem) without breaking.

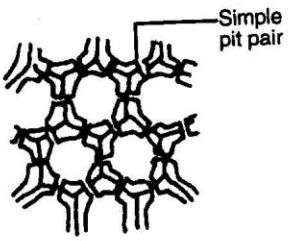
(*iv*) When cells of collenchyma contain chloroplast, they manufacture sugar and starch (food).

17. Sclerenchyma :

- Sclerenchyma cells are dead and without any protoplasm.
- It is composed of long, narrow and thick-walled cells.
- The walls of sclerenchyma cells are greatly thickened with deposition of lignin (acts as cement and hardens the cells).
- These cells are closely packed without intercellular space.
- This tissue is present in stems, around vascular bundles, in the veins of leaves and in the hard covering of seeds and nuts.
- Husk of coconut is made of sclerenchymatous tissue.
- Sclerenchyma cells are of two types :

(*i*) **Fibres :** These consist of very long, narrow, thick and lignified cells. Fibres are usually pointed at both ends and are clustered into strands.

(*ii*) **Sclereids.** These are also called grit cells or stone cells and are irregular-shaped. They are also dead and develop into various parts of the plants such as cortex, pith, phloem, hard seeds, etc. Sclereids are broad and highly thick-walled sclerenchyma cells which occur singly or in small groups.



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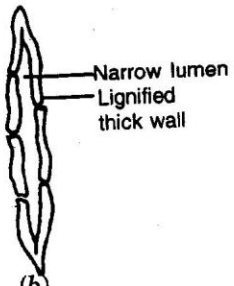


(b)

Sclerenchyma (*a*) Transverse section, (*b*) Longitudinal section

18. Functions of Sclerenchyma :

(*i*) Sclerenchyma is the chief mechanical tissue of plants which provides strength and enables them to bear various stresses.

(*ii*) It forms a protective covering around seeds and nuts.

(*iii*) It gives rigidity, flexibility and elasticity to the plant body.

19. Differences amongst :

Parenchyma	Collenchyma	Sclerenchyma
(*i*) Living cells and isodiametric in shape.	(*i*) Living cells, cells with thick corners.	(*i*) Dead cells, long and narrow with tapered ends.
(*ii*) Cell walls are thin and made up of cellulose.	(*ii*) Cell walls are thickened at corners with extra depositon of cellulose and pectin.	(*ii*) Cell walls are thick due to heavy deposition of lignin.
(*iii*) Cells have distinct nucleus and a large central vacuole.	(*iii*) Cells have distinct nucleus and dense cytoplasm.	(*iii*) Cells do not have nucleus and cytoplasm.
(*iv*) It stores food, waste products and forms packing tissue.	(*iv*) It gives mechanical support and carry out photo-synthesis.	(*iv*) It gives rigidity and mechanical strength to the plant.
(*v*) It is present in all soft parts of plant, *i.e.*, in stems roots, leaves, flowers and fruits.	(*v*) It is present below the epidermis in stems and leaves.	(*v*) It is present in xylem and phloem, in shells of nuts, in hard seeds, pulp of pear, etc.

20. Protective Tissue :

- The outermost layer of the plant body such as stems, roots and leaves are modified into protective tissue.
- The protective tissue protects the plant from undue loss of water and minor external injuries.
- These cells are specialised in number of ways to act as protective tissue.
- The two types of protective tissues present in plants are epidermis and cork.

21. Epidermis :

- It is the outermost layer of all soft parts of the plant like young stems, roots, leaves, and flowers.
- It is one cell thick and is covered with cuticle.
- The cells of epidermis are elongated, flattened and irregular in shape, without intercellular space.
- They have minute openings called stomata in the leaves and green shoots.
- The cells are parenchymatous in nature.

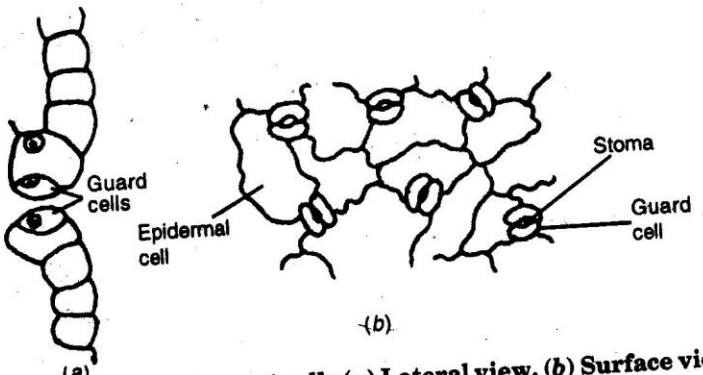
22. Functions of Epidermis :

(*i*) Epidermis acts as a protective tissue, covering the plant body.

(*ii*) It protects the plant from excessive heat or cold and from the attack of parasitic fungi and bacteria.

(*iii*) It allows exchange of gases and transpiration through stomata.

(*iv*) The cuticle of epidermis checks the excessive evaporation of water.



Epidermal cells with stomata and guard cells (*a*) Lateral view, (*b*) Surface view

23. Stomata :

- Stomata are the minute openings or pores present in the epidermis of leaf or green parts of the plant.
- Each stoma is surrounded by two kidney-shaped cells called **guard cells.**
- The concave side of guard cells has a minute space or opening in-between called stomatal opening.
- The guard cells are the only epidermal cells which contain chloroplasts.

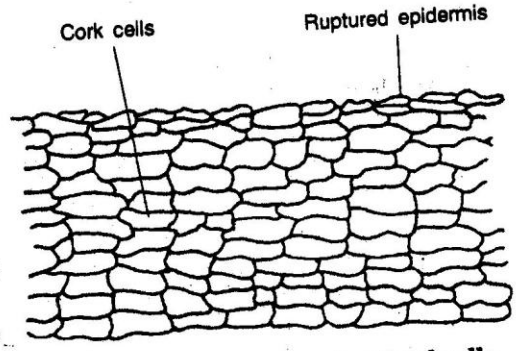
24. Functions of Stomata :

(*i*) Stomata allow gaseous exchange between the plant and the atmosphere.

(*ii*) These are sites of transpiration in plants.

25. Cork :

- It is the outermost protective tissue of older stems and roots.
- It is formed by a secondary lateral meristem called cork cambium.
- Cork cells are rectangular in shape, which are composed of dead cells.
- The cells are arranged compactly without intercellular spaces.
- Cork cells have thick walls, which are impermeable.



T.S. of cork piece showing dead cells

26. Functions of Cork :

(*i*) Cork prevents loss of water by evaporation.

(*ii*) It protects the interior of plant from the entry of harmful micro-organisms.

(*iii*) It provides protection against mechanical injury, extremes of temperature, fire, etc.

(*iv*) It is commercially used in manufacture of stoppers for bottles, insulation boards, shock absorbers, sports goods, etc.

27. Complex Permanent Tissue : Complex tissues are made of more than one type of cells. All these cells co-ordinate to perform a common function.

Xylem and **Phloem** are examples of such complex tissues. They are conducting tissues and constitute a **vascular bundle.**

Complex tissues transport water, mineral salts and food materials to various parts of plant body.

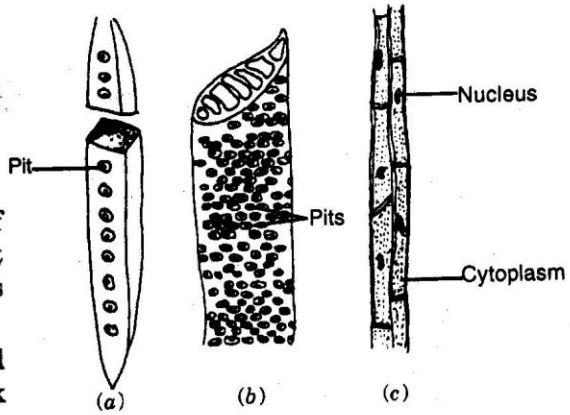
: Xylem is also called **wood**. It is a vascular and mechanical tissue, *i.e.*, it is a ting tissue. It is composed of four different types of cells— tracheids, vessels, xylem nyma and xylem fibres.

racheids : They are long, tubular dead cells with lignified walls and tapering ends.

essels : They are very long tube-like ructures formed by a row of cells aced end to end. The walls are gnified. They generally possess pits. racheids and vessels transport ater and minerals vertically.

ylem parenchyma : It consists of ving cells having thin cell walls. It ores food and helps in the sideways nduction of water.

ylem fibres : They have elongated ead cells with tapering ends and thick ell walls. They are mainly supportive n function.



Xylem (*a*) Tracheid, (*b*) Vessel, (*c*) Xylem parenchyma

tions of Xylem :

Xylem conducts water and mineral salts upwards from roots to leaves and to different arts of the plant.

The components of xylem like tracheids, vessels and xylem fibres have thick lignified walls and so they give mechanical strength to the plant body.

Xylem parenchyma is the only living tissue of xylem which helps in lateral conduction of water and storage of metabolic wastes.

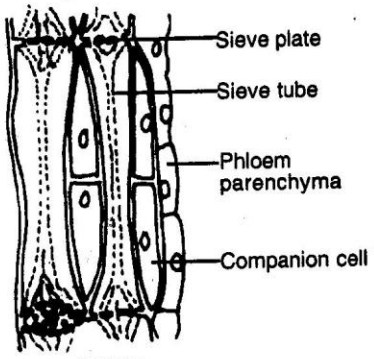
em : It is also called **bast** and is a living conducting tissue, composed of four elements— tubes, companion cells, phloem parenchyma and phloem fibres.

Sieve Tubes : They are tubular cells with end walls perforated by numerous pores which are called sieve plates. The sieve tubes do not have a nucleus but have a thin layer of cytoplasm.

Companion Cells : These are small elongated cells having dense cytoplasm and prominent nucleus.

Phloem Parenchyma : These are thin-walled living parenchymatous cells which are mainly concerned with storage and transportation of food.

Phloem Fibres : These are thick-walled, elongated dead sclerenchymatous cells which provide mechanical strength to the tissue.



Section of phloem

ctions of Phloem :

Phloem transports food from leaves to the storage organs and later from storage organs to growing regions of the plant body.

Phloem fibres of some plants are a source of commercial fibres, *e.g.*, jute, hemp,

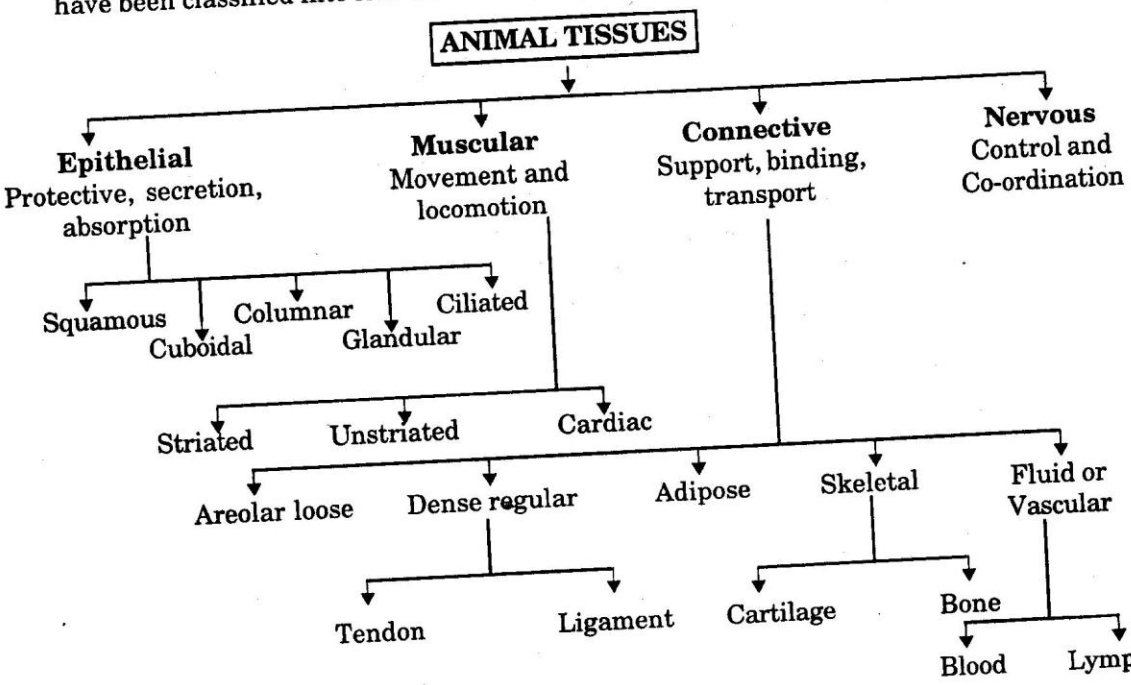
32. Differences between :

Xylem	Phloem
(*i*) Only one type of cells that is xylem parenchyma are living cells.	(*i*) It has three types of living cells— sieve tubes, companion cells and phloem parenchyma.
(*ii*) It conducts water and minerals from roots to aerial parts of the plants.	(*ii*) It translocates prepared food from leaves to storage organs and growing parts of body.
(*iii*) Xylem lies deeper in plant organs.	(*iii*) It is situated towards outer side.
(*iv*) The main conducting cells—the vessels are dead cells.	(*iv*) The main conducting cells—the sieve tubes are living cells.
(*v*) It provides mechanical strength to the plant.	(*v*) It does not provide mechanical strength to the plant.

33. Differences between :

Tracheids	Vessels
(*i*) They are unicellular.	(*i*) They are multicellular.
(*ii*) The ends are tapering or oblique.	(*ii*) The ends are rounded or transverse.
(*iii*) They are small-sized.	(*iii*) They are large-sized.
(*iv*) More lignified, so have narrow lumen.	(*iv*) Less lignified, so have wide lumen.
(*v*) Found in pteridophytes (ferns), gymnosperms and a few angiosperms.	(*v*) Found only in angiosperms.

34. Classification of Animal Tissues : Based on the functions they perform, animal tissues have been classified into four different types as follows :



ithelial Tissue :

Epithelial tissue is the simplest tissue.

It provides a protective covering forming a continuous sheet on most organs and cavities within the body.

The cells are closely packed and without intercellular spaces.

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.

All epithelium is usually separated from the underlying tissue by an extracellular fibrous basement membrane.

unctions of Epithelial Tissue :

(*i*) Epithelial cells protect the underlying cells from drying, injury, bacterial or viral infections and from harmful effects of chemicals.

(*ii*) Inside the body, epithelial cells form lining of mouth and alimentary canal and protect these organs.

(*iii*) Epithelial tissues help in absorption of water and nutrients.

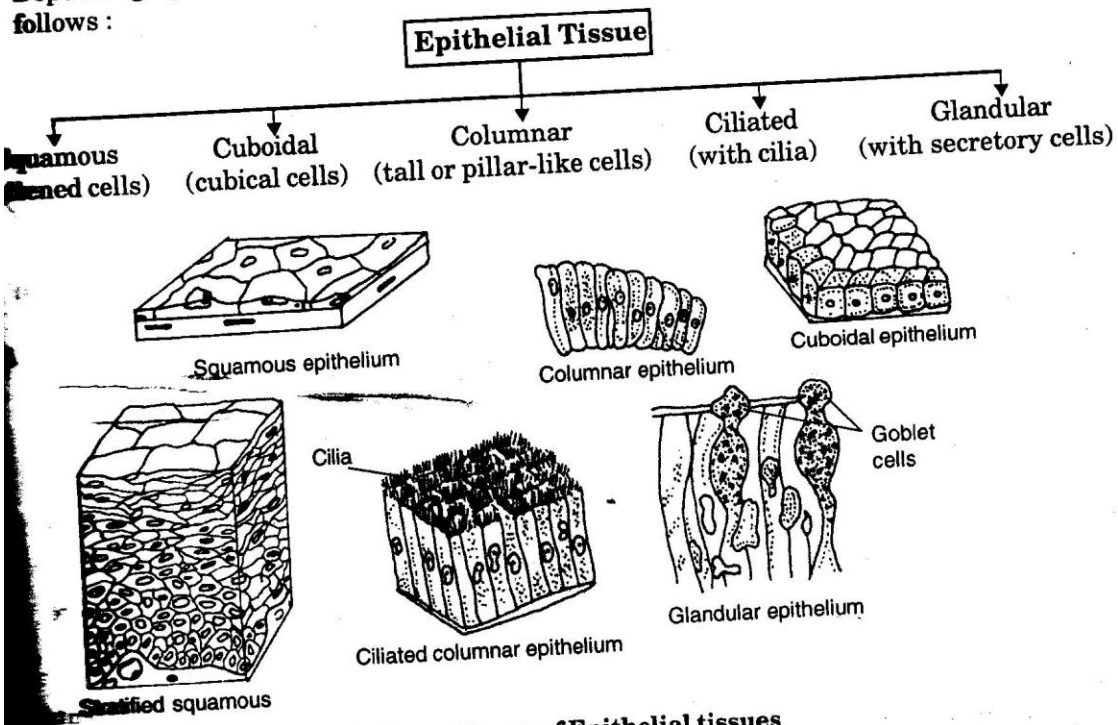
(*iv*) It helps in elimination of waste products.

(*v*) Some epithelial tissues secrete a variety of substances such as sweat, saliva, enzymes, etc.

(*vi*) Epithelium forming the lung alveoli allows diffusion of gases between blood and alveolar air.

Types of Epithelial Tissue :

Depending upon the shape and function of the cells, the epithelial tissue is classified as follows :



Different types of Epithelial tissues

38. **Squamous Epithelium :** Simple squamous epithelium consists of extremely thin and flat cells forming a delicate lining, *e.g.*, the oesophagus and the lining of the mouth. Skin epithelial cells are arranged in many layers to prevent the wear and tear. Since they are arranged in a pattern of layers, the epithelum is called **Stratified Squamous Epithelium.**

39. **Cuboidal Epithelium :** It consists of cube-like cells with rounded nuclei, and forms the lining of kidney tubules and ducts of salivary glands, where it provides mechanical support. It also helps in absorption, excretion and secretion.

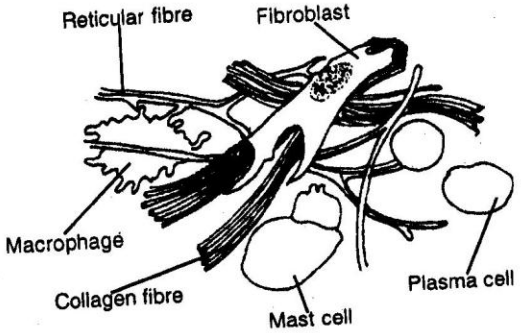
40. **Columnar Epithelium :** It consists of tall cells which are pillar-like having elongated nuclei. It is found in the inner lining of the intestine where absorption and secretion occurs. This columnar epithelium facilitates movement across the epithelial barrier.

41. **Ciliated Epithelium :** In the respiratory tract, the columnar epithelial tissue also has cilia, which are hair-like projections on the outer surfaces 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.

42. **Glandular Epithelium :** Sometimes epithelial cells acquire additional specialisation as gland cells, which can secrete substances at the epithelial surface. A portion of the epithelial tissue folds inward to form a multicellular gland called glandular epithelium.

43. **Connective Tissue :**
- The connective tissue is specialised to connect the various body organs.
- It can connect bones to each other, muscles to bones, bind tissues and give support to various parts of body by forming packing around organs.
- The cells of connective tissue are living, loosely spaced and embedded in an intercellular matrix. The matrix may be jelly-like, fluid, dense or rigid.
- The nature of matrix differs with the function of the particular connective tissue.
- In animals, connective tissues are of five types—areolar loose, dense regular, adipose, skeletal and vascular or fluid.

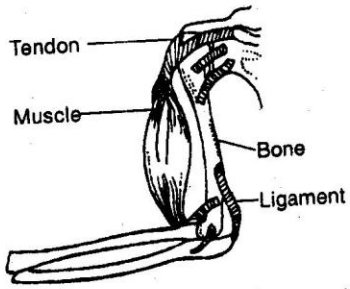
44. **Areolar Loose Connective Tissue :** These are loose and cellular connective tissues and consist of two kinds of fibres—white collagen fibres and yellow elastic fibres. They act as a supporting and packing tissue between organs lying in the body cavity. They are found between the skin and muscles, around blood vessels and nerves and in the bone marrow and also help in repair of tissues.



Areolar tissue

45. **Dense Regular Connective Tissue :** It is a fibrous connective tissue having densely packed collection of fibres and cells. It is the principal component of tendons and ligaments.

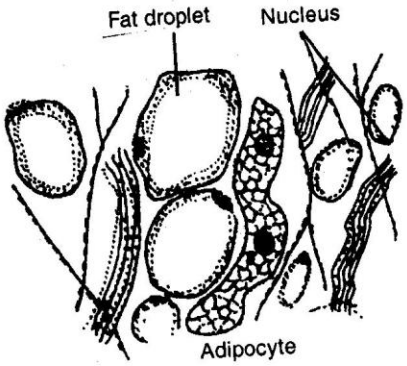
(i) **Ligaments :** They are elastic structures with considerable strength which connect bones to bones and are composed of yellow elastic tissues. Ligaments contain very little matrix. They strengthen the joints and permit normal movement but prevent over extension. Sprain is caused by excessive pulling of ligaments.



Attachment of tendons and ligaments

(ii) **Tendons :** They are strong and inelastic structures that join skeletal muscles to bones and are composed of white fibrous tissues.

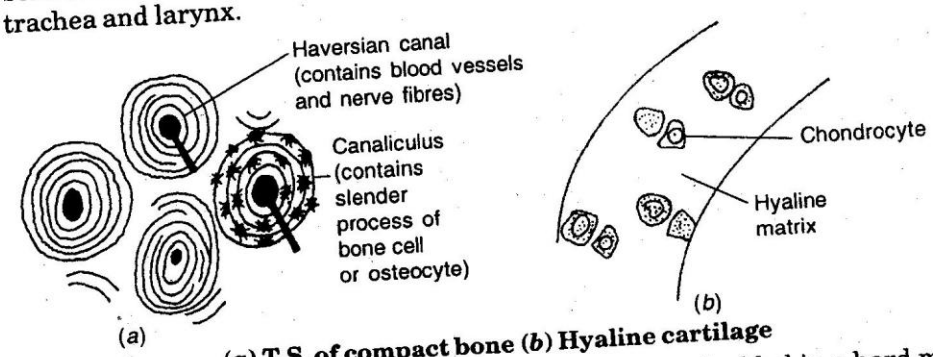
Adipose Tissue : This tissue is an aggregation of fat cells or adipocytes and each fat cell is rounded or oval. It serves as a fat reservoir and keeps visceral organs in position forming shock-absorbing cushions around kidneys and eyeballs. Fat storing adipose tissue is found below the skin and between internal organs. The cells of this tissue are filled with fat globules. Storage of fats also lets it act as an insulator.



Adipose tissue

Skeletal Tissue : The skeletal or supporting tissue includes cartilage and bone which forms the endoskeleton of vertebrate body and protects the vital organs of the body.

(i) **Cartilage :** The cartilage is a specialised connective tissue which is compact and less vascular having an extensive matrix of delicate network of collagen fibres and having cells, chondrocytes. It provides support and flexibility to the body parts and also smoothens bone surfaces at joints. Cartilage has widely spaced cells and is present in the nose, ear, trachea and larynx.

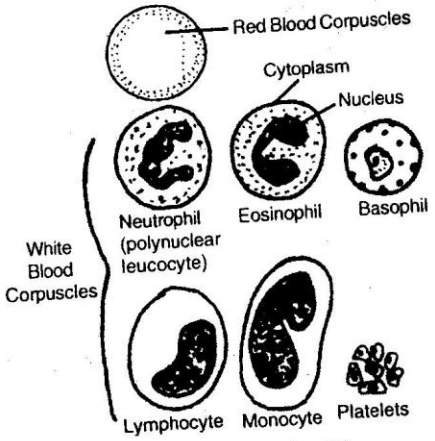


(a) T.S. of compact bone (b) Hyaline cartilage

(ii) **Bone :** Bone is a very strong and non-flexible tissue embedded in a hard matrix made up of both organic matter (protein) and inorganic matter (calcium and phosphorous compounds). Due to the presence of these minerals, bones are hard. It provides shape and also skeletal support to the body. It also anchors the muscles and supports the main organs of the body.

Fluid or Vascular Tissue : This tissue links the different parts of the body and maintains continuity in the body. It includes blood and lymph.

(i) **Blood :** It is a fluid (liquid) connective tissue. In this tissue, the cells move in a fluid matrix or medium called **blood plasma**. The blood plasma contains cells called blood corpuscles which include red blood corpuscles (RBCs), white blood corpuscles (WBCs) and platelets. RBCs and WBCs are living while plasma and platelets are non-living. The plasma contains proteins, salts and hormones and its main function is transportation of materials.



Types of blood cells

The RBCs or Erythrocytes are the red cells which are circular disc-shaped cells having no nucleus and contain a pigment called haemoglobin.

The WBCs or leucocytes are larger than RBCs and are colourless due to the absence of haemoglobin but they have a nucleus.

White blood corpuscles are of two types—**granulocytes** including basophil, eosinophil and neutrophil and **agranulocytes** including lymphocytes and monocytes.

Blood flows and transports gases, digested food, hormones and waste materials to different parts of the body.

(*ii*) **Lymph :** It is a colourless fluid having plasma and WBCs. Lymph escapes out from blood capillaries into body tissues. It helps in exchange of materials between tissues and blood. It acts as an intermediary. Due to the presence of WBCs such as lymphocytes, lymph protects the body against infections. It forms the defence or immune system of the body.

49. Functions of Blood :

(*i*) Blood transports nutrients, hormones and vitamins to the tissues and carries excretory products from the tissues to the excretory organs.

(*ii*) RBCs of blood help in the transport of respiratory gases, oxygen and carbon dioxide.

(*iii*) WBCs of blood fight with diseases by producing antibodies and engulfing the germs.

(*iv*) Blood platelets help in the clotting of blood.

(*v*) Blood conducts heat and regulates body temperature.

50. Differences between :

Tendon	Ligament
(*i*) It is strong and non-flexible.	(*i*) It is elastic and flexible.
(*ii*) It joins muscles to bones.	(*ii*) It joins bones to bones.
(*iii*) It is formed of white fibrous connective tissue.	(*iii*) It is formed of yellow fibrous connective tissue.

51. Differences between :

Bone	Cartilage
(*i*) Bones are hard and non-flexible.	(*i*) Cartilages are flexible.
(*ii*) Blood vessels present.	(*ii*) Blood vessels absent.
(*iii*) Matrix is made up of protein and mineral salts.	(*iii*) Matrix is made up of protein.
(*iv*) A narrow cavity is often present in the interior.	(*iv*) A narrow cavity is always absent.
(*v*) Matrix is arranged in concentric circles.	(*v*) Matrix is uniform, not in concentric circles.
(*vi*) Bone cells make connection through fine canaliculi.	(*vi*) Canaliculi are absent.
(*vii*) It is porous.	(*vii*) It is non-porous.

rences between :

Blood	Lymph
It is red vascular tissue.	(*i*) It is white vascular tissue.
It occurs in blood vessals.	(*ii*) It occurs in lymph vessels and around the body tissues.
It is formed of plasma, erythrocytes leucocytes and platelets.	(*iii*) It is formed of plasma and only leucocytes.
) Haemoglobin is present in RBCs.	(*iv*) Haemoglobin is absent.
) Its functions include transportation of materials, defence, blood clotting, etc.	(*v*) It acts as an intermediary between blood and tissue.

scular Tissues :

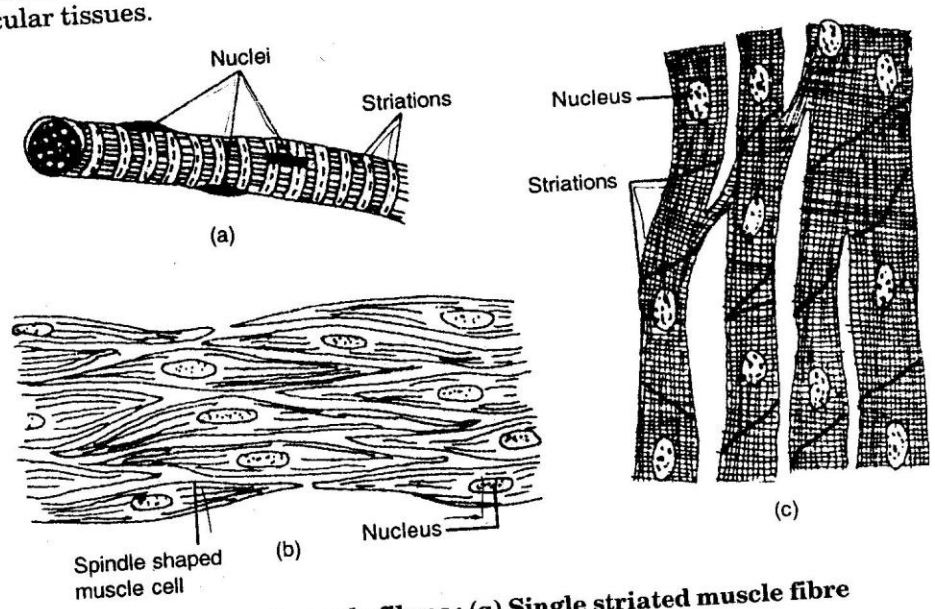
The contractile tissues are made of muscle cells which are elongated and large-sized and are so called muscle fibres.

These tissues help in various types of movements of body parts and locomotion.

On the basis of their location, structure and function, they are of three types—striated, unstriated and cardiac muscles.

Muscles contain special proteins called contractile proteins, which contract and relax to cause movement.

The movement of internal organs such as heart and alimentary canal, are all caused by muscular tissues.



Different types of muscle fibres : (*a*) Single striated muscle fibre (*b*) Smooth muscle fibres (*c*) Cardiac muscle

(*i*) **Striated or Skeletal or Voluntary Muscles :** They are attached to the bones and help in body movement and so called **skeletal muscles**. The striated muscle cells are long or elongated, cylindrical, unbranched and multinucleate. These muscles provide the force of locomotion and all other voluntary movements of the body. Since the entire muscle fibres show alternate dark and light bands or stripes or striations, they are called striped muscles. These muscles work according to our will, so are also

called **voluntary muscles**. Their nuclei are peripheral in position. Striated muscles occur in muscles of limbs, body wall, face, neck, etc.

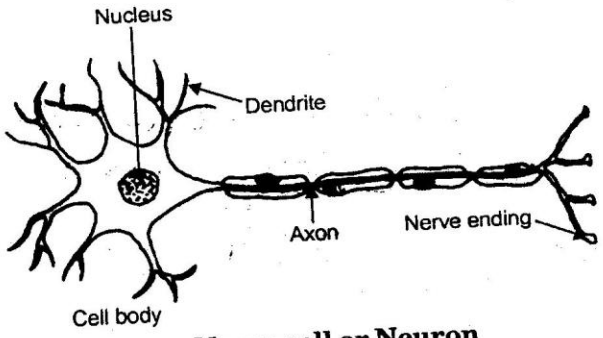
(ii) **Unstriated or Smooth or Involuntary Muscles :** They occur as bundles or sheets of elongated spindle-shaped cells or fibres with a single centrally located cigar-shaped nucleus in the centre of cytoplasm or sarcoplasma and contractile threads called myofibrils which run longitudinally through the cell. Since, the fibrils do not bear bands or striations, hence they are smooth muscles. These muscles do not work according to our will so are involuntary muscles. Smooth or involuntary muscles control the movement of food in the alimentary canal or the contraction and relaxation of blood vessels. They are also found in the iris of the eye, in uterus, and in the bronchi of the lungs.

(iii) **Cardiac Muscles :** This type of muscle tissues are present in the muscles of the heart and are composed of branched, cylindrical and uninucleate cells. Cardiac muscles show rhythmic contraction and relaxation of the heart and help to pump and distribute blood to various parts of the body.

54. Differences amongst :

Striated Muscle	Smooth Muscle	Cardiac Muscle
(*i*) It is present in limbs, tongue, etc.	(*i*) It is present in visceral organs.	(*i*) It is present in myocardium of heart.
(*ii*) It is arranged in bundles.	(*ii*) It is arranged in sheets.	(*ii*) It is arranged as a network.
(*iii*) Its ends are blunt.	(*iii*) Its ends are tapering.	(*iii*) Its ends are flat and zig-zag.
(*iv*) Its surface covers the sarcolemma.	(*iv*) Its surface covers the plasma membrane.	(*iv*) Its surface covers the sarcolemma.
(*v*) The cells of this tissue are multinucleate.	(*v*) The cells of this tissue are uninucleate.	(*v*) The cells of this tissue are uninucleate.
(*vi*) It contracts rapidly but soon undergoes fatigue.	(*vi*) It contracts slowly and does not get fatigued.	(*vi*) It contracts rapidly but does not get fatigued.
(*vii*) It is striated.	(*vii*) It is non-striated.	(*vii*) It is striated.
(*viii*) It is voluntary.	(*viii*) It is involuntary.	(*viii*) It is involuntary.
(*ix*) It is also called skeletal or voluntary muscle.	(*ix*) It is also called unstriated or involuntary muscle.	(*ix*) It is also called involuntary or heart muscle.
(*x*) Alternate light and dark bands or striations.	(*x*) No striations.	(*x*) Faint regular striations.
(*xi*) Intercalated discs are absent.	(*xi*) Intercalated discs are absent.	(*xi*) Intercalated discs are present.
(*xii*) Cells are long, cylindrical and unbranched.	(*xii*) Cells are long, pointed and spindle-shaped.	(*xii*) Cells are cylindrical and branched.

55. Nervous Tissue : The cells of nervous tissue are highly specialised for being stimulated and then transmitting the stimulus very rapidly from one place to another within the body. The brain, spinal cord and nerves are all composed of the nervous tissue. The cells of this tissue are called **nerve cells or neurons**. Each neuron has three parts — the cyton or cell body, dendrites and the axon.



Nerve cell or Neuron

(*i*) **Cyton :** It is the cell body of a nerve cell that has a large central nucleus and cytoplasm, from which long thin hair-like parts arise.

(*ii*) **Dendrite :** The short branched fibre of neuron which receives nerve impulses.

(*iii*) **Axon :** A single long conducting fibre extending from a neuron that transmits impulses away from the cell body.

6. Functions of Nervous Tissue :

(*i*) Nervous tissue controls all the body activities.

(*ii*) It co-ordinates among various body parts during any body function.

(*iii*) Dendrons carry nerve impulses towards the cyton whereas axon carries impulses away from the cyton.

7. Differences between :

Axon	Dendron
(*i*) It is always single in number.	(*i*) It may be one or more in number.
(*ii*) It is long and may or may not be branched.	(*ii*) It is small-sized and is always branched.
(*iii*) It conducts nerve impulses away from cyton, so are **efferent** in nature.	(*iii*) It conducts nerve impulses towards the cyton, so are **afferent** in nature.

8. Synapse : It is the junction or region of union of axon of one neuron with the dendrite of another through which nerve impulses are transferred.

9. Neuron : Nerve cell or neuron is an elongated branched cell that is the functional unit of the nervous system. It is specialised for conduction of impulses.

10. Plasma : It is the fluid component of blood excluding blood cells.

11. Platelets : They are the minute disc-shaped anucleated fragile fragments of larger bone marrow cells in mammalian blood. They help in clotting of blood and are also called thrombocytes.

QUESTIONS (1 MARK)