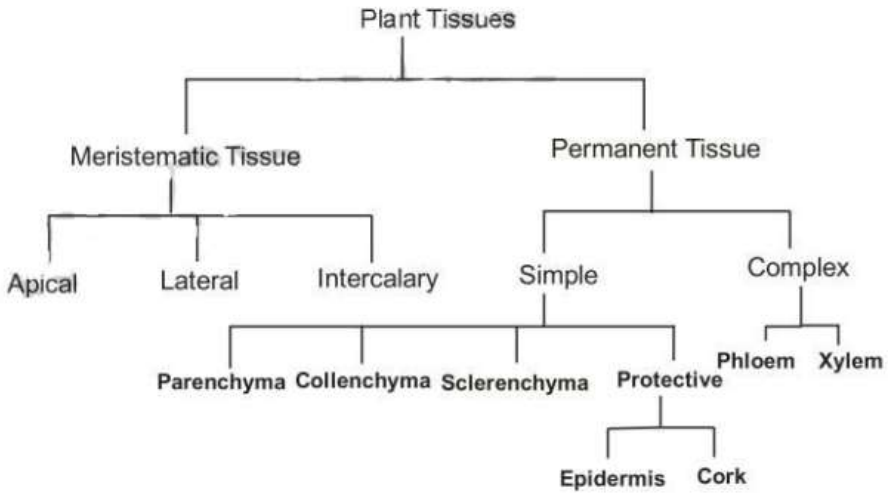
Tissues

Tissues
Tissue is a group of cells that work together to perform a particular function.

Division of Labour / Cell Specializing
In simple organisms, all body functions are done by the single cell itself like Amoeba. But in complex organisms (like in human, plants etc.), different groups of cells perform different functions.
As different groups of cells or tissues are specialized in doing different job, any work is done much more efficiently compared to unicellular organism.

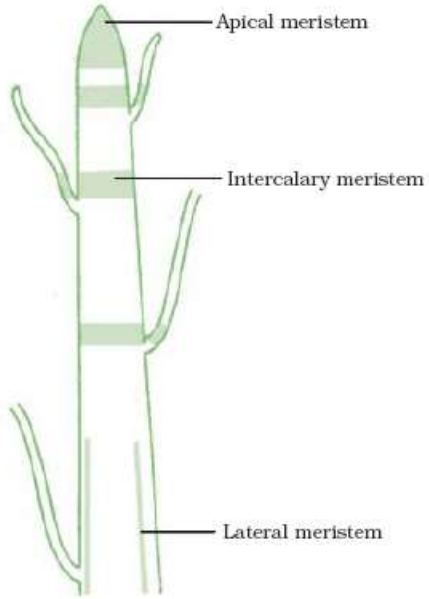
Tissues are mainly classified in two types:
1. Plant Tissues **2. Animal Tissues**

Plant Tissues



Meristematic Tissue (Meristem)
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: Present at tip of stem & roots. It is responsible for growth in length.
2. Lateral Meristem (Cambium): Present beneath bark. It is responsible for growth in girth of trunk.
3. Intercalary Meristem: Present in nodes of leaves & stem.



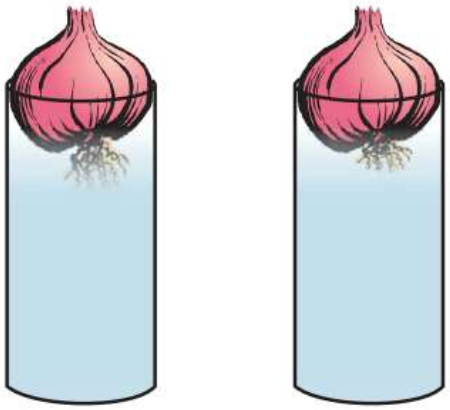
Properties of cells of meristem:

- Cells of meristematic tissues are very active and work faster.
- They do not have vacuoles.

Experiment:

- Take 2 onions in jars as shown.
- Observe the growth of roots for 5 days.
- Cut the tips of the roots of onion in jar 2.
- Observe the growth of roots for next few days.
- Roots in jar 2 stop growing.

When tip of roots are cut, apical meristem present there is lost. So no further growth happens.



Jar 1 Jar 2

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.
Cells of meristematic tissues differentiate to form different types of permanent tissues.
Permanent tissues are of two types:

1. Simple Tissues: This type of tissue is composed of same type of cells.
2. Complex Tissues: Group of different type of cells performing common task together.

Simple Tissues

a. Parenchyma simple tissues: Cells of parenchyma tissues are live. They are oval, elongated and loosely packed with large inter-cellular space. Cells of parenchyma have small nucleus, large vacuole and thin cell wall. These tissues are found throughout the plant.

Function:

- Supports plant body.
- Stores food and nutrients in vacuoles.
- Sometimes contain chlorophyll and thus perform photosynthesis. Such parenchyma tissues are called chlorenchyma.
- In aquatic plants, cells of parenchyma have large air cavities which allow plants to flood. Such parenchyma tissues are called aerenchyma.

b. Collenchyma Simple Tissues: Cells of collenchyma are live. They are oval and elongated and tightly packed with no inter-cellular spaces. Cells of collenchymas have small nucleus, large vacuoles and have thin cell wall but thick at corners. Collenchyma tissues are found below epidermis in leaves and stem.

Function:

- Provides mechanical support to plant.
- Provides flexibility to plants so that they can bend without breaking.

c. Sclerenchyma Simple Tissues: Cells of sclerenchyma are dead. They are narrow and elongated. The cell wall in sclerenchyma is thick and hard. Lignin is a chemical substance which hardens the cell wall. These types of tissues are found around vascular bundles, veins of leaves in hard covering of seeds and nuts. For example; scalerenchyma tissues are found in coconut husk.

Function:

- Makes parts of plant hard and stiff.
- Provides strength.

d. Epidermis Simple Tissues: Epidermis tissue covers the entire body of plant. Cells in epidermis are similar in structure to parenchyma (loosely) but are tightly packed. They protect plant from injury, germs and water loss. They have generally one layer of cell.

Stomata are small openings on epidermal layer of leaf and soft part of stem. A stomata is a composed of two guard cells which regulate the opening and closing of stoma. Stomata present in epidermis allow gaseous exchange and transpiration in plants.

In desert plants, epidermis and cutin (a water proof waxy substance secreted by epidermis) are thicker so water loss is further reduced.

e. Cork Simple Tissues: These types of tissue consist of dead cells with no intercellular space. They form the outer layer of old tree trucks. Cells in cork contain subenin (a chemical substance). Due to this cork can't be penetrated by gases and water. Cork tissue protects plant from injuries, germs and water loss.

Cork is light so it is used commercially for making several products like bottle stoppers, shuttle cork.

Complex Tissues

Complex tissues are of two types:

a. Xylem **b. Phloem**

Xylem: Xylem 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. vessel, tracheid, xylem parenchyma and xylem sclerenchyma (fibre).

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

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

Parenchymas are living cells. They store food and nutrients.

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

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. All types of cells are live except phoem fibres.

Sieve cells are elongated and have thin cell wall. They have cytoplasm but do not have nucleus and other organs. 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.

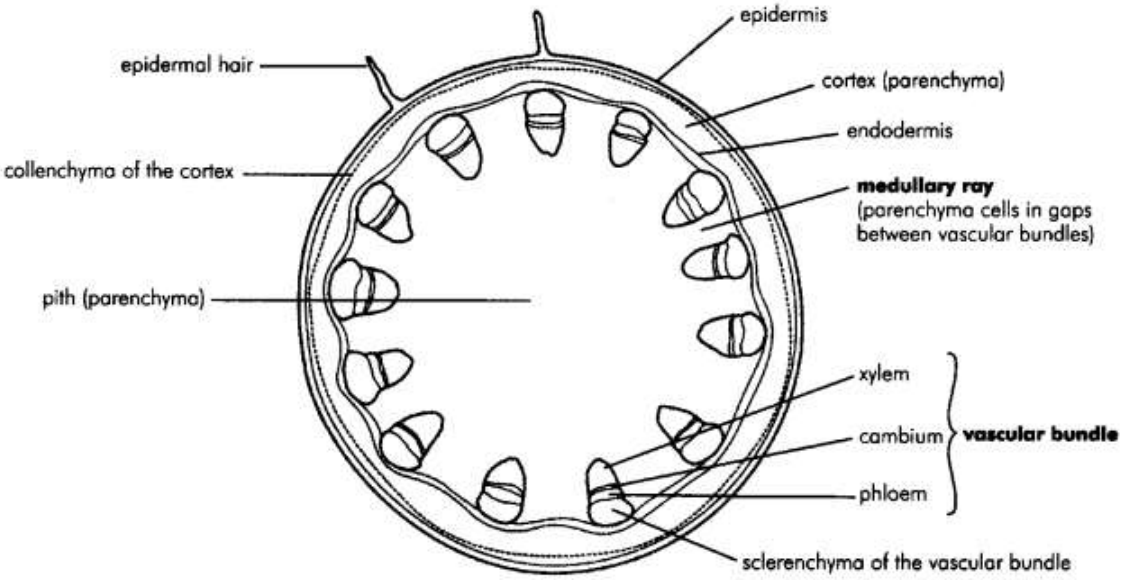
Phloem parenchyma store food.

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

Experimental Study of Stem

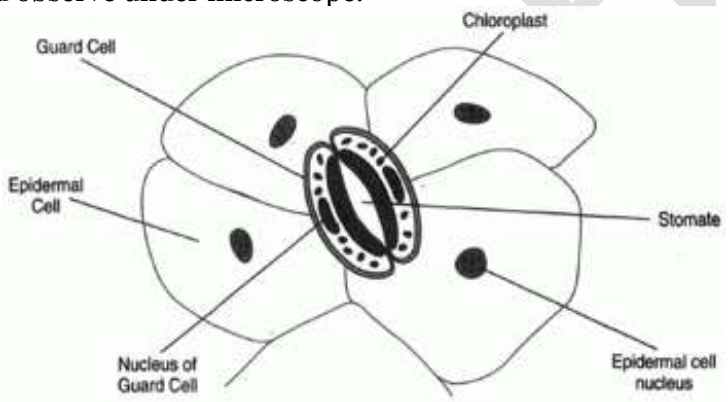
- Cut stem into thin slices.
- Stain them with safranin (chemical).
- Pick a nicely cut slice and put on slid.
- Put a drop of glycerine on slid.
- Observe under microscope.

You will see a microscopic view of stem.



Experimental Study of Epidermis

- Stretch a freshly cut leaf and break it from middle by applying pressure.
- The outermost layer of leaf will come out as a peel or skin called epidermis.
- Gently get in off and strain with safranin.
- Then put it on slid and observe under microscope.



Animal Tissue

Animal tissues are of four types:

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

Muscular Tissue

Muscular tissue is composed of elongated cells called muscle fibres. This tissue allows movement in body by contraction and relaxation. It contains special contractile protein which contract and relax to cause movement.
Muscular tissues are of three types:

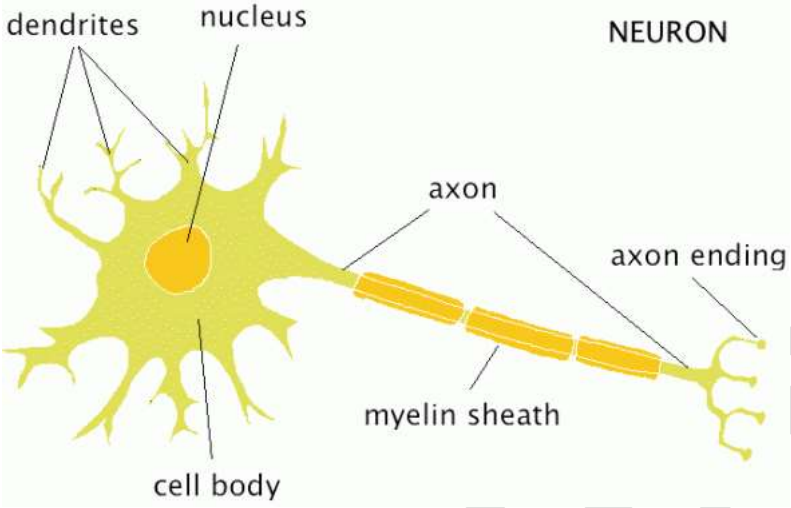
Smooth: The cells of smooth muscles are spindle shaped and each has one nucleus (c. Smooth muscle is found in those organs where involuntary movement is possible, e.g. muscles in stomach. They move automatically.

Cardiac: The cells of cardiac muscles are in the form of branched fibres. These are found in the heart. Cardiac muscles have many nucleus and striations are present in these muscles. Cardiac muscles can move continuously throughout the life in rhythmic pattern.

Striated (Skeletal): The cells of striated muscles are in the form of long, unbranched fibres. They have multi nucleus. Striations are present on muscle fibres. Striated muscles are found in those organs where voluntary movement is possible, e.g. hands, legs, back, neck, etc.

Nervous Tissue

Nervous tissue makes the nervous system and is composed of specialized cells called neuron. A neuron consists of a cell body (cyton) with a nucleus and cytoplasm from which numerous hair like structures arise called dendrites. One long extension is called Axon. Neurons are connected end to end to form nerves through connective tissue. Nervous tissues are found in brain, spinal cord and nerves.



Functions:

- They give us ability to respond to stimuli.
- They transmit information from body parts to brain.
- They transmit orders from brain to body parts.
- Nervous and muscular tissue together control body movement in all animals.

Connective Tissue

Connective tissues contain cells in a matrix. Matrix is a chemical substance in solid, liquid or jelly form. Connective tissues are of various types:

1. Bones: Cells in bone are embedded in matrix of calcium and phosphate compounds. Bones form framework of body. They facilitate movement of muscles. Bones are hard and inflexible and they have blood vessels.

2. Cartilages: They are soft tissues found in ear, nose, trachea, larynx and between bone joints. Cartilage smoothens the bone joints. They have wide spread cells in solid matrix of proteins and sugars. They do not have blood vessels.

3. Tendons: Tendon is made up of white fibres. They connect bones to muscles.

4. Ligament: Ligament is made up of white and yellow fibre. It connects bone to bone. It is more flexible compared to tendon.

5. Areolar: It consists of cells and fibres in matrix. It is found between skin and underlying muscles, around blood vessels, around nerves and bone marrow. Areolar tissue is strong enough to bind different types of tissues and soft enough to maintain flexibility. It fills space inside internal organs and supports them.

6. Adipose: It stores fat below the skin and between internal organs. When present in excess, results in obesity. It provides cushioning to internal organs and gives shape to body parts like limbs, breasts. Adipose acts as insulator and protects from cold.

7. Blood: Blood is a fluid composed of blood cells, platelets and plasma (liquid matrix). It flows throughout the body and transports various materials like gases, digested food, waste material and

hormones. Blood plasma contains two types of blood cells: Red Blood Cells (RBC) and White blood cells (WBC).

8. Lymph (Liquid): Lymph is a whitish fluid obtained from blood itself. It contains blood plasma, WBC, platelets but no RBC. Lymph transports food materials, waste materials and gases which blood cannot transfer.

Epithelial Tissue (Epithelium)

Skin which covers and protects all our body is epithelium. Other occurrences of epithelium are inner lining of mouth, linings of blood vessels, covering of other organs and cavities in body. Cells in epithelial tissue are tightly packed with no intercellular space. They are separated from other tissues by fibrous basement membrane.

Functions:

- It protects the organs which it covers.
- It keeps different organs separate.
- Epithelium forms a selectively permeable layer over body and other organs.
- It allows certain substances to pass through and stops others.
- In certain cases, it secretes and acts as glands.

Types of Epithelial Tissue:

Squamous: It consists of thin, flat disc like polygonal or irregular-shaped cells with round and flat nucleus. They form lining of nose, pericardial cavity, blood vessels etc. They protect the underlying parts of body from mechanical injury. It prevents the entry of germs inside the body. It facilitates diffusion of gases.

Cuboidal: It consists of cube like cells of almost equal height and width. Cuboidal tissue are found in kidney tubules, salivary glands etc. They provide mechanical support to organs and help in absorption and excretion.

Columnar: It consists of tall, cylindrical cells. The free end of the cells consists of figure-like projections. Columnar tissues are found in the inner surface of stomach, intestine etc. Columnar helps in absorption of nutrients, secretion of gastric juices and provides mechanical support to the organs.

Glandular Epithelium: Glandular epithelium tissues are tissues that form multi-cellular glands which produce chemicals.