Lab.7 **Tissues**

The plant body has four basic organs: roots, stems, leaves, and flowers/fruits which composed of tissues. Tissues are cell complexes, which are similar in origin and structure, and are carrying out specific functions.

Tissues are classified to

A- Meristematic tissues

B- Permenant tissues

A- Meristematic tissues: - They are groups of densely packed cells with thin cell walls. Meristematic tissue consists of meristematic cells that have the capacity to divide and form new cells. These tissues can be found in root tips, shoots, buds, and any place where new growth occurs.

The properties of meristem tissue are:

1- Small size

2- Cells are capable of active cell division

3- The cells surrounded by primary cell wall (thin wall)

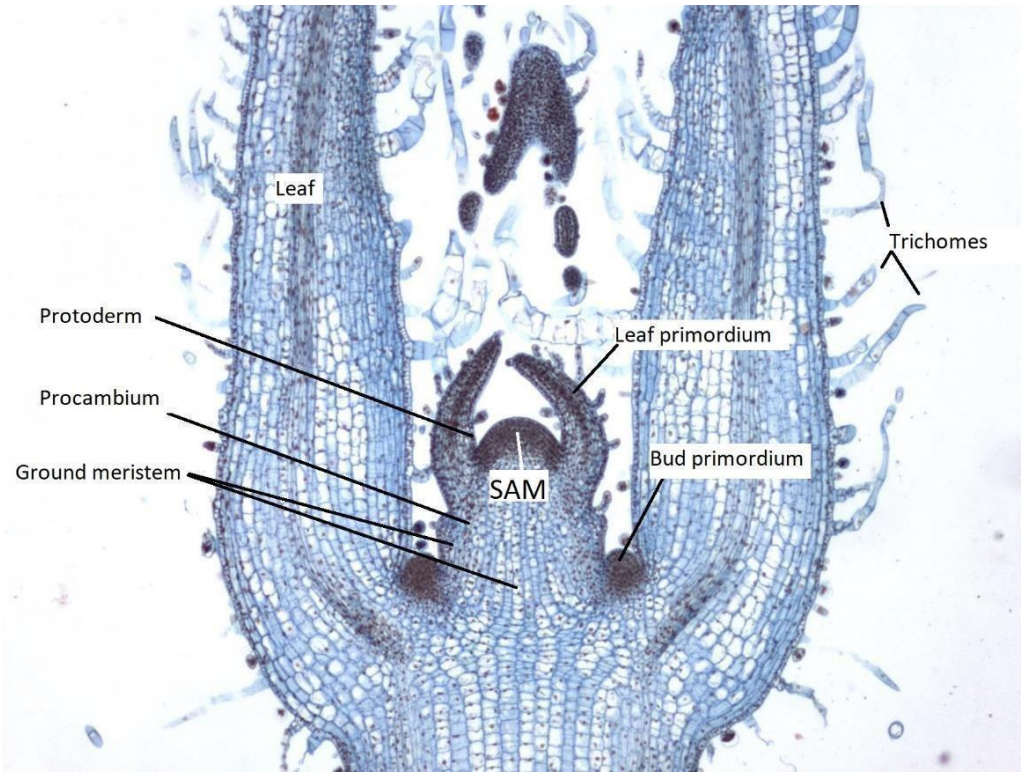
4- No intercellular spaces is found

5- The cells have less vacuoles or absent

6- They are rich in cytoplasm

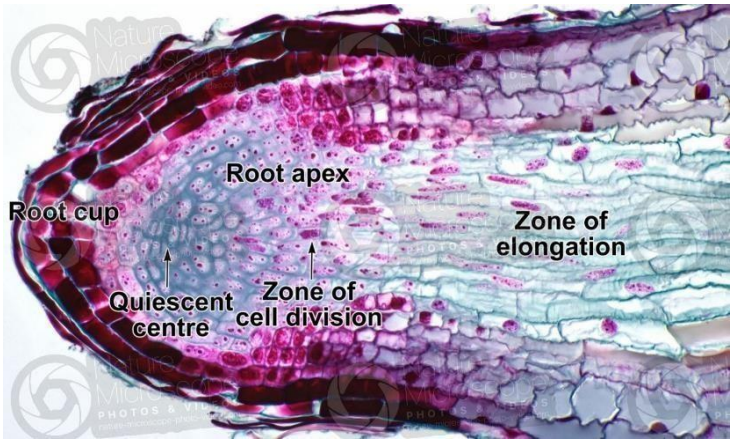
The meristematic tissues are divided according to position to **apical meristems**, **intercalary meristems** and lateral meristems

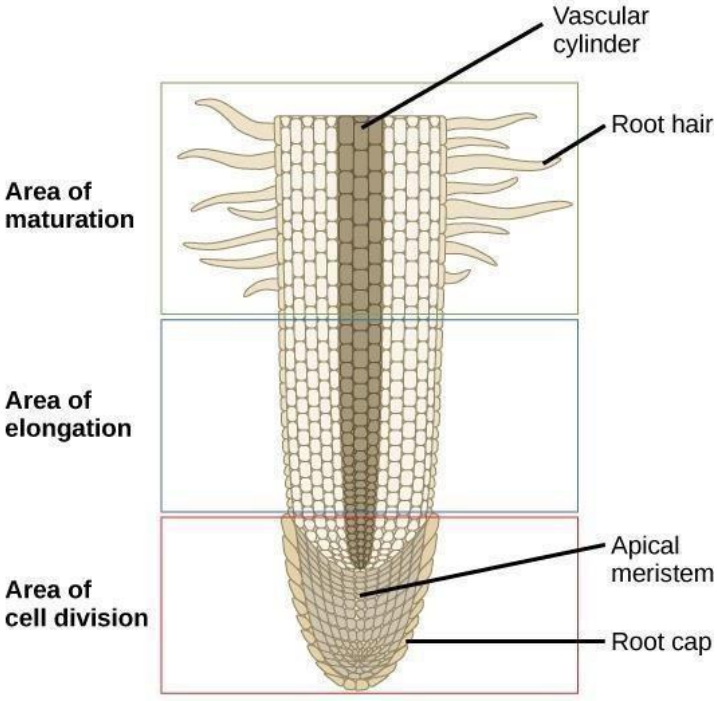
***** Apical meristems: -** They are specialized zones of growth found at the tips of plants. These are responsible for the extension of shoots and roots and are also responsible for the primary plant body.



Longitudinal section of Coleus stem tip showing the meristematic region

If L.S of a root tip is carried out, four root regions will be recognized: the **root cap**, the **region of cell division**, the **region of elongation** and the **region of maturation**





L.S. of pine root tip showing root regions

B- Permanent tissues are consisting of plant cells that are no longer actively dividing. This tissue is divided into

A- Simple (consisting of one cell type only), as in the case of parenchyma or collenchyma

B- Complex (consisting of two or more cell types) as in the case of xylem, phloem and epidermis. Thus, an organ such as a leaf is made of three different tissues (epidermis, mesophyll/Chlorenchyma and vasculature), with each tissue composed of up to three general cell types (parenchyma, sclerenchyma, or collenchyma).

1- Parenchyma tissues: - They are type of simple tissues which its cells are alive, metabolically active, capable of dividing, bounded by thin primary cell wall, have nucleus, various amounts of cytoplasm, and one or more vacuoles. Usually intercellular spaces occur in the tissue. Altogether, parenchyma represents about 90% of the cells found in a typical herbaceous seed plant.

The main functions of parenchyma tissues are

A- Photosynthesis

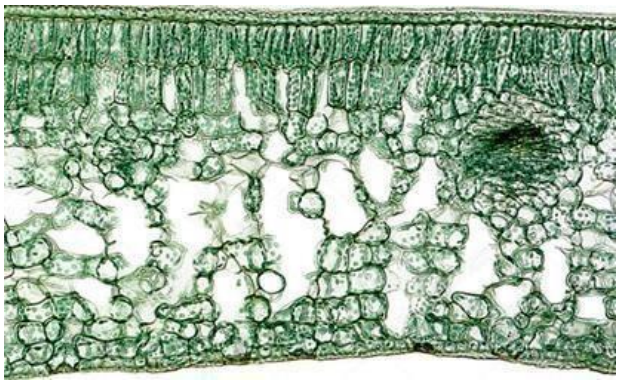
B- Nutrient assimilation

C- Respiration

D- Storage and secretion

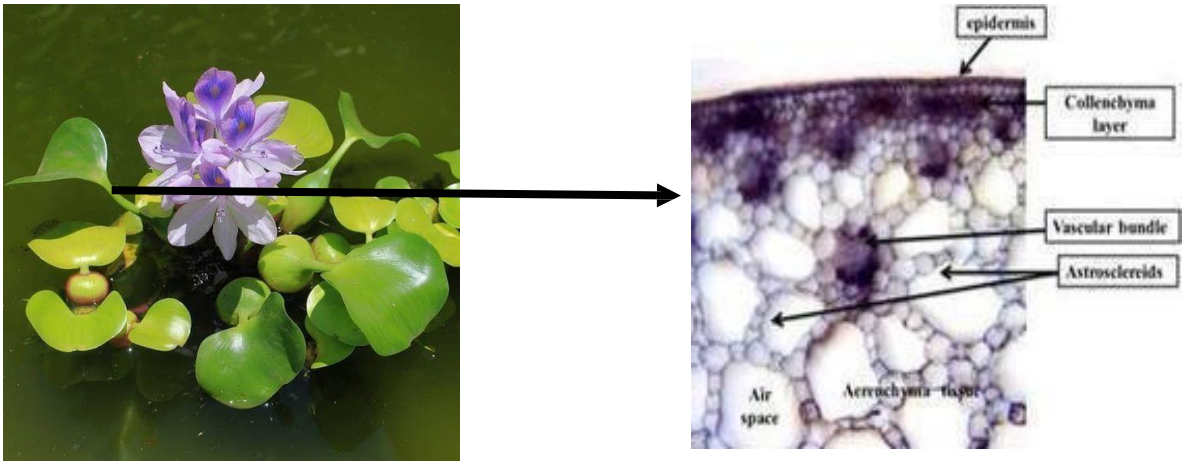
*** Parenchyma tissue can be divided according to its function to

A- Chlorenchyma: - It is chloroplast-containing parenchyma of leaves that carry out. photosynthetic activity because their thin primary cell walls allow more efficient diffusion of light, water, gases, and metabolites.



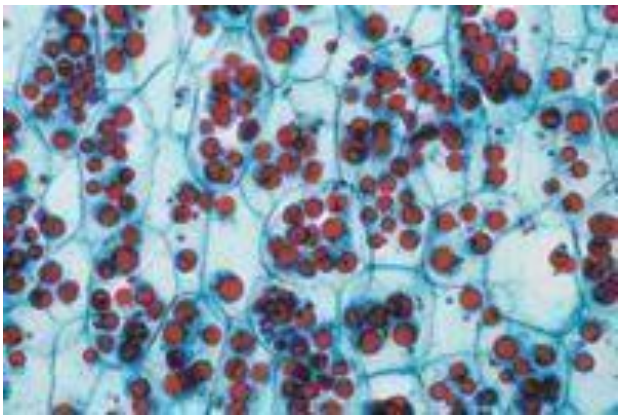
Cross section of a Camellia leaf (Tea plant) showing Chlorenchyma

B- Aerenchyma (Air storage): - it is composed of parenchyma cells and common in the leaves, stems, and roots of aquatic plants. In these plants, the air in the spaces helps in aeration, floating leaves or stems and also to give the plants floating and support. The buoyancy of many water plants further enables them to take light at the surface of the water for effective photosynthesis.



C.S. of petiole of Water Hyacinth (*Eichhornia crassipes*) showing aerenchyma

C- Food storage parenchyma: - Parenchyma cells store food material in the form of oil, fats, proteins, and starch, for example, parenchymatous tissues in roots and stem tubers.



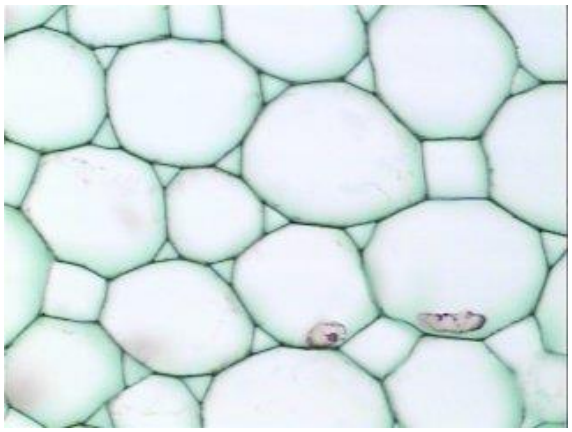
Food storage parenchyma of C.S. of castor oil endosperm

D- Water storage parenchyma: - These store water as they act as a water reservoir in succulent plants such as Cactaceae, aloe, agave, etc. The cells are characterizing by thin-walled, chlorophyll free and water turgid cells.

C.S of *Salsola oppositifolia* leaf showing storage parenchyma

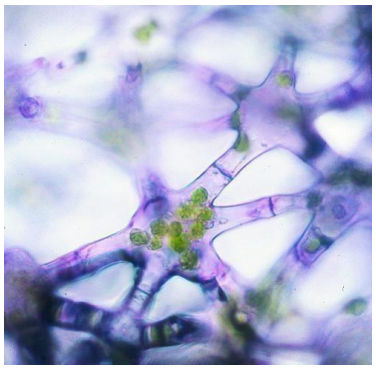
*****Parenchyma tissue can be divided according to its shape to**

A- Ordinary parenchyma cells: - They are the most dominant type of parenchyma in the plant, and it have large intercellular spaces, and also characterized by their large vacuoles. They distributed in the pith of stems.



Ordinary parenchyma cells in the pith of stem

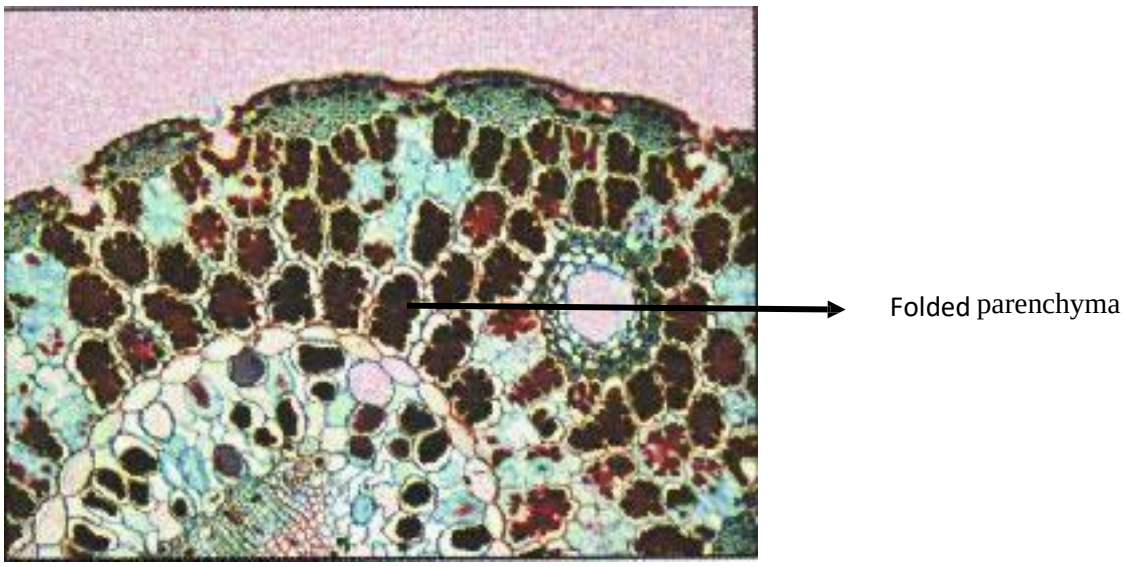
B- Stellate parenchyma: - They are present in the petioles and midribs of Canna and banana leaves. These are a type of aerenchymatous tissues that are made up of parenchyma cells and are found in aquatic plants.



C.S. of Canna petiole showing stellate parenchyma stained with Toluidine Blue

C- Columnar parenchyma: - it can be found in the palisade tissue of leaves.

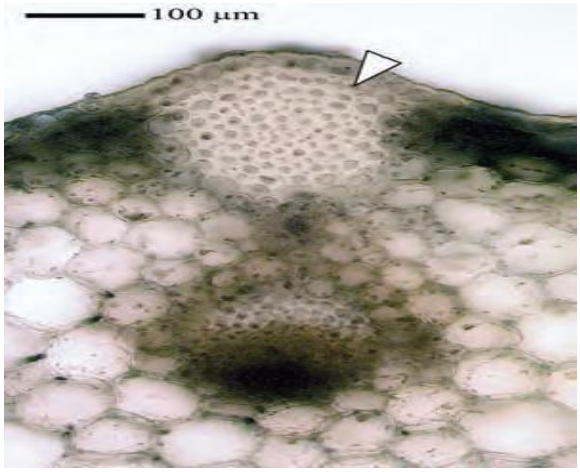
D- Folded parenchyma: - It is s the parenchyma cells with folds around their edge, which usually a characteristics of some gymnosperm for example the pine leaf.



C.S. of Pine leaf showing folded parenchyma

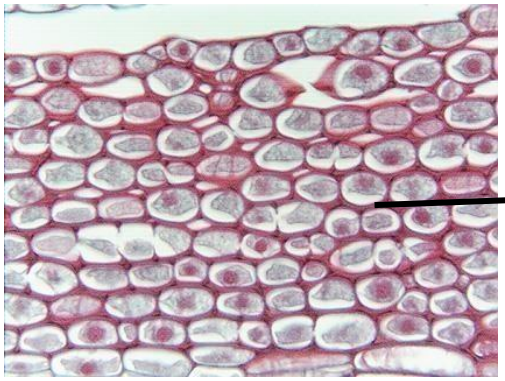
2- Collenchyma: - It is living supportive tissue that has elongated cells and an unevenly thickened primary cell wall. Its main function is the mechanical support of young stems and leaves; like parenchyma cell, collenchyma cells can restart meristematic activity. Collenchyma is not a widespread tissue in the body of the plants as it observed as supporting tissue in growing organs of numerous herbaceous and woody plants (stems, leaves and flowers). There are different types of collenchyma **depending on the thickenings** of their cell walls.

A- Angular collenchyma: The thickenings of the cell walls are located in the angles or corners of the cells and there are no intercellular spaces. This type of collenchyma cells can be seen in herbaceous stems and petiole



Unstained C.S. of celery petiole showing a bundle of angular collenchyma (arrowhead)

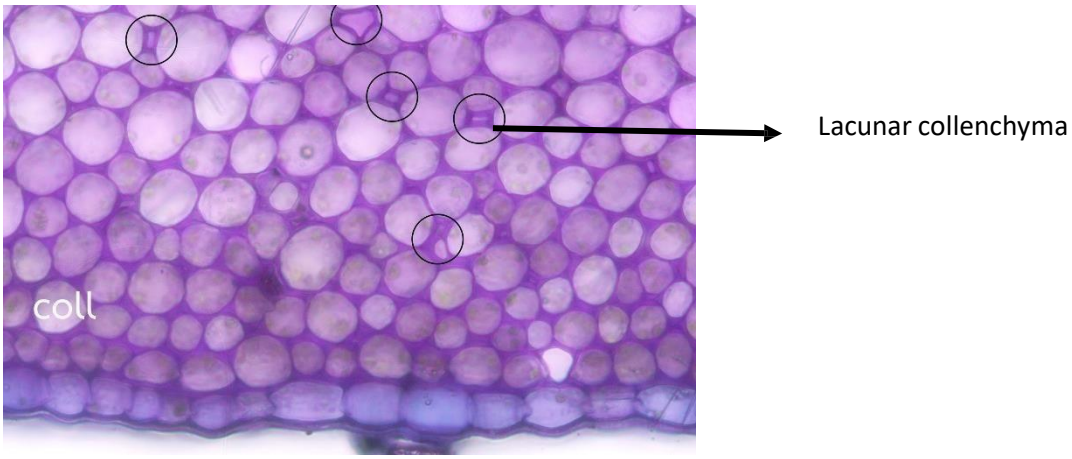
B- Lamellar collenchyma: - It is very much alike to angular collenchyma but the cells are regularly arranged. Thickening occurs at the inner and outer tangential walls.



Lamellar collenchyma

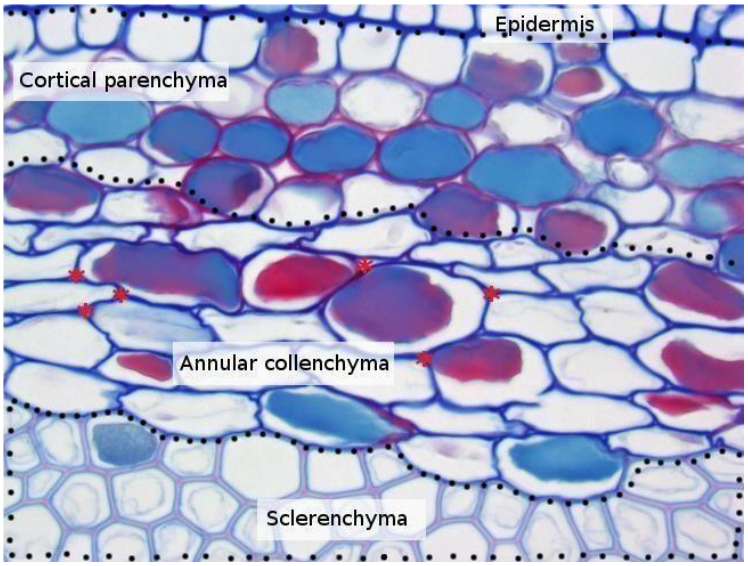
C.S of stem of elder (Sambucus) showing lamellar collenchyma

C- Lacunar collenchyma:-It is consisting of thickening around the cell walls facing the cavity lumen or intracellular spaces



Lacunar collenchyma in C.S. of stem

D- Annular collenchyma: - This is the only type of collenchyma where the thickenings of the cell walls are uniform around the cell. It contains empty intercellular spaces.

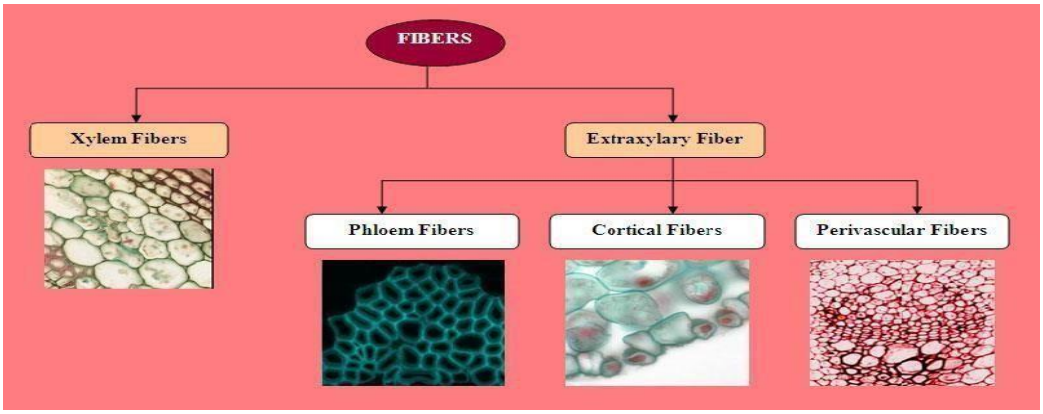


C.S. of mallow (*Malva sylvestris*) stem, the red star showing annular collenchyma

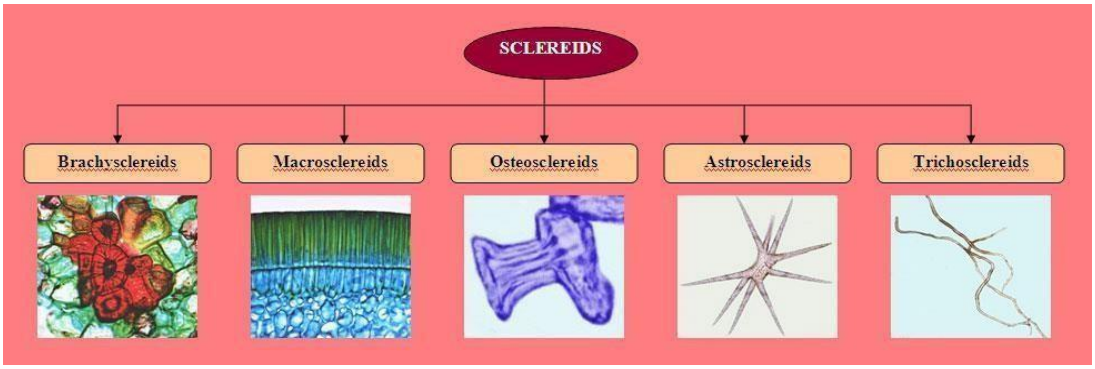
3- Sclerenchyma tissue:-It is type of simple tissue is composed of cells with rigid cell walls and the cells lack contents at maturity became dead.

Sclerenchyma has a t function in the support of organs that do not grow anymore. This tissue is classified into three categories: **fibers**, **sclereids**, and **water-conducting sclerenchyma.**

***** Fibers: -** They are long, narrow, thick-walled cells that are dead at maturity. Fibers are found in various parts of plants, often in association with vascular tissues, particularly phloem in primary growth and secondary xylem (wood). Fibers are classified into four types as mentioned in diagram below.



*****Sclereids: -** They are smaller in size than fibers and more varied in shape with thick secondary walls that are heavily lignified. They occur singly or in clusters in various locations in the plant body such as stems, seed coats, fruit pulp, and leaves (especially in the mesophyll). They are classified into five types as illustrated in diagram below:



Practical work:-

1- Prepare C.S from stem of any available dicot plant to observe ordinary parenchyma.