

Exercise 4

Aim: Study of tissues and diversity in shapes and sizes of plant cells.

Principle: Tissue is a group of cells performing a common function. Tissue may be simple (parenchyma, collenchyma and sclerenchyma) i.e., containing only one type of cells or complex (xylem, phloem) that is containing more than one type of cells. The tissues are also classified into meristematic or permanent tissues. Cells of different types of tissues differ in their structure, shape, size, function and wall composition.

In the present exercise we will try to understand the structure of cells that constitute various tissues and their organization.

Requirements:

A. Permanent slides of:

- (i) T.S. of *Nerium* leaf, T.S. of lotus leaf, T.S. of lotus petiole/ or stem,
- (ii) V.S. of shoot apex and root apex,
- (iii) T.S. of *Cucurbita*/*Mentha* stem,
- (iv) Macerated material of *Bougainvillea*/*Vitis*, *Tridax*

B. Requirements for maceration technique:

Small twigs of locally available plants, glycerine, safranin, cotton blue, boiling test tube/beakers (100ml), glass rod, slides, needles, burner, tripod stand, wire gauge, microscope, sharp edged knife, muslin/cheese cloths and thread.

For Maceration fluid - Dissolve 10% nitric acid with equal amount of chromic acid. Chromic acid is prepared by adding 100ml of conc. H_2SO_4 slowly in 10 ml of water. Add 50 gm of potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$). This is the stock solution. 10 ml of this stock solution is diluted upto 100 ml for preparing working solution of maceration fluid.

Procedure

- A. • Collect a few, thin green young branches of recent growth from locally available woody plant preferably of the thickness of tooth pick.
- Cut the twigs into small bits of 0.5 cm length.
- Transfer the pieces into the beaker containing water and boil for 10-15 minutes or till all pieces of sample settle at the bottom. The procedure removes all the air present inside the tissues of the sample.

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- Transfer the material into a hard boiling tube/beaker containing maceration fluid and boil for 10-15 minutes or till it becomes soft and pulpy.
- Tie muslin cloths to the mouth of the beaker and wash the material with tap water repeatedly to remove traces of maceration fluid.
- Take some materials and add a few drops of safranin to stain the xylem or cotton blue for phloem.
- Take the stained material on a glass slide in a drop of glycerine and tease with the help of two needles to separate the cells with needles. Place a cover slip and observe under microscope. Compare your observation with the given diagram.

B. Examine the following permanent slides:

- T.S. of *Nerium* leaf - for spongy and palisade tissue.
- T.S. of Lotus leaf, T.S. of lotus petiole for aerenchyma.
- V.S. of shoot apex and root apex for meristem.
- T.S. of *Cucurbita* or *Mentha* stem for simple tissues.

Observation

Identify the cells of parenchyma, collenchyma, or schlerenchyma (Fig. 4.1) as follows:

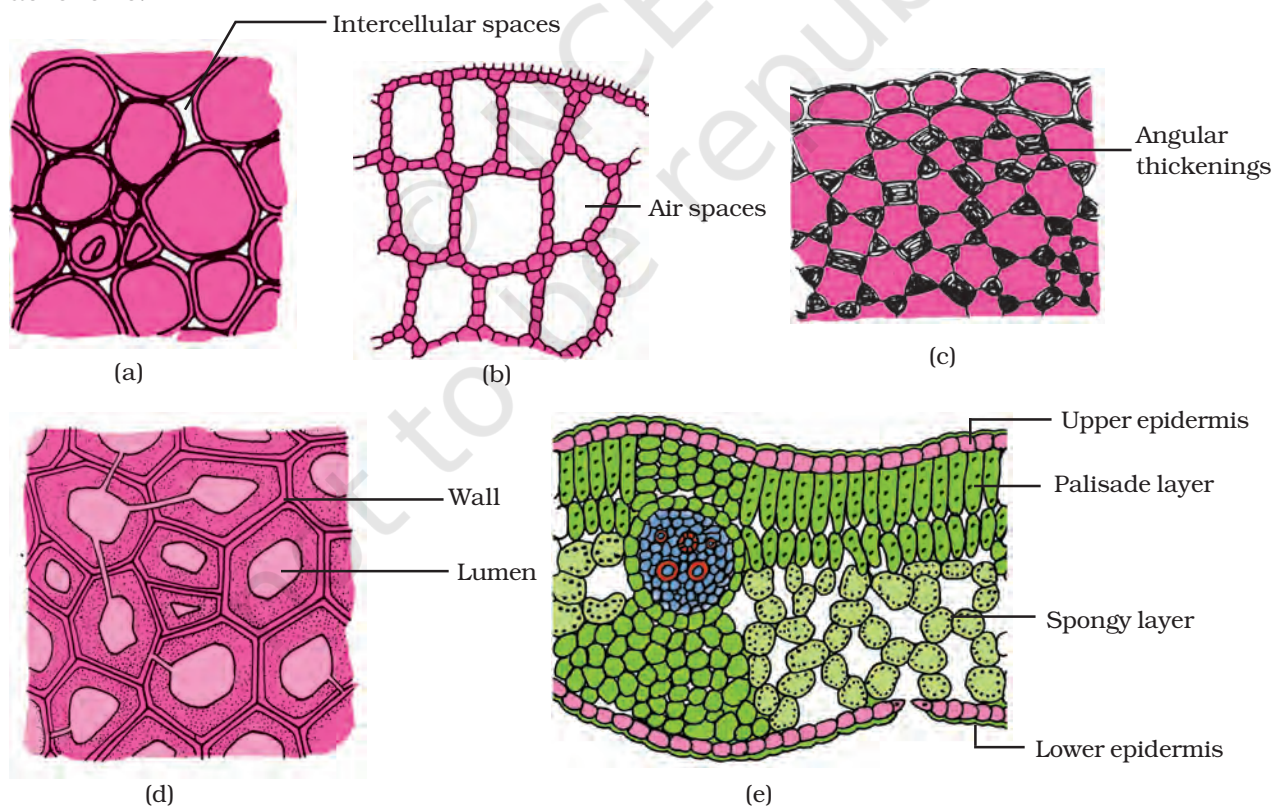


Fig. 4.1 Different plant tissues (a) Parenchyma (b) Aerenchyma (c) Collenchyma (d) Sclerenchyma (e) Palisade and spongy tissues of leaf

Parenchyma cells containing chloroplast are chlorenchyma which could be a tissue with loosely arranged cells (spongy) or compactly arranged columnar cells (palisade). If large intercellular spaces are present between the cells, the tissue is called aerenchyma.

Parenchyma tissue that forms the outer covering of root, stem or leaves is called as epidermis or protective tissue.

Parenchyma	Collenchyma	Sclerenchyma
Cells are thin walled. Only primary wall present	Thick primary wall at the corners.	Thick walled
Cells loosely arranged	Cells compactly arranged	Cells compactly arranged.
Cells are living, nucleus present	Cells living, nucleus seen	Cells dead, devoid of cellular contents.
Spherical, polygonal, oval, rectangular or rod shaped.	Shapes are variable.	Elongated
Many intercellular spaces.	Intercellular spaces absent	Intercellular spaces absent
Cells vacuolated	Vacuoles absent	Vacuoles absent

Observe the section of leaf. The leaf mesophyll is covered over by upper and lower epidermis. Stomata are present on the lower epidermis or on both upper and lower epidermis of the leaf depending on the type of plant under study.

Observe these tissues, their position and characteristics in the sections of plant materials. Draw diagrams and show the location of each tissue type.

Note: Teachers may prepare temporary stained section of the material.

Questions

1. Why are large air spaces present in aerenchyma?
2. In what type of plants do you expect to find aerenchyma tissue?
3. To observe palisade parenchyma, which part of a plant should be taken for preparation of slide?
4. What is the wall of sclerenchymatous cell made up of?
5. What type of cells have angular thickenings? What is the function of such kind of cells?