

Plant and Animal Tissues

A **tissue** is a group of similar or dissimilar cells engaged in similar functions. All multicellular organisms including plants possess tissues. Like animals, in plants also, broad categories of tissues are present. Two major types of tissues in plants are - **meristematic** and **permanent**.

Meristematic Tissues

Meristematic tissue, also known as **meristem**, is composed of immature and continuously dividing cells.

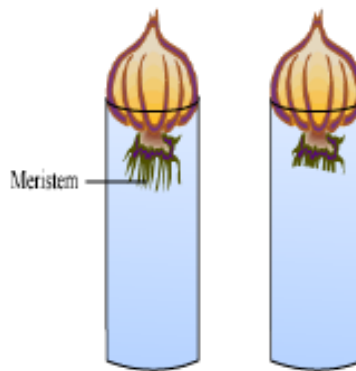
Can you think of the region where these cells are found? Have you observed that some plants can produce a new leaf in a single day?

In plants, shoot and root tips are made up of meristematic tissues.

Have you ever seen a meristematic tissue?

Let us observe meristematic tissues:

Take an onion bulb and place it in a jar filled with water. You will observe a continuous growth of onion roots.



Now, take another onion bulb and place it in a jar filled with water after cutting its roots. Observe its growth. You will observe that its growth has been seized.

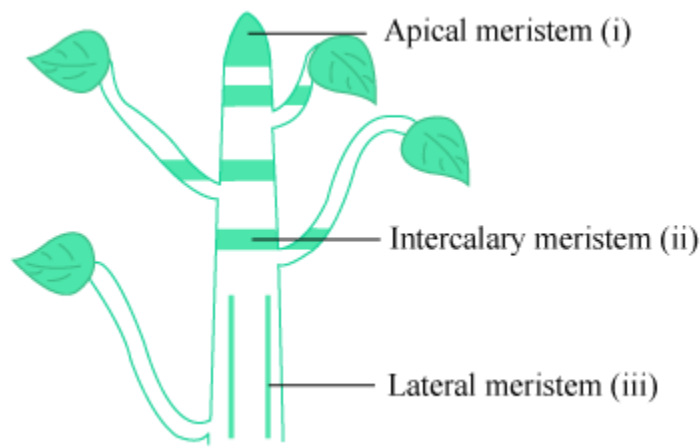
Characteristics of Meristematic Tissues

- They are made up of immature cells or undifferentiated cells.
- Their cells are small in size.

- Their cells are metabolically highly active with a dense cytoplasm.
- Intercellular space is negligible, often absent.
- Cell wall is thinner with a prominent nucleus.

Types of meristematic tissues:

Meristem can be further classified based on the position or locations of meristematic tissues. They are of three types



- **Apical meristem:** They are present at the tips of stems, roots, and branches. They are responsible for the axial growth in a plant.
- **Intercalary meristem:** They are present at the base of internodes, and are responsible for the growth of internodal region.
- **Lateral meristem:** They are present on the lateral side of stems and roots. Lateral meristem is responsible for the radial growth of plants. Vascular cambium and cork cambium are examples of lateral meristem.

Do you know that permanent tissues like xylem, phloem etc. are derived from meristematic tissues?

Permanent Tissues

Are flowers, stems, and roots composed of the same types of tissues or cells? No. They have different functions. Therefore, they should have different cells to perform specific functions.

A flower cannot change into a leaf and a leaf cannot change into a stem. Therefore, these tissues are permanent and do not differentiate.

Permanent tissues are composed of mature cells, which have lost their power of division. Cells in a permanent tissue attain definite shape, size, and functions. They may be dead or living. Permanent tissues are derived from meristematic tissues.

Permanent tissues are broadly classified into two major groups:

- **Simple permanent tissue:** Similar types of cells are grouped together, which perform the same types of functions.
- **Complex permanent tissue:** Different types of cells are grouped together for specific functions.

Let us explore about the simple permanent tissue.

Simple permanent tissues are of three types – parenchyma, collenchymas and sclerenchyma

Parenchyma: It is the most common plant tissue. It is composed of unspecialized cells with relatively thin cell walls. The cells in parenchyma tissues are living. These tissues form the bulk of herbaceous plants and their leaves, fruits, and flowers.

The cells in parenchyma tissues are loosely packed. Hence, there are large spaces between them. The cell wall in this tissue is made up of cellulose. A large central vacuole and a distinct nucleus are present in the dense cytoplasm.

The shape of the cell may be oval, round, or polygonal. Sometimes the parenchyma may contain chlorophyll and perform the process of photosynthesis.

Collenchyma: These tissues provide flexibility to the plant. Collenchyma tissues help in the easy bending of some parts of the plant, such that they do not break. These tissues can be found in leaf stalks below the epidermis. The cells of these tissues are living and elongated. The cell wall is irregularly thickened at the corners and there is very little space between the cells. Large vacuoles can be easily seen.

Sclerenchyma: The third type of simple permanent tissue is sclerenchyma tissue.

The cells in sclerenchyma tissues consist of long, narrow, and thick-walled cells. The cell walls are thickened due to the deposition of a chemical substance called lignin. This tissue is made up of dead cells and there are no intercellular spaces.

This tissue is present in the stems, in the veins of the leaves, and in the hard coverings of seeds and nuts. The husk of a coconut is also made up of sclerenchyma.

Functions of sclerenchyma are to provide strength to the plant and its various parts and to give flexibility and elasticity to the various parts of the plant.

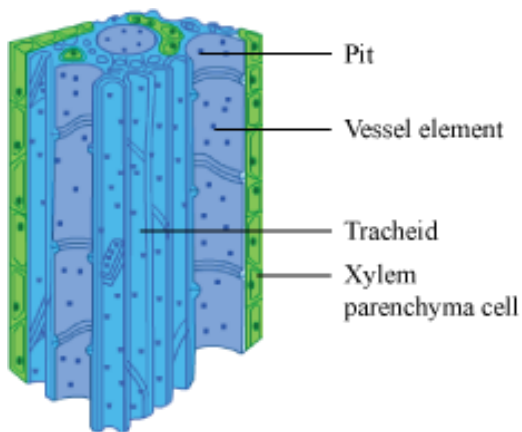
Complex Permanent Tissues

Do you know what complex permanent tissues are and what are its types?

Complex permanent tissues are conducting tissues, which take part in the transport function of plants. They are of two types—**xylem** (which transports water), and **phloem** (which transports food materials). The presence of this vascular tissue is an important feature of all complex terrestrial plants.

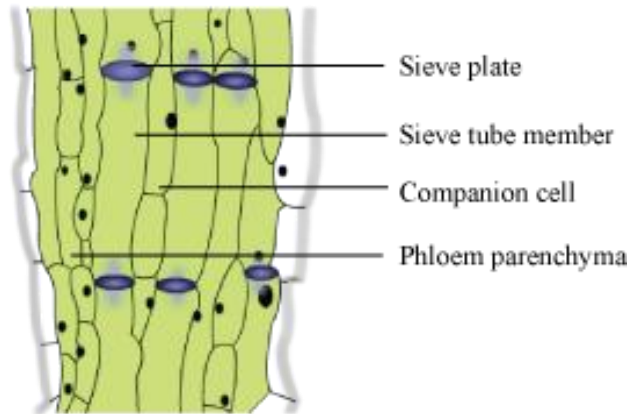
Xylem comprises of the following:

- **Xylem vessels** and **tracheids** are tubular structures, which allow vertical transport of water and minerals. Vessel cells are continuous, while tracheids are discontinuous. They are both conductive tissues.
- **Xylem parenchyma** stores food and conducts water sideways.
- **Xylem fibres** are supportive in function.



Phloem comprises of the following:

- **Sieve tubes** are tubular cells with perforated walls.
- **Companion cells** are elongated cells, which are always associated with sieve tubes. They perform metabolic functions and helps in water translocation.
- **Phloem parenchyma** is a cell associated with the phloem tissue. They pack other types of cells together.
- **Phloem fibres** are non-living cells.



Epidermis

It is present on the outer surface of the entire plant body. The cells of epidermal tissue form a continuous layer without any intercellular spaces.

Functions of epidermis

- It is a protective tissue of the plant body.
- It protects the plant against mechanical injury.
- It allows exchange of gases through the stomata.
- It prevents the plant from parasitic infection.

Animal Tissues

The human body performs different types of functions. Since different cells perform different functions, the body must have many cells to perform one or more specific functions. Animal tissues are broadly classified into four different groups, namely **epithelial, connective, muscular, and nervous tissues**.

Epithelial Tissues

Epithelial tissues form the outermost covering of the body, body cavity, and internal organs. It separates different organ systems in the body.

Cells in this tissue are arranged as tightly- packed continuous sheets, without any intercellular space.

Epithelial tissues are found in the surface cells of skin, buccal cavity, blood vessels, alveoli, and kidney tubules.

Do you know that since epithelium covers the body and all organs, all particles entering or leaving the body pass through it! Therefore, epithelial cells play an important medium in the transportation of substances in and out of the body.

Different types of epithelial tissues

Based on different shapes of epithelial cells, epithelium can be broadly classified as **squamous epithelium**, **columnar epithelium**, and **cuboidal epithelium**.

(i) Squamous epithelium

- Present as thin, delicate, flat lining.
- Present in the lining of the mouth, oesophagus, and skin.
- Skin forms a protective covering on the body surface, it often gets damaged. Therefore, it is present in multiple layers. This is called **stratified squamous epithelium**.



Squamous epithelium



Stratified squamous epithelium

(ii) Columnar and ciliated columnar epithelium

When you think of the word column, what structure comes to your mind? Is it a pillar?

Columnar epithelial cells are pillar-like cells.

- They are present in the inner lining of the intestine and respiratory tract.
- Their functions include secretion of mucus and absorption of digested food.

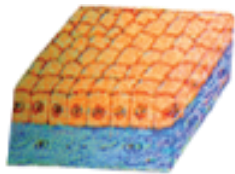


Columnar epithelium

Columnar epithelial cells are often marked by the presence of cilia. Cilia are hair-like projections coming out of cells. Cilia can move freely. This helps the mucus to move forward. These cells are called **ciliated columnar epithelium**.

(iii) Cuboidal epithelium

Cuboidal epithelium is composed of cube-shaped epithelial cells.



Cuboidal epithelium

- They are present in the lining of kidney tubules and ducts of salivary glands.
- Some special cells form the surface of secretory glands and gland cells.
- Glandular epithelium is often formed by the inward folding of epithelial tissues.

Connective Tissues

How do tissues form a compact mass? It is because of the presence of **connective tissues**. They are loosely packed cells, present in intercellular spaces.

Based on the region and function, their compositions differ.

The different types of connective tissues present in the body are – **fluid connective tissue, skeletal tissue and connective tissue proper**.

1. **Fluid connective tissue** – Consists of blood and lymph.

Blood is a connective tissue. Blood consists of three different types of cells:

Red blood cells (RBC), white blood cells (WBC), and platelets (present in liquid part of plasma). The plasma consists of various proteins, minerals, salts, hormones etc.

Lymph – It is blood minus the red blood cells. It helps to protect the body against different infections.

2. **Skeletal Tissue**

Bone is another connective tissue. Bone

- Provides structural support to the body because it is strong and non-flexible.
- Provides a platform for muscles and organs for anchorage to the body.
- Is composed of mainly calcium and phosphorus.

Ligaments connect bones to each other. Hence, they are also connective tissues.

They are elastic and strong in nature.

Tendons are similar to ligaments. Unlike ligaments, tendons connect muscles to bones. Tendons are fibrous and strong, but they are not very flexible.

Cartilage is another example of connective tissues. The matrix in cartilage is composed of proteins and sugars. It is present in the nose, ear, trachea, and larynx.

3. **Connective tissue proper** - It consists of areolar tissue and fibrous tissue.

Areolar tissue – It is another type of connective tissue. They are present between the skin and muscles, in the bone marrow. They are present in spaces found inside the organs. They also support organs because of the presence of cells (macrophages and mast cells), which also help in the repair of tissues.

Yellow fibrous tissue – It is found in the ligaments that join the bones and in the walls of the arteries. It has greater strength but limited flexibility.

White fibrous tissue – It is found in the tendons which connect muscles to the bones. It has strength as well as elasticity.

Do You Know?

We can bend and move our ears and nose because cartilage is flexible!

The adult human body contains 206 bones, while infants contain 300 bones!

Nervous Tissues

Suppose we want to move our hand, but the question comes how we are going to do it?

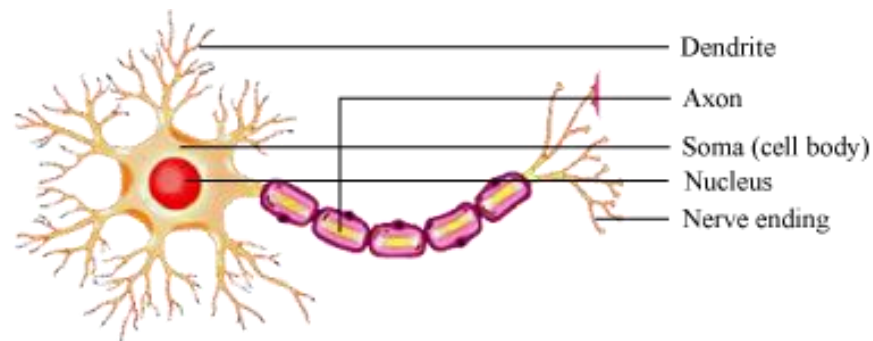
Brain is the region where this information is generated, and the muscles are the tissues that are responsible for the movement.

The nervous system coordinates the functioning of all other systems.

- They are present in the brain, spinal cord, and nerves.
- They are composed of neurons.

Neurons consist of a **cell body** and an **axon**. The cell body contains a nucleus and cytoplasm. The axon elongates from the cell body and branches into many dendrites.

Many nerve fibres with connective tissues form a **nerve**.



Types of nerve cells

Based on the mode of transmission of nerve impulse, nerve cells are of three types.

1. Sensory nerve cells: These nerve cells carry information from sense organs to brain.

2. Motor nerve cells: These transmit messages from brain to the muscles and glands of the body.

3. Mixed nerve cells: These are found in the central nervous system and serve as connective between sensory and motor neurons.

Muscular Tissues

Movement is an important function in animals. The system called **muscular system** performs this function. The muscular system is composed of muscular tissues.

Bend your fingers to form a fist and then release the same. Repeat the process and observe the movements of your skin. What do you observe? You will observe contractions and relaxations of muscles. Muscle cells are elongated cells that contain special contractile proteins to aid this function.

Types of muscular tissues

Some movements are controlled, while some other movements cannot be controlled. Therefore, these muscles are categorised into **voluntary muscles** and **involuntary muscles**. **Both of these muscles have some distinguishing features lets have a look on these.**

Voluntary muscles

- Their movements can be controlled.
- Cells of muscular tissues are elongated with many nuclei; they can be branched or unbranched.
- When observed under the microscope, they appear as alternating dark and light bands. Therefore, they are called **striated muscles**.

Involuntary muscles

- Their movements cannot be controlled.
- Cells are long and pointed. It has a single nucleus.
- They can be found in the alimentary canal, uterus, iris, bronchi of the lungs etc.
- They are **non-striated muscles**.
- The tissues present in the heart contract and relax in a rhythmic mode, which forms the heart beat. These tissues are called **cardiac tissues**.