

# TISSUES

In unicellular organisms all the life processes such as digestion, respiration, excretion, reproduction etc are performed by the single cell.

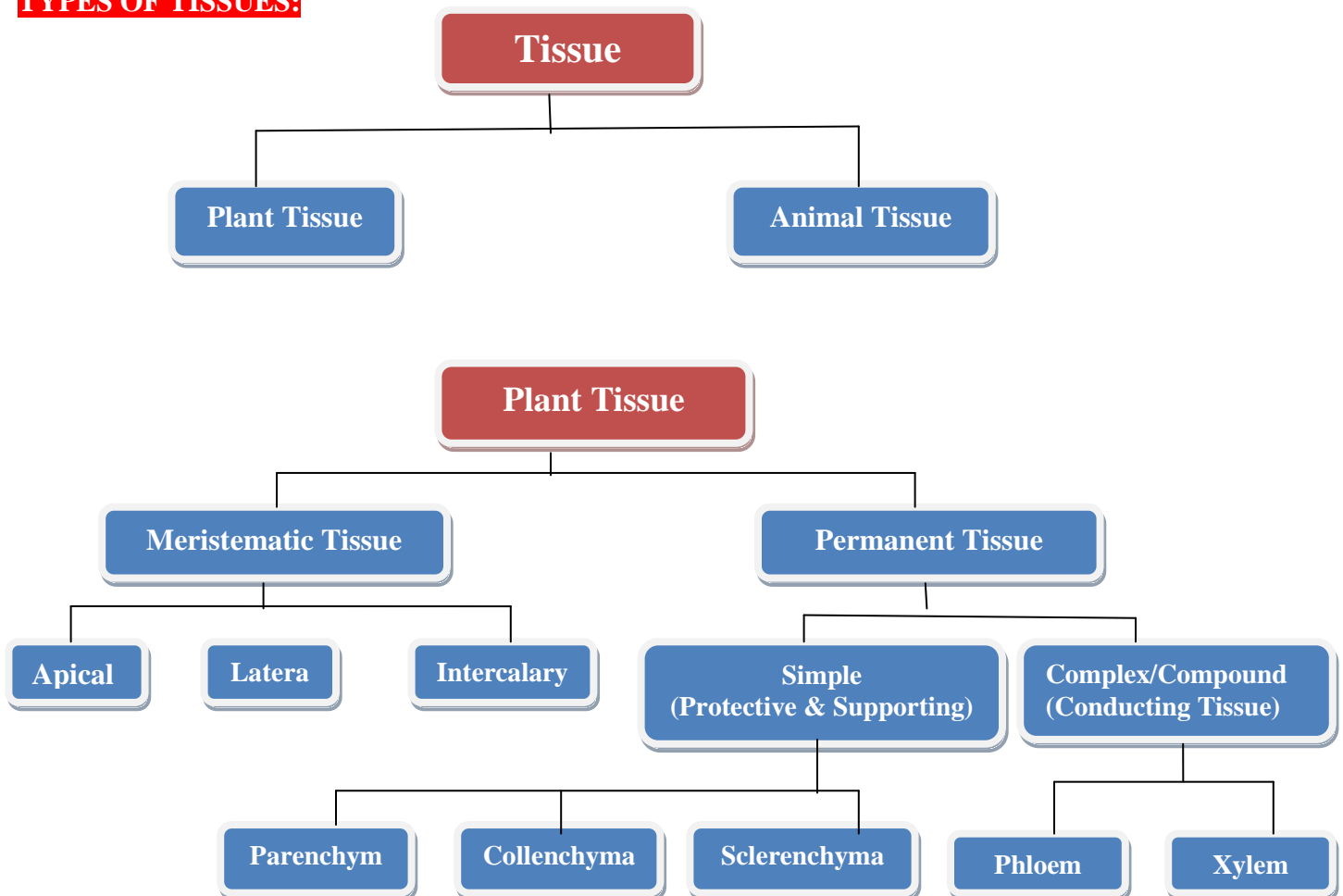
But in multicellular organisms different groups of cells perform different functions. Thus there is division of labour in the cell and each tissue is composed of cells that originate from common parent cells and have a characteristic shape, size and arrangement.

**TISSUE:** A group of cells that are similar in structure and work together to achieve a particular function forms a tissue.

Importance of tissue:

1. Formation of tissues has brought about division of labour in multicellular organisms.
2. Tissues become organized to form organs and organs into organ system.
3. Workload of individual cell has been decreased.
4. Due to improved organization and higher efficiency, multicellular organisms have higher survival.

## **TYPES OF TISSUES:**



**MERISTEMATIC TISSUE:**

- It consists of undifferentiated, actively dividing cells i.e. helps in growth of the plant and
- Found in those regions of the plants that grow. e.g. - root tip, shoot tip & cambium.
- These tissues are living and bring about an increase in the length and girth (thickness) of the plant.

**Characteristics of Meristematic tissue:**

1. The cells are in active stage of cell division.
2. Each Meristematic cells contains dense or abundant cytoplasm and a single large nucleus.
3. The Meristematic cells are compactly arranged i.e. without intercellular space between them.
4. Cell wall is made of thin cellular layer.
5. Cells may be spherical, oval, polygonal or rectangular in shape.
6. Cells may or may not contain vacuoles.

**Function:**

1. It have the ability to divide, hence they continuously divide to produce new cells which keep differentiating to form specialized cells of the plant.
2. The cells of the root tip and shoot tip bring about an increase in length of the plant.
3. The cells in the lateral region i.e. cambium bring about an increase in the girth (thickness) of the plant.

**Types of Meristematic tissue:****(A) Apical meristem:**

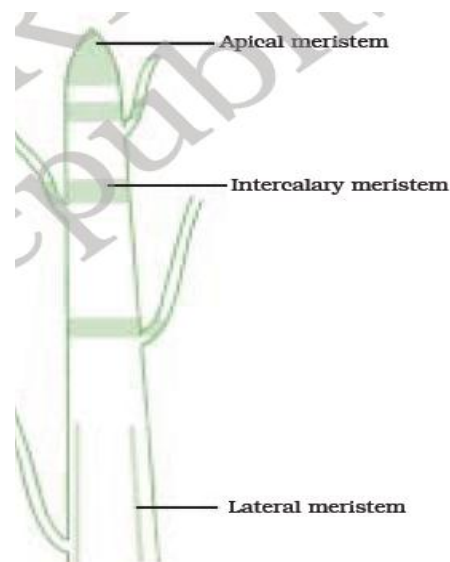
- Present at the apex of root or stem.
- Responsible for increase in length of an axis.

**(B) Lateral meristem / Cambium:**

- They lie on the lateral side of stem and root
- Help in increasing the thickness (girth) of the stem & root.

**(C) Intercalary meristem:**

- They lie at the base of the leaves or internodes on twigs.
- Help in longitudinal growth of plants i.e. responsible for increase in length of intermodal region.

**PERMANENT TISSUE:**

- These tissues originate from the Meristematic tissues.
- Different types of permanent tissues are formed by the differentiation of cells of the Meristematic tissue.

**Cell differentiation:** the process of taking up a permanent shape, size & function is called differentiation.

**Characteristics:**

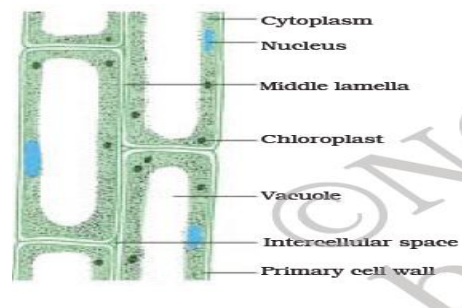
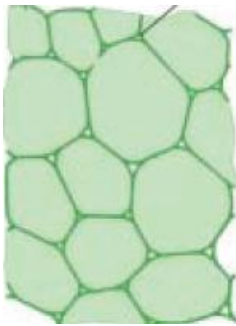
1. Cells have lost the power of division i.e. they do not divide.
2. They have a definite form and size.
3. They are differentiated cells and carry out specific function.
4. They may be living or dead cells.
5. They may have thin / thick cell wall.
6. The cells are large with vacuolated cytoplasm.

## Types of permanent tissues:

(A) **Simple permanent tissue:** are made of structurally similar cells i.e. these tissues are composed of one type of cells only. On the basis of nature of cells they are of three types.

### (1) Parenchyma:

- It is the most primitive and fundamental tissues i.e. it is the most common simple tissue in plants with relatively little specialization.
- The cells are living.
- Shape may be spherical, oval or polygonal.
- The cell wall is thin and made up of cellulose.
- The cells are loosely packed with large intercellular space.
- There is a large central vacuole and dense peripheral cytoplasm containing a distinct nucleus.
- Found in soft part of the plants such as cortex of roots, ground tissues in stem & mesophyll of leaves.



**Function:** storage of food.

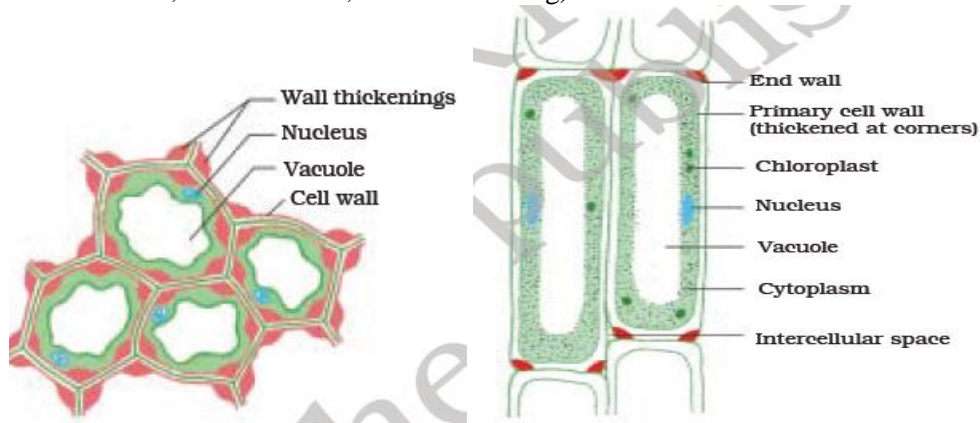
### Specialized parenchyma:

- I. Chlorenchyma: Parenchyma with chloroplast.
- II. Aerenchyma: Parenchyma with air-cavity.
- III. Stellate / Steel parenchyma: - Star shaped parenchyma.
- IV. Idioblast: Parenchyma with ergastic (metabolic waste product) substance.

### (2) Collenchyma:

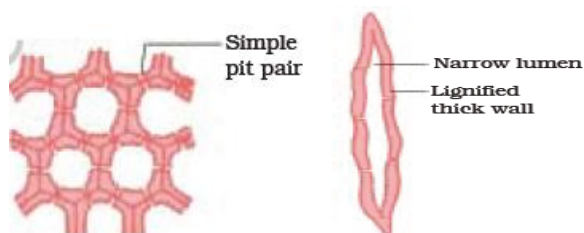
- Cells are living.
- Cells are elongated and irregularly thickened at the corners.
- Intercellular space is very little.

**Function:** provide mechanical strength. (It provides flexibility to the plant thus allows easy bending in various parts of the plant leaf & stem, absent in root, without breaking).



**(3) Sclerenchymal:**

- The cells of this tissue are dead.
- The cell wall is long and narrow.
- Cell wall is very much thickened due to deposition of lignin (a chemical substance which act like cement and hardens them).
- The cell wall is so thick that there is no intercellular space inside the cell.
- Present in stems, around vascular bundles, in the veins of the leaves and in the hard covering seeds and nut.



In older plants the outer protective tissues i.e. epidermis undergoes certain changes and is replaced by secondary meristem. 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 cork are dead and compactly arranged without intercellular spaces. They also have a chemical called suberin in their walls that makes them impervious to gasses and water.

**(B) Complex permanent tissue:** Made up of structurally different cells. All these cells coordinate to perform a common function.

Xylem and Phloem are example of such complex permanent tissue. They are conducting tissue and constitute a vascular bundle.

Function: Transport water, minerals, salts and food materials to various parts of plant body.

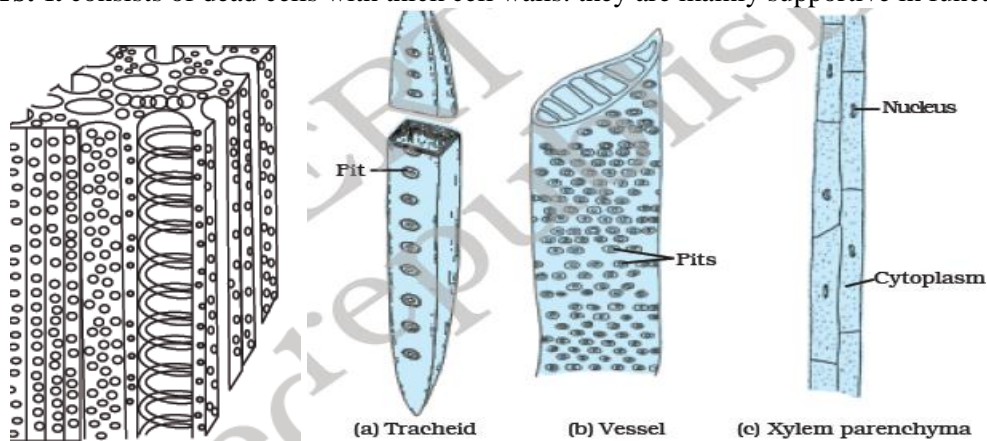
(1) **Xylem:** It is composed of four different types of cells –

(a) **Trachid:** Are dead, thick walled, lignified tubular cells.

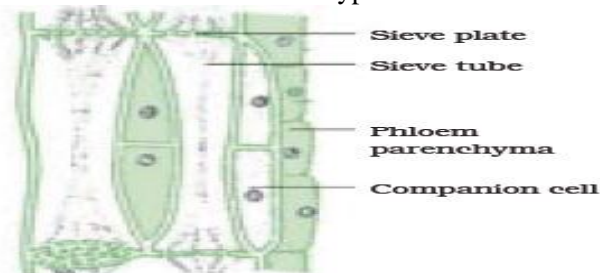
(b) **Vessels / Trachea:** - Dead, thick walled, lignified tubular cells(Present in xylem of angiosperms only, absent in Pteridophyta and Gymnosperms).

(c) **Xylem parenchyma:** It consists of living cells having thin cell walls.

(d) **Xylem fibers:** It consists of dead cells with thick cell walls. they are mainly supportive in function.

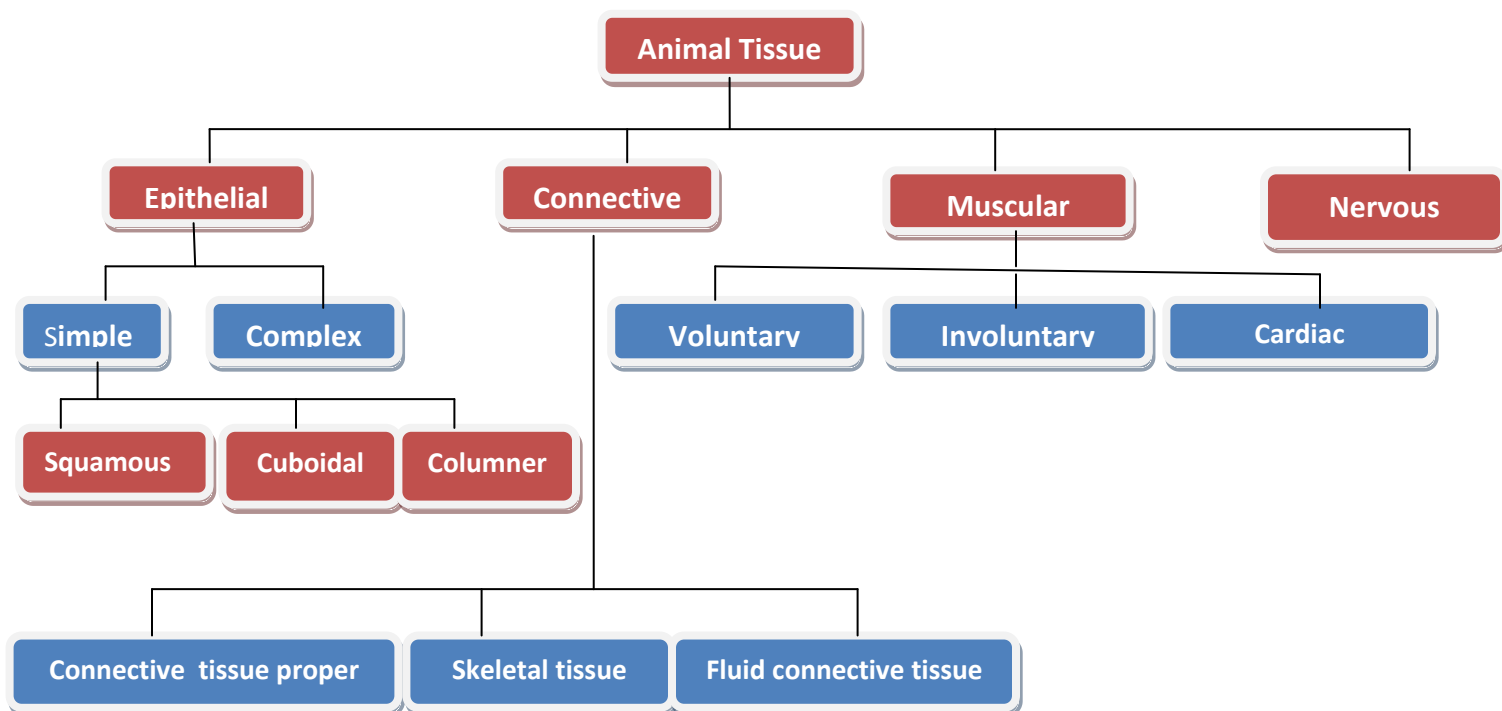


(2) **Phloem:** it is also called bast and consists of four different types of cells-



- (a) **Sieve tube:** They are tubular cells with end walls perforated by numerous pores which are called sieve plate. The sieve tube do not have nucleus but have a thin layer of cytoplasm.
- (b) **Companion cells:** These are small elongated cells having dense cytoplasm and prominent nucleus.
- (c) **Phloem parenchyma:** These are thin walled, having parenchymatous cells which are mainly concerned with storage and transportation of food.
- (d) **Phloem fibers:** These are thick walled elongated dead sclerenchymatous cells which provide mechanical strength to the tissues.

Function: Transportation of food from leaves to storage organs and latter from storage organs to growing regions of the plant body.



**(A) EPITHELIAL TISSUE:** The epithelial tissue covers the surface and lines tubes and cavities thus covers or protects the organs in the animal body.

➤ Is commonly called covering and lining tissue

**Characteristics features:**

- Cells are tightly packed and form continuous sheet.
- They have only small amount of connecting material between them and almost no intercellular space.
- All epithelium usually separated from the underlying tissue by an extracellular fibrous basement membrane
- Avascular tissue lacking distribution of blood vessels.

**Depending upon the space & function of the cells, the epithelial tissue is classified as follows:**

**Simple epithelial tissue:**

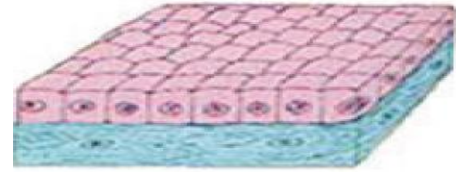
**(a) Squamous epithelium / pavement epithelium:**

- Cells are extremely thin & fat and form a delicate lining.
- Lining of oesophagous, lining of mouth, lining of blood vessels, lining of alveoli of lungs, lining of Bowmans capsule of Nephron.



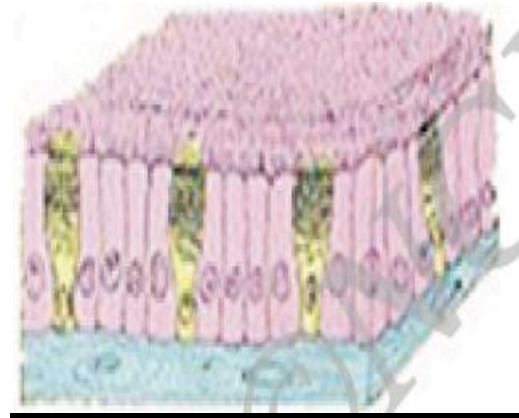
**(b) Cuboidal epithelium:**

- Cells are cube shaped.
- Forms the lining of kidney tubule and ducts of salivary gland.

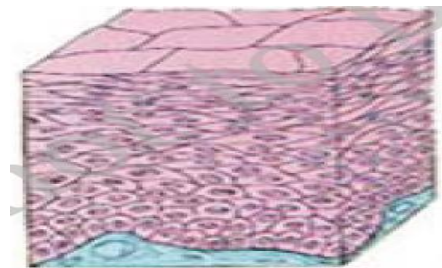
**(c) Columnar epithelium:** (columnar= pillar like)

- It consists of tall cells.
- It is found in the inner lining of intestine where absorption and secretion occurs. This facilitates the movement across the epithelial barrier.
- The cells of columnar epithelium modified to three types of epithelia.

- Ciliated epithelium: Cells have cilia at their free end which helps in movement of small particles. Lines the fallopian tubes & respiratory tract.
- Glandular epithelium: Cells modified to form gland.
- Sensory epithelium: Cells modify to form sensory cell (sensory cells are those cells which receives stimuli) e. g. - rod cells & cone cells, taste buds organ of corti of the internal ear.

**Complex epithelial tissue:**

e.g.-**Stratified squamous epithelium**:- skin epithelial cells are arranged in many layers to prevent wear and tear. Since they are arranged in a pattern of layers the epithelium is called Stratified squamous epithelium.

**(B) CONNECTIVE TISSUE:**

- The connective tissues are specialized to connect the various body organs.
- It can connect bone to each other, muscles to bones, bind tissues and give support to various parts of the body.

**Characteristics features:-**

- 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 depending upon the function of particular connective tissue. (matrix:- it is secretion of cells of tissue)

**Types Of connective tissue:****1. Connective tissue proper:-**commonly called packing tissue.

Is of following three types:-

**(a) Areolar tissue/ Loose connective tissue:****(b) Fibrous tissue:** make following two structure:

**Tendons:** connects muscles with skeletal tissue (cartilage & bone)

**Ligaments:** connects skeletal tissue with each other.

**(c) Adipose tissue:** found distributed most abundantly below our skin which is mainly concerned with storage of fat.**2. Skeletal tissue:** Forms both cartilage and bone.

**(a) Cartilage:** it provides supports & flexibility to the body parts and also smoothen bone surface at joints. It is present in the nose, Ear, Trachea & Larynx.

**(b) Bone:** it is very strong and non-flexible tissue. Due to presence of phosphorous and calcium bones are hard.

### 3. Fluid connective tissue: it includes blood & lymph.

#### (a) BLOOD:

➤ it contains both matrix (called Blood plasma) in which cells (called Blood corpuscles) floats.

**Blood plasma:** (55% = 2.75litre) : contains water(91-92%) Protein(7-8%- Albumin, Globulin, Fibrinogen, & Prothrombin) , Nutrients(0.1%-Amino acid, Lipid, vitamins, minerals), electrolytes(Na<sup>+</sup>, K<sup>+</sup>, Cl<sup>-</sup>, Ca<sup>++</sup> etc.), Nitrogenous metabolic waste (Urea- 34mg/100ml of blood, Uric Acid- 5mg/100ml of blood, Creatinin- 1mg/100ml of blood,bilirubin-0.1mg/100ml of blood), Dissolved gasses (co2-2ml/100mlk of blood, N<sub>2</sub>- 0.9ml/100ml of blood, O<sub>2</sub>-0.2ml/100ml of blood), Hormones & anticoagulant like Heparin.

**Blood corpuscles:** are of three types-

- (i) **RBC/ERYTHROCYTES:** Help in transport of respiratory gasses.
- (ii) **WBC/LEUCOCYTES:** Fight with diseases by producing antibodies and
- (iii) **BLOOD PLATELETS:** Help in blood clotting.

<b>TENDON</b>	<b>LIGAMENT</b>
It is strong and non-flexible	It is elastic and flexible
It joins muscle to bone	It joins bone to bone
It is formed of white fibrous connective tissue	It is formed of yellow fibrous connective tissue.

#### (b) LYMPH:

- It is colourless fluid having plasma & WBC.
- Lymph escapes out from blood capillaries into body tissues and flows in Lymph Vessels.
- **Function:** Helps in exchange of material between tissue and blood and also protects the body against infection.

<b>BONE</b>	<b>CARTILAGE</b>
Bones are hard and non-flexible	Are flexible
Blood vessels present	Blood vessels absent
Cavity is present	Cavity is absent
It is porous	It is non-porous

<b>BLOOD</b>	<b>LYMPH</b>
It is red in colour	It is white in colour
It flows in blood vessels	It flows in lymph vessels
RBC remain present	Lacks RBC

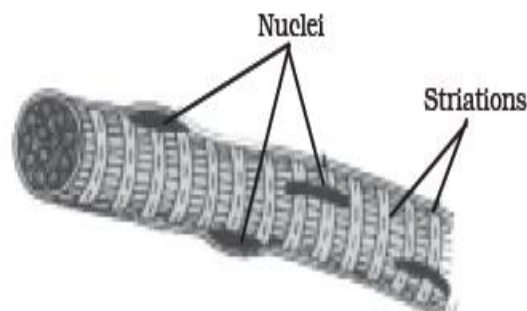
### (C) MUSCULAR TISSUE:

- Consists of elongated cells called muscle fibers.
- These tissues help in various types of movement in body parts and locomotion.
- Muscle contains special protein called contractile protein (Myosin, Actin, Troponin, tropomyosin) which contract and relax to facilitate movement.

On the basis of structure of muscles fibers Muscular tissue are of following three types:-

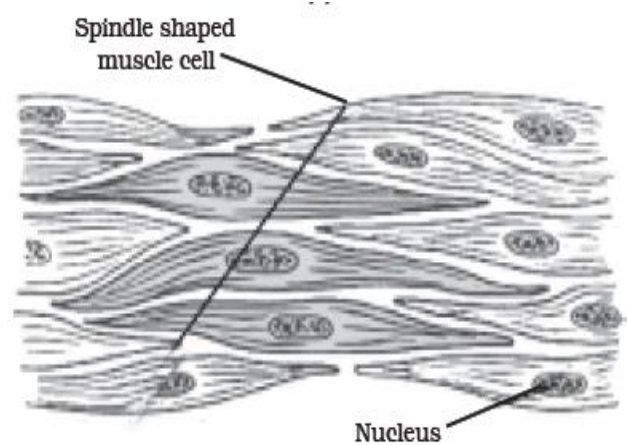
#### (1) Striated / Stripe / Voluntary / Skeletal muscular tissue:

- They are called skeletal muscular tissue because they are mostly attached to the bones.
- They are called striated muscular tissue because of the presence of alternate light & dark band or striations.
- The cells of this tissue are long, cylindrical, unbranched and multicellular (having many nuclei)



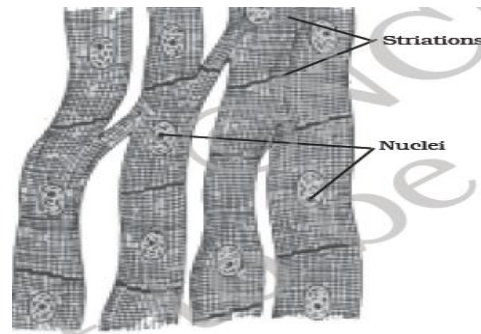
## (2) Involuntary muscular tissue / Smooth muscular tissue / Unstriated muscular tissue:

- Movement is not controlled by our will.
- They are called smooth muscular tissue because remains attached with smooth organs i.e. visceral organs.
- They are called unstriated muscular tissue due to absence of striations.
- The cells are long with pointed ends (spindle shaped) and uninucleated (having a single nucleus)
- They are found in the alimentary canal, blood vessels, iris of the eye, ureters & in the bronchi of the lungs.



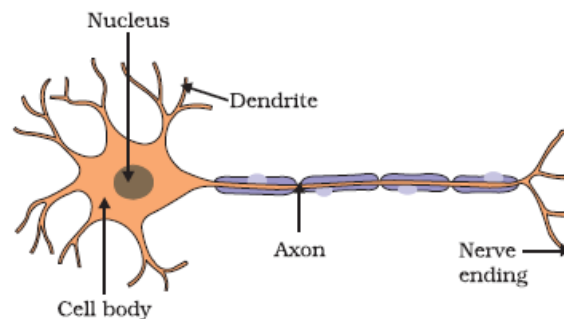
## (3) Cardiac muscular tissue / Striated involuntary muscular tissue:

- They are called cardiac muscular tissue because found restricted on the wall of the heart.
- Striated involuntary muscular tissue:- due to the presence of the striations and movement being not controlled by our will.
- Heart muscle cells are cylindrical, branched and uninucleate.



## (D) NERVOUS TISSUE:

- Tissue is composed of cells called nerve cells/ neuron.
- Nerve cells are highly specialized for being stimulated and then transmitting the stimulus very rapidly from one place to another within the body.
- The brain and spinal cord are composed of nervous tissue.
- Each neuron has three parts- Cyton / Cell body, Dendrites and axon.



**Cyton:** It has large central nucleus and cytoplasm from which long thin hair-like parts arise.

**Dendrite:** The short branched fibre of neuron which receives nerve impulse.

**Axon:** A single long conducting fibre extending from a neuron that transmits impulse away from the cell body.

### Function of nerve cell:

1. Controls all body activities.
2. It coordinates among various body parts during any body function.
3. Dendrite carries nerve impulse towards the cyton whereas axon carry nerve impulse away from the cyton.

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



