

PLANT ANATOMY

TYPES OF PLANT TISSUE

Presented by

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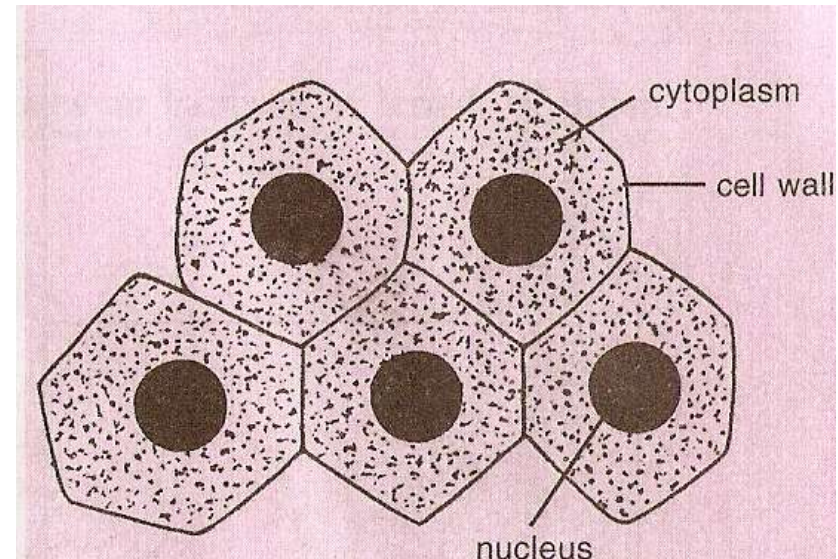
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TYPES OF PLANT TISSUE

- **Meristematic tissue**
- Apical meristems
- Lateral meristems
- Intercalary meristems
- **Permanent tissue**
- Simple permanent tissue
- Parenchyma
- Collenchyma
- Sclerenchyma
- Complex permanent tissue
- Xylem
- Phloem
- **Protective tissue**
- Epidermis
- Cork (phellem)

MERISTEMATIC TISSUE

- Apical meristems
- Lateral meristems
- Intercalary meristems



*Meristematic Tissue As Seen In
Cross Section*

MERISTEMATIC TISSUE

Nature-cells of meristems divide continuously & help in increasing the length girth of the plant. These cells show the following characteristics:

1. The cells of meristematic tissue are similar in structure & have thin cellulose cell walls.
2. The meristematic cells may be spherical, oval, polygonal or rectangular in shape.
3. The meristematic cells are compactly arranged & do not contain any intercellular space between them.
4. Each meristematic cell contains dense or abundant cytoplasm & a single large nucleus.
5. The meristematic cells contain few vacuoles or no vacuoles at all.

Occurrence-Meristematic tissues are growth tissues & are found in those regions of the plant that grow. According to their position in the plant, meristems are apical, lateral & intercalary.

Function-the main function of meristematic tissue is to continuously form a number of new cells.

APICAL,LATERAL & INTERCALARY

- **Apical meristems**:-these are situated at the growing tip of the stems & roots ,i.e., At shoot apex & root apex. Apical meristems are also found at apices of the leaves.

It brings about the elongation of the root & stem. It results in increase in the height of the plant, which is called **primary growth**.

- **Lateral meristems**-these are found beneath the bark(cork cambium) & in vascular bundles of dicot roots & stems(cambium).They occur in thin layers.Cambium is the region which is responsible for growth in thickness.

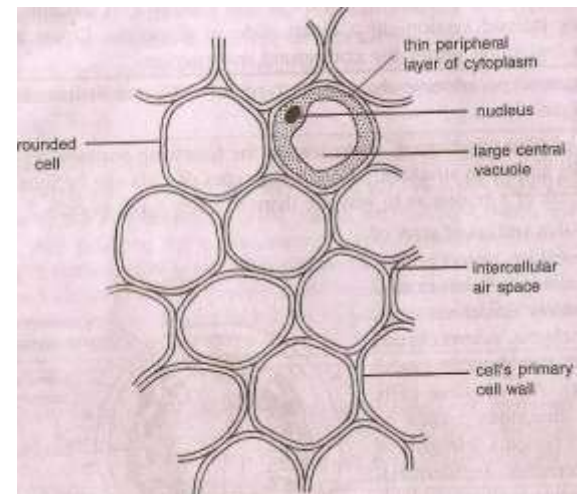
It causes the organ(stem or root) to increase in diameter & girth.This is called **secondary growth**.

- **Intercalary meristems**-they are located at the base of leaves or internode,e.g.,Stem of grasses & other monocots.

It produces an increase of length of organ.

PERMANENT TISSUE

- Simple permanent tissue
 - Parenchyma
 - Collenchyma
 - Sclerenchyma
- Complex permanent tissue
 - Xylem
 - Phloem



Parenchyma

PERMANENT TISSUE

- These tissues derived from the meristematic tissues but their cells have lost the power of division & have attained their definite forms. Permanent tissues are classified into two-simple & complex.
- **Simple permanent tissue**-these tissues are composed of cells which are structurally & functionally similar. Thus, these tissues are all made of one type of cells. They are of three types-
 - I. Parenchyma
 - II. Collenchyma
 - III. Sclerenchyma
- **Complex permanent tissue**-the complex tissues consist of more than one type of cells. All these co-ordinate to perform a common function. Complex tissues transport water, mineral salts (nutrients) & food material to various parts of plant body. Complex tissues are of following two types :
 - I. Xylem or wood
 - II. Phloem or bast

Xylem & phloem are both conducting tissues & also known as **vascular tissues**; together both of them constitute **vascular bundles**.

PARENCHYMA

- **Nature**-parenchyma forms the bulk of the plant body. Parenchyma cells are living & possess the power of their division. The cells are rounded or isodiametric, i.e., Equally expanded on all sides. The parenchymatous cells are oval, round, polygonal or elongated in shape. The cell wall is thin & encloses a dense cytoplasm which contains a small nucleus & surrounds a large central vacuole. In other words, parenchyma cells have living protoplasm. Intercellular spaces are abundant.
- **Occurrence**-the parenchyma is widely distributed in plant body such as stem, roots, leaves, flowers & fruits. Thus, the parenchyma tissue is found in the soft parts of the plant such as cortex of roots, ground tissues in stems & mesophyll of leaves. It is also distributed in pith, medullary rays & packing tissue in xylem & phloem.
- **Functions**-
 1. Parenchyma serves as a packing tissue to fill the spaces between other tissues & maintain the shape & firmness of the plant due to its turgid cells.
 2. Due to turgidity property, parenchyma forms the main means of support to the stem of herbaceous plants.
 3. The main function of parenchyma is to store & assimilate food. Parenchyma serves as **food storage tissue**.
 4. Transport of materials occurs through cells or cell walls of parenchyma cells.
 5. Parenchyma cells are metabolically active; their intercellular air spaces allow gaseous exchange.

COLLENCHYMA

- **Nature**-collenchyma tissue consists of living cells. It shows many of the features of parenchyma but is characterised by the deposition of extra cellulose at the corners of the cells. In collenchyma, intercellular spaces are generally absent. Collenchyma cells are elongated in shape. They often contain a few chloroplasts.
- **Occurrence**-the cells of collenchyma are located below the epidermis of dicotyledon stem & petiole. These cells also occur in midribs of dicot leaves. Collenchyma is absent in monocot stems, roots & leaves.
- **Functions**- collenchyma is a mechanical tissue; it provides mechanical support & elasticity. Thus, collenchyma provides tensile strength with flexibility to those organs in which it is found. It allows easy bending in various parts of a plant without actually breaking it. When cells of collenchyma contain some chloroplasts, they manufacture sugar & starch.

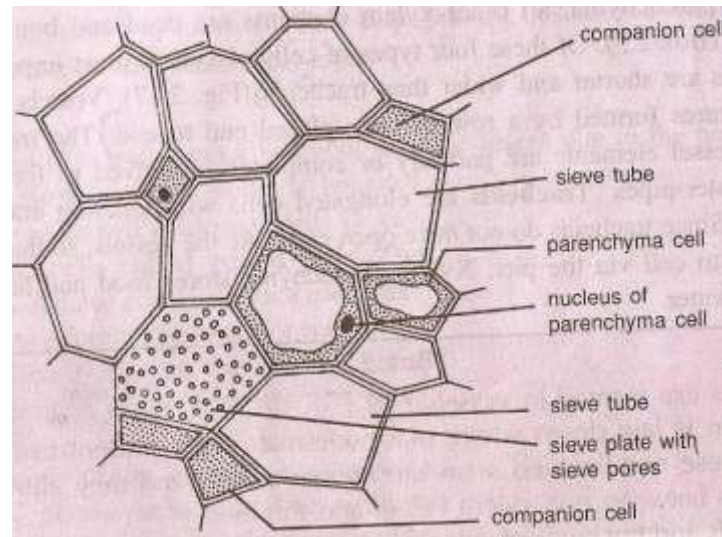
SCLERENCHYMA

- **Nature**-sclerenchyma cells are dead cells & they are devoid of protoplasm. The walls of cells of sclerenchyma are greatly thickened with deposition of lignin. Such cells are called lignified. Due to excessive thickening of the wall of a sclerenchyma cell, its cell cavity or lumen becomes nearly absent. The cells of sclerenchyma are closely packed without intercellular spaces.
- **Occurrence**-the sclerenchyma occurs in abundance either in patches or definite layers. They are found in stems, roots, veins of leaves, hard covering of seeds & nuts. Sclereids form the gritty part of the most of the ripe fruits & contribute hardness to the seed coat & nutshells.
- **Functions**-the sclerenchyma is mainly mechanical & protective in function. It gives strength, rigidity, flexibility & elasticity to the plant body & thus, enables it to withstand various strains.

COMPLEX PERMANENT TISSUE

➤ *Xylem*

➤ *Phloem*



Phloem

XYLEM

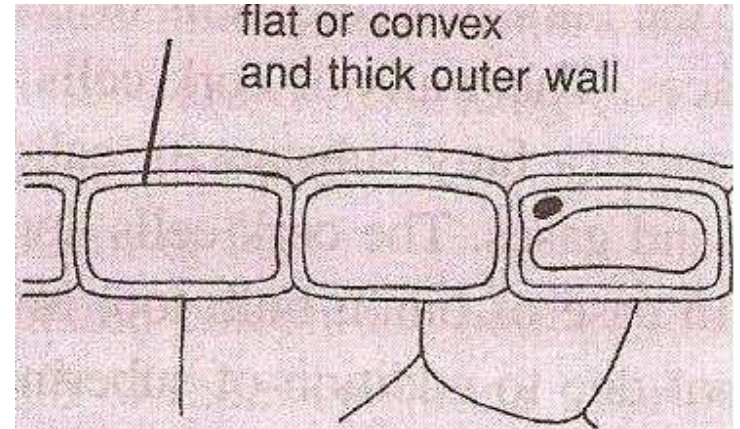
- **Nature**-xylem is a vascular & mechanical tissue. In other words, it is a conducting tissue. Xylem is composed of cells of four different types: **tracheids; vessels or tracheae; xylem parenchyma; xylem sclerenchyma.** **Except** xylem parenchyma, all other xylem elements are dead & bounded by thick lignified walls. Of these four types of cells of xylem, most important cells are vessels. Vessels are very long tube-like structures formed by a row of cells placed end to end. Tracheids are elongated cells with tapering ends. They conduct water.
- **Functions-**
 - i. The main function of xylem is to carry water & minerals salts upward from the root to different parts of shoots.
 - ii. Since walls of tracheids, vessels & sclerenchyma of xylem are lignified, they give mechanical strength to the plant body.

PHLOEM

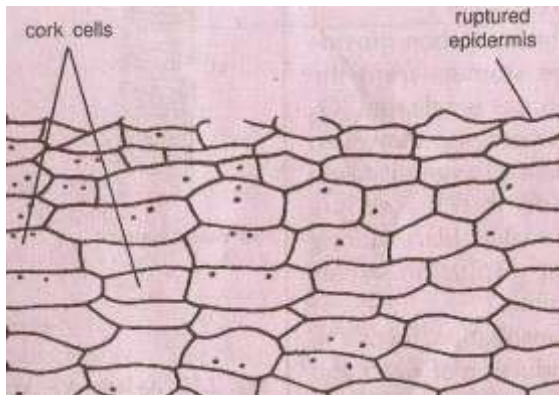
- **Nature**-like xylem, it contains tubes but has no mechanical function. phloem is composed of following four elements or cells. 1. **sieve tubes**; 2. **companion cells**; 3. **phloem parenchyma** & 4. **phloem fibres**. except for phloem fibres, phloem cells are living cells.
- **Functions**-phloem transport photosynthetically prepared food materials from the leaves to the storage organs & later from storage organs to the growing regions of the plant body.

PROTECTIVE TISSUE

- *Epidermis*
- *Cork (or phellem)*



Epidermis



Cork

EPIDERMIS

- It is usually present in the outermost layer of the plant body such as leaves, flowers, stem & roots. Epidermis is one cell thick & is covered with cuticle. Cuticle is a water proof layer of a waxy substance called cutin which is secreted by epidermal cells. Cuticle possess variable thickness in plants such as it is more thicker in xerophytic plants. Cells of epidermis are elongated & flattened & do not contain any intercellular space between them. Their inner contents are similar to parenchyma cells.
- The main function of epidermis is to protect the plant from desiccation & infection. In fact, cuticle of epidermis helps to reduce water loss by evaporation from the plant surface as well as helping in preventing the entry of pathogens.

CORK

- As plants grow older, the outer protective tissue undergoes certain changes. A strip of secondary meristem, called phellogen or cork cambium replaces epidermis of stem. Cork cambium is a simple tissue having only one type of cells. The cells of cork cambium are rectangular & their protoplasms are vacuolated & contain tannins & chloroplasts. Cork cambium gives off new cells on its both sides, thus, forming cork on the outer side & the secondary cortex or phelloderm on the inner side. The layer of cells which is cut by cork cambium on the outer side ultimately becomes several layered thick cork or the bark of trees. Cells of cork are dead & compactly arranged without intercellular spaces. The walls of cork cells are heavily thickened by deposition of an organic substance, called suberin. Suberin makes these cells impermeable to water & gases. The cork cells do not contain protoplasm but are filled with resin or tannins. In case of onion bulb too, in the skin of onion the cell walls become thick & water proof due to addition of suberin. Cork is protective in function. Cork cells prevent desiccation, infection & mechanical injury.