

TISSUES

- Multicellular organisms are made of millions of cells. Cells show division of labour and each cell performs a particular function efficiently. Such cells are grouped together and is called tissue.
- **TISSUE** : A group of cells that are similar in structure and origin and perform similar function.
- **HISTOLOGY** : Study of tissues

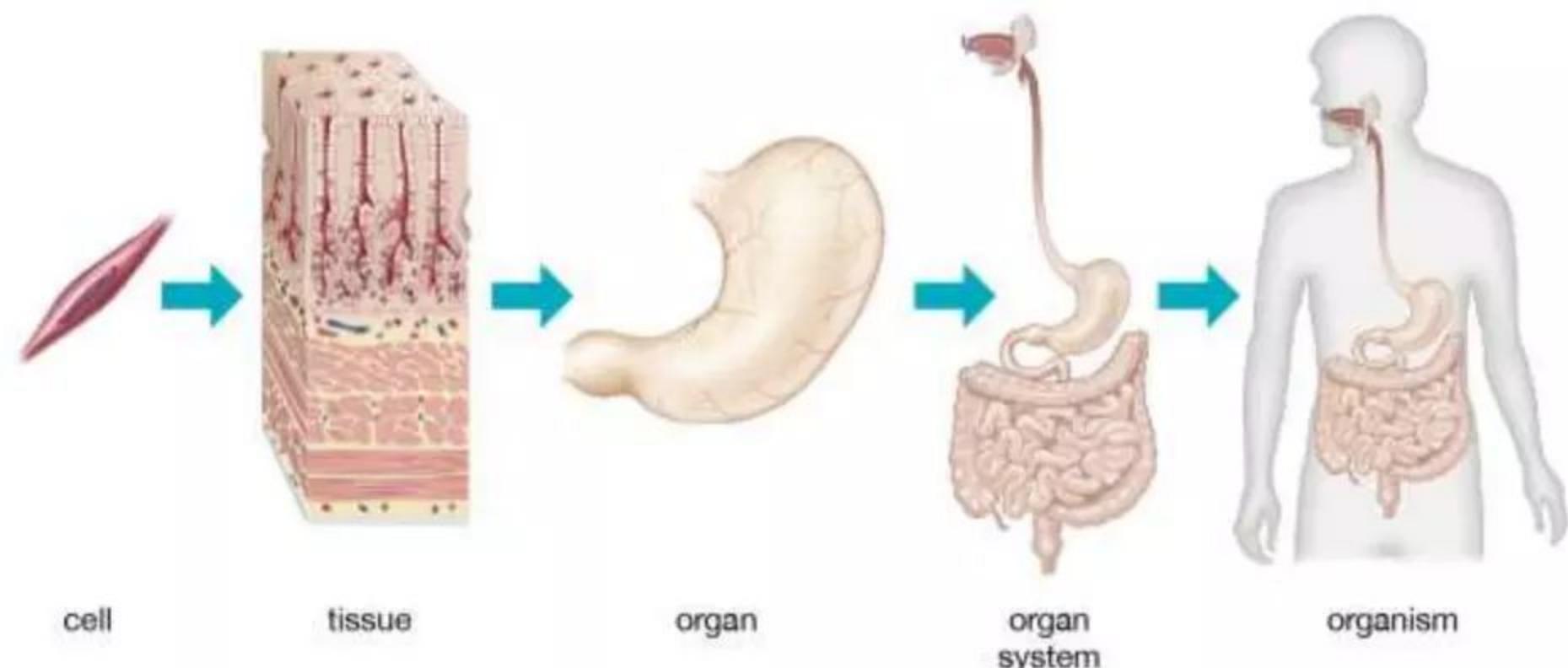
- What is the utility of tissues in multi-cellular organisms?

Multi-cellular organisms have millions of cells. Each group of cell is called tissue and it performs a special function efficiently.

Eg: muscle cells (contract and relax to bring movement), nerve cells (carry message) and blood, all are tissues.

In plants, xylem and phloem conduct water and food from one part of the plant to other parts.

- So, multi-cellular organisms show division of labour.



Tissues are mainly classified into two types

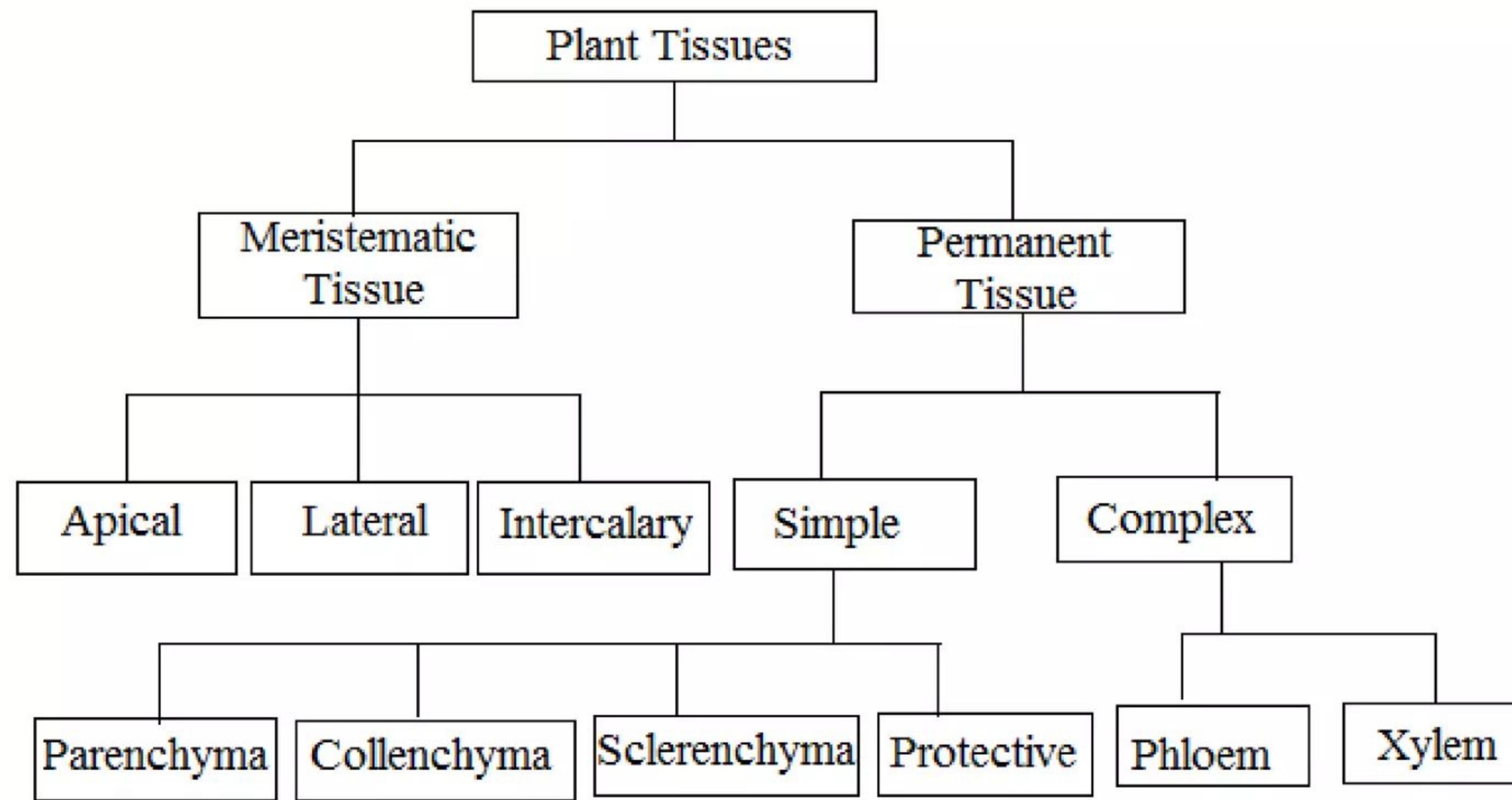
1. Plant Tissues
2. Animal Tissues

1. Plant Tissues

- Plants do not move, i.e., they are stationary.
- Most of the tissues they have are supportive, which provides them with structural strength.
- Most of these tissues are dead, as they can provide better mechanical strength than the live ones, and need less maintenance.
- Some of the plant tissues keep on dividing throughout the plant life. These tissues are localised in certain regions.

Types Of Plant Tissues

1. Meristematic Tissues
2. Permanent Tissues



➤ **Meristematic Tissue**

Meristematic tissues are responsible for growth in plants. Cells in these tissues can divide and form new cells.

➤ **Meristematic Tissues Are Of Three Types**

1. Apical Meristem

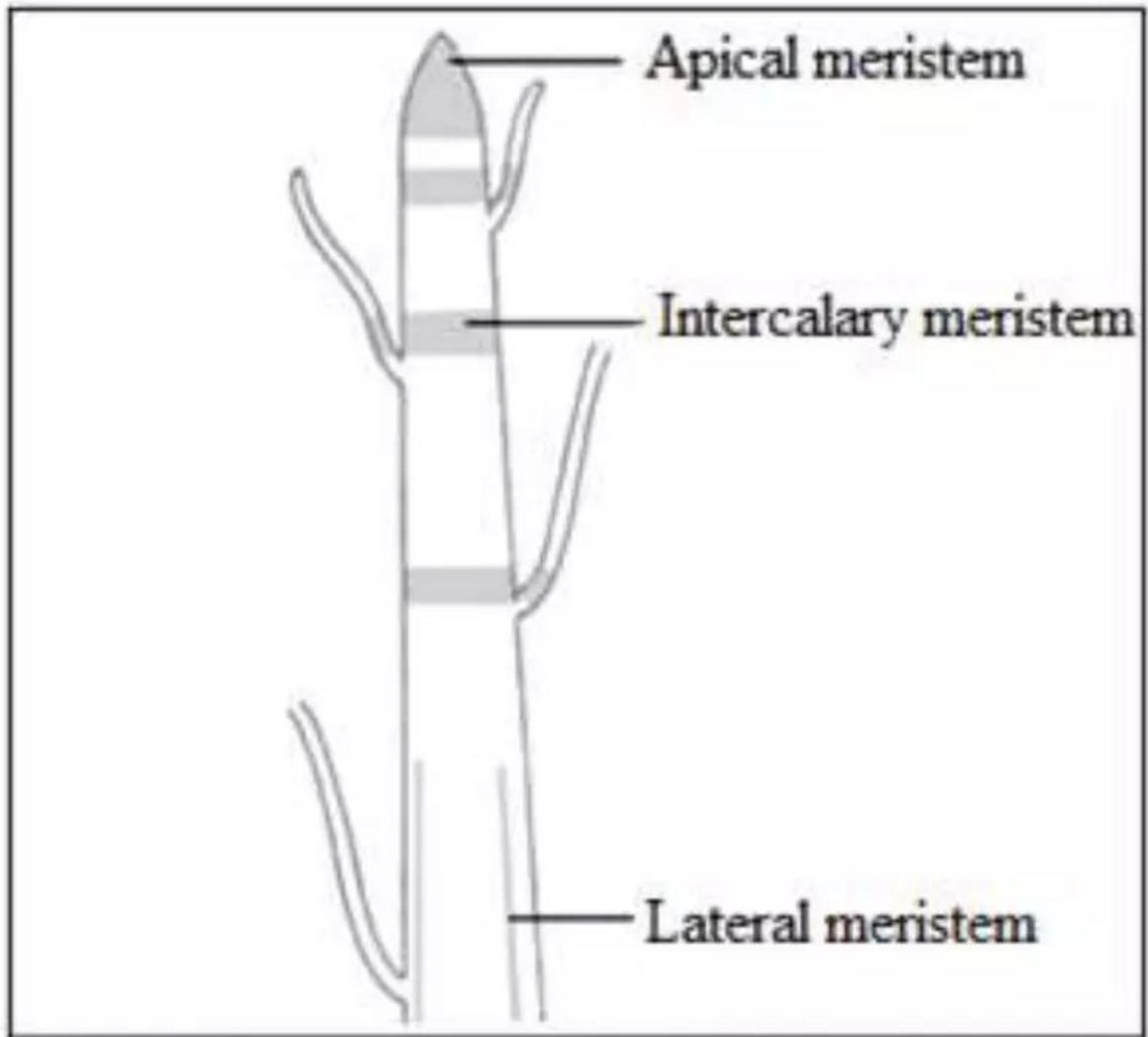
It is present at the growing tip of the stem and roots and increases the length. .

2. Lateral Meristem (cambium)

It is present beneath the bark. It is responsible for growth in girth of trunk.

3. Intercalary Meristem

It is present at internodes or base of the leaves and increases the length between the nodes.



**Location of meristematic tissue
in plant body**

Permanent Tissue

- Tissue that comes from meristematic tissue and are matured.
- Made of dead cells that have lost the power to divide.
- Have a definite shape, size and function and may be dead or living.
- The process by which cells arise from meristematic tissue and take up a permanent shape, size and function is called **differentiation**.

➤ **Permanent Tissues Are Of Two Types**

1. Simple tissues
2. Complex tissues

➤ **Simple tissues**

This type of tissue is composed of same type of cells.

These are again classified into two types

1. Supportive tissues
 - a. Parenchyma
 - b. Collenchyma
 - c. Sclerenchyma
2. Protective tissues
 - a. Epidermis
 - b. Cork

1. Parenchyma Simple Tissues

- Cells of parenchyma tissues are live.
- They are oval, elongated and loosely packed with large inter-cellular space, forming basic packing of tissue and are found throughout the plant body.

➤ Functions Of Parenchyma

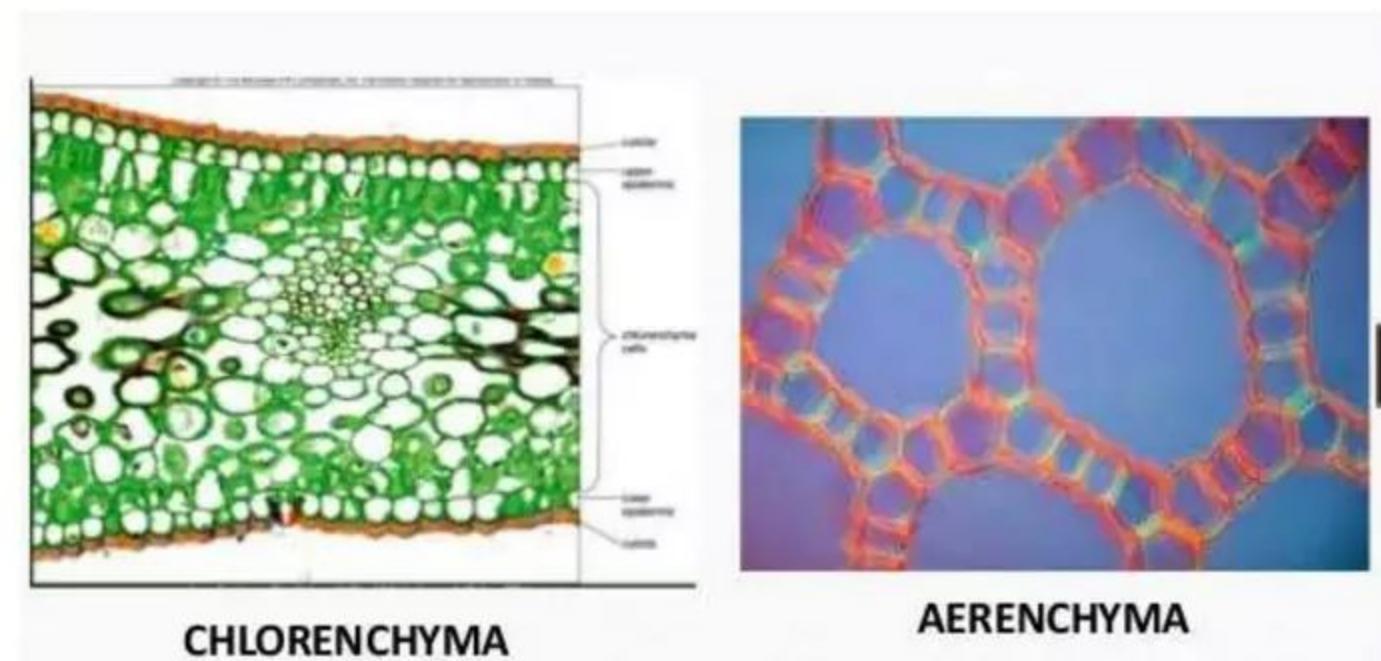
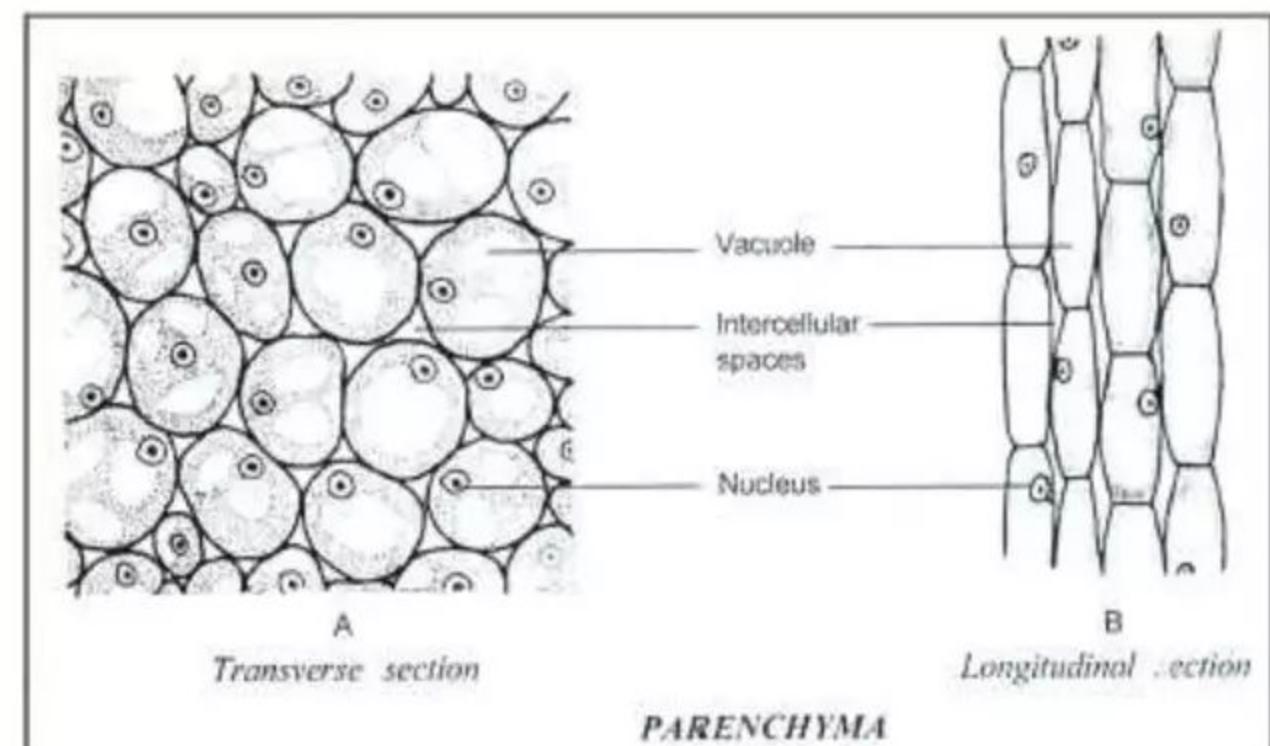
- They provide mechanical support to the plant body.
- They store food and nutrients in vacuoles.

Chlorenchyma

Parenchyma with chlorophyll which performs photosynthesis is called as chlorenchyma.

Aerenchyma

In aquatic plants, cells of parenchyma have large air cavities to give buoyancy to the plant and is called aerenchyma .



➤ **Collenchyma simple Tissues**

- Cells of collenchyma are live.
- They are oval and elongated and tightly packed with no inter-cellular spaces.
- They are found below epidermis in leaves and stem.

➤ **Functions Of Collenchyma Tissues**

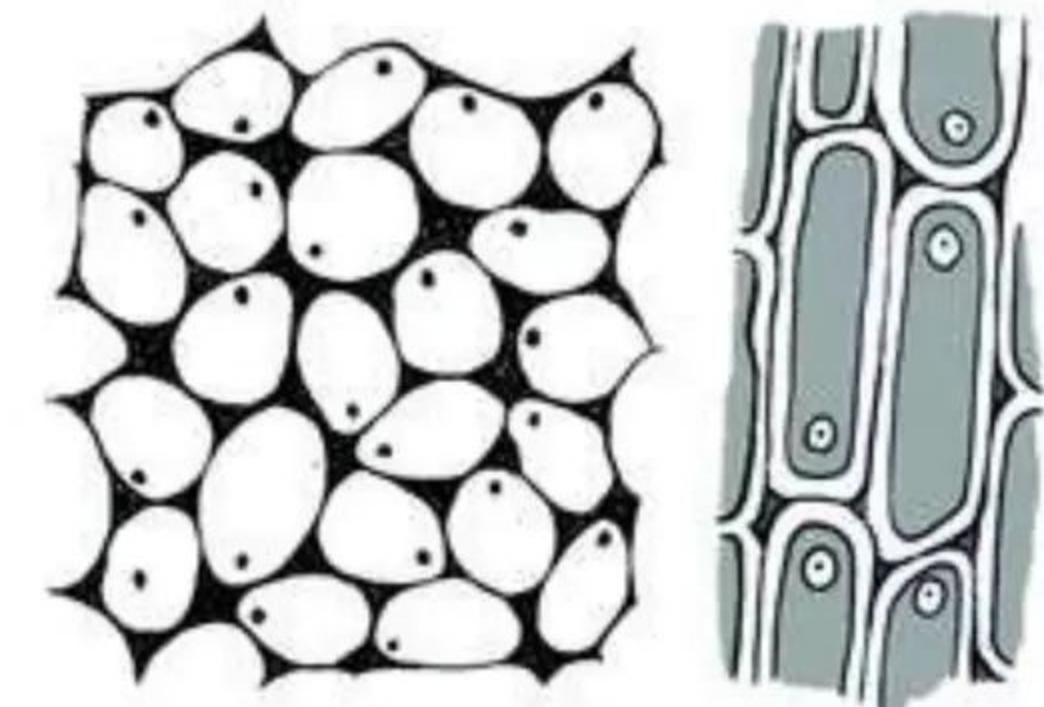
- They provides mechanical support to plant.
- They also provide flexibility to plants so that they can bend without breaking.

➤ **Sclerenchyma Simple Tissues**

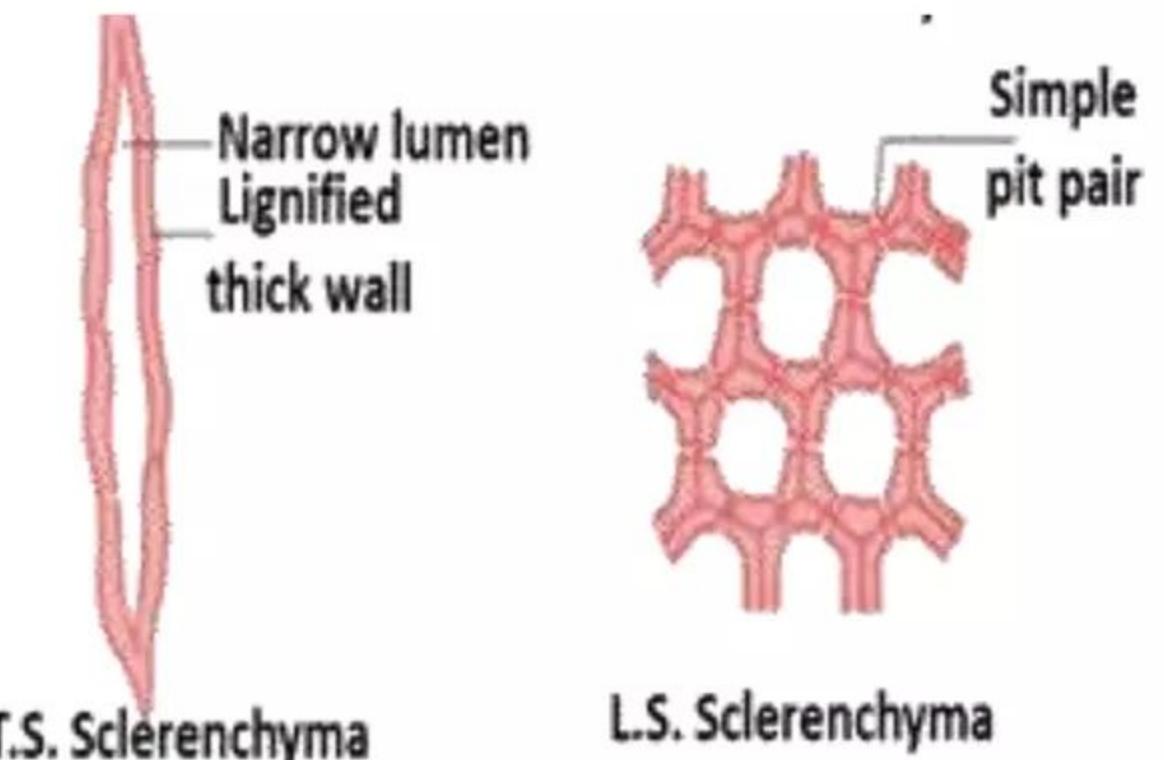
- Cells of sclerenchyma are dead.
- They are narrow and elongated.
- The cell wall in sclerenchyma is composed of lignin which makes it hard.
- Sclerenchyma are found around vascular bundles, veins of leaves in hard covering of seeds and nuts.
- For example: Sclerenchyma tissues are found in coconut husk.

➤ **Functions Of Sclerenchyma**

- They help to makes parts of plant hard and stiff.
- Also provides mechanical strength.



Collenchyma



Parenchyma	Collenchyma	Sclerenchyma
These tissues are responsible for photosynthesis, storage of food, gaseous exchange and floating of plants.	These tissues are responsible for providing flexibility to the plants so that they can bend easily.	These tissues are responsible for making plants hard and rigid.
They are a group of living cells with cell wall made of cellulose.	They are a group of living cells with cell wall made of cellulose and pectin.	They are made up of dead cells having cell wall made of lignin.
The parenchyma cells have large intercellular spaces between them.	They have no intercellular space in between them.	The cells do not have any intercellular spaces.
There are thin walls that surround each cell.	The cells present in these tissues are broad and irregularly thick at corners.	The cells have a long structure with thick walls.
They are found in leaves and newly formed branches.	They are present in leaves and stems of a plant.	They are found in stems, veins of the leaves and coverings of nuts and seeds.

Protective tissues

They protect the plant body by forming an outer layer.

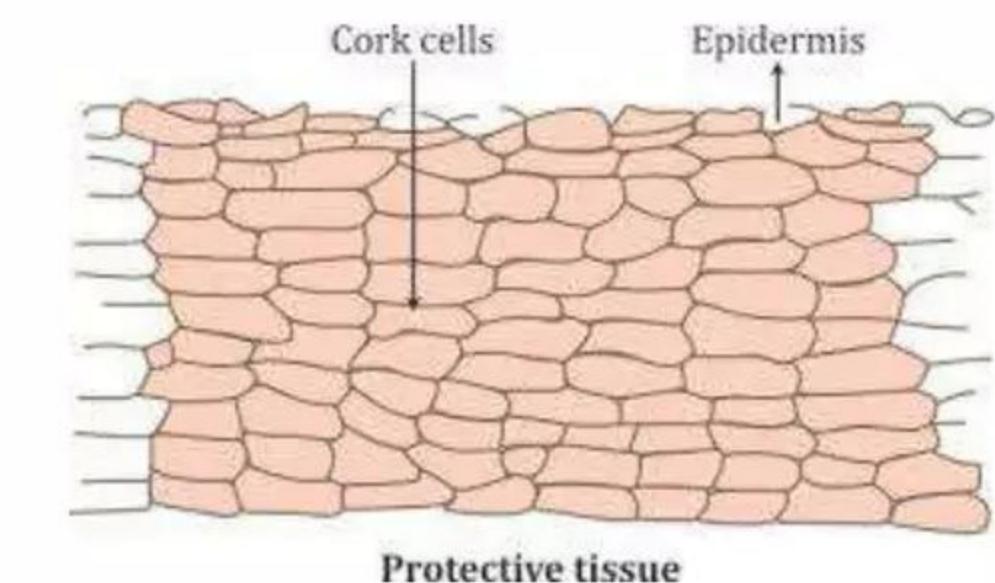
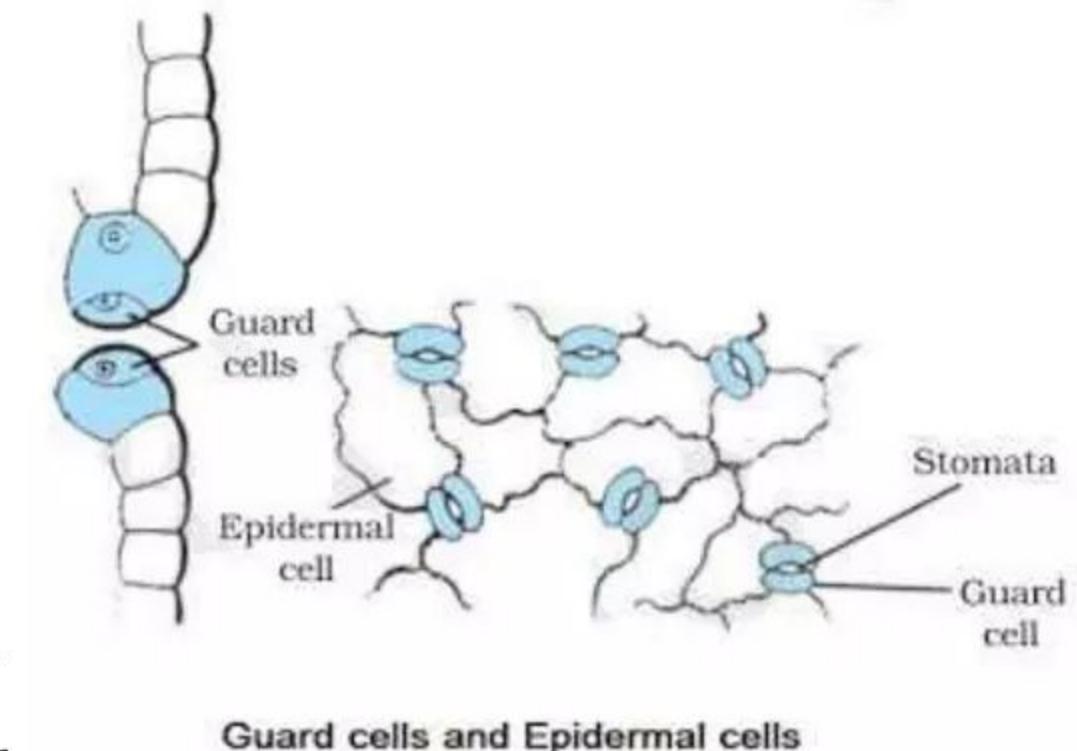
There are two types of protective tissues

1. Epidermis Simple Tissues

- Epidermis tissue covers the entire body of plant.
- They protect plant from injury, germs and water loss.
- Cells of epidermal tissue form a continuous layer without intercellular spaces.
- **Stomata** are small openings on epidermal layer of leaf and soft part of stem to facilitate the gaseous exchange and transpiration in plants. Each stomata is composed of two guard cells which regulate the opening and closing of stomata.
- In desert plants, epidermis and cutin (a water proof waxy substance secreted by epidermis) are thicker to reduce loss of water due to transpiration.

2. Cork Simple Tissues

- These types of tissue consist dead cells with no intercellular spaces.
- They form the outer layer of old tree trunks.
- Cork cells have a chemical called suberin in their walls that makes them impervious to gases and water.
- Cork tissue protects plants from injuries, germs and water loss.
- Cork being light in weight is used for making several products like bottle stoppers and shuttle cork.



Complex Tissues

Group of different type of cells performing common task together are named as complex tissues.

Complex tissues are of two types:

1. Xylem
2. Phloem

➤ Xylem

This is the tissue that transports water and nutrients from root to upper parts of plant. It is composed of four types of cells

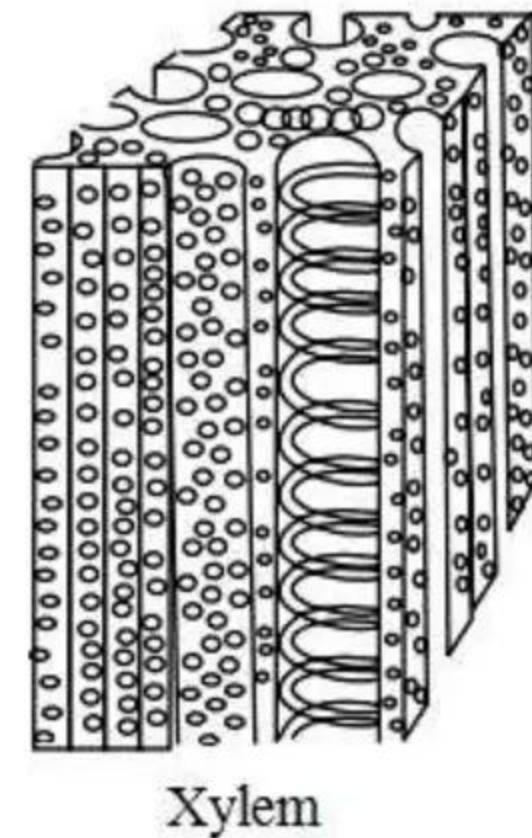
1. Tracheid,
2. Vessel,
3. Xylem parenchyma
4. Xylem sclerenchyma (fibre).

Tracheid's are long elongated cells with tapered ending. Tracheid cells are dead. Tracheid transports water through pits.

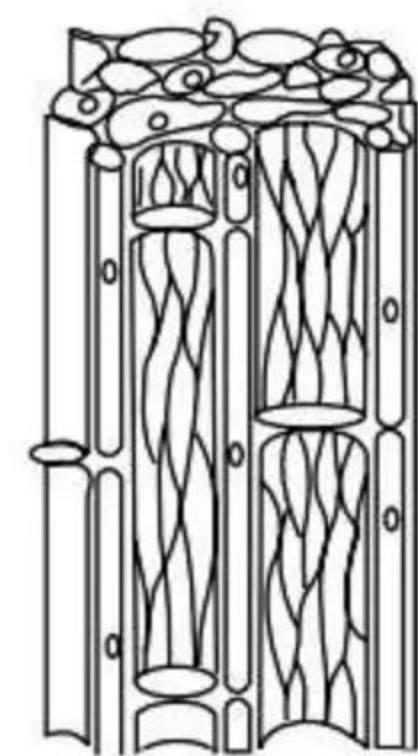
Vessel is a pipe like structure. Vessels are dead and have lignified thick cell wall. Upper and lower portion of cell wall is absent.

Xylem Parenchyma are living cells. They store food and nutrients.

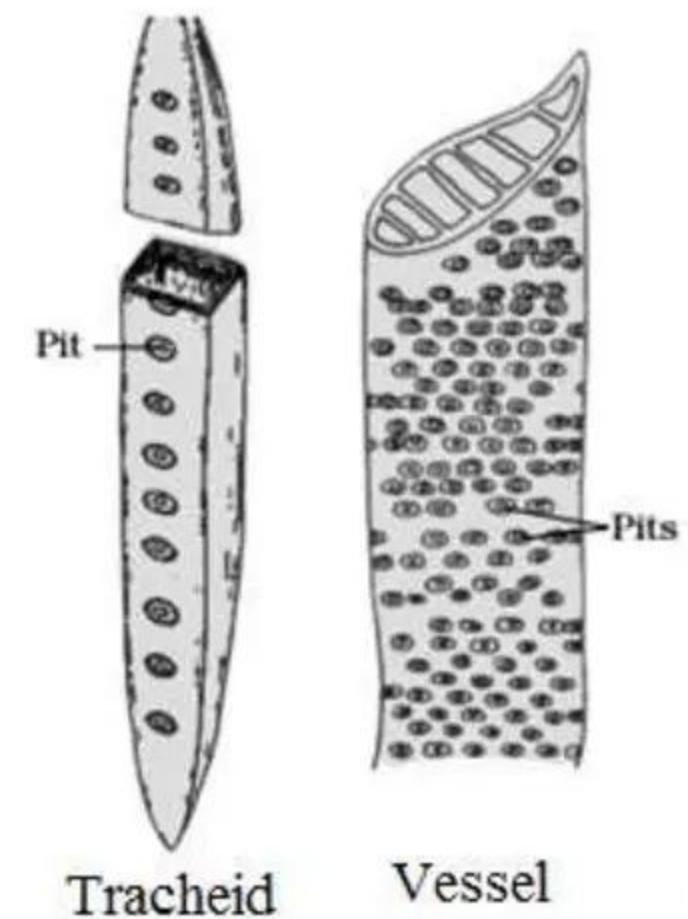
Xylem Sclerenchyma (fibres) are dead cells. They provide mechanical support to plant.



Xylem

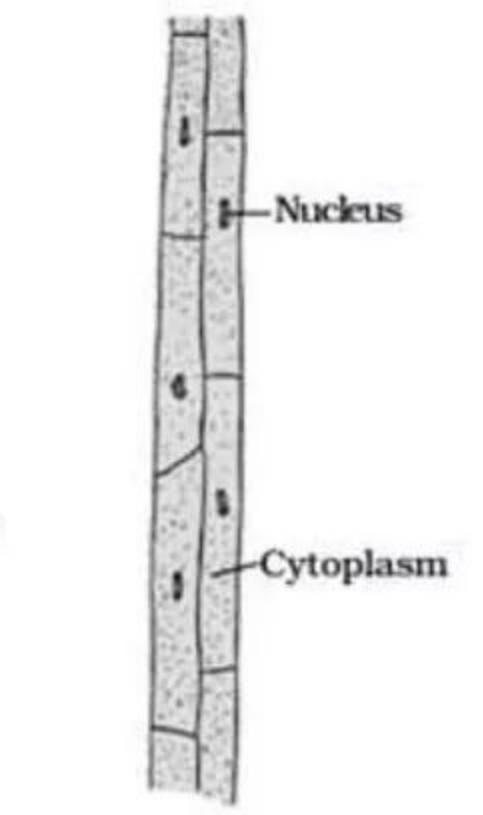


Phloem



Tracheid

Vessel



Xylem parenchyma

➤ Phloem

Phloem is the tissue that transports food from site of photosynthesis to different parts of plants.

It is composed of four types of cell.

1. Sieve cells
2. Companion cells
3. Phloem parenchyma
4. Phloem fibres.

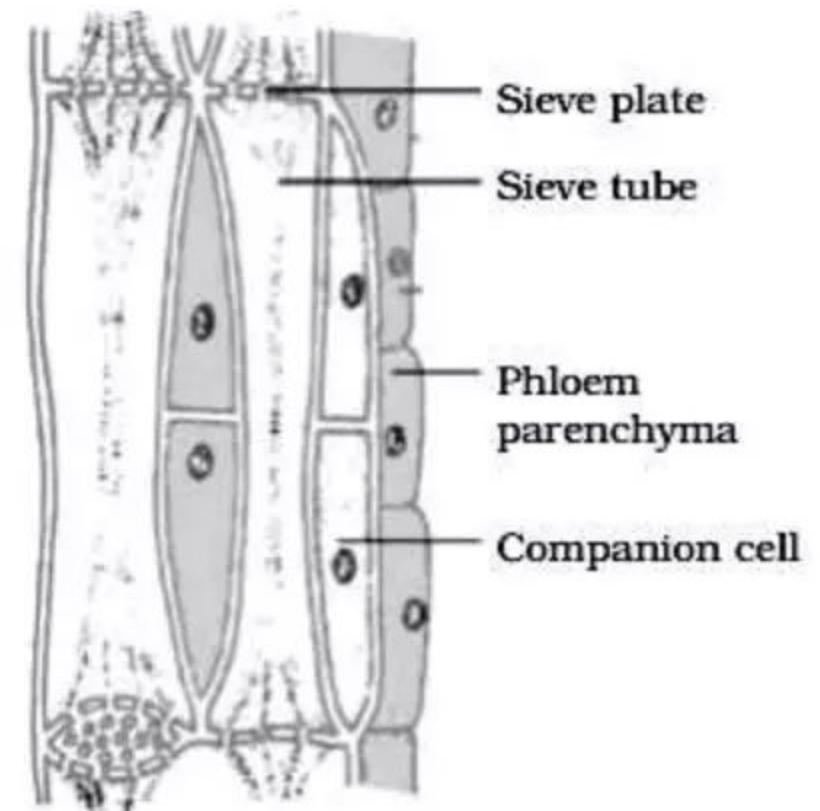
All types of cells are live except phloem fibres.

Sieve cells are elongated and have thin cell wall. They have cytoplasm but no nucleus and other organelles. These cells are responsible for transportation of food and nutrients

Companion cells have cytoplasm, nucleus and other organelles. They perform the tasks required for sieve cells for living.

Phloem parenchyma store food.

Phloem fibres have thick cell wall and they provide mechanical support to plant.



Sectional view of phloem

	XYLEM	PHLOEM
Made of	Dead Cells	Living Cells
Cell wall thickness	Thick	Thin
Cell wall material	Lignin (rigid)	Celluloses
Permeability	Impermeable	Permeable
Cytoplasm	None	Cytoplasm lining
Transports...	Water & minerals	Food
Carried to....	Leaves	Growing parts & storage organs
Direction of flow	Upwards	Up & down
Tissue also has ...	Fibres	Companion cells

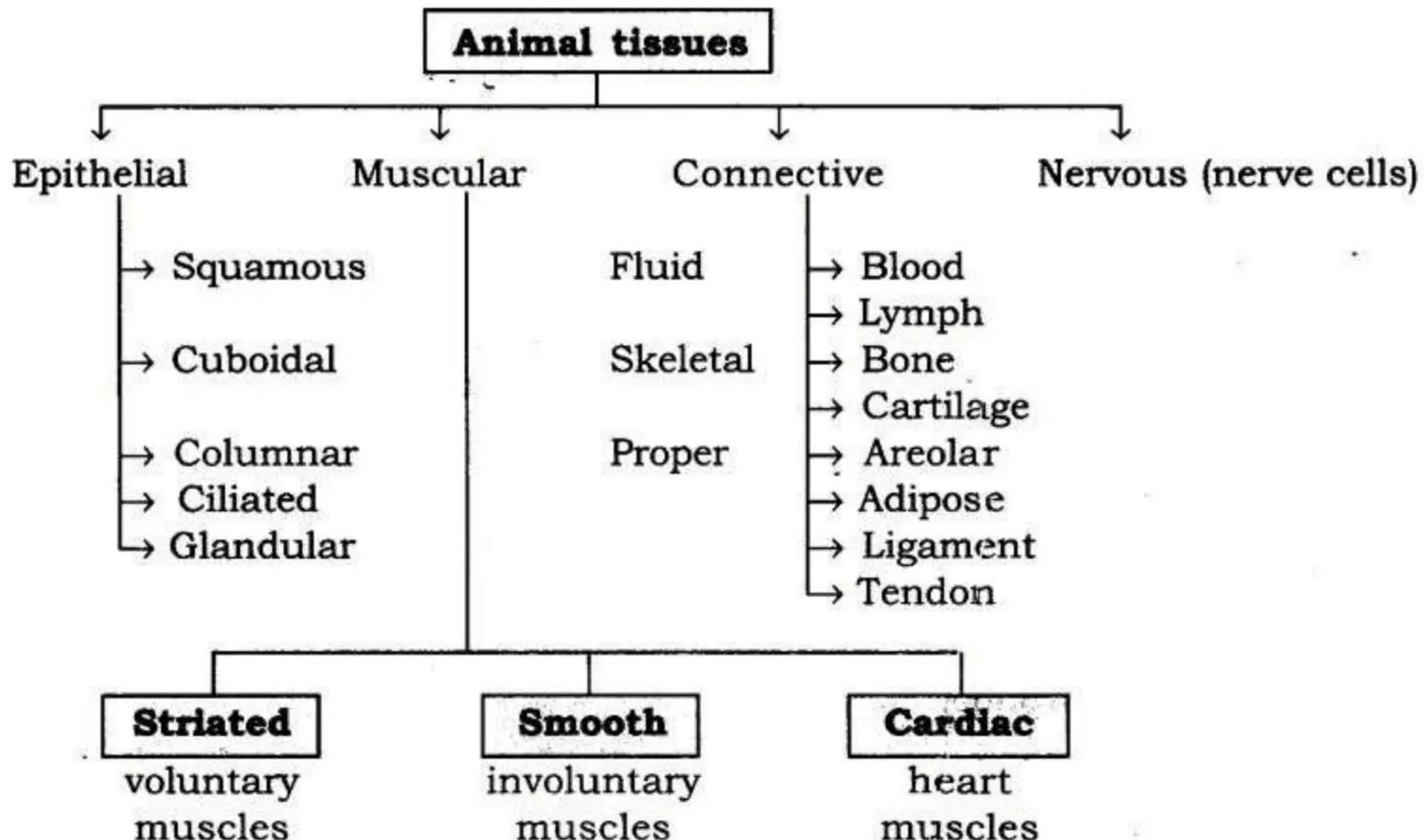
2. Animal Tissues

- All tissues are living.
- Growth is uniform all over the body.
- Due to extensive body mobility these tissues require more energy and maintenance.
- The organs and organ systems in animals are highly developed.

➤ Types of Animal Tissues

Animal tissues are classified into four types based on the functions they perform:

1. Epithelial Tissues
2. Connective Tissues
3. Muscular Tissues
4. Nervous Tissues



1) Epithelial Tissue

They are the protective tissues of the human body.

They cover many organs and cavities that are present inside the body.

➤ Where are the epithelial tissues found in the human body?

- The lining of the blood vessels
- The lining of the mouth
- Kidney tubules
- Skin
- Lung alveoli

➤ Structure And Functions Of The Epithelial Tissues

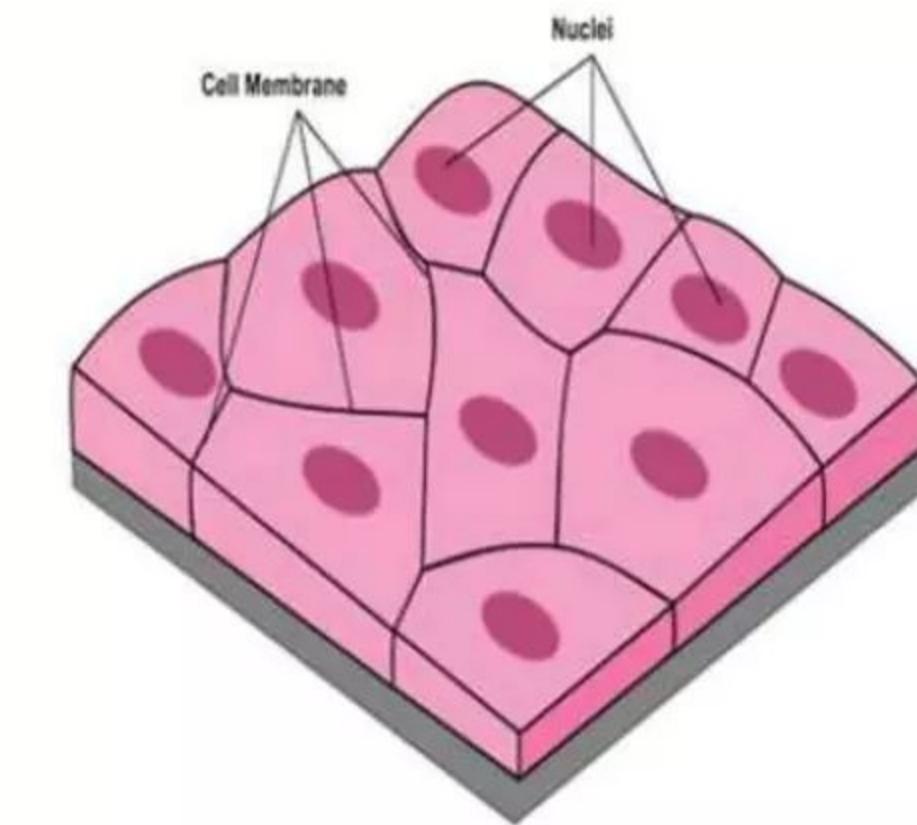
- The main function of the epithelial tissues is to act as a barrier and separate different organs and systems from each other.
- There is no space between the cells of epithelial tissues
- The cells are permeable. This makes it possible for them to exchange materials between different parts of the body and also between the body and the external environment.
- The epithelial tissues remain separated from the tissues beneath them because of a thin membrane over them.

Types Of Epithelial Tissues

Various types of epithelial tissues are:

a) Simple Squamous Epithelium

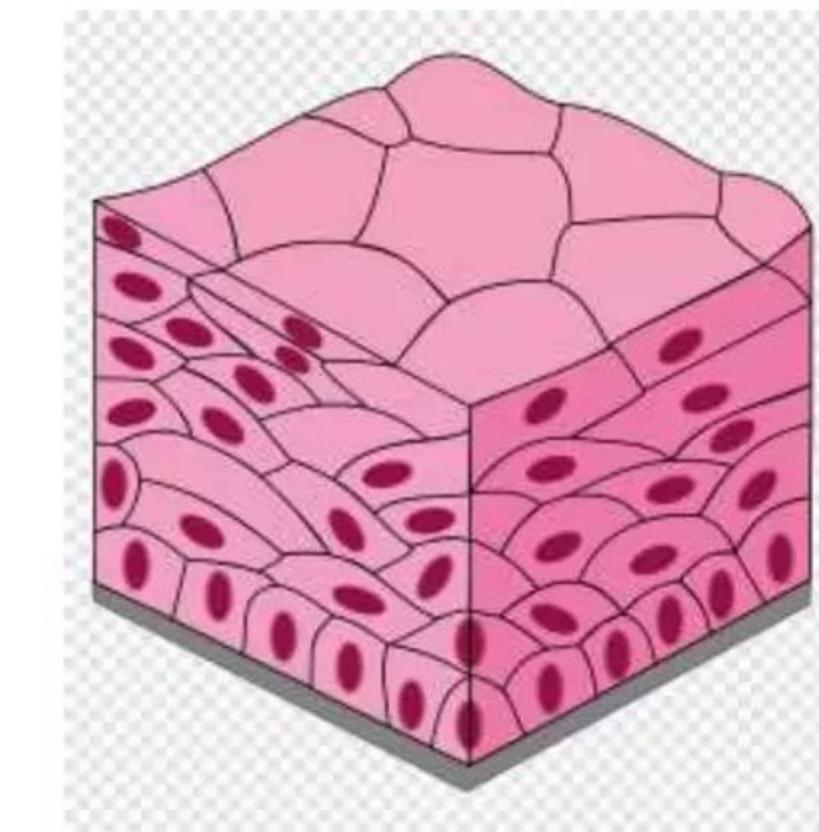
- In cells lining blood vessels or lung alveoli, where transportation of substances occurs through a selectively permeable surface, there is a simple flat and extremely thin kind of epithelium which is named as simple squamous epithelium.
- It is found in the lining of the mouth, oesophagus, lung, alveoli, etc.



Simple Squamous Epithelium

b) Stratified Squamous Epithelium

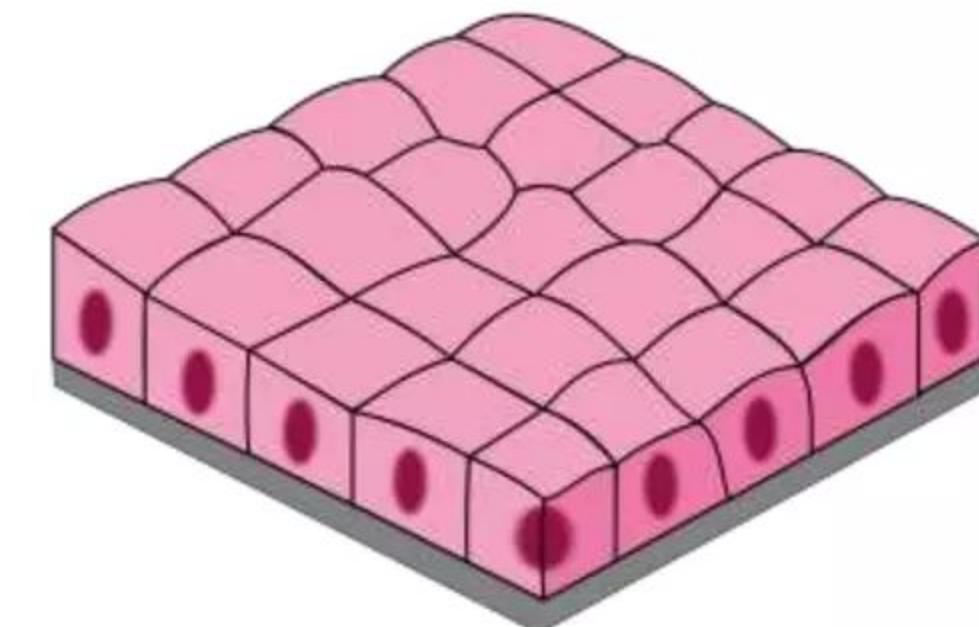
- The skin, which protects the body, is also made of squamous epithelium.
- Skin epithelial cells are arranged in many layers to prevent wear and tear. Since they are arranged in a pattern of layers, the epithelium is called stratified squamous epithelium.



Stratified Squamous Epithelium

c) Cuboidal Epithelium

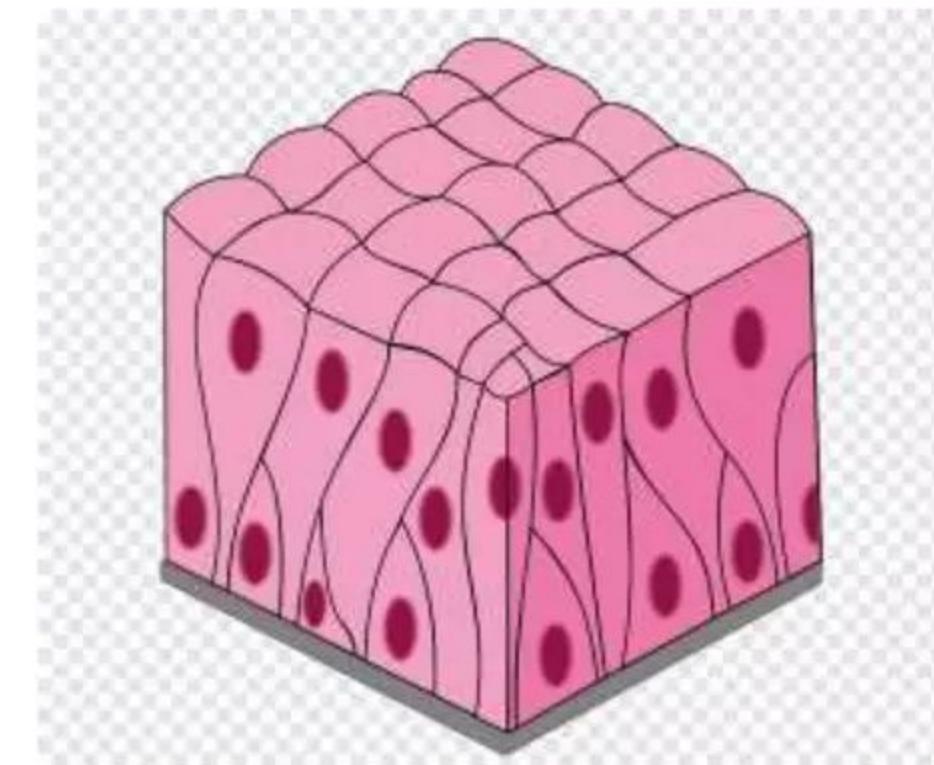
- This is cuboidal in shape and forms the lining of kidney tubules and ducts of salivary glands.
- In some cases a portion of the epithelial tissue folds inward to form a multicellular gland. This is called **glandular epithelium**.
- It performs a function of secretion and absorption.



Cuboidal Epithelium

d) Columnar Epithelium

- Where absorption and secretion occur, as in the inner lining of the intestine, tall epithelial cells are present and are named as columnar epithelium.
- In the respiratory tract, on the outer surfaces of epithelial cells there are hair like projections called cilia. These cilia can move, and their movement pushes the mucus forward to clear it. This type of epithelium is named as **ciliated columnar epithelium**.



Columnar Epithelium

Different Types Of Epithelium Tissues

	Simple Squamous	Stratified Squamous	Columnar	Ciliated Columnar	Cuboidal	Glandular
Structure	They have delicate cell lining and possess a flat thin structure	The epithelium Squamous cells are arranged in several layers	They are the column-like shape tissues	Columnar epithelial tissues which have Cilia present on them	They are cube-shaped cells which are involved in absorption and secretion.	These are special gland cells that can secrete substances
Found in	Alveoli and bowman's capsule- nephron in kidney	Skin	Intestine	Respiratory system	Kidney tubules	Sweat glands in the skin

2) Connective Tissues

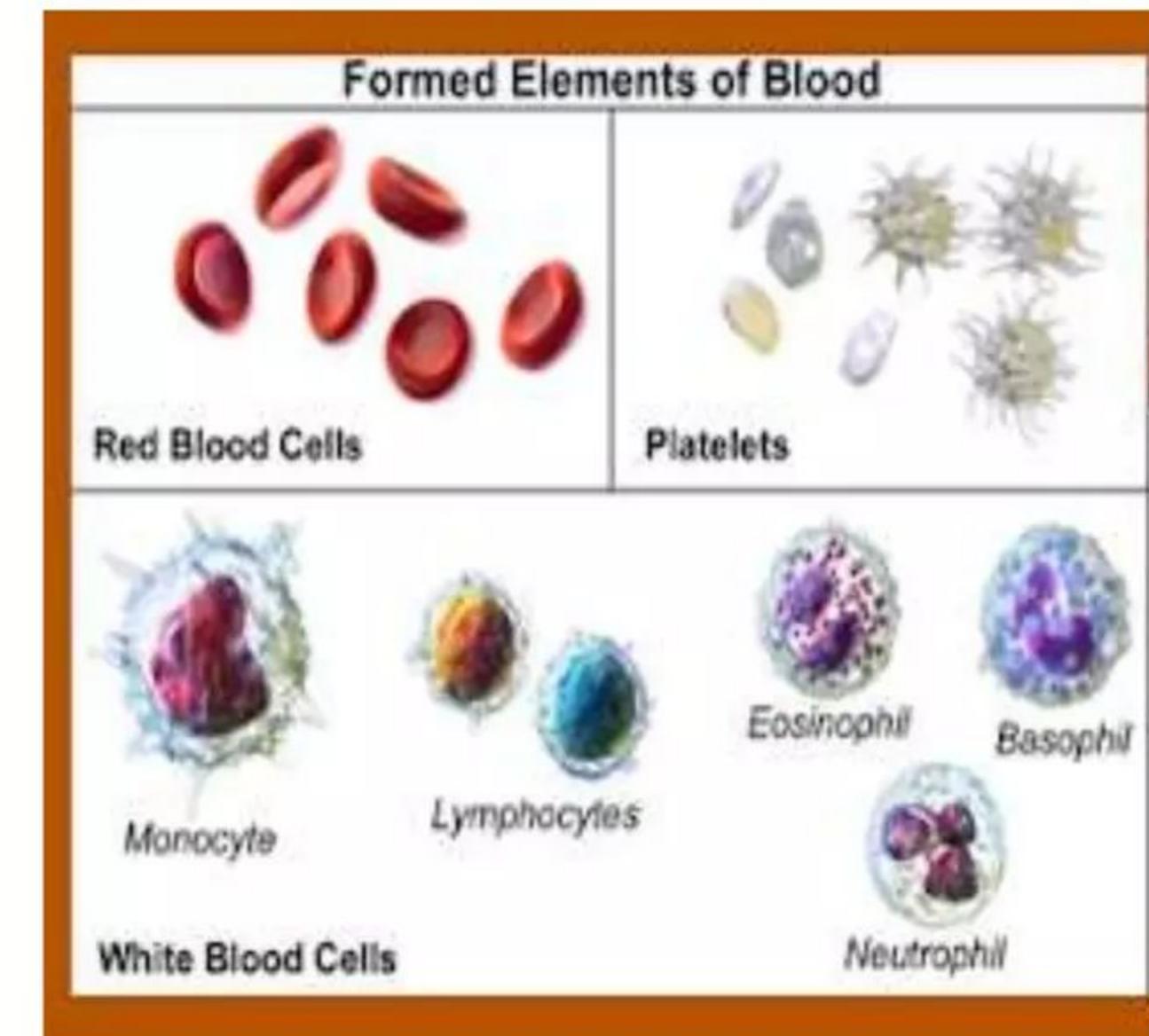
➤ Structure and function of connective tissues

- They are loosely bound cells present in an intercellular Matrix.
- This matrix can be of different types – Dense, Rigid, Fluid or Jelly-like.
- Depending upon the functionality of the connective tissue, the nature of the matrix varies in them.

➤ Examples of Connective Tissues

1. Blood

- The main function of blood is to transport gases, food, waste materials and hormones in the body.
- Therefore, blood has a fluid Matrix present in it which is called **Plasma**.
- The plasma contains the red blood cells, the white blood cells and blood platelets.
- The RBC have hemoglobin pigment which carries oxygen to tissues.
- White blood cells fight diseases and platelets are involved in clotting of blood when injured.
- The plasma also contains proteins and hormones in it.



2. Bones

- Bones form a framework of the body over which the muscles are wrapped together.
- The bone tissue is strong and inflexible in nature.
- Therefore, the bone cells are present in a rigid matrix which is formed from calcium and phosphorus.



3. Cartilage

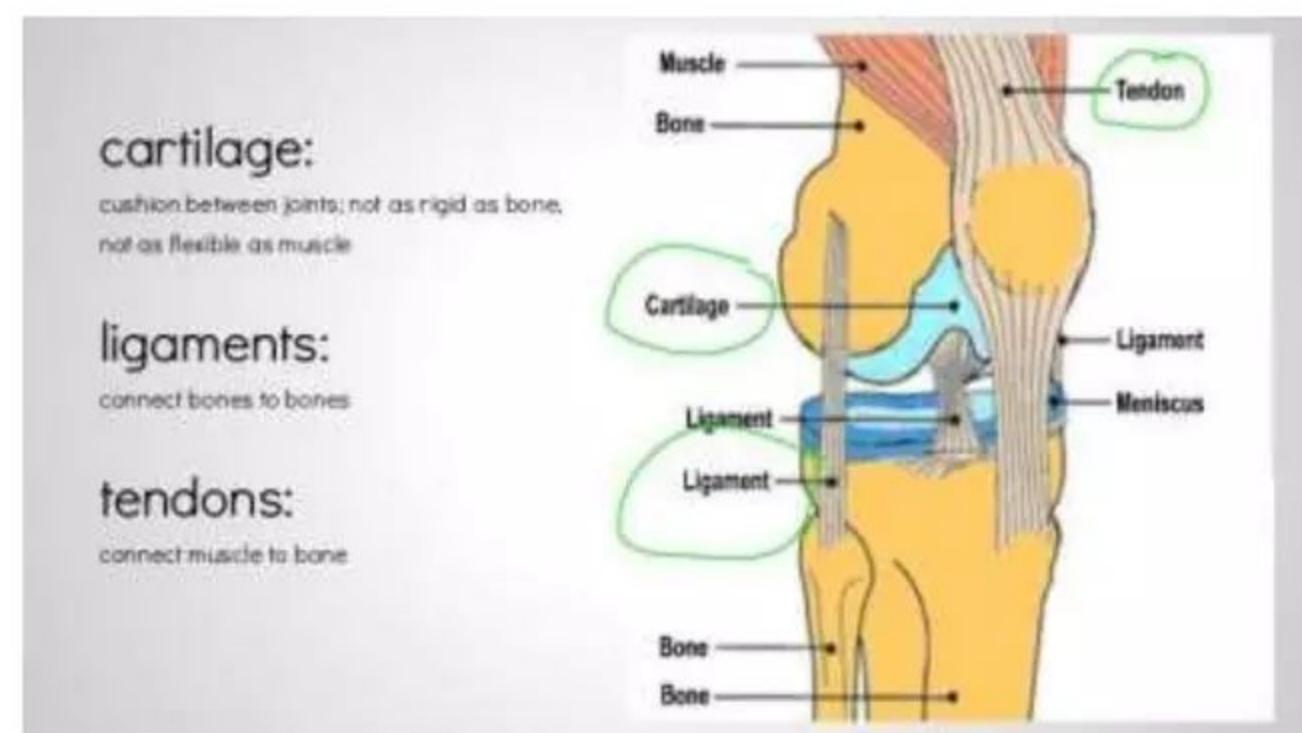
- Cartilage is present over the joints of the bones and provides them with a smooth structure.
- For example in the nose tip and ear pinna, trachea, larynx.
- They contain solid matrix made of protein and sugar. They have homogenous matrix.
- It provides support and flexibility to various parts of our body.

4. Ligaments

- A ligament connects two bones together.
- It has an elasticity which facilitates the connection.
- The cells of ligaments have a little matrix.

5. Tendons

- The tendons tissues are responsible for connecting bones and muscles together.
- They have limited flexibility but very great strength.



Types Of Connective Tissue

Various types of connective tissues are

a) Areolar tissue

- They are found in the skin and muscles, around the blood vessels, nerves, etc.
- This tissue acts as a filter in between the spaces present inside the organs of the body.

➤ Function Of Areolar Tissue

- It fills the space inside the organs, supports internal organs and helps in repair of tissues.

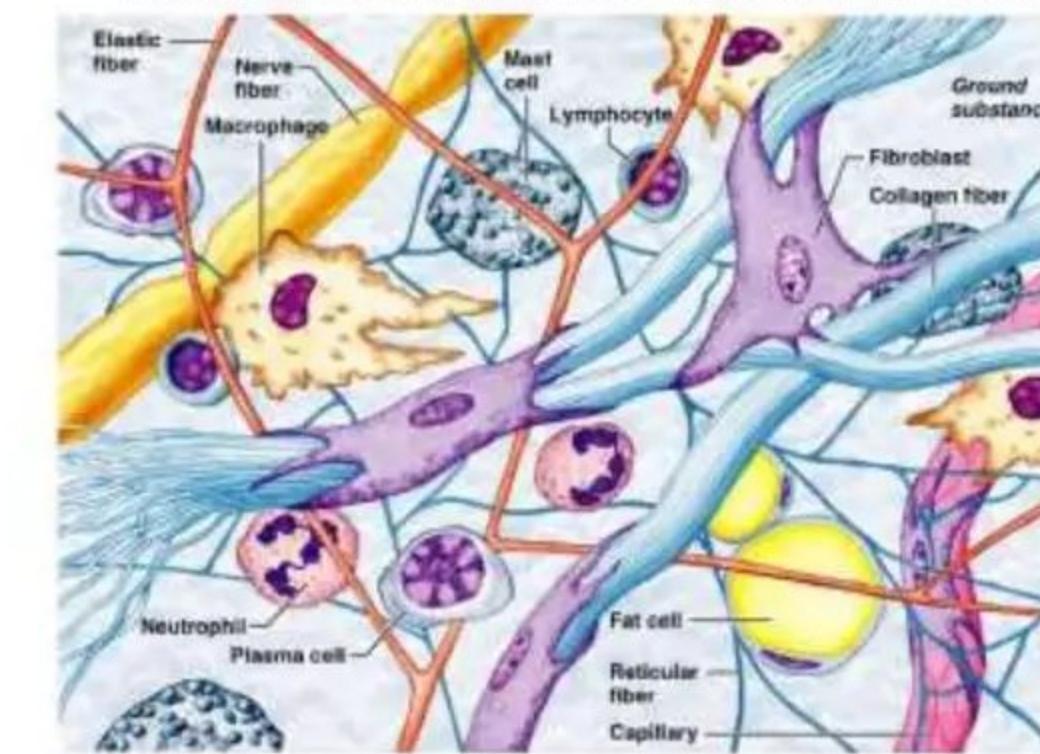
b) Adipose tissue

- It is found between the internal organs and below the skin.

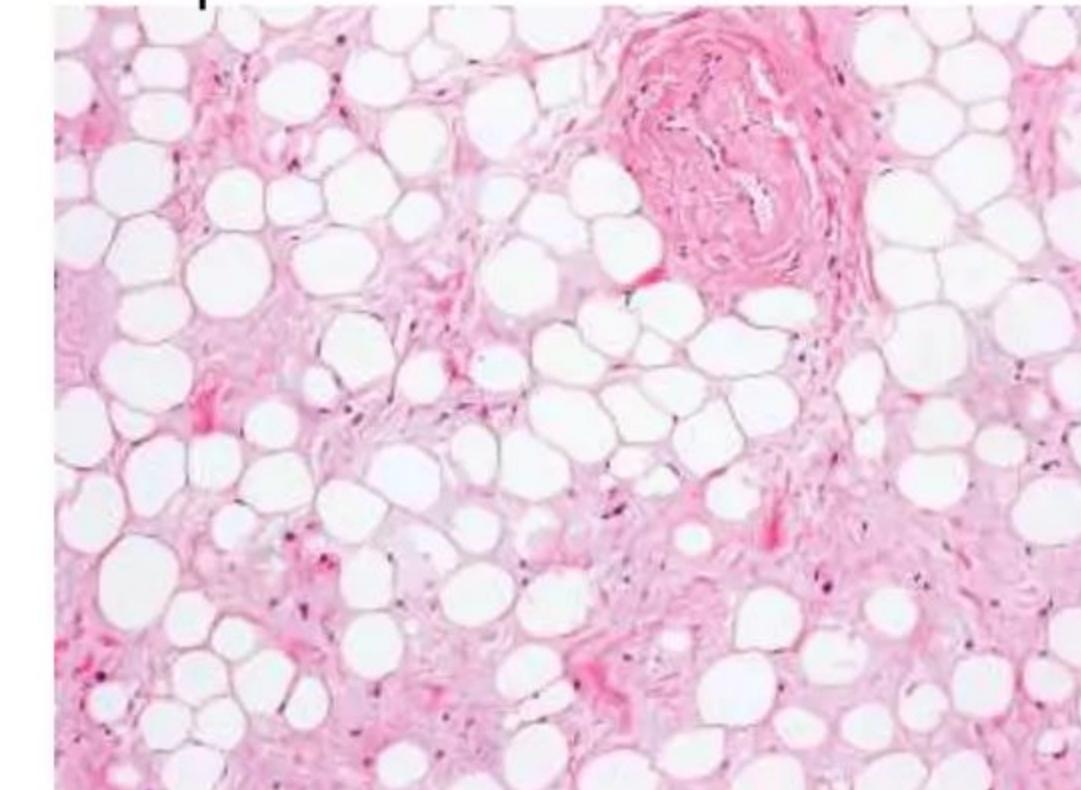
➤ Function Of Adipose Tissue

- It stores fats.
- It act as an insulator

Areolar Connective Tissue: Model



Adipose Connective Tissue



3) Muscular tissues

- Muscular tissue consists of elongated cells, also called muscle fibres. This tissue is responsible for movement in our body.
- Main function of muscular tissues is to provide movement to the body.
- Muscles contain special proteins called **contractile proteins**, which contract and relax to cause movement.

➤ Types of Muscular Tissues:

Muscular tissues are of three types

a) Striated Muscles or Skeletal Muscles or Voluntary Muscles

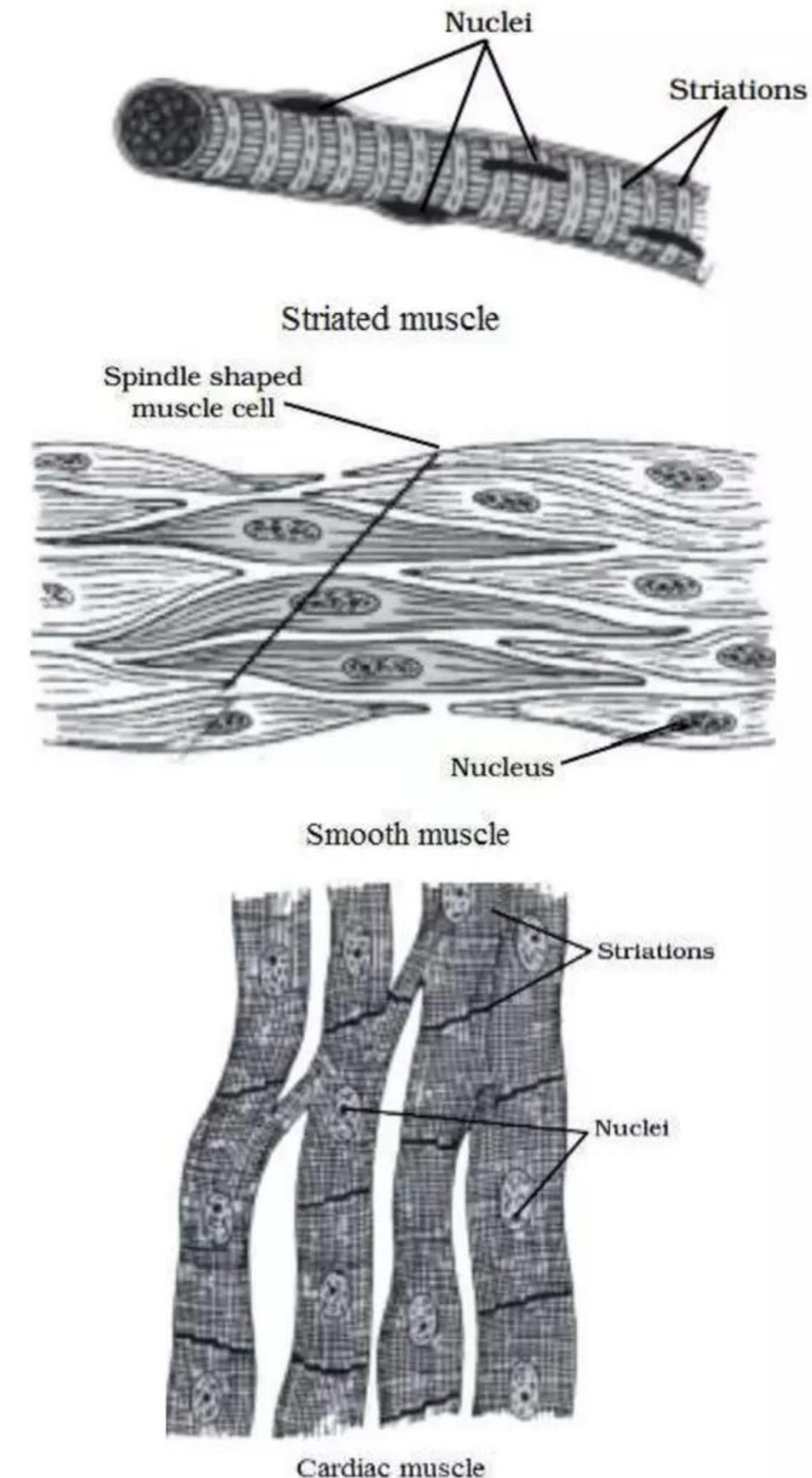
- These muscles are also called skeletal muscles as they are mostly attached to bones and help in body movement.
- Cells are cylindrical, unbranched and multinucleate.

b) Smooth Muscles Or Involuntary Muscles

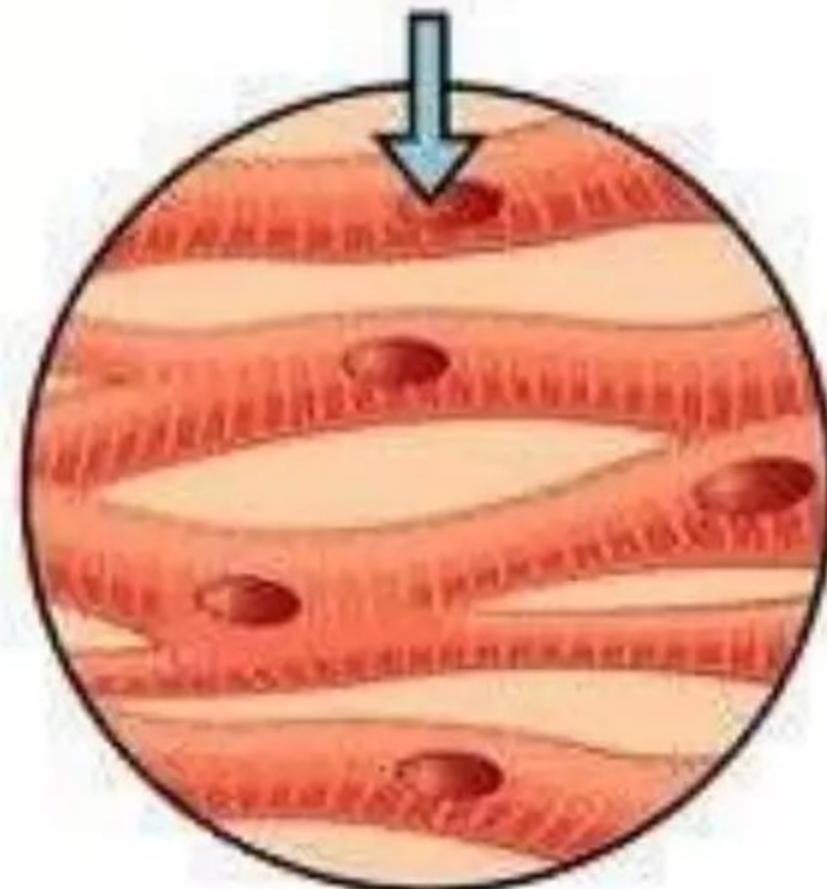
- They are found in the iris of the eye, in ureters and in the bronchi of the lungs.
- Cells are long, spindle-shaped and possess a single nucleus.

c) Cardiac muscles or involuntary muscles

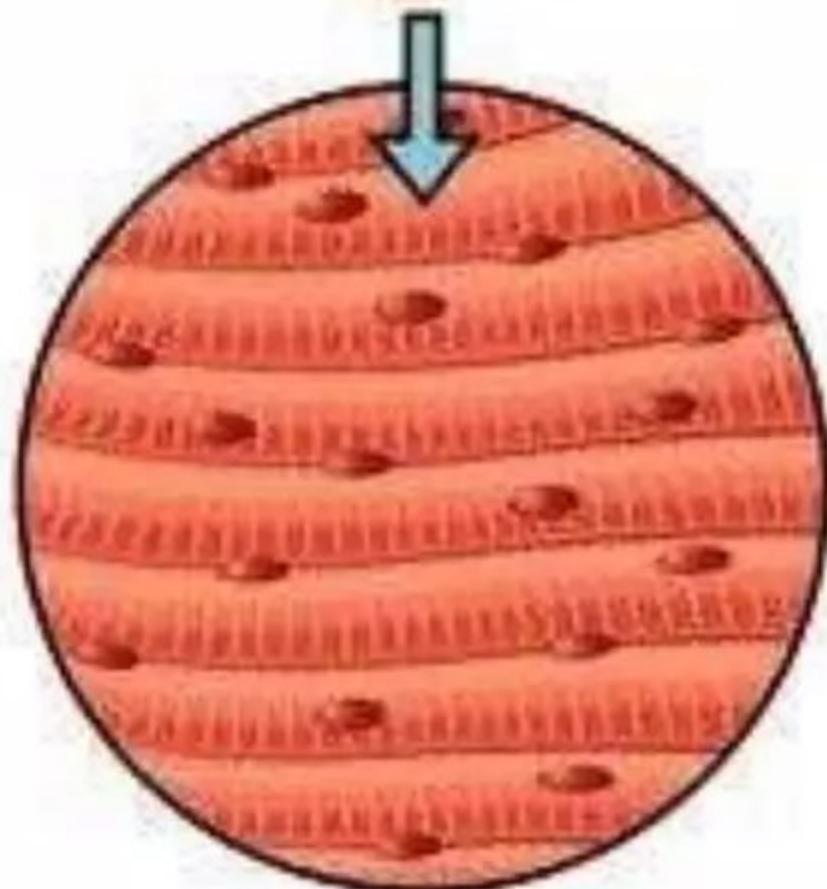
- They help in rhythmic contraction and relaxation of the heart.
- Cells are cylindrical, branched and uninucleate



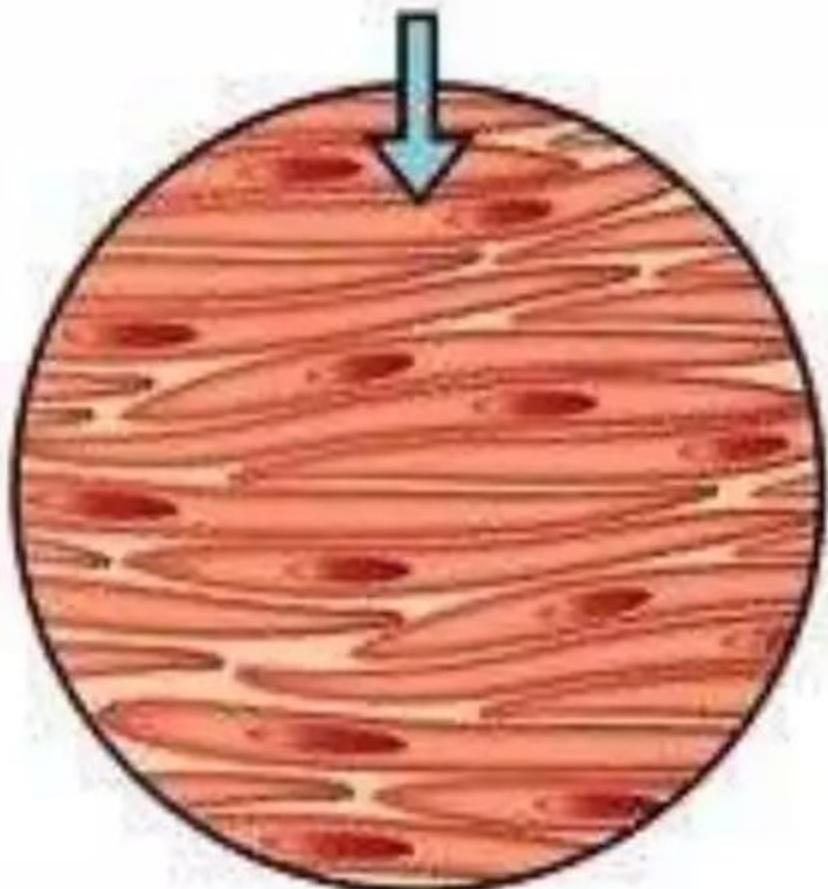
Striated/ Skeletal/ Voluntary muscles	Smooth/ Unstriated/Involuntary muscles
We can move them according to our own will	We cannot start or stop the movement of involuntary muscles.
They are also called Skeletal Muscles as they are attached to the bones.	They also called Smooth Muscles .
They are also called Striated Muscles because of the presence of dark and light bands over them	They are also called Unstriated Muscles because they do not have any light or dark bands on them.
The cells of voluntary muscles have more than one nucleus, they do not have any branches, and have a long cylindrical structure.	The cells of the involuntary muscles are long and have pointed ends.
For Example , Muscles of our hands and legs.	For Example , The muscles in the alimentary canal and the Iris of our eyes.



Cardiac muscle tissue
(Involuntary control)



Skeletal muscle tissue
(Voluntary control)



Smooth muscle tissue
(Involuntary control)

4) Nervous Tissue

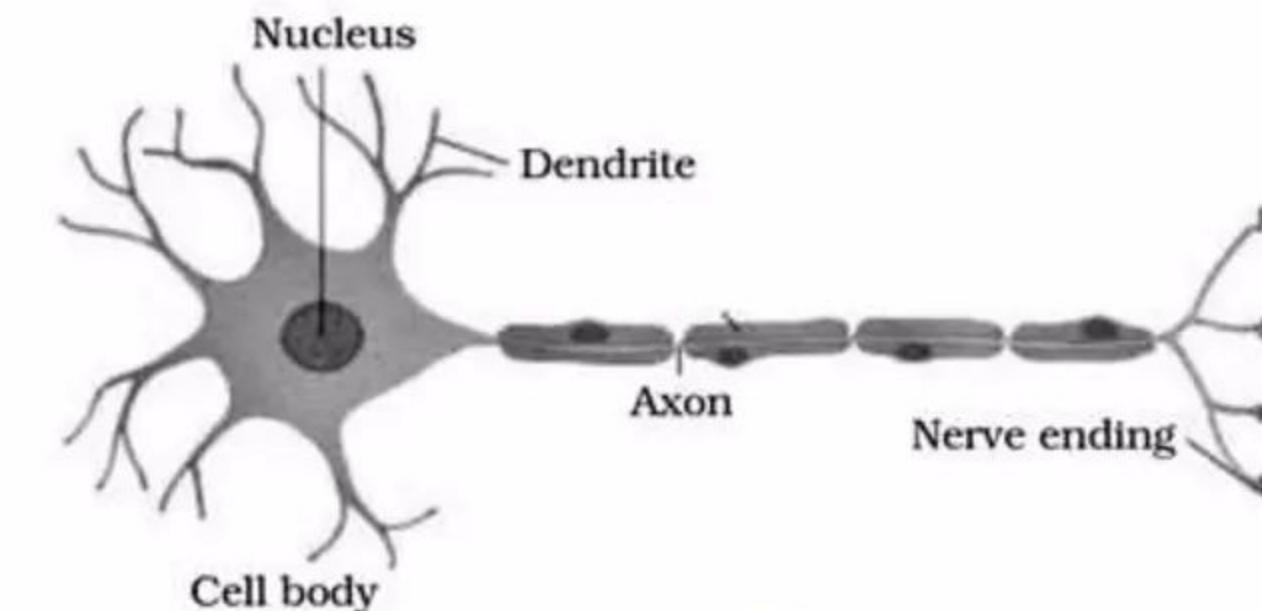
➤ How do we react to stimuli?

This is because of the nervous tissues present in our body. They are capable of transmitting information quickly from the brain to different parts of the body and vice-versa.

- Therefore nervous tissues are found in nerves, brain, and spinal cord.
- The Nervous tissue is made up of cells called the **Nerve Cells or Neurons**.
- These neurons connect together to form the nerves of our body.

➤ Structure of a Neuron

- It is an elongated cell with a Cell Body that consists of some branch-like structure called Dendrites.
- There is a Nucleus present in the center of the cell body.
- The Nerve Endings of the cell are connected with the cell body via Axon.
- A nerve cell can be up to 1 m long.



Structure of neuron

The Structure of Neuron

1. Dendrites

- They are tree-like extensions (highly-branched) at the beginning of a neuron.
- They increase the surface area of the neuron.
- They receive chemical signals from different neurons of the body.
- They then convert these chemical signals into electrical signals and pass them to the neuron cell body.
- A neuron can have a single dendrite or multiple dendrites

2. Cell Body

- The main function of the cell body and nucleus of the neuron is to maintain the functionality of the cell.
- It does not play an active role in the transmission of the signal.
- It produces proteins that are required by different parts of the neuron to work properly.
- It contains different cell organelles such as mitochondria, Golgi apparatus etc. that perform various functions of the cell.

3. Axon

- Neurons have one axon in general.
- It is a long structure that connects the cell body to the terminals and it also connects with other neurons, cells and organs of the body through nerve terminals.
- It allows in fast transmission of signals. The larger the diameter of the axon the faster it will transmit signals.
- It is covered with a special insulating substance called myelin. It helps in rapid transmission of signals.

THANK YOU