TISSUE

A group of cells that are specialized to perform a particular function forms a tissue.

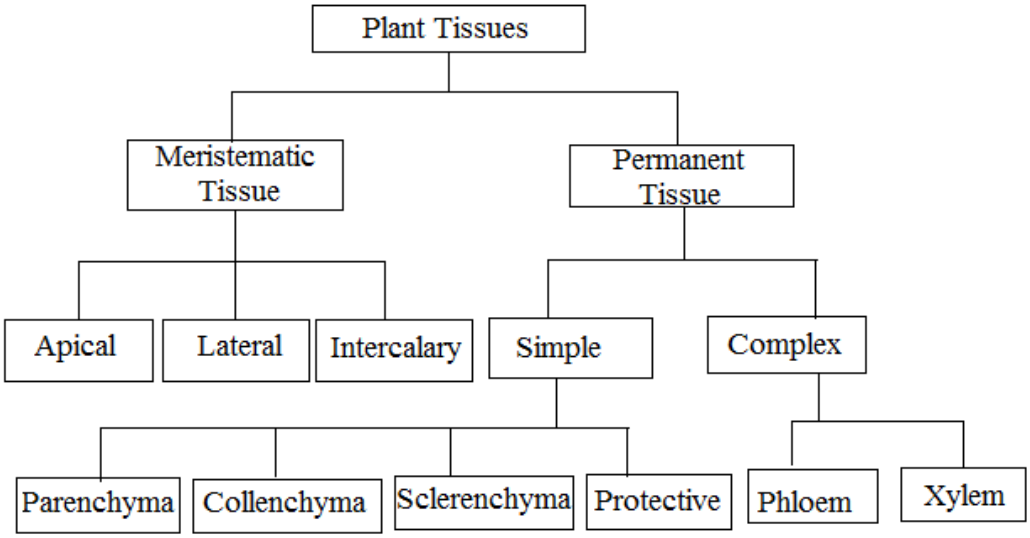
Tissues are mainly classified into two types:
1. Plant Tissues 2. Animal Tissues

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:

Based on the dividing capacity of the tissues, various plant tissues can be classified as growing or meristematic tissue and permanent tissue which have further sub-divisions as explained below:



A. Meristematic Tissue

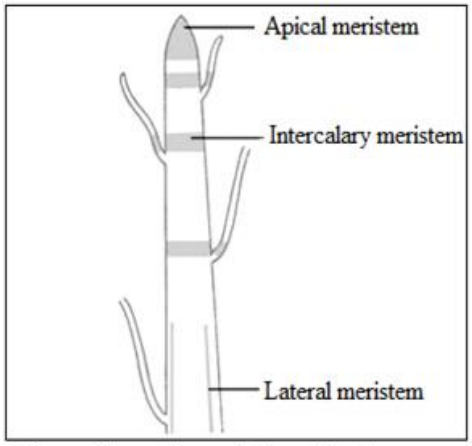
Meristematic tissues are responsible for growth in plants. Cells in these tissues can divide and form new cells.

Meristematic tissues are of three types:

(I) Apical meristem: It is present at the growing tip of the stem and roots and increases the length. .

(II) Lateral meristem (cambium): It is present beneath the bark. It is responsible for growth in girth of trunk.

(III) 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

B. Permanent Tissue

- Cells of meristematic tissues change their shape & size to get specialised in performing other functions in plants body. This process is called Differentiation.
- Once the cells of meristematic tissue divide to a certain extent, they become specialized for a particular function.

Permanent tissues are of two types:

Simple tissues and Complex tissues

(I) SIMPLE TISSUES: This type of tissue is composed of same type of cells. These are again of four types:

(A) 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 .

(B) COLLENCHYMA SIMPLE TISSUES: Cells of collenchyma are live. They are oval and elongated and tighily packed with no inter-cellular spaces. They are found below epidermis in leaves and stem.

Functions of collenchymas tissues:

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

(C) SCLERENCHYMA SIMPLE TISSUES: Cells of sclerenchym 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: Scalerenchyma tissues are found in coconut husk.

Functions of sclerenchyma:

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

(d) 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 transperation 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.

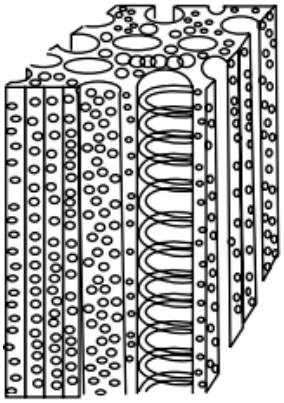
2. Cork simple tissues: These types of tissue consist dead cells with no intercellular spaces. They form the outer layer of old tree trunks.

Cork cells have a chemical called suberin in their walls that makes them impervious to gases and water.

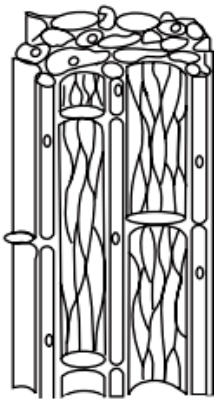
Cork tissue protects plants from injuries, germs and water loss.

Cork being light in weight is used for making several products like bottle stoppers and shuttle cork.

(ii) Complex tissues: Group of different type of cells performing common task together are named as complex tissues.
Complex tissues are of two types:
(a) Xylem (b) Phloem

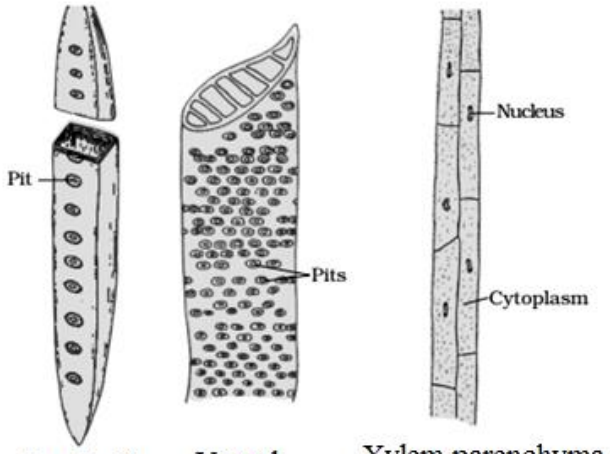


Xylem



Phloem

(A) 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 i.e., tracheid, vessel, xylem parenchyma and xylem sclerenchyma (fibre).



Tracheid Vessel Xylem parenchyma

1.Trachieds are long elongated cells with tapered ending. Trachied cells are dead. Trachied transports water through pits.

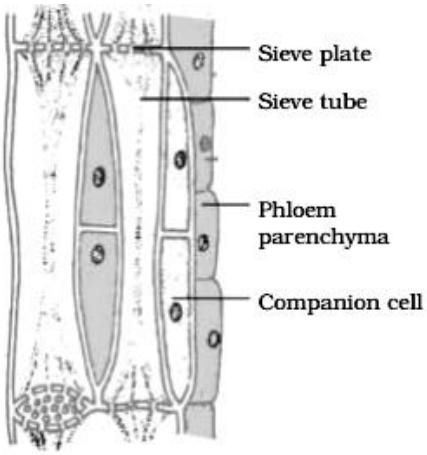
2. Vessel is a pipe like structure. Vessels are dead and have lignified thick cell wall. Upper and lower portion of cell wall is absent.

3. Parenchymas are living cells. They store food and nutrients.

4. Sclerenchymas (fibres) are dead cells. They provide mechanical support to plant.

(B) 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 i.e. sieve cells, companion cells, phloem parenchyma, phloem fibre or blast fibre. Al types of cells are live except phoem fibres.



Sectional view of phloem

1. 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

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

3. Phloem parenchyma store food.

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

TRANSPORT OF SUBSTANCES THROUGH PLASMA MEMBRANE

Selectively Permeable Membrane:

Plasma membrane permits the entry and exit of certain materials in the cells. Therefore, it is named as selectively permeable membrane.

Substances can pass through the plasma membrane by two processes:

1. Diffusion

2. Osmosis

Diffusion

It is the process of movement of substances from a region of high concentration to the region of low concentration until uniform concentration is finally acheived.

For example:

- During the respiration, due to the difference of the concentration of carbon dioxide (CO_2), inside and outside of the cell, CO_2 is given out a waste product, moving out from region of high concentration to region of low concentration.
- Similarly, oxygen (O_2) enters the cell by the process of diffusion when level of concentration of O_2 inside the cell decreases.

Osmosis

It is the process of movement of water from its high concentration region to its low concentration region through semi-permeable membrane.

Different types of solutions exhibiting osmosis are:

(i) Hypotonic Solution:

If the medium surrounding the cell has a higher water concentration than the cell, i.e., if the solution is very dilute solution, then the cell will gain water by osmosis. Such dilute solution is called Hypotonic solution.

Endomosis: Though water molecules are free to pass across plasma membrane in both sides but more water will enter inside the cell. The cell will therefore swell up and increase in volume. This process is called **Endosmosis.**

(ii) Isotonic Solution:

If the medium surrounding the cell is of exactly the same water concentration as inside the cell, there will be no net movement of water across membrane resulting in no change in size of cell. Such solution is called Isotonic solution.

(iii) Hypertonic solution:

If the medium surrounding the cell has a lower water concentration than inside the cell, i.e., if the solution is highly concentrated, then the cell will lose water through osmosis. Such concentrated solution is called Hypertonic solution.

Exomosis: When the water moves out of the cell placed in a highly concentrated solution, it wall cause the cell to shrink. This process is known as Exosmosis.

Plasmolysis and Cytolysis:

The biological phenomena of exosmosis when a cell or tissue is placed into a strong hypertonic solution, is termed as plasmolysis, whereas the reverse process is **cytolysis**, which occurs if the cell is placed in a hypotonic solution resulting in a lower external osmotic pressure and a net flow of water into the cell.

Difference between Diffusion and Osmosis:

S. No.	Diffusion	Osmosis
1.	It can take place in any medium.	It can take place only in liquid medium.
2.	Semipermeable membrane is not required.	Semipermeable membrane is required.
3.	Here the diffusing molecules may be solids, liquids or gases.	It involves the movement of solvent molecules only.
4.	It is dependent on the free energy of the molecules of the diffusing substance only.	Here the diffusion of the solvent molecules is affected by the presence of other substances (solute) in the system.
5.	An equilibrium in the free energy of the diffusing molecules is achieved.	Equilibrium in the free energy of the solvent molecules is never achieved.

Mediated Transport:

Plasma membrane renders the transposrt of many molecules of biological significance. Such essential molecules are moved across the membrane by special proteins called transport proteins or permeases. This process of forced diffusion of certain substances through the plasma membrane is called mediated transport.

Note: Permeases used in the process are quite specific to the substance they transport.

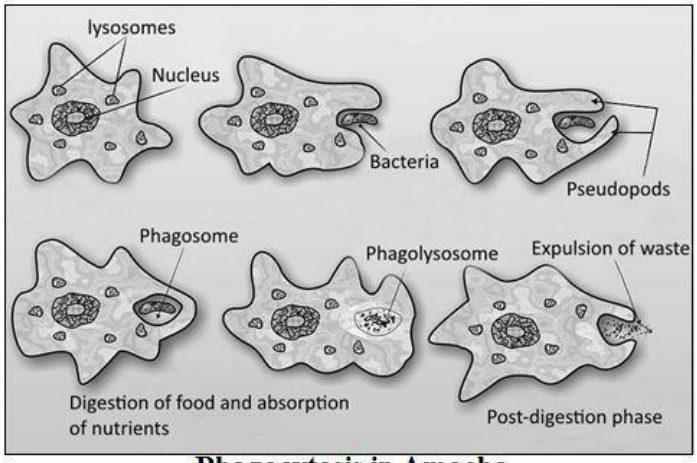
Types of Mediated Transport:

It is of the following two types:

(i) Facilitated transport/diffusion: Here, the permeases assists a molecule to diffuse through the membrane that it cannot otherwise penetrate.
(ii) Active transport: In this case, the energy is supplied to the system to transport the molecules in a direction opposite to a concentration gradient.
Endocytosis:
It is the process of ingestion of materials by the cells through the plasma membrane.

It describes all three similar processes: phagocytosis (cell eating), potocytosis (cell drinking) and receptor-mediated endocytosis.

Phagocytosis: It is a method of intake of food materials by certain organisms like protozoa (Amoeba). The flexibility of the cell membrane enables the cell to engulf the solid particles of food and other materials from its external environment.



Phagocytosis in Amoeba

Exocytosis:
In this process the membrane of a vesicle can fuse with plasma membrane and extrude its contents to the surrounding medium. This process is also named as cell vomiting.

Cells exhibit exocytosis to:

- Remove the undigested residues od=f substances brought in by endocytosis.
- Secrete substances such as hormones, enzymes
- Transport a substance completely across a cellular barrier.

ANIMAL TISSUES

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

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

1. **Epithelial tissues:** Form the covering of the external surfaces, internal cavities and organs of the animal body. Various types of epithelial tissues are:
    - **Simple squamous epithelium:** Single layer of flat cells.
      Location in the human body: Lining of the mouth, oesophagus, lung, alveoli, etc.
    - **Cuboidal epithelium:** Consists of cube like cells.
      Location in the human body: Lining of the kidney tubules and ducts of the salivary glands. It's function is secretion and absorption.
    - **Columnar epithelium:** Consists of elongated or column-like cells.
      Location in the human body: Inner lining of the intestine and gut. Its function is of secretion and absorption.
2. **Connective tissues:** Specialised to connect various body organs. Various types of connective tissues:, are:
    - **Areolar tissue:** Found in the skin and muscles, around the blood vessels, nerves, etc.
    - **Adipose tissue:** Acts as the storage site of fats; found between the internal organs and below the skin; acts as an insulator for the body.
    - **Dense regular connective tissue:** Main components are tendons and ligaments; tendons connect muscles to bones, while ligaments connect two bones together.
    - **Skeletal tissue:** Main components of skeletal tissues are cartilage and bone.
    - **Fluid tissue:** Blood is the vascular tissue present in animals.
3. **Muscular tissues:** Main function of muscular tissues is to provide movement to the body. Muscular tissues are of three types:
    - **Striated muscles or skeletal muscles or voluntary muscles:** Cells are cylindrical, unbranched and multinucleate.

- **Smooth muscles or involuntary muscles:** Cells are long, spindle-shaped and possess a single nucleus.
- **Cardiac muscles or involuntary muscles:** Cells are cylindrical, branched and uninucleate.

4. **Nervous tissues:** Present in the brain, spinal cord and nerves.
    - **Neuron:** Cells of the nervous tissue.
    - **A neuron:** consists of a cell body, an axon and a dendrite.

YOU CAN DO DIAGRAMS FROM ANY WHERE