

TISSUES : Plant and Animal Tissues

A tissue is a group of similar cells performing a specific function.

Relationship between tissue, organ, organ system and organism.

Several tissues together contributing to some specific function inside the body, constitute **an Organ** (such as tongue having epithelial cells, nerve cells, muscle cells, etc.). Many organs acting together to perform a specific life process constitute an **Organ System** (such as the digestive system). Organ systems together constitute the **organism** (e.g. the root system and the shoot system constitute the plant, an organism).

PLANT TISSUES

Plant tissues are basically of two types-

{A}. Meristematic tissue (cells can multiply to produce new cells) (Gk. meristos; divided).

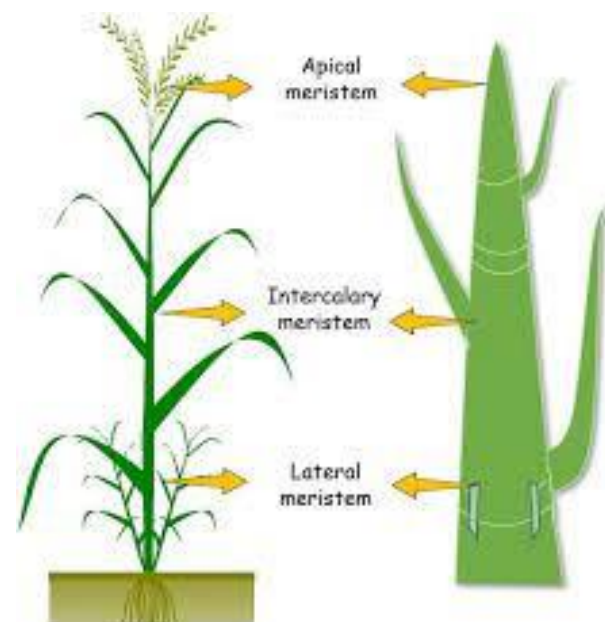
B. Permanent tissue (non-dividing and specialised) cells.

{A} Meristematic tissue or Meristem

- Found at all growing points of a plant, such as the tips of roots, stems and branches.
- Also present between the bark and the wood of trees where it leads to growth in the diameter of the stem.

Chief characteristics of meristematic tissue :

- (1) Cells are small
- (2) Cells are usually cubical
- (3) Cell wall is thin
- (4) Nuclei are large
- (5) Vacuoles almost absent.
- (6) Cells tightly packed with almost no intercellular spaces



(7) The cells actively divide adding new cells to the plant

(8) New cells thus produced are transformed into mature permanent tissues

The meristematic tissue can be classified into two categories: Apical meristem and lateral meristem.

(i) Apical or Terminal meristem. This is located near the tips of roots and stems and also in the growing young leaves near the tips of stems, as well as on the tips of axillary buds.

(ii) Lateral or Cambium meristem. This is situated below the bark and is responsible for increase in the girth (diameter) of the stem.

B. Permanent tissues are made up of cells which have lost their ability to divide. They take a permanent shape to perform some permanent function. They may be living or dead.

According to the function performed, the permanent tissues are of three types: Protective, Supporting and Conducting.

1. Protective tissue

- cells with thick walls.
- found on the surface of roots, stems and leaves.

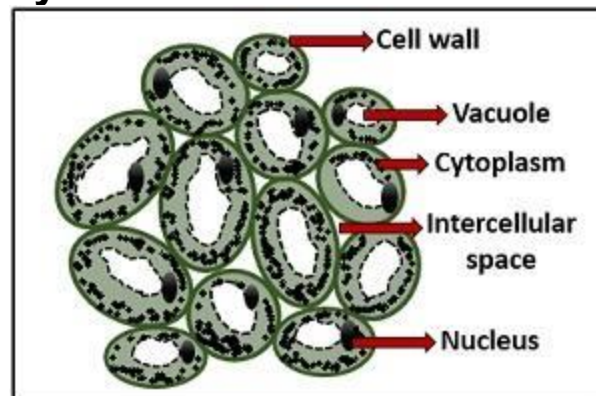
Examples: Epidermis of leaves which secretes a waxy water-proof material. Cork cells in the barks contain another strong water-proof material.

2. Supporting tissue is of several types. The three most important ones are : (a) parenchyma, (b) collenchyma, and (c) sclerenchyma.

(a) Parenchyma

- large thin-walled cells, oval, circular or polygonal in shape.
- found in soft parts of plants, such as in the cortex (outer region) and in the pith.

Function – Store food and provide support

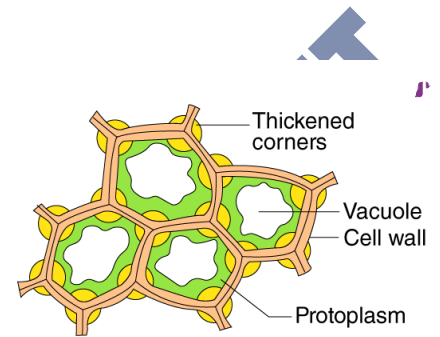


PARENCHYMATOUS TISSUE OF PLANT

(b) Collenchyma (collen: glue)

Made up of cells which are elongated and the cell wall is thickened at the corners). It is found in the leaf stalks and below the epidermis of stems.

Function: helps to support the parts of a plant.

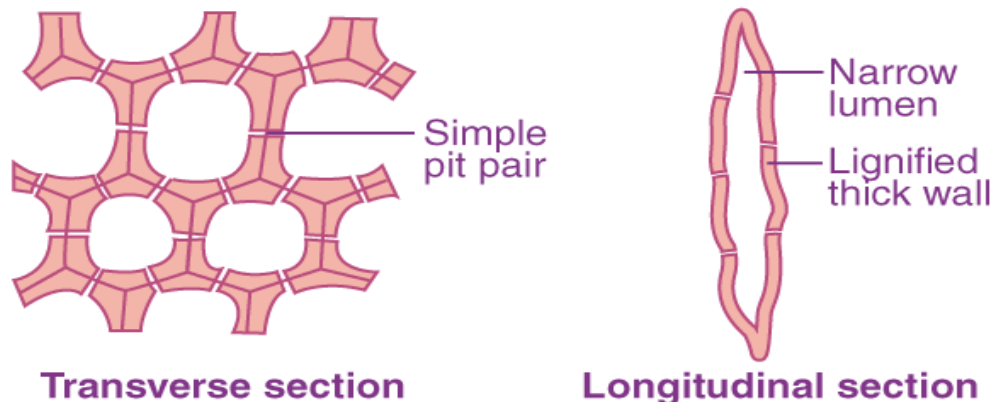


(c) Sclerenchyma (scleros : hard)

Composed of long, narrow cells, which have become dead; these cells develop very thick walls due to the deposition of **lignin**. It is found in stems and veins of the leaves.

Ropes, mats and textiles are made of plant fibre & walnut shells, skin of pear are Sclerenchyma cells

Function: provide strength



Simple Tissues: which are made of only one type of cells.

3. Conducting tissue, also called the vascular tissue, provides a passage for water and dissolved materials to move up and down in the plant. The xylem and phloem are the two types of conducting tissues.

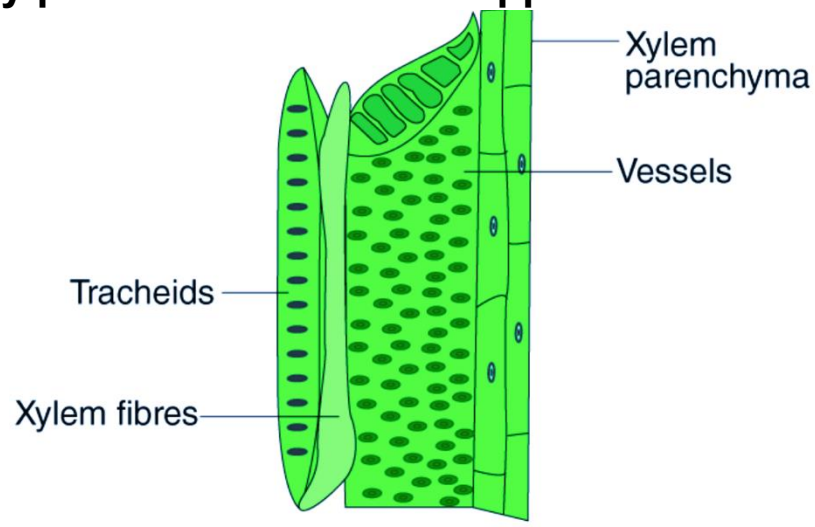
(a) **Xylem cells** are elongated and thick-walled. These cells are somewhat in the form of tubular passages. They provide for upward movement of water and dissolved materials absorbed from the soil by the roots to other parts of the plant.

- **Tracheids** are made up of elongated dead cells with large cavities without any contents forming a long tube. They provide mechanical support.

- **Xylem Vessels or tracheae** are long tube-like structures meant for transporting water, and dissolved minerals. They are made up of elongated cells placed end to end.

- **Xylem parenchyma** consists of living parenchyma cells associated with the xylem. These cells serve for the storage of food (sugars and starch), and also help in the conduction of water and minerals.

- **Xylem fibres** are made up of dead sclerenchyma cells. They are thick-walled, long, narrow cells with tapering ends. Their main function is to provide mechanical support to the plant.



(b) Phloem cells (phloos: bark) provide a passage for the downward movement of food manufactured in the leaves to various parts of the plant. They also provide for the upward movement of the prepared food towards the growing new leaves.

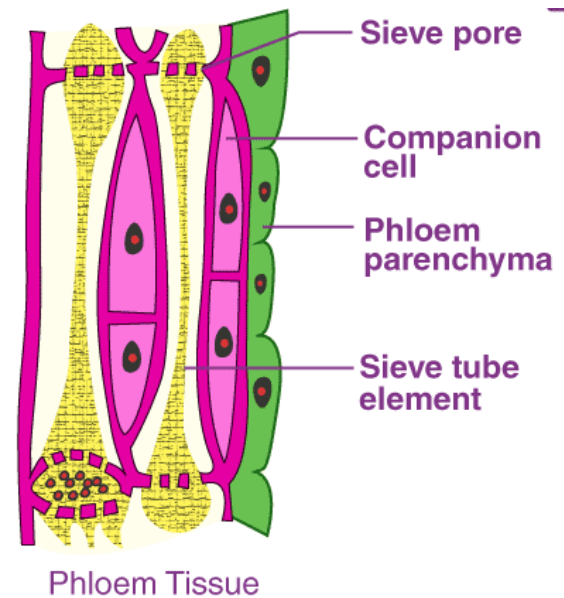
The phloem tissue consists of sieve tubes, companion cells, phloem parenchyma cells and phloem fibres.

• **Sieve Tubes** are made up of elongated cells placed end to end forming a long tube. The transverse walls called **sieve plates** are perforated. They help in the transport of food from leaves to storage organs and other parts of the plant.

• **Companion cells** living parenchyma cells closely associated with sieve tube cells. They help in the functioning of the sieve tube cells.

• **Phloem parenchyma** is a parenchymatous tissue found associated with phloem. Mainly concerned with storage of starch, fat and other organic food material.

• **Phloem Fibres** are sclerenchymatous cells found associated with phloem. They mainly provide support.



Xylem and Phloem are together called as **Vascular Bundles**. Example : The Veins of leaves.

Complex Tissues are those which are made of more than one types of cells working together. Ex- Xylem and Phloem tissues

ANIMAL TISSUES

The main kinds of animal tissues are as follows:

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

1. **EPITHELIAL TISSUE** is a thin, protective continuous sheet of cells.

Location: It covers the surface of the body and lines the various body cavities and internal organs, including the blood vessels. **Examples:** The outermost layer of skin and the lining surfaces of the mouth, nose, lungs, stomach, etc.

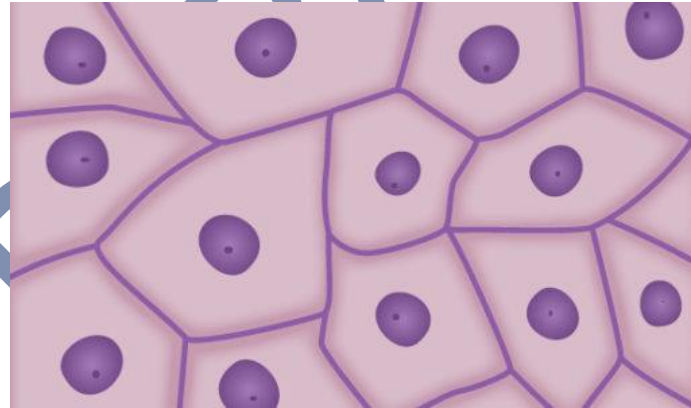
Shape: Epithelial cells may be flat, cuboidal or columnar in shape.

In all cases, the cells of the epithelial tissue fit tightly together leaving no space between them.

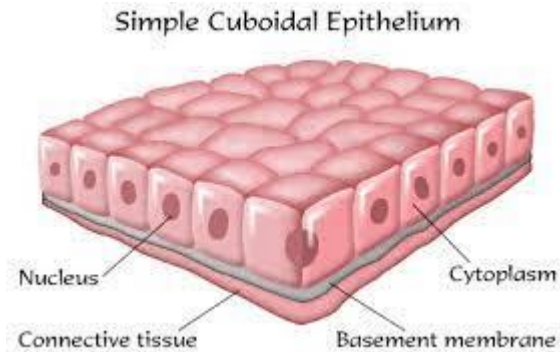
Function: The epithelial tissue functions for protection, absorption and secretion, sensory perception, etc. Its four structurally distinct categories are as follows:

(a) Squamous epithelium is composed of cells, which are thin, flat with prominent nuclei closely packed. **Examples:** Found lining the mouth and nasal cavities, blood vessels and lymph vessels.

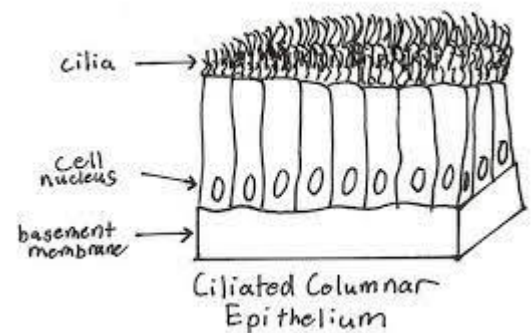
The squamous epithelium protects the underlying parts from mechanical injury, germs, harmful chemicals, and drying up.



(b) Cuboidal epithelium is found in some parts of kidney tubules and in some glandular ducts such as those of salivary glands, pancreatic duct.



(c) Columnar epithelium contains vertically arranged cylindrical or brick-like cells. These cells are usually tall in size. Columnar epithelium is generally found in the inner lining of the stomach and intestines.



(i) Ciliated columnar epithelium: At some places in the body, such as in the lining of the trachea, the columnar epithelium is ciliated. The cells of ciliated epithelium have thread-

like protoplasmic projections called **cilia**, at their free ends. The cilia constantly keep lashing and move the materials which enter these regions.

(ii) Glandular epithelium contains some large cells which secrete certain chemical substances. Such cells are common in the lining of the stomach and the intestine. Ex- the sweat glands, tear glands or the liver.

(d) Stratified epithelium: Found in the skin and the cornea. It is composed of several layers (strata) of the same or different kinds of epithelial cells.



2. CONNECTIVE TISSUE binds one tissue with another, and also connects various organs, keeping them in their proper places. It has three characteristics:

- (i) Abundance of intercellular substance - the matrix
- (ii) Fewer cellular elements, and
- (iii) Fibres

The connective tissue is classified as follows:

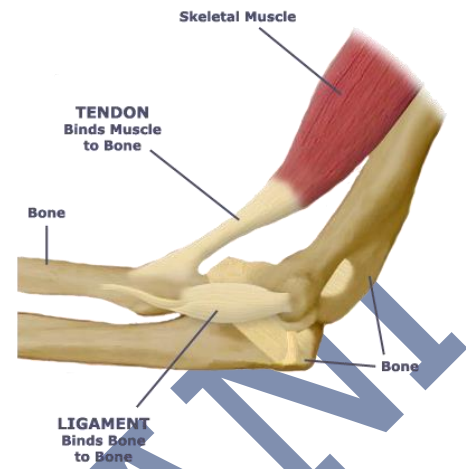
- I. Connective tissue proper packing and binding the organs serves for
- II. Supportive connective tissue - gives support (cartilages and bones)
- III. Fluid connective tissue - blood and lymph

I. Connective Tissue Proper - it's three sub - categories are as follows:

(a) Areolar (packing) tissue - It is most widely spread, occurring beneath the epidermis of skin. It makes the skin elastic and helps it to withstand pulling strain.

(b) Adipose (fat) tissue - It has specialized cells which store fat. This tissue forms padding under the skin and around kidneys, eye ball, etc.

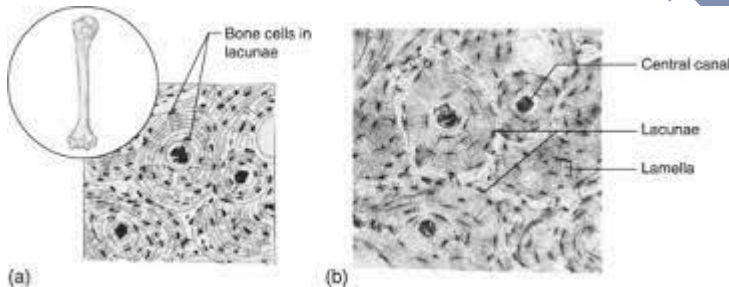
(c) **Fibrous connective tissue** - It is made of elongated cells referred to as 'fibres'. The fibres are strong and bundled together by areolar tissue. They form the **tendons** which connect muscle to bone, and **ligaments** which connect bone to bone and hold them in position.



II. Supportive Connective Tissue

(a) **Cartilage is a non-porous tissue**. It has a thickened intercellular substance (matrix). It has no blood vessels or nerves. Cartilage is semi-transparent and elastic. Cartilages are found in the tip of the nose, external ears, trachea and bronchial tubes, between vertebrae, and at the ends of long bones.

(b) **Bone is a hard porous tissue**. It has a good supply of blood vessels and nerves. It consists of both living cells (called osteoblasts) and a rigid mass of inorganic salts.



III. Fluid connective tissue (blood and lymph)

(a) Blood is composed of:

(i) The liquid part - plasma and

(ii) The cellular part- red blood cells, white blood cells and platelets

(b) **Lymph** is the fluid surrounding the body cells. It is essentially the blood plasma that has oozed out of the blood vessels. It contains white blood cells and not the red blood cells.

3. MUSCLE TISSUE forms the muscles of the body. Muscles can contract and relax. Thus, they help the body in its movements.

Three kinds of muscles are:

- (a) striated (skeletal, striped, or voluntary) muscles,
- (b) unstriated (smooth, unstriped, or involuntary) muscles, and
- (c) heart or cardiac muscles.



Striated Muscle
Cells



Unstriated Muscle
Cells



Cardiac Muscle
Cells

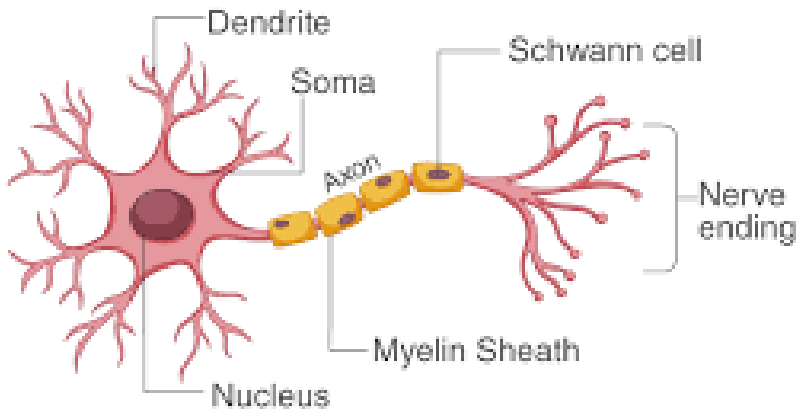
(a) Striated muscles are under the control of our will. They are made of long fibres (cells) which are nucleated and striated - light and dark bands run across the fibres.

(b) Unstriated muscles are not under the control of our will. They are made up of spindle - shaped/slender tapering cells which are uninucleated.

(c) Cardiac muscles are involuntary in function and found only in the walls of the heart. The fibres of cardiac muscle are striated, uninucleated and branched.

4. NERVOUS OR NEURAL TISSUE constitutes the nervous system. This tissue is made up of specialised elongated cells called **neurons**. Each nerve cell consists of a cell body called **perikaryon or cyton** containing the nucleus, one or more elongated hair-like extensions called **dendrites or dendrons**.

STRUCTURE OF NEURON



SIR TARUN RUPANI