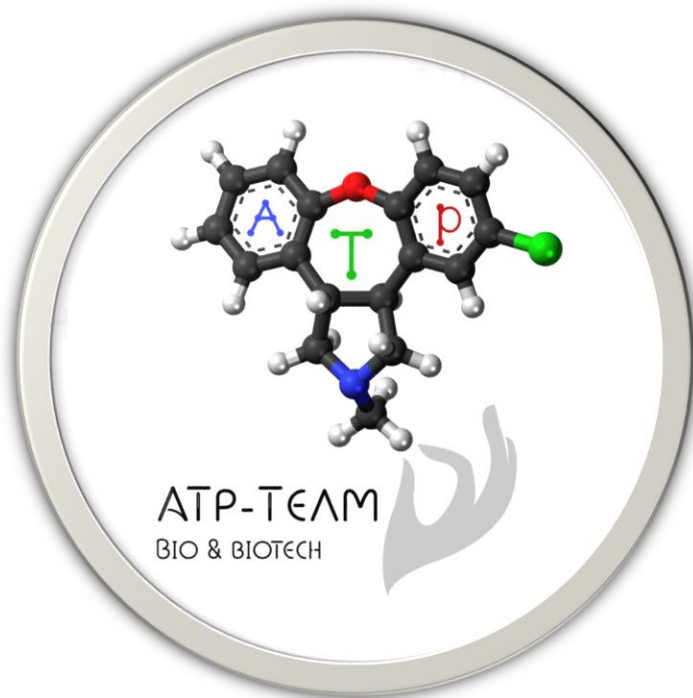


ATP TEAM

تلخيص مادة مختبر علوم حياة عامة (1)

110 104 103

2021



Collected by :

Saifeddin Alnatsheh

Madeleine Jaara

Introduction

The cell is the fundamental biological unit .It's the smallest and the simplest biological structure possessing all of the characteristic of the living condition, and to understand how the bodies of creatures work we have to know how the cells works.

We can't see the cell components by our naked eye so the microscope was designed to help us to explore the cell .

- **Types of microscopes :**

1. **compound microscope** : use visible light as a source of illumination (light microscope)
2. **stereoscopic microscope** : use visible light as a source of illumination (light microscope)
3. **scanning electron microscope** :use electrons as the source of illumination (electron microscope)
4. **transmission electron microscope**: use electrons as the source of illumination (electron microscope)

- In this subject we will study only about the light microscopes.
- SO the only things you need to know about the electron microscope that :
 1. It can **magnify** up to **million** times (**10^6**).
 2. It use **electromagnetic lens** .

- There are many **variations** of light microscopes including :
 - phase-contrast
 - darkfield
 - polarizing
 - UV

- The microscopes in biology lab are usually compound **binocular** or **Monocular** light microscopes.

- **Parts and functions of compound light microscope:**

1. **The head** : supports both of Ocular lens and objective lens .
 - **Ocular lens** magnification (**× 10**)

2. **Revolving nosepiece** : carries the 4 objective lenses :

- **Scanning lens** : magnification (**× 4**) .
- **Intermediate lens** : magnification (**× 10**) .
- **High-power lens** : magnification (**× 40**)
- **Oil immersion lens** : magnification (**× 100**)

3. **The arm** : supports the stage and condenser lens

4. **The condenser lens** : focus the light from the lamp through the specimen

- **The height of Condenser can be adjusted by adjustment knobs**
- **There are 2 types of adjustment knobs:**
 - **Coarse adjustment knob**
 - **Fine adjustment knob**

5. **Iris diaphragm**: controls the width of the circle of light and, therefore, the amount of light passing through the specimen

6. **The stage** : supports the specimen to be viewed .

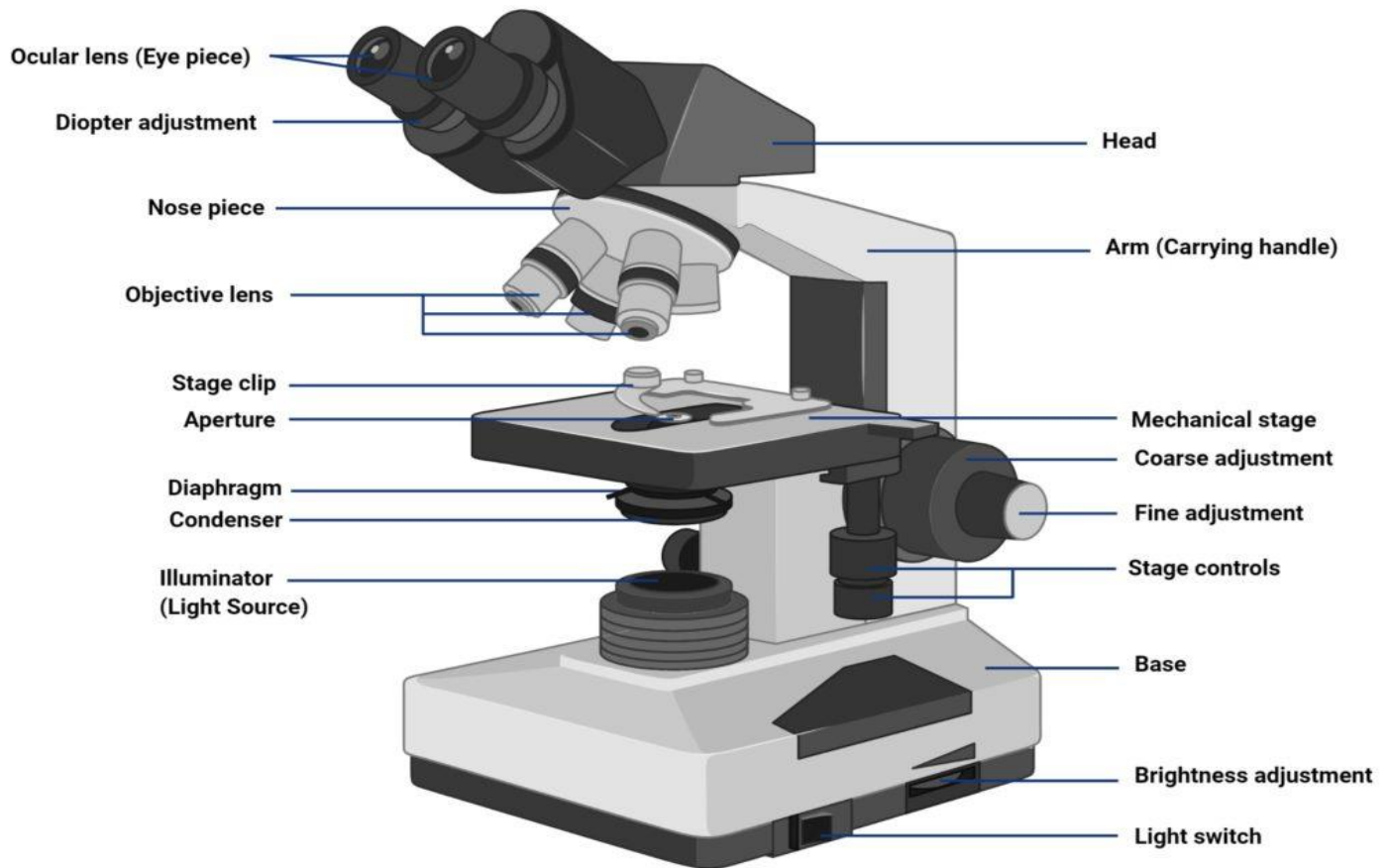
- The stage can be moved right and left and back and forth by two **stage adjustment knobs**.
- The slide is secured under the **stage clip**.

7. **The base** : acts as a stand for the microscope and houses the lamp.

8. **light intensity lever** : control the intensity of the light that passes through the specimen.

- The distance between the eye-pieces in the **Monocular microscope** called the **interpupillary distance** .
- The distance between the specimen and the objective lens is called the **working distance**

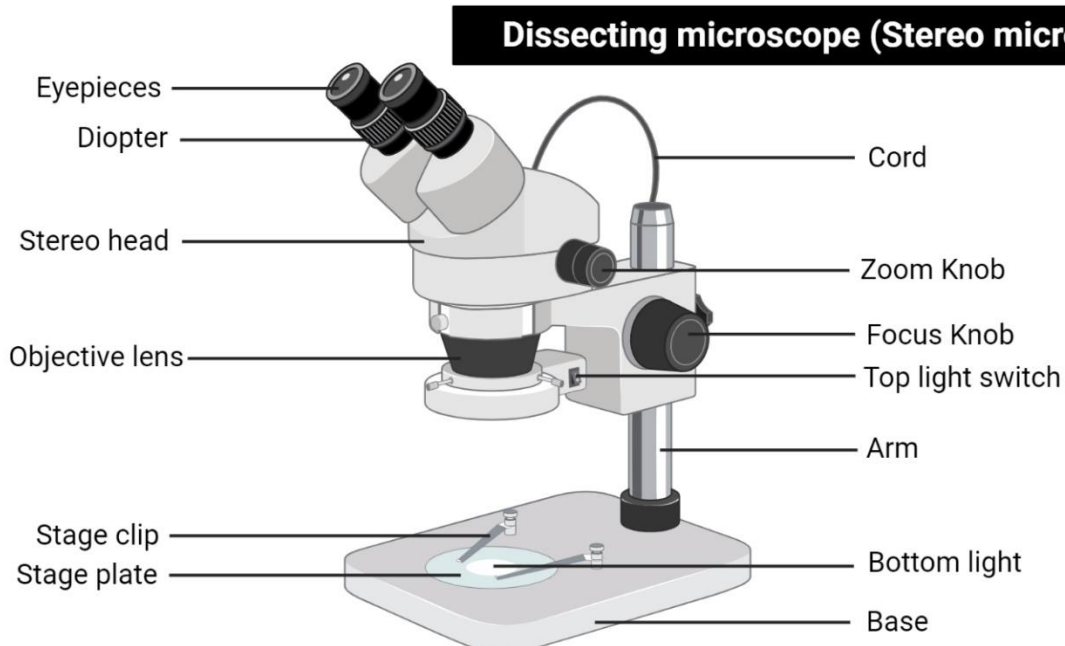
Microscope Parts



• Tips : BIO & BIOTECH

- Do not turn the fine adjustment knob more than two revolutions in either direction.
- After the 40× objective is in place, focus using the fine adjustment knob.
- Never focus with the coarse adjustment knob when you are using the high-power objective.
- Slides should be placed on and removed from the stage only when the 4× objective is in place.

- The stereoscopic microscope has a magnification of 7 $\times$ to 30 $\times$.
- The stereoscopic microscope is similar to the compound microscope except in the following ways :
 - The depth of field is much greater than with the compound microscope ,so objects are seen in three dimensions (**3D**)
 - the light source can be directed down onto as well as up through an object, which permits the viewing of objects too thick to transmit light
- Light directed down on the object is called reflected or incident light.
- Light passing through the object is called transmitted light.
- In stereoscopic microscope objects are seen in **3D** .but in the compound microscope objects are seen in **2D** .



The 
Biology
Notes



- The cell is the unit of structure and function

Cells → tissue → organ → system → organism

- Cells can be :

- **Prokaryotic cells**: lack nuclei and membrane
- **Eukaryotic cells**: have true nucleus with nuclear envelop and membrane

- Eukaryotic cells are classified according to the mode of nutrition into :

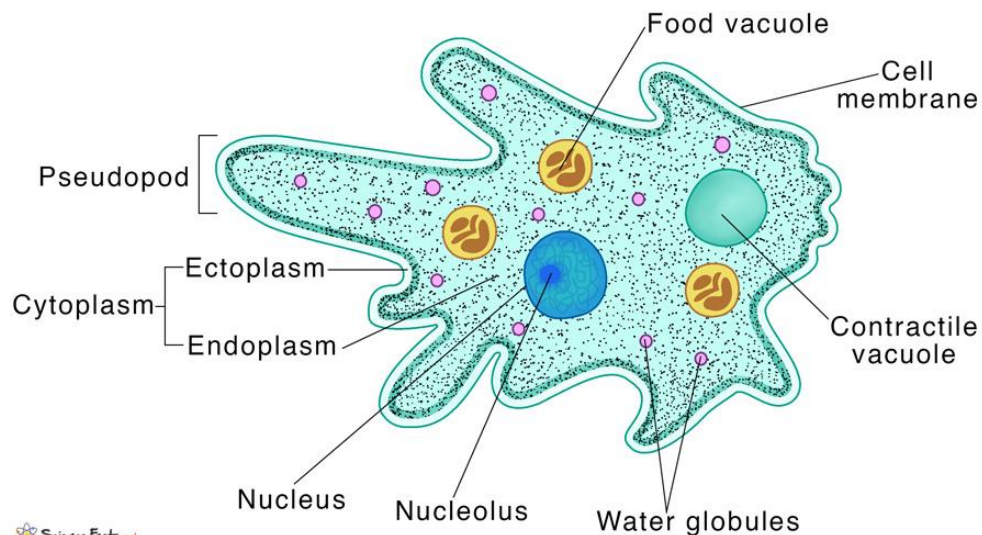
- **Autotrophic**: can produce its own food
- **Heterotrophic**: eats other plants or animals for energy and nutrients

- Eukaryotic cells are classified according to number of cells into:

- **Unicellular** Ex. Amoeba
- **Colony** Ex. Scenedesmus
- **Multicellular** Ex. Volvox

- Unicellular cells :

Amoeba



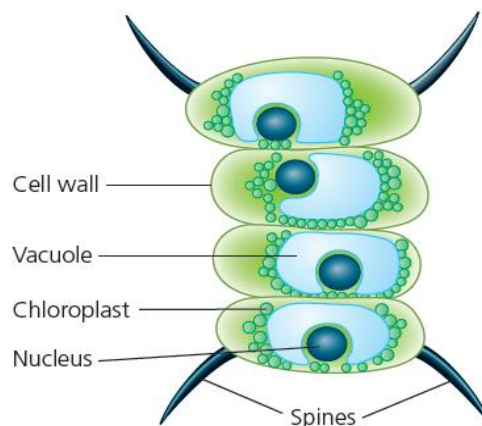
- **Parts and function of Amoeba :**

1. **cell membrane**: is the boundary that separates the organism from its surroundings
2. **Ectoplasm**: is the thin, transparent layer of cytoplasm directly beneath the cell membrane
3. **Endoplasm**: is the granular cytoplasm containing the cell organelles
4. **Nucleus**: directs the cellular activities .
5. **Contractile vacuoles**: gradually enlarge as they fill with excess water
6. **Food vacuoles**: are small, dark, irregularly shaped vesicles within the endoplasm and they contain undigested food particles.
7. **Pseudopodia** (“false feet”): They are used for locomotion as well as for trapping and engulfing food in a process called **phagocytosis**

- The Amoeba is Heterotrophic cell.

- **Colony cells :**

- **Scenedesmus** is an aquatic algye that usually occurs in simple colonies of four cells.



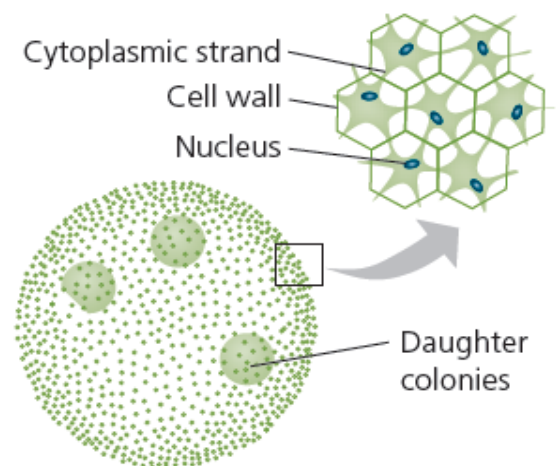
- **Parts and function of Scenedesmus :**

1. **Nucleus**: is the spherical organelle in the approximate middle of each cell
2. **Vacuoles**: are the transparent spheres that tend to occur at either end of the cells.
3. **Spines**: are the transparent projections that occur on the two end cells
4. **Cell walls**: surround each cell.

- Scenedesmus is Autotrophic
- We use methylene blue to stain the specimen

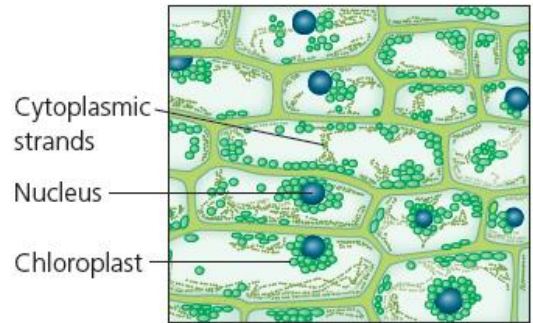
- **Multicellular cells**:

- Volvox is an aquatic green algye
- Volvox is an Autotrophic
- **Daughter colonies (sex cells) : specialized for reproduction.**
- **Vegetative cell are connected by Cytoplasmic strands**



- **Plant cells:**

- **Plants are multicellular autotrophic organisms**



- **Parts and functions :**

1. **cell wall:** is the **rigid** outer framework surrounding the cell and it gives the cell a **definite shape** and **support** .
2. **Protoplasm:** is the organized contents of the cell, exclusive of the cell wall.
3. **Cytoplasm:** is the protoplasm of the cell, exclusive of the nucleus
4. **central vacuole:** is a membrane-bound sac within the cytoplasm that is filled with water and dissolved substances. This structure serves to store metabolic wastes and gives the cell **support** by means of turgor pressure. Animal cells also have vacuoles, but they are not as large and conspicuous as those found in plants.
5. **Chloroplasts:** carry the pigment **chlorophyll** that is involved in photosynthesis
6. **Nucleus:** controls cell metabolism and division

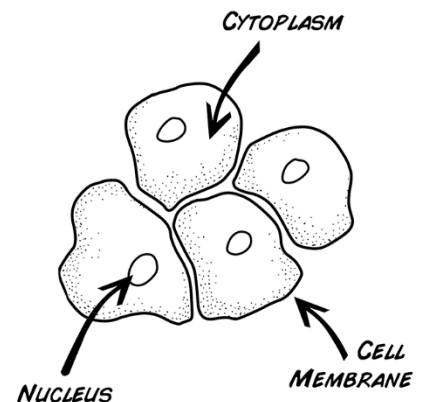
- **Animal cells:** & BIOTECH

- Animals are multicellular heterotrophic organisms.

- **parts and functions:**

1. **cell membrane** is the boundary that separates the cell from its surroundings.
2. **Nucleus:** is the **large**, circular organelle near the **middle of the cell**.
3. **Cytoplasm** is the granular contents of the cell, exclusive of the nucleus.

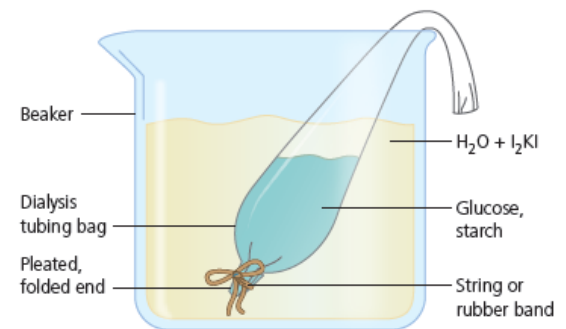
EPITHELIAL CELLS



- Organelle membranes and the plasma membrane are **selectively permeable**
- **Diffusion:** molecules move from an area where they are in high concentration to one where their concentration is lower.
- **Osmosis:** diffusion of water through a selectively permeable membrane from a region where it is highly concentrated to a region where its concentration is lower.
- **There is three types of solutions :**
 1. **Hypertonic:** solution that has a greater concentration of solutes on the outside of a cell when compared with the inside of a cell.
 2. **Hypotonic:** solution has a lower concentration of solutes than another solution.
 3. **Isotonic:** solution is one that has the same osmolarity, or solute concentration, as another solution.

- **Diffusion through membrane:**

- The separation of glucose and starch depend on **size of molecules not the concentration.**
- Glucose is **smaller** than starch so it will move out of dialysis tubing bag.



- **You will use two tests in your experiment:**

1. **(I₂KI) test for presence of starch (lugol's)**
 - When I₂KI is added to the unknown solution, the solution turns **purple or black** if starch is present.
 - If no starch is present, the solution remains a pale **yellow-amber** color.

2. Benedict's test for reducing sugar

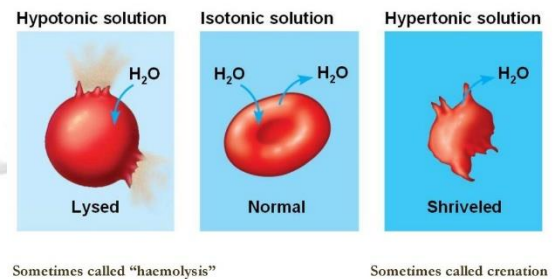
- When Benedict's reagent is added to the unknown solution and the solution is heated, the solution turns **green, orange, or orange-red** if a reducing sugar is present (the color indicates the sugar concentration).
- If no reducing sugar is present, the solution remains the color of Benedict's reagent (**blue**).

• Osmotic Activity in Cells:

1. Animal cells:

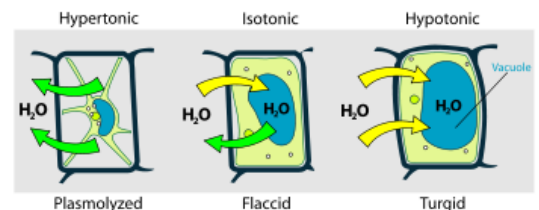
- The cells which put in **hypotonic** solution will gain water by **osmosis** and become **lysed**.
- the cells which put in **hypertonic** solution will lose water by **osmosis** and become **shriveled**.
- The cells which put in **isotonic** solution **won't** gain or lose water so it will be **normal** cell.

Osmosis and Animal Cells



2. Plant cells:

- The cells which put in **Hypertonic** solution will **lose** water by **osmosis** and become **plasmolyzed**.
- The cells which put in **Isotonic** solution **won't** gain or lose water by **osmosis** and become **flaccid**.
- The cells which put in **Hypotonic** solution will gain water by **osmosis** and become **Turgid**.



- It is known that huge numbers of biochemical reactions take place in living cells that lead as a whole to the various aspects of life of growth and reproduction and these interactions require vital media to accelerate and direct them according to the need and activity of the cell called enzymes, and enzymes are specific protein molecules, which are found in living cells, mediating The vital reactions and in the absence of them stop in those reactions and lead the cell to perdition and death.
- Enzymes can be considered as biological intermediaries whose efficacy is sometimes reduced by the presence of inhibitors that lead to changes in their physical and chemical state. They can also initiate biological reactions, and are characterized by specific selective properties, that is, for each specific enzyme reaction. Likewise, enzymes as biological media reduce the energy level (potential energy) of the chemical reaction in general compared with inorganic media. And that the outputs are generally compared to inorganic media. And that the final products of chemical reactions appear in a percent, and usually a final complex of chemical reactions appears one hundred percent. Usually, a stage complex is formed between the enzyme and the Substrate reaction substance called Enzyme complex Substrate, abbreviated (ES) through the active center, and is achieved with a specific connection to the ends of amino acids, which leads to Giving the specific space shape that is associated with the high quality of the enzyme, according to the lock and key theory, where there is a geometric correspondence between the enzyme molecule and the reaction material.

- **Enzyme:**

- Enzyme: biological catalyst that accelerates /speed up the reaction without being consumed .
- **Most** enzyme are protein ,they speed up reaction by lowering reaction energy ,the most important feature of the enzyme that they are highly specific .

أهم ميزة بالأنزيم أنه انتقائي.. أي كل تفاعل له أنزيم خاص به وكل أنزيم له مادة تفاعل محددة

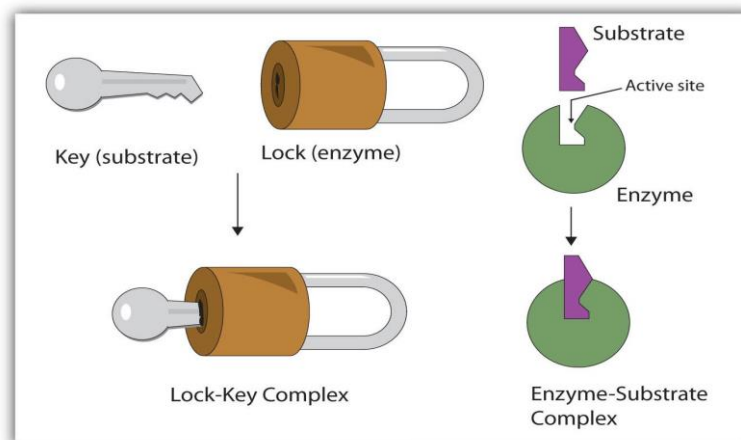
❖ every enzyme has substrate ... "المادة التي بيشتغل عليها الأنزيم"
and they are has an active site ...

وهو الموقع النشط .. "عبارة عن شكل محدد يلائم ال substrate بشكل خاص ولا يناسب غيرها "

❖ تشبه وبشكل كبير نظرية القفل والمفتاح .. كل قفل له مفتاح خاص به ولا يلائم غيره ..

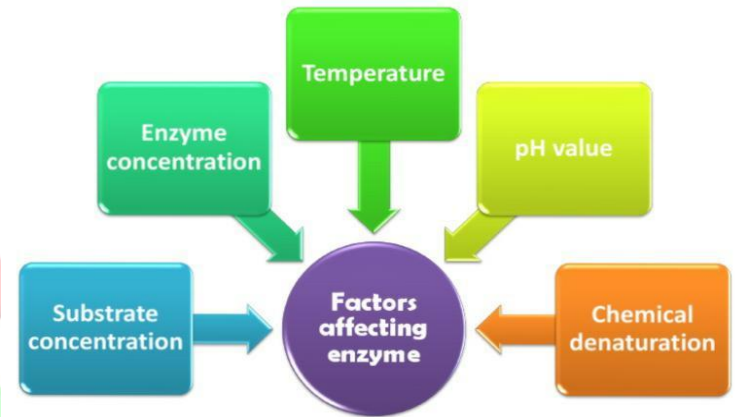
- **The Cofactors :**

هي عوامل مساعدة لنفس الأنزيم ؛ عادةً ما تكون أيونات ؛ و في أجسامنا غالبًا ما تكون فيتامينات.



- **Factors affecting enzyme activity :**

- Enzyme activity can be affected by a variety of factors, such as **temperature, pH, concentration** and **chemicals**.
- Enzymes work best within specific **temperature** and **pH** ranges, and sub-optimal conditions can cause an enzyme to lose its ability to bind to a **substrate**.



- **Chemicals :**

1. Activates → Cofactors → organic coenzymes
2. Inhibitors → Competitive → in active site → Non competitive →

ارتباط بالانزيم يغير في شكل الأنزيم نفسه.. وبالتالي يضغط على شكل الأنزيم ويمنع ال substrate بالارتباط بال Active site

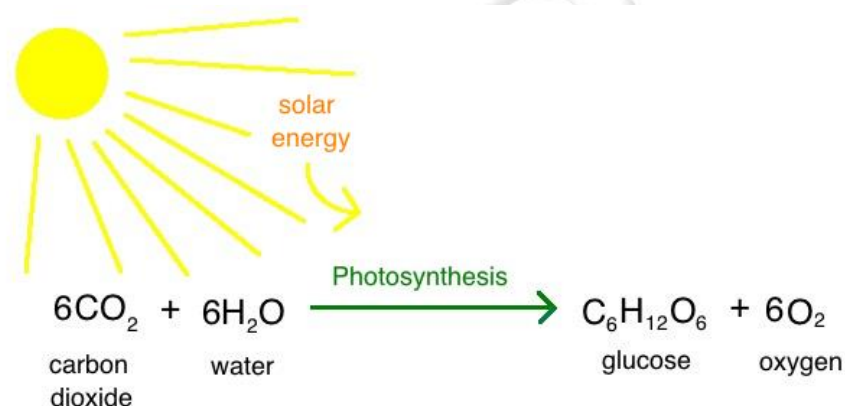
- **Denaturation of enzyme :**

- **Enzyme** structures unfold (**denature**): when heated or exposed to chemical denaturants and this disruption to the structure typically causes a loss of activity.
- Protein folding is key to whether a globular protein or a membrane protein can do its job correctly. It must be folded into the right shape to function
و هو تشوه في شكل الأنزيم نتيجة إرتفاع /تغير مفاجئ في درجة الحرارة
- In low of Temperature: يكون الأنزيم فعال ولم يحصل له أي تشوه "يمكن إعادة استخدامه".

Photosynthesis:

transforming light energy into chemical energy to synthesize organic compounds (glucose) from CO₂, and in the process water is used and O₂ is released .

- We determine photosynthetic activity by testing for the production of starch, using **iodine potassium iodide (I₂KI)**
- The color of the iodine is yellow-amber .
- (I₂KI) stains starch into **purple-black** color .
- A change from the yellow-amber color of the iodine solution to a purple-black solution is a **positive test** for the presence of starch .
- The plant which used in the experiment called **geranium** .
- **Photosynthesis in plants:**



- **cellular respiration in animals:**



- **Pigments in Photosynthesis:**

- A pigment is a substance that absorbs light. If a pigment absorbs all wavelengths of visible light, it appears **black**.
- Green colors in plants are produced by the presence of **chlorophylls *a* and *b*** located in the **chloroplasts**.
- Yellow, orange, and bright red colors are produced by **carotenoids** and it also located in
- Blues, violets, purples, pinks, and dark reds are usually produced by a group of water soluble pigments.
- The anthocyanins, that are located in cell vacuoles and do not contribute to photosynthesis.

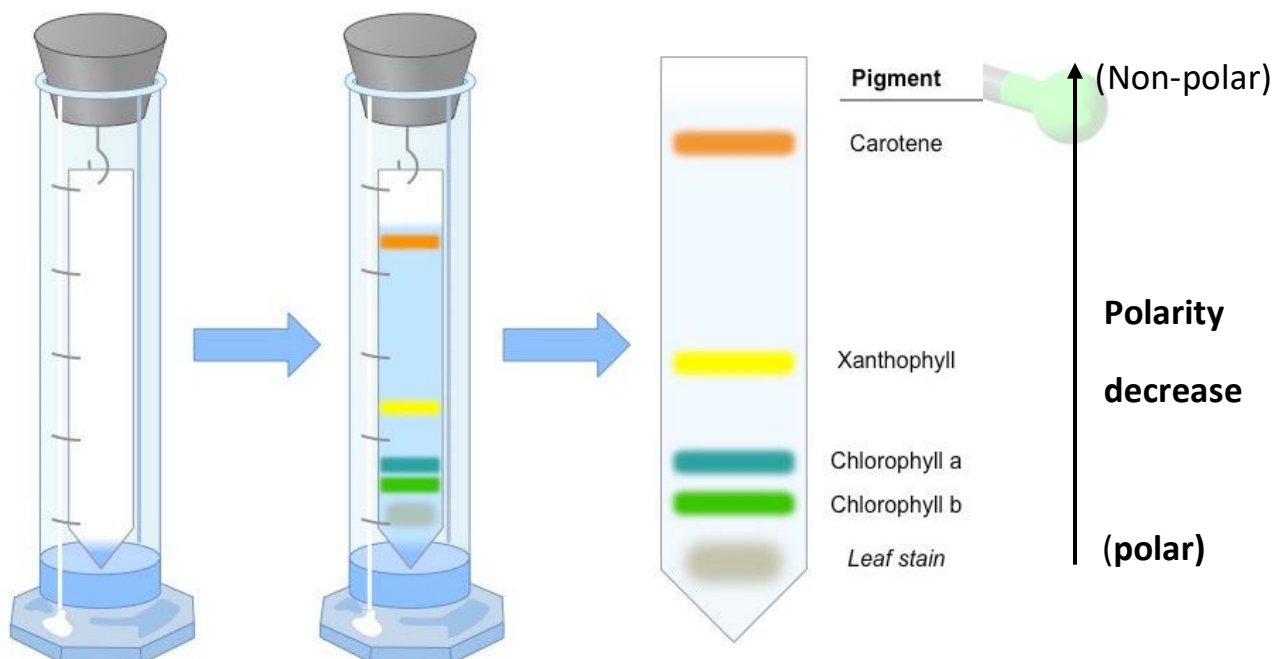
- **Separation of Plant Pigments by Paper Chromatography:**

- **Thin layer Chromatography (TLC)**

- The plant used in this experiment is **spinach**.
- A **blender** was used to rupture the cells, and the pigments were then extracted with **acetone**.
- the pigments will move at different rates, depending on their **different solubilities in the solvents** used and the degree of attraction to the paper .
- Chromatography paper is a **polar** (charged) substance.
- The solvent, made of hexane, ether and acetone, is relatively **nonpolar**.
- The *most nonpolar* substance will dissolve in the nonpolar solvent ***first***
- The *most polar* substance will be attracted to the polar chromatography paper; therefore, it will **move last**.

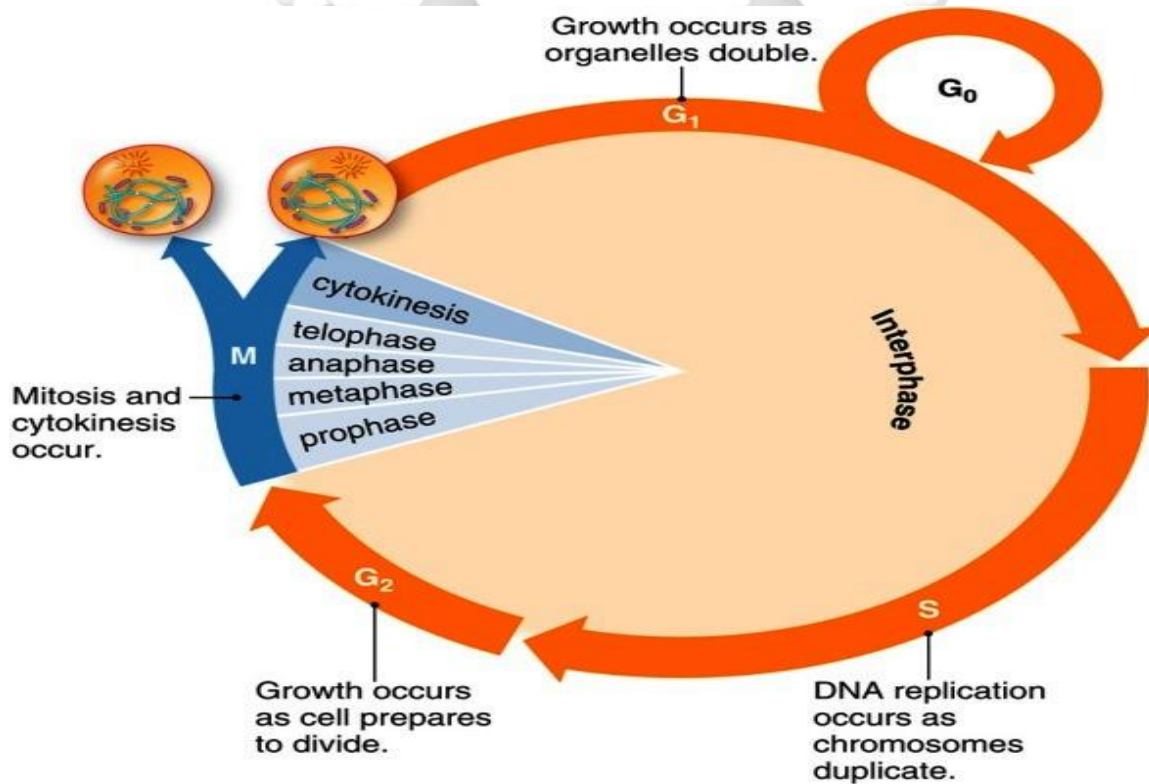
- Types of pigments shown in the experiment :

1. **Xanthophyll**: Appear in dark yellow color.
2. **Chlorophyll a**: Appear in light yellow color.
3. **Chlorophyll b**: Appear blue green color.
4. **Beta carotene**: Appear in yellowish green color.



- Least polar: Beta carotene
- Most polar: Xanthophyll

- من المعروف أن مركز التحكم في الخلايا هي : النواة.. لأنها تحتوي على DNA الحامل لكل الصفات الوراثية.
- ✓ المعلومات الجينية للكائن الحي تكون على شكل جينات .. مرتبة على هيئة كروموسومات.
- ✓ الكروموسوم الواحد عبارة عن جزيء DNA كامل محمولة عليه كل الصفات الوراثية .
- **Cell cycle:** all the events that take place in the cell from the beginning of one cell division until to the next division



Cell cycle: 1. Interphase 2. M.phase

- **Interphase:-** “preparation” فيه الخلية أجزاء تتضاعف
G₁ organelles فيه تتضاعف كمية السيتوبلازم ، تتضاعف جميع العضيات
S DNA هي فقط مرحلة تضاعف ال
G₂ تكمل الخلية ما نقصها من عضيات

• M.phase:-

1. Karyokines (nuclear division) .. تنقسم فيها الكروموسومات
2. Cytokines (cytoplasm division) .. تنقسم وتتوزع السيتوبلازم ومحتوياته

• Aim of cell division:

2. **Reproduction:** 1. sexual (meiosis) at gametes , 2. A sexual (mitosis)
3. **Replacement (mitosis)**
4. **Growth (mitosis)**

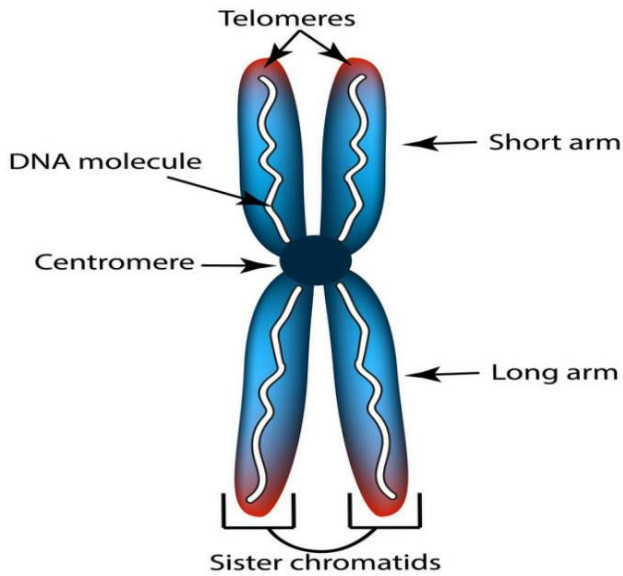
- The human has 46 chromosomes = (2n) "diploid "
(1n) 23 chromosomes from male
(1n) 23 chromosomes from female

- بمعنى.. كل شي 1n يكون haploid الي يكون أصلاً اجا من ال diploid (2n) الناتج من الإنقسام المنصف الذي يحدث عند إنتاج كائن جديد
- أما مثلاً اذا احتاج الجسم تعويض تالف بجزء ما بالجسم كما يحدث عند تعويض تلف الجروح ، ينقسم انقسام متساوي 2n

- Deference between mitosis and meiosis :

	Mitosis	Meiosis
<i>Number of chromosomes in daughter cell</i>	Same number of chromosomes	Half number of chromosomes
<i>Number of cells</i>	Two cells (2n)	Four cells (1n)
<i>Genetic variation</i>	Genetically identical cell	Non identical
<i>Type of cell</i>	Somatic cells	Sex cell

Chromosome X



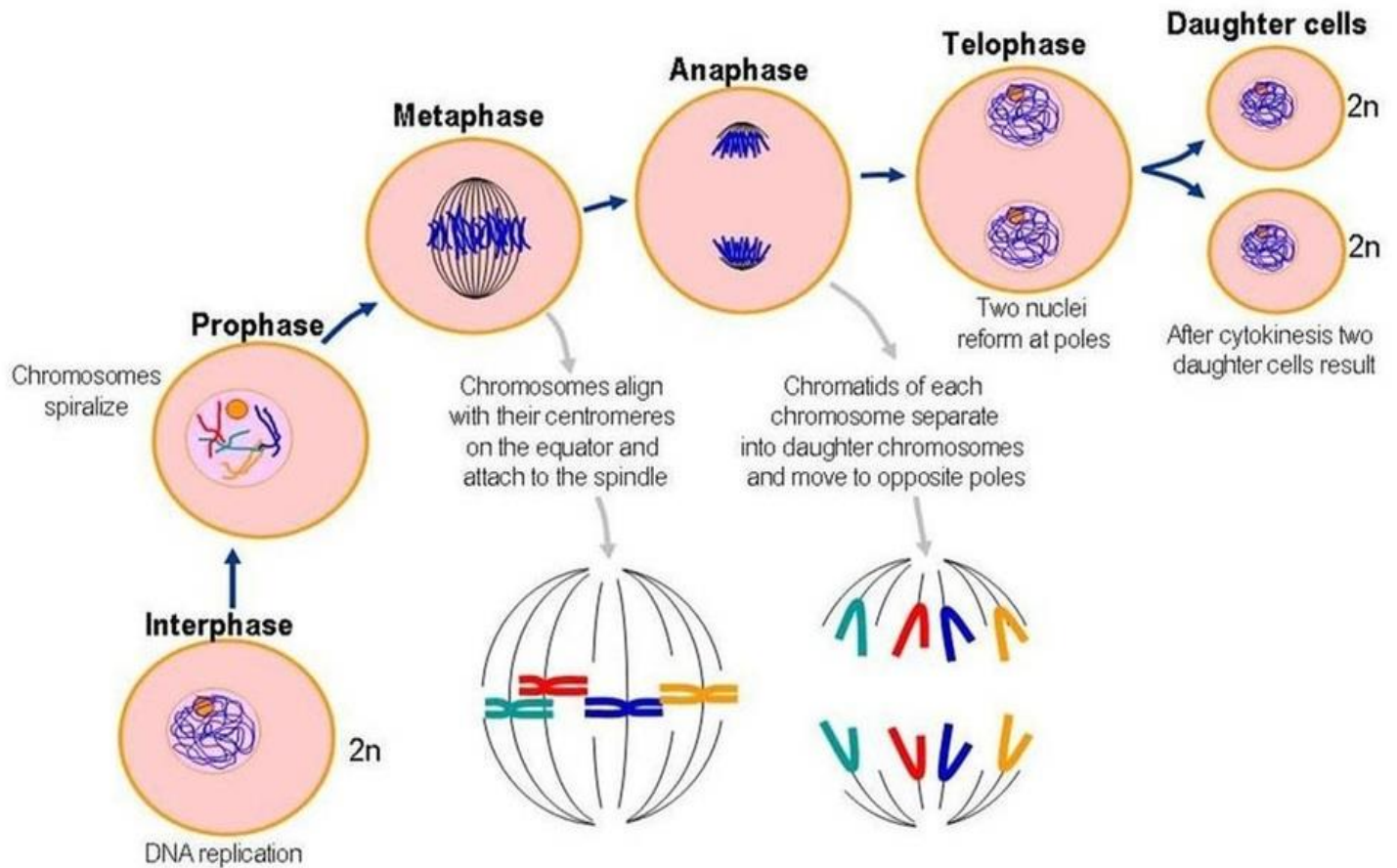
- الكروموسوم: يتكون من كروماتيدين متطابقين

ف فعلياً كل كروماتيد هو عبارة عن كروموسوم فردي single chromosome

عليه جزيء DNA كامل. لكن عندما يكون هنالك كروماتيدين مربوطين ببعض بقطعة مركزية وهي السنترومير, Centromere يكون قد تكون كروموسوم

كامل ، تضاعف ب ال S phase

- الكروماتيدين التابعين ل نفس الكروموسوم بنسبيهم sister chromatids



- Mitosis : $2n \rightarrow 2n, 2n$:

A. Karyotinesis :

- Prophase (الطور التمهيدي)
 - Metaphase (الطور الإستوائي)
 - Anaphase (الطور الانفصالي)
 - Telophase (الطور النهائي)
- karyokinesis stages

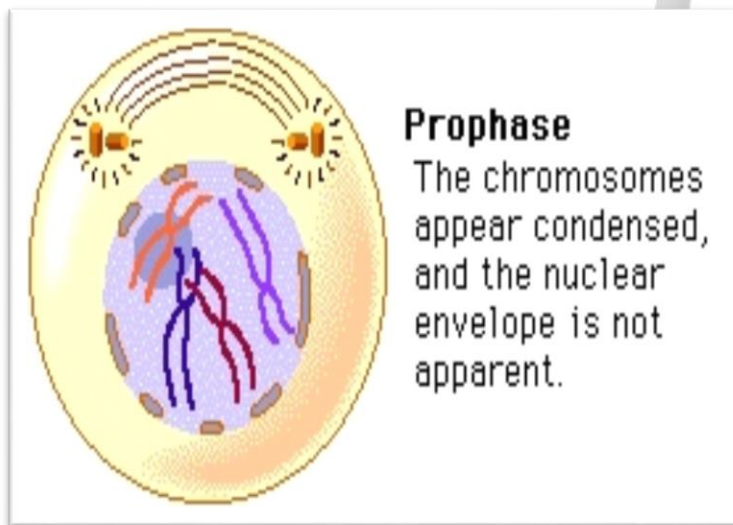
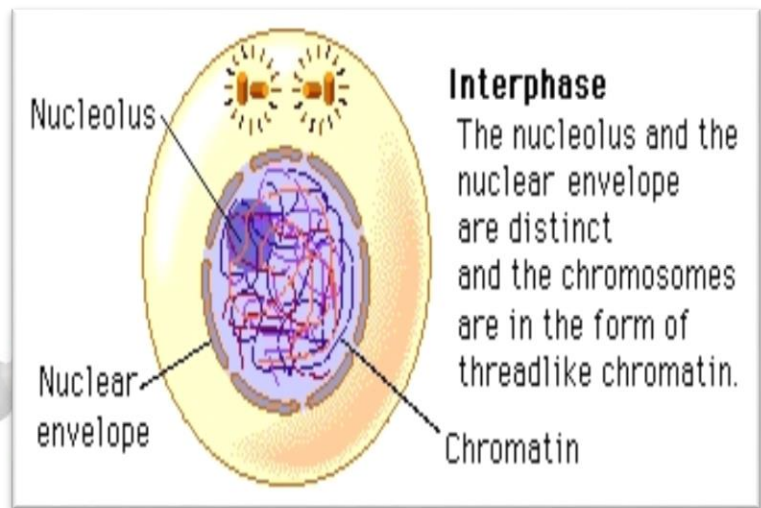
- عادةً بآخر مرحلة الي هي Telophas بتدخل عندي مرحلة Cytokines

- الخلية قبل م تبلش بمرحلة Karyokinesis بتكون بأول مرحلة الي هي Inter .. phase

عشان أميز تحت المجهر  أنو هاي الخلية بمرحلة ال interphase وكيف بتكون ال DNA..

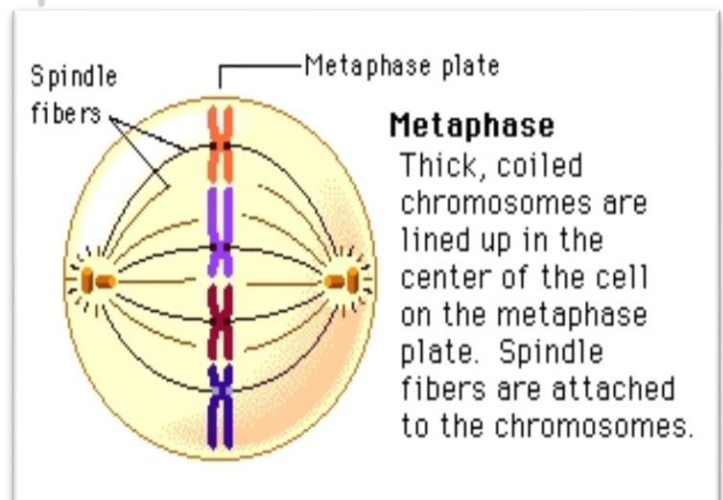
.. DNA قبل م تبلش بمرحلة الانقسام بنسميهم دائماً كروماتين أو شبكة كروماتينية بتكون الكروموسومات كثير رفيعة وملفين على بعض وغير مرئيين

1. Before mitosis actually starts, interphase begins. Interphase is when the cells start to copy its DNA. After interphase, mitosis begins. The steps of mitosis are prophase, metaphase, anaphase, telophase, and then cytokinesis.

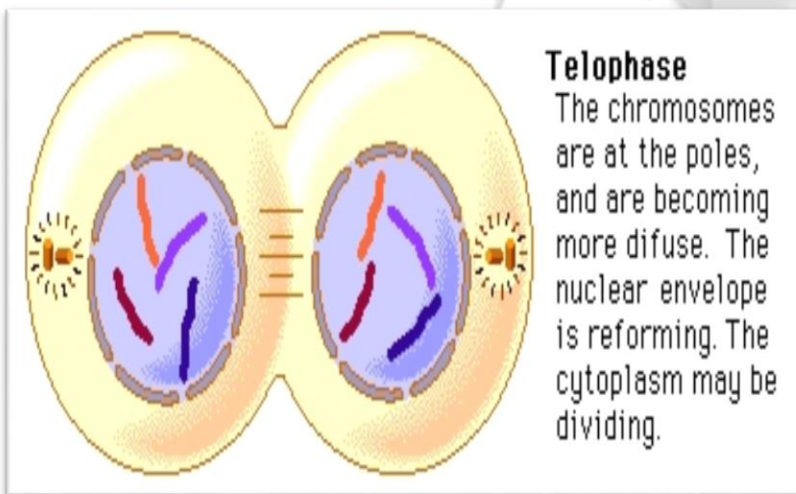
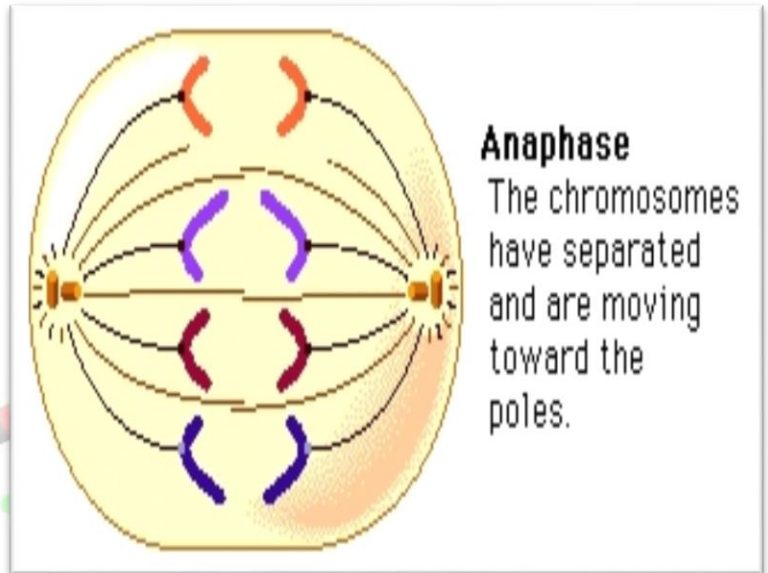


2. The 1st phase is Prophase. During prophase, the chromatin condenses into chromosomes, the centrioles separate, spindles form, and the nuclear envelope disappears.

3. The next step is metaphase. During metaphase, the chromosomes are lining up in the middle while the spindles attach to the centromeres

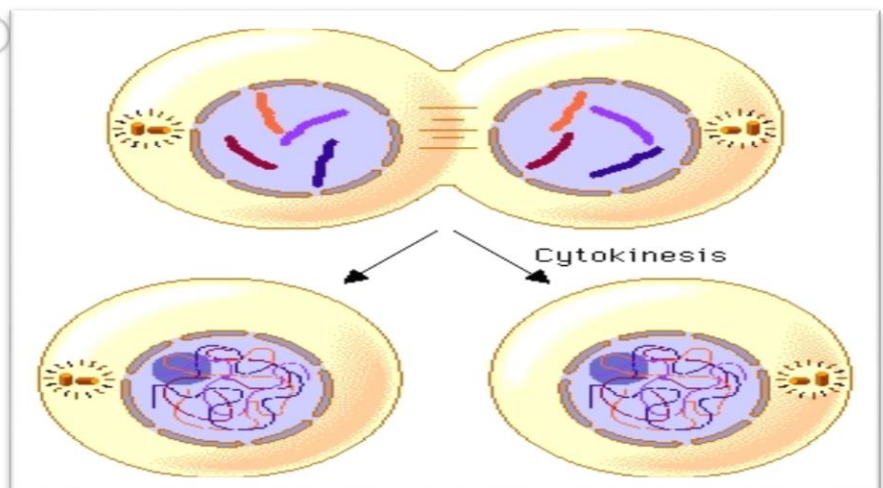


4. After metaphase, the next step is anaphase. During anaphase, the chromosomes are pulling apart at the centromere to create 2 sister chromatids. After that, the chromatids separate



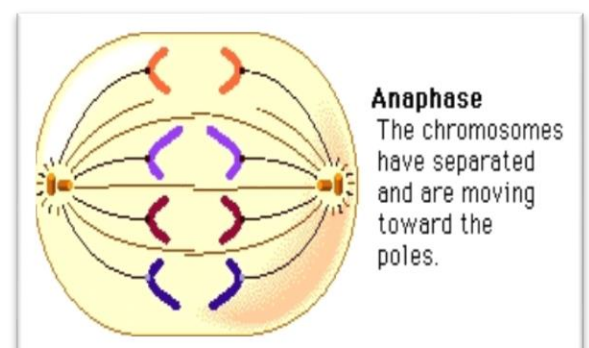
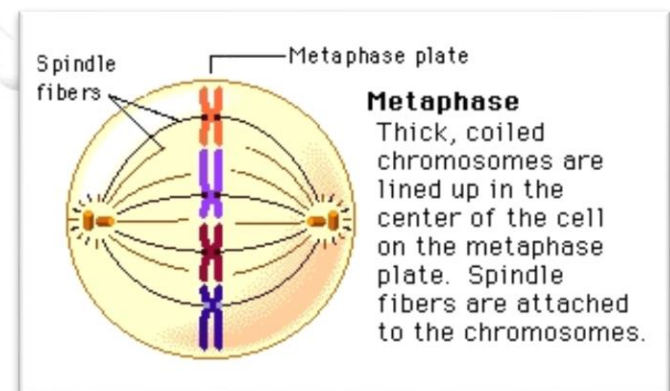
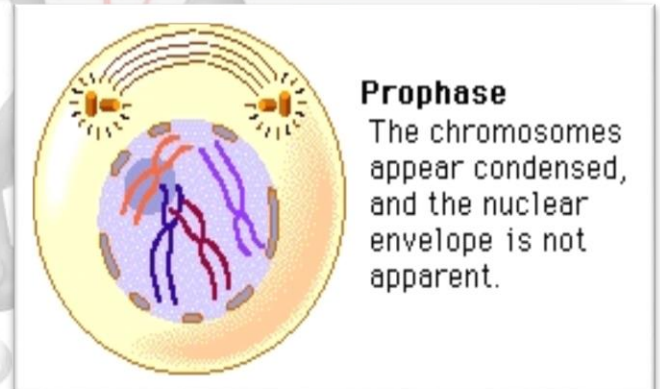
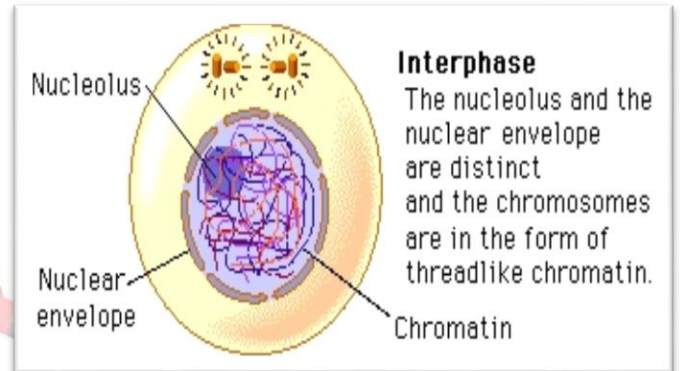
5. The next step is telophase. The chromatids are now chromosomes again. The nuclear envelope reforms and the spindles will disappear.

6. after telophase, its cytokinesis or "cell movement". The division of the cytoplasm of the cell begins. When cytokinesis is done, the whole process begins again.

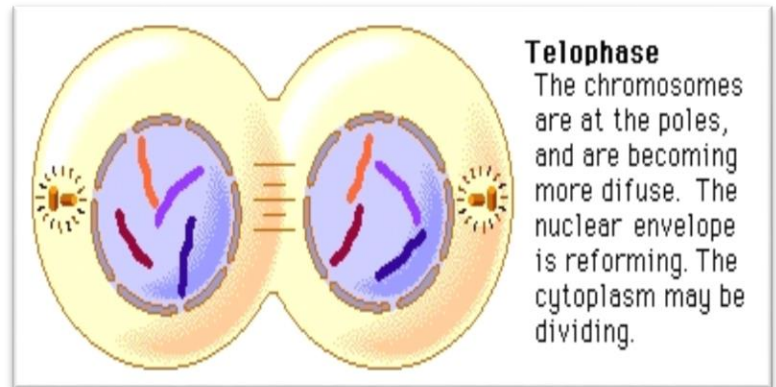


- **Meiosis : $2n \rightarrow 1n, 1n, 1n, 1n$**

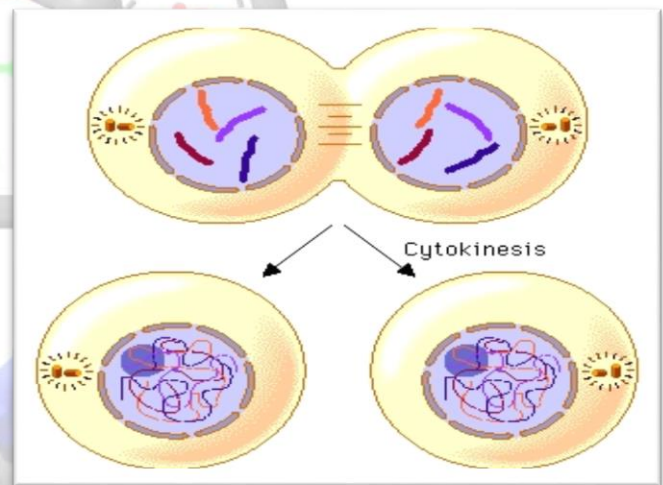
- This starts with interphase. During **interphase**, the cell grows and the cell copies DNA.
- Then, meiosis starts. **Prophase 1** is the start of the process. This exchanges DNA & creates genetically recombined cells.
- **Metaphase 1** is the second step. During this, the chromosomes line up in tetrads (which are pairs of homologous chromosomes) one from each parent.
- **Anaphase 1** is next. The homologous pairs separate to opposite poles of the cell.



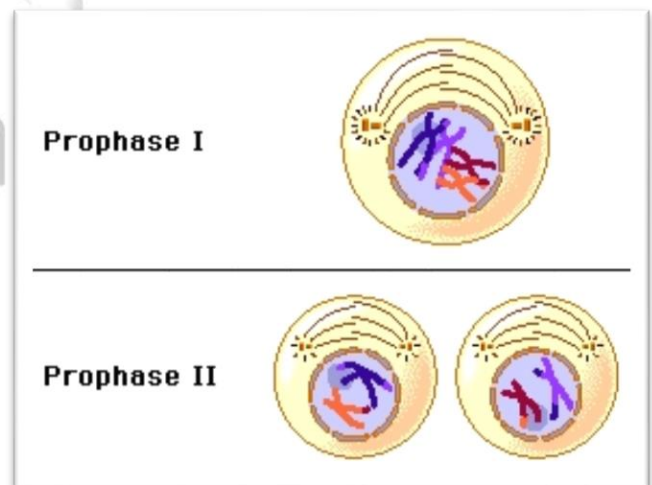
- When **Telophase** starts, two nuclei form



- **Cytokinesis** form 2 daughter cells



- **Prophase 2** is the step that prepares to divide

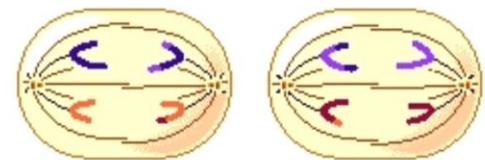


- **Anaphase 2** is where the chromosomes separate into sister chromatids

Anaphase I

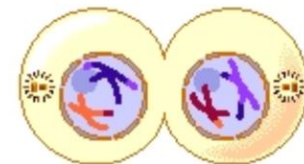


Anaphase II



- **Telophase 2** is where the chromatids split into 2.

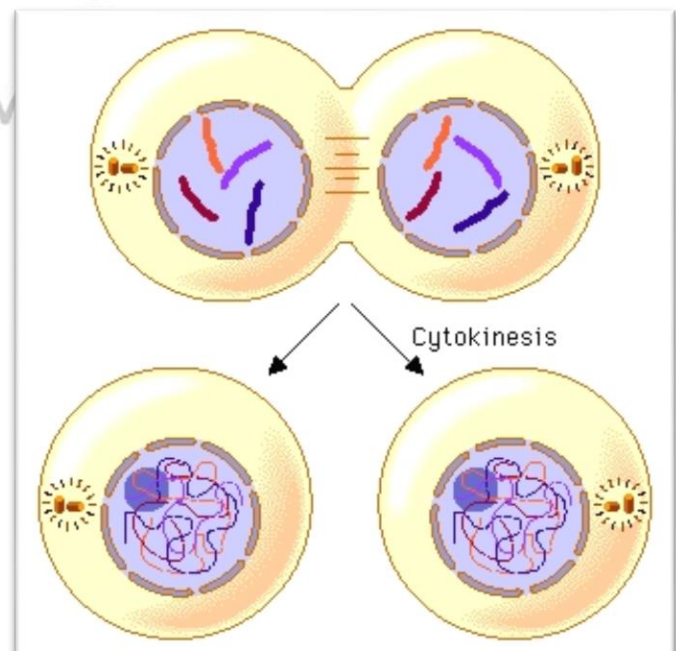
Telophase I



Telophase II

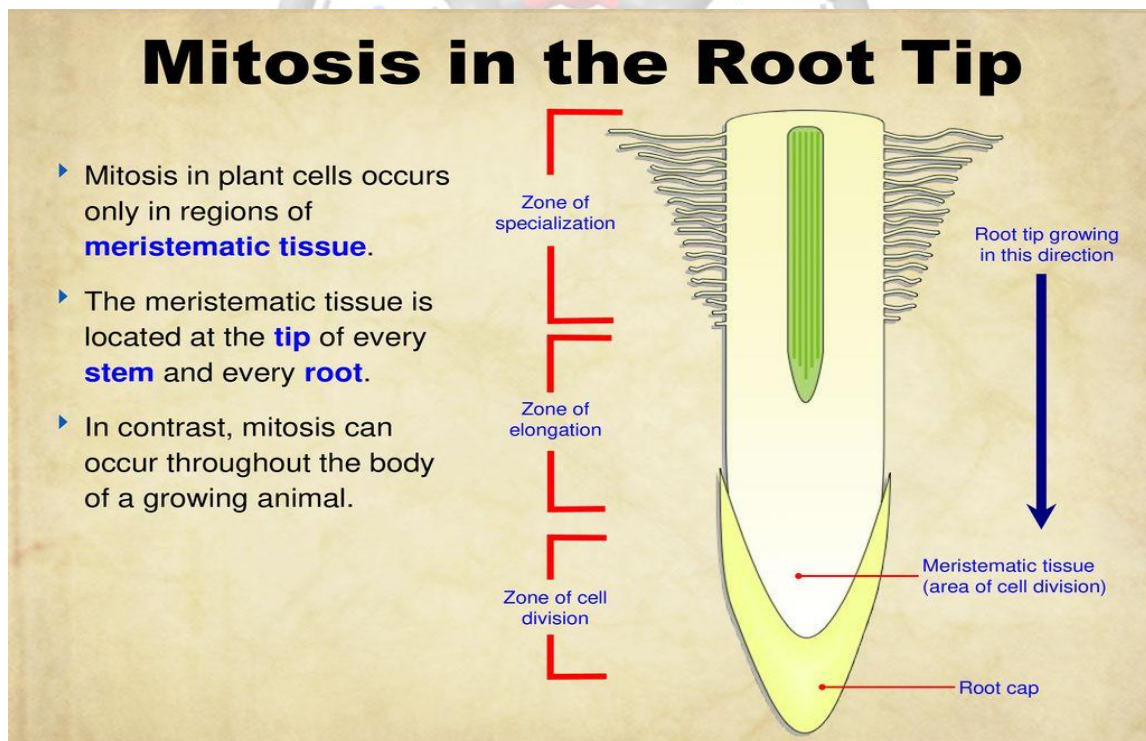


- The very last step is cytokinesis. During this, it ends with 4 daughter cells being created.

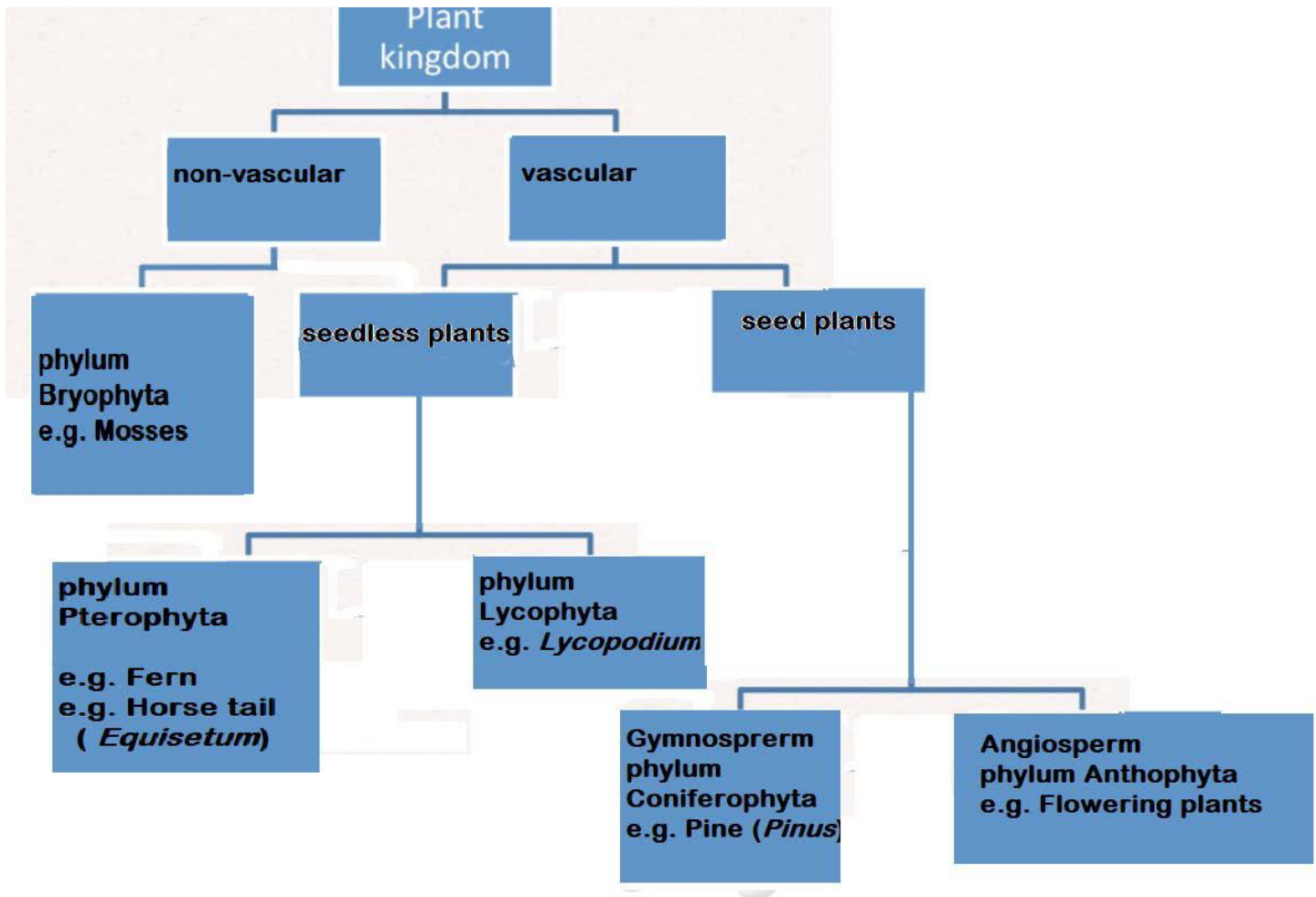


- **Mitosis in plant:**

- The plant used in the lab is : **onion**
- Mitosis in Allium Root tip (القمم النامية)
- Zone of cell division (الجزر)



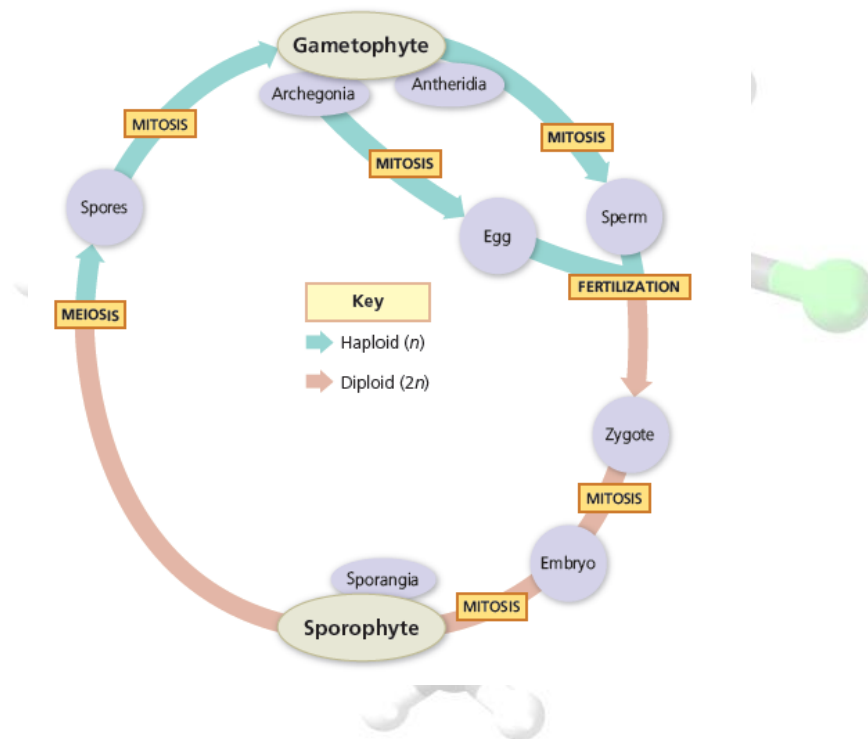
BIO & BIOTECH



- The plant body is often covered with a **waxy cuticle** that:
 1. prevents desiccation
 2. prevents gas exchange
- THE problem solved by the presence of openings called **stomata** (sing., **stoma**).
- Flowering plants are the most diverse and successful group in an amazing variety of habitats .

• Plant life cycle :

- All land plants have a common sexual reproductive life cycle called **alternation of generation**:



- plants alternate between a haploid **gametophyte** generation ($1n$) and a diploid **sporophyte** generation ($2n$).
- In living land plants, these two generations differ in their morphology, but they are still the same species.
- In all land plants except the **bryophytes** (mosses and liverworts), the diploid sporophyte generation is the dominant generation.
- The essential features in the alternation-of-generations life cycle, beginning with the sporophyte, are:
 1. The diploid sporophyte undergoes **meiosis** to produce haploid **spores** in a protective, non-reproductive jacket of cells called the **sporangium**.
 2. Dividing by **mitosis**, the spores germinate to produce the haploid gametophyte.

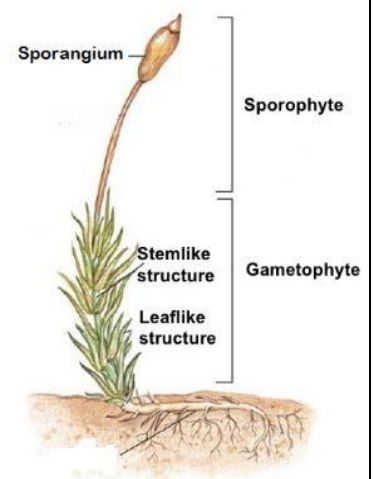
- The gametophyte produces **gametes** inside a jacket of non-reproductive cells, forming **gametangia** (sing., **gametangium**).
- **Eggs** are produced by **mitosis** in **archegonia** (sing., **archegonium**).
- **sperm** are produced in **antheridia** (sing., **antheridium**).
- The gametes fuse (**fertilization**), usually by entrance of the sperm into the archegonium, forming a diploid **zygote**, the first stage of the next diploid sporophyte generation.

Haploid (1n)	Diploid (2n)
- Gametophyte - Sperms - Eggs - spores	- Sporophyte - Zygote - embryo

• Nonvascular Plants (Bryophytes) :

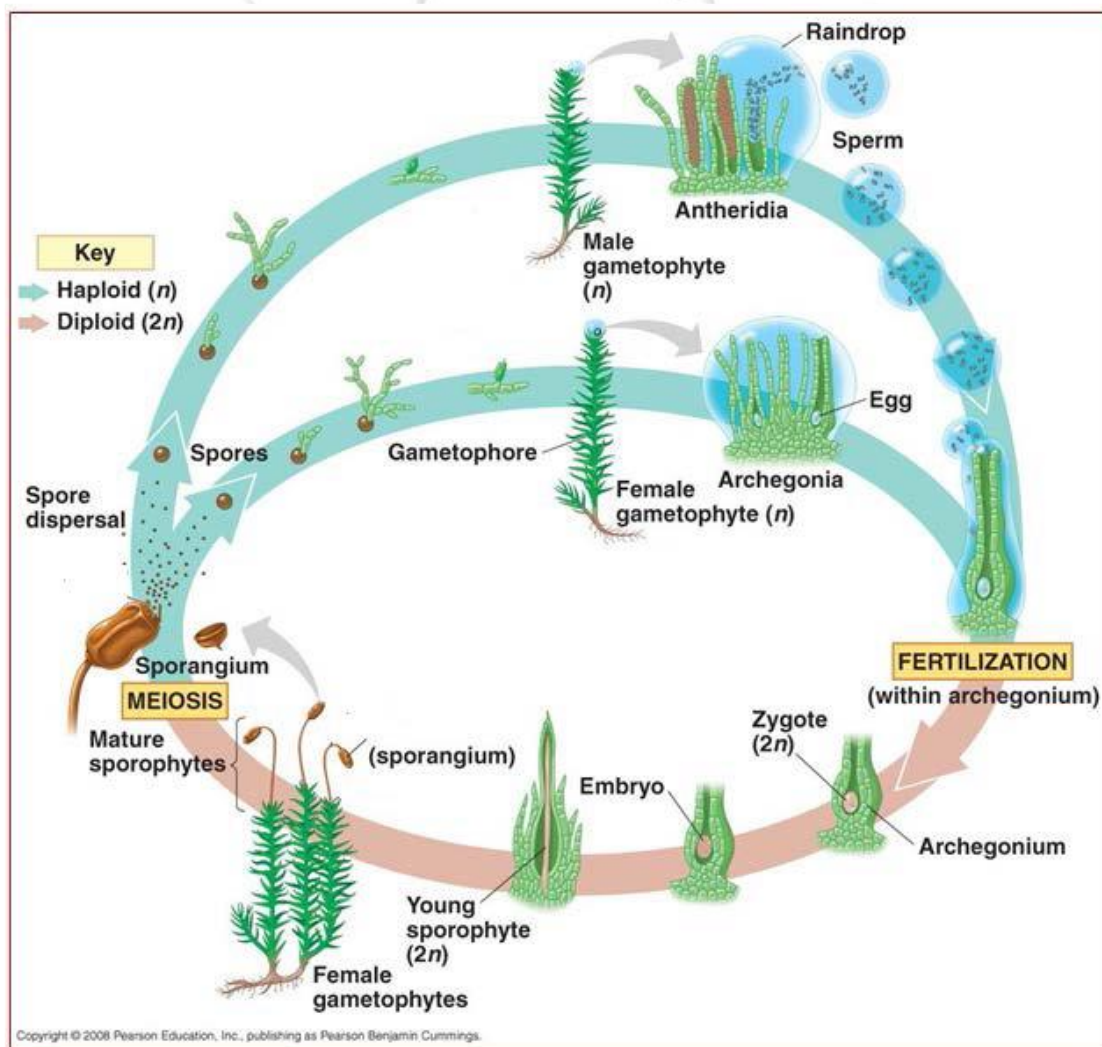
- Bryophytes are an ancient group of nonvascular plants.
- Bryophytes are small plants that generally lacking vascular tissue.

• The Structure of a Moss



- Bryophytes have **water-conducting tubes** appears to be present in some mosses. And these tubes are unrelated to the vascular tissue in vascular plant .
- Bryophytes have a different life cycle because the **gametophyte is the dominant conspicuous** .

- Because bryophytes are Non-vascular, they are restricted to **moist habitats** for their reproductive cycle. And have never attained the size and importance of other groups of plants.
- The gametophyte plants remain close to the ground, enabling the motile sperm **to swim from the antheridium to the archegonium and fertilize the egg**.



- They have a cuticle but lack stomata on the surface of the gametophyte **thallus** (plant body that lacks vascular tissue), which is not organized into roots, stems, and leaves.
- Stomata are present on the sporophyte in some mosses and hornworts.
- Bryophytes are not important economically, with the exception of sphagnum moss, which in its harvested and dried form is known as **peat moss**.

- **Seedless Vascular Plants :**

- The amphibians dependence on water for external fertilization and development of the unprotected, free-living embryo.

- **Features of seedless plants :**

- All seedless vascular plants have vascular tissue, which is specialized for conducting water, nutrients, and photosynthetic products
- Their life cycle is a variation of alternation of generations, in which the **sporophyte** is the **dominant** plant
- the gametophyte is usually **independent** of the sporophyte.
- These plants generally have leaves, and roots, as well as stomata and structural support tissue.
- They **require water** for fertilization (feature of motile sperm).
- The gametophyte is **small** and restricted to moist habitats.

- **We will study 2 phyla in this category:**

1. **Phylum pterophyta** : Includes:

- ***Fern***
- ***Equisetum***
- ***horse tail***

2. **Phylum lycophyta**: Includes :

- ***Lycopodium***

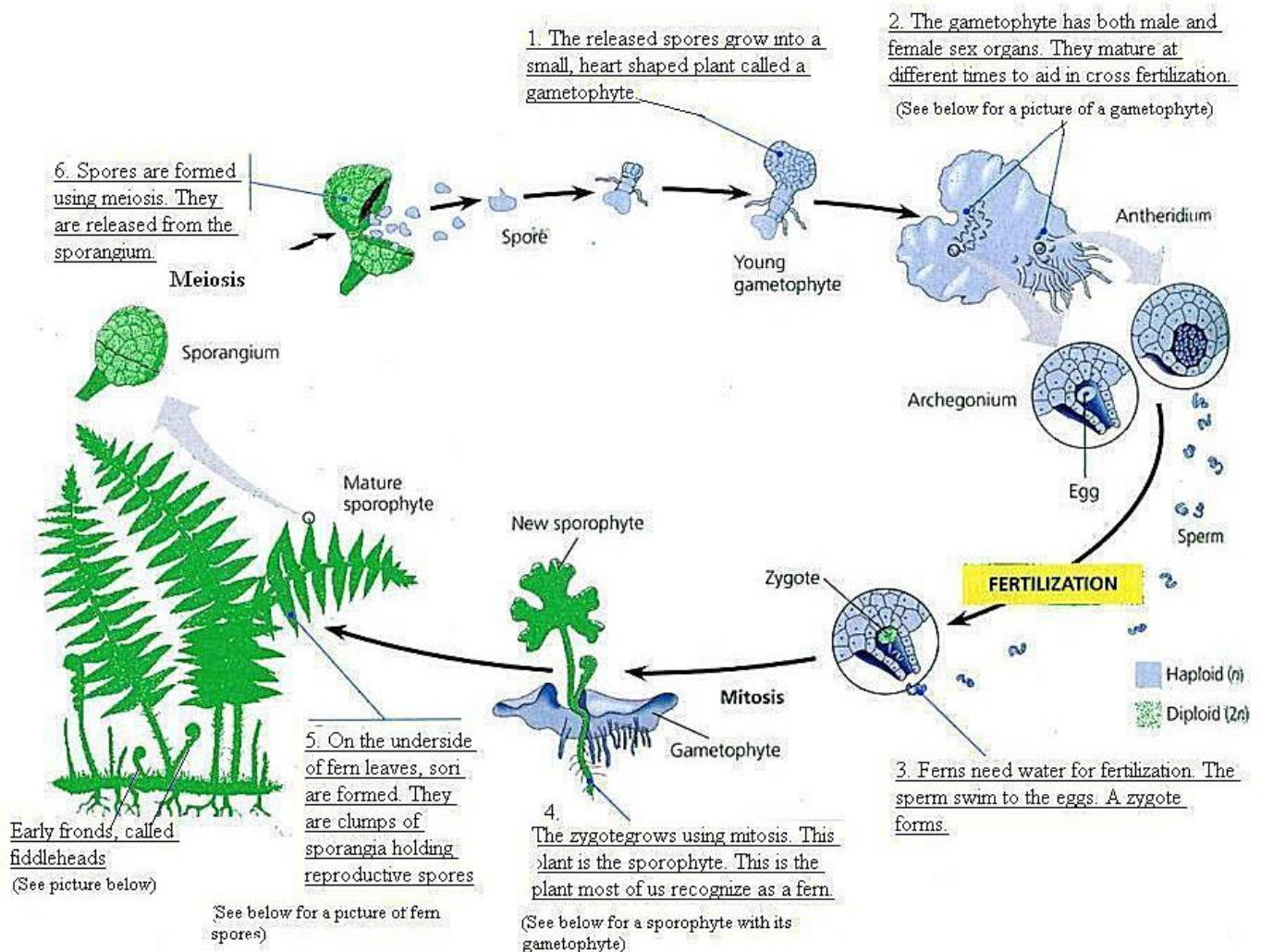
- The only important members of this groups in **Economic** are the **ferns**, a significant horticultural resource.

- **Phylum pterophyta – ferns:**

- **Features of Ferns :**

1. They are the most successful group of seedless vascular plants.
2. Lack woody tissue.
3. Small size.
4. Occupying habitats from the desert to tropical rain forests.

- **Haploid** spores of ferns fall to the ground and grow into heart-shaped gametophyte plant.
- All seedless plants depend on an external source of **water** for sperm to swim to an egg to effect fertilization and for growth of the resulting sporophyte plant.
- The gametangia which bear male and female gametes are borne on the underside of the gametophyte archegonia
- **Fern life cycle:**



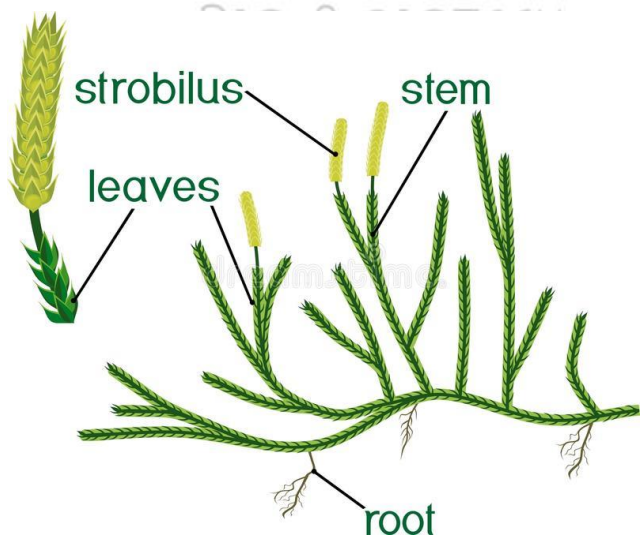
- Phylum pterophyta - *Equisetum* (horse tail):



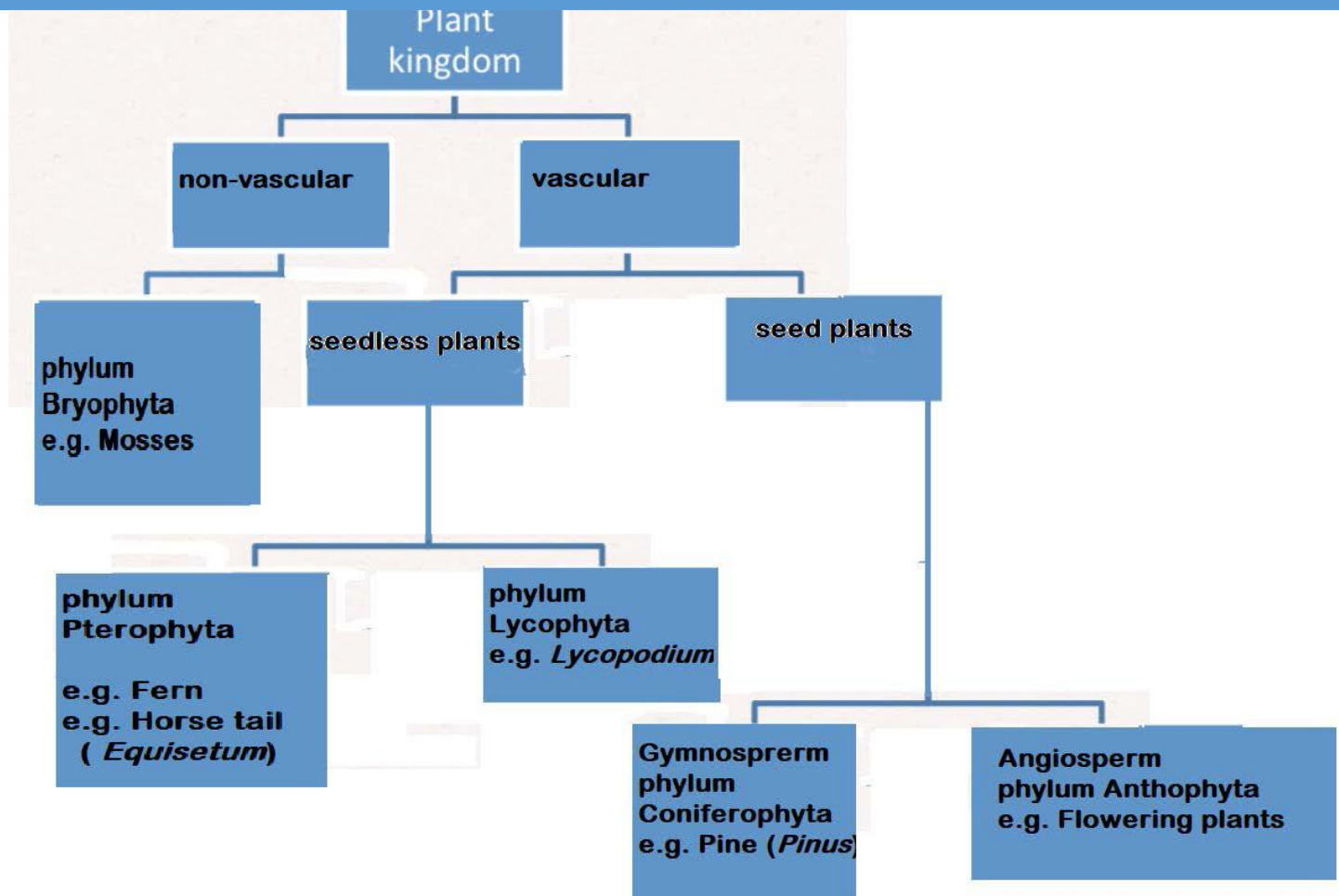
Strobilus

- Strobilus do **meiosis** and Give us **Spores**
- The right side of the plant represent the **sporophyte** .

- Phylum lycophyta - *Lycopodium*



- Strobilus do **meiosis** and Give us **Spores**.



• SEED VASCULAR PLANTS:

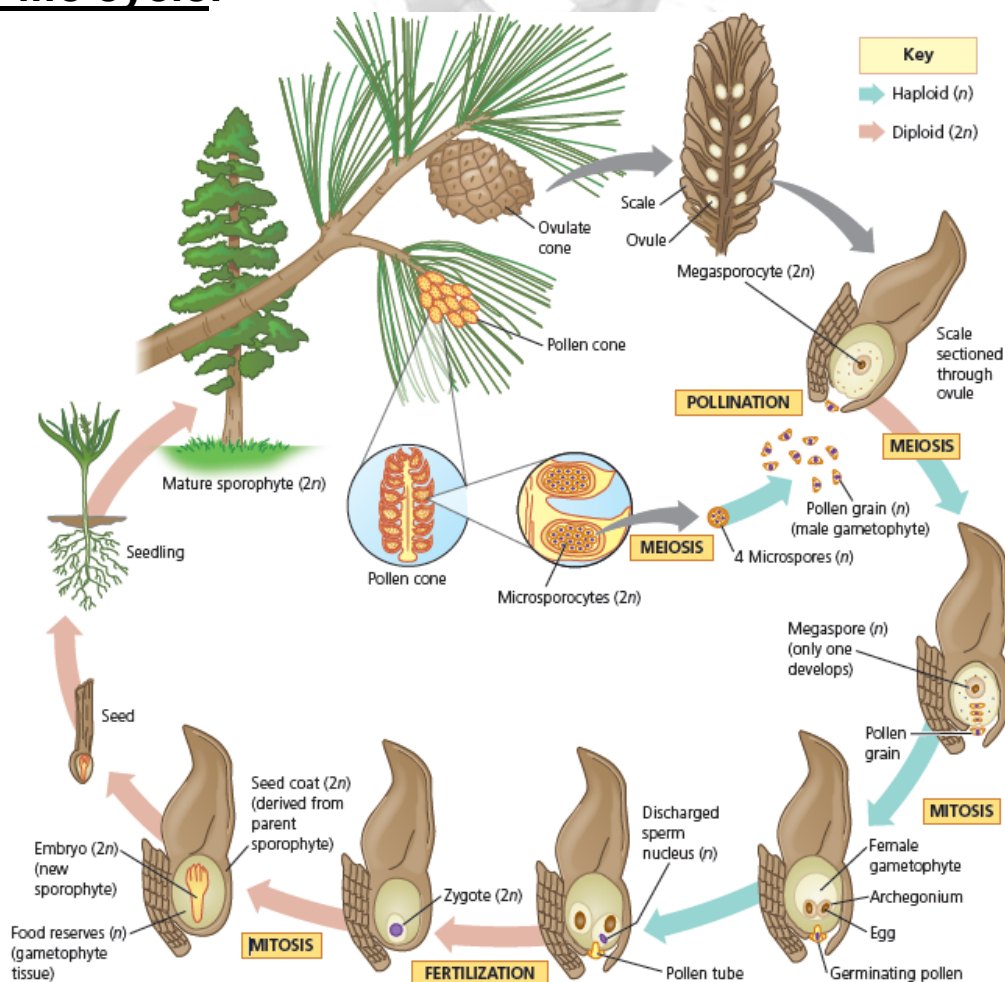
- These plants have vascular system and bear seeds.
- **Seed** is dormant embryo with nutritive material covered with protective layer.
- **Sporophyte** is dominant.
- They have very reduced **gametophyte** .
- **These plants are heterosporous produce 2 type of spores:**
 1. **megaspore** that develops into the female gametophyte.
 2. **microspore** that develops into the male gametophyte.
- Seed vascular plants consist of **gymnosperms** and **angiosperms**.

• Gymnosperms:

- Gymnosperm means that is no fruit cover the seeds "naked seed".
- Life cycle in **gymnosperms** (time from seed to seed) is **long**.
- Need **wind** for fertilization (pollination) .
- **Male gametophyte** which is the **pollen grain** are produced in the **male cones** (pollen cones).
- **Female gametophyte** are produced in the **female cones** (ovulate cones) .
- Female cones are **larger** than male cones.

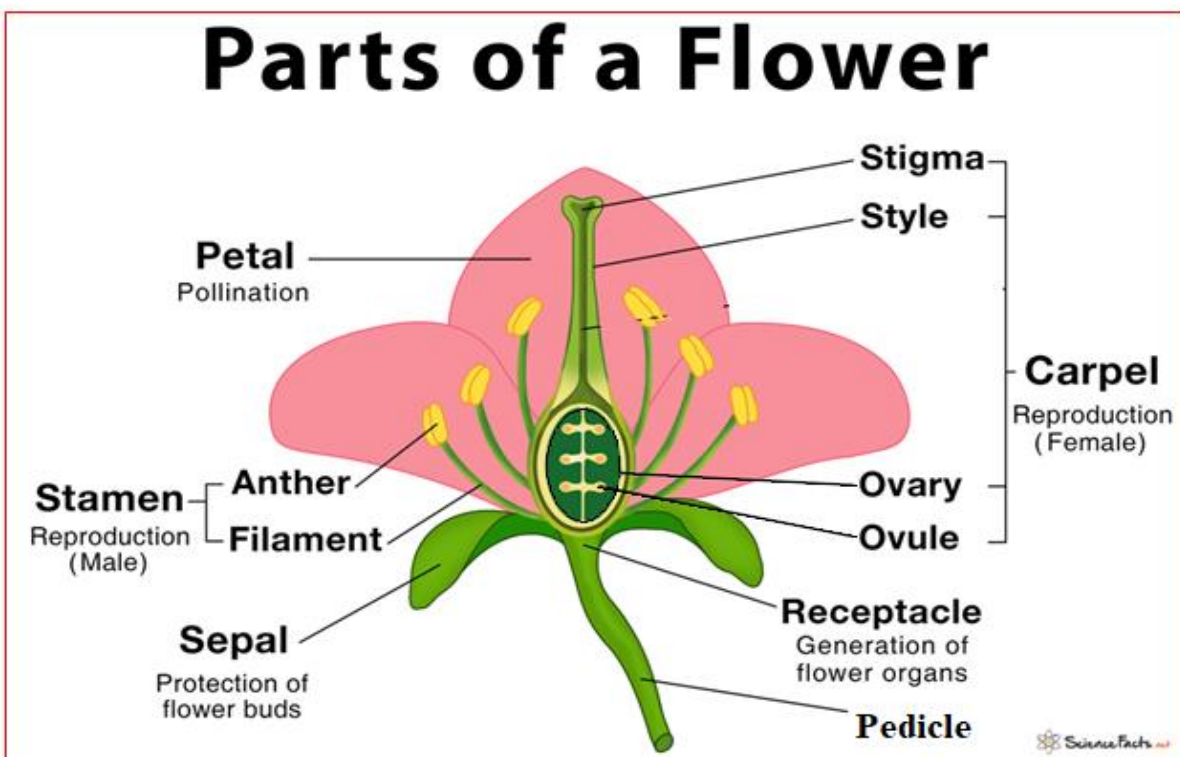
Example for **gymnosperms**: phylum coniferophyta , plant is **pine** (*Pinus*).

• Pine life cycle:



• Angiosperms:

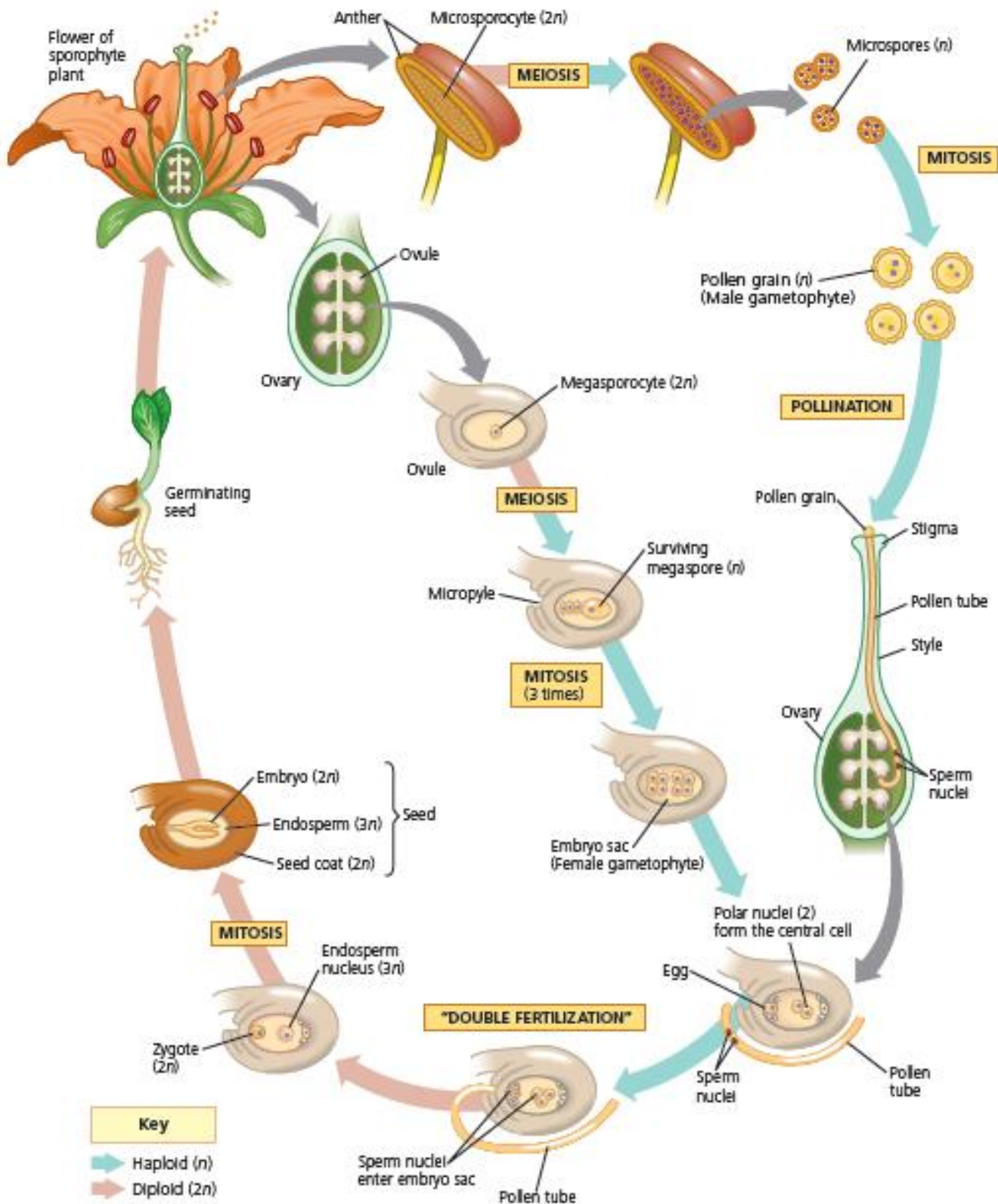
- Angiosperms now occupy well over 90% of the vegetated surface of Earth and contribute virtually 100% of our agricultural food plants.
- The plant have a flower (flowering plants) .(phylum anthophyta)
- The Seeds are covered with fruit ,so this structure provides **protection** and **enhances** dispersal of the young sporophyte.
- the process of flower pollination is mediated by:
 - insects
 - wind
 - birds and bats
 - water
 - specific agents
- **Male gametophyte** is the pollen grain.
- **Female gametophyte** is part of the flower ovule.
- The life cycle (from seed to seed) can be **short** (a year) of **long**.
- The showy flowers (attracting attention by color or shape or smell) are mostly pollinated by **animals**.



• Parts of flower:

- **Pedicle:** The stalk of a flower.
- **Receptacle:** The part of a flower stalk where the parts of the flower are attached .
- **Sepal:** The outer parts of the flower (often green and leaf-like) that enclose a developing bud. Collectively called **calyx**.
- **Petal:** The parts of a flower that are often conspicuously colored. Collectively called **corolla**.
- **Stamen:** The pollen producing part of a flower (male reproduction part), usually with a slender **filament** supporting the **anther**.
- **Anther:** The part of the stamen where pollen is produced.
- **Carpel:** The ovule producing part of a flower (female reproduction part). Consist of **stigma**, **style**, **ovary** and **ovule**. The mature ovary is a **fruit**, and the mature ovule is a **seed**.
- **Stigma:** The part of the carpel that receive the pollen grain .
- **Ovary:** The enlarged basal portion of the carpel where ovules are produced.

• Flower life cycle:



• There are 4 types of Plant Tissue:

1. Dermal tissue
2. Ground tissue
3. Vascular tissue
4. Meristematic tissue

• Dermal Tissue (The Epidermis) :

- The epidermis forms the **outermost layer of cells**, its usually **one cell thick**, And it covers the **entire plant body**.
- The epidermal cells are often **flattened and rectangular** in shape.
- (الخلايا مسطحة و مستطيلة الشكل)
- Most aboveground epidermal cells covered with **cuticle** (waxy material prevent water loss) .
- (الخلايا الموجودة على الاسطح الخارجية تكون مغطاة بمادة شمعية لمنع فقدان الماء)

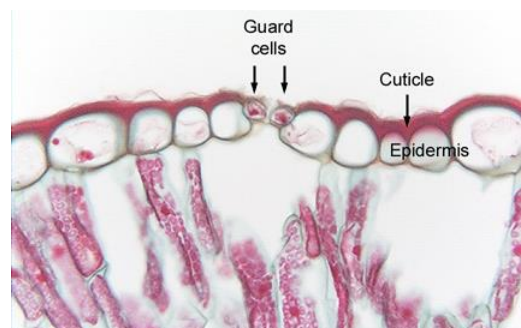
Cross section



- Leaf surface showing **epidermis** with **stomata** and **guard cells**.
- The epidermis provides **protection** and regulates gas exchange and transpiration (water evaporation) . (توفر البشرة الحماية وتنظم تبادل الغازات)

• Specialized epidermal cells include:

- **Trichom** which is hair-like structure.
- Guard cells of stomata.
- Root hair.



- **Ground Tissue** :

- Ground tissue Includes :

Characteristics and functions

Parenchyma	- Most common cell in plant. (الأكثر شيوعا في النبات) - Living cells with thin cell wall and large vacuoles. - Function in: photosynthesis, support, storage of material and lateral transport. (تقوم بالبناء الضوئي و الدعامة و التخزين و النقل الجانبي للمواد)
Collenchyma	- Found beneath epidermis. (توجد تحت البشرة) - Living cells with uneven thickening of cell wall. - Function in: providing flexible-support to young (primary growth) plants. (توفير الدعم المرن للنباتات الصغيرة)
Sclerenchyma	- Dead cell at maturity with thick cell wall that may contain lignin. - Most common type of sclerenchyma are thin long fiber. - Function in: providing strength and support. (الدعامة والصلابة)

- **Vascular Tissue** :

- **Function** : transporting materials throughout the plant body
(نقل المواد عبر جسم النبات)

- **Vascular tissue Includes two type of complex tissue:**

1. **Xylem (الخشب) :**

- **Function :** Transport of water and minerals throughout the plant **and** provide support.
(الدعامة و نقل الماء المعادن الى اجزاء النبات)

- **Types of Cells in xylem:**

- **Vessel:** large in diameter with open end, joined end to end to form continuous tubes throughout the plant.
- **Tracheids:** thin and long cells with perforated tapered end, joined end to end to form continuous tubes throughout the plant
- **Parenchyma:** for storage and lateral transport.
- **Fiber:** for additional support.

- **Tracheids and vessel elements** are the primary water-conducting cells.

2. **Phloem (اللحاء) :**

- **Function :** transport of the photosynthetic products. (نقل نواتج البناء الضوئي)

لا تحسب المجدَ تماً أنتَ آكله
لن تبلغَ المجدَ حتى تلعقَ الصَّبْرَ

• Types of Cells in phloem:

- **Sieve – tube cell:** the main conducting cell. It is a living cell that lack nucleus and have sieve-plate, joined end to end to form continuous tubes throughout the plant.
- **Companion cell:** associated with sieve-tube cell. Regulate the function of sieve-tube cell.
- **Phloem parenchyma:** for storage and lateral transport
- **Phloem fiber:** for additional support.

• Meristematic Tissue :

- Meristematic tissue is a tissue in plants that consists of **undifferentiated** cells (meristematic cells) capable of **cell division** (mitosis).

((نسيج في النباتات يتكون من خلايا غير متميزة (خلايا مرستيمية) قادرة على الانقسام الخلوي (انقسام متساوي))

- Meristems give rise to various tissues and organs of a plant and are responsible for growth. (يكون أنسجة وأعضاء مختلفة للنبات وتكون مسؤولة عن النمو)

• We have 4 different types of meristematic tissue:

1. **Primary meristems:** located in shoot buds and root tips, responsible for primary growth of plants
(تقع في براعم النبتة ورأس الجذر ، وهي المسؤولة عن النمو الأولي للنباتات) -
2. **Pericycle:** located in the root, divide to produce lateral root.
(تقع في الجذر ، تنقسم لإنتاج جذر جانبي) -
3. **Vascular cambium:** locate between xylem and phloem, responsible for secondary (woody) growth of plants. (يقع بين نسيج الخشب واللحاء ، وهو المسؤول عن النمو الثانوي (الخشبي) للنباتات) -
4. **Cork cambium:** locate inside the cork, responsible for secondary (woody) growth of plants.
(المسؤول عن النمو الثانوي (الخشبي) للنباتات) -

• Plant organs :

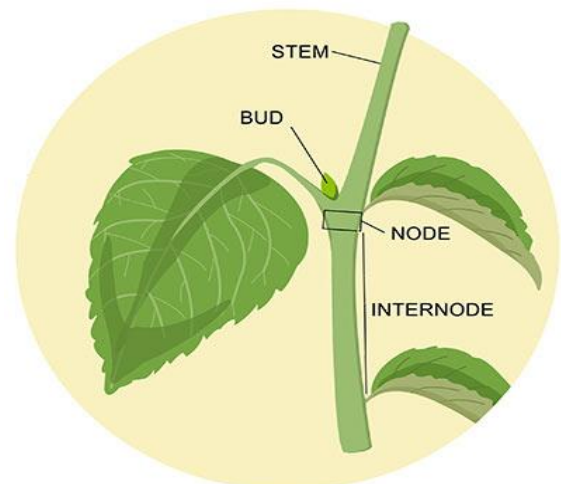
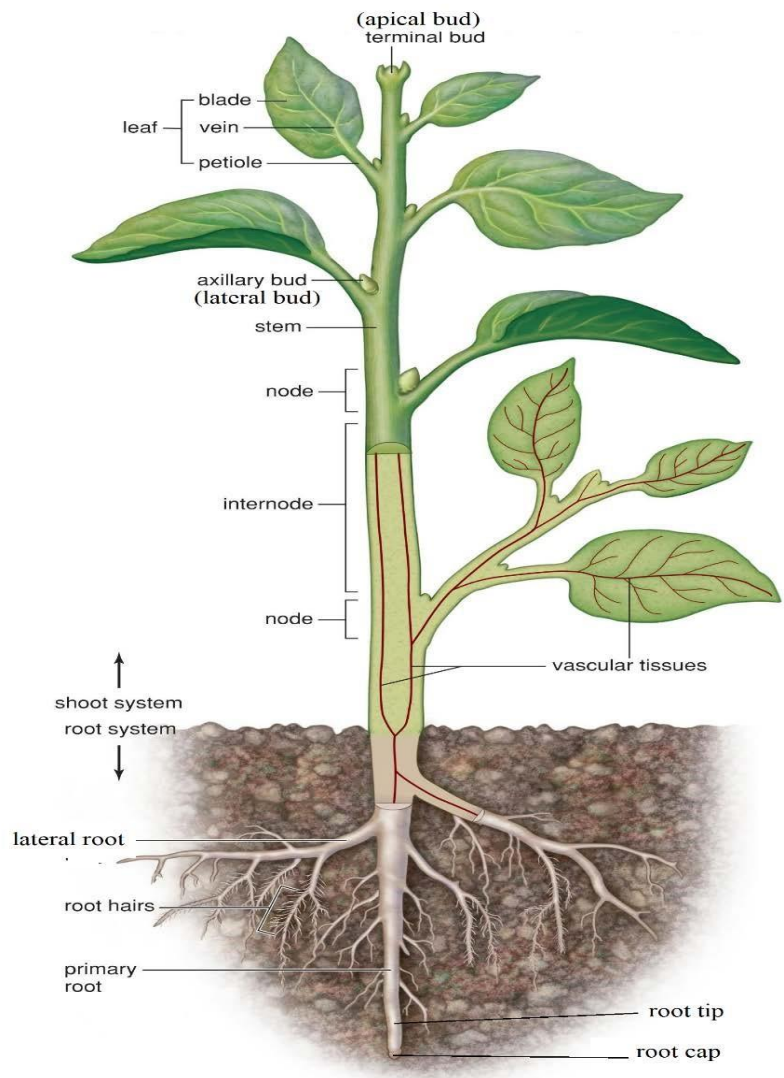
• Primary stem :

- The **stem** is the main plant axis

• Stem functions:

1. Support of shoot parts such as leaves, flowers and fruits.
 2. Transport of fluids in the xylem and phloem.
 3. Primary stems are photosynthetic.
 4. Storage
- The stem is normally divided into **nodes** and **internodes**
 - In most plants stems are located **above the soil** surface but some plants have **underground stems**.

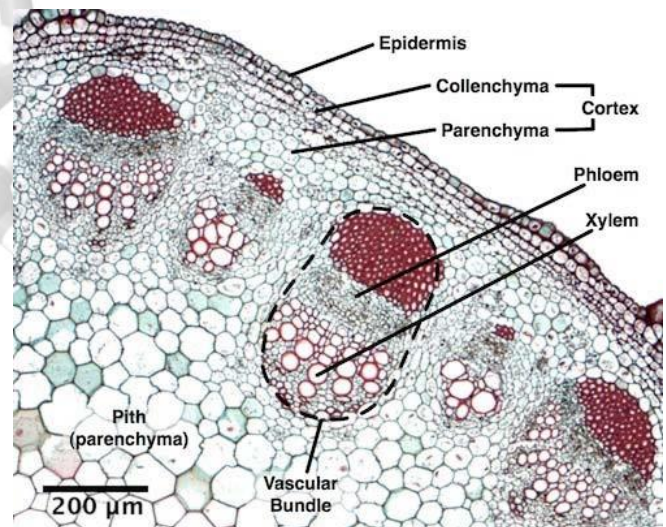
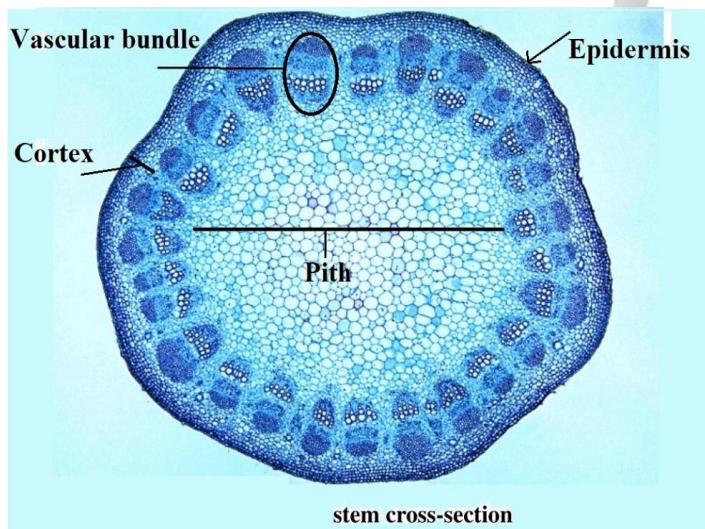
- معظم النباتات توجد سيقانها فوق سطح التربة ولكن البعض لها سيقان تحت الأرض .



- **Primary stem cross section:**

- Epidermis:** the outer-most layer, covered with a waxy layer to prevent water lose called **cuticle**.
- Cortex:** is the outer layer lying between the **epidermis** and the **vascular bundles**.
 - The cortex is composed of **collenchyma** and **parenchyma** cells.
- Vascular bundles:** composed of **phloem**, **xylem** and **sclerenchyma** (bundle) cap.
 - **Vascular bundles** form a distinct ring visible when the stem is viewed in cross section.
- Pith:** the layer in the center, composed of **parenchyma** cells.

- **study the following pictures:**



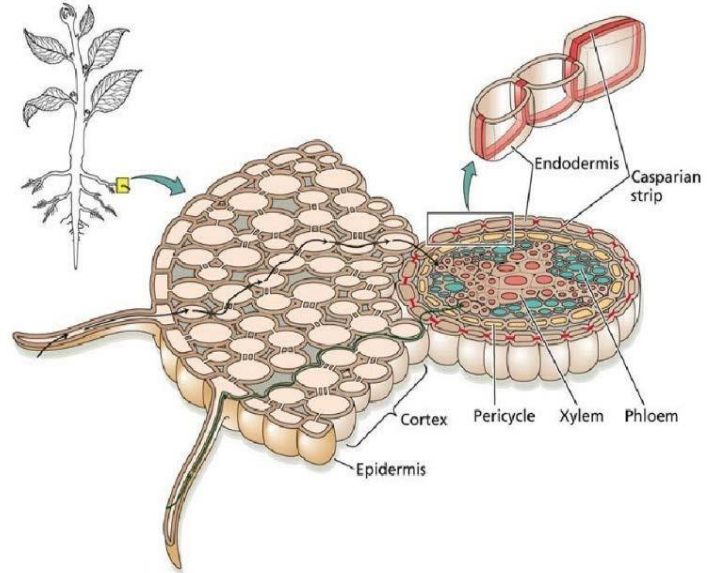
- **Primary root :**

- **Root functions :**

- ❖ Anchorage to the soil and support.
- ❖ Absorption and conduction of water and minerals.
- ❖ Storage

• **Primary root cross section:**

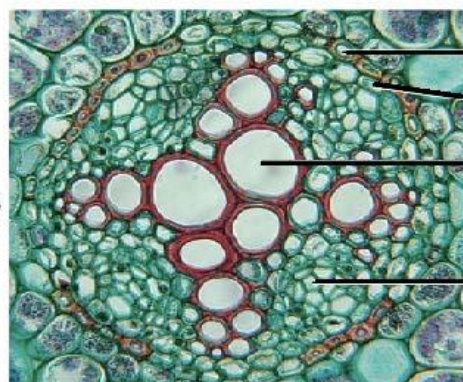
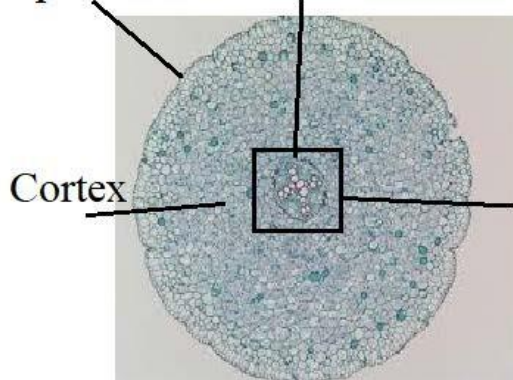
1. **Epidermis:** the outer-most layer.
2. **Cortex:** is the layer between the epidermis and the vascular cylinder. The cortex is composed of collenchyma and parenchyma cells.
3. **Vascular cylinder** is the bundles of vascular tissue that run within the core (center) of root. d) **No Pith** in the root.
4. **Endodermis:** is the inner-most layer of cortex. The cells are surrounded with **Casparian strip** witch made of **suberin**, a waxy material that extends completely around each cell .
- These cells regulate the water movement from root cortex to the xylem.
5. **Pericycle:** a meristematic tissue divides to produce the lateral root .
6. **Xylem** : have cross (X) shape in the middle of the vascular cylinder.
7. **Phloem** : surround the xylem as shown in the figures.



Root Endodermis and Casparian strip

Epidermis Vascular cylinder

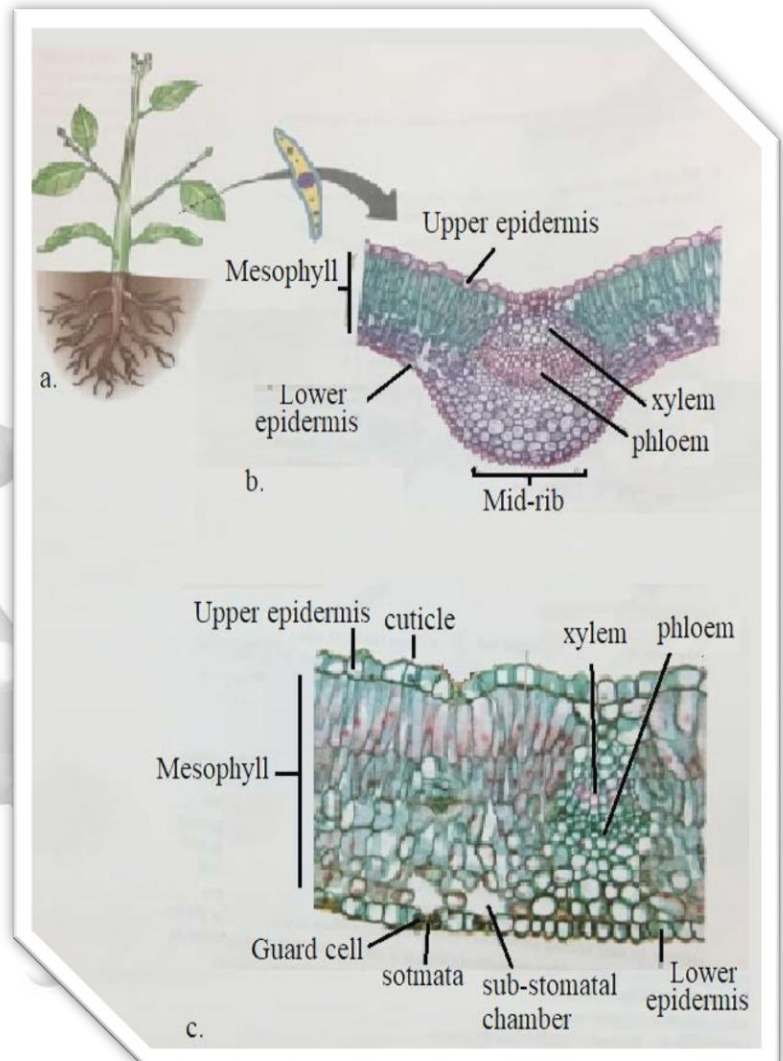
Cortex



Cross section of Root

• Leaf :

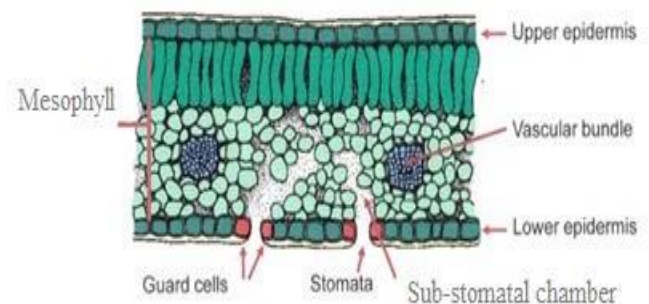
- The main **functions** are **photosynthesis** and **gas exchange**.
- A leaf is often **thin** and **flat**, so it **absorbs** the light better.
- Most leaves have **stomata**, which regulate gas exchange with the atmosphere.
- **Guard cells** regulates opening and closure of stomata.
- **Sub-stomatal chamber**: is the air-space beneath the stomata to facilitate gas exchange.
- The epidermis is covered with **cuticle**.



• Leaf cross section :

- Upper epidermis.**
- Mesophyll**: the layer between the upper and lower epidermis, it is parenchyma cells function in **photosynthesis**.
- Lower epidermis.**
- Vascular bundle.** The main vein is Called **mid-rib**

Leaf cross section



- **Secondary (Woody) stem :**

- The increase in stem thickness results from secondary growth is due to the activity of the **vascular cambium** and **cork cambium**.
- The **vascular cambium** is located between xylem and phloem.
- The cells of the vascular cambium divide and form **secondary xylem** to the inside and **secondary phloem** to the outside.
- The **cork cambium** divides to produce **cork**.
- The cork cambium and cork cells are collectively termed the **periderm**.
- The **periderm** substitutes for the epidermis and cortex present in primary stem.
- **Bark** is the periderm and secondary phloem collectively.
- **Annual ring** (secondary xylem ring): Concentric circles visible in cross-sections of woody stems. Each year the vascular cambium layer produces a layer of secondary xylem. An examination of the number of annual rings can reveal **the age of the tree**.

- **Cross section of secondary stem:**

Layers from outside to inside are:

- a) Cork
- b) Cork cambium
- c) Secondary phloem
- d) Phloem ray (are parenchyma cells located between the secondary phloem)
- e) Vascular cambium
- f) Secondary xylem (annual ring)
- g) Lateral ray (parenchyma cells pass through the secondary xylem)
- h) Pith (in the center, composed of parenchyma cells)

❖ **REMEMBR: Periderm is cork and cork cambium**

