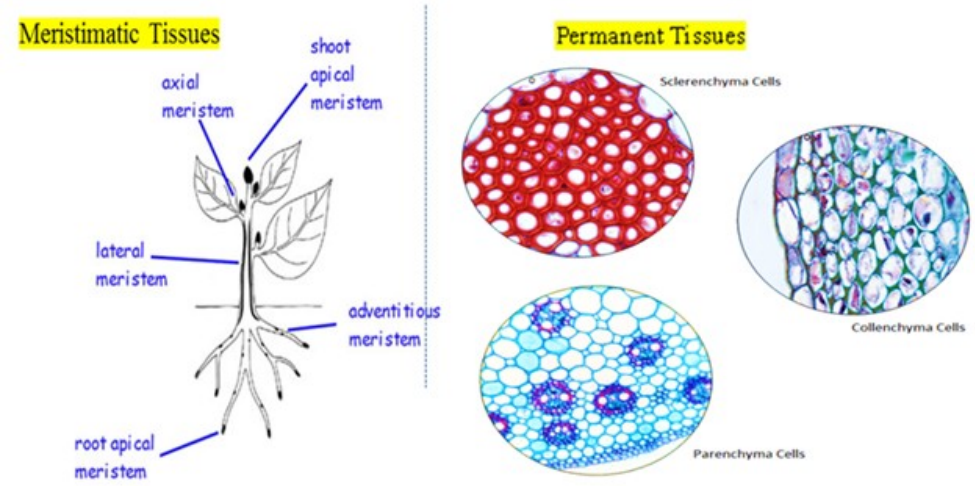
Plant Tissues

A collection of cells performing a specific function is called tissue. Plant tissues can be grouped into plant tissue systems each performing specialized functions. A plant tissue system is defined as a functional unit, connecting all organs of a plant. Plant tissue system is also grouped into various tissues based on their functions.

Types of Plant Tissues



Plant tissues can be broadly classified based on the ability of the cells to divide into Meristematic tissue and Permanent tissues. Meristematic tissues -consist of a group of cells that have the ability to divide. These tissues are small, cuboidal, densely packed cells which keep dividing to form new cells. These tissues are capable of stretching, enlarging and differentiating into other types of tissues as they mature. Meristematic tissues give rise to permanent tissues. Meristematic tissues can be of three types depending on the region where they are present: Apical meristems, lateral meristems, and intercalary meristems.

Permanent tissues are derived from the meristematic tissues and have lost their ability to divide. They have attained their mature form. They are further classified into two types: Simple and complex permanent tissues.

Permanent Tissues

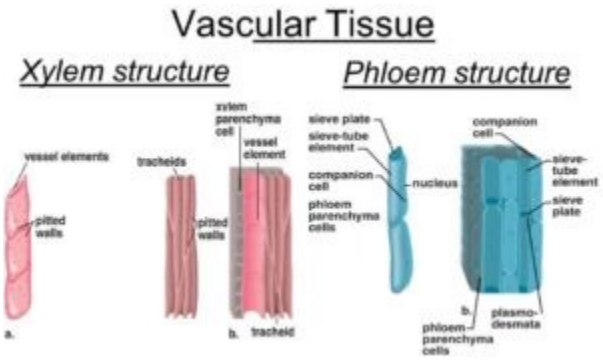
The permanent tissues form the major portion of the plant.

Simple Permanent tissues

- **Parenchyma**– These tissues are found in the soft parts of a plant such as the roots, stems, leaves and flowers. The cells of this tissue are loosely packed and contain large intercellular spaces between them. Each cell has a vacuole at the center. The functions of parenchyma tissues are storage, photosynthesis and to help the plant float on water. Living.
- **Collenchyma-** Are similar to parenchyma cells with thicker cell walls (uneven thickness) esp. at corners. They are meant to provide mechanical support to the plant structure in parts such as petiole, midrib of the leaf. Living. Cell wall composed of pectin, cellulose and hemicellulose.
- **Sclerenchyma-** The cells of this tissue are dead. They are rigid, contain thick and lignified secondary walls. Their main function is to provide strength and support to parts of the plant.

Complex Permanent Tissue

Unlike simple permanent cells which look the same and are made up of one type of cells, complex permanent tissues are made up of more than one type of cells. These different types of cells coordinate to perform a function. Xylem and Phloem are complex permanent tissues and are found in the vascular bundles in the plants.



Xylem- It consists of tracheids, vessels, xylem parenchyma and xylem fibres. Tracheids and vessels are hollow tube-like structures that help in conducting water and minerals. The xylem conducts only in one direction i.e, vertically. The xylem parenchyma is responsible for storing the prepared food and assists in the conduction of water. Xylem fibres are supportive in function.

Phloem- It consists of four of elements: sieve tubes, companion cells, phloem fibres and the phloem parenchyma. Unlike the xylem, phloem conducts in both directions. It is responsible for transporting food from the leaves to the other parts of the plant. Phloem contains living tissues except for fibres that are dead tissues.

Functions of plant tissues

Plant tissues have different functions depending upon their structure and location

- Help provide mechanical strength to organs.
- They help in providing the elasticity and flexibility to the organs.
- They help the tissues to bend easily in various parts of a plant like- leaf, stem, and branches without damaging the plant
- The xylem and phloem tissues help in transportation of material throughout the plants

- They divide to produce new cells and help in the growth of the plants.
- They help in various cellular metabolisms like photosynthesis, regeneration, respiration etc.

Types of vascular bundles.

There are mainly three types of vascular bundles:
(i) **Radial**: Those in which the xylem and the phloem lie radically side-by-side (for example, in roots of seed plants). This is the most primitive type.

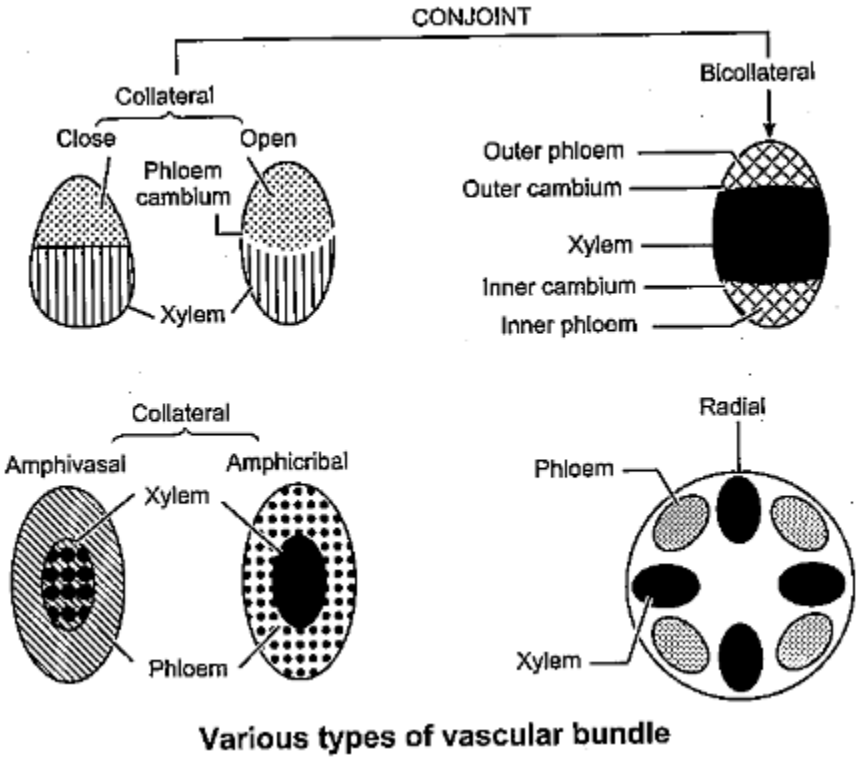
(ii) **Conjoint:** Those in which the two types of tissues are separated from one another. Here xylem and phloem together form a bundle. The two sub-types are **collateral** and **bicollateral.**

(a) Collateral: The xylem and phloem lie together on the same radius in such a position that xylem lies inwards and the phloem outwards. Here the phloem occurs on one side of the xylem strand. In the dicotyledonous stem, the cambium is found to be present in between xylem and phloem, such bundles are called open (for example, in *Helianthus*) and when the cambium is absent, it is called closed (for example, in monocotyledonous stems).

(b) Bicollateral: In such bundles, the phloem is found to be present on both sides of xylem. Simultaneously two cambium strips also occur. Various elements are arranged in the following sequence-outer phloem, outer cambium, xylem, inner cambium and inner phloem. Such bundles are

commonly found in the members of Cucurbitaceae. Such bundles are always open.

(iii) **Concentric**: Those in which one type of tissue surrounds or ensheaths the other. The concentric bundles may be of two subtypes, amphivasal bundle as found in Dracaena., Yucca and other monocots and some dicots. If the phloem surrounds the xylem, it is amphicribal as found in many ferns. Such bundles are always closed.



Various types of vascular bundle

Table 9.5: Anatomical differences between root and stem			
S.No.	**Characters**	**Root**	**Stem**
1.	Epidermis	Absence of cuticle and epidermal pores.	Presence of cuticle and epidermal pores.
		Presence of unicellular root hairs.	Presence of unicellular and multicellular trichomes
2.	Outer Cortical cells	Chlorenchyma absent	Chlorenchyma present
3.	Endodermis	Well defined	ill-defined or absent.
4.	Vascular bundles	Radial arrangement	Conjoint arrangement
5.	Xylem	Exarch	Endarch

Anatomical differences between dicot stem and monocot stem

Dicot stem	Monocot stem
1. Hypodermis is made up of collenchymatous cells.	1. Hypodermis is made up of sclerenchymatous cells.
2. Ground tissue is differentiated into cortex, endodermis, pericycle and pith.	2. Ground tissue is not differentiated, but it is a continuous mass of parenchyma.
3. Starch sheath is present.	3. Starch sheath is absent.
4. Pith is present.	4. Pith is absent.
5. Pericycle is present.	5. Pericycle is absent.
6. Medullary rays are present.	6. Medullary rays are absent.
7. Vascular bundles are open.	7. Vascular bundles are closed.
8. Vascular bundles are arranged in a ring.	8. Vascular bundles are scattered. in the ground tissue.
9. Bundle cap is present.	9. Bundle sheath is present.
10. Protoxylem lacuna is absent.	10. Protoxylem lacuna is present.
11. Phloem parenchyma is present.	11. Phloem parenchyma is absent.

Difference between monocot and dicot root

Monocot roots	Dicot roots
1. Xylem is **polyarch**.	1. Xylem is usually **tetrarch.**
2. Pith is usually large at the centre.	2. Pith is usually absent.
3. Metaxylem vessels are generally **circular** in cross section.	3. Metaxylem vessels are generally **polygonal** in cross section.
4. Conjunctive tissue is sclerenchymatous in Maize.	4. Conjunctive tissue is usually parenchymatous.
5. There is no secondary growth.	5. Secondary growth is generally present.