Cell

It is a basic unit of life in all organisms.

A plant cell is a type of eukaryotic cell that is the basic structural and functional unit of plant organisms. It is characterized by a rigid cell wall . It contains chloroplasts, responsible for photosynthesis, Plant cells typically have a large central vacuole, storing water and maintaining turgor pressure. Their shape is often rectangular or square, and they lack centrioles. These cells work collectively to enable plant growth, nutrient storage, and adaptation to their environment. **Plant cell composed of :**

1) Cell Wall

It is a rigid layer which is composed of polysaccharides cellulose, pectin and hemicellulose. It also comprises glycol-proteins and polymers such as lignin, cutin, or suberin. It is located outside the cell membrane. Cell wall consists of three layers: **primary**, **secondary** and the **middle lamella**.

Functions of cell wall

1-Provides structural strength. It gives rigid support, Maintain the integrity of its stems, leaves and other structures.

2-Protection against mechanical and osmotic stress

3-Help of regulating intake and retention of water. It also filters the molecules passing in and out of the cell.

4-It can also sense the presence of pathogenic microbes and control the development of tissues within the cell because of its storage site of regulatory molecules.

2) Cell membrane

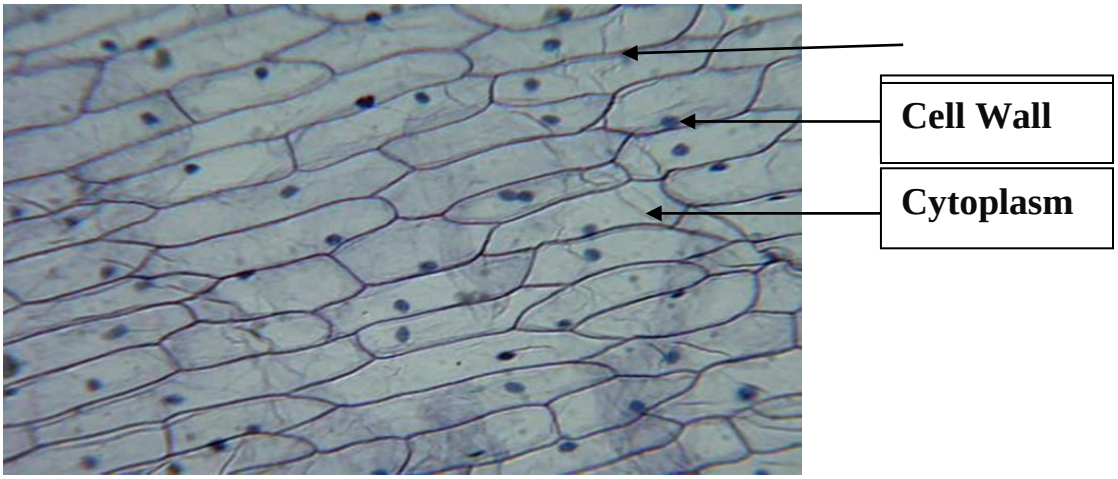
It is composed of a phospholipid bilayer with embedded proteins that separates the internal contents of the cell from its surrounding environment. A phospholipid is a lipid molecule with two fatty acid chains and containing a phosphate- group.

a)-Controls the passage of organic molecules, ions, water, and oxygen Wastes (such as carbon dioxide and ammonia) into and out of the cell,

b)- allow small and/or non-polar molecules to pass through because its semi-permeable.

3) **Cytoplasm**, the semifluid substance of a cell that is external to the nuclear membrane and internal to the cellular membrane,
4) **Cytosol,** the fluid mass that surrounds the various organelles.
5) **Nucleus** is a membrane-bound structure that is present only in eukaryotic cells. The vital function of a nucleus is to store DNA or hereditary information required for cell division, metabolism and growth.
6) **Nucleolus:** It manufactures cell's protein-producing structures and ribosomes.
   Nucleopore, Nuclear membrane is perforated with holes called nucleopore that allows proteins and nucleic acids to pass through.

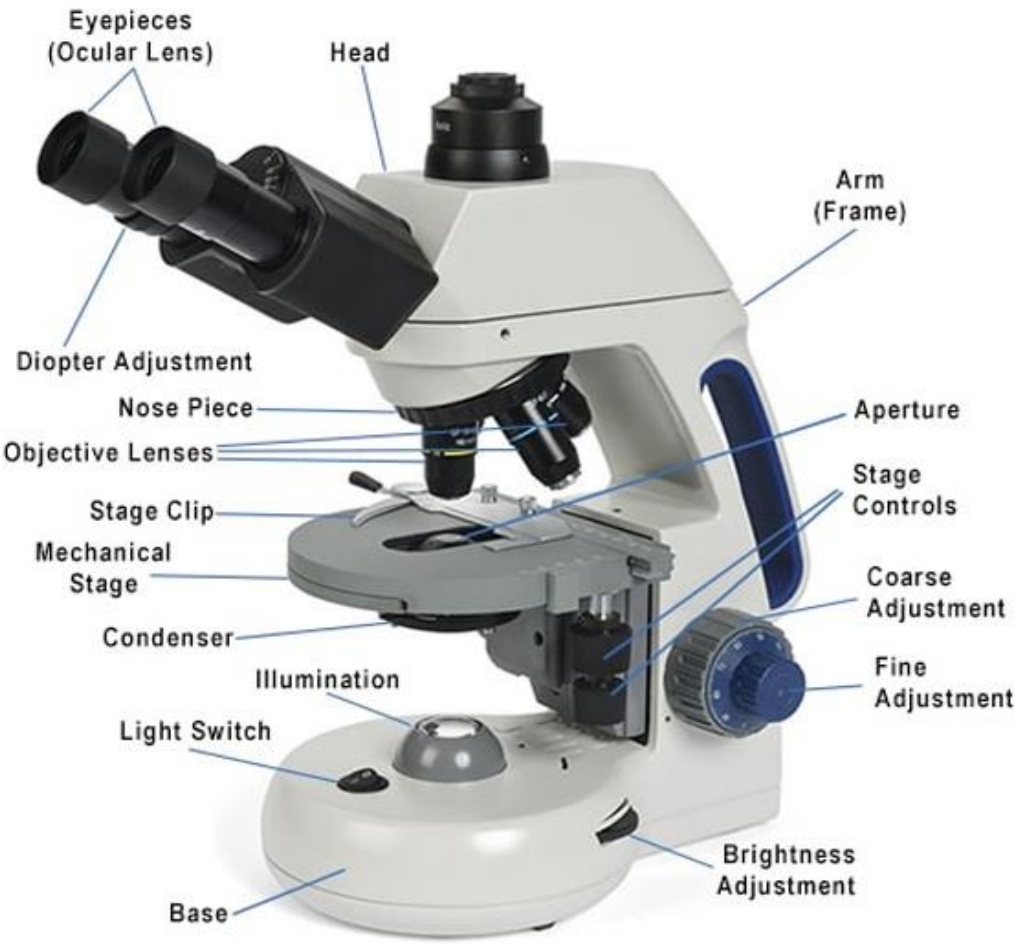
To depict the structure of a plant cell, an epidermal cell of onion (*Allium cepa*) will be used as an example.



C.s of *Allium cepa*

Microscope Slide Preparation.

Microscope, instrument that produces enlarged images of small objects, allowing the observer an exceedingly close view of minute structures at a scale convenient for examination and analysis.



Microscope slides are transparent pieces of glass or plastic that help in displaying the sample clearly.

How to Prepare Microscope Slides?

The method used to prepare the slide depends on the nature and type of sample to be examined. There are two types of prepared slides: dry methods and wet methods. Each type of preparation method is used for different types of cells.

Prepare the slide using the wet method

The wet method is used to examine live and aqueous samples. It consists of three layers, the bottom layer is the slide, and the next (top) part is the special liquid (sample drop), the last part is a small square of glass or plastic that is placed on top called cover slide.

1- Select a clean slide, by wash the slide with water then dry it using a clean cloth, do not use tissue or paper towels as these can leave lint behind, if your slide is dirty or smudged you won't be able to effectively examine your specimen

2- place a drop of liquid in the middle of the slide (for example, water, glycerin, or Immersion oil, If the sample is not clear in the liquid, forceps can be used to move the sample into the liquid.

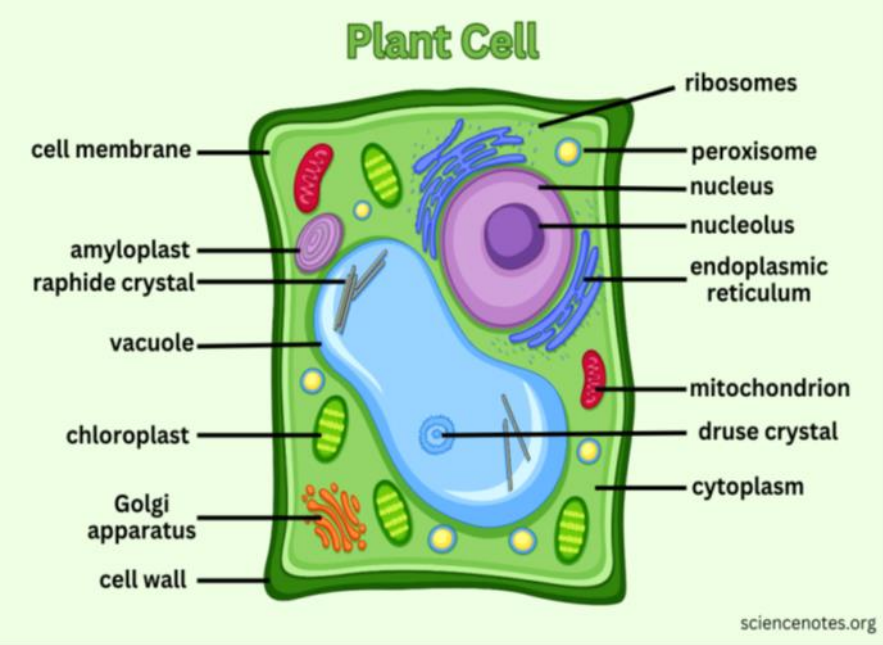
3- Slice off a thin piece of the sample specimen, place it on the center of the slide use a pair of forceps.

4- Place one side of the cover slide at an angle avoiding air bubbles., sometimes bubbles occur as a result of using a viscous liquid. If the size of the liquid drop is very large, it will give an unclear view because the liquid will spread completely over the slide, the cover slide used to reduce evaporation and protect the microscope lens from exposure to the sample.

The components of plant cell

1. Living component: which include cell membrane , cytoplasm, nucleus, plastids, mitochondria, endoplasmic reticulum, ribosomes, dectosomes and others.

2.Non-living component: which include vacuoles, starch grains, aleurone granules, lipid drops and crystals.



Living component

Plastids

- Plastid is organelle which are found in the cells of plants and algae. They are necessary for essential life processes, like photosynthesis.

- They are also the site of storage of important chemical compounds used by the cells of autotrophic eukaryotes.

- Its function depends on the presence of pigments. which are also the ones responsible for the color of a plant structure (e.g. green leaf, red flower, yellow fruit, etc.).

Types of Plastids

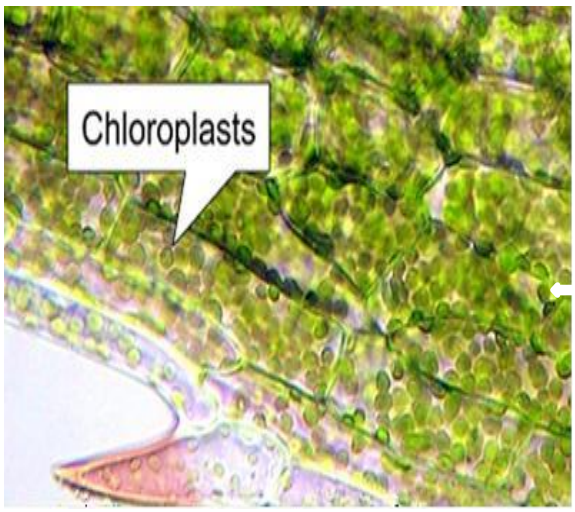
There are different types of plastids with their specialized functions. mainly classified based according to presence or absence pigments and it is:

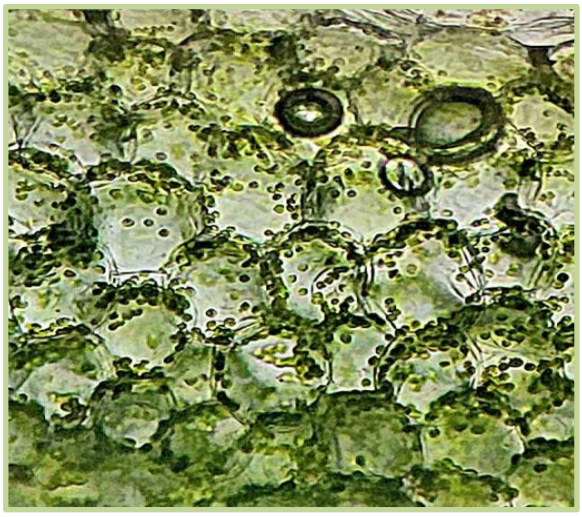
A.Chloroplasts

- Found in the mesophyll tissue in plant leaf, they are spherical, oval, or discoid in higher plants, cup-shaped, or spiral or star as in some algae.

Chloroplasts Shape

- They are the sites for food synthesizing by the process of photosynthesis, plastids have their own DNA and ribosomes.





C.s in stem of *Iris* **C.s in leaf of *Aloe***

- The chloroplast is bounded by two lipoproteins in membranes, an **outer** and an **inner** membrane, with an **intermembrane** space between them.

- The inner membrane encloses a matrix, the **stroma** which contains small cylindrical structures called **grana**. Most chloroplasts contain 10-100 grana. The chloroplast is filled with thylakoids, which is where photosynthesis occurs, and chlorophyll remains. thylakoids are arranged in stacks known as **granum,** each granum contains around 2 - 100 parallel thylakoids.
- The plural for granum is grana, the grana is linked to other granum by membranous structure called stroma lamella.

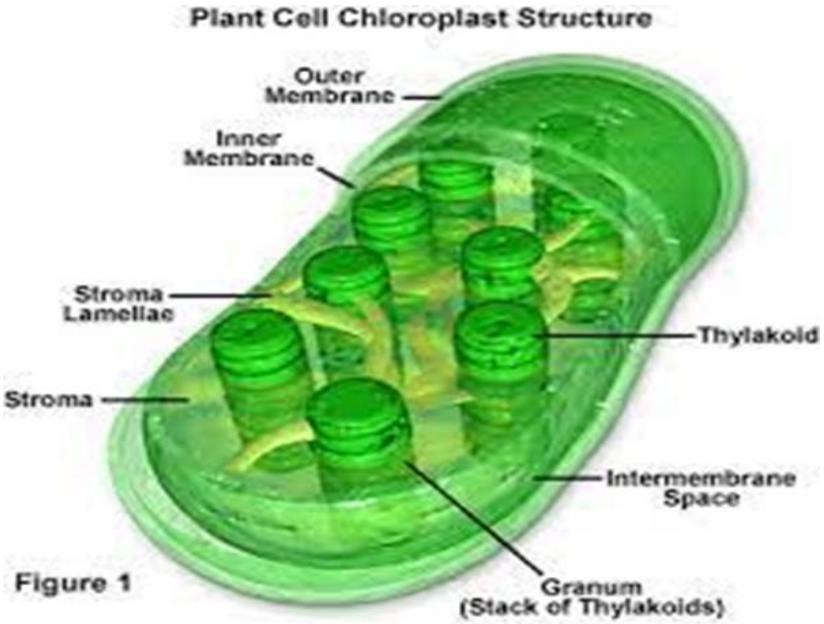


Figure 1

B.Chromoplasts

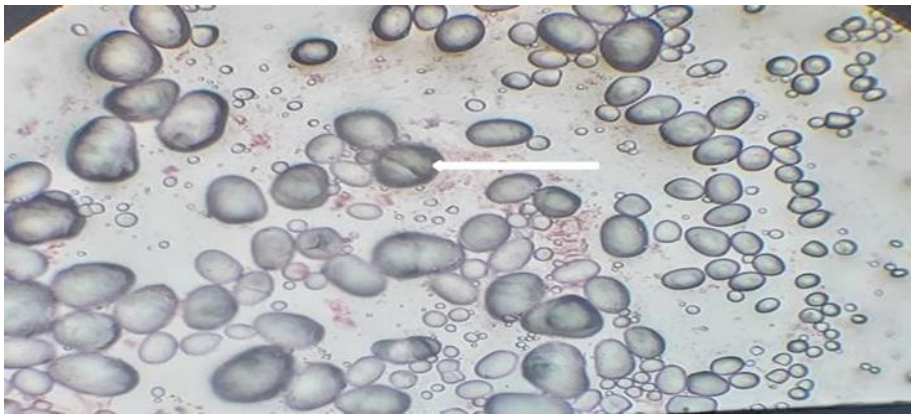
Chromoplasts are units where pigments are stored and synthesized in the plant.

- These are found in flowering plants, fruits, and aging leaves.
- The carotenoid and xanthophyll pigments allow for the different colors seen in fruits and the fall leaves. red, yellow or orange in color.
- One of the main reasons for these structures and the colors is to attract pollinators.
- The chloroplasts actually convert to chromoplasts.

C.s in Tomato fruit (Chromoplast)

C. Leucoplasts(colorless)

- Leucoplasts are the non-pigmented organelles.
- They are found in the non-photosynthetic parts of the plant, such as the roots.
- Depending on what the plant needs, they may become essentially just storage sheds for starch called (**Amyloplasts**) , lipids called (**Elaioplasts**), and proteins (**Proteinplasts**).
- They are more readily used for synthesizing amino acids and fatty acids.
- leucoplasts sometimes differentiate into more specialized plastids.



Potato tuber (Leucoplast)

Nonliving components in cells

Non- living components in plant cell refer to the structures or substances that are not alive but play important roles in the cells function.

These include **starch grains**, **vacuoles** containing cell sap and **crystals**.

- **Starch grains :** are non-living, energy-storing structures found in plant cells, where excess glucose produced during photosynthesis is stored in the form of starch

They act as storage units for energy that the plant can use when needed.

The characteristics of starch grains differ from one plant to another

These granules differ in:

1. The site and shape of the grain that called hilum.
2. Presence or not presence layers.
3. Size and shape of the starch granules.

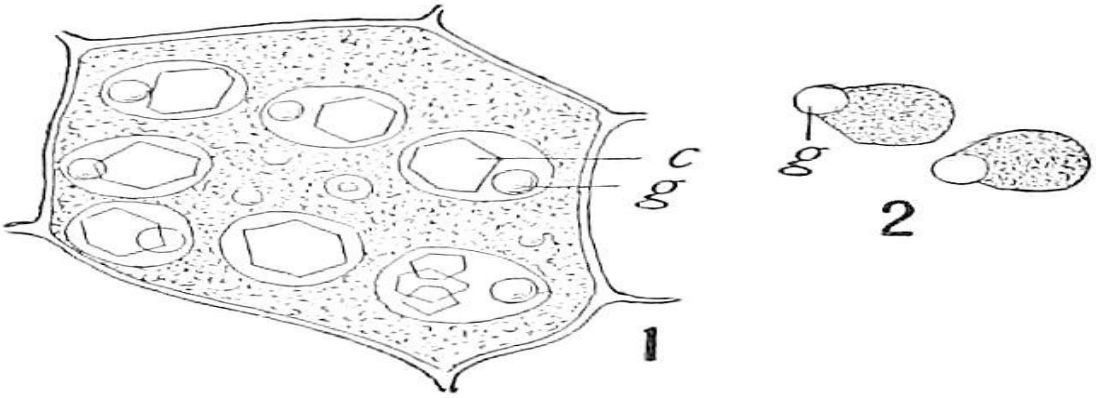
There are three type of starch grains:

1- **simple starch grains :** all the layers are organized around one hilum
there are three form of simple starch grains
A- Concentric helium in wheat
B- Eccentric helium in potato
C- Cracked in bean

2- **Semi-compound starch grains :** two or more hilums and the layers are organized around each one and then organized around about all.

3- **Compound starch grains :** contains more hilum and there was barrier between every two hilum adjacent and the layers are organized around each one independently and it does not incorporate with them.

- **Vacuoles :** they are structures found inside the plant cell that contain of fluid called vacuolar juice or cell sap ,separated from the cytoplasm by a special membrane called vacuoles membrane (Tonoplast)
- **Aleurone grains:** It is Protein substance, presence in most parts of plant, some time being circular or ovoid in it's shape. consists of two parts, a semi-crystalline body called (crystalloid), and another spherical body called (globoid). Examine a slid of Ricinus sp. seeds .



Lab 4 : practical Botany

Non -living component in plant (part 2)

2- Crystals

Crystals produced by plants are the final products of cellular metabolic processes, which usually are deposited in vacuoles and cytoplasm. The most common inorganic crystals are constituted by calcium salts, like calcium oxalate and calcium carbonate ,Crystals are found in diverse geometrical shapes.

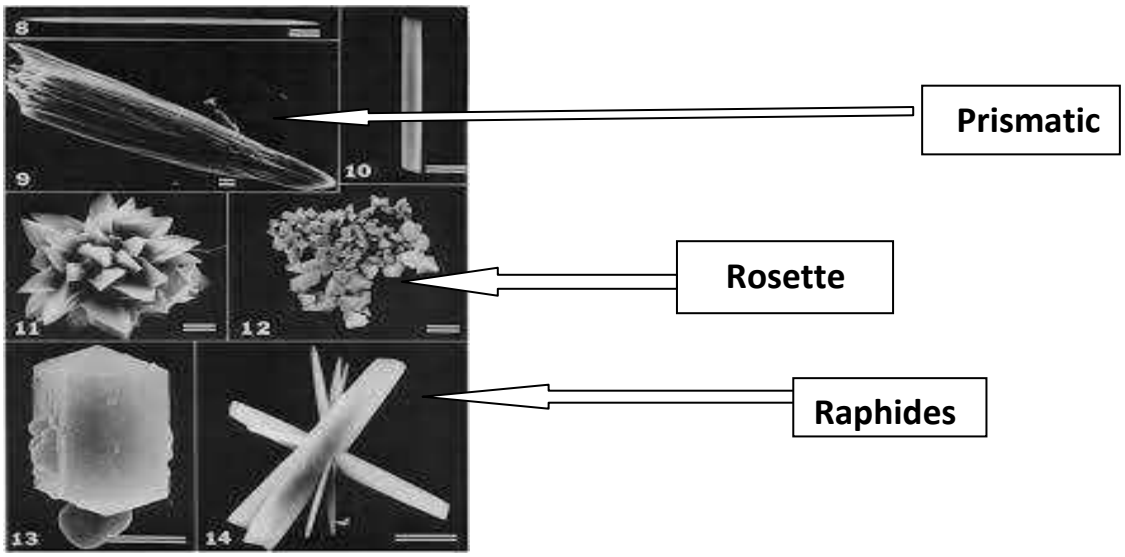
They observed in almost kinds of plant cells, which are differ in their structure and shape., so based in the chemical composition, there are two kind of crystal:-

A-Calcium oxalate crystal : are more important type to the cell, Formed in plants to get rid of excess calcium salts where it reacts with oxalic acid formed by metabolism of CHO ,that's because of the toxic effects of oxalic acid, which is accumulated inside the protoplasm as a result of the metabolic activities in the cell, so the oxalic acid united with calcium salts to form crystals, which they are less toxic than oxalic acid, Some of crystals are single other are united to structure as crystals masses.

Calcium oxalate (CaOx) crystals are considered common compounds that are found in diverse groups of plants.

Ca oxalate crystals has a great importance in identification and differentiation of different plants,Ca- oxalate crystals precipitate in different shapes and sizes

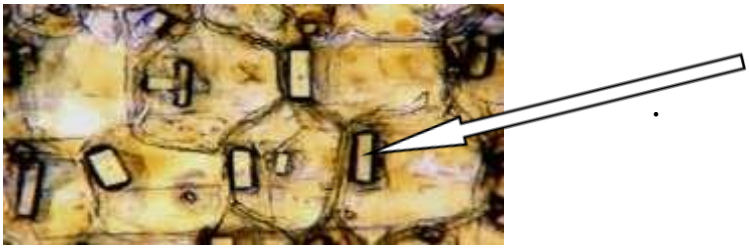
There are three forms of calcium oxalate crystals :



1. Prismatic crystals- prism like

or pyramid like crystals

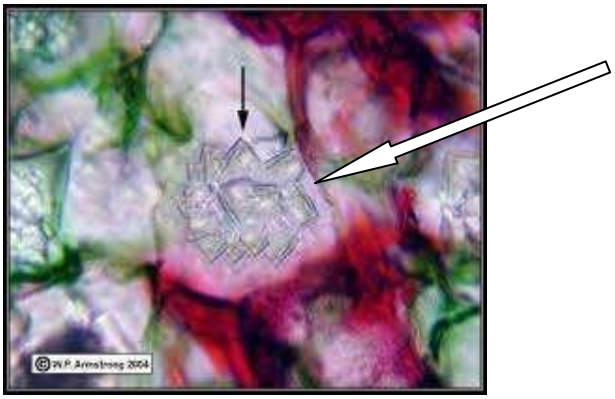
Example: ***Allium cepa***



2. Druses or Rosette crystals – aggregate

of crystals which has flower-like appearance

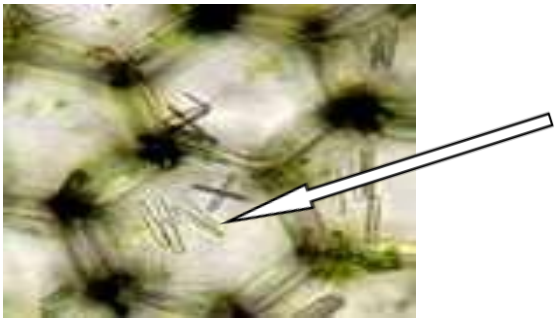
Example:- ***Nerium oleander***

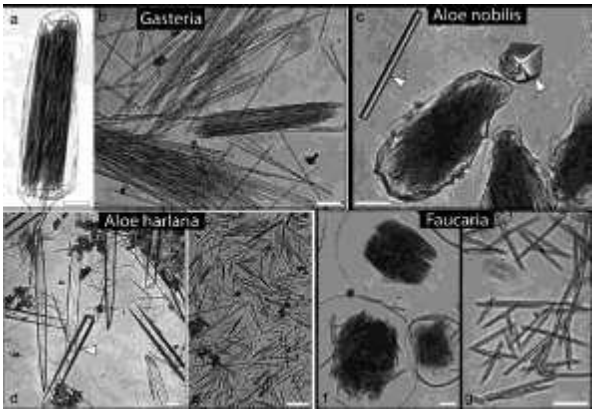


3. Raphides – needle like crystals which

occur singly or in groups or bundles .

Example:- ***Tradescantia***





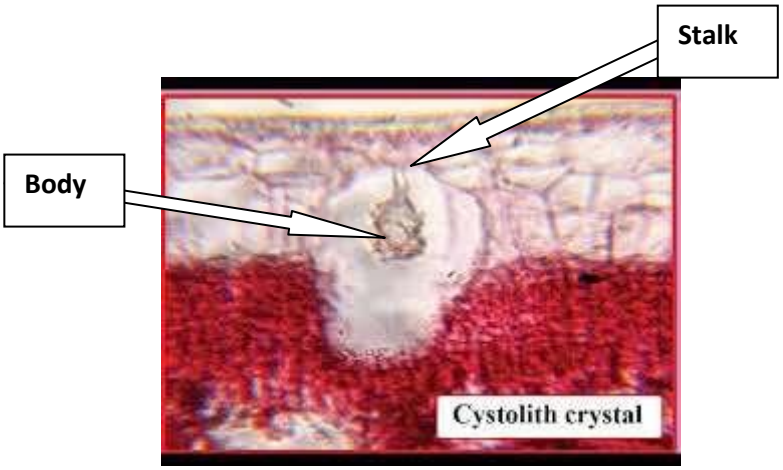
B- Calcium carbonate crystals : there are one type of calcium carbonate crystals, that is the cystolith, which are out growth of the cell and occur in parenchyma and epidermis, the cell containing this type of crystals called (**lithocyte).**

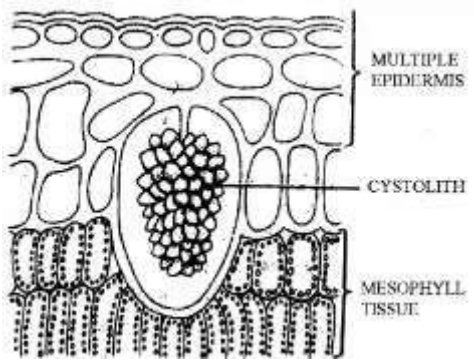
This kind of crystals are observed in ***Ficus elastic***

The calcium carbonate crystals are consist of two parts :

1. The body composed of (Calcium carbonate).

2. Stalk composed of (Cellulose).



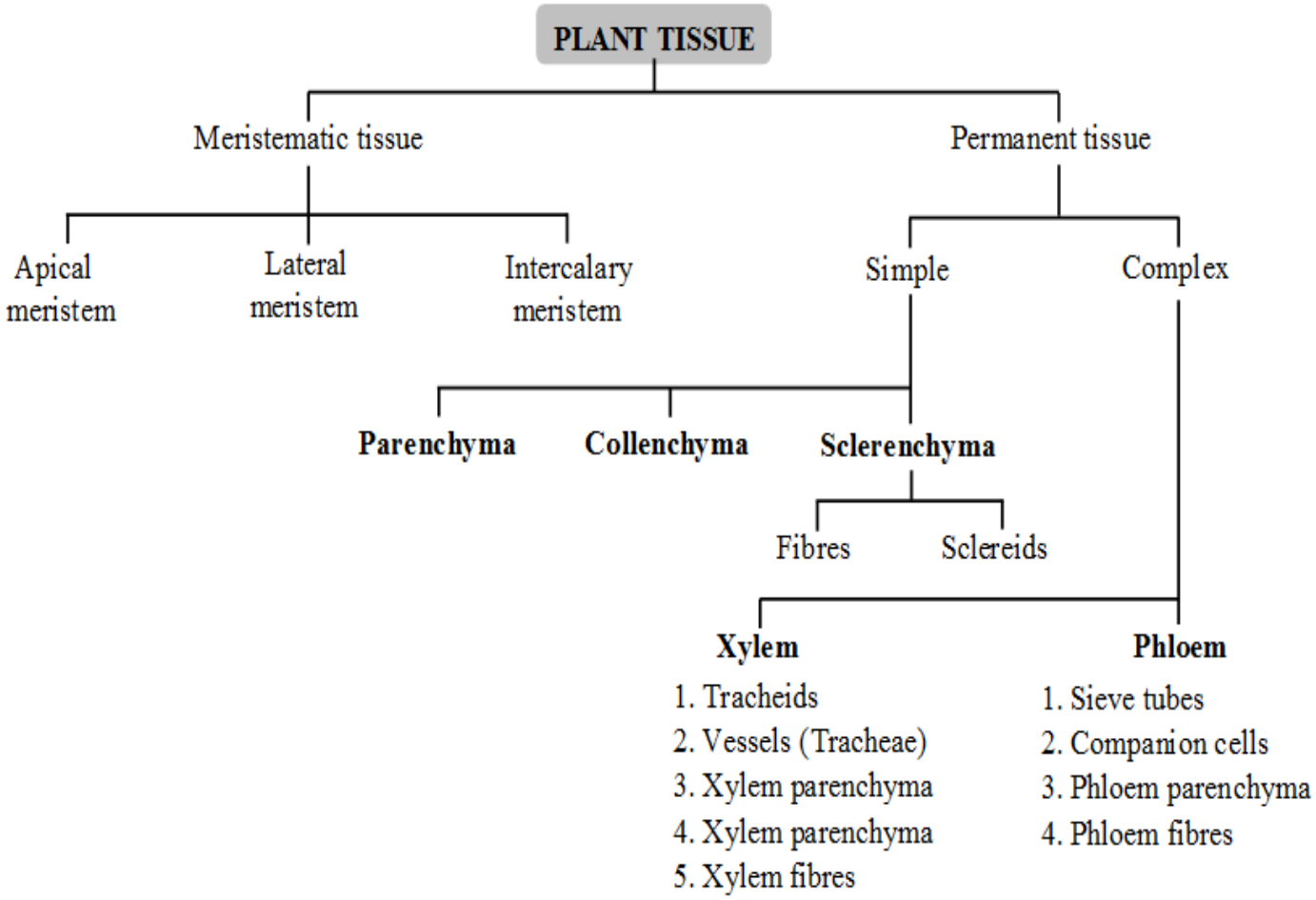


Ficus elastica

Tissue :Group or masses of cells that are alike in origin ,Structure and function .

Plant tissues classified in to

1-**Meristematic tissue** 2-**The permanent**



Meristematic tissues:

Consist of undifferentiated cells which were capable of continued cellular division, as a result the meristematic cell represent the site of cell division in plants. This tissue founds in zones of plant where growth take place and keep the plant growing.

Characteristices of meristematic tissue:

1- Small in size

2- Thin primary cell wall

3- Have the ability to divide

4- Have dense cytoplasm, few vacuoles or absent

5- Large nucleus

6- Contain dense protoplast

7- Lacking intercellular spaces between cells

Meristematic tissues can classified according to:

a. Their position in plant body

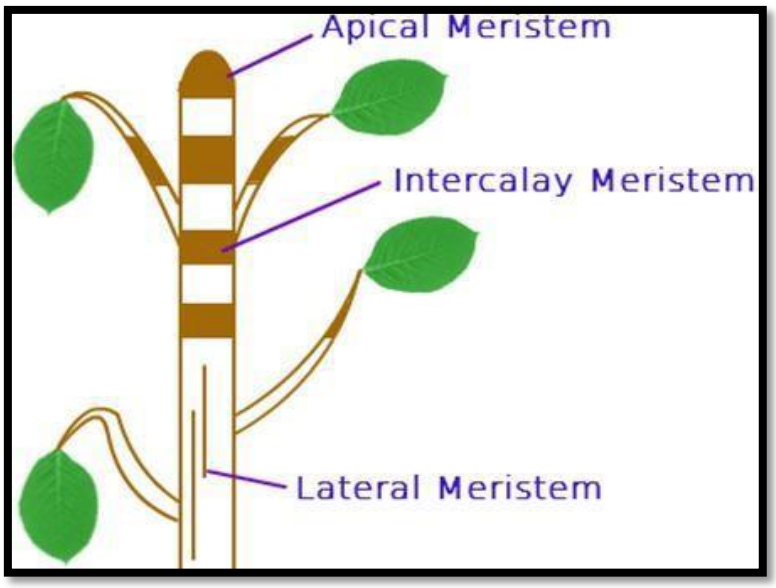
b. The origin

Meristimatic tissues according to their position in plant body

1- Apical meristems: Meristematic cells location near the tips of roots and shoots and produce primary tissues which plays an important role in the elongation of roots and shoots.

2- Intercalary meristems: it is located in between permanent tissue faraway from apical, it is usually present at the base of leaves and above the node and at the base of inter node in many monocot stems and grasses, it is responsible for the elongation of the internodes regions and the formation of branches at the nodal regions.

3-Lateral meristems: Cylindrical tissue parallel to the epidermis which form in mature regions of roots and shoots, this meristems produce secondary growth which increases the width of the plant by **vascular cambium** and **cork cambium (phellogen)**.

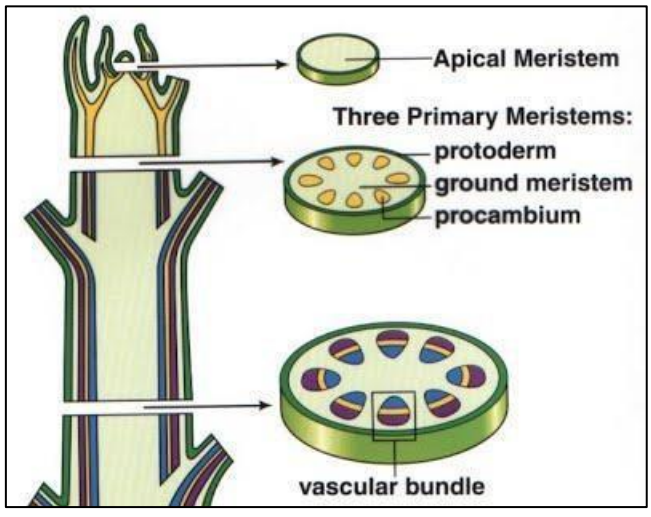


Meristematic tissues according to their position in plant body

b- Meristematic tissues according to origin

1- Primary meristems: tissues that form primary plant body and originate from promeristem so it consist apex in stems and roots and leaf primordium, which consist of: **Protoderm , Procambium , Ground meristem** . see L.S. *Vicia Faba* leaf.

2- Secondary meristems: tissues that form secondary part in plant as like as vascular cambium and cork cambium see in Tilia sp.



Primary and secondary meristems