

## 9<sup>th</sup> Tissues - I



In unicellular organisms a single cell is capable of performing all the vital activities. For example, digestion, respiration, excretion, etc., occur inside a single cell of Amoeba, while multicellular organisms have well-developed division of labour. Multicellular plants also have separate cells to synthesize food and to conduct water and food. In complex multicellular organisms, cells of the same shape and characteristics are organised into groups to carry out a common function. Each such group of cells, forms a tissue. Some tissues are formed of cells of different shapes and sizes, but they are generally of the same origin and perform the same function.

A tissue is defined as a group of cells with similar structure, organized to do a common function. Although the basic cell structure is the same in plants and animals, but there are visible differences so far as organization at the tissue level is concerned. Moreover, the plant body is usually fixed, i.e., they do not move about except a few unicellular algae. Most plant tissues are dead and supportive. They no longer have living protoplasm. As they do not move, they do not require much energy.

- Animals move from place to place in search of food, shelter and mate. Therefore, they require more energy as compared to plants. Most animal tissues contain living cells.

- Plants have some localized regions with special tissues that can divide throughout their life. There is no such distinct region in animals. Growth in animals remains uniform.

**PLANT TISSUES:** Plant tissues are basically of two types—meristematic and permanent. This differentiation is based on the ability of the mature cells of the tissue to divide and produce new cells. Meristematic tissue cells are capable of dividing, while permanent tissue cells are not.

**Meristematic Tissue:** This tissue consists of actively dividing cells and is present in the growing regions of plants, e.g., the tips of roots and stems. The cells can be round, oval, polygonal or rectangular, but there are a few things they have in common. They are packed closely without intercellular spaces, have thin cellulose walls, dense cytoplasm and prominent nuclei. Vacuoles are almost absent in such cells because they are completely filled with sap.

- There is more than one way of classifying meristematic tissue. On the basis of origin, meristems (meristematic tissue) are of two types—primary and secondary. The former are derived directly from the meristems of the embryo. The latter develop later in the life of the plant from permanent tissues.

- There is another way of classifying meristems, based on the position in the plant. Depending on the region of the plant where it is present, meristematic tissue can be of three types—apical, lateral and intercalary.

- Apical (from apex) meristem, as the name suggests, is present at the growing tips of stems and roots. Apical meristem is primary meristem. Cell division in this tissue causes elongation of the stem and root. Cells derived from the primary meristem differentiate into permanent tissues.

- Lateral meristematic tissue occurs along the sides of the central (longitudinal) axis of the plant. It

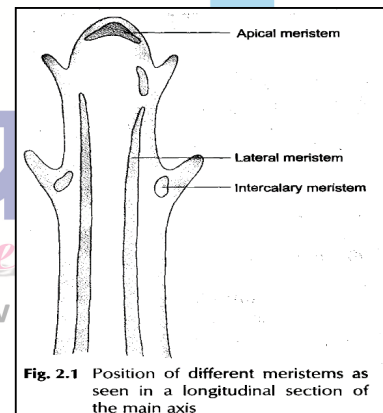
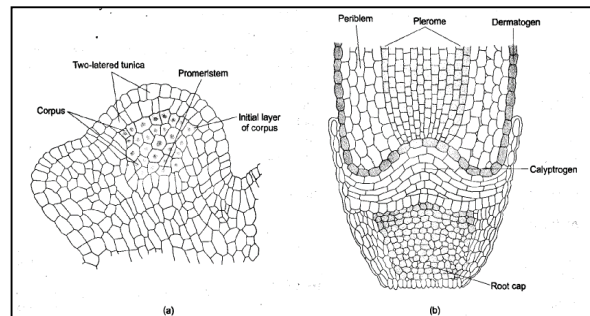


Fig. 2.1 Position of different meristems as seen in a longitudinal section of the main axis



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gives rise to vascular tissues. Each year new vascular tissues are formed to transport food. These appear as rings. These rings of small and large vessels which are added on each year, cause growth in the thickness of the stem or trunk. Intrafascicular cambium present in vascular bundles and cork cambium found underneath the bark of trees are examples of lateral meristem. Lateral meristems are secondary meristems.

- **Intercalary meristems** occurs at the base of leaves or internodes. These cells grow fast and soon change into permanent tissues.

**Permanent Tissue** - The division and differentiation of the cells of meristematic tissues give rise to permanent tissues. Cell division is the formation of two or more daughter cells from one mother cell. A cell has broadly two parts: nucleus and cytoplasm. In cell division both parts divide successively.

- Cell differentiation is when developing tissues and organs change from simple to more complex forms to become specialized for specific functions. The cells of permanent tissues lose the capacity to divide and attain a permanent shape, size and function.

- Depending on their origin, permanent tissues are of two types—primary and secondary. Primary permanent tissues are derived from apical and intercalary meristems, Secondary permanent tissues are derived from lateral meristems, or cambium cells. On the basis of their composition, permanent tissues can be simple or complex. Besides these there are special secretory tissues.

- Simple permanent tissues consist of similar permanent cells that perform the same function or a similar set of functions. Parenchyma, collenchyma and sclerenchyma are three types of simple permanent tissues.

- Complex permanent tissues are a group of different types of cells that perform a common function. Xylem and phloem are two types of complex permanent tissues.

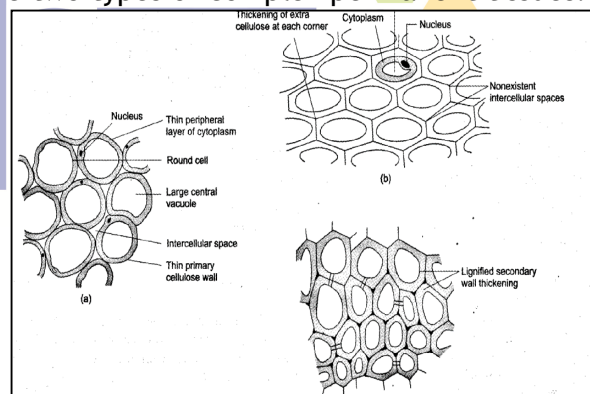
**Parenchyma:** This tissue is composed of large, thin-walled cells which are generally oval or spherical. The cells are not packed closely, i.e., there are intercellular spaces. These living cells with a nucleus and a vacuole are found in the soft parts of the plant. They store food, fill up spaces between other tissues and provide temporary support to the plant. When they contain chloroplasts, as in leaves, they help manufacture food.

**Collenchyma:** This tissue is composed of cells that are elongated and thickened with cellulose at the corners. There is no intercellular space. Collenchyma provides mechanical support to plant organs and is found in leaf stalks and below the epidermis of stems. It helps leaves and stems bend without breaking. It provides support, protection and flexibility to plant organs. It is generally absent in roots.

**Sclerenchyma:** The tissue is composed of long, narrow cells whose walls are evenly thickened with lignin. Lignin is a chemical that acts like cement, sticking fibres and hardening them. Sclerenchyma cells are dead. They are packed together closely and provide strength and flexibility to plant parts.

- They are present in stems, veins of leaves, the hard covering of seeds and nuts, and the husk of coconut. Fibre-yielding plants like jute and flax contain this tissue in abundance.

- **Epidermis** is the outermost protective layer. If you study the section of a leaf, many pores will be observed in the epidermis. These pores are stomata. Due to a protective role, the epidermis forms a continuous layer. Intercellular spaces are

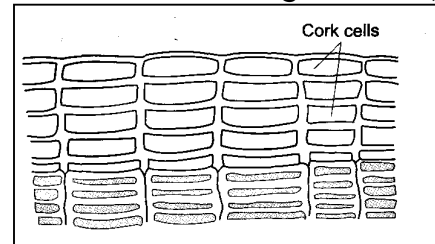




absent. Stomata helps in the diffusion of gases in leaves. Transpiration, i.e., loss of water vapour from leaves, also takes place through stomata. These pores are surrounded by two kidney-shaped guard cells which regulate the opening and closing of stomata.

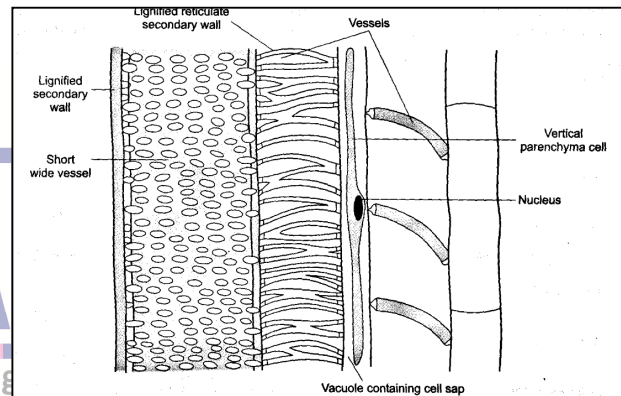
- Various parts of the plant are made of the above-mentioned tissues. They get modified on the outermost boundaries of the plant parts and form protective tissues that protect inner tissues. This outermost layer is initially one cell in thickness and is covered with cutin.

- Cutin is a complex, waterproof chemical substance. It checks the evaporation of water from the outer surface of the plant body. As roots and stems grow older, tissues at the periphery divide and form cork cells. Cork cells are dead and are arranged compactly in radial rows without intercellular spaces. The protective nature of cork is due to the deposition of suberin on the walls. Suberin is a waxy substance which makes the wall of a cork cell impervious to gases and water. This is why cork is used for bottle stoppers. Cork is also a good thermal as well as an electric insulator.



**Xylem:** Xylem, or wood, as it is often called, is a complex tissue. The cells are thick-walled, tubular and often dead. This tissue has four types of cells—tracheids, vessels, xylem parenchyma and xylem fibres. Of these only tracheids and vessels transport sap.

- Tracheids are elongated, tube-like cells with sloping walls, enclosing a large, empty cavity. The cavities are empty because the cells are dead. The walls are heavily thickened with lignin. Fitting together end to end, vessels form long tubes or pipes for the conduction of water and minerals from the root to the leaf.



- The partitions between the cells dissolve to form long pipelines. Vessels too are dead cells with lignified walls. All vascular plants do not have vessels. Ferns, for example, have only tracheids.

- Wood parenchyma is made of parenchymatous cells which store food and help in the lateral conduction of water or sap. Wood fibres are long Sclerenchymatous cells associated with xylem. They are mainly mechanical or supportive in function. In fact, other than wood parenchyma all xylem cells are dead and lignified, and hence, they provide mechanical strength.

**Phloem:** Phloem too is a complex tissue made up of four types of cells, or elements— sieve tubes, companion cells, phloem fibres and phloem parenchyma. It is not necessary for the phloem to contain all four types of cells. Phloem cells are living cells (except phloem fibres) which help transport food from leaves to the storage organs and growing regions of the plant.

- Sieve tubes are a collection of thin-walled

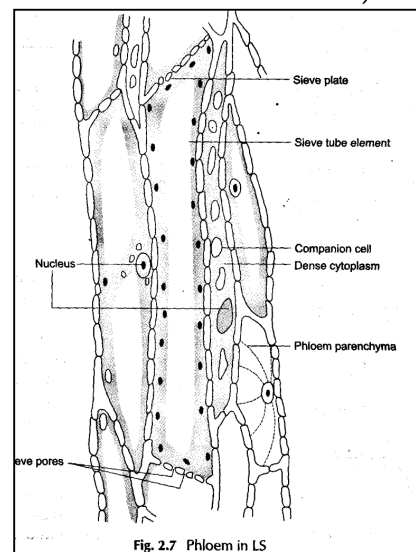


Fig. 2.7 Phloem in LS

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elongated cells placed end to end to form slender, tubular structures.

- The walls between the cells have pores, much like a sieve, and are called sieve plates. That is how the cytoplasm of the cells is continuous, passing through the pores from one cell to the next. In the same way food is transported through these tubes. The cells, or elements as they are called, do not have nuclei.

- **Companion cells** generally occur with sieve tubes and are connected to them through pores. These are small cells with dense cytoplasm and a large, elongated nucleus. These cells are not present in all plants. For instance, ferns and pines do not have them.

- Phloem fibres are dead sclerenchyma cells. All plants do not have them. Parenchyma cells also form a part of the phloem. When present, they store food and help to conduct it.

**Special tissues:** Besides simple and complex tissues, plants also have special tissues whose function is secretion. These tissues secrete latex, gums, resins, oils, etc. Latex is a thick, sticky white fluid secreted by rubber, banyan, fig trees and garden plants like oleander (kaner in Hindi). Tissues secreting latex are called laticiferous and those secreting oils, resins, etc., are glandular. Citrus and rose plants secrete oils, while gums and resins are secreted by many coniferous trees.

