according to number of cell in each organisim

Ecx 2.5 (41)

The cells

cell: the fundamental biogical unit (smallest, simplest).

cell's function: ① prossing all the characteristics of the living condition

② every activity taking place in living organisim is related to mitabolic activites in cell

---

According to number of cells ← ②

cell

unicellular (singel celled)

- living function: (handled by cell)
  ① resperation ② reproduction ③ digestion ④ excretion
- unicellular: lack stomic cells

multicelluar (clusters of cell)

- the organism that have the two (or more) types of cells
  - stomic جسمية
  - reproductive جنسية
  - → not capable of prepetuating when it's isolated in wild — كلها خلايا متخصصة
- here cells aren't independent (rely on each other)
- every cell has it's own function, we need all cell's type to stay alive.

Aggregates and colonies (clusters of cell)

- the cells in these clusters is independent (don't rely on each other)
- every single cell can do all the function (one cell could produce a whole organism)
- have the two (or more) types of cells
  - stomic
  - reproductive
- Some of cells in these organisim are speialized (but it's not constant) (speialized cells may be organized into tissues, that do particular functions for the organism.)

- colonies: clusters composed of a consistent and predictable number of cells.
- simple colonies: cluster of cells of simillar types with predictable structer. → have no physiological connection

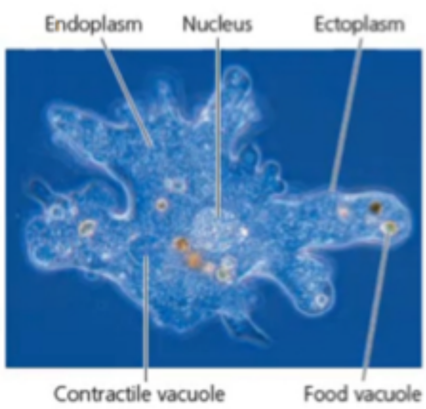
colonies

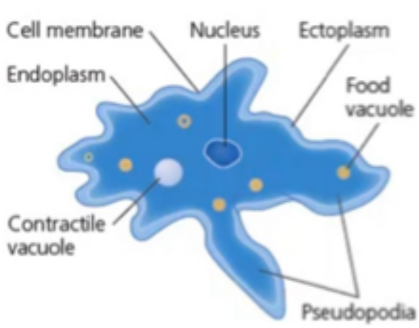
- complex → ① two types of cell ② with different function
- simple → ① one type of cell ② All of it do the same function

---

① Amoeba: heterotrophic, unicelluar

- pseudopodia: movement, fedding, false feet
- cytoplasm → Ectoplasm (outside — light blue)
  → Endoplasm (inside — dark blue)
- Nucleus: control cell activity, has ginitic material
- cell membrane: boundary that separates the organism from it's surroundings
- Food vacuoles: contain undigested food





Notes

The five kingdom

Animal, plant, Fungai, protisa (euka), Bactria (pro)

---

① cell

- prokaryotic → lack nuclei and membrane-bound organells (RNA/DNA) (in cytoplasm without a membrane around it)
- eukaryotic → Any cell that has membrane-bound organell (DNA inside nucle with membrane)

---

③ cell

- somatic → cells that are not reproductive
- reproduction → specialize in reproduction

---

colonial algae → in these type of algae

معش شرط جنسيه (مسؤوله عن التكاثر).

if either type of cell is isolated from the colony, they may be reproductive

مستعمره — له تنقسم و تنشئ مستعمره.

other algae → would also have stomic and rep. cells but their (algae) stomic cell never become rep. cells.

→ Also: isolated and rep. cells can't persist independently but must be connected with stomic cell to live.

Slide

- permanent — we have three ex. 4 each:
  - unicellar → Amoeba
  - colonies → Scenedesmus
  - multicelluar → volvox
  (eukaryotic)
- temporary

---

③ Organisim

- autotrophic → take inorganic make it orgaine to poduce E
- heterotrophic → take organic to poduce E

② Scenedesmus : simple colonie , autotrophic

2. Examine living *Scenedesmus* under the compound microscope. *Scenedesmus* (Figure 2.9) is an aquatic green alga that is common in aquaria and polluted water.

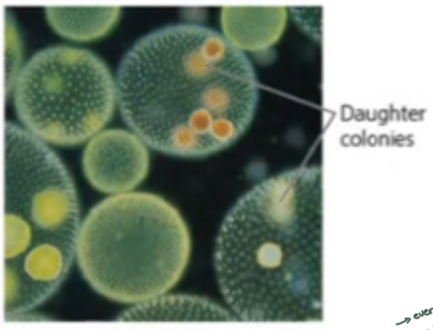
The **nucleus** is the spherical organelle in the approximate middle of each cell.

Vacuoles are the transparent spheres that tend to occur at either end of the cells.

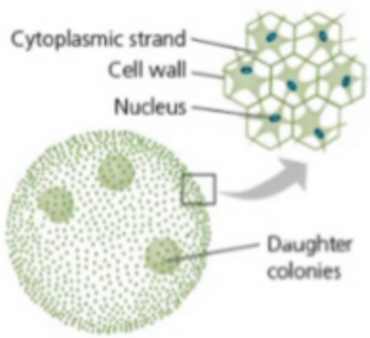
Spines are the transparent projections that occur on the two end cells.

Cell walls surround each cell.

③ volvex : multicellar , autotrophic

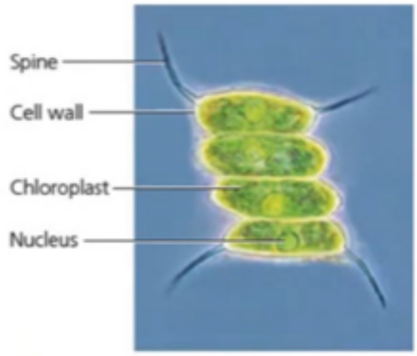


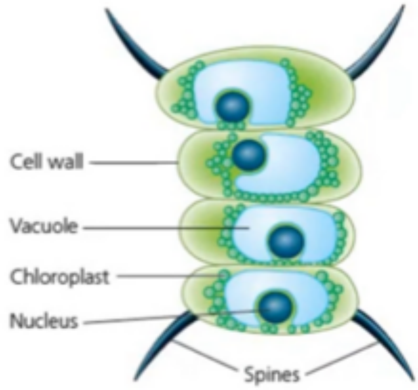
→ every cell has flagella



. Observe that the cells of this organism lie in a transparent matrix forming a large hollow sphere. The approximately 500 to 50,000 (depending on the species) nonreproductive somatic cells are permanently united by cytoplasmic connections. These cells have chloroplasts for photosynthesis and flagella that beat in a coordinated motion to move the colony like a ball. During asexual reproduction, certain cells in the sphere (reproductive cells) enlarge and migrate inward to become daughter colonies.

. Identify the following structures: **somatic cells** with **cytoplasmic connections** and **flagella.** Depending on the magnification of your microscope, you may be able to distinguish **cell walls** and **nuclei** in the cells. **Daughter colonies** are smaller spheres within the larger colony. These are released when the parent colony disintegrates.





Exercise 2.1

The Microscope

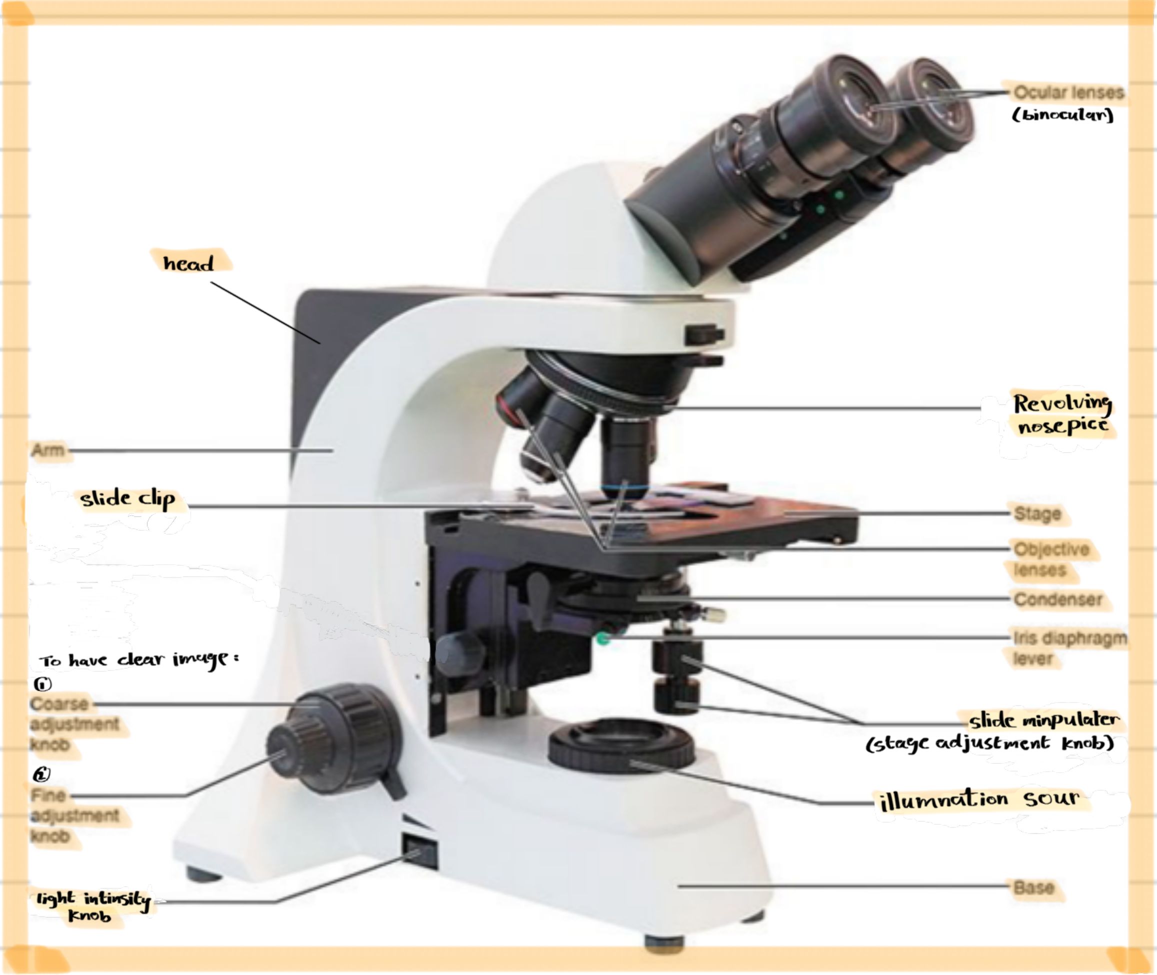
there is two types of the microscope [electron and Light] .

And there is many varitations in Light microscopes :

phase-contrast / darkfield / polarizing / UV

We gonna study two types of L.M a. compound microscope b. stereoscopic

a. compound microscope



- The head support ocular lens (eyepice)
- interpupillary distance: the space between the eyepices
- field of view : the circle of light that we sees in the M
- objectives lenses
  - scanning lens (4x) smallest length
  - intermediate (10x)
  - high-power (40x)
  - oil lens (100x) bigest length

- Base: stand for M, conect all parts togther, contain light soure.
- light intinsity knob : control the lightworm.
- 2D invirted image
- Tot magni. = 10 * obj magni. (max 1000 /min 40)
- ocular lens magnification is 10 X
- slide minupulater function: move the slide (up, down, forword, backword)

Notes

Microscop
- electron
- Light
  - compound
    - binocular
    - monecular
  - stereoscopic

	e.M	L.M
illumnation sour	e^-	light
reguification	$10^6 x$	$10^3 x$

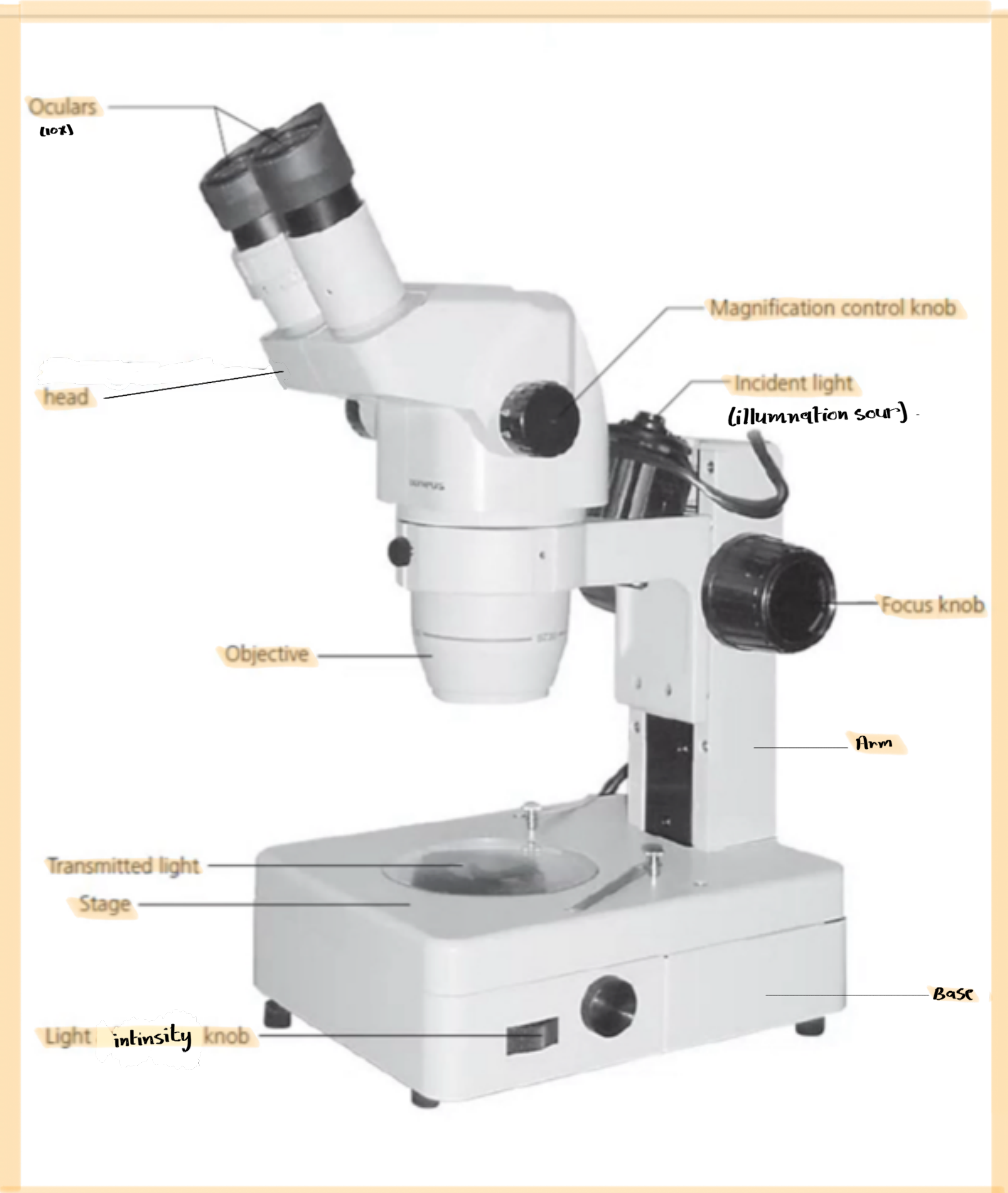
- The M is a tool to magnifie the images.
- condenser lense function: condensate the light intensity.

- Iris diaphragm: rings controls by a lever that controls the light intensity by change the distance between the rings

- Adjustment Knobs
  - fine → move stage small movement (can't even tell) → could be used with all lenes
  - coarse → move stage clearly → use with scannig lens

- parfocal lenses : Just a little refocusing is required when moving from one lens to another. (make the study easier)
- Working distance : the space between the slide (specimen) and the lense.

b. stereoscopic (dissecting) تشريحي



_ The light directed (موجه) down on the sample "incident light" reflected light , it comes above the sample.

_ " transmitted " : light goes throgh the sample.

_ 3D , not invirted image.

_ There is no revolving nosepice

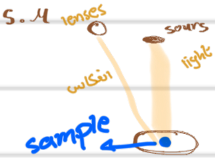
_ it has just one lens, then how could we change the magnification?

by magnification knob.
Just in this M لـ

_ it has just one adjustment knob: " Focus knob "

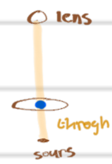
_ The main diffirance is the: " illumnation sours "

[1] S.M



result (image): 3D , not reflected

[2] C.L M



result (image): 2D , reflected.

Diffusion and Osmosis

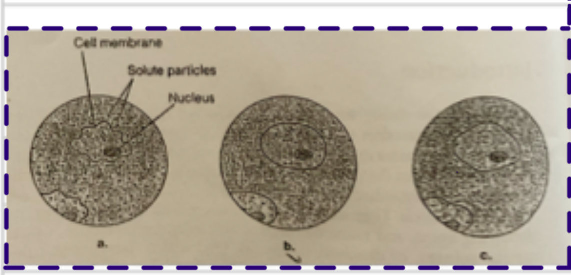
- Diffusion: physical process which molecules move from an area where they (molecules) are in high concentration to one where their concentration is lower.
- the moving for these molecules needs energy : the K.E in all atoms and molecules.

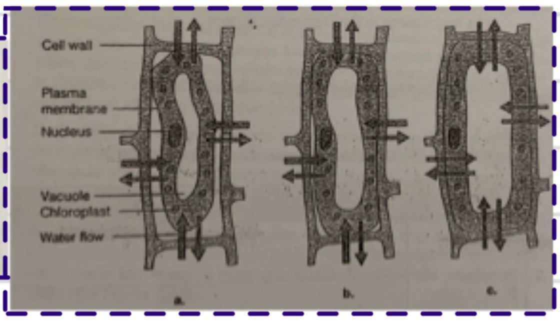
- Osmosis (type of diffusion) : is it the diffusion of water throgh a selectivety permeable membrane from a region where it is highly concentrated (low for molecules) to a regien where it's concetration is lowor (higher for molecules).

Three terms of solution:

Hypo	ISO	Hyper
- solute > cell	- solute = cell	- solute < cell
↓	↓	↓
H_2O inside cell (gain water)	net flow = zero	H_2O outside cell (loss water)

cell	Hypo	ISO	Hyper
Animal	swell → lysis (c)	Normal (b)	shrink (a)
plant	swell → Turgid (c)	Flaccid (b)	plasmolysis (a) (water leave central vacule / cytoplasm and protoplast shrink may pull away from cell wall ↵)
Red Blood	swell → Hemolysis	Normal	crenation





Notes

نفاذية إختيارية

- selectivity permeabe

---

solute: out

cell : in

H_2O inside → solute(∵) → outside

H_2O outside → solute(∵) → inside

H_2O (solvent) : high → low (solution)

molecules (solute): low → high

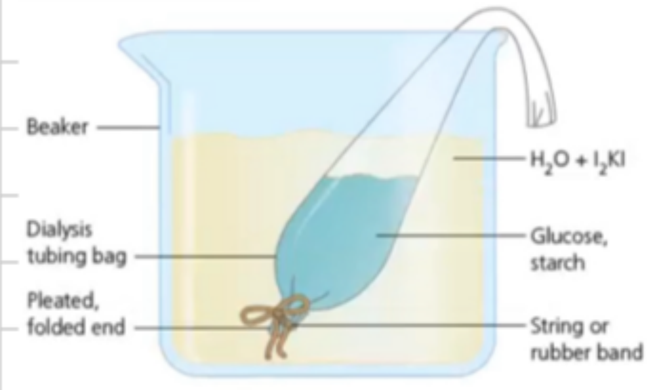
---

ex. steps :

cork borer → potato tuber → different sucrose (M)

wt. ← D.w ←┘

Experiment "B" (P: 58)



- Dialysis tubing : is a membrane made of regenorated cellulose fibers formed into a flat tube.

- in this ex. we will use two tests :

1 lugo's (I_2KI)
  ↳ for starch presence
  - present: purple, black, dark blue
  - not: pale yellow, amber

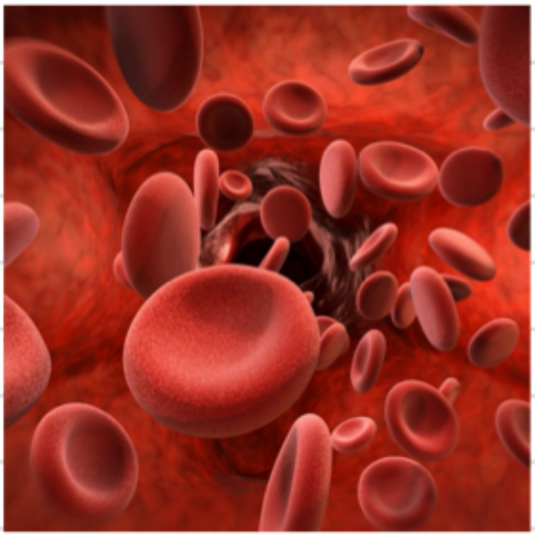
2. Benedict's test
  ↳ for redcing suger (glocose).
  - present: green, orang, orang-red
  - not: Benedict's colore (blue).

- Resalts : → glucose : diffused → starch : didn't diffuse.

Exercise 3.2

Introduction :

Red blood cells (e



- Mature red blood cells (erythrocytes) : a packages of hemoglobin bind to a plasma membrane permeable to small molecules (O_2, CO_2) and not impermeable to larger molecules (protines, Nacl, sucrose)

- In mammals (ثديات) → these cells : ① lack nuclei ② their shap is flattend (مسطح) and pinched (مقروص) inward (للداخل) into biconcave disk. (ثنائي التقعر)

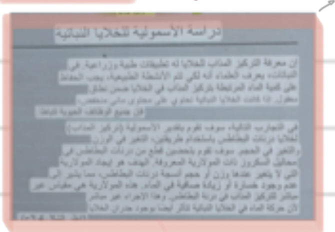
- primary function : gas transport
  - → O_2 and CO_2 diffution across the membrane allow the cell to do it.
  - → which is enhanced (تعزيزها) by the increased surface area created (ناتجه من) by the shape of cell

- these cells respond dramaticlly if they are not in an isotonic.

① hypotonic (water moves into)
  ↳ cell → swell / membrane → burst or lysis (تحلل)

② hypertonic (water moves out)
  ↳ cell → shrivel and appear bumpy or crenate

Exercise 3.3 (the potato)


دراسة الأسموزية للخلايا النباتية

→ to understand

- if plant cells have a reduced water contact, all vital function slow down.

- we use a socrose solution here.

Experiment A

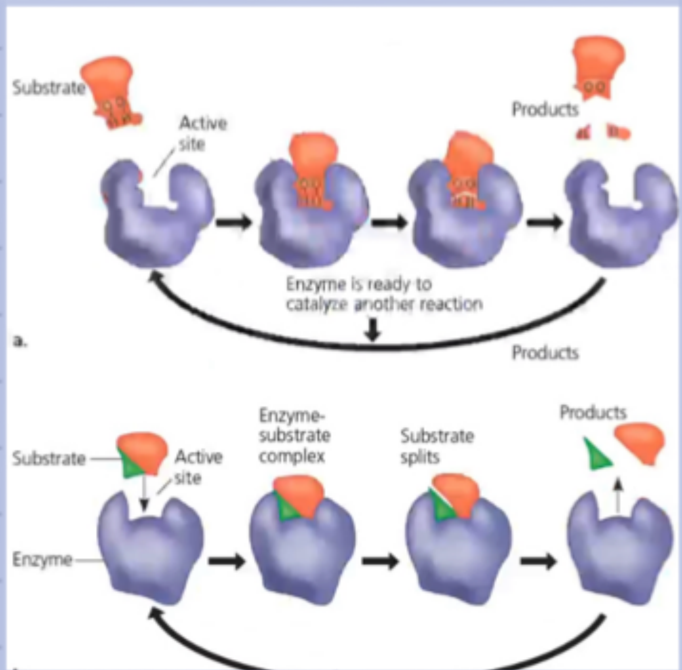
(the purpose is to know hyper/hypo/iso for potato)
↳ using Δ weight, Δ volum

- → loss weight (loss water) → hypertonic
- → gain weight (gain water) → hypotonic
- → simple change (net of water movement is zero) → isotonic

Enzymes

Introduction:

- Enzyme: ① biological catalysts ② speed up chemical reaction ③ does not consumed (without being used up or altered)
- A small amount of enzyme can alter a relavely enormous amount of substrate (sub)
  - the activeside bind in with sub forming complex
  - sub + enzyme = enzyme-sub complex
  - when catalysis done the complex dissociates to (enzyme/ product)
  - enzymes: part or whole protins / highly spesific in function
  - lower the energy of activation (Ea)
  - accelerate the rate of reaction



- Enzyme Activity: influenced by many factors
  - PH
  - T
  - activators/inhibitors
- temprature may change the 3D shape of enzyme (Denaturation)
- PH: enzyme is most effective at optimal PH (most of enzyme at PH=7)
- specific chemicals: may also bind to an enzyme and modify it's shape.

Chemicals
- (be active) → Activators
  - ↓ ex → cofactors (coenzyme if it's organic)
    - may simply be metal ions
    - ↓ nonprotin / bind to active side (usually) / essential for enzyme to work
- (shut off activity) → inhibitors
  - classified according to thir action to
    - competitive
    - noncompetitive

Exercise 4.3

Amylase: found in many animals's saliva (including human)

Animals and human utilize (use) strach as a source of food

starch, The principal reserve carbohydrate stors of plant

starch: is a polysaccharide composed of a large number of glucose monomers joined together

Amylase able to diges starch, How?

In short, amylase breaks up the chains of glucose molecules in starch into maltose a two-glucose-unti compund Further digestion of this disaccharide requires other enzymes present in pancreatic and intestinal secretions.

- to follow the digestion of strach into maltose by amyles → we use the fact that it turns to purple color (yellow amber — dark purple)

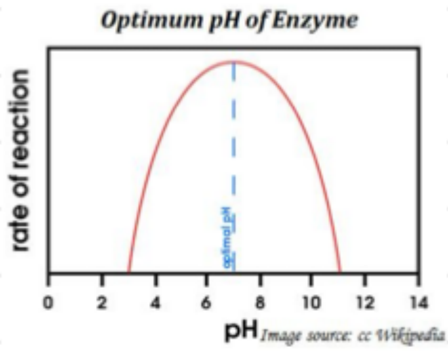
في التمرين التالي، ستتعرف على تأثير الإنزيم ودرجة الحموضة ودرجة الحرارة على نشاط إنزيم الأميليز. يوجد الأميليز في لعاب العديد من الحيوانات والبشر التي تستخدم (النشا كمصدر للغذاء. النشا، المخزون الاحتياطي الرئيسي للنباتات، يتكون من كمية كبيرة من الجلوكوز المتحد. الأميليز - قادر على هضم النشا باختصار، يقوم الأميليز بتكسير سلاسل النشا إلى المالتوز وهو منتج نهائي. ويتطلب المزيد من الهضم وجود إنزيمات أخرى في الإفرازات المعوية لمساعدتنا على متابعة النشا إلى المالتوز عن طريق الأميليز اللعابي. حقيقة أن النشا، ولكن ليس، يتحول إلى اللون الأرجواني الداكن عندما يكون بمحلول I_2KI (هذا المحلول عادة ما يكون باللون الأصفر الكهرماني) (amber) ارسم لمساعدتك في هذه التفاعلات في هامش دليل المختبر الخاص بك. في التجارب التالية، معدل النشا في مختلف يسمح بمعدل. تذكر أن معدل المنتج (المالتوز في هذه الحالة) سيعطي نفس النتيجة، لكن اختبار النشا أبسط.

Experiment "C"

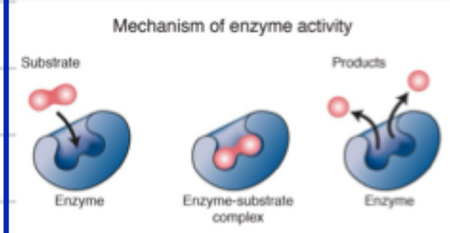
Temprature on amylase activity

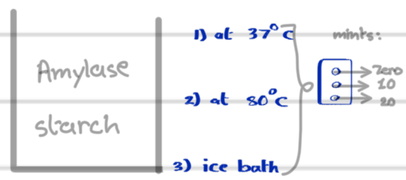
Notes

Introduction:

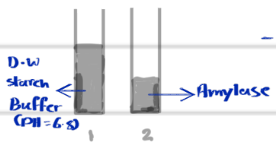


- chemical reaction accelerate as temperature ries, bc T speed up molecules's motion. However, at high T, the integrity of proteins can be irreversibly denatured.
- The activity of enzyme depend on proper tertiary (3) and quaternary (4) structures. So, the optimal T of enzyme activity may vary depending on the structure of the enzyme.



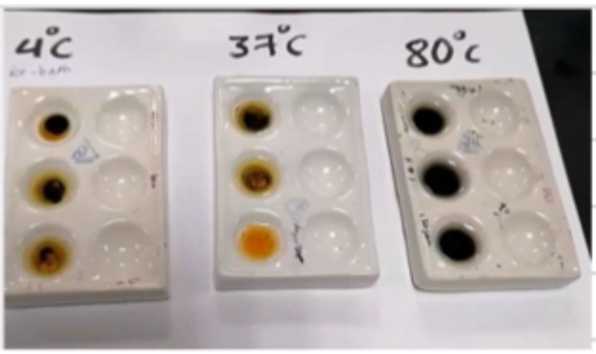


Experiment explination



- prepare 3 samples like this (6 test tubes)
- the first 10 min during heating the test tubes (must be sperete) is just for reach the right T (37°/80°/4°) c.
- Add small amount to big one (2 to 1)
- use Iogo's to find starch (dark purple / blue / black)

Results



- dark color → starch
- light color (orange) → no stare

Photosynthesis

- Earth is an open system requiring an input of energy to drive the prosses of life
- All energy entering the biosphere is channeled from the sun into orgnic molecules via the photo. prosses.
- sun's H_2 —converted→ He
  - photons (energy)
- Photons pass earth serface and a type of it get absorbed by pigments in chloroplasts of plant (starting prosses of photo.)

Just one type:

1. certain wavelength (visible light)
2. electromagnetic spectrm

- Photosynthesis:

light energy → chemical energy

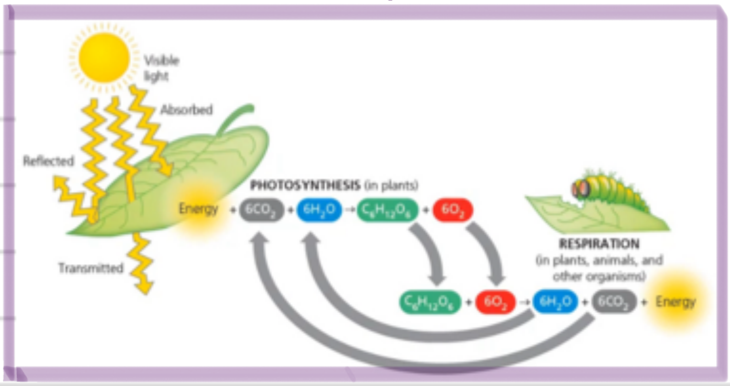
used to synthesize orgainc compound (glucose) from (CO_2 / H_2O) to releas (O_2 / glucose / energy)

- glucose may:
  - converted to sucrose and transported
  - or
  - stored in the polymer starch

- Function of organic moleaues: building blockes for plant growth and development

- Animals consume plants and convert these plant molecules into their own organic molecule and energy sources.

- The produced Oxygen is necessary for aerobic resparation in organism.



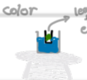
- Energy flow through photo. and respa. / - Energy flow (sun → biological system)
- visible light may be
  - reflected
  - transmitted
  - absorb

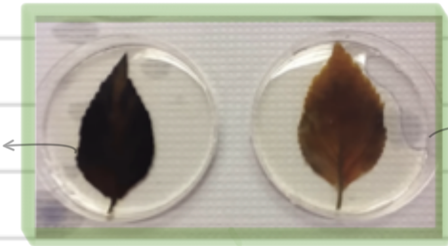
- Exsercise 6.1

We need two leaves (for one week)

- kept in light ①
- kept in dark ②

- in plant the excess glucose stord as starch in leaves.
- in this exsercis we want know which leave (1·2) would be able to do photo
- Steps:
  - remove green color from the leave by:
    1. adding 80% alcohol (ethanol) in a test-tube
    2. put it in beaker with water
    3. heat ethanol → absorb green color
  - wash the two leavs
  - use logul's (I₂KI) to each leave to find starch
    - yallow leave ✗
    - black leave ✓
  - Strach existance means → photo. prosses happed here





note: alchole (Ethyl) is highly flammable.

I will win just watch

Last but not least :

Exsercis 6.3

(138 / 139 / 140)

Sepration of photo - pigments using Thin layer chromatography

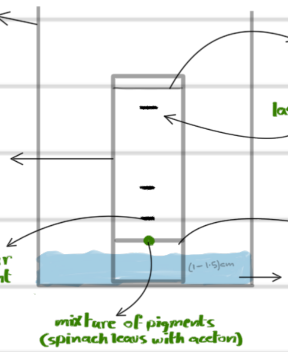
the technique

steps:

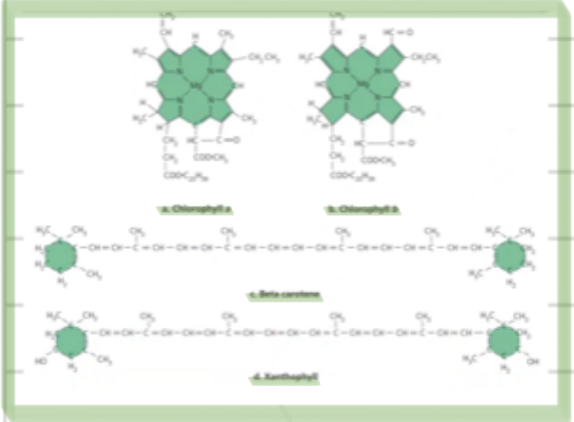
— plant leave —Break→ pestle and Mortar 

→ Add acetone (to absorbe the pigments) → apply it on silica

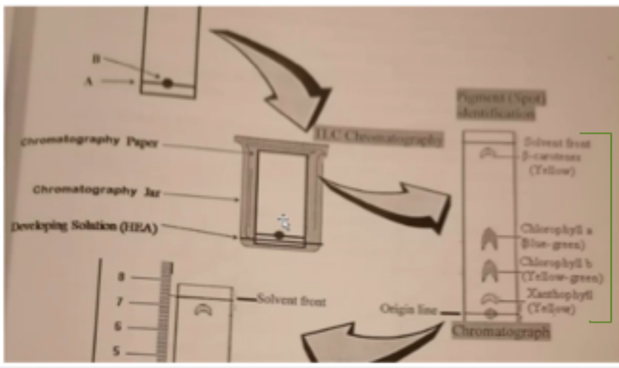
→ put it in Jar → give it time

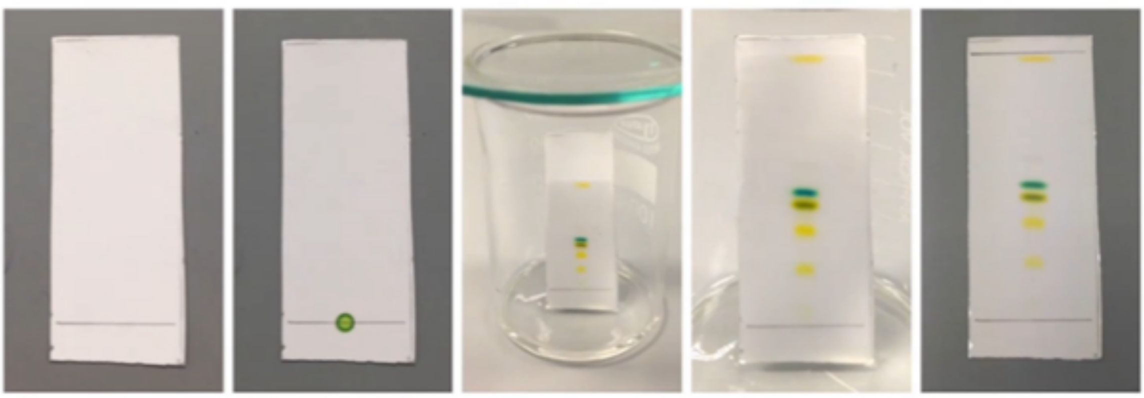


— pigments expected to appear :



Result





Mitosis

Introduction

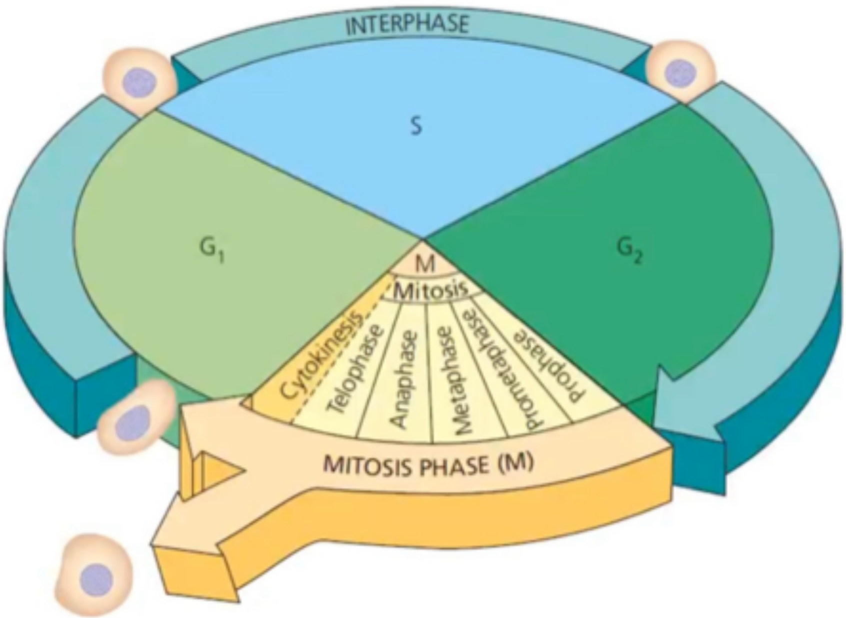
The nuclei in cells of eukaryotic organisms contain chromosomes with clusters of genes, discrete units of hereditary information consisting of duplicated deoxyribonucleic acid (DNA). Structural proteins in the chromosomes organize the DNA and participate in DNA folding and condensation. When cells divide, chromosomes and genes are duplicated and passed on to daughter cells. Single-celled organisms divide for reproduction. Multicellular organisms have reproductive cells (eggs or sperm), but they also have somatic (body) cells that divide for growth or replacement.

In somatic cells and single-celled organisms, the nucleus divides by **mitosis** into two daughter nuclei, which have the same number of chromosomes and the same genes as the parent cell. For example, the epidermis or outer layer of skin tissue is continuously being replaced through cell reproduction involving mitosis. All of these new skin cells are genetically identical. Yeast and amoeba are both single-celled organisms that can reproduce asexually through mitotic divisions to form additional organisms—genetically identical clones.

Cancerous cells are characterized by uncontrolled mitotic and cell division, and therefore, the study of mitosis and its regulation is key to developing new cancer treatments. In 2009, three scientists studying chromosomes and the regulation of mitosis were awarded the Nobel Prize in medicine for their discovery of telomeres. Telomeres are DNA sequences on the ends of chromosomes that become shorter during every mitotic cycle of somatic cells. Without telomeres protecting the chromosome ends, important genes located at the ends of chromosomes might be lost in mitosis. The loss of telomeres in each division of somatic cells may be one of many regulatory mechanisms

FIGURE 7.1

The cell cycle. In interphase (G_1, S, G_2), DNA replication and most of the cell's growth and biochemical activity take place. In the M phase, the nucleus divides in mitosis, and the cytoplasm divides in cytokinesis.



cell cycle
interphase
G1 (cell growth)
S (DNA replication)
G2 (cell growth)
Mitotic (M) phase
mitosis (nucleus divids)
cytokinesis (cytoplasm divids)

mechanisms that limit the number of mitotic cycles that cells can undergo. If telomeres fail to shorten, cells may continue to divide, as in cancer cells.

In multicellular organisms, in preparation for sexual reproduction, a type of nuclear division called **meiosis** takes place. In meiosis, certain cells in ovaries or testes (or sporangia in plants) divide twice, but the chromosomes only replicate once. This process results in the four daughter nuclei with new combinations of chromosomes. Eggs or sperm (or spores in plants) are eventually formed. In contrast to mitosis, the process of meiosis contributes to the genetic variation that is important in sexual reproduction. Generally in both mitosis and meiosis, after nuclear division the cytoplasm divides, a process called **cytokinesis.**

Events from the beginning of one cell division to the beginning of the next are collectively called the **cell cycle.** The cell cycle is divided into two major phases: interphase and the mitotic (M) phase. The M phase represents the division of the nucleus and cytoplasm (Figure 7.1).

1 2

Lab Study A. Interphase

During interphase, a cell performs its specific functions: Liver cells produce bile; intestinal cells absorb nutrients; pancreatic cells secrete enzymes; skin cells produce keratin. Interphase consists of three subphases, G_1, S, and G_2, which begin as a cell division ends. As interphase begins, there is approximately half as much cytoplasm in each cell as there was before division. Each new cell has a nucleus that is surrounded by a **nuclear envelope** and that contains chromosomes in an uncoiled, or decondensed, state. In this uncoiled state, the mass of DNA and protein is called **chromatin.** Located outside the nucleus is the **centrosome,** a granular region that contains a pair of **centrioles** in animal cells. The centrosome is the organizing center for microtubules (Figure 7.2).

centrosome → centrioles → in animals cell
→ microtubules → in plant cell

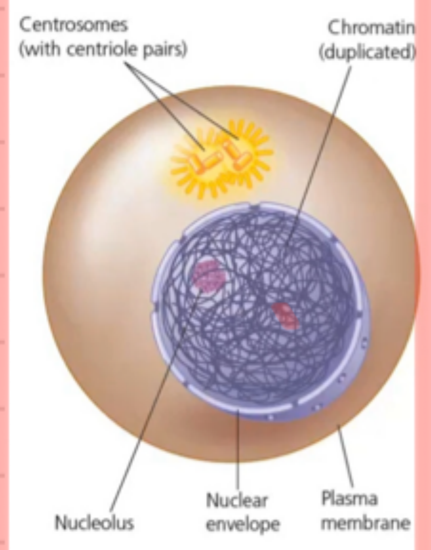


FIGURE 7.2
Interphase.

1. Build two pairs of homologous chromosomes, one long pair and one short pair. Construct the first homologous pair of single chromosomes using 10 beads of one color for one member of the long pair and 10 beads of the other color for the other member of the pair. Place the magnetic centromere at any position in the chromosome, but note that it must be in the same position on homologous chromosomes. The centromere appears as a constricted region when chromosomes are condensed. Build the short pair with the same two different colors, but use fewer beads. You should have enough beads left over to duplicate each chromosome later.
2. Model **interphase** of the cell cycle:
   a. Pile all the assembled chromosomes in the center of your work area to represent the decondensed chromosomes as a mass of chromatin in G_1 **(gap 1).** → G → growth.

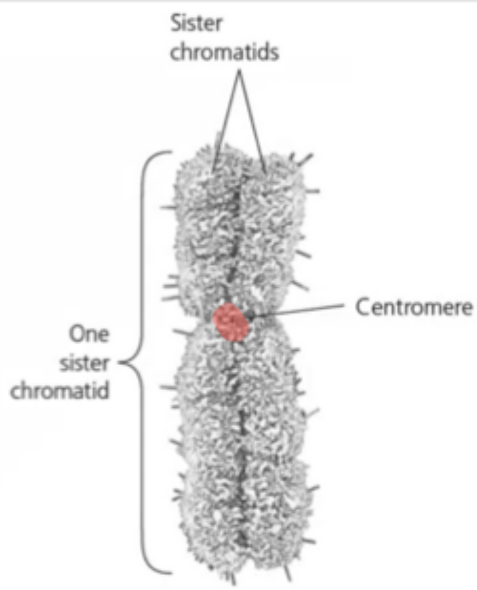


FIGURE 7.3
Duplicated chromosome composed of two sister chromatids held together at the centromere; condensed as in prometaphase.

single chromosome

Lab Study B. M Phase (Mitosis and Cytokinesis)

In the M phase, the nucleus and cytoplasm divide. Nuclear division is called *mitosis*. Cytoplasmic division is called *cytokinesis*. Mitosis is divided into five subphases: prophase, prometaphase, metaphase, anaphase, and telophase.

1. To represent **prophase,** leave the chromosomes piled in the center of the work area.

   Prophase begins when chromosomes begin to coil and condense. At this time they become visible in the light microscope. Centrioles continue to move to opposite poles of the nucleus, and as they do so, a fibrous, rounded structure tapering toward each end, called a **spindle,** begins to form between them. Nucleoli begin to disappear (Figure 7.4).

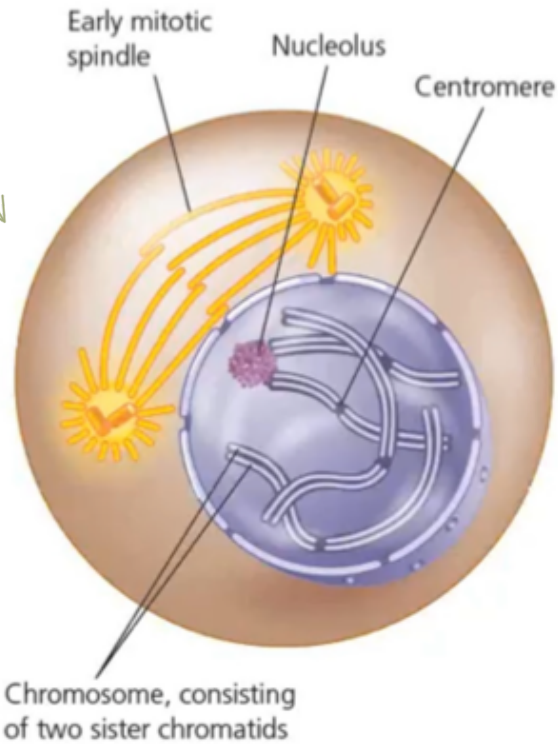


FIGURE 7.4
Prophase mitosis.

2. At **prometaphase,** the centrioles are at the poles of the cell. To represent the actions in prometaphase, move the centromeres of your chromosomes to lie on an imaginary plane (the equator) midway between the two poles established by the centrioles.

   During prometaphase, chromosomes continue to condense (Figure 7.3). The nuclear envelope breaks down as the spindle continues to form. Some spindle fibers become associated with chromosomes at protein structures called **kinetochores.** Each sister chromatid has a kinetochore at the centromere. These spindle microtubules now extend from the chromosomes to the centrosomes at the poles. The push and pull of spindle fibers on the chromosomes ultimately leads to their movement to the equator. When the centromeres lie on the equator, prometaphase ends and the next phase begins (Figure 7.5).

   How many duplicated chromosomes are present in your prometaphase nucleus?

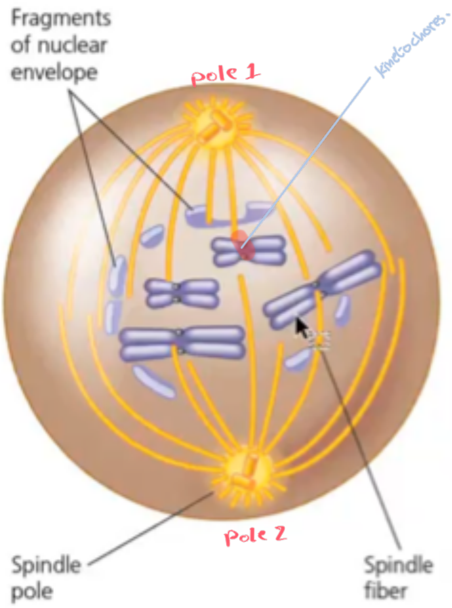
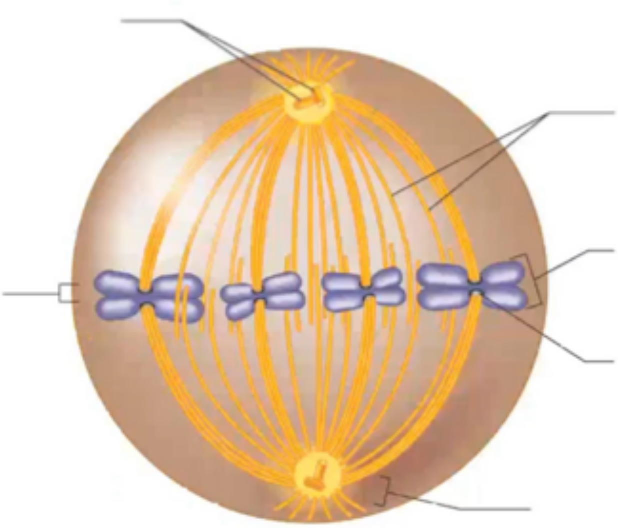


FIGURE 7.5
Prometaphase mitosis.

3. To represent **metaphase,** a relatively static phase, leave the chromosomes with centromeres lying on the equator.

   In metaphase, duplicated chromosomes lie on the equator (also called the metaphase plate). The two sister chromatids are held together at the centromere. Metaphase ends as the centromere splits.

   Label Figure 7.6 with *chromosome, spindle fibers, centrosome, centrioles, kinetochore, equator.*



4. Holding on to the centromeres, pull the magnetic centromeres apart and move them toward opposite poles. This action represents **anaphase.**

After the centromere splits, sister chromatids separate and begin to move toward opposite poles. Chromatids are now called **chromosomes.** Anaphase ends as the chromosomes reach the poles (Figure 7.7).

Describe the movement of the chromosome arms as you move the centromeres to the poles.

Certain biologists are currently investigating the role played by spindle fibers in chromosome movement toward the poles. Check your text for a discussion of one hypothesis, and briefly summarize it here.

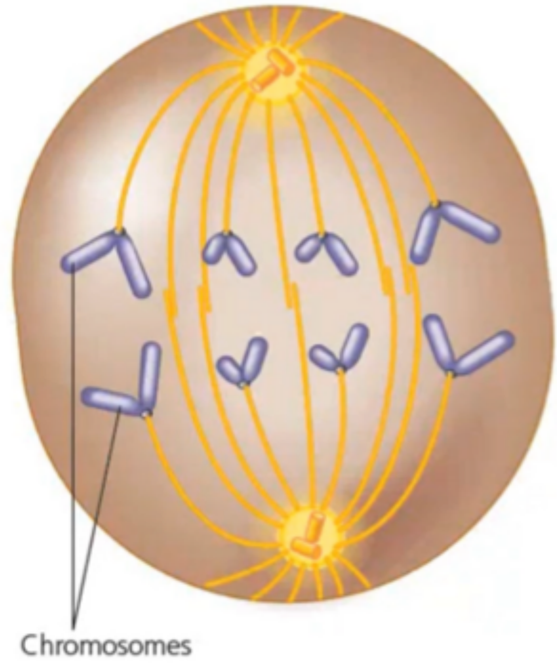


FIGURE 7.7
Anaphase mitosis.

5. Pile your chromosomes at the poles to represent **telophase.**

As chromosomes reach the poles, anaphase ends and telophase begins. The spindle begins to break down. Chromosomes begin to uncoil, and nucleoli reappear. A nuclear envelope forms around each new cluster of chromosomes. Telophase ends when the nuclear envelopes are

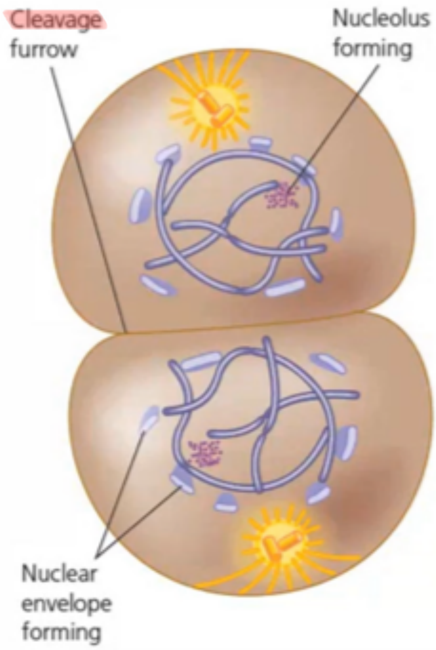


FIGURE 7.8
Telophase mitosis.

6. To represent cytokinesis, leave the two new chromosome masses at the poles.

The end of telophase marks the end of nuclear division, or mitosis. Sometime during telophase, the division of the cytoplasm, or cytokinesis, results in the formation of two separate cells. In cytokinesis in cells of animals, fungi, and slime molds, a **cleavage furrow** forms at the equator and eventually pinches the parent cell cytoplasm in two (Figure 7.9a). Actin and myosin, the same molecules found in muscle cells, contribute to the formation of the cleavage furrow. In plant cells, membrane-bound vesicles migrate to the center of the equatorial plane and fuse to form the **cell plate.** This eventually extends across the cell,

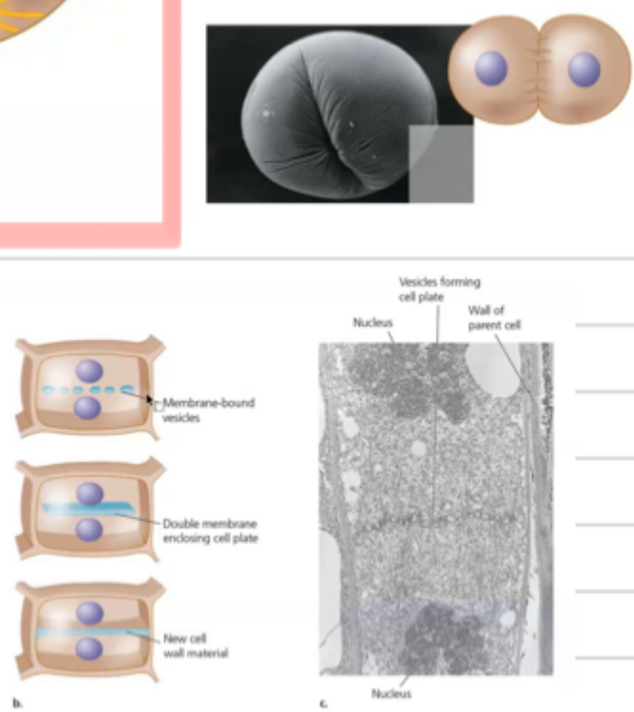


FIGURE 7.9
Cytokinesis in animal and plant cells. (a) In animal cells, a cleavage furrow forms at the equator and pinches the cytoplasm in two. (b) In plants, a cell plate forms in the center of the cell and grows until it divides the cytoplasm in two. (c) Photomicrograph of cytokinesis in a plant cell.

7.2 plant cell (onion)

FIGURE 7.11
Interphase.
Observe the dividing cells under the microscope. Draw and label an interphase cell in the box on the right.

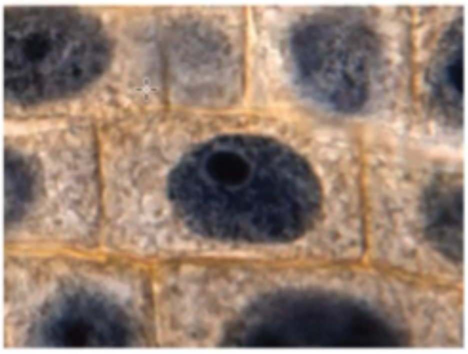


FIGURE 7.12
Prophase.

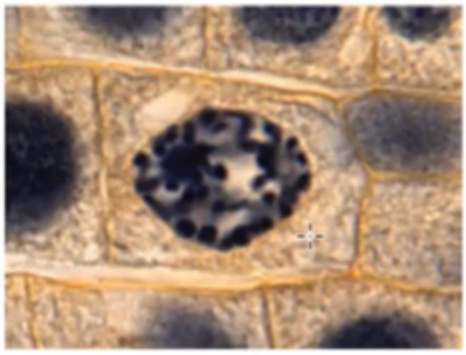
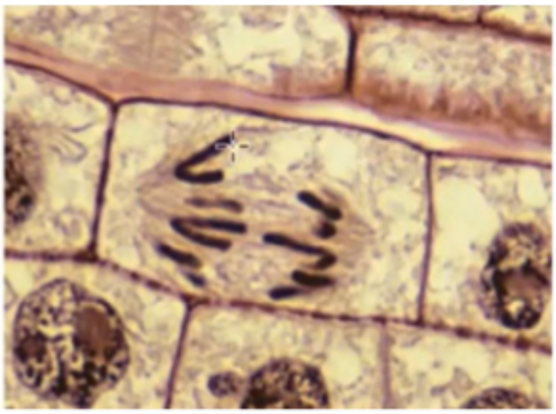


FIGURE 7.12
Prophase.
(prometa phase)

FIGURE 7.14
Metaphase.

FIGURE 7.15
Anaphase.



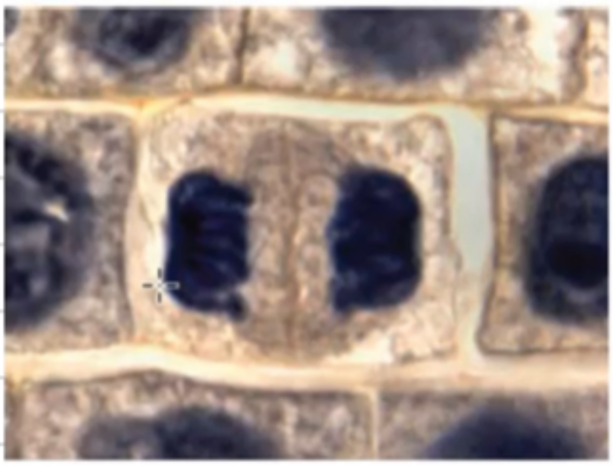
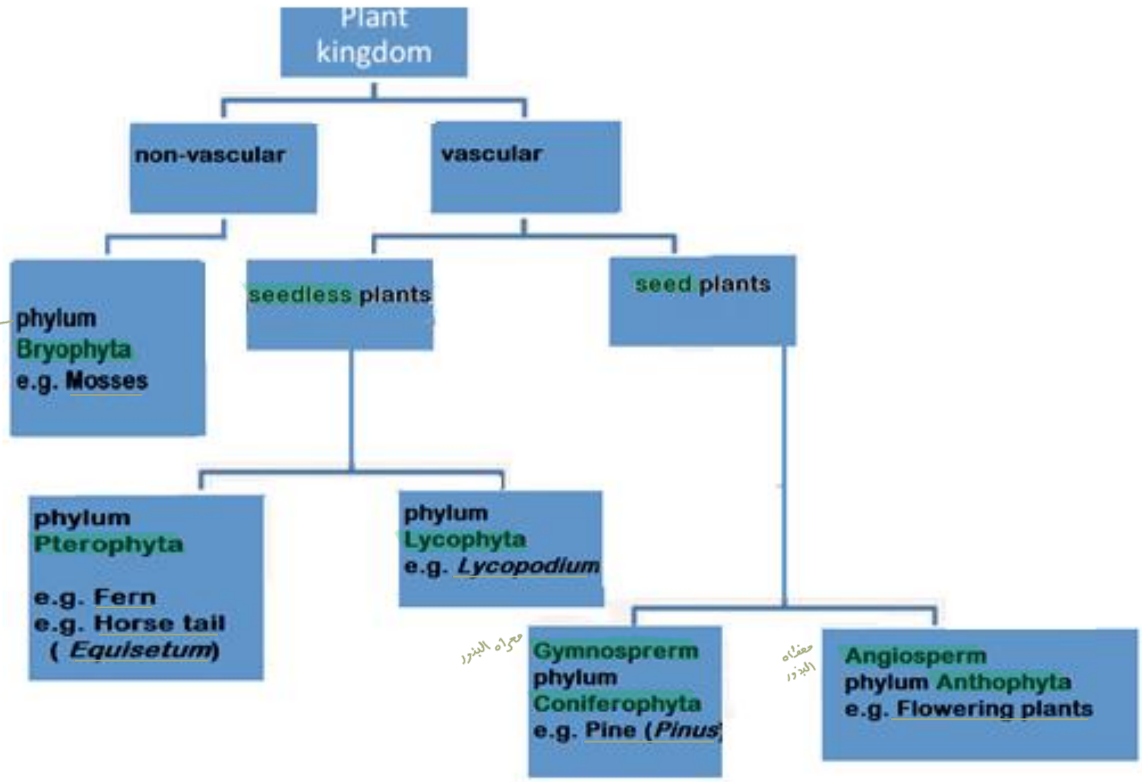


FIGURE 7.16
Telophase and cytokinesis.

PLANT DIVERSITY PART ONE:

Nonvascular plants and seedless vascular plants

- Kingdom **Plantae**
- **Phylum** is a principal taxonomic category that ranks above class and below kingdom.



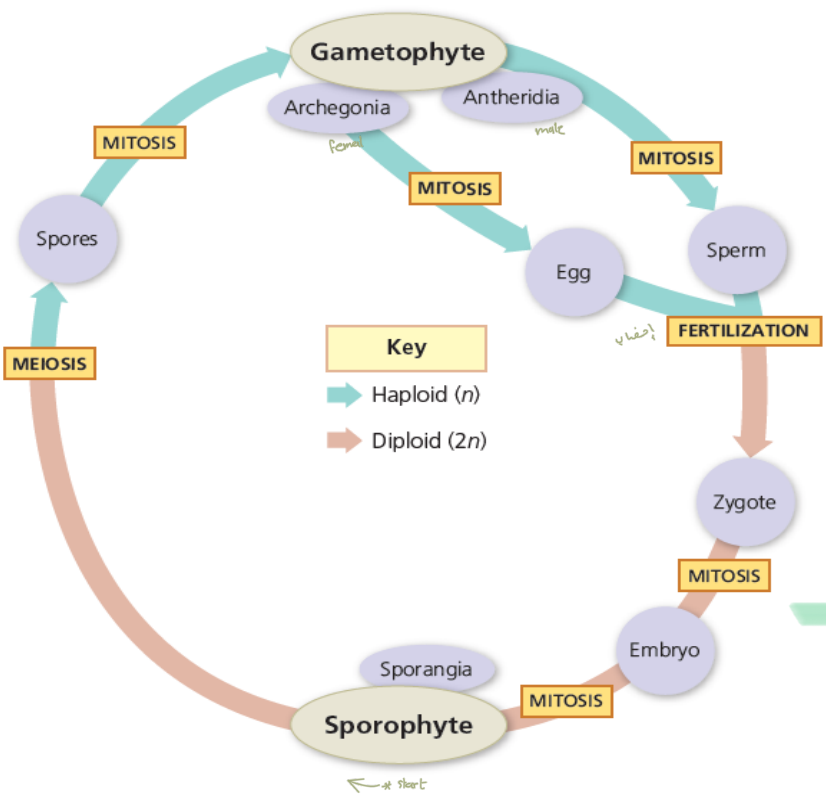
Plant life cycle:

- All land plants have a common sexual reproductive life cycle called **alternation of generations,** in which plants alternate between a haploid **gametophyte** generation and a diploid **sporophyte generation**.
- 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, the diploid sporophyte generation is the dominant generation.

- **The essential features in the alternation-of-generations life cycle, beginning with the sporophyte, are:**
  - ✓ The diploid sporophyte undergoes meiosis to produce haploid **spores** in a protective jacket of cells called the **sporangium.**
  - ✓ Dividing by mitosis, the spores germinate to produce the haploid **gametophyte**
  - ✓ The gametophyte produces **gametes** inside a jacket of cells, forming **gametangia** (sing., **gametangium**).

Gametangium protects the gametes.

  - ✓ **Eggs** are produced by mitosis in **archegonia** (sing., **archegonium**), and **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.
- Note that both gametes and spores are haploid in this life cycle.
- Unlike the animal life cycle, the plant life cycle produces gametes by mitosis.
- spores are produced by meiosis.



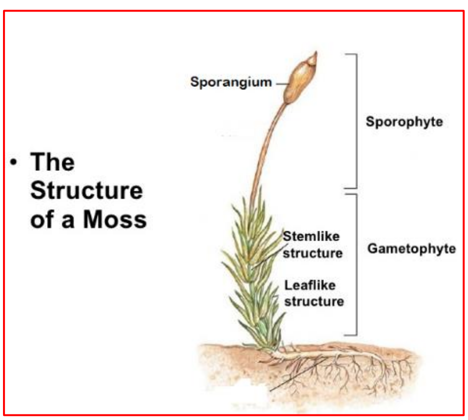
Alternation of generations. In this life cycle, a diploid sporophyte plant alternates with a haploid gametophyte plant. Note that haploid spores are produced on the sporophyte by meiosis, and haploid gametes are produced in the gametophyte by mitosis.

Non- vascular plants:

- Gametophyte is dominant.
- Restricted to moist habitat. (wet enviroment)
- Need water for fertilization.
- The gametophyte remains close to the ground enabling the motile sperm to swim from the antheridium to the archegonium to fertilize the egg.
- Small plants.
- Lack vascular tissue.
- **Thallus** (plant body that lacks vascular tissue) have no root, stem, or leaves.
- The body is covered with cuticle but lack stomata (ثغور). (Some mosses sporophytes have stomata)
- Bryophytes are not important economically, except for **sphagnum moss**, which in its harvested and dried form is known as **peat moss**. Peat moss is absorbent, is an antibacterial agent, and was reportedly once used as bandages and diapers. Today peat moss is used in the horticultural industry, and dried peat is burned as fuel in some parts of the world.
- We will study phylum **Bryophyta**, plant Mosses.

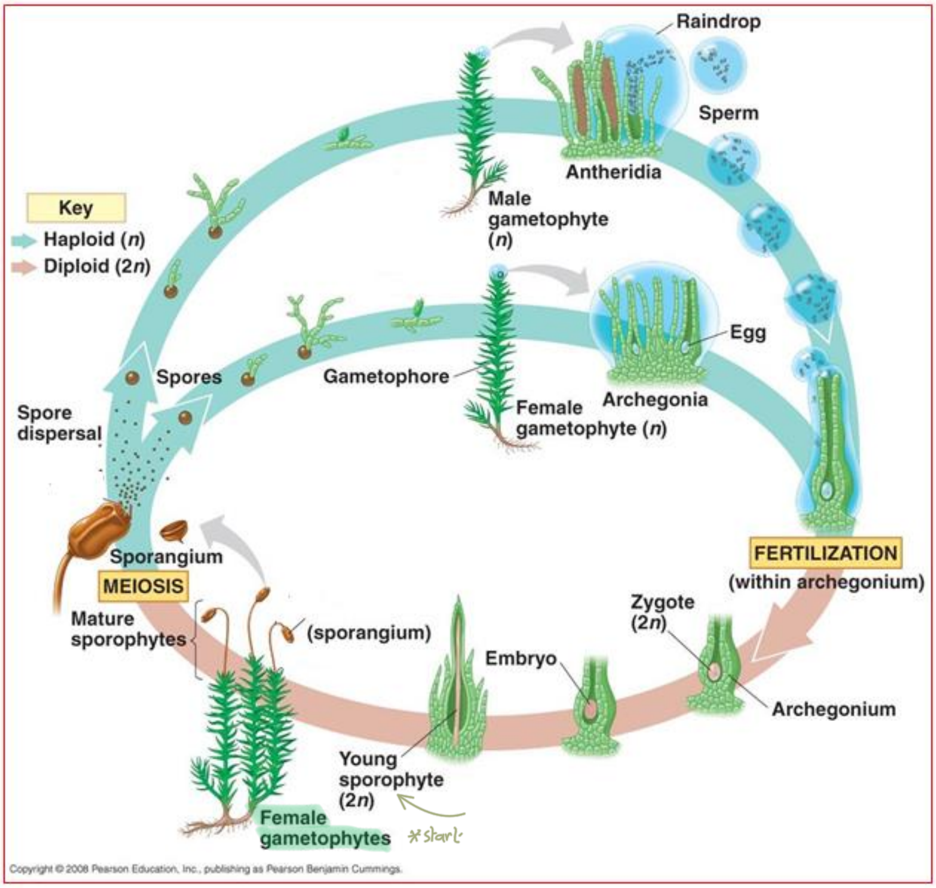
Mosses:

- Sporophyte dependent on gametophyte and attached to it, receiving its moisture and nutrients from the gametophytes.



Mosses life cycle page 396:

refer to your manual page 397 point 3 and 4 if you need to review the cycle.



Vascular seedless plants:

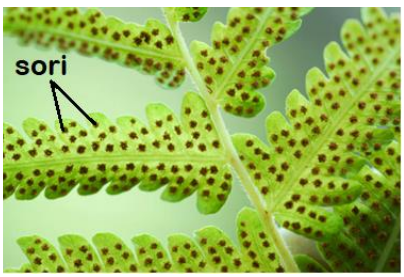
- Have vascular tissue.
- The gametophyte is usually independent of the sporophyte.
- These plants generally have well-developed stems, leaves, and roots, as well as stomata.
- They still require water for fertilization.
- The gametophyte is small and restricted to moist habitats.
- Economically, the only important members of this group are the ferns, a significant horticultural resource.
- Nonvascular plants and most seedless vascular plants produce one type of spore (**homospory**).

- Some seedless vascular plants and all seed vascular plants produce two kinds of spores (**heterospory**). Large spore called **megaspores** divide to give female gametophyte and small spore called **microspores** divide to give male gametophyte.
- The phyla included in the seedless vascular plants:
  1. Phylum pterophyta (plants: fern and Equisetum" horse tail")
  2. Phylum lycophyta (plant Lycopodium)

1-A) Phylum pterophyta: Fern

- In **ferns** note the leaves, which arise from an underground stem called a **rhizome,** which functions like a root to anchor the plant. Roots arise from the rhizome.
- Gametophytes have **rhizoids.**
- Observe the dark spots, or **sori** (sing., **sorus**), which are clusters of sporangia,

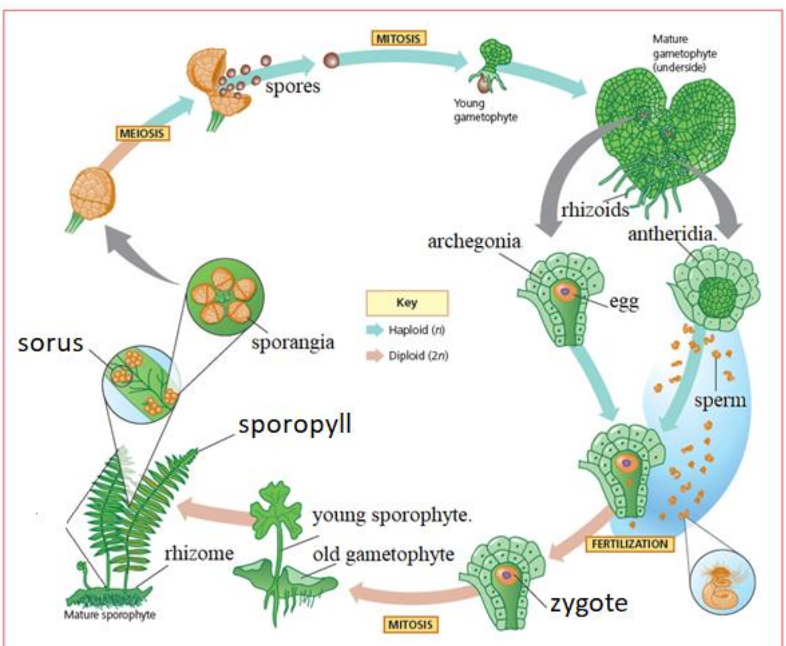
Fern leaf with sori (sporophylls).



Fern leaves

Fern life cycle:

refer to your manual page 404 <u>if</u> you need to review the cycle.

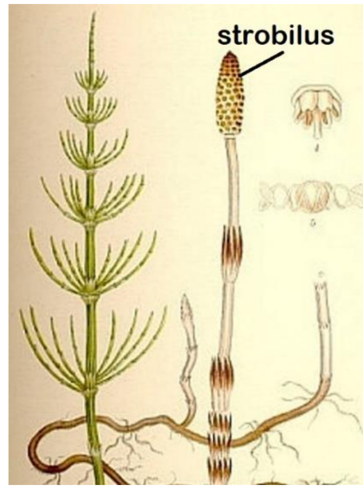


Fern life cycle. The familiar leafy fern plant is the sporophyte, which alternates with a small, heart-shaped gametophyte.

1- B) Phylum pterophyta: Equisetum (horse tail)

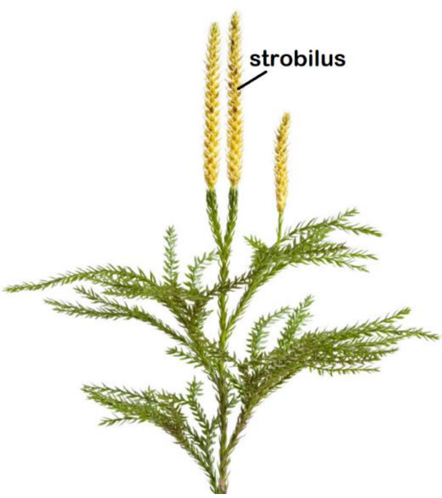
- **Strobili**: These are clusters of **sporangia,** which produce **spores.**

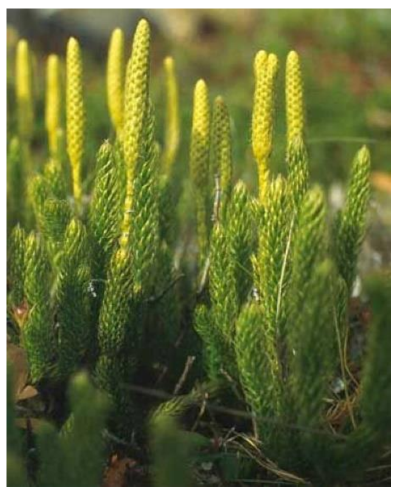
Horsetail, *Equisetum.* Horsetail stems with strobili containing sporangia.



2-Phylum lycophyta: (plant Lycopodium)

- Strobilus is a cluster of sporangia.





PLANT DIVERSITY PART TWO:

Seed vascular plants:

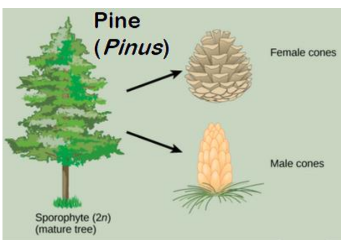
- These plants have vascular systems and bear seeds.
- **Seed is** a dormant embryo with special nutrient tissue and covered with a protective layer or coat.
- **Sporophyte** is dominant.
- They have reduced (smaller-sized) **gametophyte**:
- These plants are **heterosporous**
- Seed vascular plants consist of **gymnosperms** and **angiosperms.**

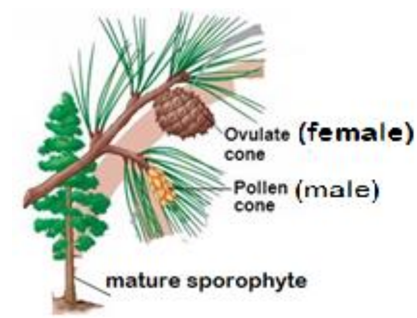
1- Gymnosperms:

- The name gymnosperm (“naked seeds”) refers to the fact that the seeds are unprotected on the surface of a bract, usually in cones.
- The term *gymnosperms* refer to a diverse group of seed plants that do not produce flowers nor fruit.
- All are **wind pollinated**.
- The **male gametophyte** is contained in a multinucleated pollen grain, and the **female gametophyte** is retained within the sporangium in the ovule of the sporophyte generation.
- Gymnosperms have advanced vascular tissues: xylem for transporting water and minerals and phloem for transporting photosynthetic products. The xylem cells are called **tracheid**.
- The largest and best-known phylum is **Coniferophya,** which includes **pines** (*Pinus*) and other cone-bearing trees and shrubs.
- The largest and tallest trees on Earth are also conifers.
- Gymnosperms are economically and ecologically important plants.
- Life cycle (time from seed to seed) is long.
- All are woody plants (trees or shrubs) only.

- 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.
- Gymnosperms are **heterosporous,** producing two kinds of spores:
    1. Male **microspores,** which develop into **pollen** that contains the male gametophyte,
    2. Female **megaspores.** The megaspore develops into the female gametophyte, which is not free-living nourished by the sporophyte parent plant. The female gametophyte develops archegonia, each containing an egg.

<u>We will study phylum coniferophyta, plant pine (Pinus).</u>





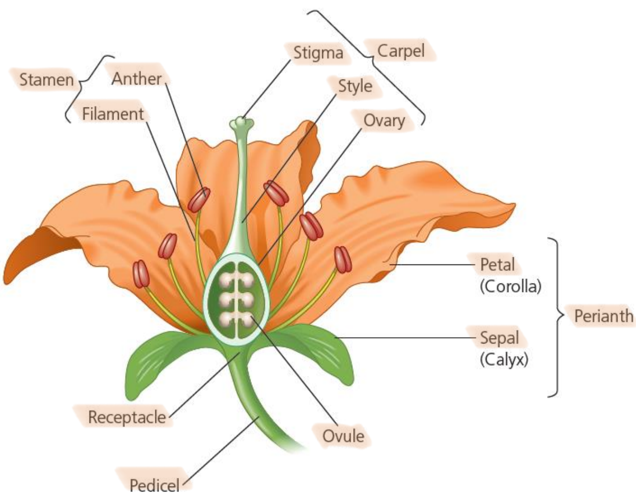
2- Angiosperms:

- **Flowering plants**, or **angiosperms** (phylum **Anthophyta**).
- Most numerous, widespread, and important plants on Earth.
- Angiosperms now occupy well over 90% of the vegetated surface of Earth and contribute virtually about 100% of our agricultural food plants.
- The **flower** is one of the unique features of this group.
- Pollination may occur by different kinds of **animals** such as insects, birds, mammals, and bats—in addition to **water** and **wind**.
- Flowers attract pollinators by color, scent, size, shape, nectar and pollen.
- Angiosperm has reduced size gametophyte.
- They are also **heterosporous.**
- The **pollen grain** contains the male gametophyte, and the multinucleated **embryo sac** is all that remains of the female gametophyte.
- The female gametophyte provides nutrients for the developing sporophyte embryo through a unique triploid (3n) **endosperm** tissue (endosperm will develop into a rich nutritive material for the support and development of the embryo and it's also unique to angiosperms).
- The **seed** is composed of the sporophyte embryo ($2n$), the nutritive endosperm ($3n$), and the seed coat ($2n$).
- Another unique feature of angiosperms is the **fruit.**
- The flower **ovary** will mature into fruit, while the flower **ovule** after fertilization will mature (develop) into **seed**.
- The fruit provides protection and enhances dispersal of the young sporophyte into new habitats.
- Flowering plants can be woody (trees or shrubs), but many are herbaceous.
- Life cycle (from seed to seed) either short (a year) or long.
- Xylem tissue is composed of ***tracheids*** (as in gymnosperms), and ***vessels***. The phloem cells, called *sieve-tube elements,* provide more efficient transport of the products of photosynthesis.
- The **flowers** of angiosperms are composed of male and female reproductive structures, which are frequently surrounded by attractive or protective leaflike structures collectively known as the **perianth.**

- The flower functions both to protect the developing gametes and to ensure **pollination** and **fertilization.**
- Plants with inconspicuous, often dull in color flowers are usually wind pollinated. While showy flowers are mostly pollinated by animals.

All flowering plants (angiosperms) are classified in the phylum **Anthophyta** (Gk. *anthos,* "flower").

Study the Flower structures and functions:



Floral Parts

Pedicel: stalk that supports the flower.
Receptacle: tip of the pedicel where the flower parts attach.
Sepal: outer whorl of bracts, which may be green, brown, or colored like the petals; may appear as small scales or be petal-like.
Calyx: all the sepals, collectively.
Petal: colored, white, or even greenish whorl of bracts located just inside the sepals.
Corolla: all the petals, collectively.
Perianth: the corolla (petals) and calyx (sepals) all together.
Stamen: pollen-bearing structure, composed of filament and anther.
Filament: stalk that supports the anther.
Anther: pollen-producing structure that terminates the stamen.
Carpel: female reproductive structure, composed of the stigma, style, and ovary, often pear-shaped and located in the center of the flower.
Stigma: receptive tip of the carpel, often sticky or hairy, where pollen is placed; important to pollen germination.
Style: tissue connecting stigma to ovary, often long and narrow, but may be short or absent; pollen must grow through this tissue to fertilize the egg.
Ovary: base of carpel; protects ovules inside, matures to form the fruit.

- A unique characteristic of angiosperms is also the **carpel** which encloses the ovules.

Plant Anatomy

- plants have three tissue systems that are continuous throughout the organs (roots, stems, leaves), which is:

1) Dermal 2) ground 3) vascular

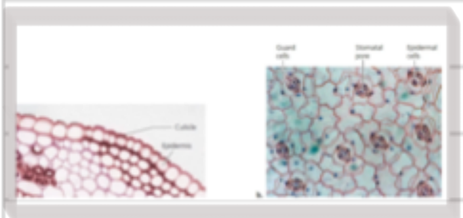
- And one tissue that actively divide by mitosis are called: 4) meristematic tissues

plant tissues

Dermal: Epidermis

- forms the outermost layer (one cell thick layer)
- shape: flattened, rectangular
- Function: provides protection and regulates movement of materials.
- Most epidermal cells on aboveground are: Covered by a waxy cuticle which prevent water loss

Specialized Epidermal cells:
- guard → stomata
- trichomes → hairs
- unicellular root hairs



Ground

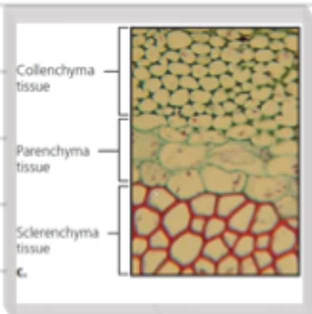
- location: beneath the epidermis and suround vascular tissues

cells typs that found in ground:

parenchyma (living cell)
- most common cell in plants
- thin walled (weak) with large vacuoles
- function:
  1. photosynthesis
  2. support
  3. storage
  4. lateral transport

collenchyma (living cell)
- fond near the serface of stem, leaf petioles and veins
- uneven thickening of cell wall
- function: flexable support to young plant

sclerenchyma (may be dead cell at maturity)
- thickened cell walls may contain lignin.
- function: provide strength and support to mature plant
- most common type: long, thin fibers.



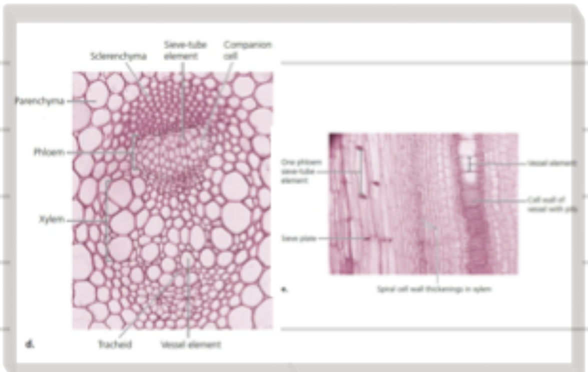
vascular

(system for trasport throughout plant body)

Xylem → complix (composed of several cells type) ← Pholem

Xylem
- Function: ① transport of water and materials ② provides support.
- primary water-conducting cells:
  - Ⓐ Tracheids: long, thin with perforated tapered ends
  - Ⓑ vessel elements: larger open-ended join end to end
  - Ⓒ parenchyma: storage, lateral transport
  - Ⓓ sclerenchyma Fibers: Additional support

Pholem
- Function: transport the products of photosythesis throughout the plants.
- this complex tissue is composed of living conducting cells → غربالي sieve-tube (which lack nucleus)
- each sieve-tube member is associated with one or more adjacent companion cells, to regulate sieve-tube member function.
- parenchyma cells found in pholem too.



Meristematic

primary
- undifferentiated cells located in buds.

Pericycle
- layer of Meristematic cells.
- Just outside the vascular cylinder in root
- Divide to produce lateral branch roots.

cambium → vasclar, cork

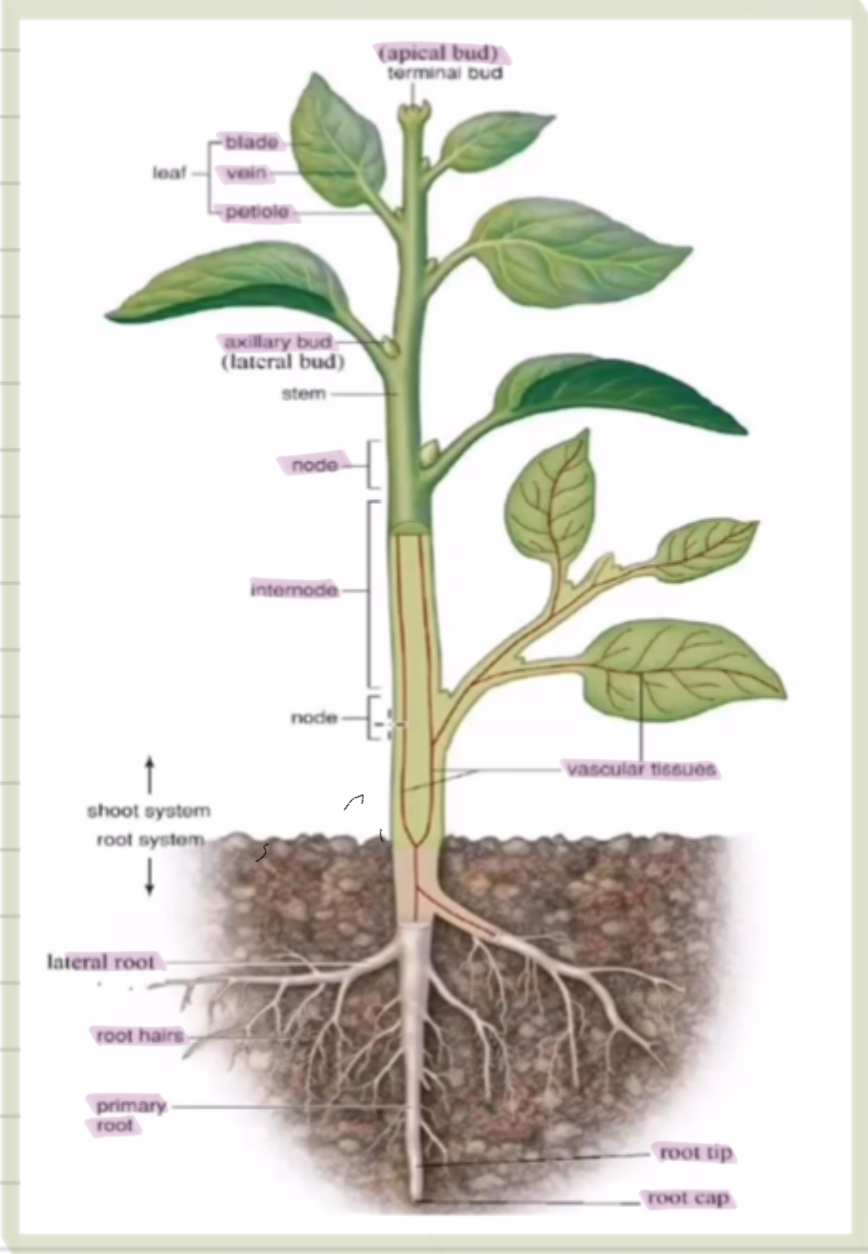
vasclar:
- lateral meristem composed of small dividing cells, located between Xylem and phloem.
- Divide to produce secondary growth → result increas in circumference.

cork:
- lateral meristem located just inside the cork layer of a woody plant.
- Divide to produce secondary growth

trasport tissues

phloem
- Dead fibers (thick walled sclerenchyma) → provide support
- sieve-tube (large, living, elongated, lack nucles cells)
- companion (small, nucleted)

Xylem
- Tracheids (thick walled, taperded ends)
- vessles (large, joined end to end)
- → Dead at maturity



(1)

Just primary

Figure 20.2. A herbaceous plant. The vegetative plant body consists of roots, stems, and leaves. The buds are located in the axils of the leaves and at the shoot tip. The roots also grow from meristem tissues in the root tip. Label the

(4)

(2)

Plants produce new cells throughout their lifetime as a result of cell divisions in meristems. Tissues produced from apical meristems are called **primary tissues**, and this growth is called **primary growth**. Primary growth occurs along the plant axis at the shoot and the root tip. Certain meristem cells divide in such a way that one cell product becomes a new body cell and the other remains in the meristem. Beyond the zone of active cell division, new cells become enlarged and specialized (differentiated) for specific functions (resulting, for example, in vessels, parenchyma, and epidermis). Using the model plant, *Arabadopsis*, research into the genetic and molecular basis of cell differentiation has rapidly advanced.

In this exercise, you will examine a longitudinal section through the tip of the stem, observing the youngest tissues and meristems at the apex, then moving down the stem, where you will observe more mature cells and tissues.

(3)

All **herbaceous** (nonwoody) flowering plants produce a complete plant body composed of primary tissue, derived from apical primary meristem. This plant body consists of *organs*—roots, stems, leaves, flowers, fruits, and seeds—and *tissue systems*—dermal, ground, and vascular. In this exercise, you will investigate the cellular structure and organization of plant organs and tissues by examining microscopic slides. You will make your own thin cross sections of stems, and view prepared slides of stems, roots, and leaves. Woody stems will be examined in Exercise 20.4.

A. Stems

main axis.

A stem is usually the main stalk, or axis, of a plant and is the only organ that produces buds and leaves. Stems support leaves and conduct water and inorganic substances from the root to the leaves and carbohydrate products of photosynthesis from the leaves to the roots. Most herbaceous stems are able to photosynthesize. Stems exhibit several interesting adaptations, including water storage in cacti, carbohydrate storage in some food plants, and thorns that reduce herbivory in a variety of plants.

You will view a prepared slide of a cross section of a stem, and, working with another student, you will use a simple microtome—an instrument used for cutting thin sections for microscopic study—to make your own slides. You will embed the stem tissue in paraffin and cut thin sections. You will stain your sections with toluidine blue, which will help you distinguish different cell types. This simple procedure is analogous to the process used to make prepared slides for subsequent lab studies.

2. Examine a prepared slide of a cross section through the herbaceous dicot stem (Figure 20.6). As you study the stem tissues and cells, refer back to "Summary of Basic Plant Tissue Systems and Cell Types," Figure 20.2.
3. Identify the **dermal tissue system,** characterized by a protective cell layer covering the plant. It is composed of the **epidermis** and the **cuticle.** Occasionally, you may also observe multicellular **trichomes** (hairs and glands) on the outer surface of the plants.
4. Locate the **ground tissue system,** background tissue that fills the spaces between epidermis and vascular tissue. Identify the **cortex region** located between the vascular bundles and the epidermis. It is composed mostly of **parenchyma,** but the outer part may contain **collenchyma** as well.
5. Next find the **pith region,** which occupies the center of the stem, inside the ring of vascular bundles; it is composed of parenchyma. In herbaceous stems, these cells provide support through turgor pressure. This region is also important in storage of water and materials.
6. Now identify the **vascular system,** a continuous system of xylem and phloem providing transport and support. In your stems and in many stems, the **vascular bundles** (clusters of xylem and phloem) occur in rings that surround the pith; however, in some groups of flowering plants, the vascular tissue is arranged in a complex network.
7. Observe that each bundle consists of ***phloem tissue toward the outside and xylem tissue toward the inside.*** A narrow layer of vascular cambium, which may become active in herbaceous stems, is situated between the xylem and the phloem. Take note of the following information as you make your observations.

trasport tissues

- phlolem
  - Dead fibers (thick walled sclerenchyma) → provide support
  - sieve -tube (large, living, elongated, lack nucles cells)
  - companion (small, nucleted)
- Xylem
  - Tracheids (thick walled, taperded ends)
  - vessles (large, joined end to end)
  - → Dead at maturity

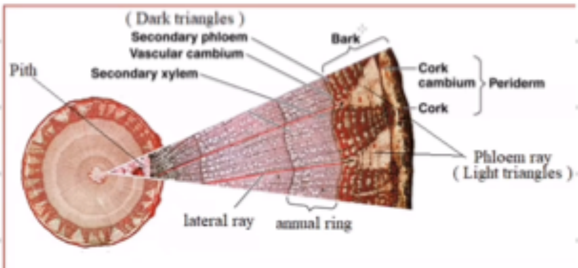
Phloem tissue is composed of three cell types:

a. Dead, fibrous, thick-walled **sclerenchyma** cells that provide support for the phloem tissue and appear in a cluster as a **bundle cap.**
b. **Sieve-tube members,** which are large, living, elongated cells that lack a nucleus at maturity. They become vertically aligned to form sieve tubes, and their cytoplasm is interconnected through sieve plates located at the ends of the cells. Sieve plates are not usually seen in cross sections.
c. **Companion cells,** which are small, nucleated parenchyma cells connected to sieve-tube cells by means of cytoplasmic strands.

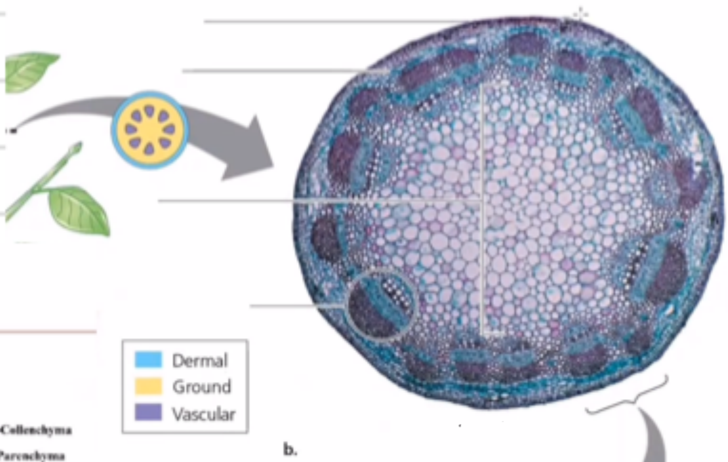
Xylem tissue is made up of two cell types:

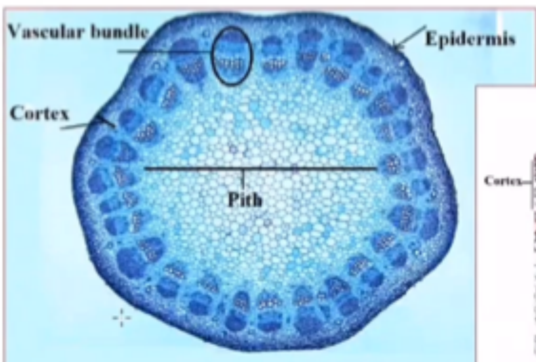
a. **Tracheids,** which are elongated, thick-walled cells with closed, tapered ends. They are dead at functional maturity, and their lumens are interconnected through pits in the cell walls.
b. **Vessel elements,** which are cylindrical cells that are large in diameter and dead at functional maturity. They become joined end to end, lose their end walls, and form long, vertical vessels.

Vascular cambium is a type of tissue that is located between the xylem and the phloem and which actively divides to give rise to secondary tissues.

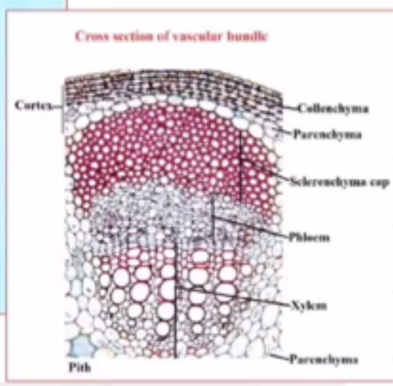


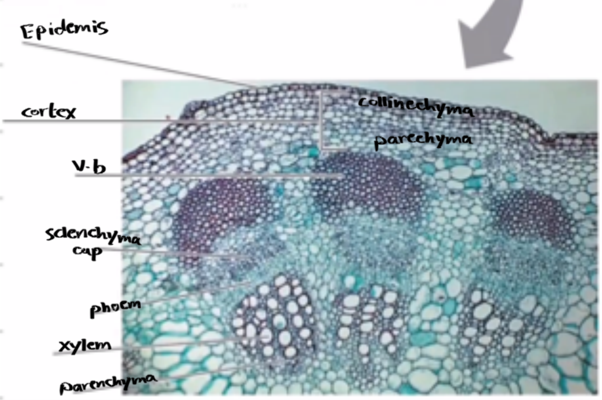
Cross section of 3-years old secondery stem





stem cross-section





B. Roots

Introduction

Roots and stems often appear to be similar, except that roots grow in the soil and stems above the ground. However, some stems (rhizomes) grow underground, and some roots (adventitious roots) grow aboveground. Roots and stems may superficially appear similar, but they differ significantly in their functions. One of the major themes of biology is that structure and function are closely related at all levels of the hierarchy of life. Therefore, we would expect that the structure of stems and roots might differ in important ways.

Roots have four primary functions:

1. anchorage of the plant in the soil
2. absorption of water and minerals from the soil
3. conduction of water and minerals from the region of absorption to the base of the stem
4. starch storage to varying degrees, depending on the plant

If the primary root continues to be the largest and most important part of the root system, the plant is said to have a **taproot** system. many main roots are formed, the plant has a **fibrous root** system.

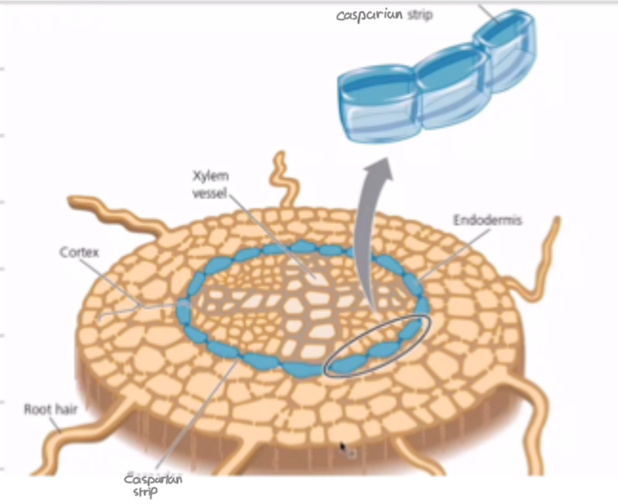
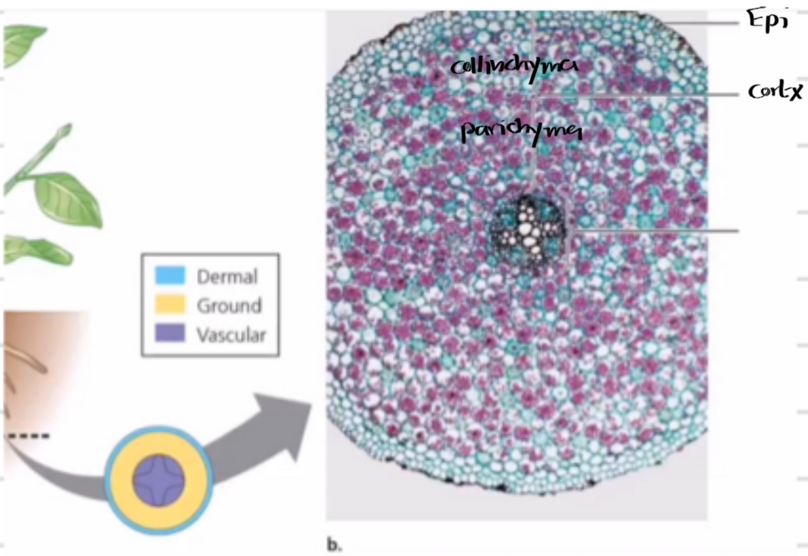
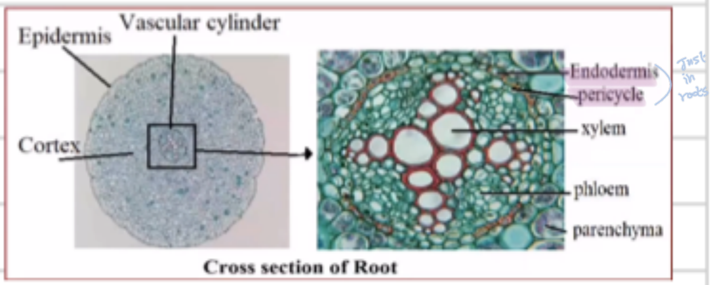
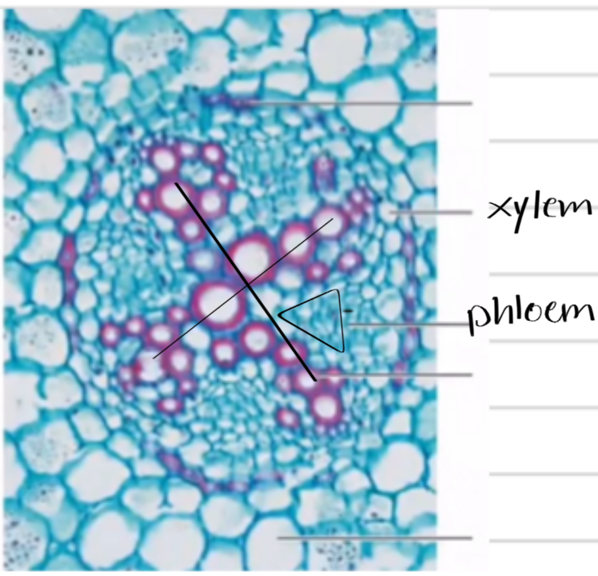


Figure 20.7.
Root endodermis. The endodermis is composed of cells surrounded by a band containing *suberin*, called the *Casparian strip* (seen in enlargement), that prevents the movement of materials along the cells' walls and intercellular spaces into the vascular cylinder. Materials must cross the cell membrane before entering the vascular tissue.





Cross section of Root



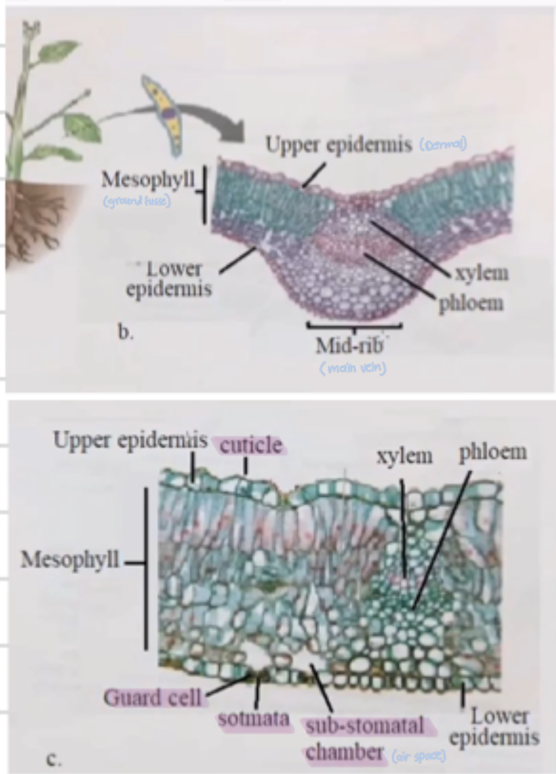
c. leaves

Introduction

epidermis [~~~ → mesophyll

Leaves are organs especially adapted for photosynthesis. The thin blade portion provides a very large surface area for the absorption of light and the uptake of carbon dioxide through stomata. The leaf is basically a layer of parenchyma cells (the mesophyll) between two layers of epidermis. The loose arrangement of parenchyma cells within the leaf allows for an extensive surface area for the rapid exchange of gases. Specialized epidermal cells called guard cells surround the stomatal opening and allow carbon dioxide uptake and oxygen release, as well as evaporation of water at the leaf surface. Guard cells are photosynthetic (unlike other epidermal cells), and are capable of changing shape in response to complex environmental and physiological factors. Current research indicates that the opening of the stomata is the result of the active uptake of K^+ and subsequent changes in turgor pressure in the guard cells.

In this lab study, you will examine the structure of a leaf in cross section. You will observe stomata on the leaf epidermis and will study the activity of guard cells under different conditions.

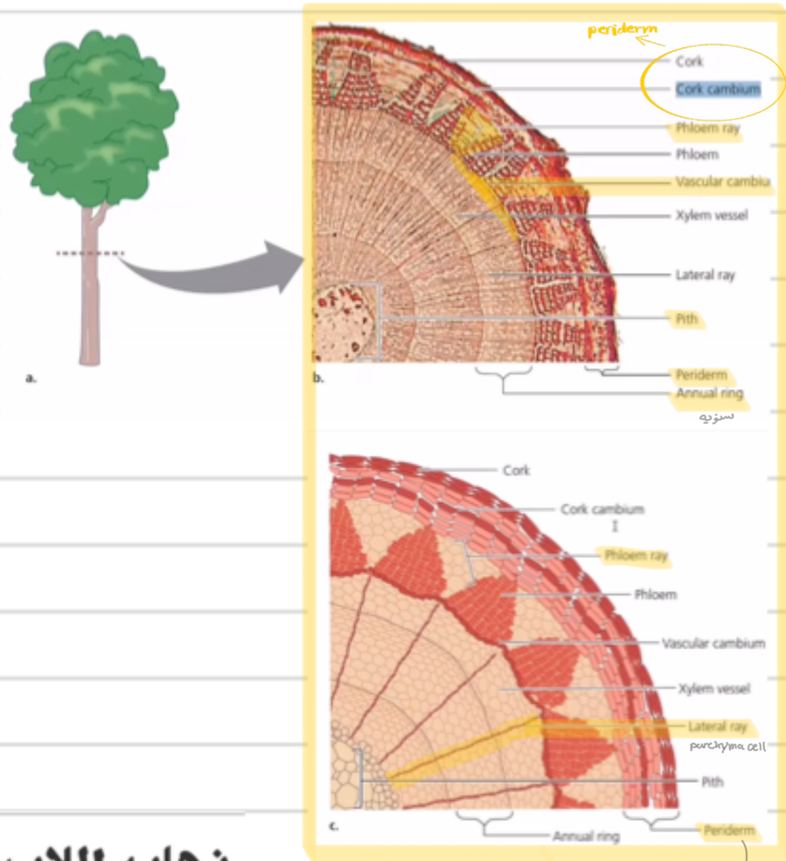


Secondary growth

Introduction

Secondary growth arises from meristematic tissue called cambium. Vascular cambium and cork cambium are two types of cambium. The vascular cambium is a single layer of meristematic cells located between the secondary phloem and secondary xylem. Dividing cambium cells produce a new cell at one time toward the xylem, at another time toward the phloem. Thus, each cambial cell produces files of cells, one toward the inside of the stem, another toward the outside, resulting in an increase in stem circumference. The secondary phloem cells become differentiated into sclerenchyma fiber cells, sieve-tube members, and companion cells. Secondary xylem cells become differentiated into tracheids and vessel elements. Certain cambial cells produce parenchyma ray cells that can extend radially through the xylem and phloem of the stem.

The cork cambium is a type of meristematic tissue that divides, producing cork tissue to the outside of the stem and other cells to the inside. The cork cambium and the secondary tissues derived from it are called periderm. The periderm layer replaces the epidermis and cortex in stems and roots with secondary growth. These layers are continually broken and sloughed off as the woody plant grows and expands in diameter.



structure found only in sec. stem that: replace the epidermis and cortex from the primary stem

primary → sec.
loosen of cortex and epidermis

نهايه اللاب
بالتوفيق
تذكرو لكل مشتهد نصيب
و العلامه العاليه حلوة تعطي دوبامين تستاهل التعب
و طالب العلم ربنا بيسرلو طريق الى الجنه

Farah shyer