TISSUE

- PLANT TISSUE - Meristematic & Permanent

■ Meristematic Tissue (growth tissue) :-

These are simple living tissues having thin walled compactly arranged immature cells which are capable of division and formation of new cells.

* Main features of Meristematic tissues are :

→ Thin Primary cell wall (cellulosic)
→ Intercellular spaces are absent (Compact tissue)
→ Generally vacuolses are absent
→ Actively dividing cells are present in growing regions of plants e.g. root & shoot tips.

* classification on the Basic of Origin

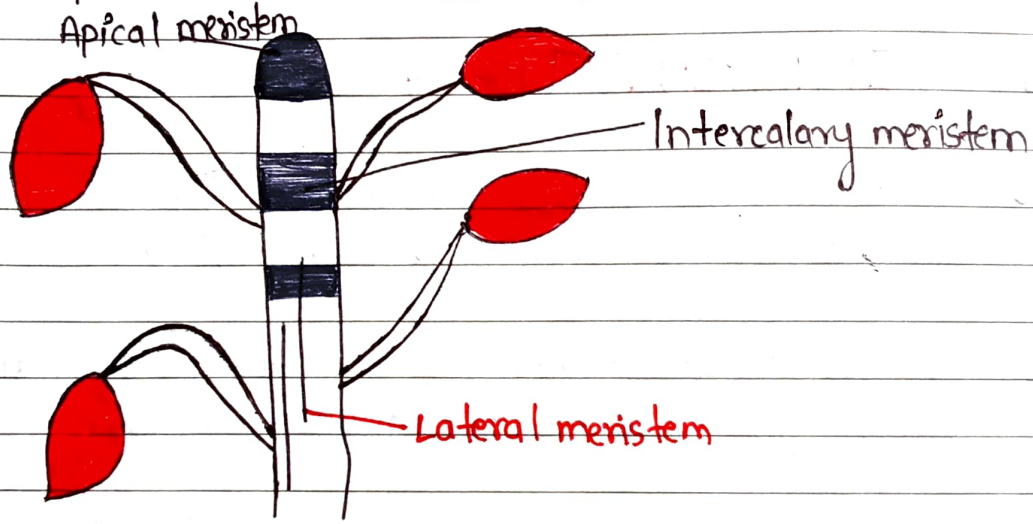
(A) Primary (Promeristem) :

- Derived directly from the meristems of embryo
- They Consist of cells derived form primary meristem.
- They add to primary growth of plants.

(B) Secondary (

- These are having cells derived from primary permanent tissue.
- They usually add to the diameter of plants.

* Classification on the basis of Location



(A) APical Meristem :

- It is present at the growing tips of stems and roots.
- Cell division in this issue leads to the elongation of stems & root, thus it is involved in primary growth of the plant.

(B) Intercalary Meristem :

- It is Present behind the apex. it help in longitudinal growth.
- It is the part of apical meristem which is left behind during growth Period.
- These are present at the base of leaf & internode region.

(c) Lateral Meristem (Cambium) :

- It is also called as secondary meristem.
- It occurs along the side of longitudinal axis of plant.
- It gives rise to the vascular tissues.
- Causes growth in girth of stem & root.
- They are responsible for secondary growth by increasing the girth.

PERMANENT TISSUE

- The permanent tissues are formed from those meristematic cells which left behind & have lost their capability to divide.
- The division & differentiation of the cells of meristematic tissues give rise to permanent tissues.
- They have definite shape, size and thickness. The permanent tissue may be dead or living.
- As a result of cell differentiation the meristematic tissues tend to form different type of permanent tissues.
- In cell differentiation, developing tissue to perform changes from simple to more complex forms to become specialized functions.

- Depending upon the structure and composition, the permanent tissues are classified into :

(A) Simple permanent tissue (supportive tissue)
(B) Complex Permanent Tissue
(C) Dermal Tissue (Protective tissue)

■ Simple Permanent Tissues :

- These are made up of one type of cells which are similar structurally and functionally.

Protective Tissues : These tissues are primarily protective in functions. They consist of :

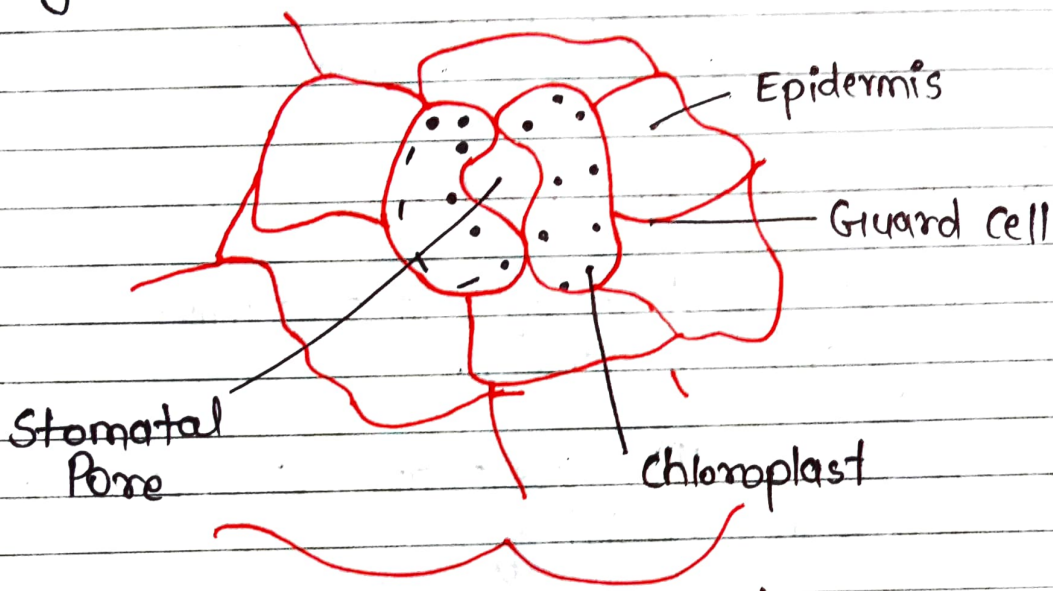
(i) Epidermis

- Epidermis forms one cell thick outermost layer of various body organs of plants such as leaves, flowers, stems and roots.

- Epidermis is covered outside by cuticle. Cuticle is a water proof layer of waxy substance called as cutin which is secreted by the epidermal cells provide protection against loss of water and invasion by microbes.

- Cells of epidermis of leaves are not continuous at some places due to presence of small pores called as stomata.

- Each stomata is guarded by a pair of bean-shaped Cells called as guard Cells. These are the only epidermal Cells which possess chloroplasts, the rest being colourless.



Stomata (figure)

- Functions of Epidermis :

- The main function of epidermis is to protect the plant from dessication and infection.

- Cuticle of epidermis cuts the rate of transpiration and evaporation of water and prevents wilting.

- function of stomata : It ~~shows~~ allows gaseous exchange to occur during photosynthesis & respiration and also helps in transpiration.

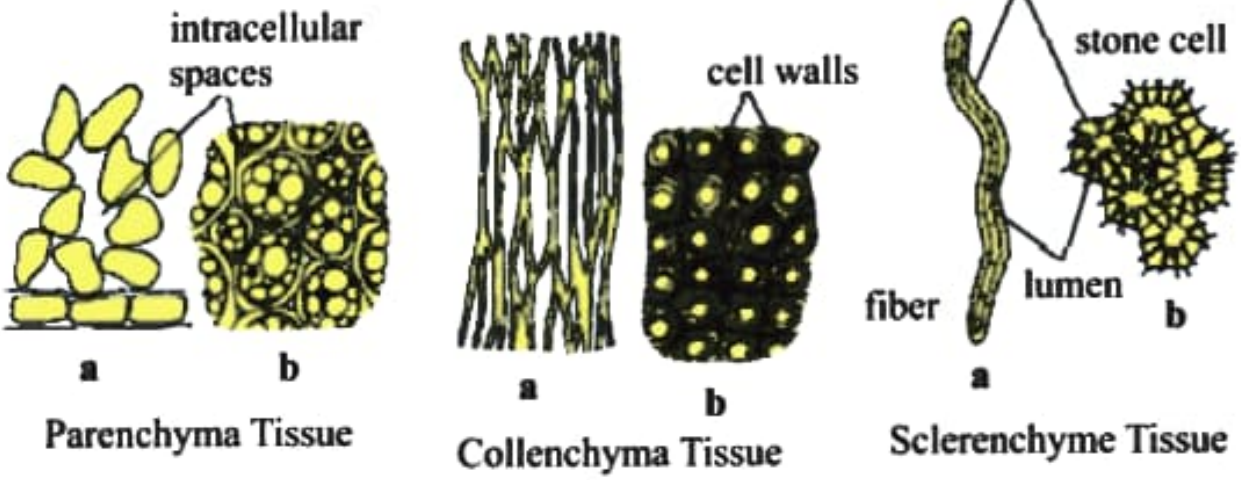
(ii) Cork or phellem :

- In older roots and stems, tissues at the periphery become cork cells or phellem cells.
- Cork is made up to dead cells with thick walls and do not have any intercellular spaces.
- The cell walls in cork deposit waxy substance called as suberin
- The cork cells are without any protoplasm but are filled with resins or tannins.

■ Functions of Cork :

- Cork is protective in function. Cork cells prevent desiccation, infection and mechanical injury.
- Imperviousness, lightness, toughness, compressibility and elasticity make the cork commercially valuable.

The Three Basic Types of Plant Tissue (Supporting Tissue)

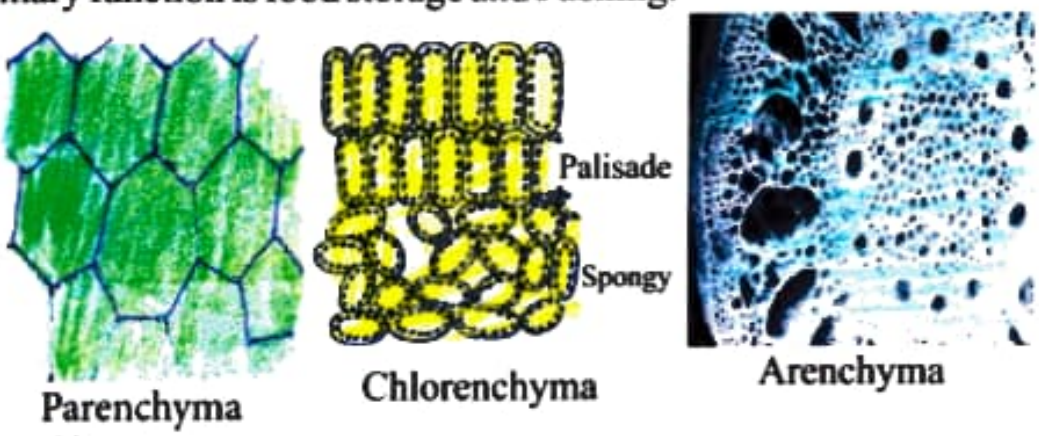


[a. longitudinal section (LS)
b. cross section (cs)]

c. Transverse Section (TS)

(i) Parenchyma : It is the fundamental Packing tissue.

- Losshy packed thin walled cells, oval or spherical in structure have large space between cells
- Cells wali mainly composed of cellulose & pection.
- Large central vacole for food & water storage.
- Primary function is food storage and Packing.



Parenchyma and its type :

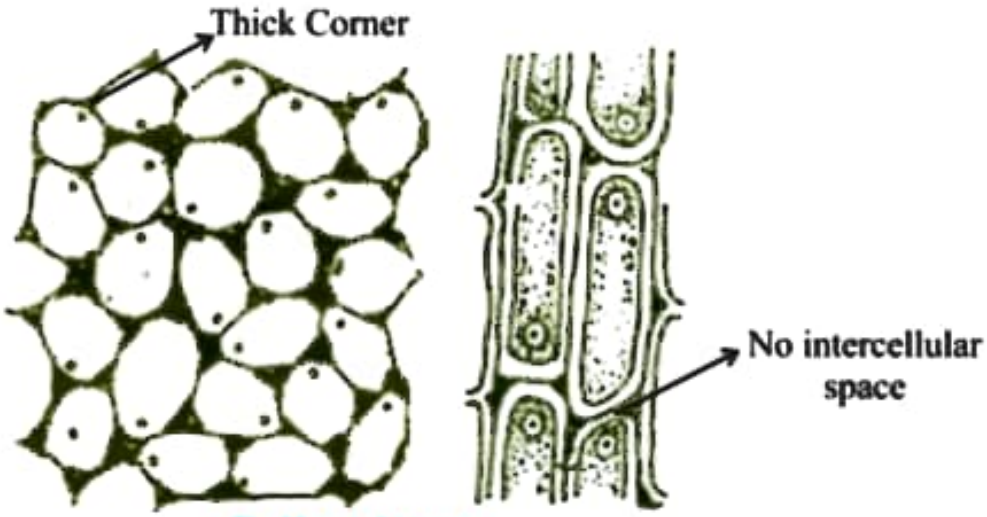
Idioblast : Some parenchyma involved in excretory substance storage are so called as idioblast, storing such as resin, tannin, gums & oils.

- In typical parenchyma chlorophyll is absent.

Chlorenchyma : Chloroplast containing parenchyma tissue are chlorenchyma which perform photosynthesis e.g., mesophyll of leaves.

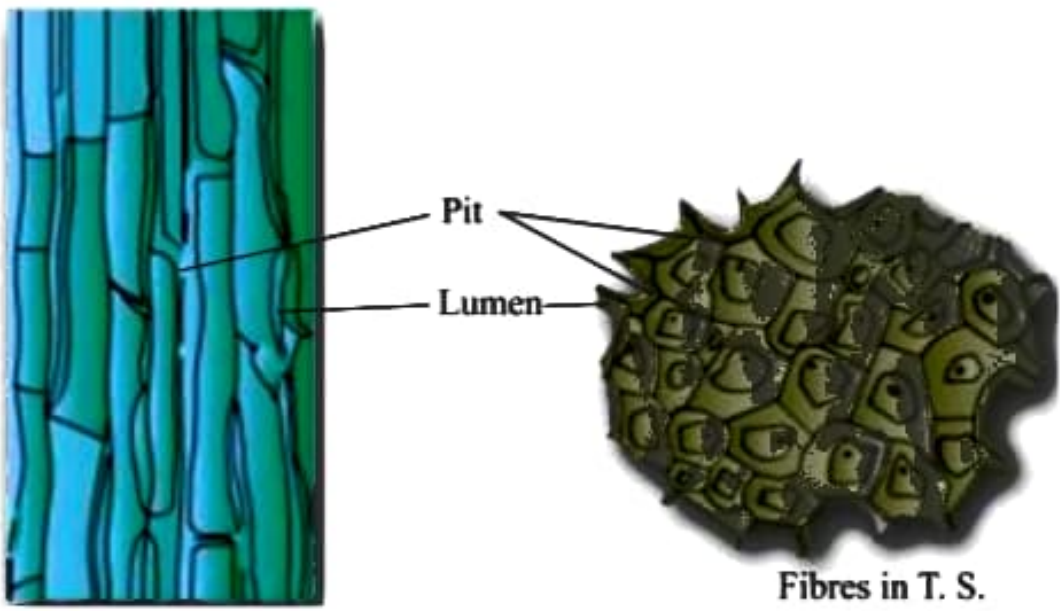
Arenchyma : In hydrophytic plants aerenchyma (a type of parenchyma containing air spaces) provides buoyancy.

(ii) Collenchyma : It is the living mechanical tissue.



Collenchyma

- Elongated cells with thick corners.
- Localized cellulose & pection hickening.
- Provides flexibility to plant parts & easy bending of various parts of plant.
- Few chloroplsasts may be present.
- Give mechanical strength & elasticity to the growing stems.
  They have no or very little intercellular spaces.



Fibres in L. S.

Fibres in T. S.

Fibres in L.S.

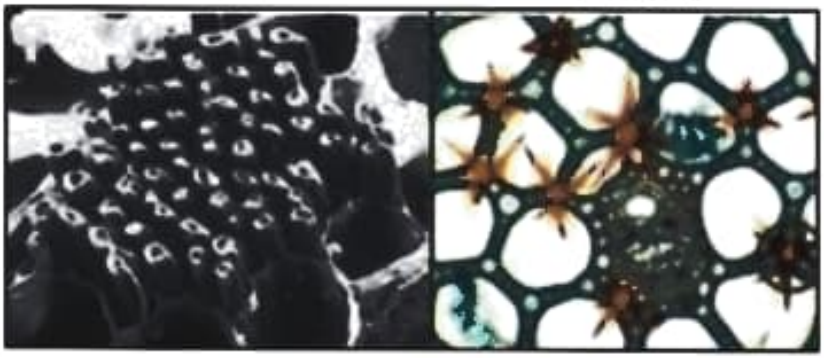
- Composed of extremely thick walled cells with little or no protoplasm.
- Cells are dead & possess very thick lignified walls.
- Ligning is water-proof material.
- Intercellular spaces are absent.

Cells of sclerenchyma are of two types :

Sclereids :

- These are also called grit cells or stone cells.
- These are small cells, where lumen is so small due to higher thickening of cell wall, as present in drup fruit (mango, coconut, walnut) legume seeds (Macrosclereid).

Fiber Sclereids



Fibers :

- They are very long, narrow, thick, lignified cells. Lumen is large as compared to sclereids. Generally 1-3 mm long.
- In the thick walls of both the fibres and sclereids are present thin areas called as pits.

Sclerenchyma Fibres

- These are used in the manufacture of ropes, mats & certain textile fibres.
- Jute and coir are obtained from the thick bundle of fibers.

Difference between Parenchyma, Collenchyma and Sclerenchyma

Features	Parenchyma	Collenchyma	Sclerenchyma
	 thin primary cell wall	 irregularly thickened primary cell wall	 thick secondary cell wall primary cell wall

Chapter - 6

Tissue

CANCEPT MAPPING

Tissue (Group of similar cell perform common specialised function)

- **Plant Tissue**
  - **Meristematic Tissue**
    - **Primary Meristem**
      - Apical **Meristem** (Tips of root and stem)
      - Intercalary (Base of leaves and internodes)
    - **Secondary Meristem** → **Lateral Meristem**
      - **Vascular** Cambium (for secondry growth)
      - **Cork Cambium** Consistof

Aerenchyma / Chlorenchyma	Parenchyma	Collenchyma	Sclerenchyma
	Oval, elongated Polygonal Living	Elongated Thickened, irregular Living	Long, narrow Lignified Dead

  - **Permanent Tissue**
    - **Simple Permanent** (ground tissue) (Made up of one type of cell)
    - **Complex Permanent** (Vasular Tissue) (Made up of more than one type of cell) — 2 Types
      - **Xylem** (Conduction of water & minerals) (Components of Xylem): Trachides | Vessels | Xylem Parenchyma | Xylem Fibers
      - (Conduction of food) **Phloem** (Components of Phloem): Sieve tubes | Companion cells | Phloem fibres | Phloem parenchyma
    - **Dermal tissue** (Epideramal tissue)
- **Animal Tissue** → (Next page)

shape	Isodiametric cells which are oval, spherical or polygonal in shape.	Circular, oval or polyhedral.	Variable in sh Fibres and scl
Wall	Thin cellulosic cell wall.	Uneven thickening on their cell wall.	Lignified secc cell wall prese
plasm	Abundant	Presnent	Absent
eus	Present (Living tissue)	Present (Living tissue)	Absent (Dead
oles	Large vacuole	Vacuolated	Absent
cellular es	Present	Absent	Absent
rrence	Basically packing tissue, all soft part of plant-pith, cortex, medullary rays.	Dicot stems, petiole and beneath the epidermis. Absent in monocot and roots.	Dicot hypoderm bundle sheath, pericycle, seed, fruits.
tions	Food storage, photosynthesis, provide buoyancy to hydrophytes	Provide tensile strength, mechanical support, phtosynthesis	Protection fro stress and stra mechanical st

(B) Complex permanent Tissues :

- It consists of more than one type of cells which work together as a unit.
- It helps in transportation of organic materials, water & minerals.
- It is also known as conducting or vascular tissue.
- Xylem & phloem together form vascular bundles.

■ **Xylem :** Also known as wood and is a vascular and mechanical tissue.
Xylem help in Transportation of water and mineral from soil to plant.

Xylem consists of four types of cells called as components :

(i) Tracheids :
- They are elongated angular dead cells mainly involved in Conduction of water and minerals.

(ii) Vessels :
They are advance elements (generally found in angiosperm)
- Vessels are cylindrical tube like structures placed one above the other end to end which form a continuous channel for efficient conduction of water.

(iii) Xylem parenchyma :

- They are small & thick walled parenchymatous cells subjected for storage of starch.

(iv) Xylem sclerenchyma :

- They are non-living fibres with thick walls and narrow cavities provide mechanical support.
- Except xylem parenchyma all other xylem elements are dead.
- The annual rings present in the trunk of a tree are xylem rings.
- By counting the no of annual rings, we can determine the age of a tree.

■ **Phloem :** It transport food from leaves to other parts of the plant. All phloem cells are living except phloem fibres.

(i) Sieve tubes :

- Sieve tubes are tubular like structure made up of elongated, thin walled cells placed end to end.
- The end walls of sieve tube cells are perforated by numerous pores, called as sieve plates.

- Number of sieve cell degenerates at maturity. However cytoplasm persist because of protoplasmic continuation of sieve tube with Companion cells through plasmodesmata.

(ii) Companion cells :

- Companion cells have dense cytoplasm and prominent nuclei.
- Sieve cells & companion cells are so called sister cells because they originate from single mother cell.

(iii) Phloem fibre :

- They give mechanical support to sieve tubes and are dead.

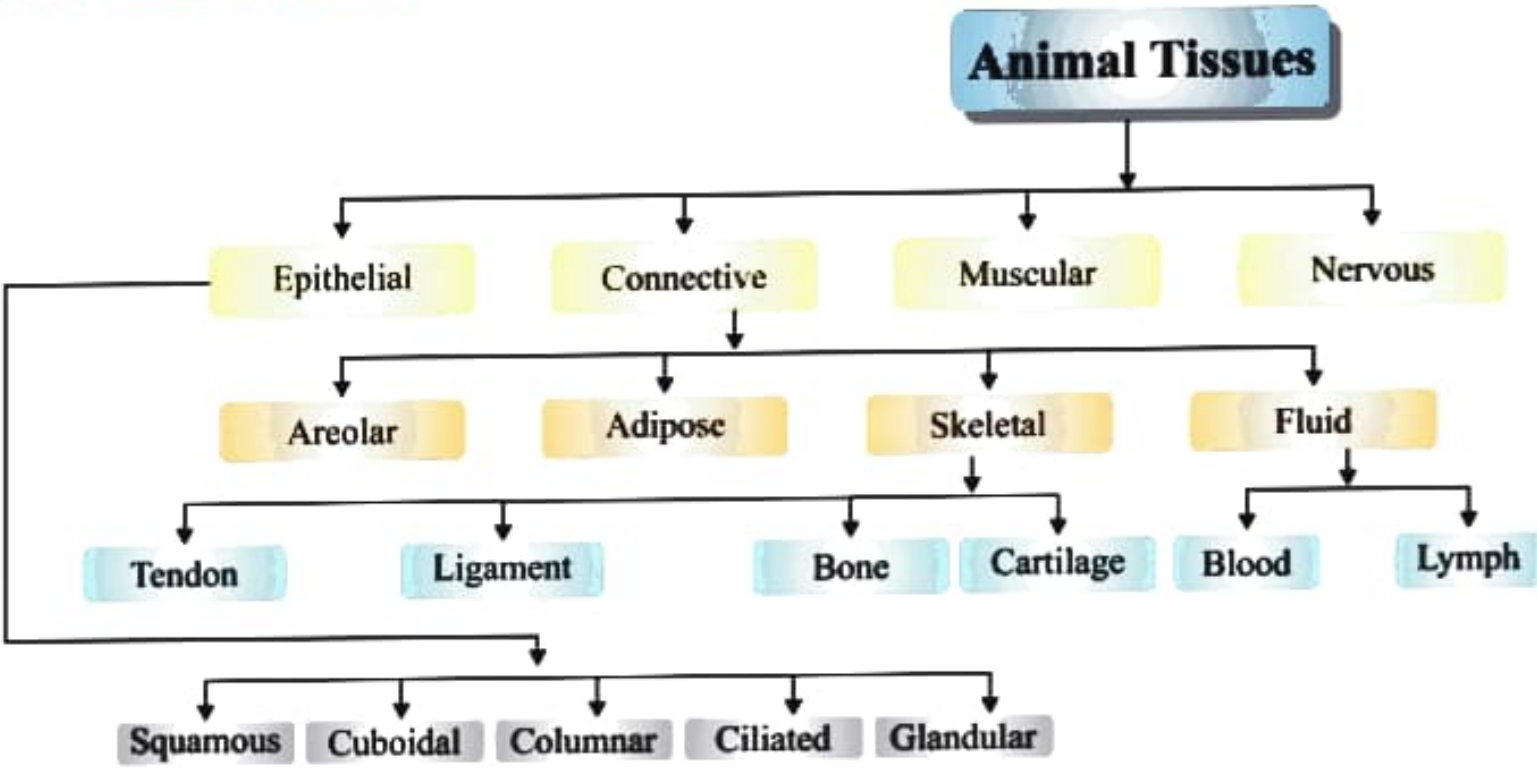
(iv) Phloem parenchyma :

- They store food and help in radial conduction of food.

Difference Between Xylem and Phloem

Features	Xylem	Phloem
Cells : Living/dead	Dead	Living
Cells :		(Except fiber)
Thickness	Thick	Thin
Material	Lignin	Cellulose
Permeability	Impermeable	Permeable
Cross walls	None	Sieve plates
Cytoplasm	None	Yes
Function	Carries water & Minerals	Carries sugars (Food)
Direction of flow	Upwards (Unidirectional)	Down and up (bidirectio
Special features	Fibres	Companion cells

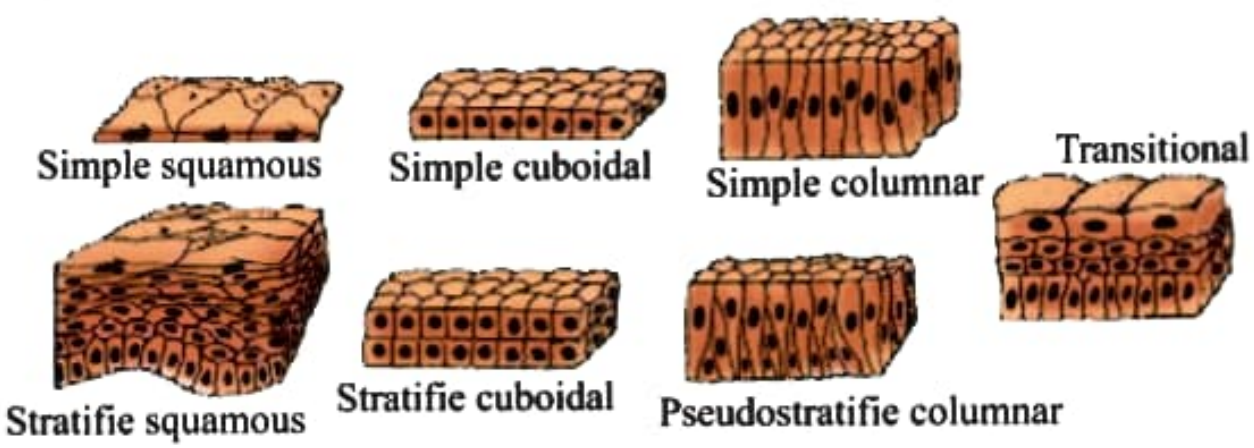
ANIMAL TISSUE



EPITHELIAL TISSUE

- Cells of epithelium are set very close to each other tightly packed and the tissue rests on a non-cellular basement membrane & consists of single layer of cells.
- It covers all the organs and line the cavities of hollow organs like stomach.
- It is premarily protective in function/

Type of Epithelium



Epithelium tissues are calssified as :

(a) squamous epithelim : Also called pavement epithelium.

- Cells arranged end to end like tiles on a floor.
- Cells are polygonal in surface view.
- It forms the delicate lining of cavities (mouth, oesophagus, nose, pericardium, alveoli etc.) blood vessels and covering of the tongue and skin.

- Epithelial cells are arranged in many layers (stratum) to prevent wear and tear in skin. This pattern is stratified squamous epithelium.

(b) Cuboidal epithelium :

- They are cube like cells that fit closely, cells look like squares in section, but free surfarce appears hexagonal.
- It is found in kidney tubules, thyroid vesicles & in glands (salivary glands, sweat glands).
- It forms germinal epithelium of gonads (testes & ovaries).
- It involves in absorption, excretion & secretion. It also provides mechanical support.

(c) Columnar epithelium :

- Columnar means 'pillar-like' epithelium. It forms lining of stomach.
- Small intestine & colon, forming mucous membranes.
- Border of micro villi is present at the free surface end of each cell which increases absorption efficiency in small intestine.

(d) Ciliated epithelium :

- Cells may be cuboidal or columnar.
- Found in respiratory tract, living of spermduct, oviduct & kidney tubules etc.
- On its free surface are present protoplasmic outgrowths called cilia.
- It helps in the movement of ova in the fallopian tube.

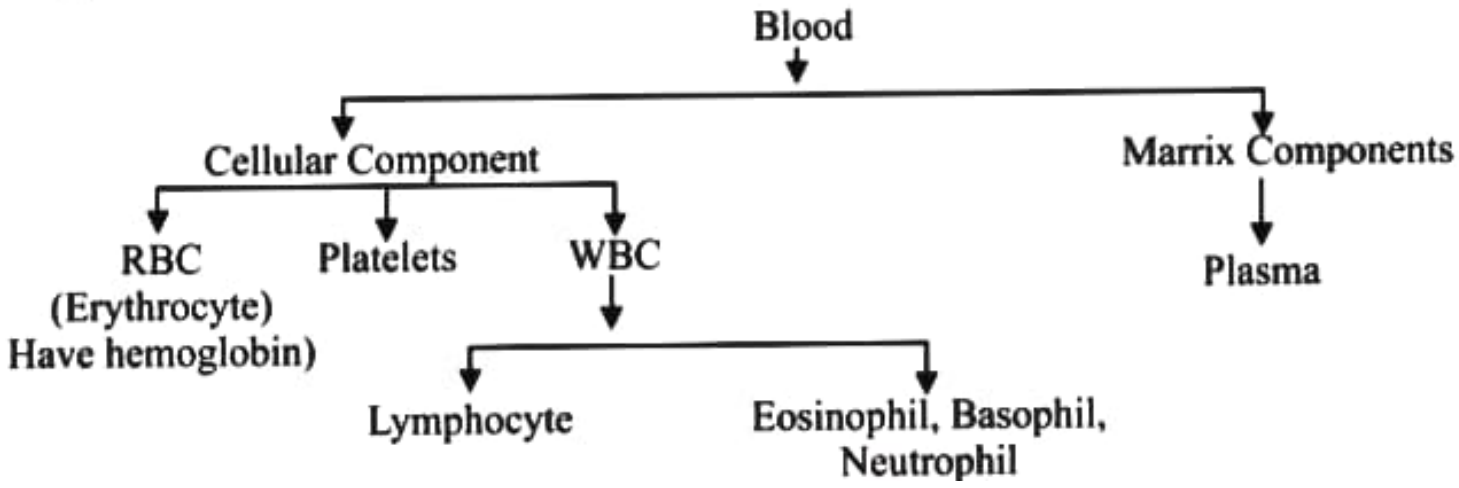
(e) Glandular

- Gland cells secretes substances at the epithelial surface.
- Sometimes position of epithelial tissue folds inward and form multicellular gland it is called Glandular epithelial.

CONNECTIVE TISSUE

- The cells of the connective tissue are widely spaced and embedded in an intercelluar matrisx.
- Their basic function is to provide support to different organs & keeping them in place.
- Connective tissue have two components : matrix and cellular part.

(f) Fluid or vascular tissue :



Blood and lymph

- Blood is a connective tissue, fluid matrix of blood is plasma having wandering or floating cells, called corpuscles, blood helps in the transportation of various materials such as nutritive substances, gases, excretory products, hormones etc.

(a) Plasma

- Form 55% part of blood. Constitution : 90-91% : water, 7% : Protein (Albumin, fibrinogen, globulin), 0.9% : inorganic salt etc.

(b) Corpuscles

- Forms 45% part of blood.

(i) RBCs

- They are also called as erthyrocytes, containing red coloured respiratory pigment called haemoglobin that helps in transportation of oxygen.

(ii) WBCs (Leuocytes : They are also called as 'Soldiers of the body'.) Provide immunity.

- They are irregular, amoeboid, phagocyte cells that protect our body by engulfing beacterial & other foreign particles. they are of five types : Monocytes, Lymphocytes, Basophiles, Neutrophiles, Eosinophils.

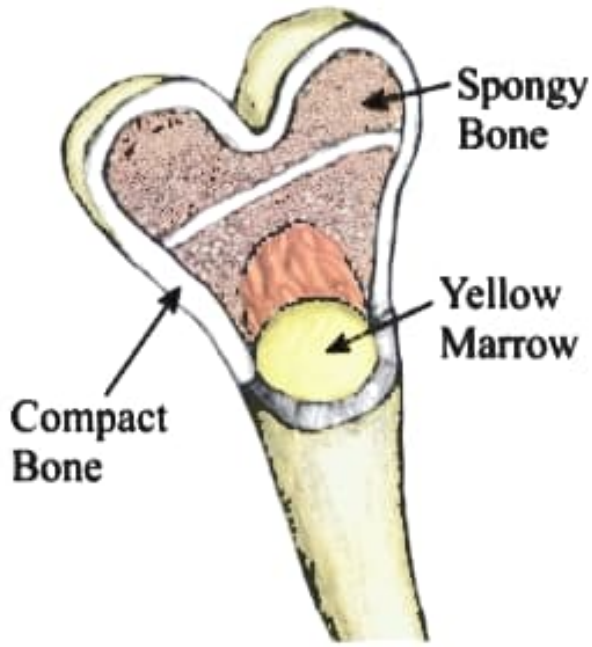
(iii) Blood platelets or thrombocytes

- They are spindle shaped cells which are involved in clotting of blood.

(b) *Skeletal Tissue*

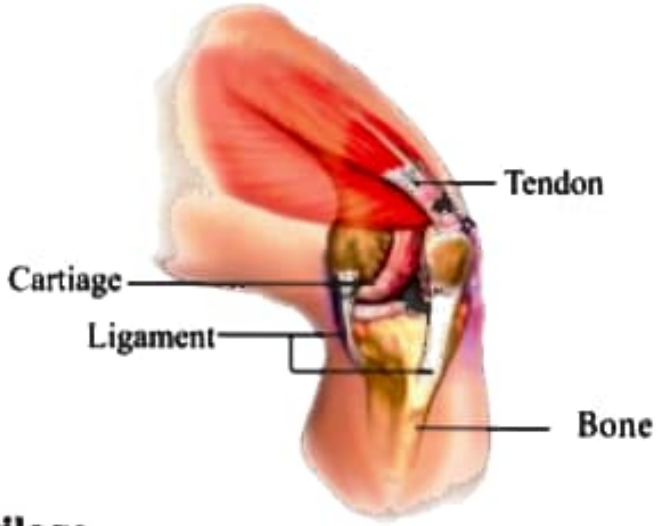
BONE :

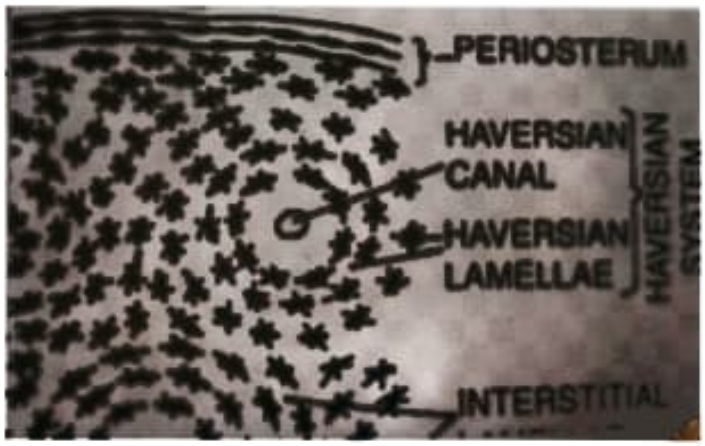
It is hard connective tissue that forms supportive framework skeltal of the body. It is of two types :



Bone

- Matrix of bone is very hard because of salts such as calcium phosphate, $CaCO_3$ (60-70%) etc. and a protein ossein.
- Bone cells (osteoblasts) are embedded in this hard matrix.
- Matrix is deposited in the form of concentric layers of lamellae formed round a central canal, the done cells occupy small spaces between the concentric layers of matrix.





T.S. of Bone

Cartilage

- This tissue is elastic, less harder as compared to bones.
- Elasticity is due to presence of chondrin (protein). Cells are called as chondros which are widly spaced and matrix is reinforced by fibres.
- It occurs at joint of bones, in the nose, ear, tracea & larynsx.
- It provides flexibility and great tensile strength.

T.S. of Cartilage

(c) *Dense regular connectiver Tissue (Fibrous Tissue)*

(i) Ligament *(ii) Tendon*

It is most abundant type of connective tissue. It si further divided into following types :

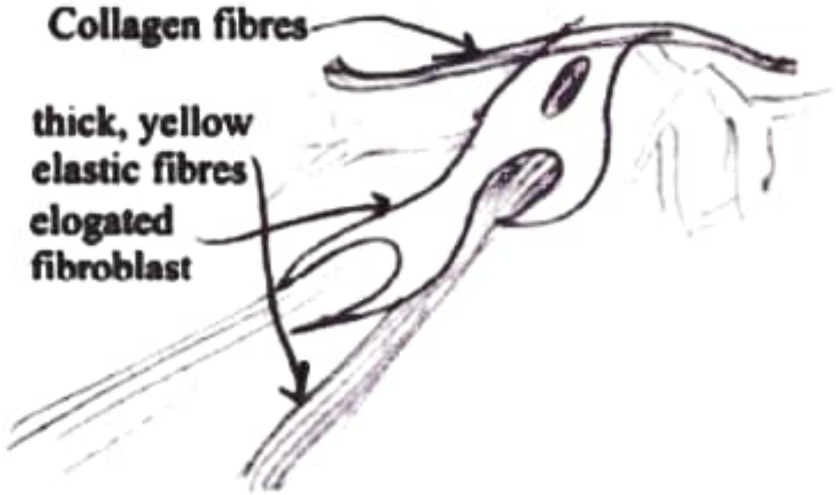
(i) Yellow fibrous connective tissue (Ligament)

- They are very elastic due to the presence of a network of yellow fibers in its matrix called as ligament which attaches bone to bone.

(ii) White fibrous connective tissue (Tendon)

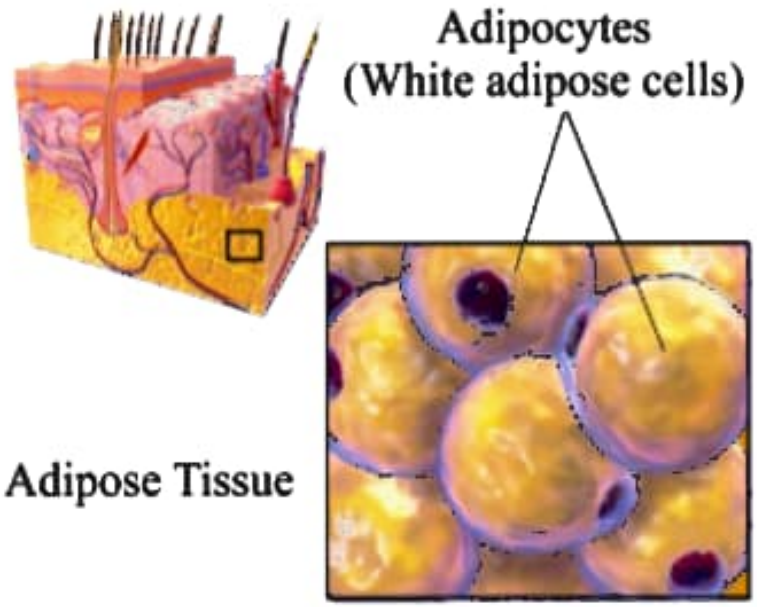
- They are very little matrix containing abundant white fibres forming layers and inclastic in nature.
- Bundles of this tissue are called as tendons, which attaches muscles to the bones.

(d) *Aerolar tissue :*



- This tissue fills spaces inside organs and is found between the skin & muscles, around blood vessels, nerves and in the bone marrow.
- It is a supporting and packing tissue.

(e) *Adipose tissue :*



- These are oval and round cells, filled with fat globules called adipocytes.
- It is found in subcutaneous layer below the skin, around the heart, brain and below the eyeblass. It acts as an insulator and prevents loss of heart from the body.
- It serves as a fat resorvoir and keeps visceral organs in position.

MUSCULAR TISSUE

- Movements are brought about in our body with the help of muscular tissue.

- They are long fibre-like cells called muscle fibres.
- They are capable of contraction or relaxation because they are made up of contractile Proteins. (Action and Myosin)

Types of Muscular Tissue

Skeletal Muscle

Cardiac Muscle

Smooth Muscle

(a) *Striated muscles*

- This muscles shows alternate light and dark bond hence the name is striped or sprained muscles.
- They are also called as voluntary muscles because these are under th control of one's well.
- Muscle fibers or cells are multinucleated and unbranched.
- Each fibre is enclosed by thin membrance which is called as sarcolemma. Cytoplasm is called as sarcoplasm.
- These muscle get tired and need rest.

(b) *Cardiac muscle fibres*

- They are involuntary muscles.
- Only found in the walls of heart.
- They are uninucleated and branched. Branches are united by intercalated disc.
- In these muscles rhythmic contraction and relaxation occurs through the life & never get tired.

(c) *Non-striated muscles or smooth muscle*

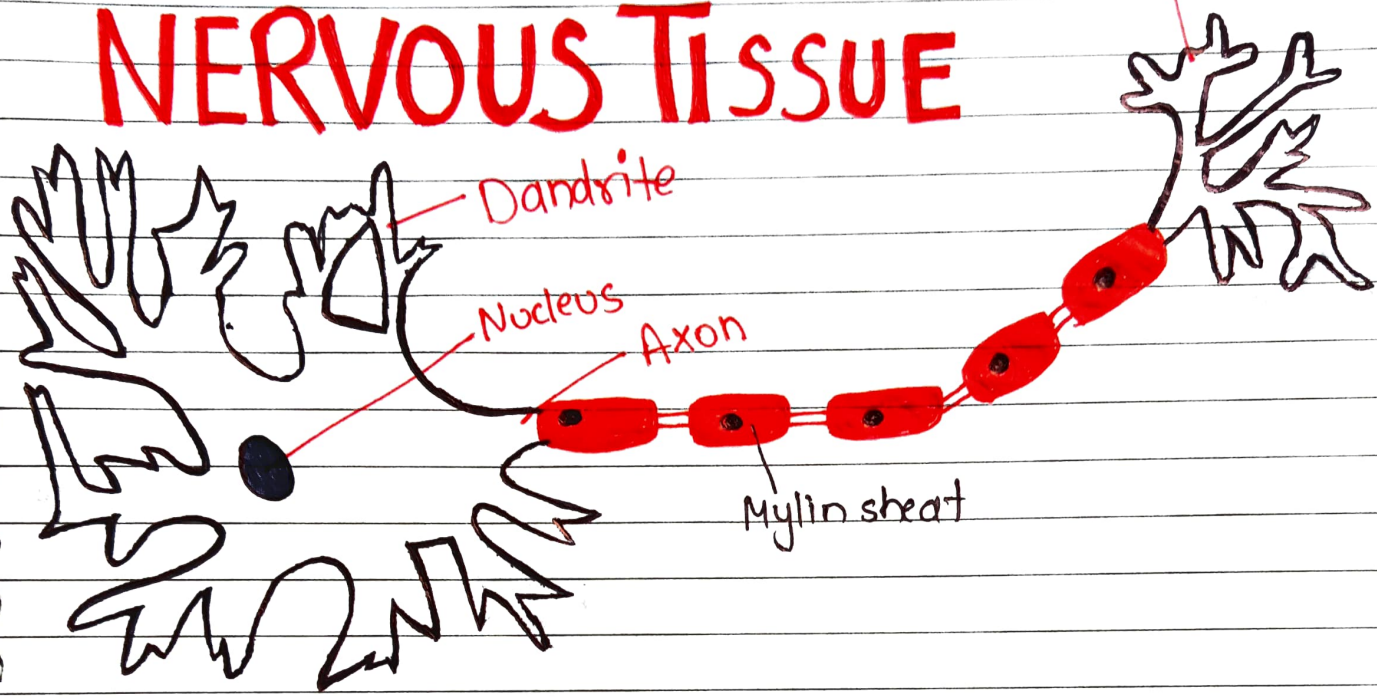
- They are involuntary muscles also called as smooth muscles.
- These muscle fibers are uninucleated and spindle shaped.
- They are not enclosed by membrane but many fibres are joined together i bundles. They constitute internal organs.
- Such muscles are found in thewalls of stomach, intestine, urnary bladde bronchi, irir of eye etc.
- Peristalitic movements in alimentary canal are brough about by smooth muscles

Striated	Non-striated	Cardiac
1. They are present in the limbs, body walls, tongue, pharynx and beginning of oesophagus.	1. They are present in the oesophagus (posterior part only). urino-gential tract, urinary bladder, vessels, iris of eye, dermis of skin, and arrector pili muscles of hair.	1. Thye are present in the wall of the heart, pulmonary veins and superior vena cava.
2. Cylindrical	2. Spindle shaped.	2. Cylindrical.
3. Fibres unbranched.	3. Fibres unbranched	3. Fibres branched.
4. Multinuclecate.	4. Uninucleate	4. Uninucleate.
5. Bounded by sarocolemma.	5. Bounded by plasmalemma.	5. Bounded by sarcolemma
6. Light and dark bands present	6. Light and dark bands absent	6. Faint light and dark bands present.
7. No oblique bridges and interoalated discs	7. No oblique bridges and intercalated discs.	7. Oblique bridges and interealated discs present.
8.Nerve supply from central nervous system.	8. Nerve supply from autonomic nervous system.	8. Nerve supply from the brian and autonomic nervous system.
9. Blood supply is abundant.	9. Blood supply is scanty.	9. Blood supply is abundant.
10. Very rapid contraction.	10. Slow contraction.	10. Rapid contraction.
11. They soon get fatigued.	11. They donot get fatigued.	11. They never get fatigued.
12. Voluntary	12. Involuntary	12. Involuntary

Dt.:
Pg.:

Delta

NERVOUS TISSUE



- They are highly specialized tissue due to which the animals are able to perceive and respond to the stimuli
- Their functional unit is called as nerve cell or neuron.
- Cell body is cyton covered by plasma membrane.
- short hair like extensions rising from cyton are dendron which are further subdivided into dendrites.
- Axon is long, tail like cylindrical structure with fine branches at the end Axon is covered by a sheath.
- Nerve ending of one neuron is very closely placed to the dendrons of another neuron to carry impulses from one to another neuron in the form of electrochemical waves. This close proximity is called as synapse.

OBJECTIVE TYPE QUESTIONS

VERY SHORT ANSWER TYPE QUESTIONS

1. The tissue derived directly form the meristem of embryo is called as .....
2. A group of cells with similar structure organized to do a common function is called as .....
3. Which plant tissue remains in active metabolic state alwasy ?
4. Sieve tubes and companion cells are found in ..... tissue. (Xylem/ phloem/ collenchyma)
5. Long, narrow, dead cells having a thick deposition of lignin in the cell wall are called ..... cells. (Parenchyma/ cambium / sclerenchyma)
6. Which tissue is responsible for transport of water in plants ?
7. The special property of muscle fibres to contract forcefully and return to relaxed state is called ..... . (excitability / contractibility / flexibility)
8. A branch of science dealing with the study of bones is called..... . (Ornithology/ physiology/ osteology)
9. The fluid matrix of blood is called ..... . (plasma/lymph/serum)
10. Spindle-shaped, non-striated, involuntary muscle fibres present in hollow internal organs like urinary bladder are called ..... . (smooth muscle fibres/ streiated muscle fibres/ cardiac muscle fibres.)

SHORT ANSWER TYPE QUESTIONS

1. Define tissue.
2. What do you mean by division of labour ?
3. Name the different elements of xylem and phloem.
4. In hydrophytes xylem is less developed. Why ?
5. Write the composition of mammalian blood.
6. What is the function of nervous tissue ?
7. Stat the main features of muscular tissue.
8. Write down the identifying features of connective Tissue.
9. State the function of Adipose Tissue ? Name its cell ?
10. Name the muscle found in the heart. State its identifying feature.

LONG ANSWER TYPE QUESTIONS

1. What is tissue ? Explain meristematic plant tissue.
2. Mention the role of parenchyma, collenchyma and sclerenchyma.
3. Give summarized classification of animal-tissue.
4. Describe the structure of neuron with labelled diagrom.
5. Draw a neat labelled diagram of stomata & state its fuctions.
6. Differenctiate between threetyeps of Muscles ?
7. What are different kind of fibrous/Dense connective Tissue ? State its function.
8. Differentiate between Parenchmi, collenchyma and Sclerenchyma tissue?
9. How simpel permanet Tissue differ from complex Permament Tissue.
10. What are the compoments of Xylem and Phloem ?
11. Define :

(a) Cell differentiation (b) Meristamatic Tissue
(c) Tendon (d) Neuron
(e) Histology (f) Tissue
(g) Connective Tissue.

OBJECTIVE TYPES QUESTIONS

Q1. Write true if the statement is true or false if the statement is false.

1. An organ is a structure made of only one type of tissue.
2. A tissue is made of a group of cells that have the same job.
3. Instead of having a plasma membrane, plant cells have a cell wall.
4. Plant cells are prokaryotic.
5. The main function of plastids is to maintain pressure against the cell wall.

Q2. Fill in the blank with the appropriate term.

1. The _____ contains chlorophyll.
2. A membrance-bound organelle containing pigments other than chlorophyll is the _____.
3. The _____ contains dividing, undifferentiated cells.
4. _____ consists of loosely packed cells with thin cell walls.
5. The tissue type that makes up most of the plant's interior is _____.

Q3. MCQ

1. In plants which of the following have the capability of cell division ?
   (a) Parenchyma (b) Scelerenchyma
   (c) Xylem (d) Apical Meistem
2. The growth is plants is
   (a) limited to cedrtain regisons (b) uniform in all parts
   (c) limited to top region (d) limited to roots only.
3. Intercalary meristems are found
   (a) at internodes and base of leaves (b) at growing tips of roots
   (c) beneath the bark (d) at the tips of stem
4. Cells of the tissue have dense cytoplasm, thin cellulose walls and prominen anoles. Identify the tissue.
   (a) Collenchyma (b) Scelerenchymac
   (c) Meristem (d) Parenchyma
5. Dead long and narrow cells in a plant belong to which tissue ?
   (a) Parenchyma (b) Scelerenchyma
   (c) Collenchyma (d) Phloem
6. Bone is an example of _____
   (a) Muscular tissues (b) Connective tissues
   (c) Epithelial tissues (d) Nervous tissues
7. Which animal tissue are usually separated from the underlying tissue by ar extracellular fibrous basement membrane ?
   (a) Muscular tissues (b) Connective tissues
   (c) Epithelial tissues (d) Nervous tissues
8. Oesophagus and the lining of the mouth are also covered with which tissues ?
   (a) Squamous epithelium (b) Ciliated epithelium
   (c) Areolar conneective (d) Striated muscle tissues
9. Husk of a coconut is made of which tissues ?
   (a) Parenchyma tissue (b) Sclerenchymatous tissue
   (c) Collechyma (d) Xylem
10. Muscles contain special proteins called _____ that help in muscle movement.
   (a) recptor proteins (b) enzymes
   (c) nucleo proteins (DNA, RNA) (d) contractile proteins (actin and myosin)