محاضرات الأسبوع السابع والثامن

مدرس المادة : مشعل علي محمد

INTRODUCTION TO BOTANY

The oldest plants identified by ancient man and wheat occupied the first place among grain crops for its superiority in nutritional value has been found wheat grains charred in the excavations of the village (Garmo) eastern Iraq and is the oldest village has been discovered dating back to (6700 BC). It accompanies man in his food as well as in the manufacture of ships, houses, and hunting weapons... For these reasons, botany gained importance.

Botany:

Botany is one of the branches of biology and specializes in the study of plants in terms of structure, properties, classification, diseases, biochemical reactions, and interaction with the environment, and human interest in plants began early for their importance in his life, as it is a major source of food and medicines

Departments of Botany

1. Plant Morphology.

The science of phenomorphology deals with the structure and shape of plants and includes some subdivisions such as cytology, cell study,

history, histology, anatomy, the study of tissue organization in plant organs, the study of life cycles, and the study of evolution and development, as this science describes the shape of the plant in all its parts from roots to leaves, flowers, and seeds.

2. Plant physiology.

is a branch of botany, which includes all the internal chemical and physical activities of plants, and it is also concerned with studying the functions of all the organs of the plant, explaining how these organs perform their functions, and also including ways in which the plant produces and exploits its food, and how to help the different cells of the plant to grow and multiply, and how the plant responds to the surrounding world.

3. Plant taxonomy:

is a science responsible for the classification and naming of plants, taxonomy divides plants based on their relationships with each other, and is also interested in the study of plant remains, and fossils, and this science or modern taxonomy was established thanks to the Swedish science Carlos Linnaeus, and modern classification uses a binary naming system.

4. Plant Genetics:

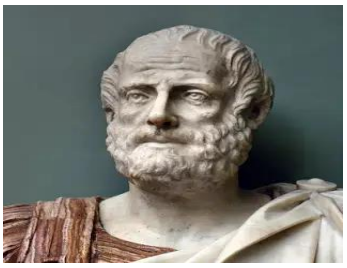
Genetics is the study of genes, and the function of genes, and many modern plants have been analyzed to use plant DNA and their genomic information, in order to study plants more accurately than before, molecular biology has opened up to taxonomists to classify plant species based on DNA, and plants have been classified into different families, and renamed as a result.

5. Plant pathology: (plant epidemiology)

Is the scientific study of diseases affecting plants caused by pathogens (infectious organisms) and environmental conditions (physiological factors), including organisms that cause infectious diseases, fungi, bacteria, and viruses.

One of the most important botanists in history:

1. Aristotle (384-323 BC)



The summit of the Golden Age of Plant Sciences established the first botanical garden and attributed botany to the proportion of water it contains. So do the longevity of trees because of their low water content and the short life of herbs due to their large water content.

2. The Greek philosopher Theophrastus (371-285 BC) or an attempt to divide plants divided into trees, shrubs, and herbs and defined the plant parts into roots, stems, and leaves according to their functional characteristics.

3. Descoris (37 BC) was the first to write about the science of plant medicine.

4. The Arabs have a long history of translating the works of the Greeks and added a lot of their own studies.
5. Jabir Ibn Hayyan (700-765 AD) is concerned with the chemical composition of the plant.
6. Ibn Sina (980-1037 AD) was interested in medicinal plants.
7. Ibn al-Bitar (1197-1248 AD) was born in Spain and traveled in search of plants to Tunisia, Egypt, Syria, Hijaz, and Iraq and described 400 plants he saw.

In the seventeenth and eighteenth centuries, the modern scientific renaissance began, and scientific societies and academies appeared, so the discoveries and studies that had a great impact on the prosperity of various scientific researches and the most important scientists for that period

1. **Levenhoek (1632-1732 AD)**

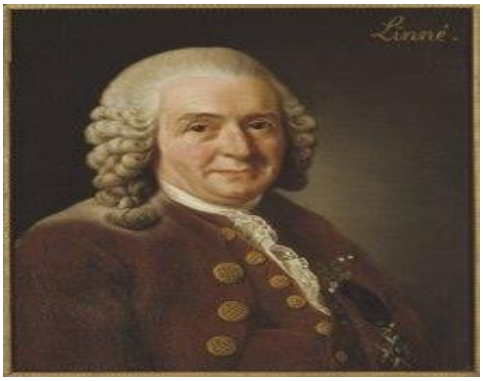
Made composite lenses and discovered and drew bacteria.

2. Robert Hooke (1632-1702 AD) defined the cell as the unit of structure in plants.

3. **Marcello malpighi: (1628 – 1694 AD)**

Discovered the stomata in the leaves and knew their usefulness and discovered the plant's breathing and stressed the importance of leaves in making food.

4. Carl Linnaeus

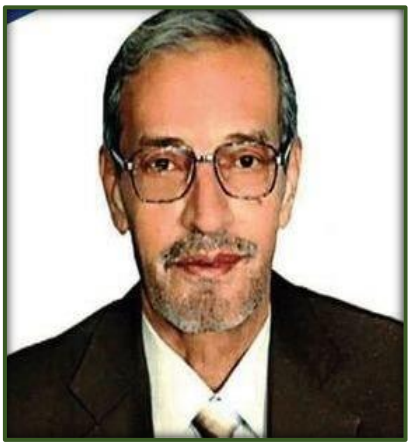


(1707 – 1778 AD A Swedish scientist classified plants according to their structure and similarity with other species, and gave all known plants a two-syllable name, which is known by the binomial nomenclature that is still used today.

And from specialists in the field of botany at the University of Mosul, where I work and learned a lot from them.

From the Department of Biology at the University of Mosul.

The Prof. Dr. Abdul Muttalib Sayed Muhammad Ali Al-Araji (1945-2022).



He has many contributions in the field of plant physiology and plant tissue culture technology and has five patents and books in the field of botany and photosynthesis and providing the library with many master's and doctoral theses in the field of botany.

عزيزي الطالب

المقدمة التاريخية للفهم فقط

تركيب الانسجة مطلوب فقط في العملي

Plant cell

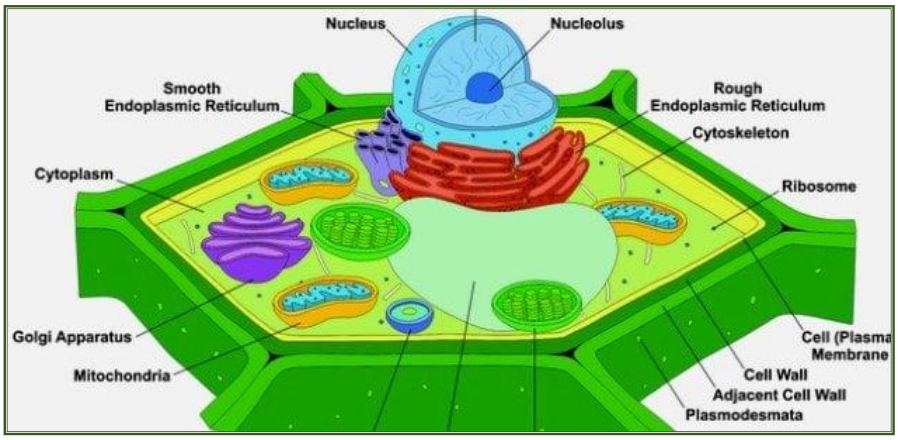


Figure1: Plant cell

The structure of the plant cell varies according to the functions it performs, it generally contains organelles in the animal cell itself, in addition to chloroplasts and a number of large vacuoles.

1. **Plasma membrane:** It is a very thin membrane that surrounds the cell, and plays an important role in the passage of nutrients and waste into and out of the cell. The cell wall in both animal and plant cells and bacteria is made up of protein complexes and phosphorylated lipids. One of its functions.

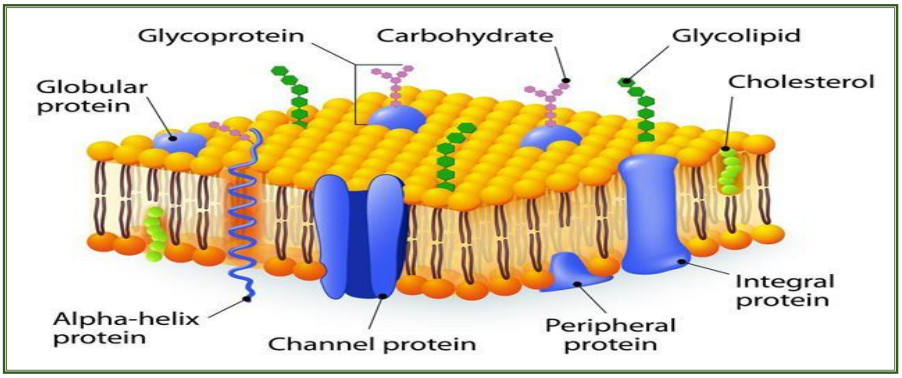


Figure 2: Plasma membrane

a. Cytoplasm preservation

b. Regulating the entry of food and waste into and out of the cell.

c. Cell protection

2. **Cytoplasm:** It is the protoplasmic mass where the organelles of the cell are embedded in it. At present, it is believed that not all essential compounds combine with specific organelles found in the cytoplasm. Most enzymes are found in the cytoplasm.

Organelles are located in the cytoplasm

a. Endoplasmic reticulum and ribosomes: The endoplasmic reticulum is a network of closed-branched membrane channels that penetrate the cytoplasm and do not open in it, but connect the plasma membrane in the nuclear envelope (a membrane surrounding the nucleus). **Ribosomes**

Ribosomes are found in the cell either accompanied by the endoplasmic network or free in the cytoplasm or in the mitochondria or plastids .

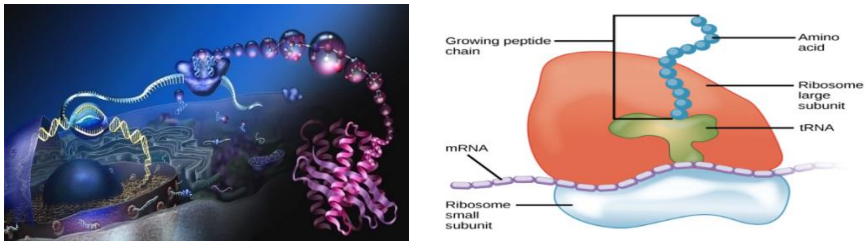


Fig.3: Ribosomes

b. Golgi complex: are vesicles stacked in parallel rows with smooth membranes, and often the body of Golgi complex to a channel and acts as a station in the way of transporting materials produced from other organelles, .

c. Lysosomes:

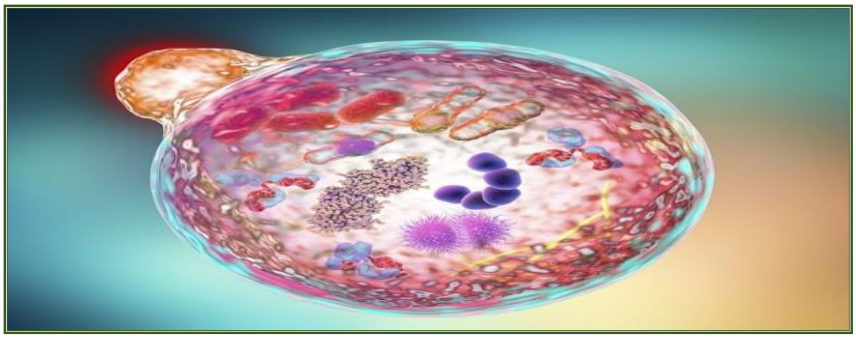


Fig.5: Lysosomes

The lysosomes form the digestive system in the cell, as they contain a number of decomposing enzymes that have PH in an acidic range and have the ability to digest organic matter,.

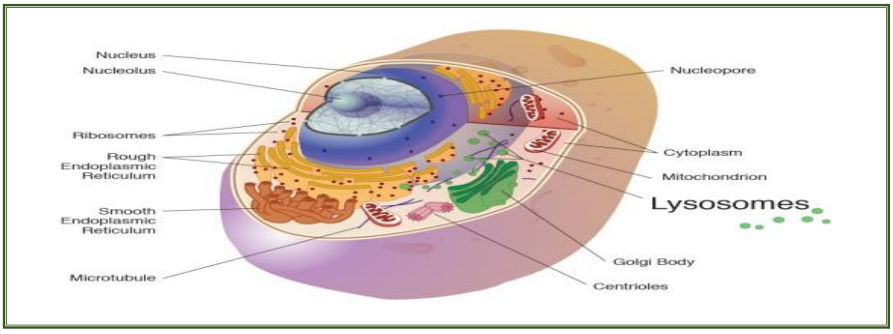


Fig.6: plant cell with Organelles

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Mitochondria:

The cell needs energy to carry out its various activities and mitochondria are the center of energy generation in the cell, because many chemical reactions that include the oxidation of nutrients and the production of energy from them occur inside the mitochondria under the influence of enzymes contained inside

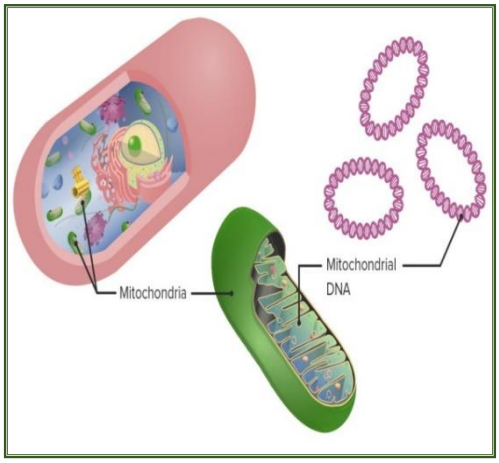


Figure 7: Mitochondria under electron microscopy

d. Plastids: Plastids are found in most plant cells and algae and are divided into three types:

- **Chloroplasts:** They contain the green pigment known as chlorophyll pigment, and these plastids carry out photosynthesis

- **Colored plastids:** They contain colored pigments in addition to chlorophyll pigment, which gives flowers and fruits different colors
- **Colorless plastids:** do not contain dyes and store starch, fat 3.

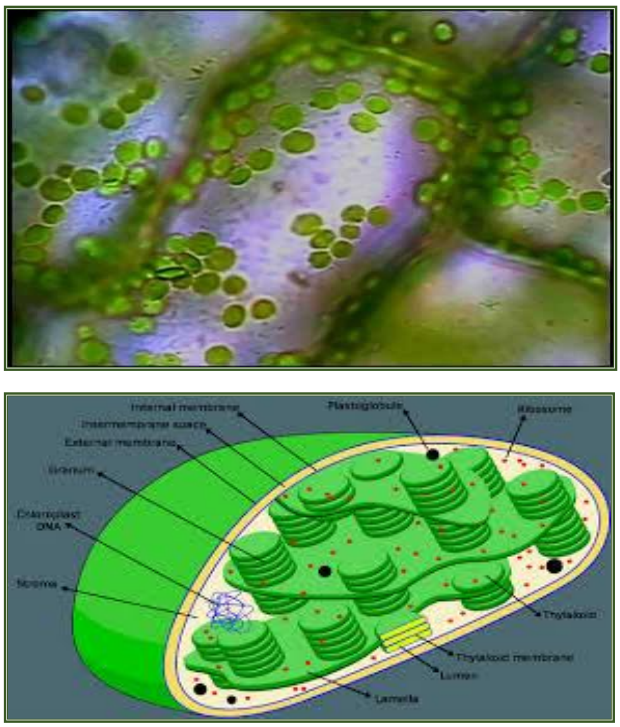


Figure 8: Chloroplast

e. Gaps: Membrane bags are found in animal cells in large numbers and small sizes and there are in plant cells gap or two large gaps occupy most of the cell space and contain gaps in plant cells on salts, candies and toxic substances in addition to some dyes that gain flowers different colors, and gaps gain plant cells strength and fullness.

3. The nucleus: The most important component of the cell is the nucleus, which is the center of vital activities in the cell and without it the cell dies. It carries genetic traits and transfers them from one cell to another and from one generation to another through division.

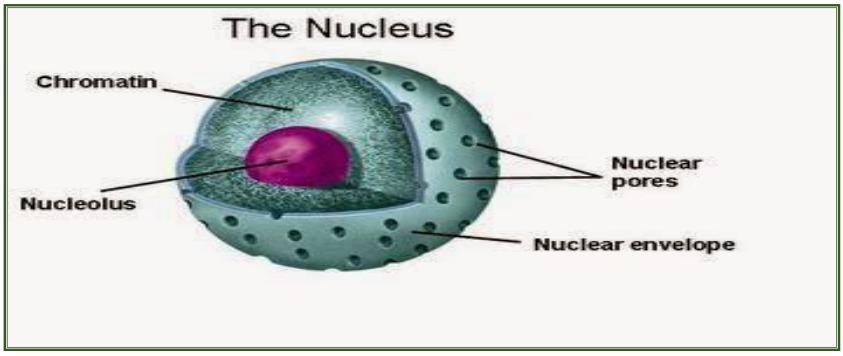


Fig. 9: The nucleus

Components of the nucleus:

1. Nuclear envelope: A double shell that surrounds the nucleus and is penetrated by many holes and works to regulate the passage of materials to the cytoplasm.
2. Nuclear fluid: fills the cavity of the nucleus and other components of the nucleus swim in it.
3. The nucleolus is one or more spherical particles and has an important role in the construction of ribosomes.
4. Chromatin: When the cell is not in a state of division, it contains a network of filaments and granules called chromatin (chromatin reticulum) and consists of two substances:

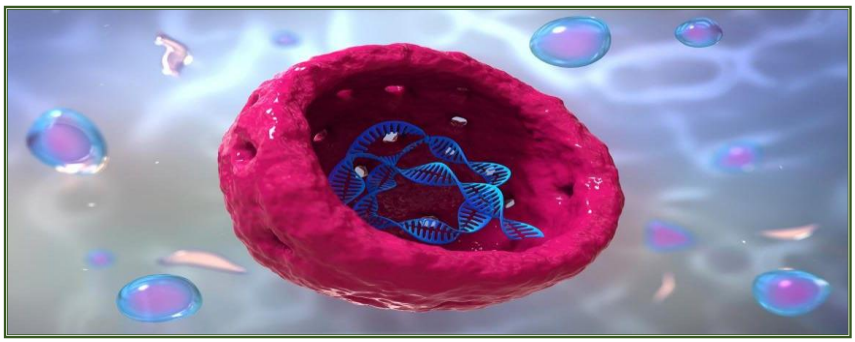


Fig .10: Protein B- DNA

A- Protein B- DNA: DNA, which is the genetic material in the cell appears in the form of filaments called chromosomes, and each

chromosome carries thousands of genetic genes consisting of DNA that determine the characteristics of the organism and transfer traits from parents to children. The adult plant body is a group of structural units, which are called cells (single: cell) cells, and the cell is defined as the unit of structure and function in the body of the organism, and a group of cells is held together to be the so-called tissue, so the tissue can be defined as a group of cells that are synthetically and functionally associated and with a special location.

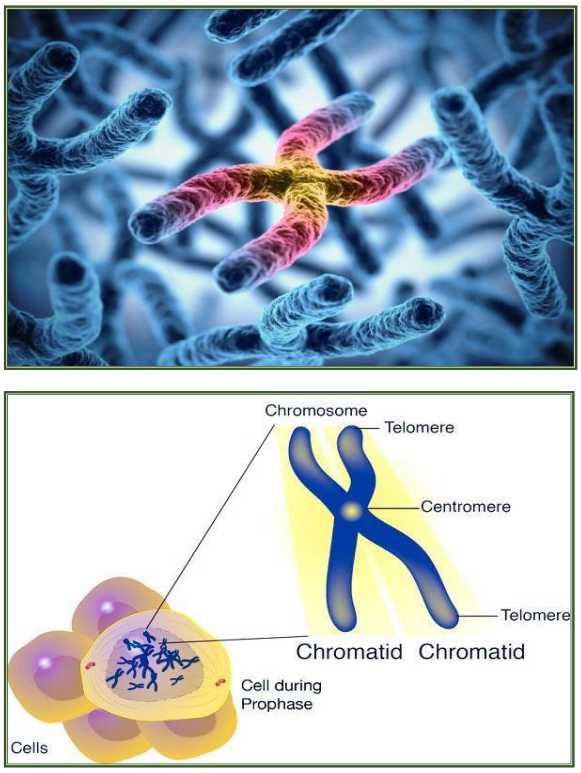


Figure 11: Chromosome

Primary wall: When the middle plate is formed, the cell increases in size and elongates, and this elongation is accompanied by imbibing the middle plate with three types of compounds:

1. Cellulose.
2. Hemicellulose.
3. Glycoprotein.

(Carbohydrate pool protein) and this sedimentation results in a thin layer thickness of 1-3 microns and this layer is called the inner surface of the median plate and the outer surface of the plasma membrane primary or primary wall. Many plant cells contain only the primary wall such as meristem cells, epidermal cells, and cells involved in metabolism. The primary walls are characterized by their elasticity as a result of the flexibility of their installation, but when new components of the walls are deposited on them, they lose part of their elasticity

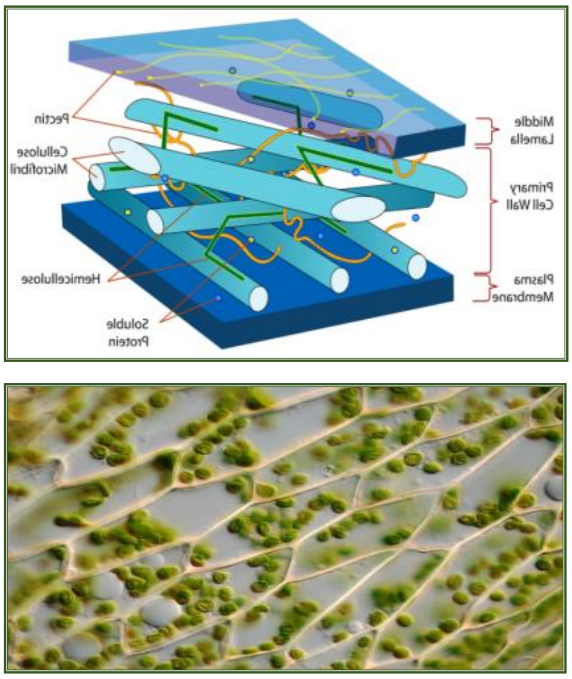


Figure 12: Primary wall

Secondary wall: When the secondary wall is formed in parenchymal cells the cell ceases to elongate. While in other cells, such as bronchioles, the wall continues to thicken after the elongation of the cells stops by depositing layers of cellulose and lignin to form the secondary wall. The thickness of the secondary wall varies between 5-10 microns and by the end of the deposition of the secondary wall, the wall loses a lot of its elasticity and eventually becomes completely non-elastic. The thickening of the secondary wall can lead to the filling of most of the cell volume and

this causes the death and decomposition of the protoplasm. Many of the secondary walls contain lignin, a polymerized alcoholic substance derived from phenyl propane compounds, which is found in the wall with hemicellulose and other cellulose-related compounds. Phenyl propane compounds and found in the wall with hemicellulose and other compounds associated with cellulose.

Classification of tissues

Tissues in the plant body can be divided based on the following foundations:

1. Depending on the location.

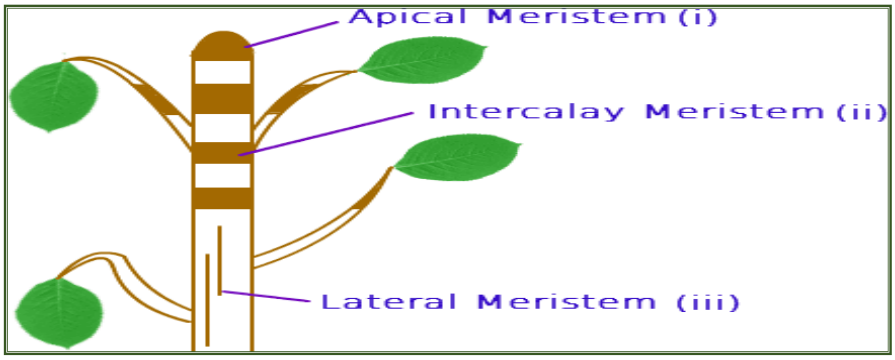


Figure 13: Type of tissues

2. Type of tissues:

Simple tissues: They are tissues made up of a group of cells similar in their characteristics, such as skin tissue, parenchyma tissue and collenchyma tissue.

Compound tissues: They are tissues made up of more than one type of cells that differ in their characteristics, such as wood and phloem.

3. Origin and Development

It is divided based on origin and stage of growth into (meristem tissues and permanent tissues).

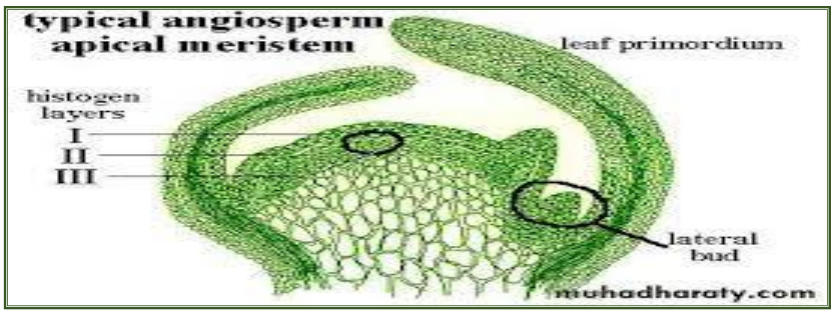


Figure 14: meristem tissues

4. Function

Such as connective, transporter, secretory tissue and others.

Root

One of the most important parts of the plant, which is heading towards the ground away from the light and does not contain nodes and phalanges and surrounds the end of the hood root cap and there is a difference in the tissue between the root and the stem. The root system originates from the radical, which grows into the primary root, which in turn branches into secondary roots and tertiary ... etc.

The root consists of the following zones (starting from the bottom towards the top):

1. **Root cap calyptra:** A group of cells that protect the apical and root meristem.
2. **Apical meristem:** A group of meristem cells whose function is to divide and generate new cells.
3. **Elongation region:** It is the area that includes the primary meristems, which will be the body of the primary plant later, represented by (protoderm-- ground meristem).
4. Maturity zone or root hair region.

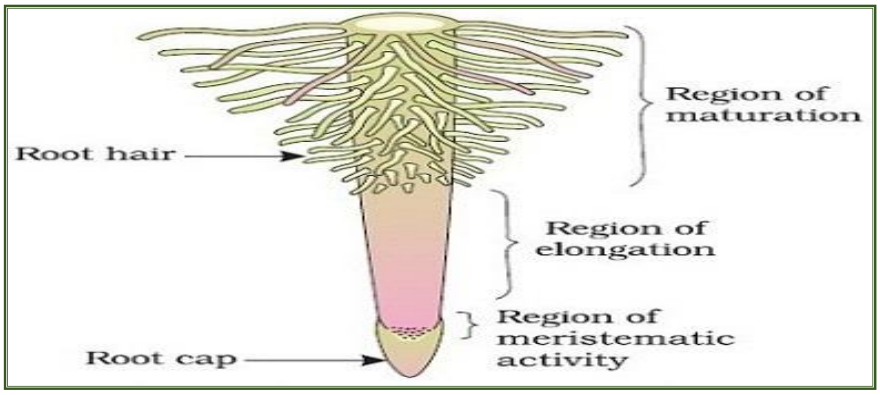


Figure 15: Root

The ripening area at the roots can be distinguished the following layers:

1. **Epidermis**

The absence of cuticles indicates the presence of a thin layer of cuticles, sometimes, and in the case of permanent skin, cell walls may be formed.

2. **Cortex:**

They are characterized by being homogeneous and simple cells, but they contain different types of cells, and the degree of others depends on the period in which they remain. In plants that suffer from secondary growth when the cortex falls off early, the cortex consists mainly of parenchymal cells, while the roots that retain their cortex, as in cotyledons, in addition to parenchyma, sclerenchyma and possibly collenchyma cells are formed.

In the roots that grow characterized by the inner layer of the endodermis inner shell, its diagonal and transverse walls contain the Caesarian strip, which is part of the primary wall.

3. The crust of the roots, as well as the ground stems, is characterized by the thickness of the crust compared to the stems in order to center the wood tissues in the center away from external influences.
4. The Roots are most likely the outer shell layer of exodermises, which is a special layer located under the epidermis or Cork, and it is very similar to the inner shell in terms of structure and function and is found in topless and covered with seeds and is less present in low vascular plants, but it is found in single cotyledons with an almost continuous layer.
5. May contain secretory cells.
6. The cortex at the roots is devoid of cholinergic cells, but it may contain fibers as a supporting tissue.
7. In the area of the root capillaries, the cortex consists of only parenchymal cells.

The roots are divided into the following:

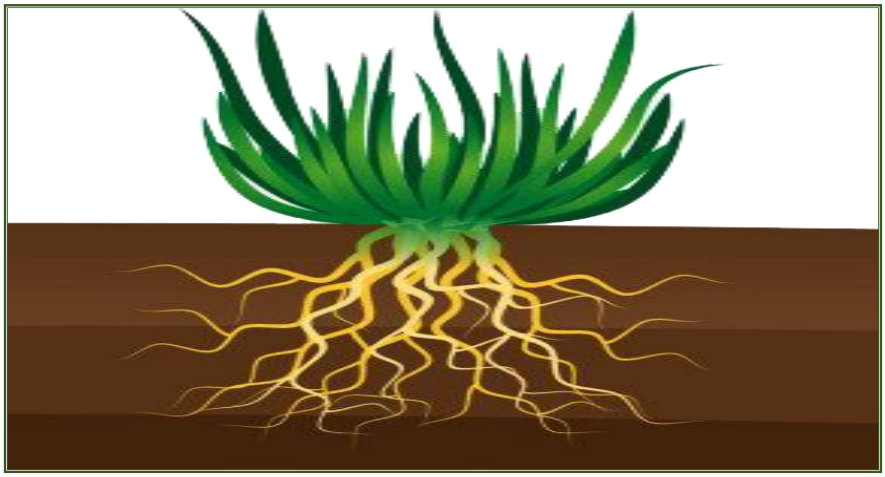
1. Tap root system in this system, the root arises from the root Radical, when the root grows to root primary, which in turn grows in a vertical direction in the soil, forming a root and a valley, and this system is usually found in the two cotyledons. The root in this system takes different forms, including:

a. **Normal:** these are thin roots that are not thickened, as in the Aster, bitter Sonchus, and Vicia beans.

b. **Fleshy root:** which is the roots of fleshy enlarged stored nutrients and be in different forms may be conical in shape as in the carrot and be this type of roots wide at the base and gradually tapering towards the top or be the form of Fusiform as in white radish Raphanus sativus or Lvti (Mtkoor) Nidiform as in Alshalgham (turnip) Brassica rapa or be rounded Globiform and red radish Beta and may be cylindrical as in white radish sometimes

2. Adventitious root: a group of roots originating from any part of the plant except the root and types:

a. Fibrous root, filamentous shape and come out or arise from the base of the stem as a result of the death of the Primary root as in grasses, and may arise from the nodes in thestems as in (strawberry).



Figuer16: Fibrous root

b. <u>Tuberous root:</u> t is the roots that store, and these are either grouped, as in the potato sweet potato Ipomoea, Dahlia, and the asphodelous plant, or they are monomorphic, in which the root has bulging parts, as in the asparagus plant, and the root resembles a bean.

c. Prop root: these are roots originating from the lower stem nodes, and these roots are not branched until they reach the soil in the Zea mays plant.

d. Parasitic root: these are special structures sent by parasitic plants within the tissues of the host plant and are called suckers, as in the dodder plant Cuscuta *europaea*

Figuer17: Parasitic root

e. **Floating root:** Which is called respiratory roots, as in the Shura plant or Avicennia officinalis.

Figure18: Floating root

f. **Aerial root:** comes out of the stem and helps to climb as in the rope of the poor Hedra Helix and sometimes absorbs water and salts directly from the rain as in the case of epiphyte.

Figure 19: Aerial root

g. **Contractile root:** there are some bulbs and corms, these roots work to pull the plant down, where the percentage of moisture is higher than the areas near the soil surface and these plants prevent the soil from drifting.

Figuer20: Contractile root

Root function

1. Stabilization: It helps the plant to settle in the ground steadily and erect in front of environmental factors.
2. 2.Absorption: One of the most important things that is done by the absorption of water and the nutrients it contains, which is the means of survival and continued growth and completion of the process of photosynthesis that depends on absorbed water.
3. Prevent soil erosion from the movement of water and wind and work to bind the molecules together.
4. Storage: The root stores food as in carrots, radishes and beetroot
5. 5.Reproduction: Although the roots are not a "proliferative" organ, some plants are means of reproduction, such as herbs, jasmine and some creeping plants, and this reproduction is known as vegetative propagation.
6. Environmental importance in the event of soil erosion will provide food and space for many living organisms.

Stem

The part of the plant that is often above the soil surface The stem is characterized by the presence of nodes and internodes, usually bearing leaves at the node area, as well as buds and sometimes scales.

The internal structure of the Stem

Is considered more complex than the root because the stems carry leaves and branches in addition to reproductive organs, as well as the presence of nodes and phalanges, but they can be considered somewhat similar in terms of the presence of three tissue systems (Dermal tissue system, Ground tissue system, Vascular tissue system), however, there are differences between the two and have been compared

The stem carries the leaves, exposes them to sunlight, delivers water and raw materials from the root to the leaves, and distributes nutrients to the parts of the plant. Photosynthesis when green as well as storing nutrients

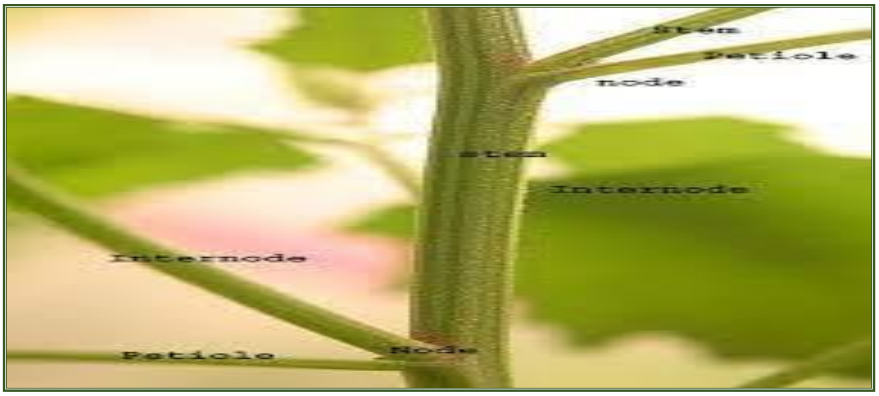


Fig.21: Plant stem components

The stems are of different types, they may be airy, or the stems are ground. Some stems are modified know (the modified stems),Anatomically, when taking a transverse section of the stem, the following layers can be observed (from the outside towards the inside).

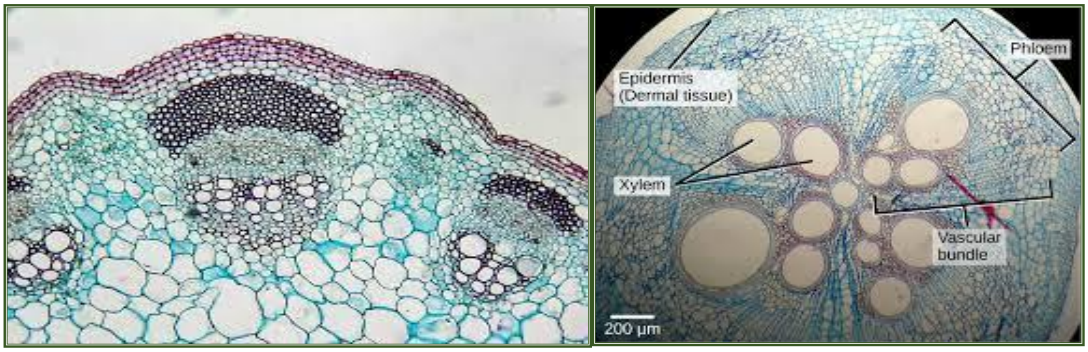


Fig.22: The internal structure of the Stem

1. Epidermis:

Epidermis

The absence of cuticles indicates the presence of a thin layer of cuticles, sometimes, and in the case of permanent skin, cell walls may be formed.

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Endodermis: the collenchyma and sclerenchyma tissue performs a supporting function.

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Stems are divided into:

1. **Ground or dirt stems:** Stems growing below the surface of the soil and can be distinguished as containing

The stems consists of nodes and phalanges, These are divided into:

a. Rhizomes as in The green gospel and reeds.

b. Onions and garlic.

c. Tubers: Potatoes and mezze.

2. **Air stems:** Regular stems grow above the ground

3. **Water stems:** Stems grow in water, either floating or submersible.

4. Types of air stems

a. winged Strems: It has longitudinal growths extending along the stem

With angles and divided into:

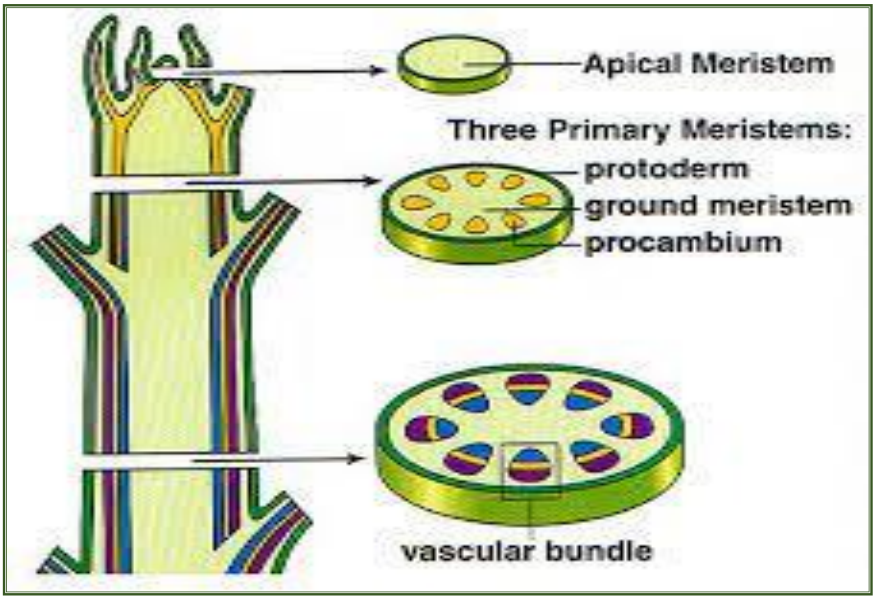
1. **Tri-angle:** Saadian family Cyperaceae.

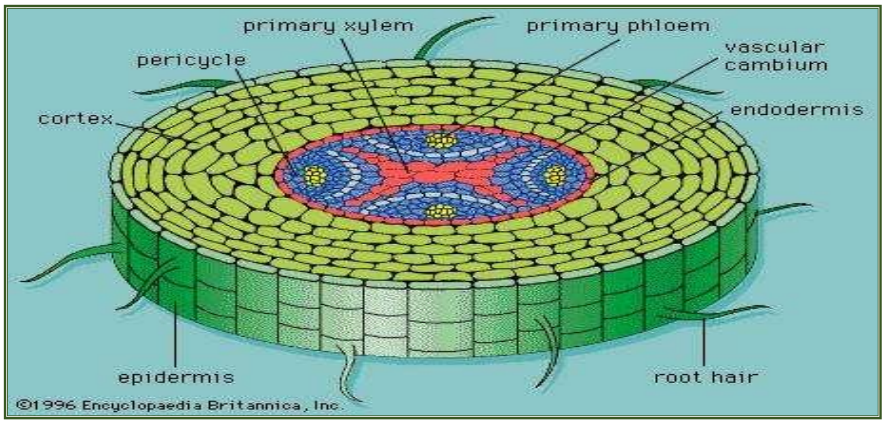
2. **Quadrangular:** Labiatae oral family.

3. **Cylindrical:** as in the family Poaceae and includes hollow :wheat, barley, reeds. And Bamboo.

4. Erect grows vertically above the soil surface as in raspberries.
5. Weak stems are divided into:

The internal structure has the following layers (from the outside towards the inside)


Apical Meristem
Three Primary Meristems:
protoderm
ground meristem
procambium
vascular bundle


primary xylem
primary phloem
pericycle
vascular cambium
cortex
endodermis
epidermis
root hair
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The most important function of the plant stem is:

1. Support for the aerobic vegetative body .

2. Delivering water and nutrients from the roots to the rest of the plant.

Leaf

The leaf is the most important part of the plant that performs the most important biochemical process in which carbon dioxide is converted into sugar in the plant.

The leaf is the vegetative part that carries the nodes of the stems and is often characterized by being wide and flat and the process of Photosynthesis and Transpiration and respiration and vary in shape according to the type of plant.

The leaves have different characteristics, they may be sitting directly on the Sessile or carried on petiole.

Anatomical characteristics of leaves

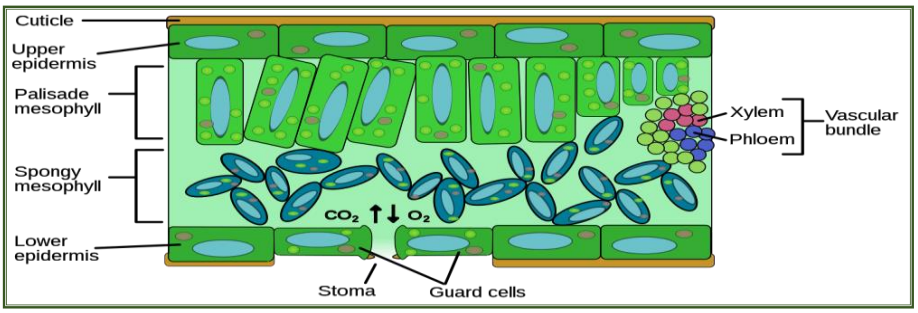

Fig.23: Internal structure of the plant leaf

1. Epidermis:

Epidermis usually consists of a single layer of cells and contains stomata stomata, normal epidermal cells typical epidermis cells, idioblasts and various appendages of the trichomes . Its function is plant protection-gas exchange-secretion Its **advantages:**

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Leaf function

1. Carrying out the most important vital process, which is the process of photosynthesis, and will be explained later in detail.
2. Carry out transpiration
3. Gas exchange by guard cells.

Flower

It is an axis branch that carries specialized leaves for the purpose of reproduction or aiding it, which is the reproductive organ in flowering plants Entophyte. A typical flower consists of four rings:

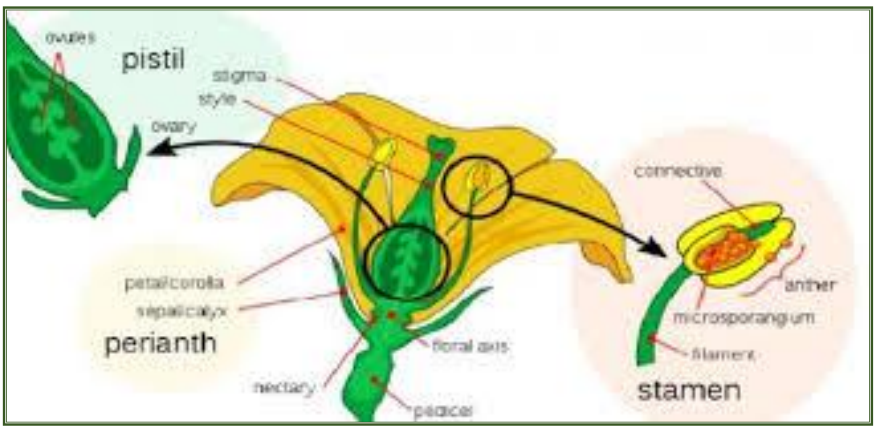


Fig. 23: Internal structure of the plant Flower

CHAPTER TWO

ENVIRONMENTAL IMPORTANCE OF THE PLANT

The importance of plants in the environment is not only being part of the food chain, but the physiological role that it plays and their interaction with the environment in which it is located, whether it is desert, mountainous, near a river or sea..... Etc.

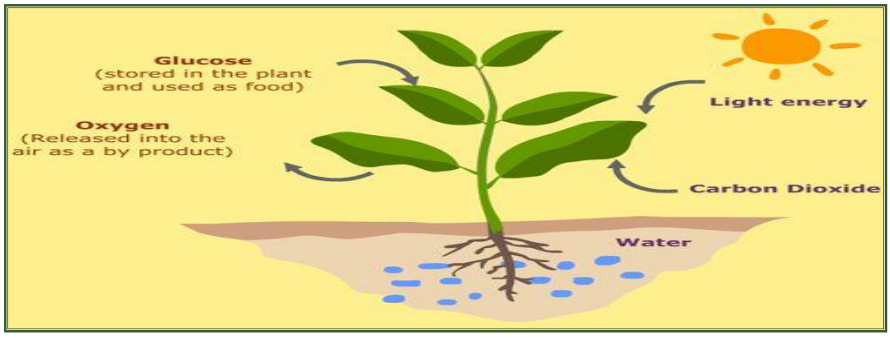
Its organs of the roots, stems and leaves with its tissue structure helped it to perform the following tasks, according to the Plant organ. Leaf,

Photosynthesis installation process, the process of respiration and transpiration, as for the roots, they absorb water and resist drought and lack of food, and the stem performs the function of transporting plant sap.

For this reason, we will highlight the most important of those functions that the plant performs in separation as follows:

1. Photosynthesis installation process

Namely, the process of introducing oxygen as an alternative to removing carbon dioxide from the atmosphere is one of the crucial biological processes for all living things on the Earth's surface, including humans. However, this does not apply to some microorganisms that do not use oxygen and use it instead of CO2.Our light source, which comes from the fusion reactions of the hydrogen atom, is the sun, which shines brightly and illuminates the world. In the fusion reaction, one helium atom (alpha particle) is created from the Union of four hydrogen protons. In the deep central regions of the sun, this difference in mass is transformed into solar energy because the mass of the helium atom is slightly less than the total masses of the four protons from which it is formed. When the Earth is far enough from the sun for the average solar energy to travel perpendicular to a unit of horizontal area for a unit of time out of the atmosphere.



The production of about 50 million tons of sugar within a complex metabolism with sequential steps based on the type of plant and its tag, which is a fundamental source of organic structure on the planet and is food for all living organisms directly or indirectly, is the most significant manifestation of the process of photosynthesis. The plant also removes tons of carbon dioxide cancellation from the atmosphere and releases oxygen at a reviving balance. Additionally, the process of photosynthesis is of "economic importance, as evidenced by the years and eons of time showing that plant tombs have evolved into one of the energy transformations. The process of photosynthesis in short converts light energy into chemical, or is the process in which solar energy is converted into photochemical energy and then into chemical energy by plant chlorophyll. All acquaintances are correct but may not give a full description of the process.

Using the following equation, we may define photosynthesis more broadly as the biological process that takes place in all organisms that contain chlorophyll and involves the conversion of inorganic components (water and CO2) into chemical organic molecules. Chlorophyll

$CO_2 + H_2O$ ---------- $CH_2O + O_2 + ATP$

light Carbohydrate

Or write in another way with the outputs

$6CO_2+12H2O+light+chloroplasts= C6H_{12}O_6+6H_2O+6O_2+Energy$

In this process, in short, oxygen is released, then CO2 is reduced, and sugar formation occurs.