PLANT ANATOMY

PLANT ORGANS

Root Structure

Plant organ: Root

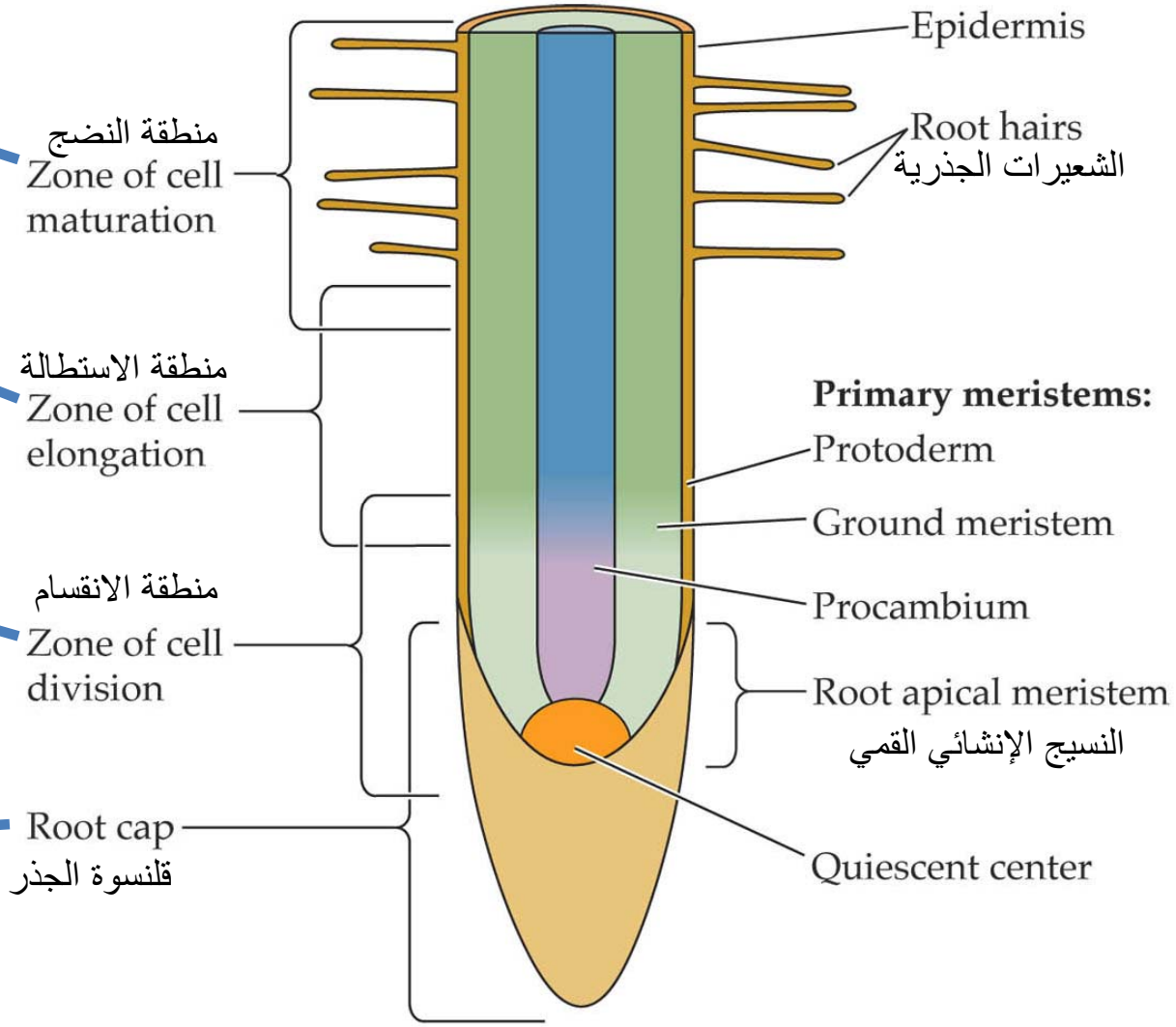
In the Zone of maturation
The cells complete maturation, and become fully functional

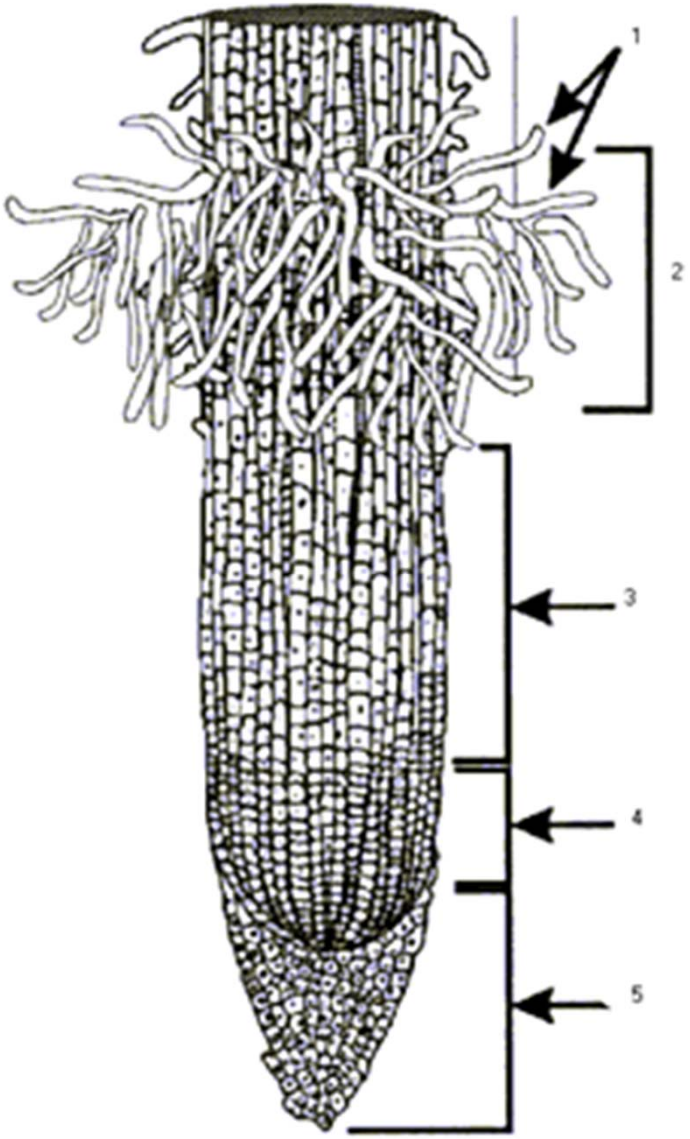
In the Zone of elongation, the root cells elongate, pushes root tip further into soil

Zone of cell division is a actively dividing region, produces root cap cells

The root tip is covered by a root cap, which protects the delicate apical meristem as the root pushes through soil during primary growth

Root Tip Zones





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Root hairs

Zone of cell maturation

Zone of cell elongation

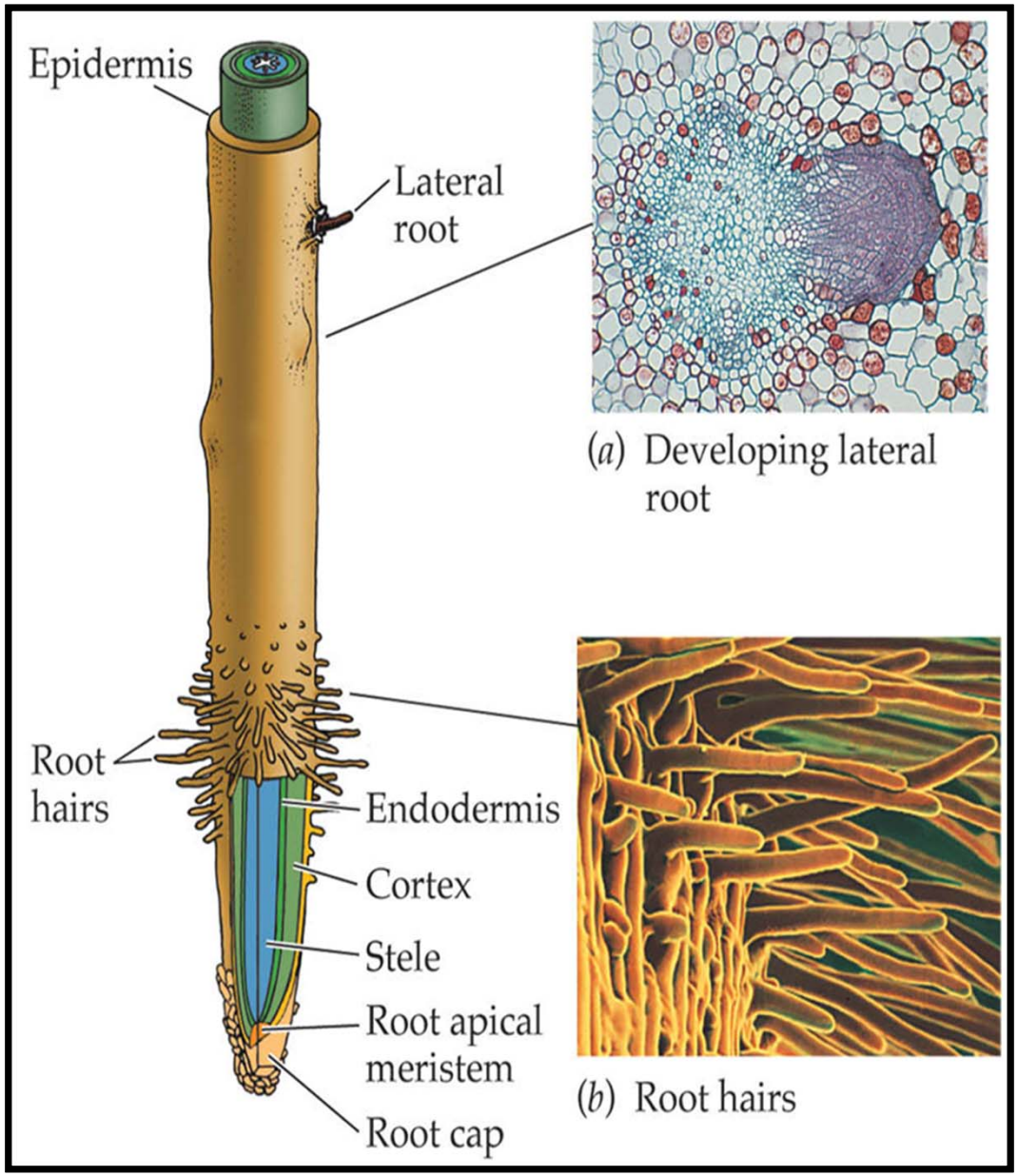
Zone of cell division

root cap

Structure of the Root:

- **Root cap** covers the apical meristem (growth tissue) at the tip of the root & produces a **slimy substance** so roots can more easily grow through the ground
- **Apical meristem** replaces cells of the **root cap** as they are damaged
- **Epidermis** covers the outside of the root & has extensions called **root hairs** that absorb water & minerals and increase the surface area of the root

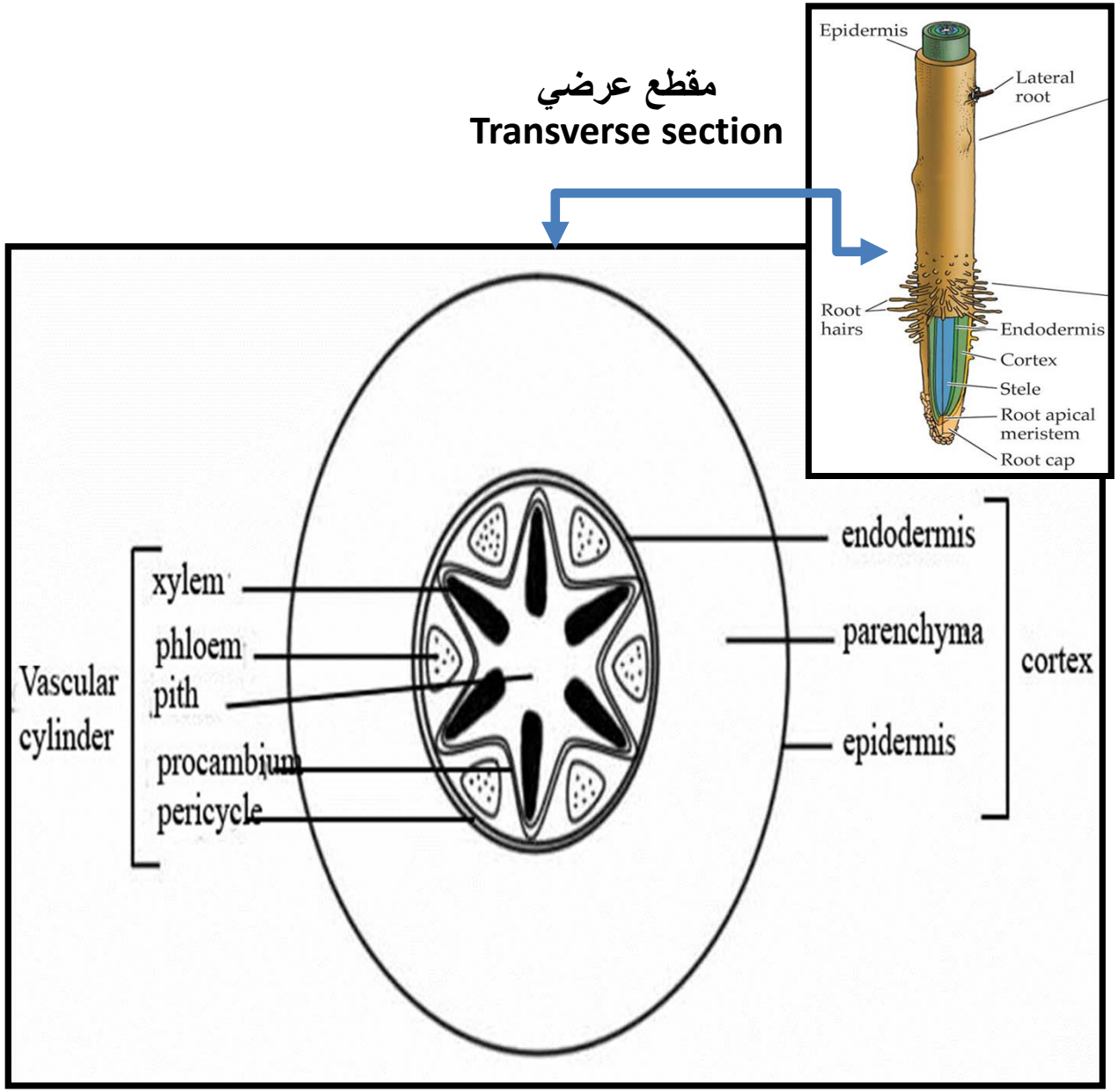
قلنسوة الجذر تغطي النسيج الإنشائي القمي (انسجة النمو) في قمة أو طرف الجذر تفرز او تنتج مادة لزجة تمكن الجذور من النمو بسهولة أكبر خلال تربة الأرض
النسيج الإنشائي القمي يعوض خلايا قلنسوة الجذر عند عطبها وتهتكها بسبب احتكاكها بالتربة
البشرة تغطي السطح الخارجي للجذر ويمتد منها زوائد دقيقة تسمى الشعيرات الجذرية التي تمتص الماء والمعادن وتزيد مساحة سطح الجذر



Structure of the Root:

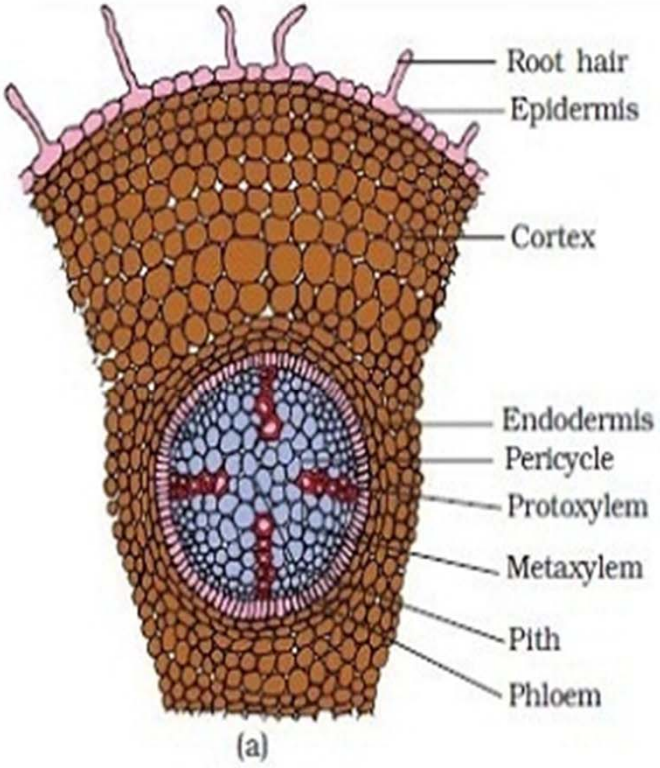
- **The outermost cell is called as epidermis** البشرة
- **The tissues in the central region (core of the root) is called the vascular cylinder** الاسطوانة الوعائية**, contains xylem** خشب **& phloem** اللحاء
- **A ground tissue called cortex** القشرة **surrounds the vascular cylinder**
- **A single cell layer called endodermis** البشرة الداخلية **separates the cortex & vascular tissue**

مقطع عرضي
Transverse section

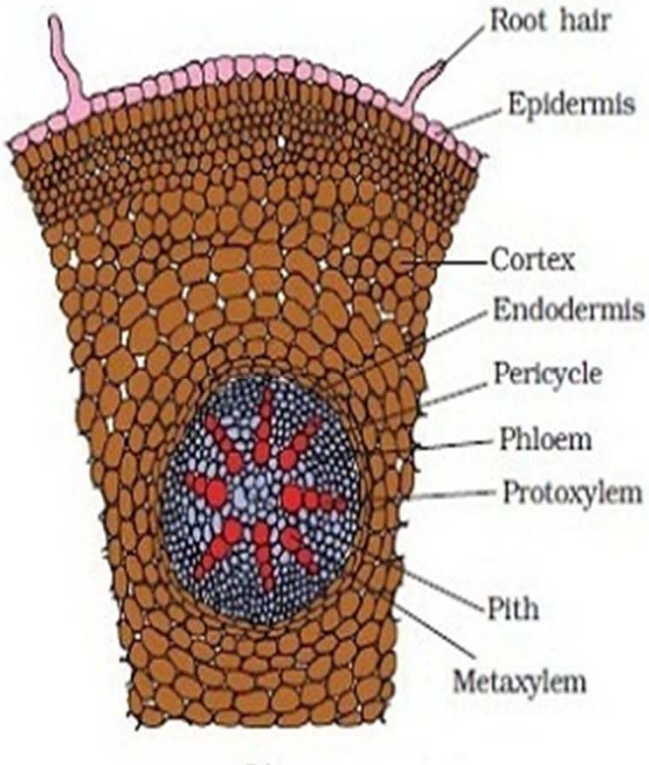


Plant organ: Root

Dicot and Monocot Root

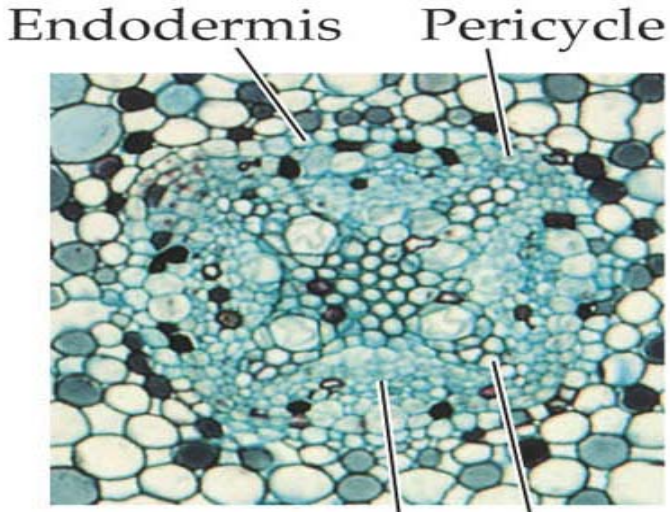


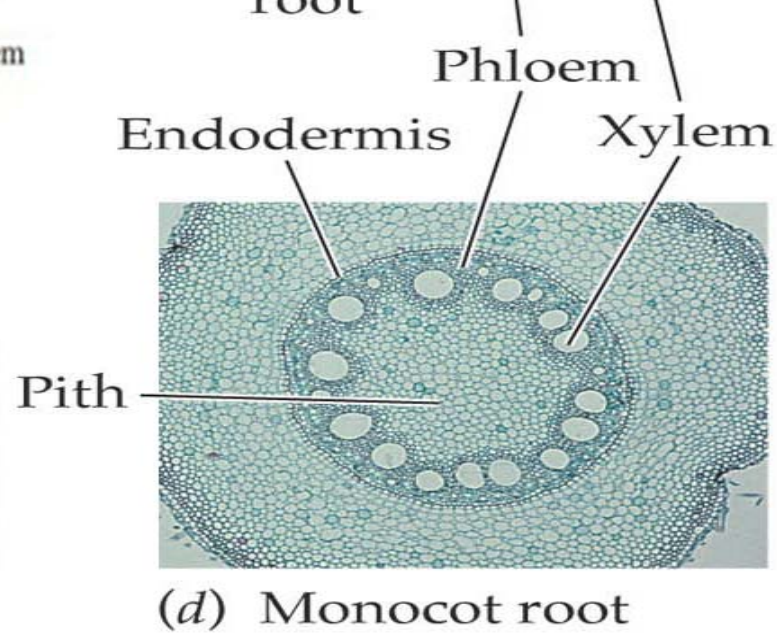
Dicot

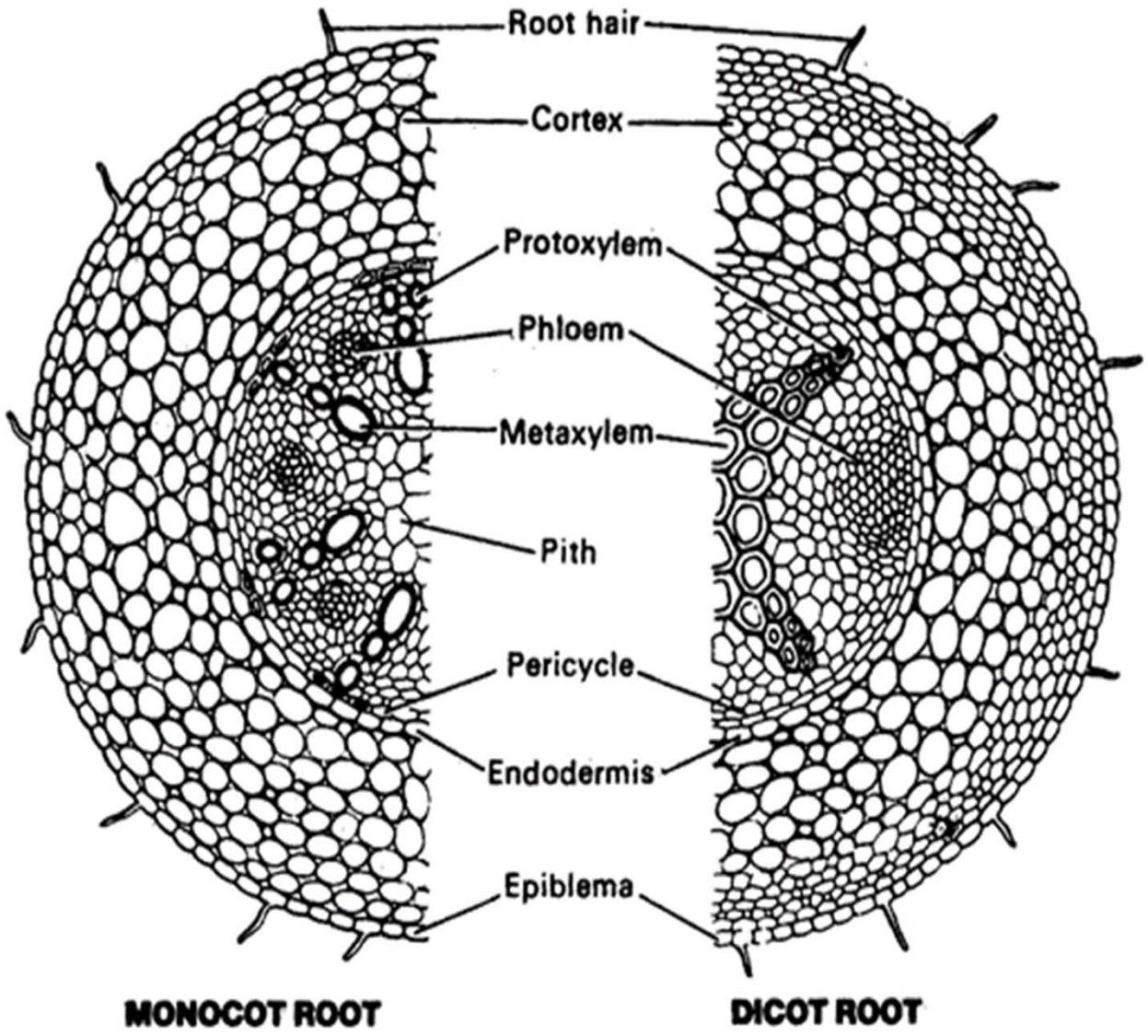


Monocot

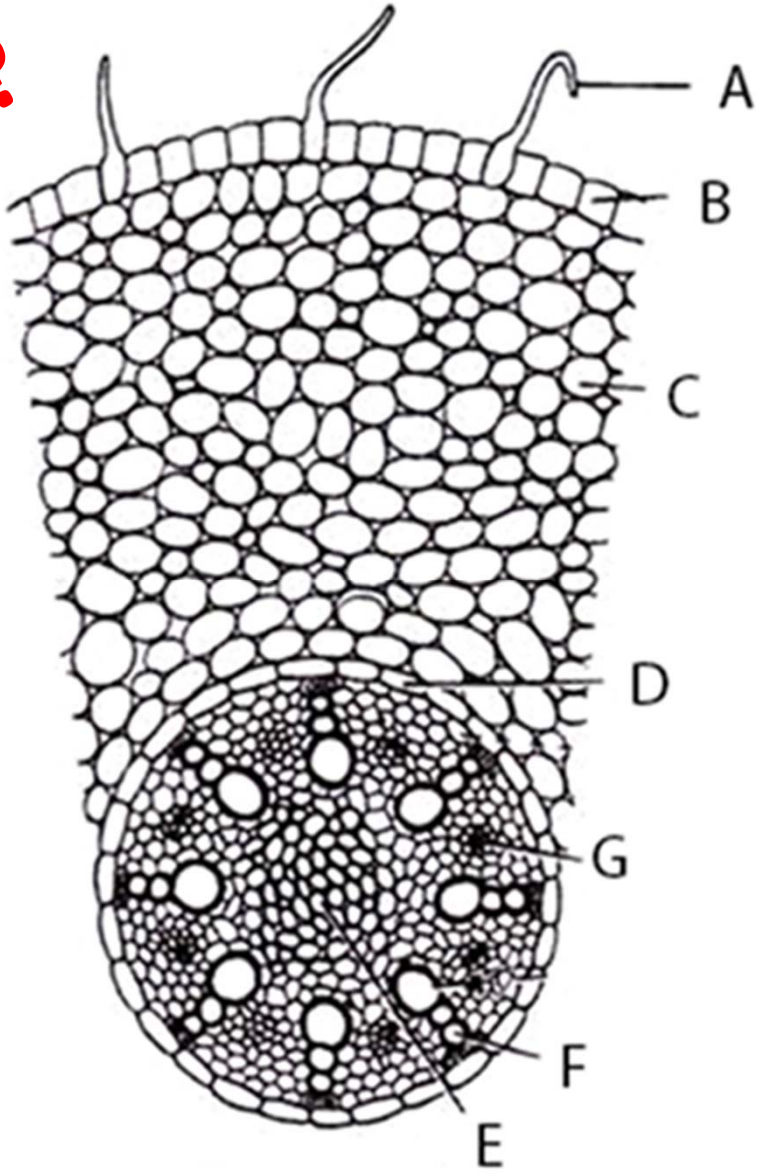
Vascular bundles الحزم الوعائية	2-6 alternate bundles of xylem and phloem.	8 or more alternate bundles of xylem and phloem.






Root hair
Cortex
Protoxylem
Phloem
Metaxylem
Pith
Pericycle
Endodermis
Epiblema
MONOCOT ROOT
DICOT ROOT

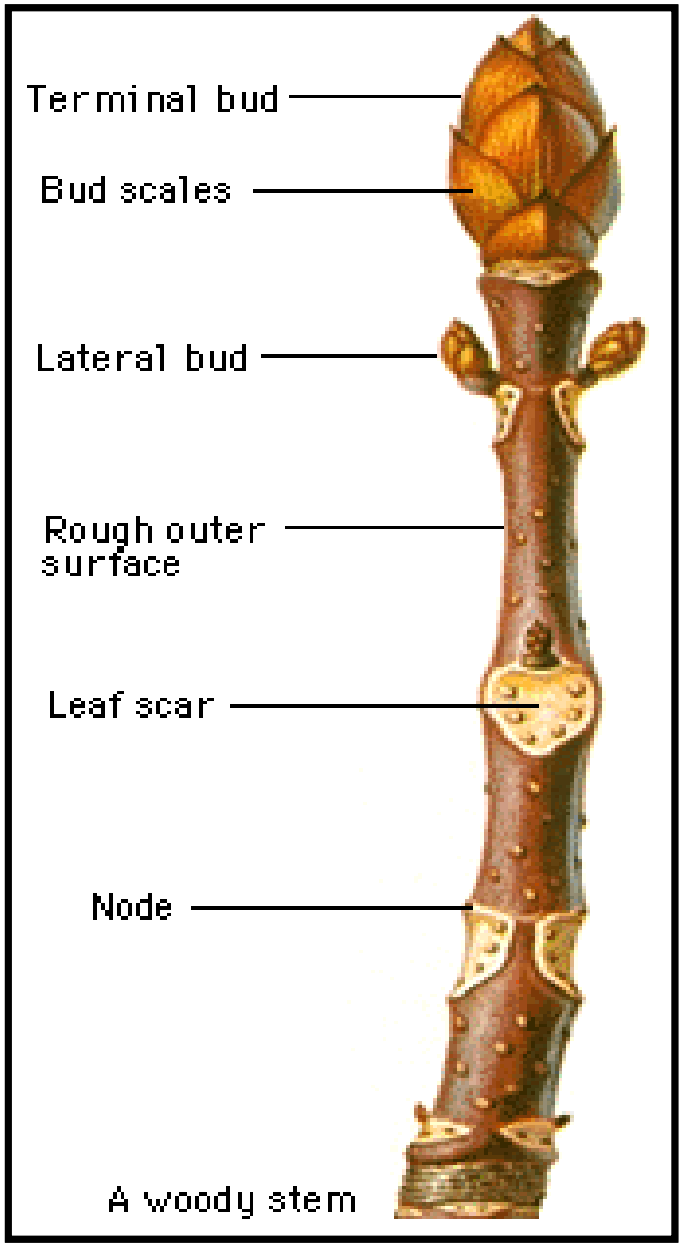
?


A
B
C
D
G
F
E

Stem Structure

Structure and Function of Stem

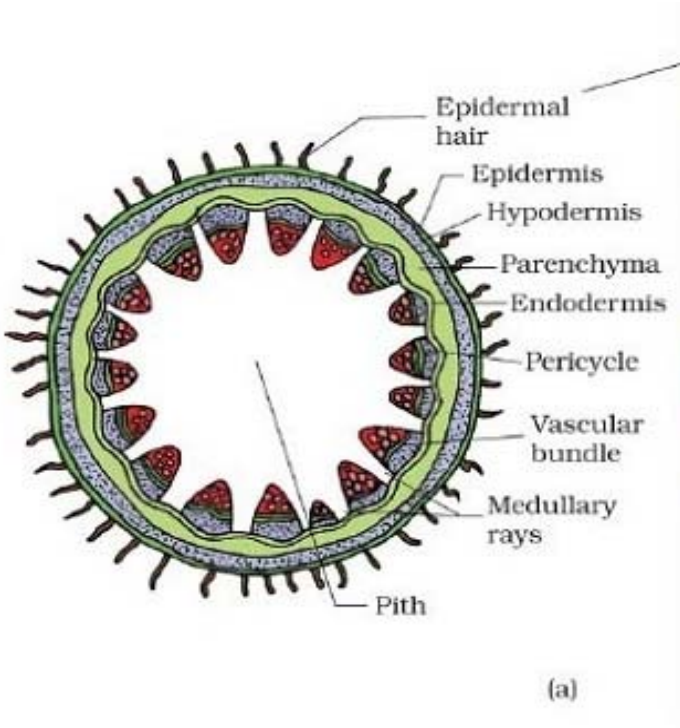
- The tip of each stem usually has a برعم طرفي **Terminal Bud** enclosed by specialized leaves called **Bud Scales** حراشف البرعم
- Adapted **to support leaves**
- **Transport water and minerals** from root to leaves
- **Transport sugars** from leaves to roots
- Stems grow from the النسيج الإنشائي القمي **tip or apical meristem**
- **Internode** المسافات بين العقد (السلاميات) is space between nodes on a stem
- Stems increase in circumference by محيط الساق **lateral meristems** الخلايا الإنشائية الجانبية
- Leaves are attached to stems at العقد **nodes**

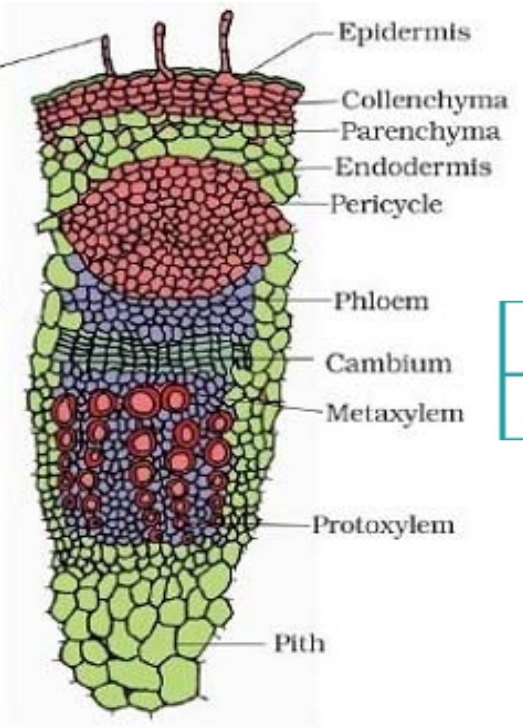


Stem Structure
Dicot and Monocot

- **Vascular Tissue** is arranged in bundles with **xylem** toward the **inside** & **phloem** toward the **outside**
- Vascular bundles are scattered throughout **monocot** stems
- Vascular bundles are arranged in rings in **dicot** stems

ترتيب الأنسجة الوعائية في الحزم ويكون الخشب باتجاه الداخل واللحاء نحو الخارج
الحزم الوعائية في سيقان نباتات ذات الفلقة تنتشر في جميع أنحاء الساق
الحزم الوعائية في سيقان نباتات ذات الفلقتين تترتيب في حلقات





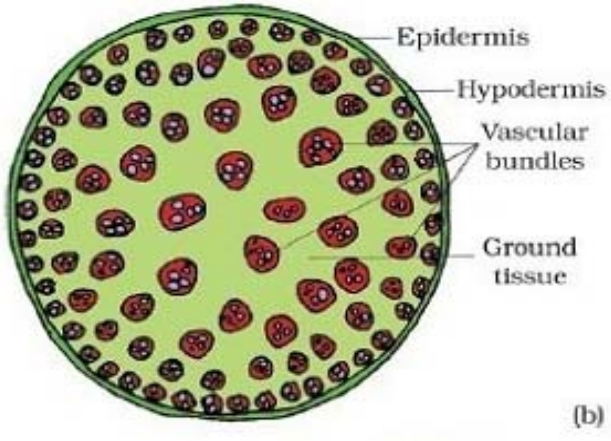
الحزم الوعائية

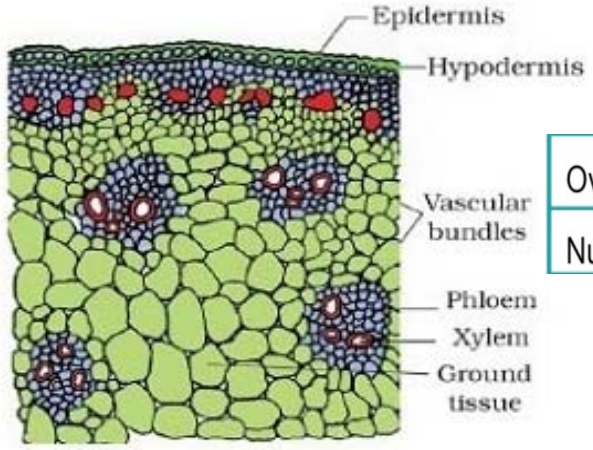
Vascular bundles

dicot

Wedge shaped.
Arranged in a ring.

وتدية الشكل
وموزعة على شكل حلقة

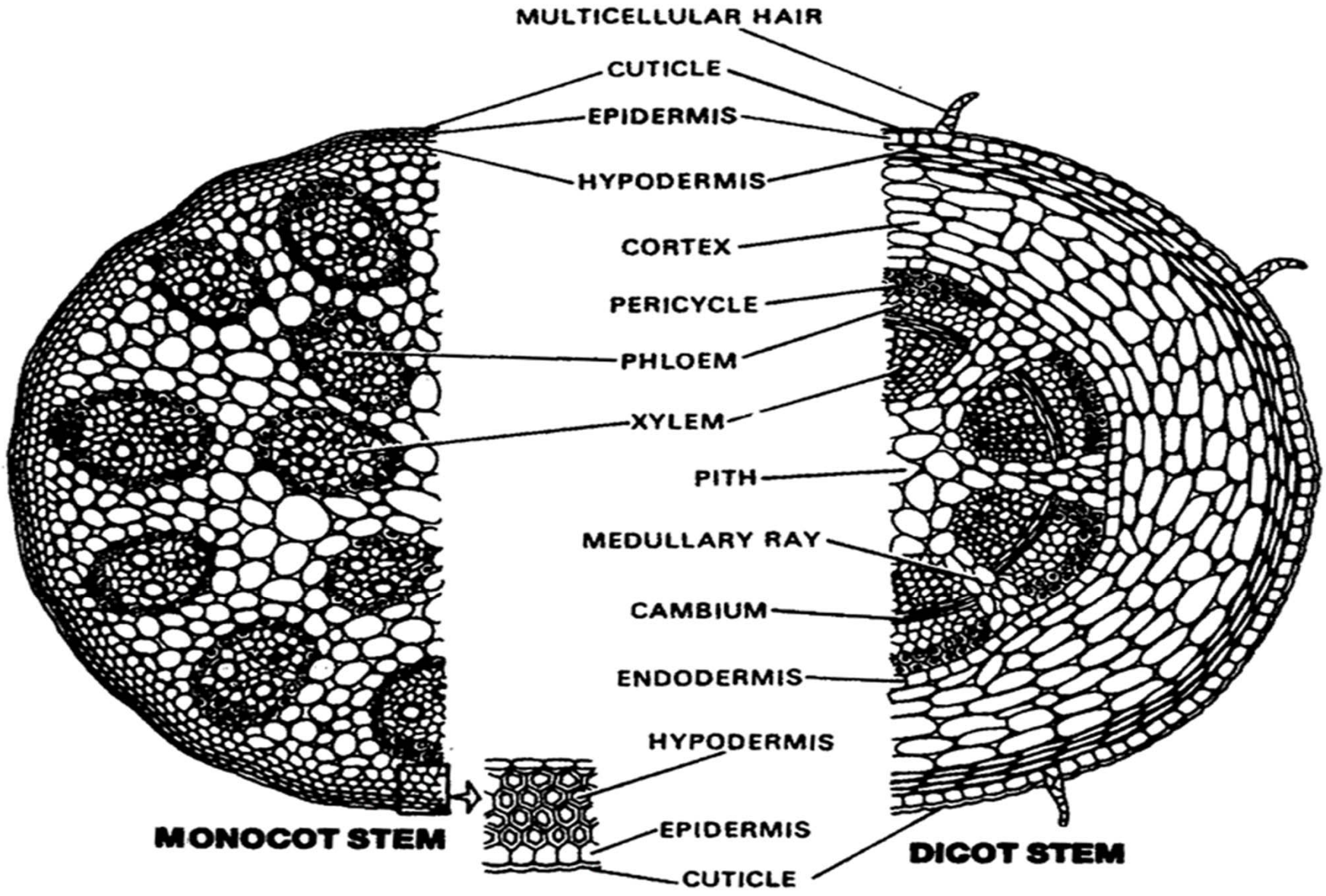


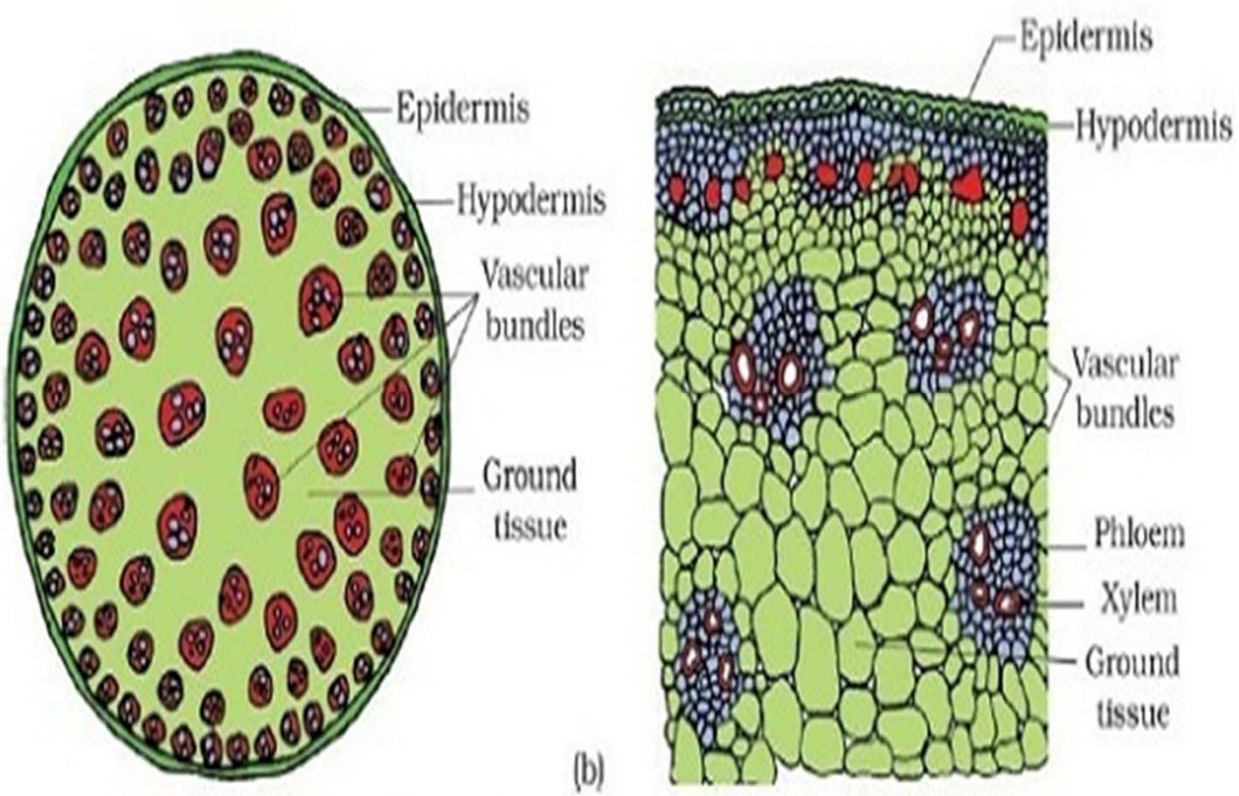


monocot

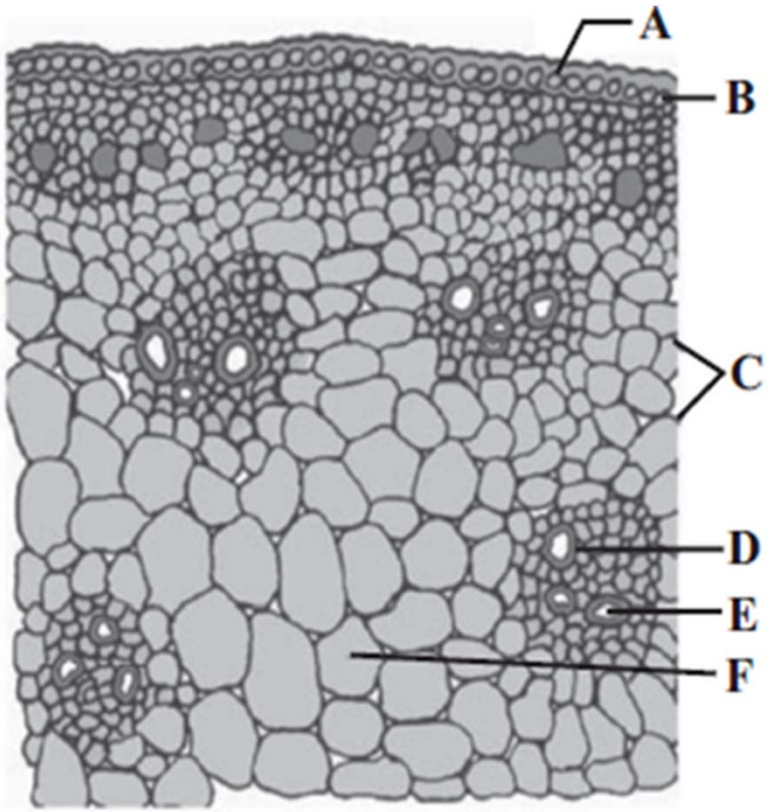
Oval in shape.
Numerous and scattered.

بيضاوية الشكل
عديدة و مبعثرة


MULTICELLULAR HAIR
CUTICLE
EPIDERMIS
HYPODERMIS
CORTEX
PERICYCLE
PHLOEM
XYLEM
PITH
MEDULLARY RAY
CAMBIUM
ENDODERMIS
HYPODERMIS
EPIDERMIS
CUTICLE
MONOCOT STEM
DICOT STEM


Epidermis
Hypodermis
Vascular bundles
Ground tissue
(b)
Epidermis
Hypodermis
Vascular bundles
Phloem
Xylem
Ground tissue

?


A
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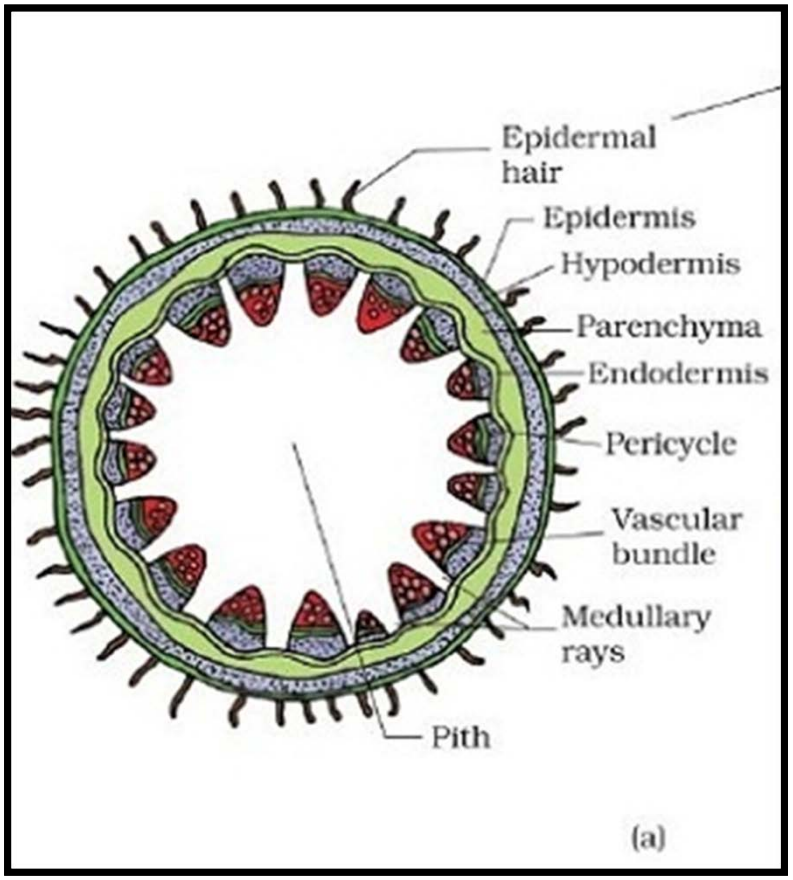
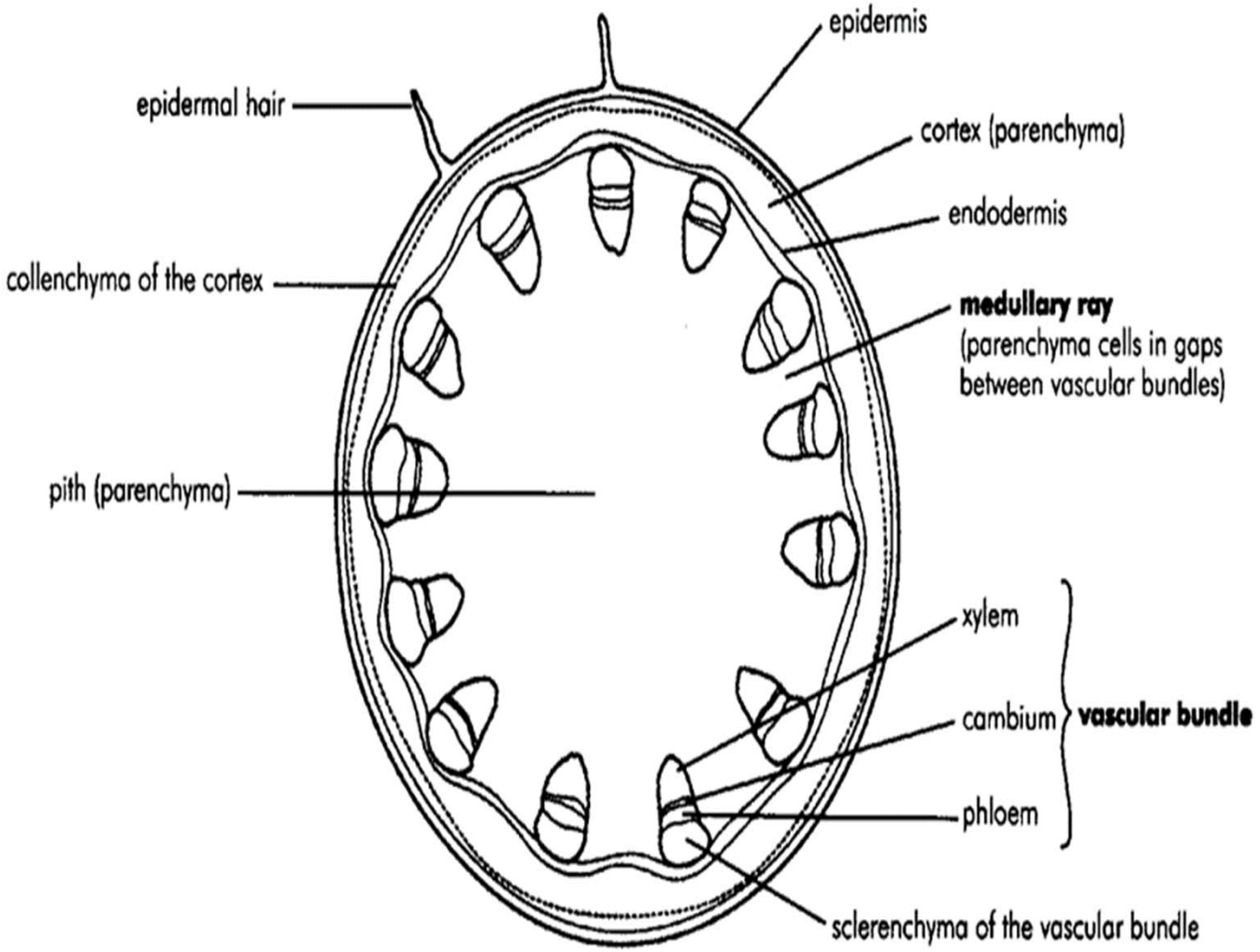

Epidermal hair
Epidermis
Hypodermis
Parenchyma
Endodermis
Pericycle
Vascular bundle
Medullary rays
Pith
(a)


epidermis
epidermal hair
cortex (parenchyma)
endodermis
collenchyma of the cortex
medullary ray
(parenchyma cells in gaps between vascular bundles)
pith (parenchyma)
xylem
cambium
vascular bundle
phloem
sclerenchyma of the vascular bundle

leaf Structure

Leaf Structure

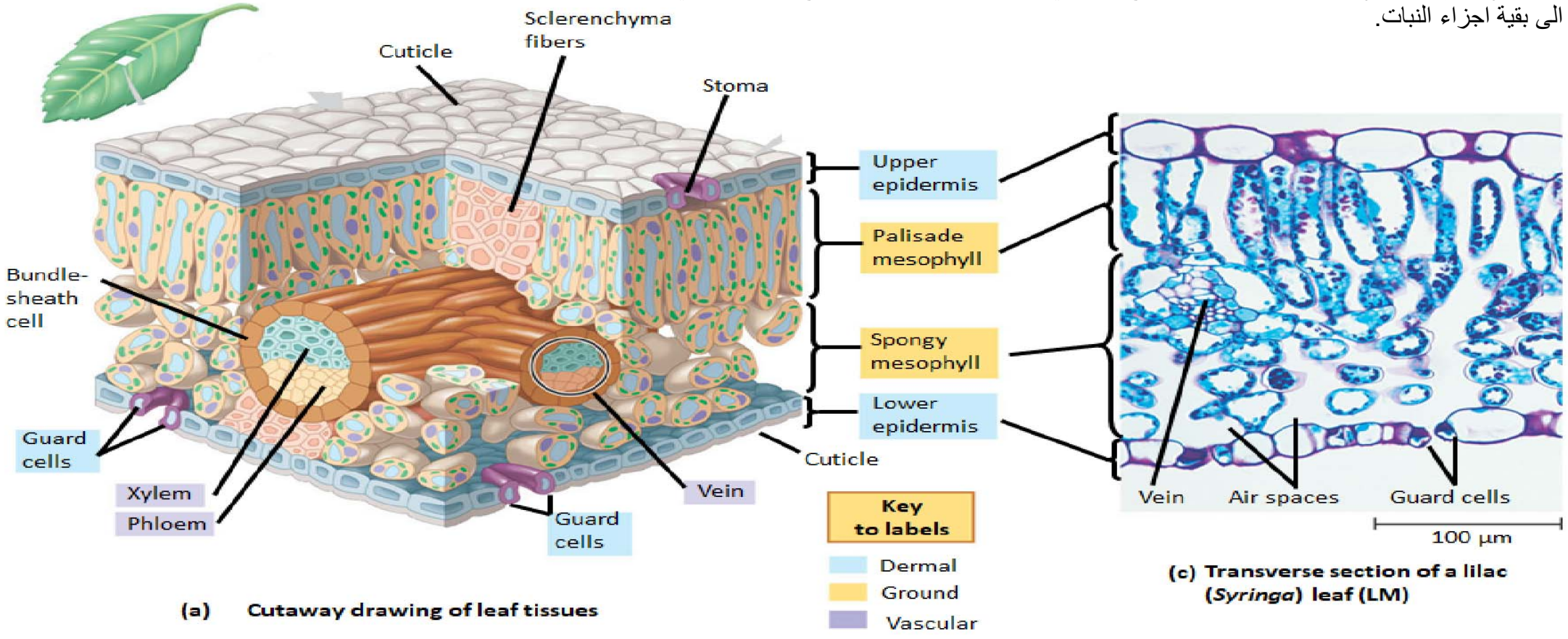
- **Leaf anatomy is adapted to carry out :**
  - **photosynthesis**
  - **limit evaporative water loss (transpiration)**
  - **transport the products of photosynthesis to the rest of the plant.**

تكيف تشريح الورقة للقيام بعملية التركيب الضوئي، والحد من فقدان المياه المتبخرة، ونقل نواتج التمثيل الضوئي الى بقية اجزاء النبات.

Leaf Structure

- **The mesophyll contains air space through which CO_2 can diffuse to the photosynthesizing cells.**
- **Veins (vascular bundles) supply mesophyll cells with water and minerals, and they transport the products of photosynthesis to the rest of the plant.**

يمر الهواء الجوي خلال النسيج الوسطي للورقة وينتشر ويصل إلى الخلايا التي تقوم بعملية البناء الضوئي
العروق(الحزم الوعائية) تزود خلايا العرض النسيج الوسطي بالماء والمعادن، وتنقل نواتج البناء الضوئي
الى بقية اجزاء النبات.



(a) Cutaway drawing of leaf tissues

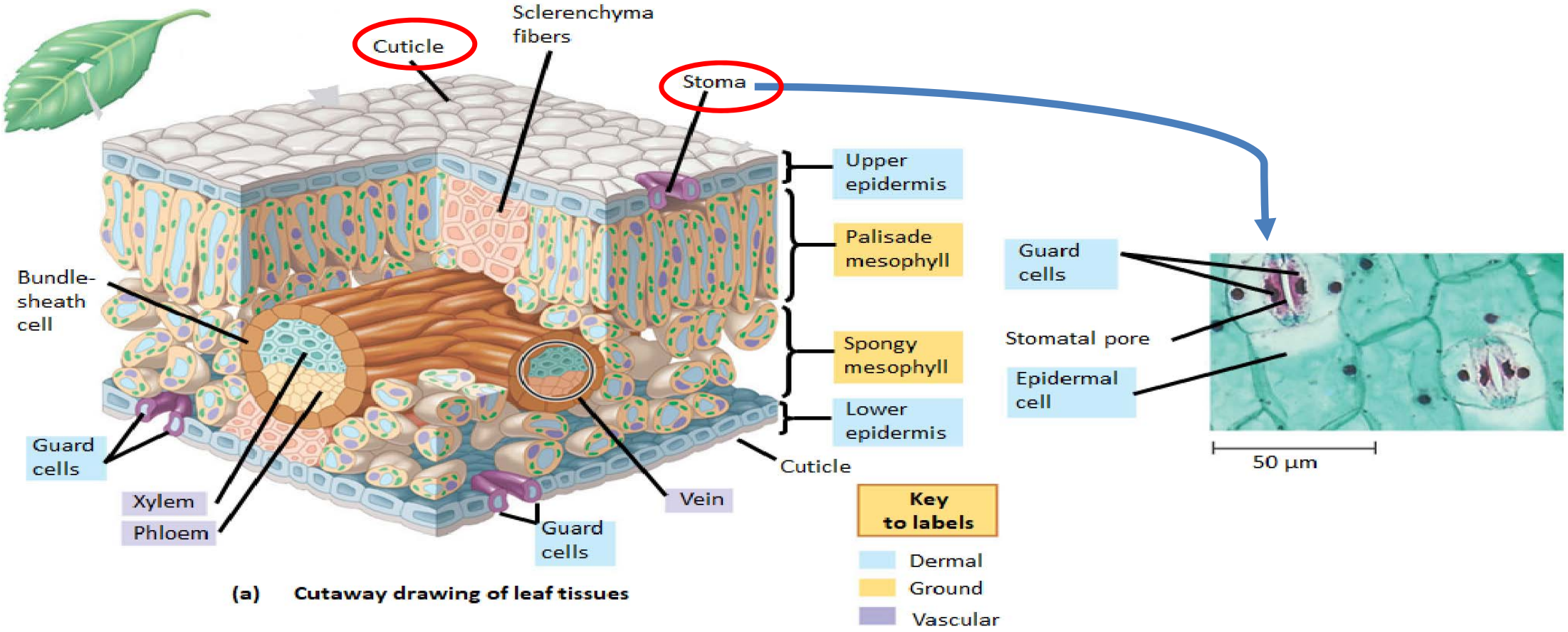
(c) Transverse section of a lilac (*Syringa*) leaf (LM)

Leaf Structure

- **The epidermis of the leaf is the outermost cell layer, which is covered by a waxy cuticle.**

- **Guard cells allow controlled gas exchange through pores in the leaf (the stomata).**

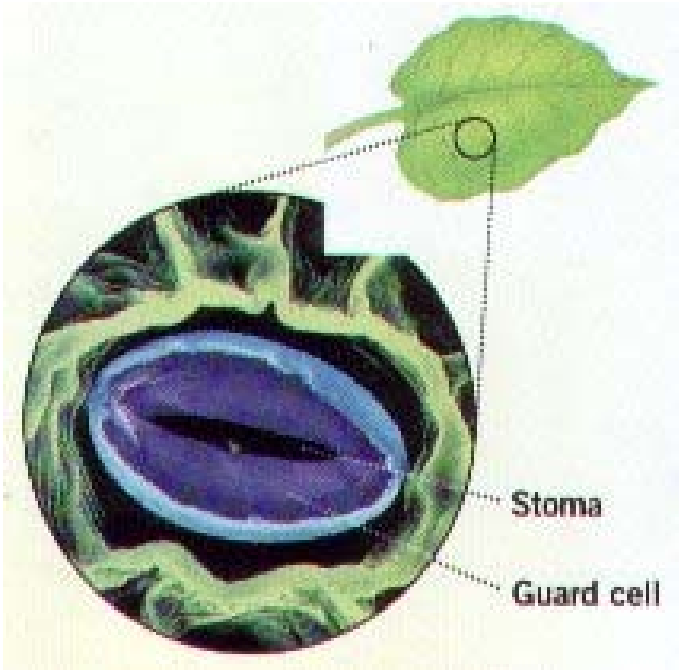
بشرة الورقة هي طبقة الخلايا الخارجية وتغطيها ادمة شمعية. من وظائف البشرة الحفاظ على الماء نواتج البناء الضوئي في ورقة.
الخلايا الحارسة تتحكم في تبادل الغازات من خلال المسام في ورقة (فتحات الثغور).

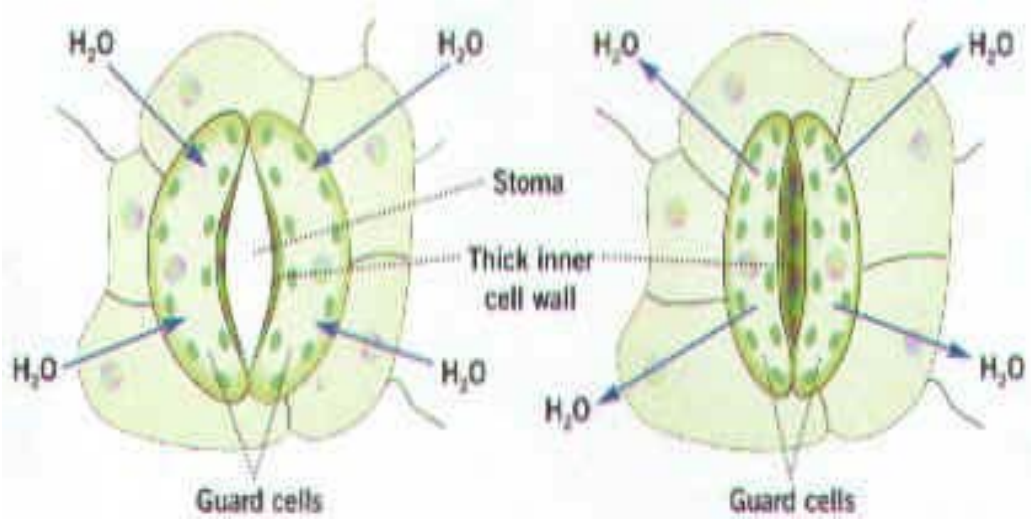


(a) Cutaway drawing of leaf tissues

Stomata:

- **Openings called stomata on the underside of leaves for gas exchange (CO2 & O2)**
- **Two guard cells on either side of the stomata open & close the openings**
- **When guard cells LOSE water, the stoma CLOSE, while the stoma OPEN when guard cells gain water & swell**

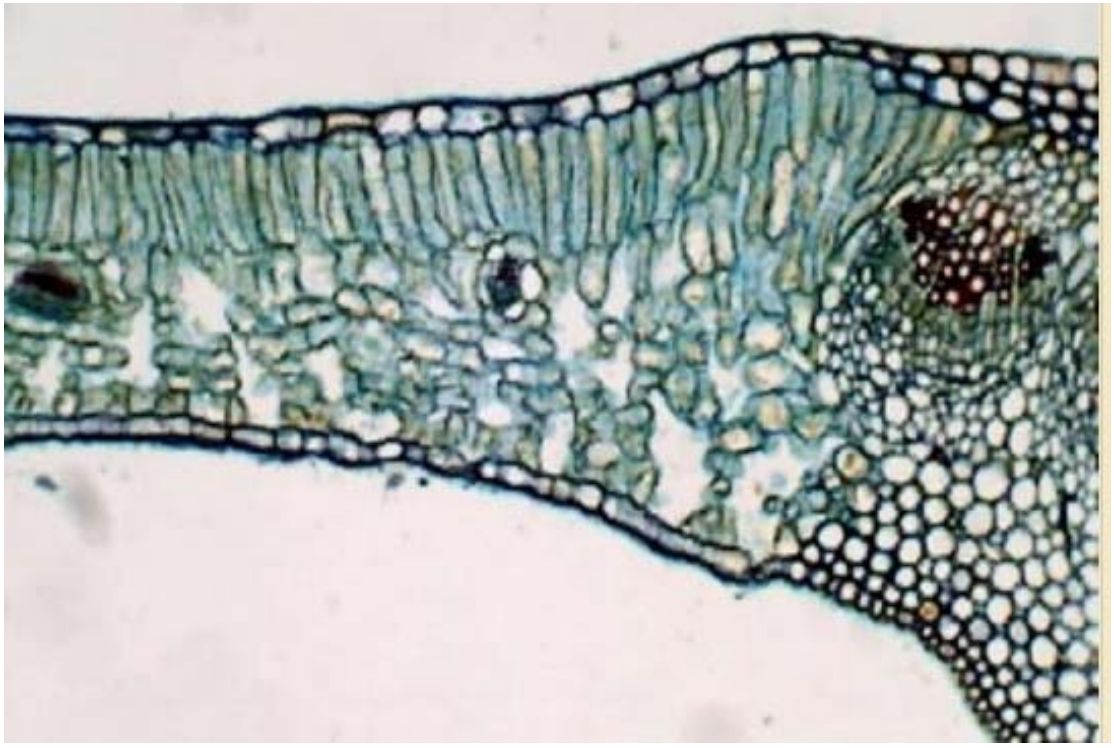


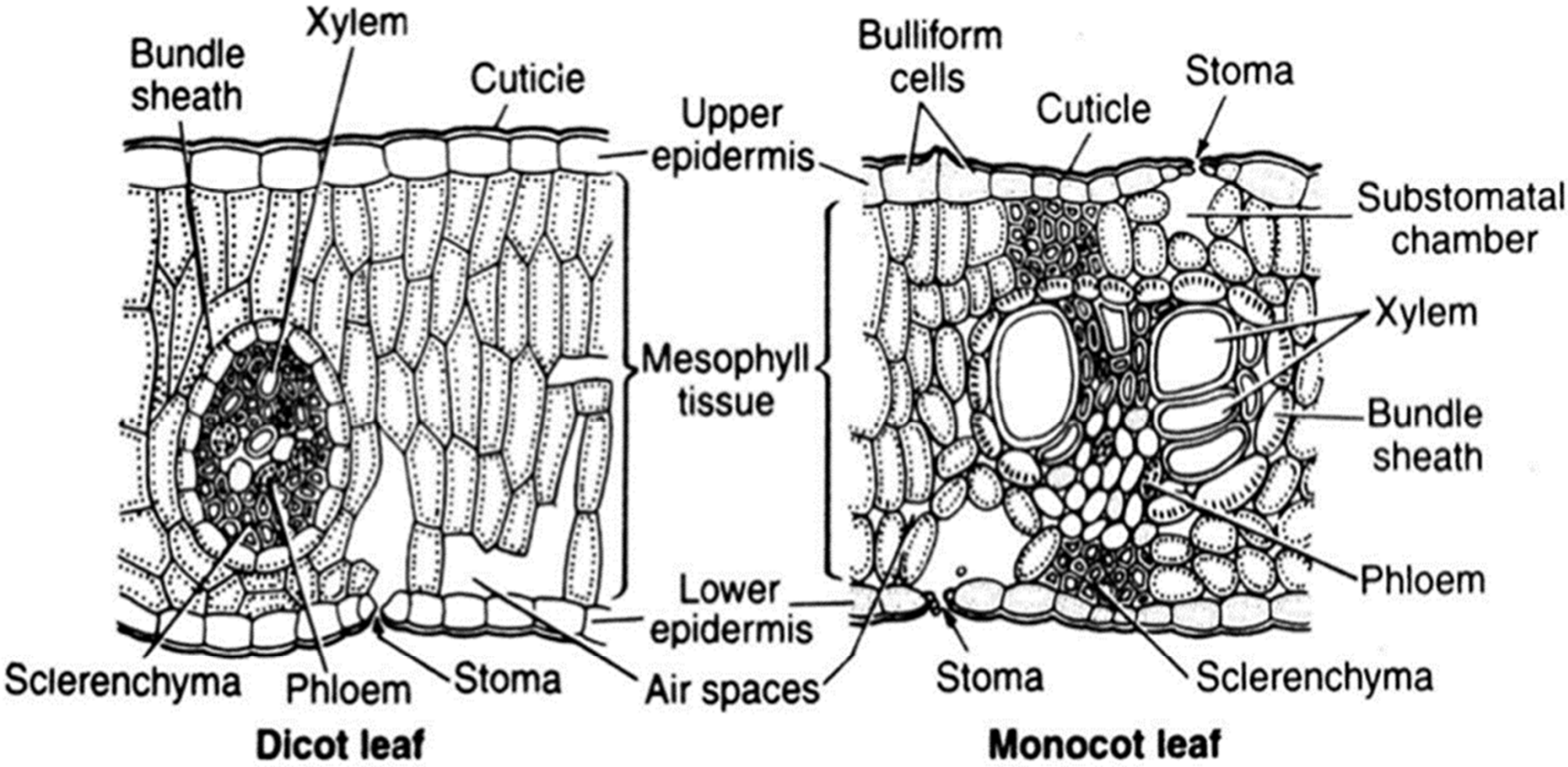


الثغور :
فتحات على الجانب السفلي من الأوراق لتبادل الغازات CO_2و O_2 تسمى الثغور
الخليتين الحارستين على جانبي الثغور تفتح وتغلق فتحات التغر
عندما تفقد الخلايا الحارسة الماء ينغلق الثغر، بينما ينفتح الثغر عندما تمتلئ الخلايا الحارسة بالماء وتنتفخ

Internal structure of Dicot and Monocot leaves

Dicot leaf	Monocot leaf
1. Cuticle thick at upper epidermis and thin at lower epidermis	Uniform cuticle on both the surface
2. Stomata are more on lower surface	Equal number of stomata on either side
3. Mesophyll is differentiated into palisade parenchyma and spongy parenchyma	Mesophyll is not differentiated into palisade and spongy parenchyma





Comparison of T.S. of a dicot and a monocot leaf

Upper epidermis

Palisade mesophyll

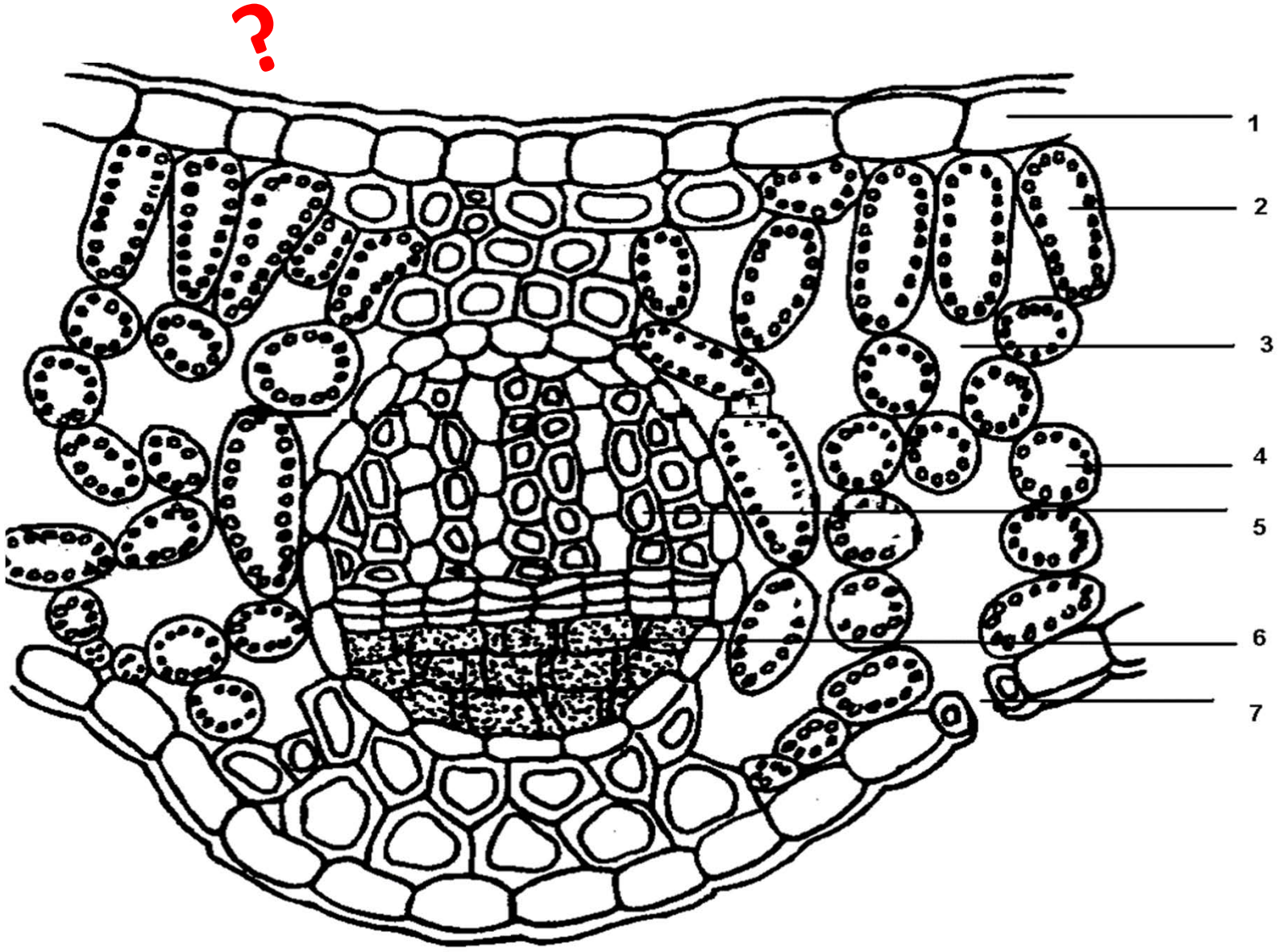
air space

Spongy mesophyll

Xylem

Phloem

stomata



Upper epidermis

mesophyll

Lower epidermis

Guard cells

stomata

Veins (vascular bundles)

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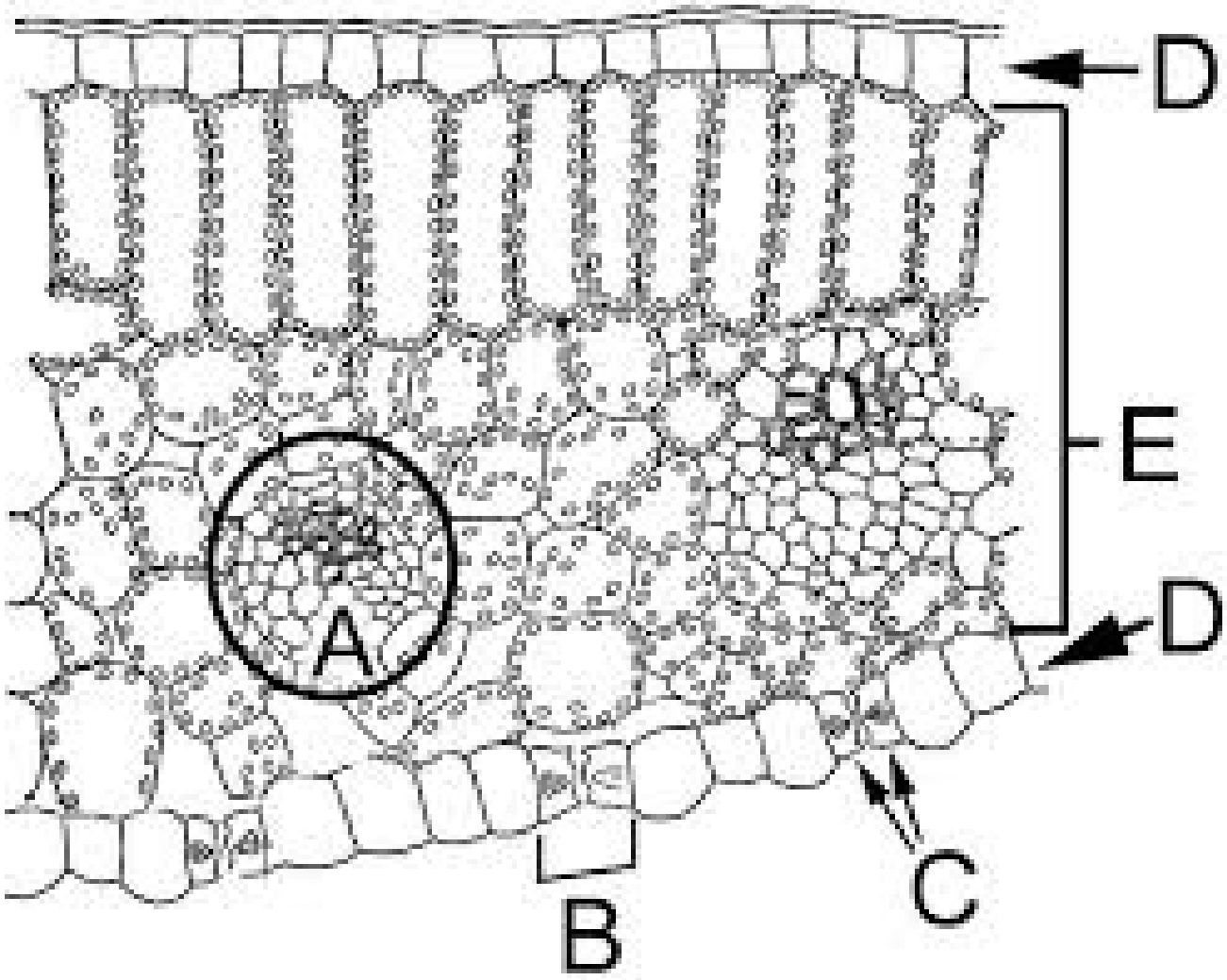

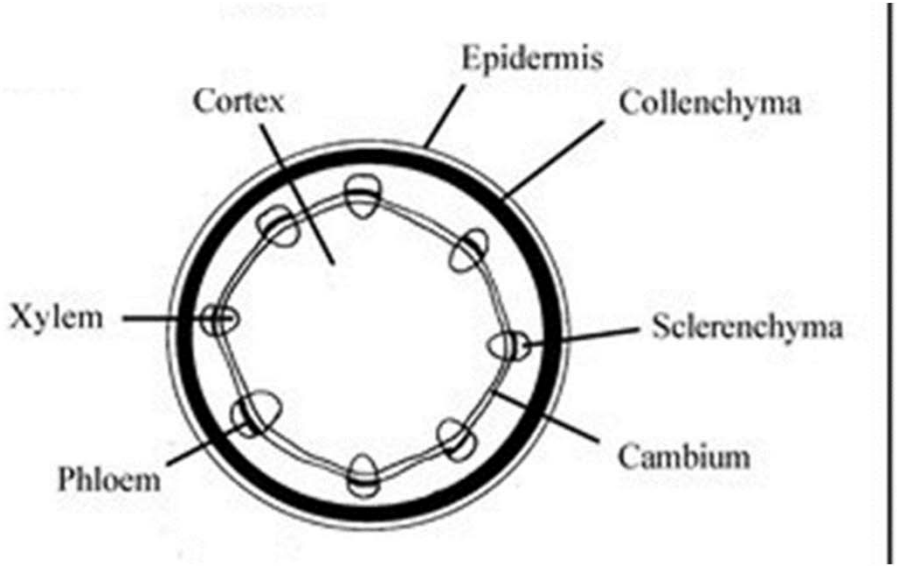

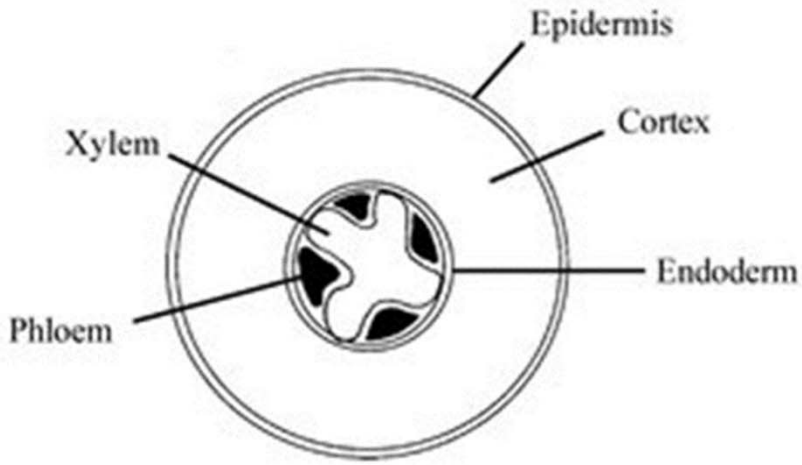

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Dicot Root

Monocot Root

Dicot Stem

Monocot Stem

Dicot leave

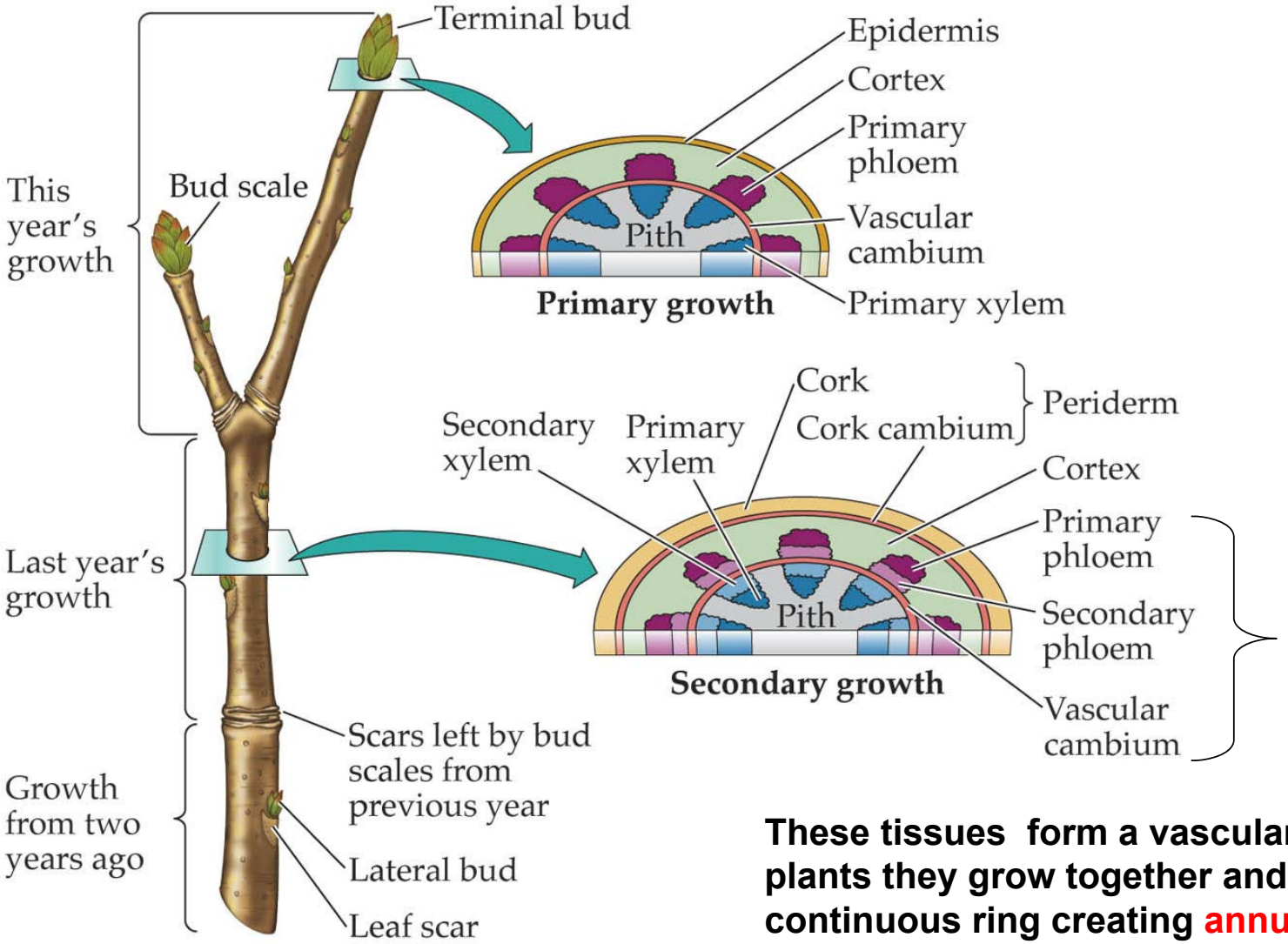
Monocot Leave

Plant Secondary Growth

النمو الثانوي في النبات

Plant Secondary Growth

النمو الثانوي في النبات

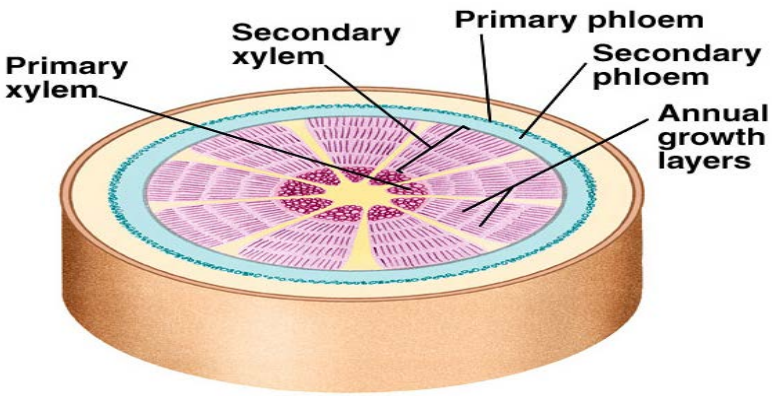


The vascular cambium is a plant tissue located between the xylem and the phloem in the stems and roots of vascular plants.

These tissues form a vascular bundle. In woody plants they grow together and diffuse to form a continuous ring creating annual growth rings.

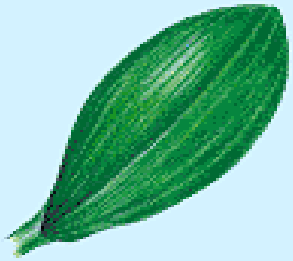
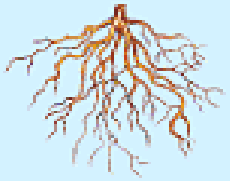
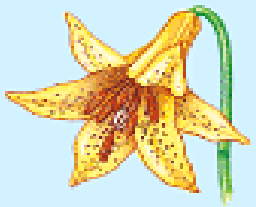
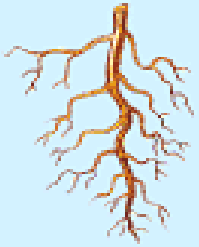
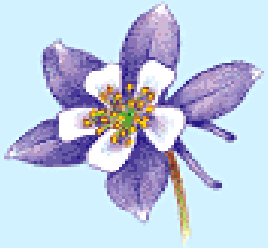
Plant Secondary Growth: Annual Ring

- **Secondary growth increases the diameter of stems and roots.**
- **Secondary growth results from the activity of vascular and cork cambia.**
- **Only eudicots have a vascular cambium and a cork cambium and thus undergo secondary growth.**
- **Annual rings can be seen by the cross sections of most tree trunks**
- **Annual rings form due to differential rates of growth in spring (when water is plentiful) and in summer.**
- **Wood that is no longer conducting water is known as heartwood.**
- **Sapwood is wood that is actively conducting water and minerals in the tree.**



النمو الثانوي يزيد من قطار السيقان والجذور.
ينتج النمو الثانوية من نشاط الأوعية والكامبيوم الفليني.
النباتات ثنائية الفلقة لديها **طبقة الكامبيوم الوعائي والكامبيوم الفليني** وبالتالي يحدث فيها النمو الثانوي.
القاطاعات العرضية لمعظم جذوع اشجار غابات المناطق المعتدلة لديها ما يسمى **بالحلقات سنوية**.
الحلقات السنوية تتشكل بسبب اختلاف معدلات النمو في فصل الربيع (عندما تكون الماء وفير)، وفي فصل الصيف(عندما تكون الماء شحيحا).
الخشب الذي لا ينقل الماء يعرف بالخشب الصلب.
الخشب الرخو هو الخشب الذي لايزال نشيطا في نقل الماء والمعادن في الشجرة.

Monocots vs. Dicots

Embryos	Leaf venation	Stems	Roots	Flowers
Monocots				
 One cotyledon	 Veins usually parallel	 Vascular bundles usually complexly arranged	 Fibrous root system	 Floral parts usually in multiples of three
Dicots				
 Two cotyledons	 Veins usually netlike	 Vascular bundles usually arranged in ring	 Taproot usually present	 Floral parts usually in multiples of four or five

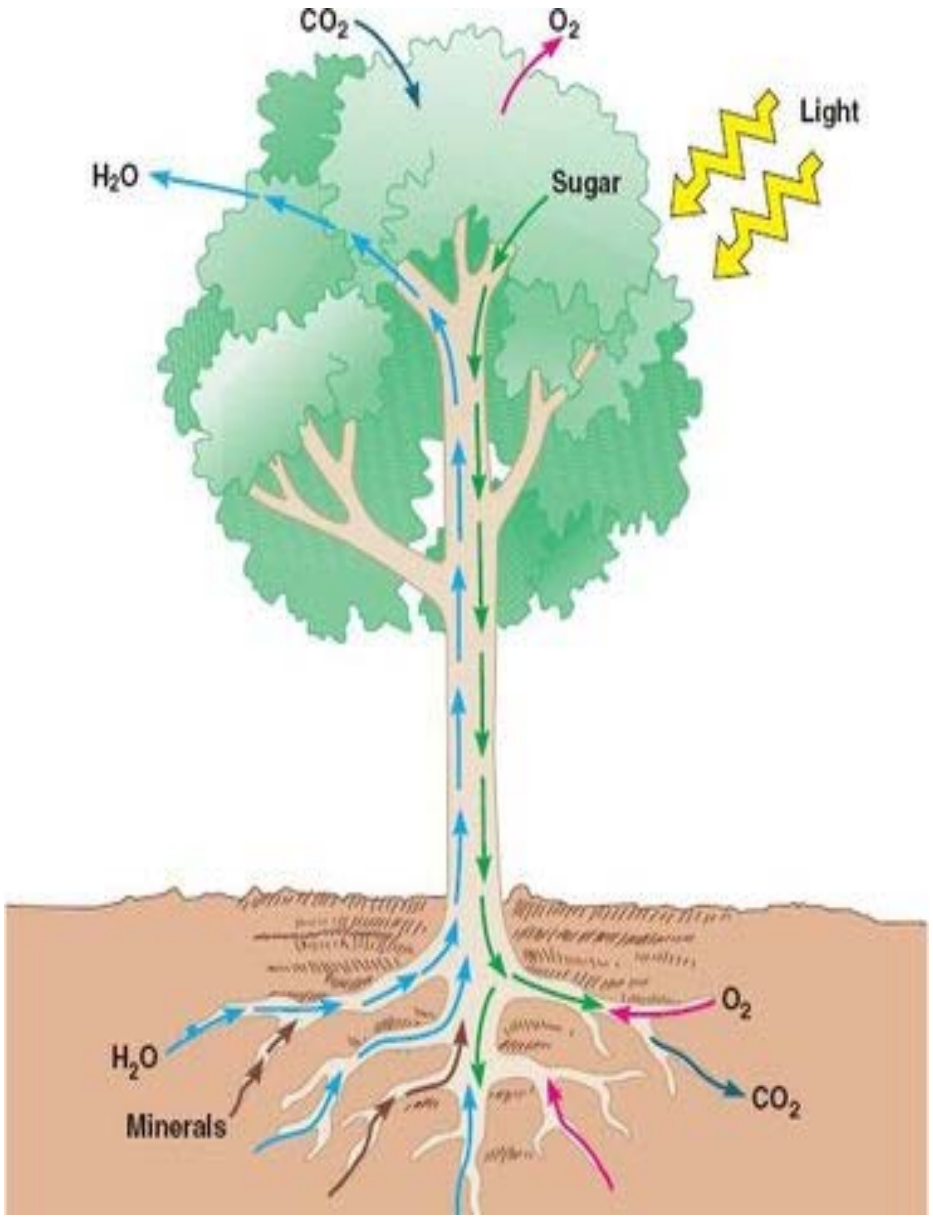
Plant Physiology

Plant physiology is a discipline of botany concerned with the functioning of plants.

There is no circulatory system in plants, but water and minerals moves from root to leaves, and nutrients moves from leaves to roots.

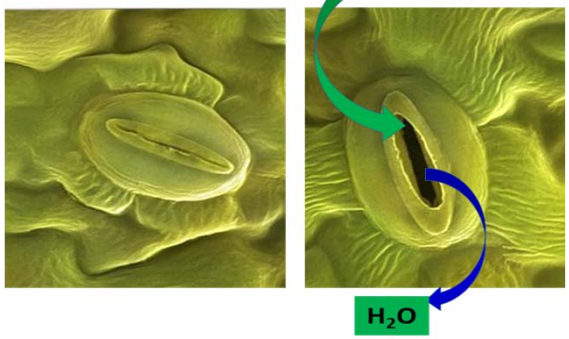
Different levels of structural organization are:

- Cell - unit of structure of all living organisms
- Tissue - composed of groups of similar cells
- Organs - composed of groups of tissues functioning together
- Organ Systems - composed of groups of organs functioning together
- Organism - an individual animal, plant, or single-celled life form



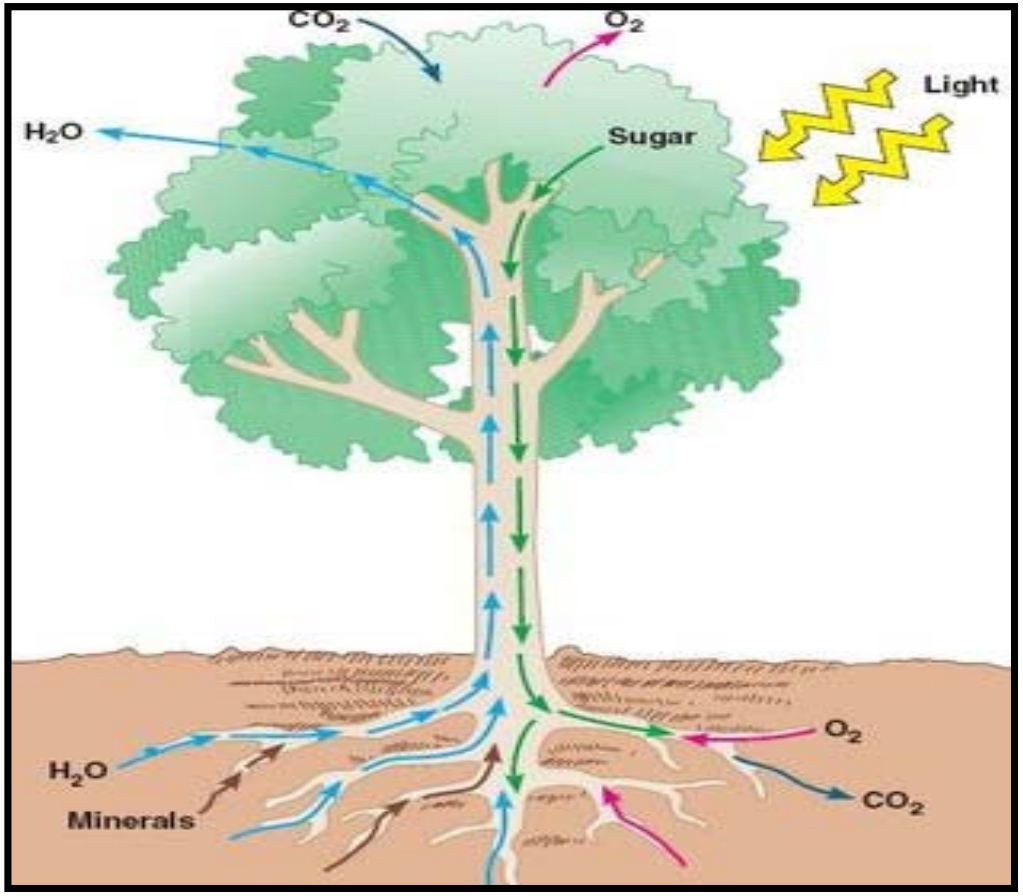
Transpiration

the evaporation of water from plant leaves



Phytohormones (Plant Hormones)

- Auxin
- Cytokinins
- Gibberellins

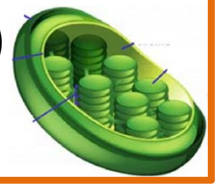


Photosynthesis

$6CO_2 + 6H_2O$

1. Photochemcial phase (Light reaction)
2. Biosynthetic phase (Calvin cycle)

$C_6H_{12}O_6 + 6O_2$



Respiration

$C_6H_{12}O_6 + 6O_2$

1. Glycolysis
2. Krebs cycle (TCA) cycle

$6CO_2 + 6H_2O + ATP(Energy)$

Types of transport in Cells

- **PASSIVE** TRANSPORT (No energy needed (ATP))
  Example: diffusion and osmosis
- **ACTIVE** TRANSPORT (Requires cellular energy (ATP))

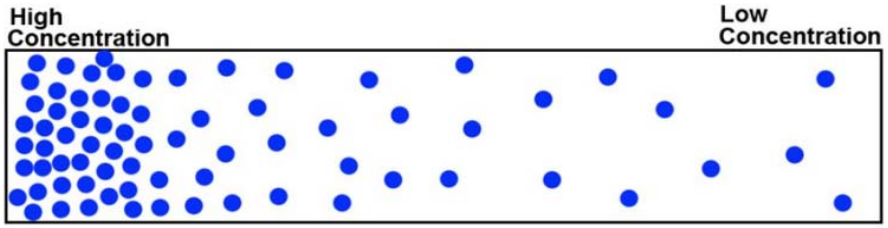
Plant-Water Relations

Three possible relationships depends on the **type of solution** and its **concentration**

- Hypotonic
- Isotonic
- Hypertonic

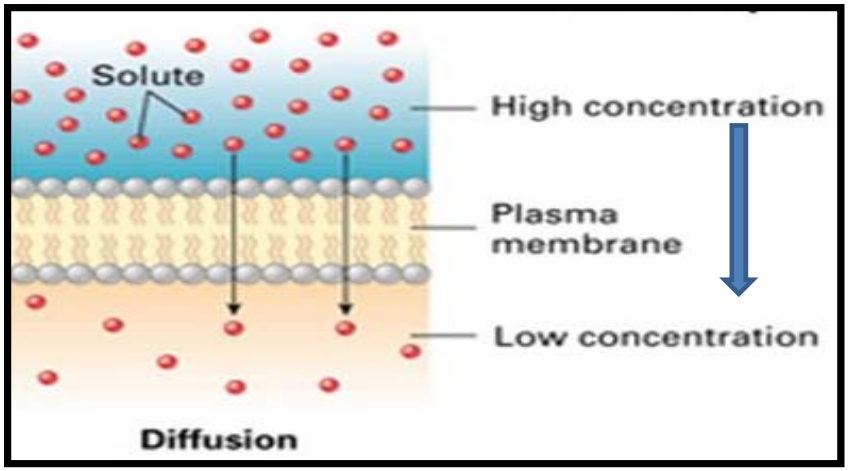
Types of transport in Cells

Concentration - the amount of a particular substance in a contained area compared with the amount of the same substance in another area



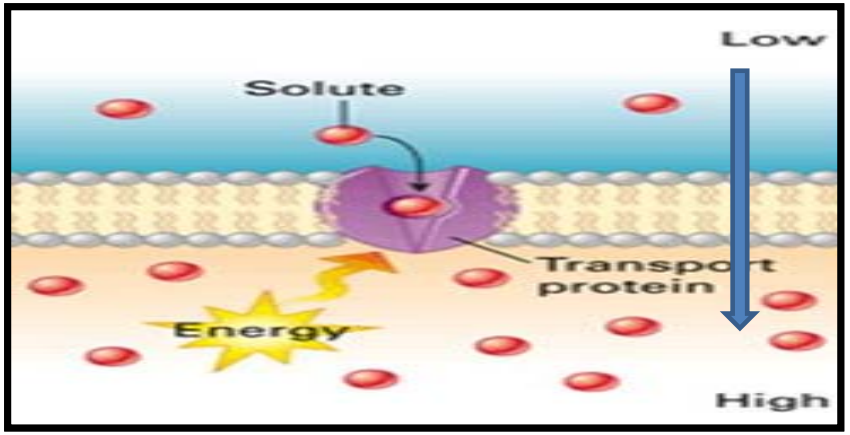
PASSIVE TRANSPORT –

- The movement of substances through a membrane from a region of high to a region of low concentration –
(النقل السلبي - حركة المواد عبر غشاء من منطقة التركيز الأعلى إلى منطقة التركيز المنخفض
- No energy needed (ATP)
لا تحتاج للطاقة (أمثلة على ذلك الانتشار والأسموزية
- Example: diffusion and osmosis



ACTIVE TRANSPORT –

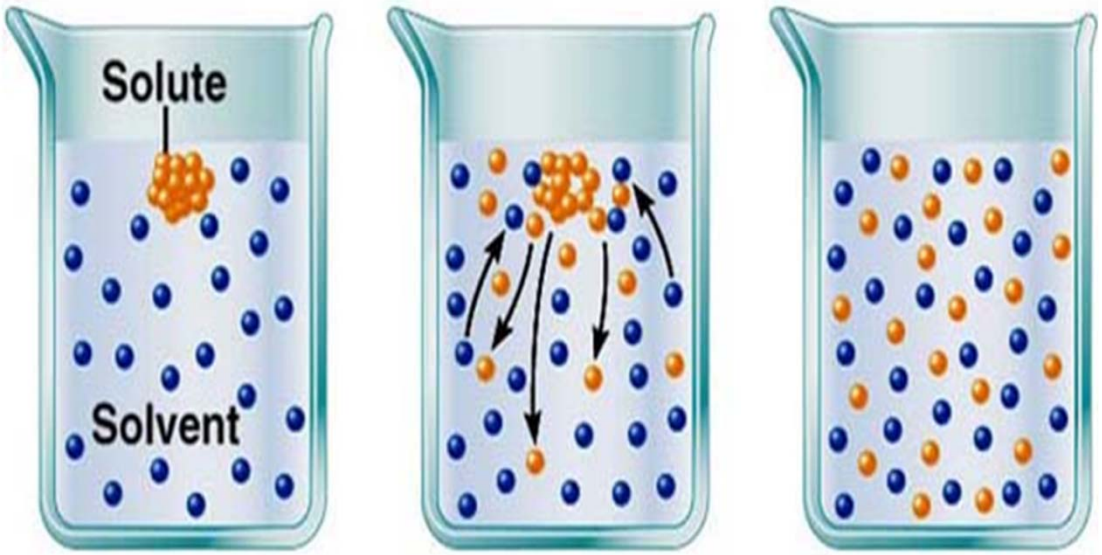
- The movement of substances through a membrane from a region of low concentration to a region of high concentration –
النقل النشط - حركة المواد عبر غشاء من منطقة التركيز المنخفض إلى منطقة التركيز العالي
- Requires cellular energy (ATP)
يتطلب استخدام طاقة خلوية



Processes of transport in the living system

الانتشار

1. Diffusion: the tendency of molecules to move from an area of higher concentration to an area of lower concentration



التناضح

2. Osmosis: movement of water through a membrane from a region of higher to lower concentration

المذاب

-Solute - substance being dissolved in a liquid (e.g. salt)

المذيب

-Solvent - substance doing the dissolving (e.g. water)

النفاذية

-Permeability - the extent to which a membrane will allow particular sized molecules to pass

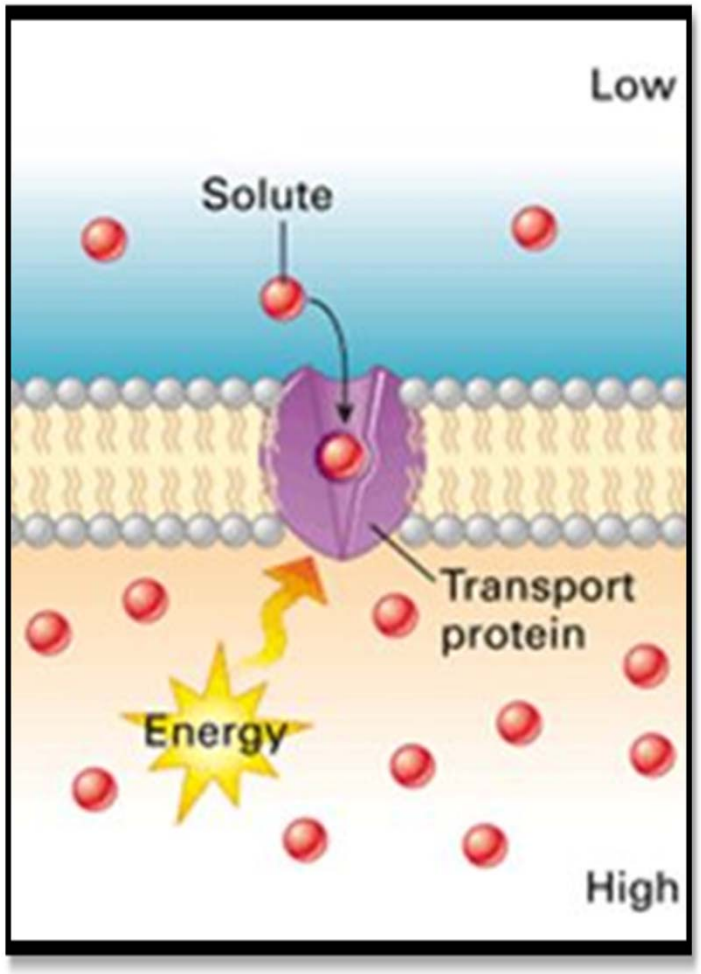
غشاء شبه نافذ (نفاذية اختيارية)

-Semi-permeable membrane (selectively permeable)-allows some molecules to pass but not others

- **The goal of both diffusion and osmosis is to reach EQUILIBRIUM within the cell.**
  الهدف من كل من الأنتشار والتناضح هو الوصول إلى التوازن او الإتزان داخل الخلية
- **EQUILIBRIUM is a condition in which the movement in one direction is equal to the movement in another direction** التوازن او الإتزان هو حالة يكون فيها حركة الماء في اتجاه أي اتجاه تساوي حركته في الاتجاه الآخر

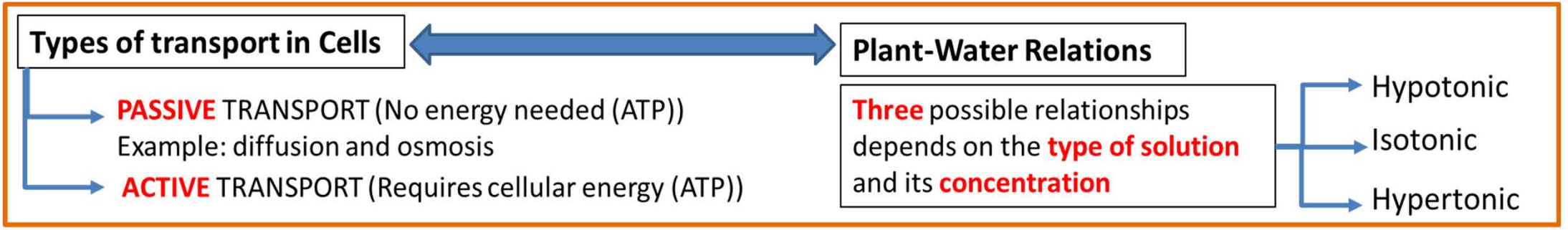
Active Transport

- the movement of a substance against the concentration gradient. (uphill)
- Active transport requires cell to USE ENERGY
- **Sodium pump** - transports three sodium ions out of the cell and two potassium ions into the cell
- Both are against the concentration gradient
- The energy needed to perform this activity is supplied by ATP (adenosine tri-phosphate)
- ATP is a unit of energy made by the cell



النقل النشط هو حركة المادة ضد تدرج التركيز. (وهذا أمر شاق)
الخلية تتطلب وتحتاج استخدام طاقة في النقل النشط
مضخة الصوديوم – عبارة عن نقل ثلاثة أيونات من الصوديوم إلى خارج الخلية واثنين من أيونات البوتاسيوم إلى داخل الخلية
كل من النقل النشط ومضخة الصوديوم ضد تدرج التركيز
يتم توفير الطاقة اللازم لتنفيذ هذا النشاط بواسطة مركب ادينوسين ثلاثي الفوسفات (أي تي بي) الغني بالطاقة
(أي تي بي) هي وحدة الطاقة التي تبنيها وتنتج في الخلية

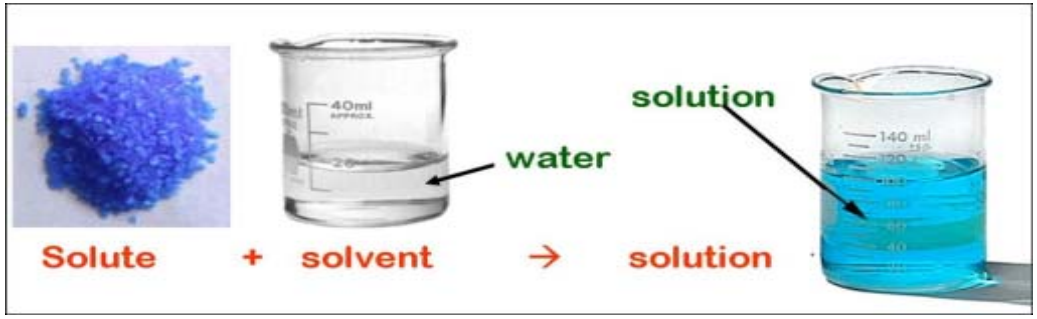
- Whether passive or active transport is needed depends on the CONCENTRATION GRADIENT
- The concentration gradient is the difference in the concentration of a substance in two different spaces
- Concentration - the amount of a particular substance in a contained area compared with the amount of the same substance in another area



سواء النقل السلبي أو النقل النشط يعتمدان على ممال التركيز
التدرج التركيز - هو الفرق في تركيز مادة في مكانين مختلفين
التركيز - كمية من مادة معينة في مكان ما مقارنة مع كمية من نفس المادة في مكان أخرى

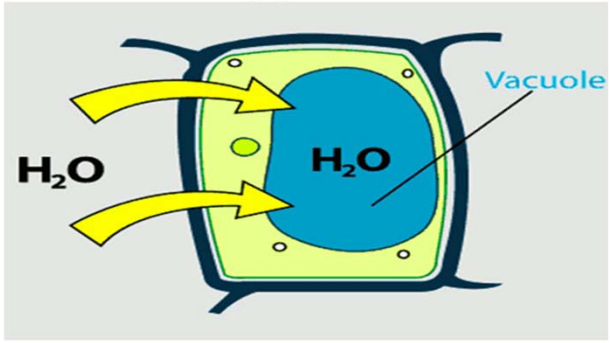
Plant-Water Relations

<u>SOLUTION</u>: A liquid mixture in which the minor component (the solute) is uniformly distributed within the major component (the solvent).



وسط او محلول ناقص التوتر. (منخفض التركيز)

Hypotonic



Turgid ممتلئة

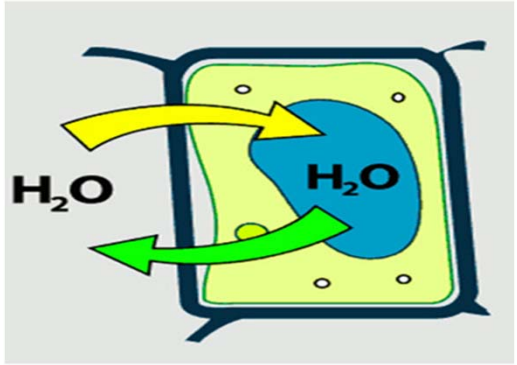
إذا كان الخلية النباتية ممتلئة تكون قوية جدا، وهي حالة صحية في معظم النباتات

Hypotonic-

A solution that causes a cell to swell because of osmosis meaning water rushes into the cell

وسط او محلول متساوية التوتر (سوي التركيز)

Isotonic



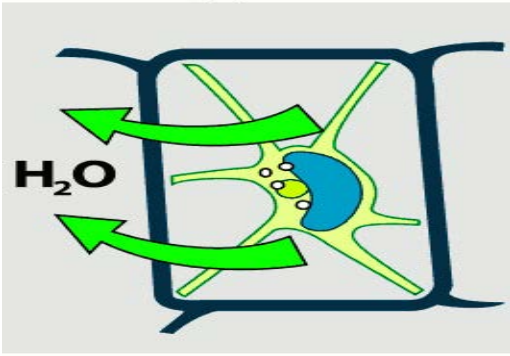
Flaccid مترهلة

Isotonic-

A solution that causes no change in cell size. Meaning there is no movement of water.

وسط او محلول مفرط التوتر (عالي التركيز)

Hypertonic



Plasmolyzed منكمشة

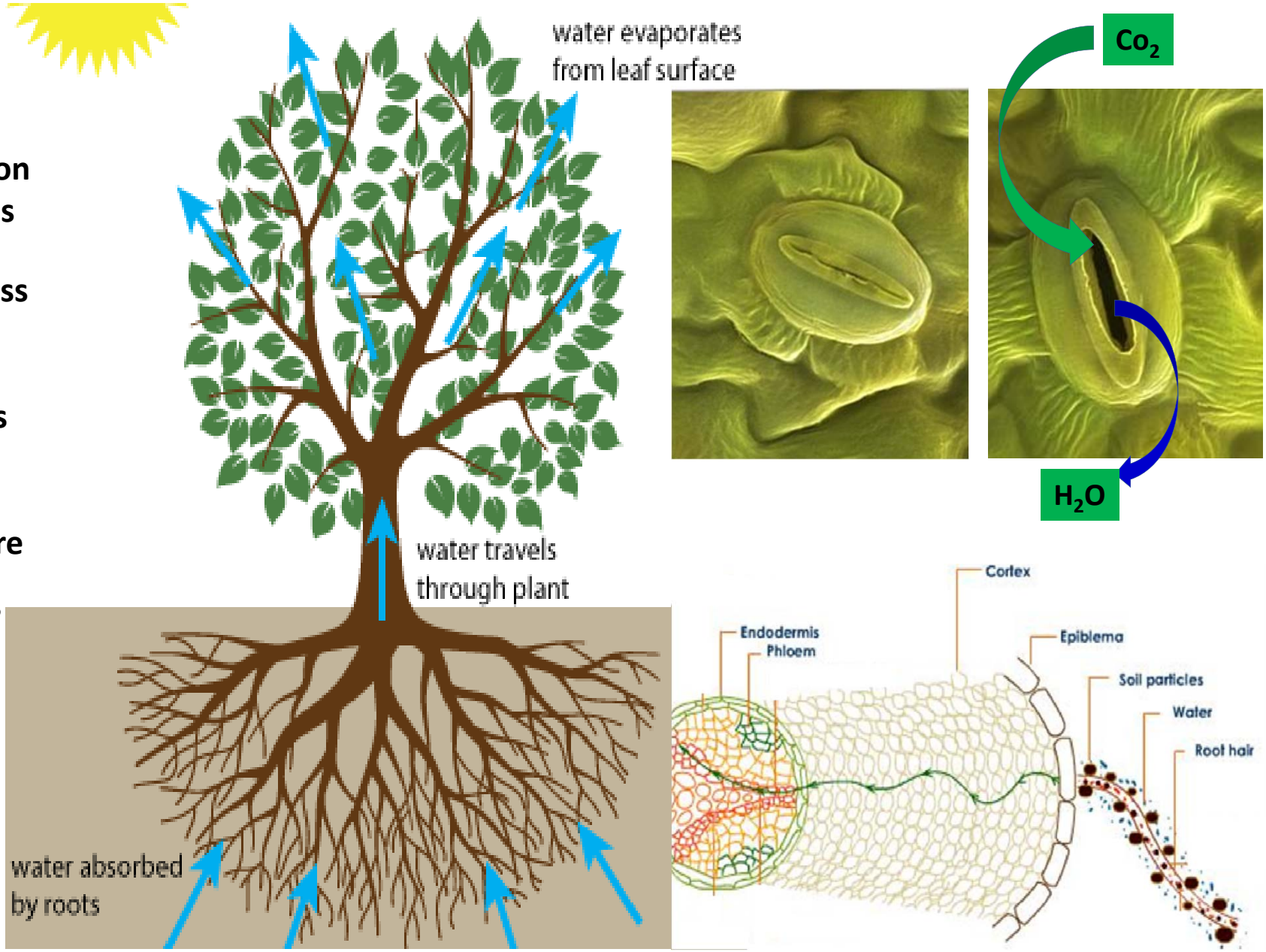
Hypertonic-

A solution that causes a cell to shrink because of osmosis. Meaning water leaves the cell.

TRANSPIRATION

It is mainly the evaporation of water from plant leaves

Transpiration is the process by which water is carried through plants from roots to small pores on the underside of leaves, where it changes to vapor and is released to the atmosphere.



Why is water important to (plant) cells?

- Water constitutes about 70% by weight of annual plants
- Water has multiple roles in plant cells

1. Thermal property: a liquid!
   - High heat potential: can absorb energy changes without large temperature changes (slows heating and cooling)
2. "Universal" solvent required for mineral uptake and transport
3. It is a requirement for biochemical reactions to proceed
   - Most enzymes are water soluble

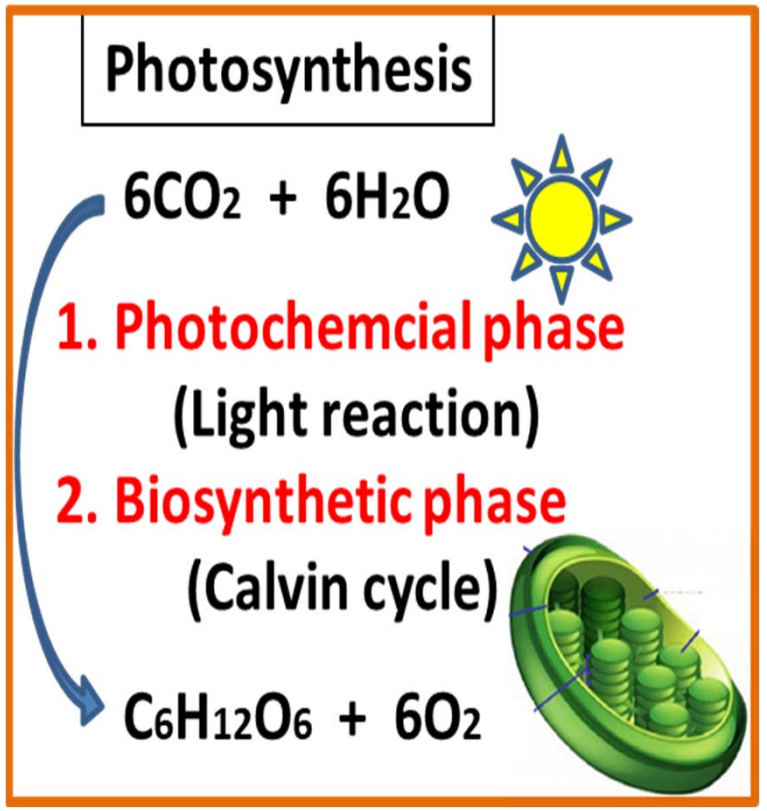
Photosynthesis

- **Green plants takes carbon dioxide (CO_2) from the air, and water (H_2O) from the soil. The plants combine the CO_2 with the H_2O to make the sugar (Glucose ($C_6H_{12}O_6$)**

- Photosynthesis is the conversion of light energy to chemical energy by chlorophyll in chloroplasts

- Overall Net equation for photosynthesis:
  - 6 Water + 6 Carbon dioxide gives glucose + 6 oxygen (when catalyzed by chlorophyll in the presence of sunlight)

$$6CO_2 + 6H_2O = C_6H_{12}O_6 + 6O_2$$



- **Photosynthesis** completes in **two phase-**

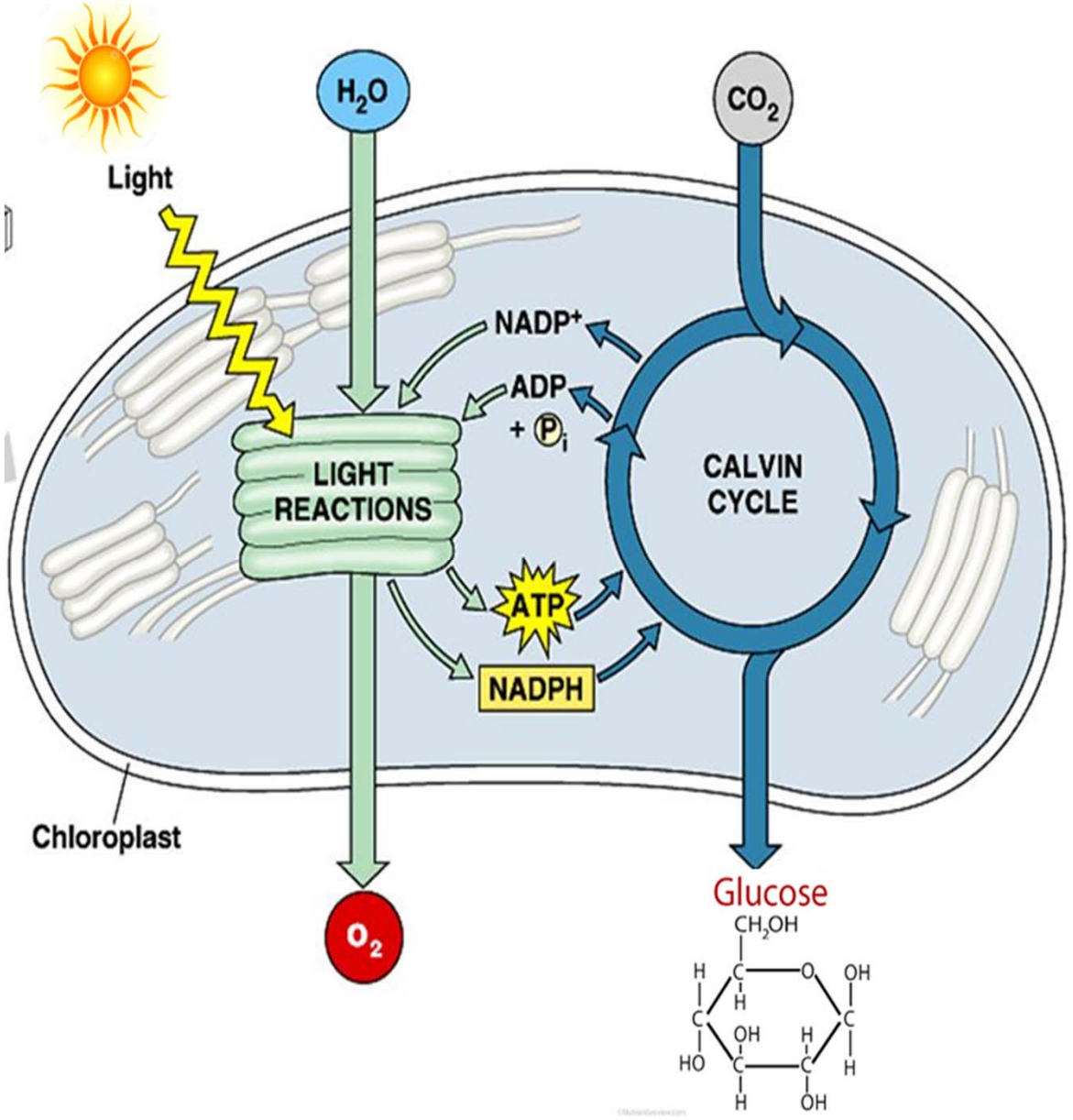
-Photochemcial phase (Light reaction)
-Biosynthetic phase (Calvin cycle)

- **In the Photochemical phase (light reaction), the water molecular breakdown into Hydrogen and Oxygen.**

- **The released Hydrogen molecules helps in the conversion Adenosine diphosphate (ADP) into Adenosine triphosphate (ATP),**

- **The released Hydrogen molecules also help in the conversion of Nicotinamide adenine dinucleotide phosphate (NADPH) into reduced Nicotinamide adenine dinucleotide phosphate ($NADP^+$)**

- **ATP and Nicotinamide adenine dinucleotide phosphate ($NADP^+$)**
- **used in Biosynthetic phase called as Calvin cycle in which CO_2 molecules convert into Glucose.**



Types of photosynthesis

- **C3**
  - **The majority of plants** In the case of C3 photosynthesis, the first organic product of carbon fixation is a three-carbon compound, 3-phosphoglycerate, which is the reason these plants are termed the C3 plants.
- **C4**
  - **CO_2 temporarily stored as 4-C organic acids resulting in more efficient C exchange rate**
  - **Advantage in high light, high temperature, low CO_2**
  - **Many grasses and crops (e.g., corn, sorghum, millet, sugar cane)**
- **CAM**
  - **Stomata open during night**
  - **Advantage in arid climates**
  - **Many succulents (e.g., cacti, euphorbs, bromeliades, agaves)**

C3

النباتات بنباتات ثلاثية الكربون أو (نباتات C3غالبية النباتات على الأرض من هذه الفئة ، المنتج العضوي الأول الناتج من تثبيت الكربون هو مركب ثلاثي ذرات الكربون، (3- فسفوجليسرات)، وهذا هو سبب تسميت)

C4

تخزن ثاني اكسيد الكربون مؤقتا كأحماض عضوية رباعية ذرات الكربون

المنتج العضوي الأول الناتج من تثبيت الكربون هو مركب رباعي ذرات الكربون، (3- فسفوجليسرات).

تتميز بكفاءتها العالية في شدة الضوء (الإضاءة العالية)، درجة الحرارة العالية، والتراكيزالمنخفضة من ثاني اكسيد الكربون

العديد منها أعشاب ومحاصيل (على سبيل المثال، الذرة، والذرة الرفيعة والدخن وقصب السكر)

CAM

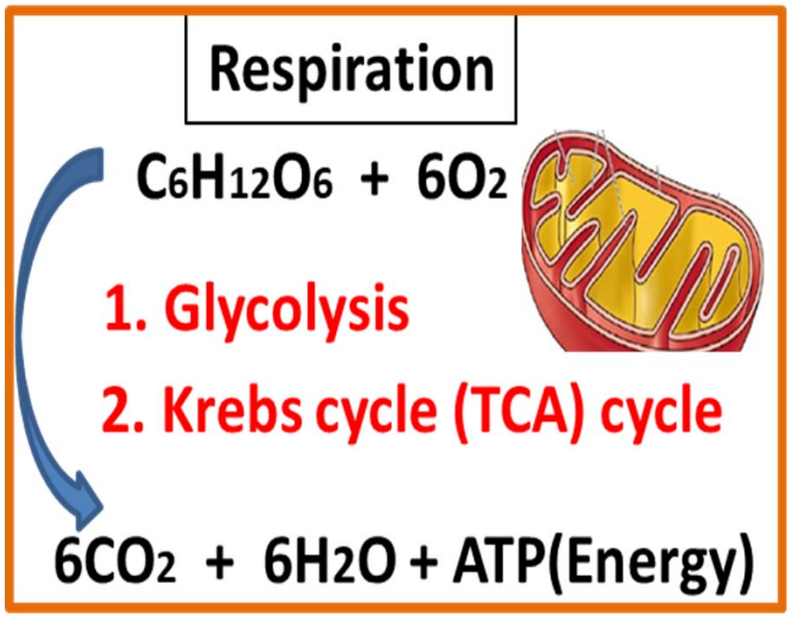
ثغورها مفتوحة أثناء الليل

تتميز بكفاءتها في المناخات الجافة

العديد منها عصارية (على سبيل المثال، الصبار،، أجافيس)

RESPIRATION

- **The breakdown of food materials within the cell to release energy in the form of ATP (Adenosine Tri Phosphate).**
- **$C_6H_{12}O_6 + 6O_2 = 6CO_2 + 6H_2O + ATP$ (Energy)**
- **It involves Cytoplasm and Mitochondria**

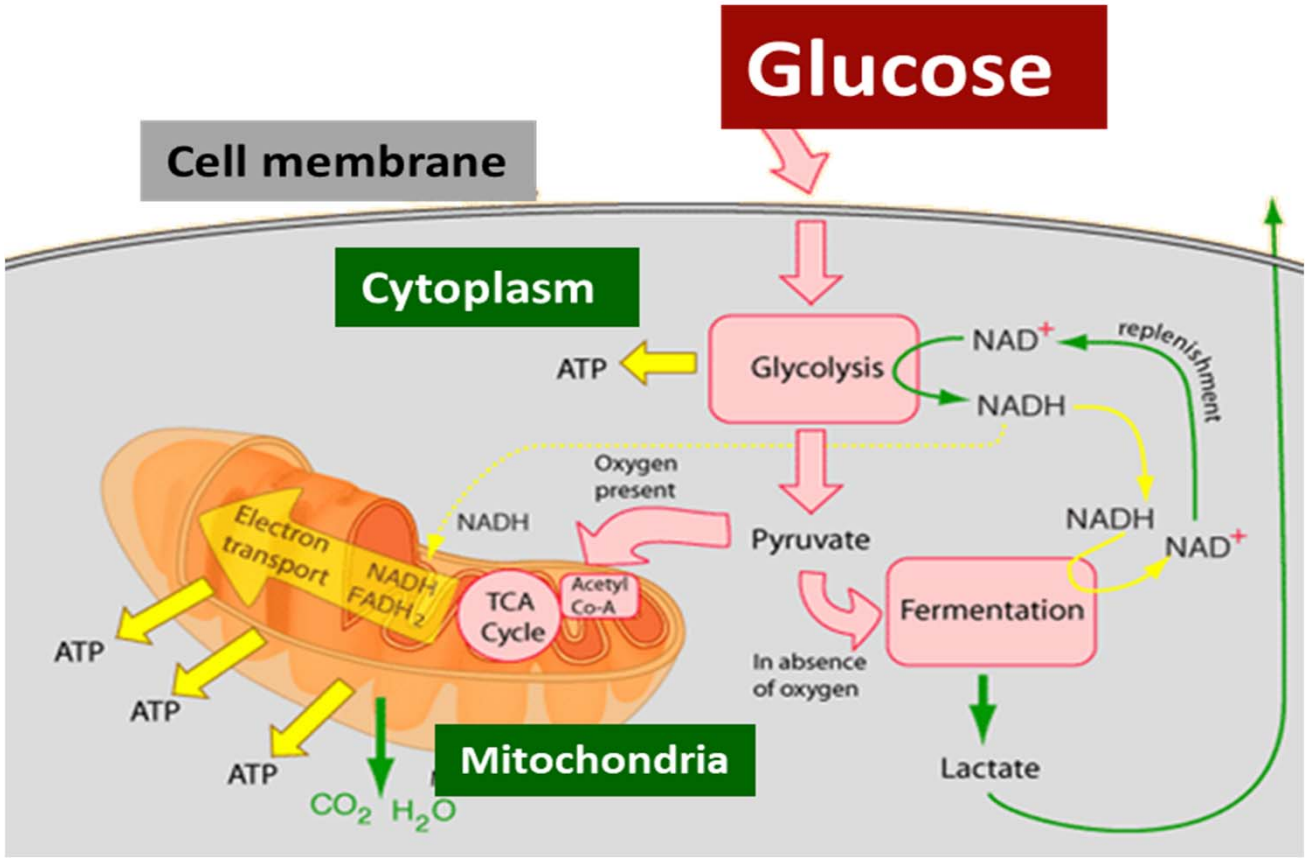


Glycolysis:

- Glucose enters into cytoplasm.
- Glucose passed thru series of enzymatic reaction in which glucose converted in to pyruvic acid.
- The process is called as Glycolysis.
- Glycolysis occurs in cytoplasm

The citric acid cycle – also known as Tricarboxylic acid (TCA) cycle or Krebs cycle:

In this cycle, in presence of oxygen, pyruvic acid resulted from the process of glycolysis enters into mitochondria, and passed thru a cyclic enzymatic reaction, and finally gives **ATP.**



ATP is used in the cell as a energy for various reactions.

The ATP produced in the Mitochondria; hence, the mitochondria is called as power house of the cell

PLANT GROWTH HORMONES

Plant hormones (also known as phytohormones) are chemicals that regulate plant growth

Hormone	Where Produced or Found in Plant	Major Functions
Auxin (IAA)	Embryo of seed, meristems of apical buds, young leaves	Stimulates stem elongation (low concentration only), root growth, cell differentiation, and branching; regulates development of fruit; enhances apical dominance; functions in phototropism and gravitropism; promotes xylem differentiation; retards leaf abscission
Cytokinins	Synthesized in roots and transported to other organs	Affect root growth and differentiation; stimulate cell division and growth; stimulate germination; delay senescence
Gibberellins	Meristems of apical buds and roots, young leaves, embryo	Promote seed and bud germination, stem elongation, and leaf growth; stimulate flowering and development of fruit; affect root growth and differentiation

Classification of Organisms

Taxonomy / Systematics

The branch of biology that deals with classification and nomenclature.

Nomenclature deals with the application of a correct name to a plant or a taxonomic group.

Kingdom:	**Plantae**
Class:	**Angiosperms**
Order:	**Arecales**
Family:	**Arecaceae**
Genus:	***Phoenix***
Species:	***P. dactylifera***

Taxonomic Hierarchy

Species:

- **Organisms sharing a set of biological traits and reproducing only their exact kind.**

  مجموعة من الكائنات الحية تشترك في مجموعة من الصفات الحيوية ولها القدرة على التزاوج فيما بينها. (النوع هو الوحدة الأساسية في التصنيف)

- **Species is the fundamental unit in taxonomy**

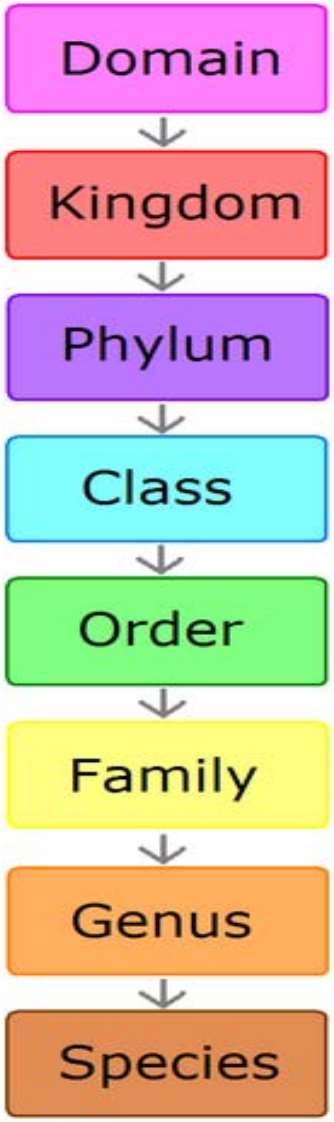
Genus: Closely related species

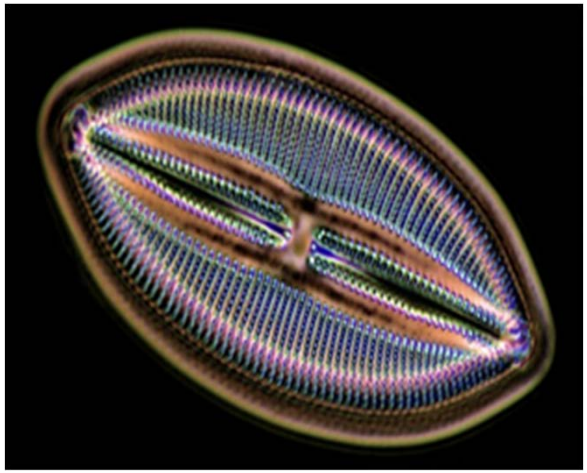
Family : Closely related genera

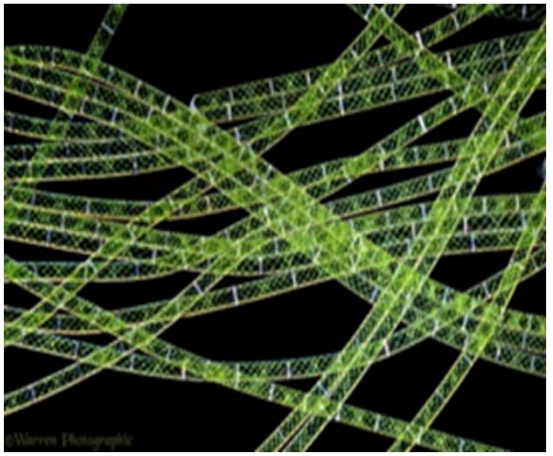
Order : Closely related families

Class : Closely related order

Phylum : Related classes



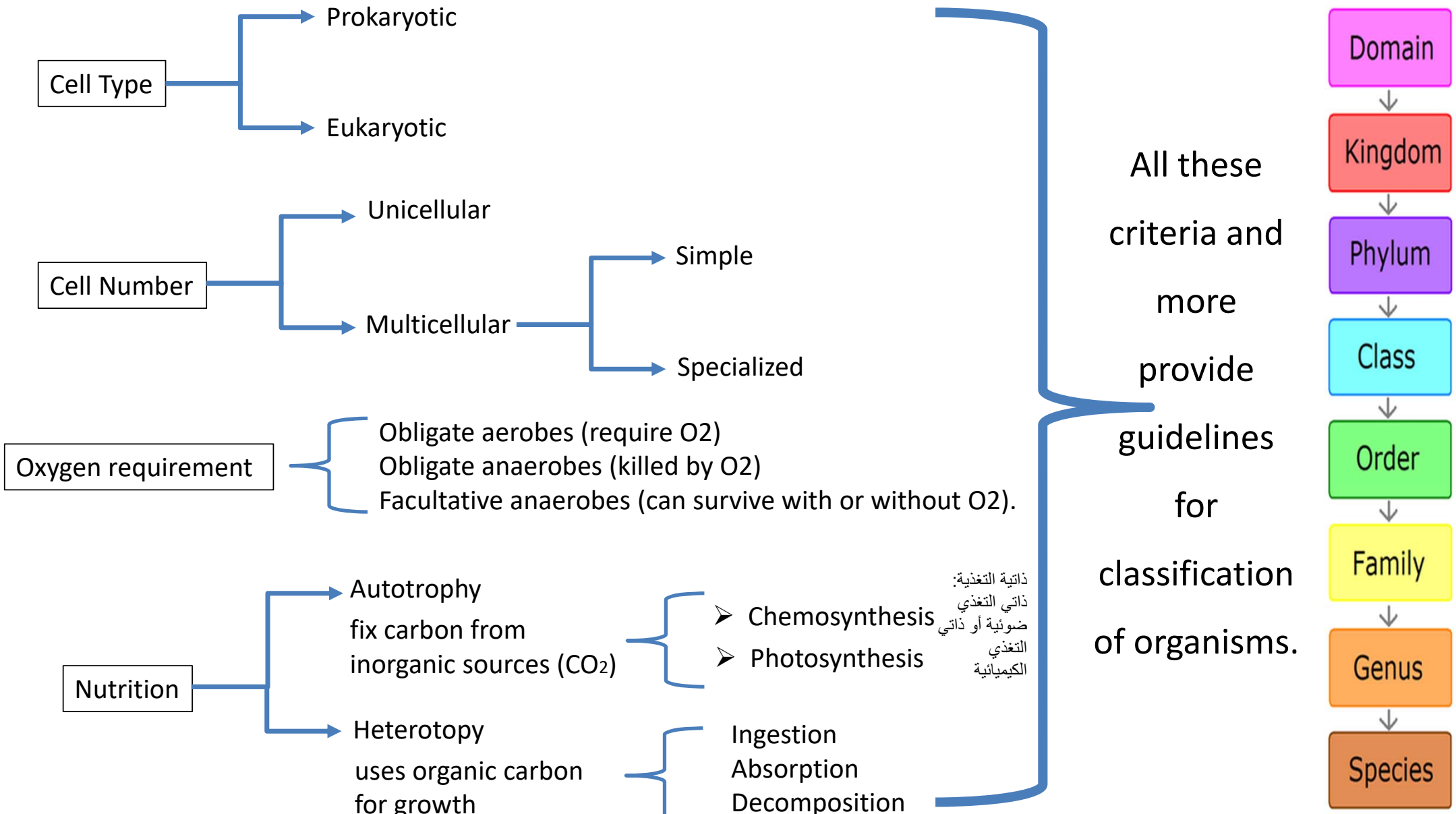




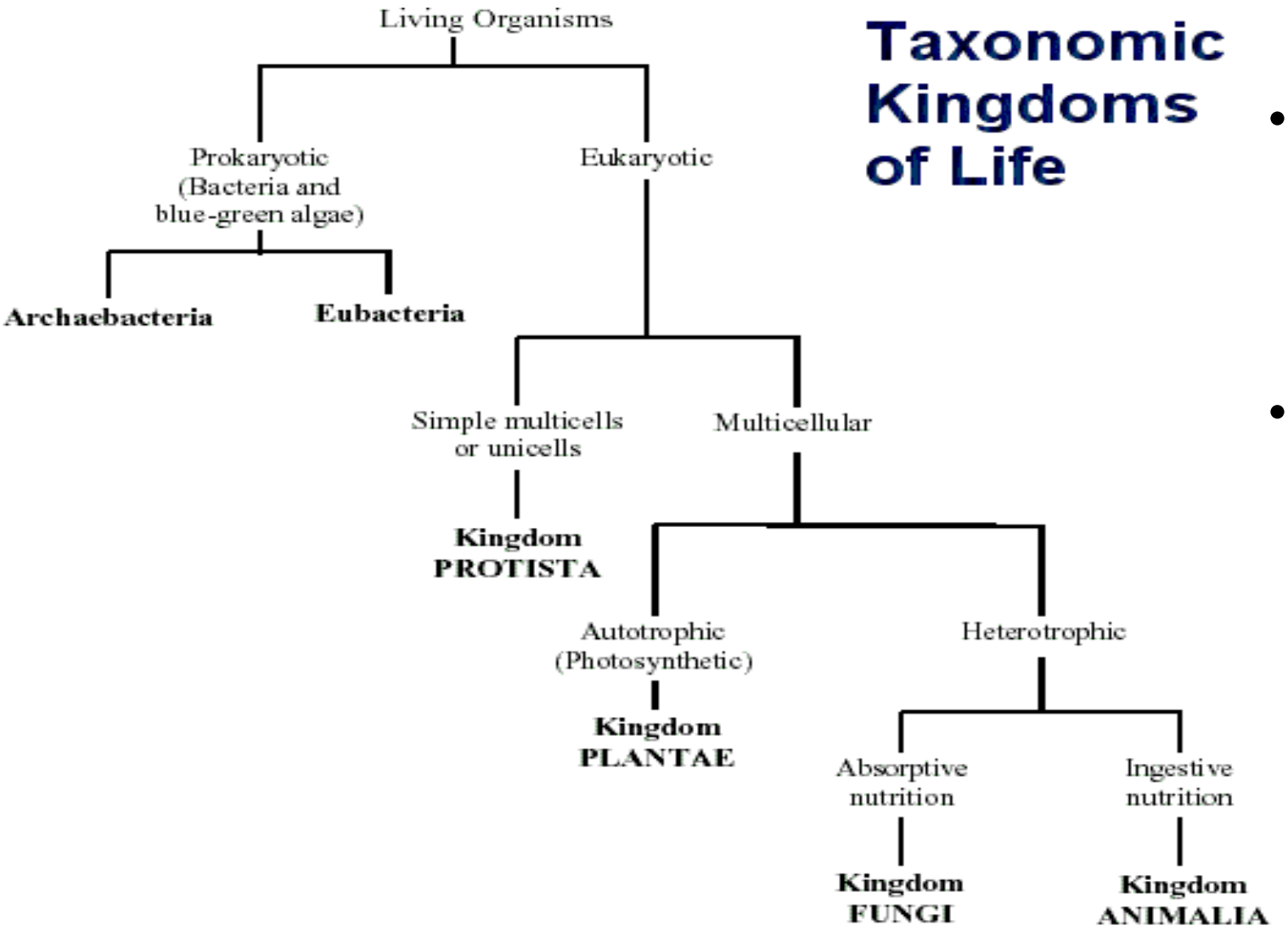








Cell Type
Prokaryotic
Eukaryotic
Cell Number
Unicellular
Multicellular
Simple
Specialized
Oxygen requirement
Obligate aerobes (require O2)
Obligate anaerobes (killed by O2)
Facultative anaerobes (can survive with or without O2).
Nutrition
Autotrophy
fix carbon from
inorganic sources (CO2)
Chemosynthesis
Photosynthesis
ذاتية التغذية:
ذاتي التغذي
ضوئية أو ذاتي
التغذي
الكيميائية
Heterotopy
uses organic carbon
for growth
Ingestion
Absorption
Decomposition
All these
criteria and
more
provide
guidelines
for
classification
of organisms.
Domain
Kingdom
Phylum
Class
Order
Family
Genus
Species

Classification of Organisms



Taxonomic Kingdoms of Life

- **The most basic category of organisms is called a *kingdom*.**
- **Most scientists divide organisms into five major kingdoms.**

وتسمى الفئة الأساسية للكائنات "مملكة".

معظم العلماء يقسم الكائنات الحية إلى خمس ممالك رئيسية

Biological Kingdoms

Five kingdom system:

Six kingdom system:

Three domain system:

Eight kingdom system:

Eu-bacteria

1. Unicellular
2. Prokaryotes
3. Both autotrophic and heterotrophic.
4. Reproduce by binary fission
5. Most of the bacteria causing disease in human.

Archae-bacteria

1. Unicellular
2. Prokaryotes with distinctive cell membranes.
3. Mostly heterotrophic, but some are autotrophic producing food by chemosynthesis.
4. Many live in harsh environments such as Sulfurous Hot Springs, very salty lakes, and in anaerobic environments, such as the intestines of mammals.

Protista

1. Unicellular and a few simple multicellular that is not specialized to perform specific functions.
2. Eukaryotes that are NOT Plants, Animal, or Fungi.
3. Protista include: subkingdom

1. Phytotrophs (plant-like protists) (photosynthetic).
2. Heterotrophs, Protozoa (animal-like protists) (ingestion).
3. Decomposers and parasites, (fungus-like protists)(Absorption)

Plantae

1. Multicellular and specialized for different functions.
2. Eukaryotic and carry out photosynthesis.
3. Plant cells have cell walls, that contain the polysaccharide cellulose.

Fungi

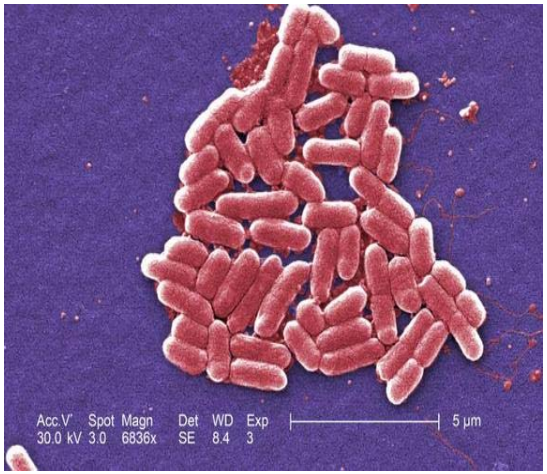
1. Mostly multicellular.
2. Eukaryotes.
3. The cell wall of fungi are made up of chemical chitin.
4. Heterotrophic and obtain their nutrients by releasing digestive enzymes into a food source.
5. act either as decomposers or as parasites in nature.

Animalia

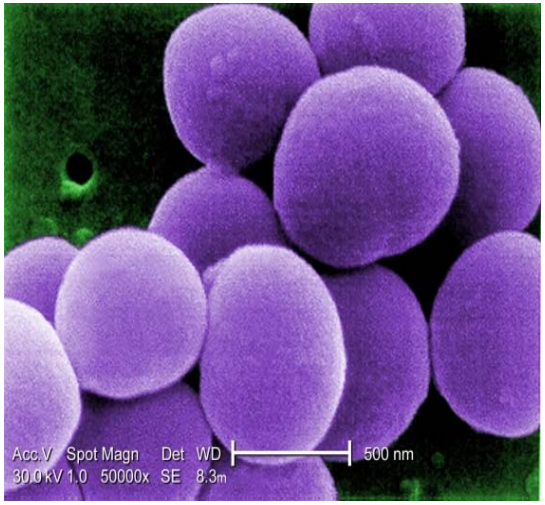
1. Multicellular.
2. Eukaryotic
3. Heterotrophic.
4. Animal cells have NO CELL WALLS.
5. Most animals can move from place to place.
6. Fish, Birds, Reptiles, Amphibians, and mammals-including humans belong to the Kingdom Animalia.
7. This Kingdom also includes sponges, jellyfish, worms, sea stars, and insects.

Kingdom	Cell type	Number of cells	Nutrition
Archaebacteria	prokaryotic	unicellular	autotrophy and heterotrophy
Eubacteria	prokaryotic	unicellular	autotrophy and heterotrophy
Protista	eukaryotic	unicellular and multicellular	autotrophy and heterotrophy
Fungi	eukaryotic	unicellular and multicellular	heterotrophy
Plantae	eukaryotic	multicellular	autotrophy and (rarely) heterotrophy
Animalia	eukaryotic	multicellular	heterotrophy

Eubacteria



Escherichia coli

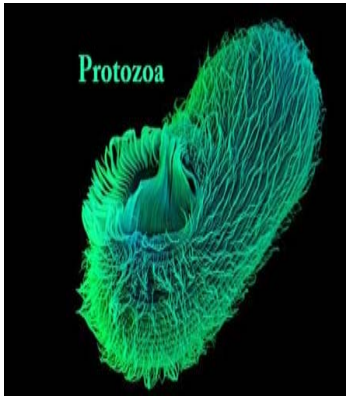


Staphylococcus

Archaebacteria

Halobacteria sp

Protista



Six kingdom system:

Eight kingdom system:

- **Algae** is a collective term for many organisms, so it is classified into different kingdoms.
- **Algae** belongs to four different kingdoms, including
    I. Kingdom Bacteria
    II. Kingdom Plantae
    III. Kingdom Protista
    IV. Kingdom Chromista.
- The classification of **algae** depends on its feature; however, the majority of algae are plants, so they are in the kingdom plantae.

Survey of Microorganisms

Microorganism is a microscopic organism; any organism too small to be viewed by the unaided eye.

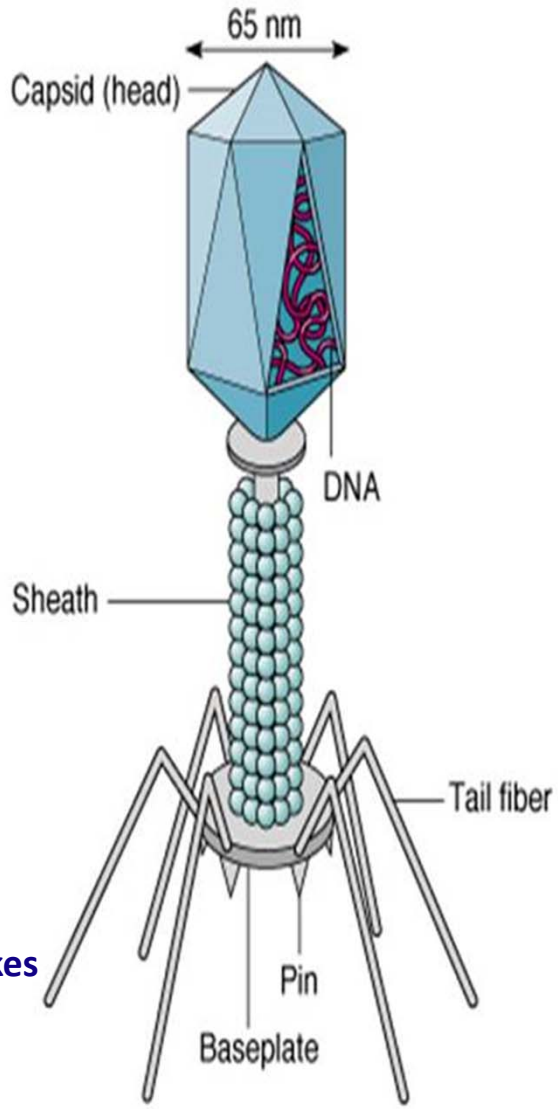
1. **Viruses**
2. **Bacteria**
3. **Cyanobacteria**
4. **Algae**
5. **Fungi**
6. **protozoa**

VIRUSES

- **Obligated intracellular parasite.** متطفلة اجباريا داخل الخلايا.
- **host specific:** بعضها لها عائل خاص بمعنى انها متخصصة في التطفل فتتطفل على كائن دون اخر او عضو دون اخر . وتقسم وفقا للعائل الى : فيروسات البكتريا (بكتيروفاج) وفيروسات حيوانية وفيروسات نباتية.
  - **bacteriophage**
  - **animal virus**
  - **plant virus**
- **according to its genetic material** ووفقا لمادتها الوراثية
  - **DNA virus** فيروس DNA
  - **RNA virus** فيروس RNA
- **Shape:** الشكل:
  معظم الاشكال شائعة هي متعدد الوجوه، وبعضها ذا شكل حلزوني

  Most common shape is icosahedral , some are helical shape
- **Structure:** البناء:
  غلاف بروتيني مواد وراثية او كابسيد . بعض الفيروسات الحيوانية لها بزوائد من البروتين السكري

  Protein capsid and genetic material some animal virus have envelope with glycoprotein spikes
- **Life cycle: lytic infection lysogenic infection** دورة الحياة: عدوى معتدلة وعدوى ضارية
- **Some animal viruses are closely associated with certain cancers** وترتبط بعض الفيروسات الحيوانية بشكل وثيق مع أنواع معينة من السرطان

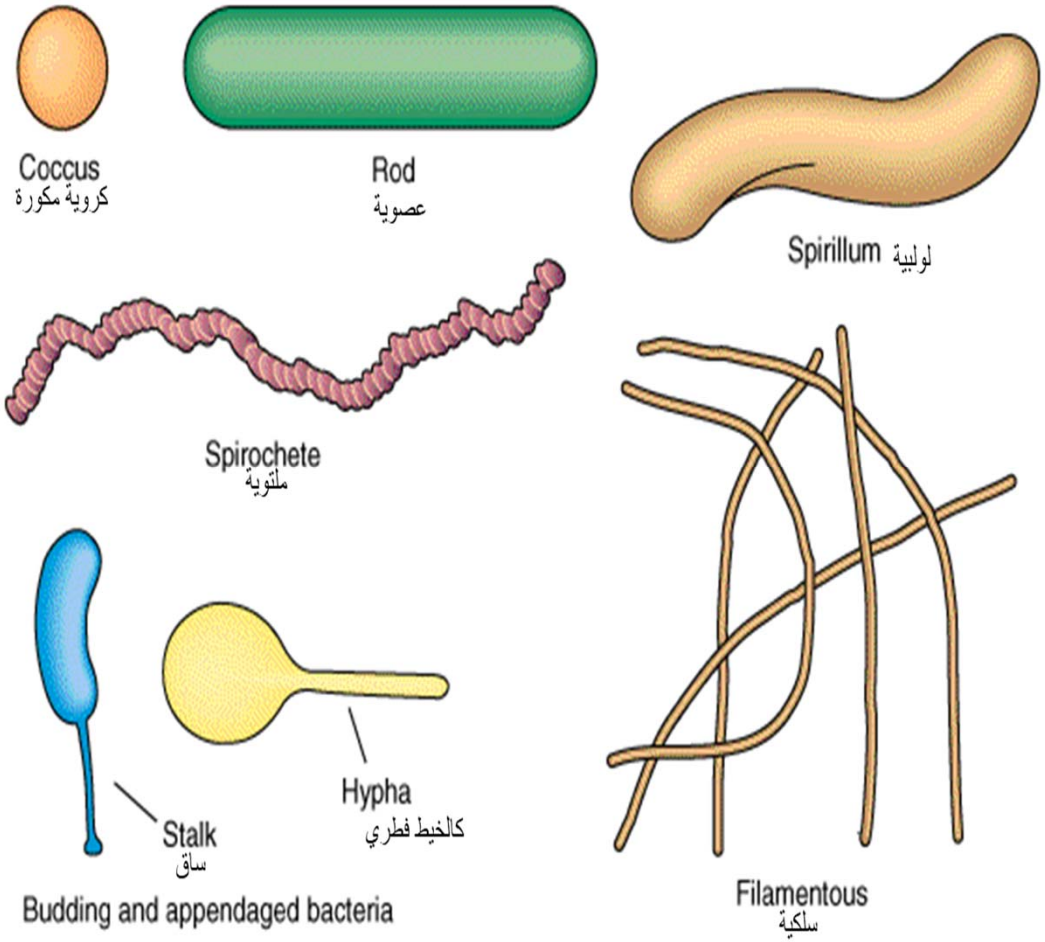


(a) A T-even bacteriophage

BACTERIA

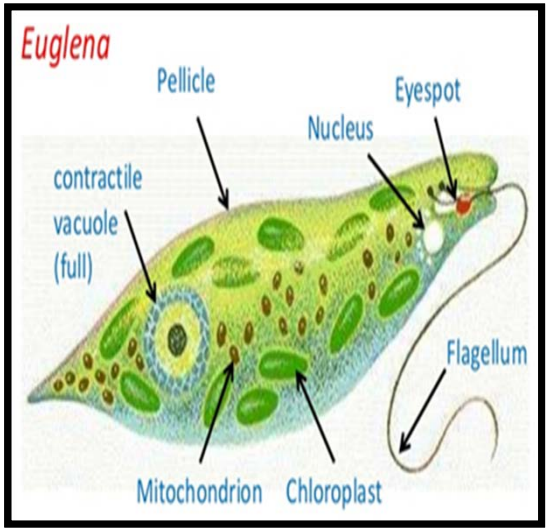
- **Bacterial are prokaryotes.**
- **Three are different shapes of bacteria:**
  - **Cocci (spherical, ovoid, or generally round shape)**
  - **Bacilli (a rod-shaped bacterium)**
  - **Spiral (Bacteria of spiral / helical shape)**

لها ثلاثة أشكال: المكورات كروية ، العصيات وحلزونية

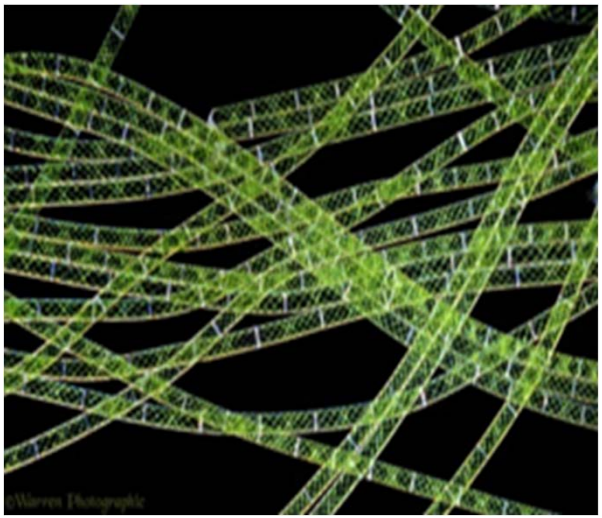


Algae

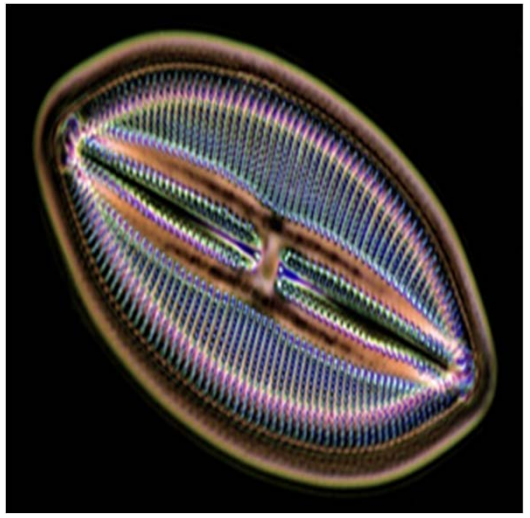
1. **Euglenoids**
   eg. Euglena
   الطحالب اليوجلينية
   على سبيل المثال.اليوجلينا (الحنديرة)
   تخزن المواد الغذائية – بصورة السكريات الدهنية - باراميلوم
   food storage - lipoid polysaccharide – paramylum



2. **Green algae**
   eg. Spirogyra and Chlamydomonas
   الطحالب الخضراء
   على سبيل المثال. كلاميدوموناس
   تخزين المواد الغذائية - بصورة النشا
   food storage – starch


Spirogyra

3. **Golden Brown algae**
   eg. Diatoms
   الطحالب البنية الذهبية
   على سبيل المثال. الدياتومات
   تخزين المواد الغذائية – زيوت ولوكوزين (سكرات متعددة)
   تحتوي فوكوزانثين، صبغة بنية اللون
   food storage – oil and leucosin (a polysaccharide)
   have fucoxanthin, a brownish pigment

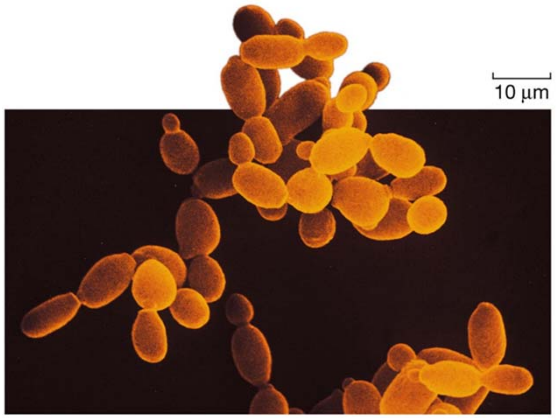

Diatoms

4. **Brown Algae**
   Mainly marine water algae
   الطحالب البنية
   طحالب المياه البحرية أساسا
   تخزين المواد الغذائية - لامينارين،
   سكرات متعددة ومانيتول
   food storage – laminarin, a polysaccharide and mannitol, a sugar alcohol


Brown Algae

Fungi

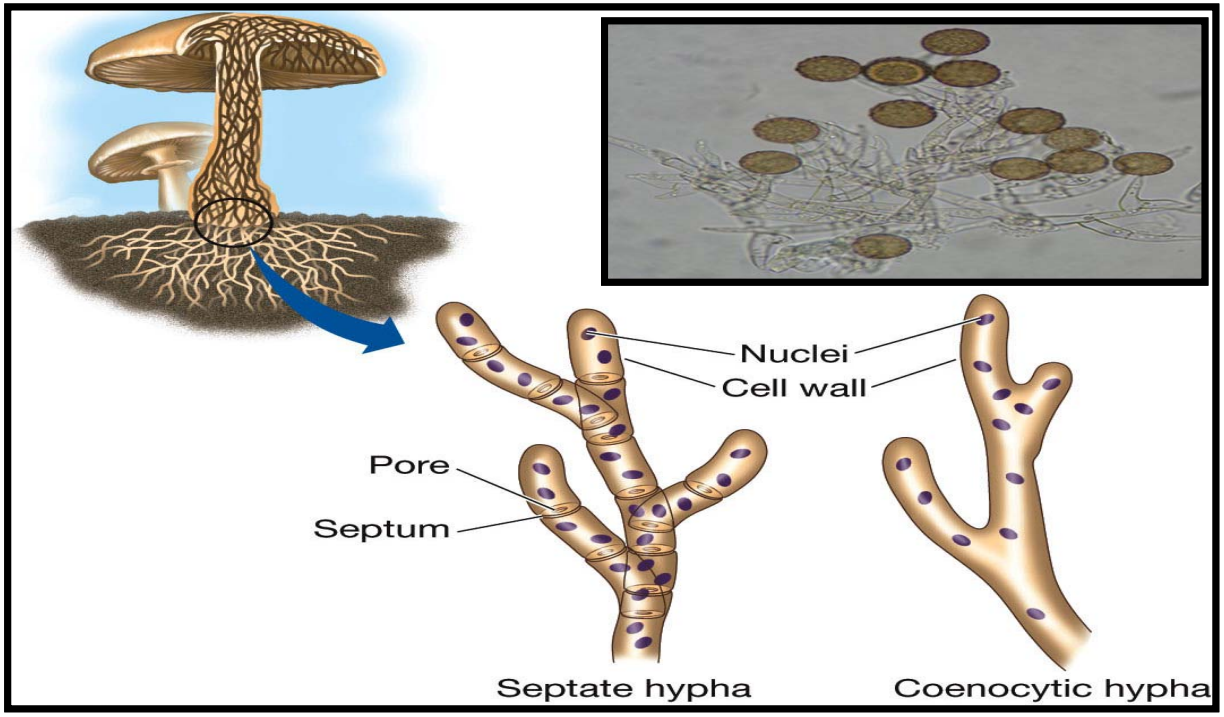
- The fungi are **not true plants because** they do not contain chlorophyll.
- Fungi are a kingdom of mostly microscopic organisms that are closely related to animals.
- Fungi are almost always invisible to the naked eye. At certain times, some fungi will produce large ‘fruiting bodies’ called mushrooms that produce huge numbers of spores for reproduction.
- The cell walls of fungi are made from a compound called ‘chitin’.

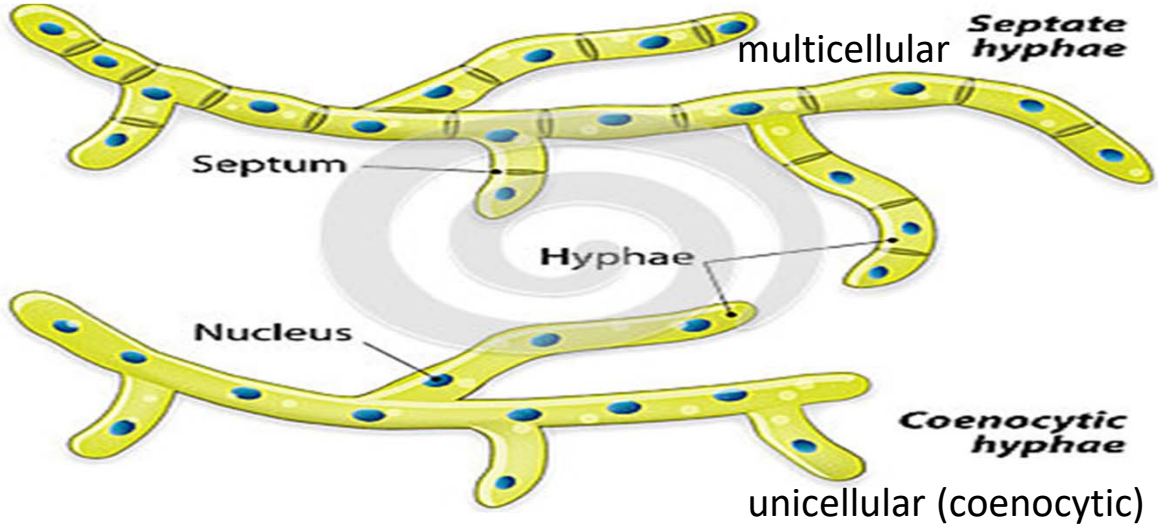


Saccharomyces sp.

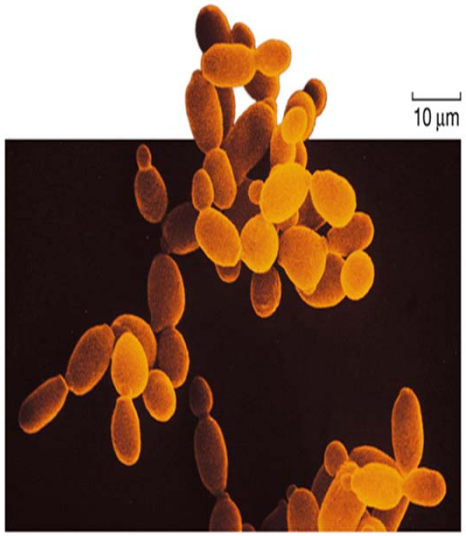
- The Fungi live as either single-celled organisms or multicellular organisms.
- Multicellular fungi:

1. Most of the body of a fungi is made from a network of long, thin filaments called ‘hyphae’. خيوط فطرية
   A. Some hyphae have incomplete cross walls or septa, and are called septate. حواجز
   B. Hyphae without septa are called coenocytic. مدمج خلوي
2. When the hyphae creates a complex network of filaments it is called a ‘mycelium’. غزل فطري
3. Because the hyphae of fungi are so thin, they have an incredibly high surface area to volume ratio. The large surface area makes fungi extremely well-adapted to absorbing nutrients from soil and other substrates.

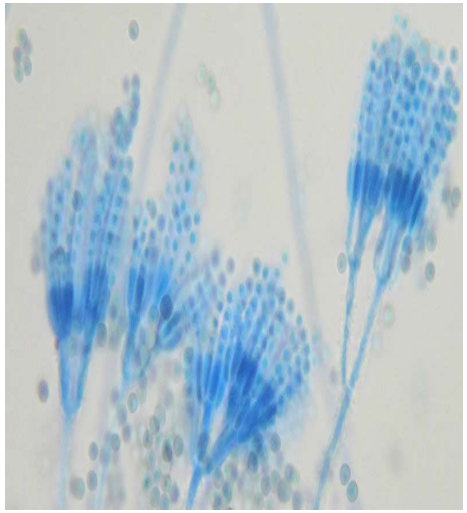




- Single-celled fungi are referred to as yeasts. The vast majority of fungi are multicellular.
- They include spore producing organisms such as **mushrooms**, **yeasts** and **molds**.



Saccharomyces sp. الخميرة



Penicillium

عفن الخبز

Yeast, Saccharomyces cerviseae, is a unicellular fungus, belongs to a group called **Ascomycetes**. Yeasts are able to metabolize carbohydrates into alcohol and carbon dioxide. Humans have utilized the fermentation of carbohydrates by yeasts to create fermented foods and drinks such as bread, beer and wine.

الفطريات الرقية أو الكيسية

A mushroom is a reproductive structure common to all species of fungi within the division **Basidiomycetes**.

الفطريات البازيدية

Molds belong to a group of fungi called **zygomycetes** ; examples are bread and fruit molds.

الفطريات الزيجوتية

LICHENS: Symbiotic Association (Nature's Perfect Marriage)

- **Lichens is association of fungus and photosynthetic organism (algae)**

الأشنات: عبارة عن فطر + كائن حي ضوئي التغذية

الفطريات الداخلة في التكافل هنا معظمهم من الفطريات الزقية

- **Mostly ascomycetes fungi associated with lichens**

الشريك الضوئي قد يكون من البكتيريا سيانية أو الطحالب، أو كلاهما.

- **Photosynthetic partner—cyanobacterium or alga, or both.**

يمكن لها البقاء على قيد الحياة في أقسى البيئات على سطح الأرض.

- **Can survive the harshest environmental condition.**
- **Lichens are very sensitive to toxic compounds—good indicators of air pollution.**

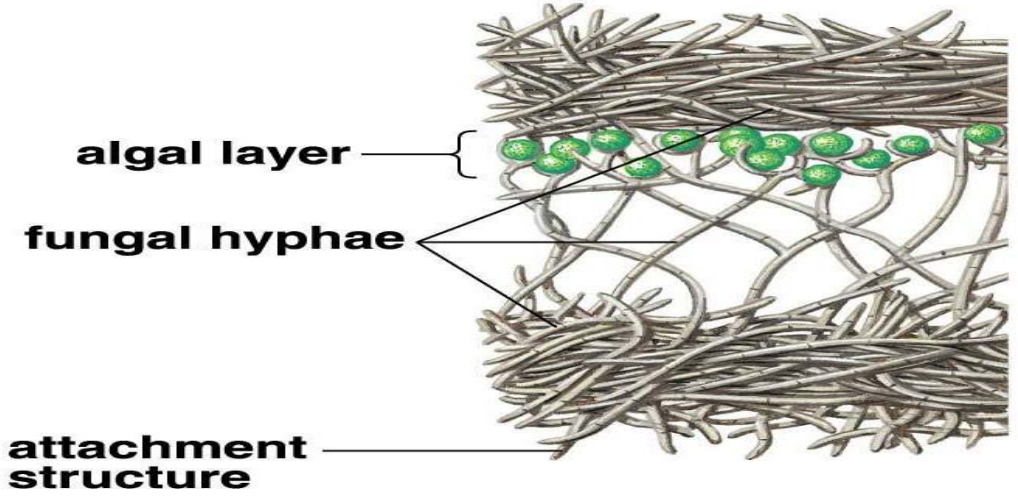
حساسة للغاية للمركبات السامة وتعتبر مؤشرات جيدة لتلوث الهواء.

الأشنات هي علامات بيئية كبيرة

- **Lichens are great ecological markers**

تستخدم كعلاج دوائي

- **Many Lichens have medicinal properties**



Plant systematics (part 1)

Eu-bacteria

1. Unicellular
2. Prokaryotes
3. Both autotrophic and heterotrophic.
4. Reproduce by binary fission
5. Most of the bacteria causing disease in human.

Archae-bacteria

1. Unicellular
2. Prokaryotes with distinctive cell membranes.
3. Mostly heterotrophic, but some are autotrophic producing food by chemosynthesis.
4. Many live in harsh environments such as Sulfurous Hot Springs, very salty lakes, and in anaerobic environments, such as the intestines of mammals.

Protista

1. Unicellular and a few simple multicellular that is not specialized to perform specific functions.
2. Eukaryotes that are NOT Plants, Animal, or Fungi.
3. Protista include: subkingdom

1. Phytotrophs (plant-like protists) (photosynthetic).
2. Heterotrophs, Protozoa (animal-like protists) (ingestion).
3. Decomposers and parasites, (fungus-like protists)(Absorption)

Plantae

1. Multicellular and specialized for different functions.
2. Eukaryotic and carry out photosynthesis (Chlorophylls a and b).
3. Plant cells have cell walls, that contain the polysaccharide cellulose.
4. Store reserve food as amylose (starch)
5. Sessile (can not move)

Fungi

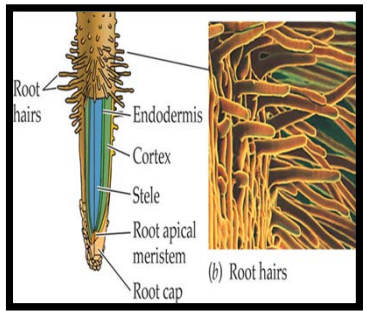
1. Mostly multicellular.
2. Eukaryotes.
3. The cell wall of fungi are made up of chemical chitin.
4. Heterotrophic and obtain their nutrients by releasing digestive enzymes into a food source.
5. act either as decomposers or as parasites in nature.

خزن المواد الغذائية الاحتياطية (المدخرة) على شكل الأميلوز (النشا)

Animalia

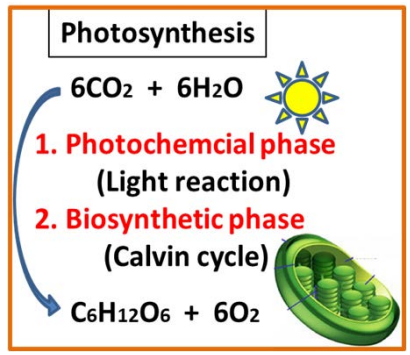
1. Multicellular.
2. Eukaryotic
3. Heterotrophic.
4. Animal cells have NO CELL WALLS.
5. Most animals can move from place to place.
6. Fish, Birds, Reptiles, Amphibians, and mammals-including humans belong to the Kingdom Animalia.
7. This Kingdom also includes sponges, jellyfish, worms, sea stars, and insects.

What do plants need to survive?



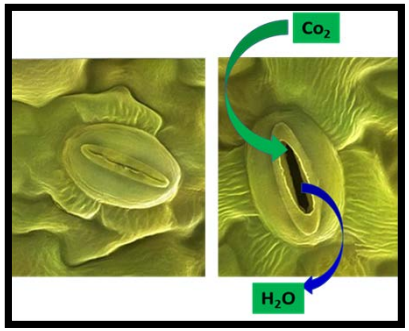
- **Sunlight**

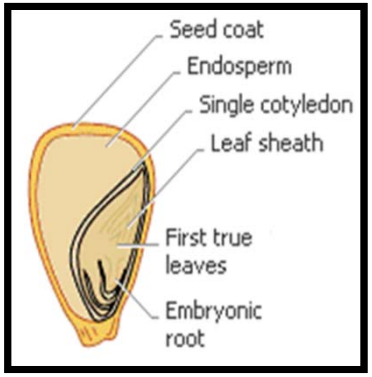
- energy of sun captured by chlorophyll and used to join CO_2 and H_2O to form glucose ($C_6H_{12}O_6$); plants need broad leaves to maximize light absorption أشعة الشمس – تمتص طاقة الشمس بالكلوروفيل وتستخدم مع ثاني اكسيد الكربو ن والماء لتشكيل الجلوكوز (النباتات تحتاج إلى أوراق واسعة لتمتص اكبر قدر من الضوء



- **Water and minerals**

- roots to absorb these الماء والمعادن – وتقوم الجذور بهذه العملية





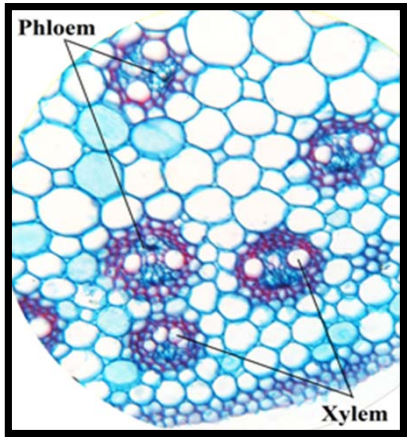
- **Gas Exchange**

– stomata in leaves تبادل الغازات – تقوم بها الثغور في أوراق

- **Protective structures** هياكل لحماية - لتحمي الأجنة النامية.

- were required to protect the developing embryos.

- **Movement of water and nutrients**
  - **Most plants have tubes – phloem (nutrients up & down) and xylem (water up)** حركة الماء والمواد الغذائية
معظم النباتات لها أنابيب - اللحاء (لنقل المواد الغذائية أسفل) والخشب (لنقل الماء الى اعلى)
  - **Some small plants use diffusion** بعض النباتات الصغيرة تستخدم عملية الأنتشار



Plant Adaptations to Land

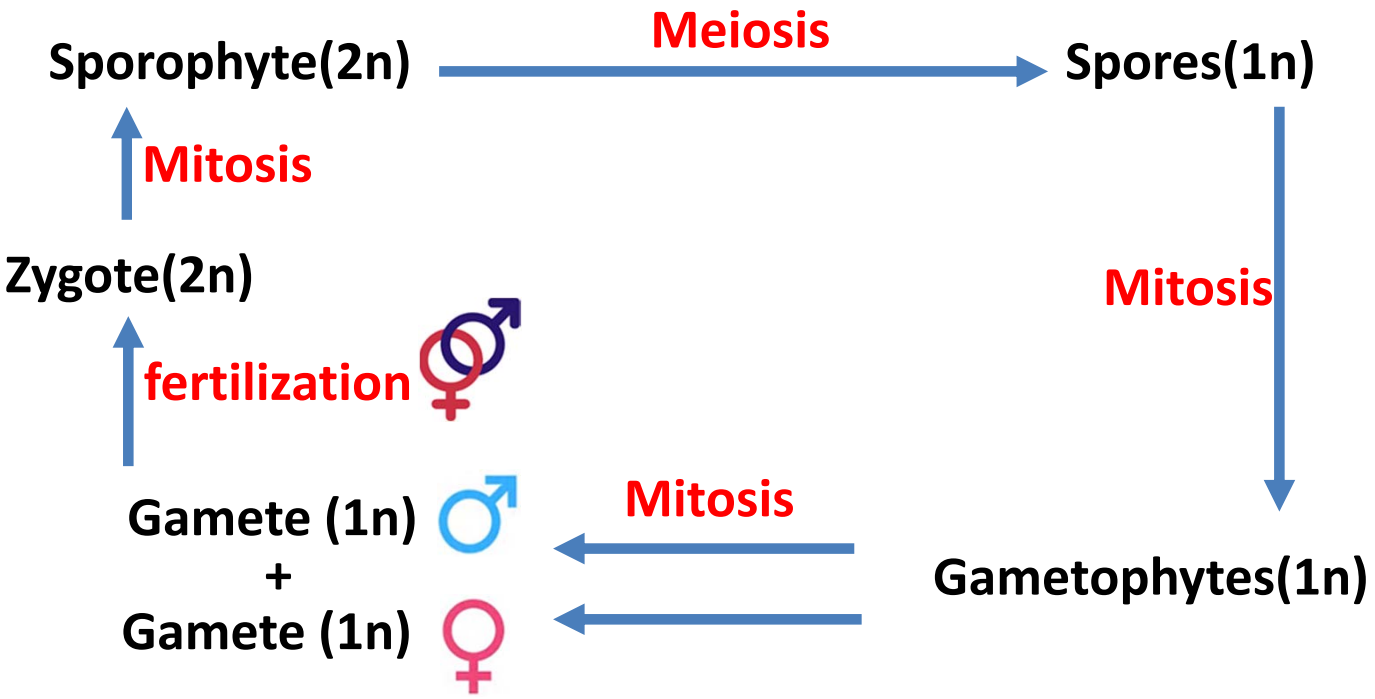
Problems:

- Need minerals
- Gravity
- Increase in Height for Light
- Adaptations for Drier environment
- Reproduction

Solutions:

- Roots absorb H_2O & minerals
- Lignin & cellulose in cell walls
- Vascular Transport System
- Waxy cuticle & stomata with guard cells
- Pollen containing sperm

All land plants have life cycles in which a multicellular diploid sporophyte phase alternates with a multicellular haploid gametophyte phase



GENERAL LIFE CYCLE OF PLANTS

Alternation of Generations تعاقب الأجيال

- **The life cycle of plants has two different phases. This is called; ALTERATION OF GENERATIONS are: (1). Sporophyte (2n) الطور البوغي ذو النوى (2ن) (2). Gametophyte (n) الطور المشيجي ذو النوي (ن)**

Spores **Gametes** **Zygote**

- Spores and gametes are singles celled and haploid (1n)
- Spores are used in asexual reproduction, while gametes are used in sexual reproduction

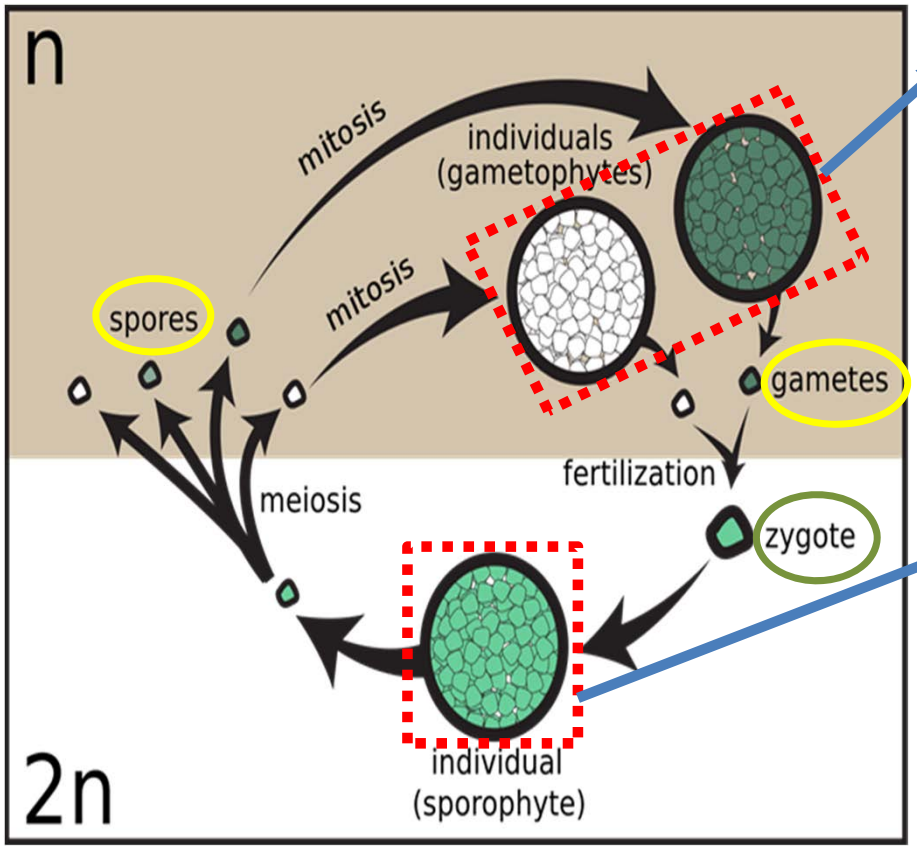
Sporophyte(2n) —Meiosis→ Spores(1n)

Spores(1n) —Mitosis→ Gametophytes(1n)

Gametophytes(1n) —Mitosis→ Gamete (1n)♂ + Gamete (1n)♀

Gamete (1n)♂ + Gamete (1n)♀ —fertilization→ Zygote(2n)

Zygote(2n) → Sporophyte(2n)

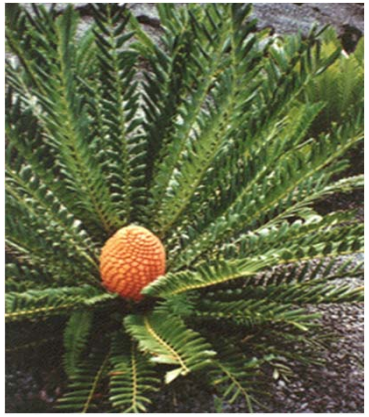


Individuals (Gametophytes)

- Haploid(1n)
- Undergoes **mitosis** to produce gametes (1n) (eggs and sperm)

Individual (Sporophytes)

- Diploid(2n)
- Produce haploid spores (1n) by **meiosis**











Lily bulb




The Plant Kingdom
Kingdom Plantae

Non-Vascular Plants
Bryophytes

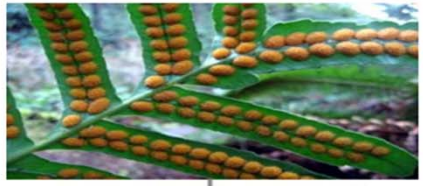
Liverworts
Marchantiophyta

Hornworts
Anthocerotophyta

Mosses
Bryophyta

Vascular Plants
Tracheophytes

Spore-Producing Plants
Pteridophyte



Seed-Producing Plants
Spermatophytes

Club Mosses
Lycopodiophyta

Horsetails
Equisetophyta

Ferns
Pteridophyta

Non-Flowering Plants
Gymnosperms

Flowering Plants
Angiosperms

Conifers
Pinophyta

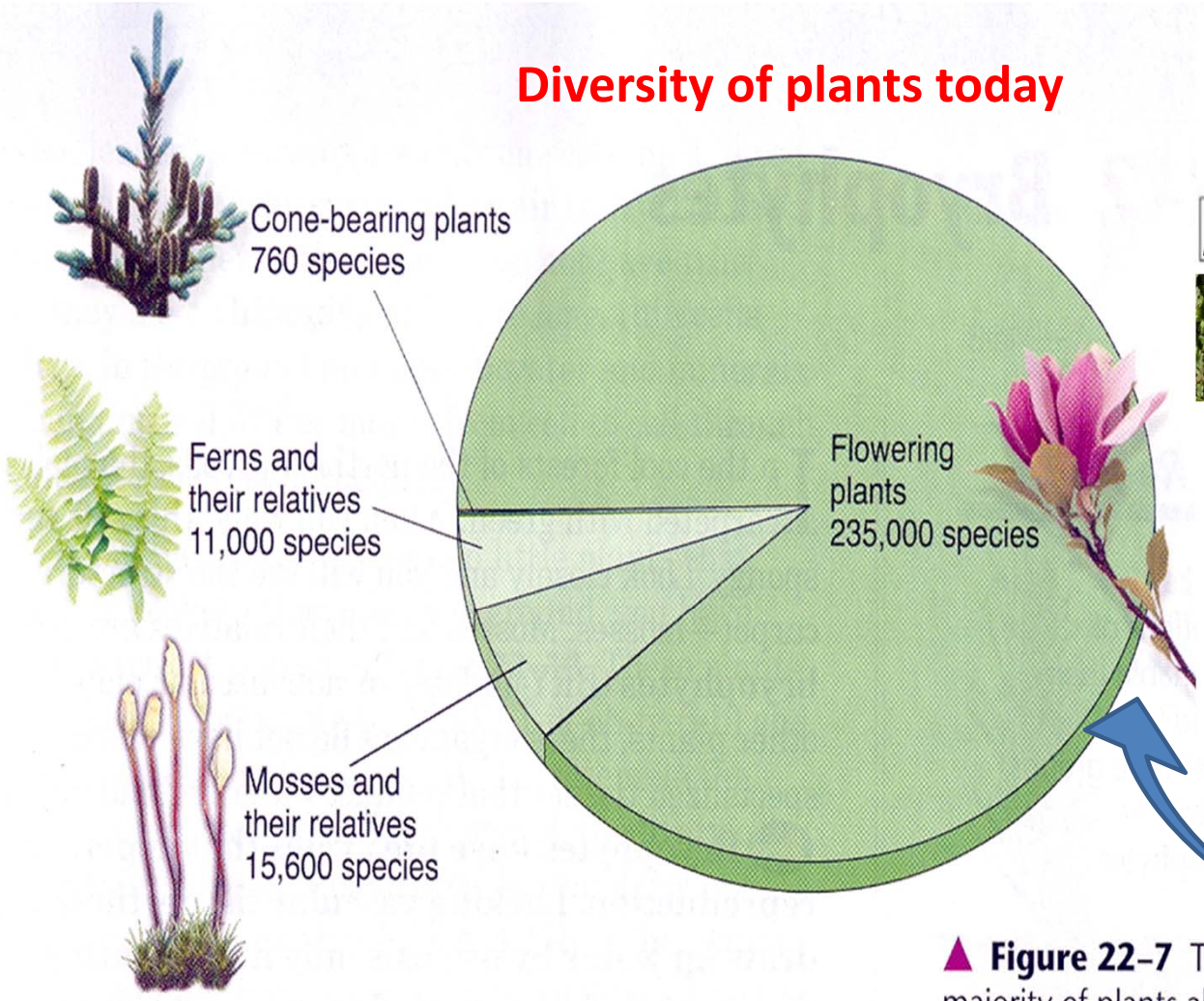
Cycads
Cycadophyta

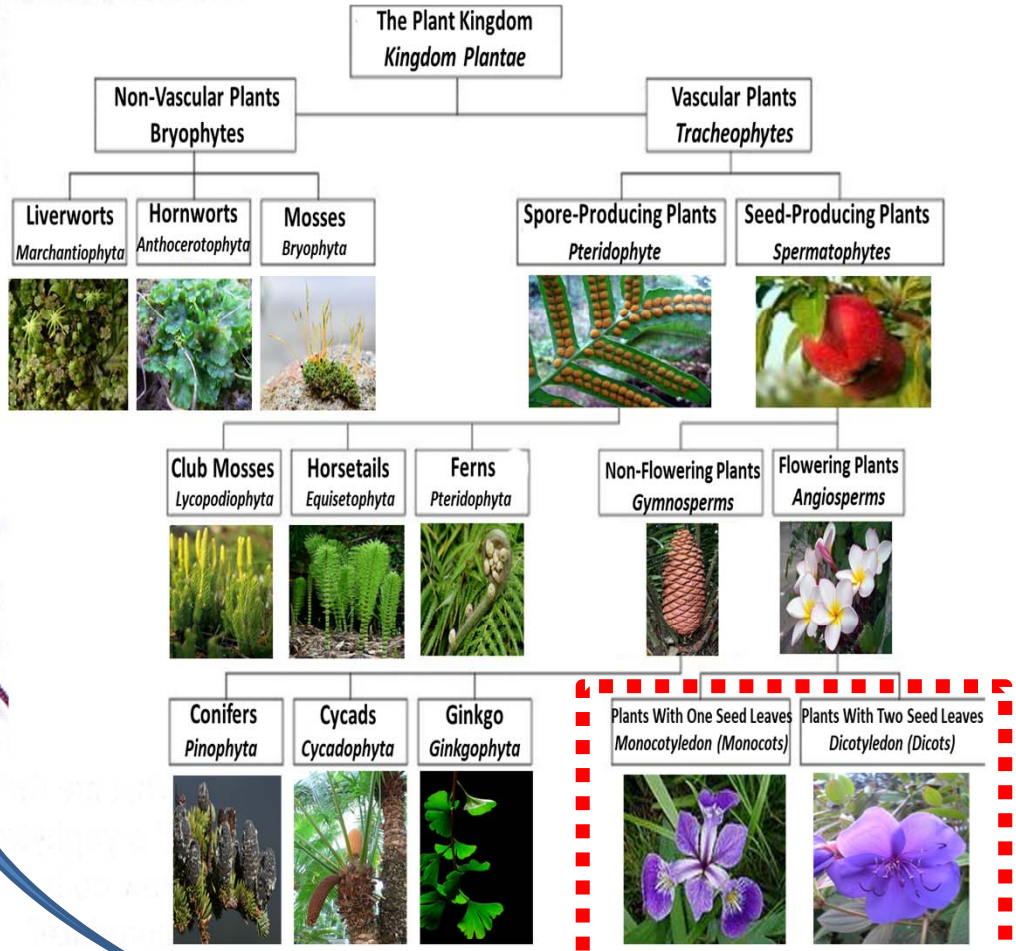
Ginkgo
Ginkgophyta

Plants With One Seed Leaves
Monocotyledon (Monocots)

Plants With Two Seed Leaves
Dicotyledon (Dicots)

Diversity of plants today





▲ **Figure 22–7** The great majority of plants alive today are angiosperms, which are also known as flowering plants. **Interpreting Graphics** *What is the second largest group of plants?*

The four main groups of plants

1. **Mosses (Bryophytes)** نباتات الحزازية

النباتات لا وعائية
(nonvascular plants)–(15,600 species)

2. **Ferns (Pterophytes)** النباتات السرخسية

وعائية لا بذرية منتجة الابواغ
(vascular, seedless plants, spore bearing plants)–(11,000 species)

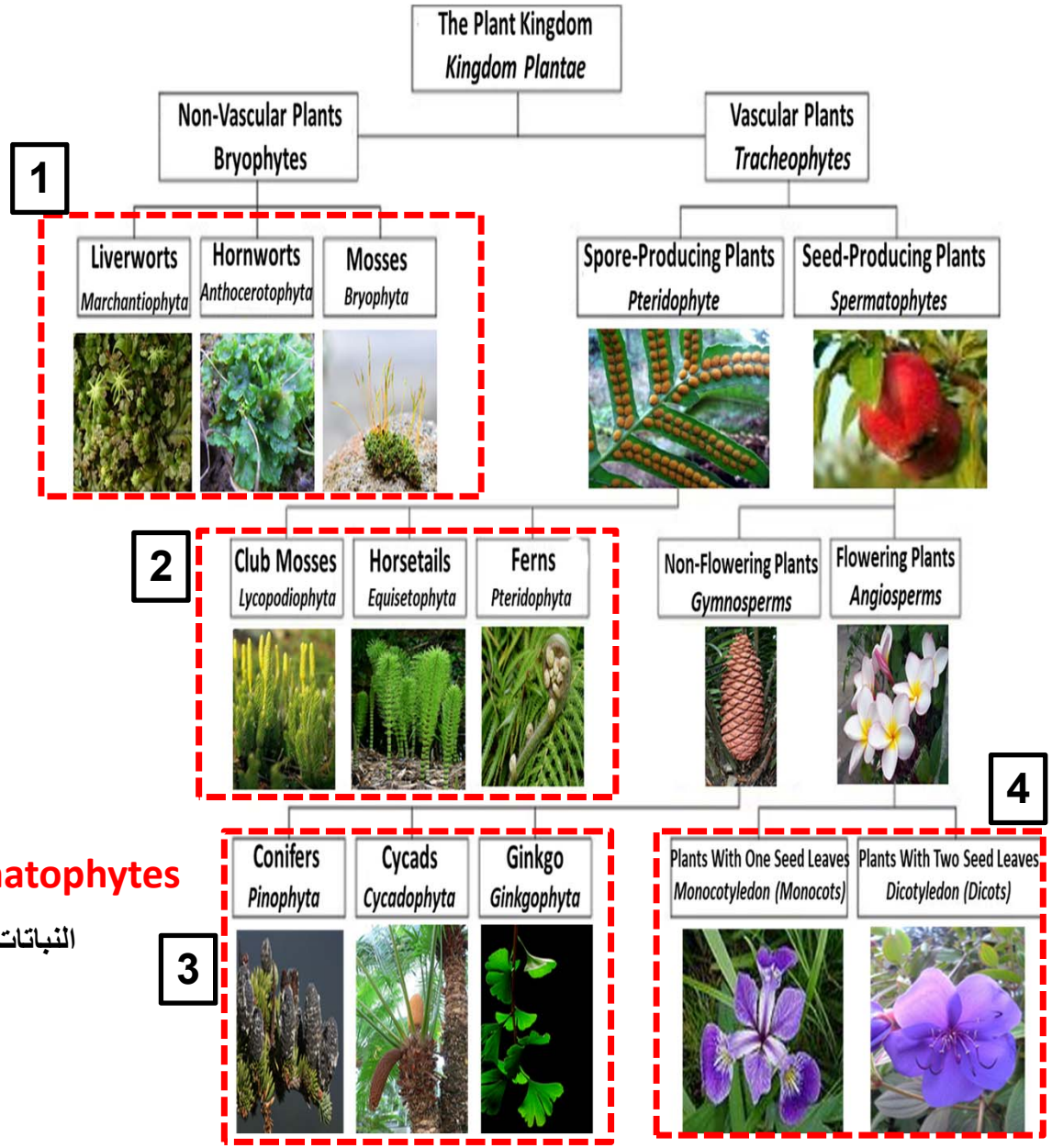
3. **Gymnosperms** عاريات البذور

وعائية عارية البذور منتجة لمخاريط
(vascular, Naked seeds, Cone-bearing Plants-(760 species)

4. **Angiosperms** كاسيات البذور

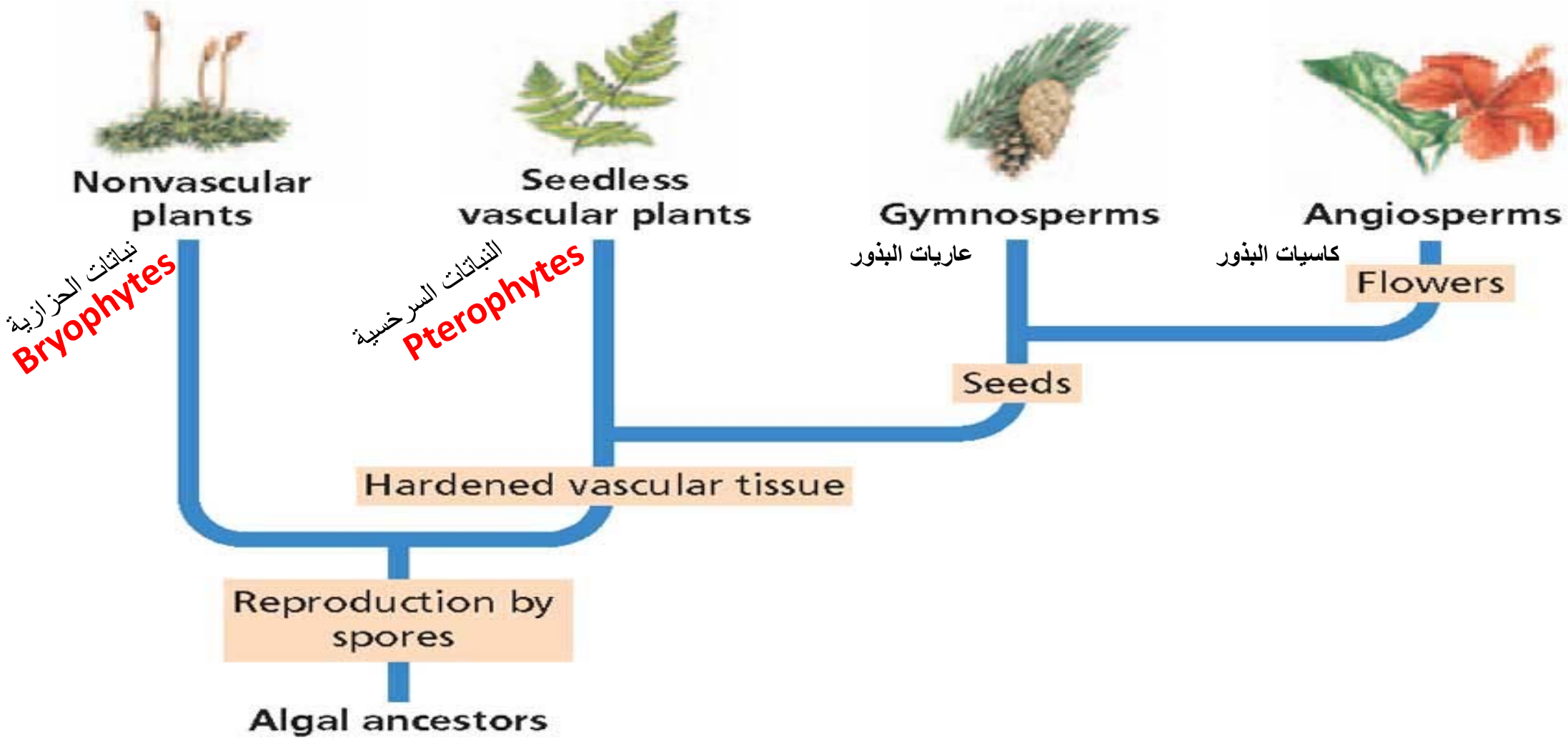
وعائية مغطاة البذور منتجة للأزهار
(vascular, Covered seeds, Flowering Plants (245,000 species)

Spermatophytes
النباتات البذرية



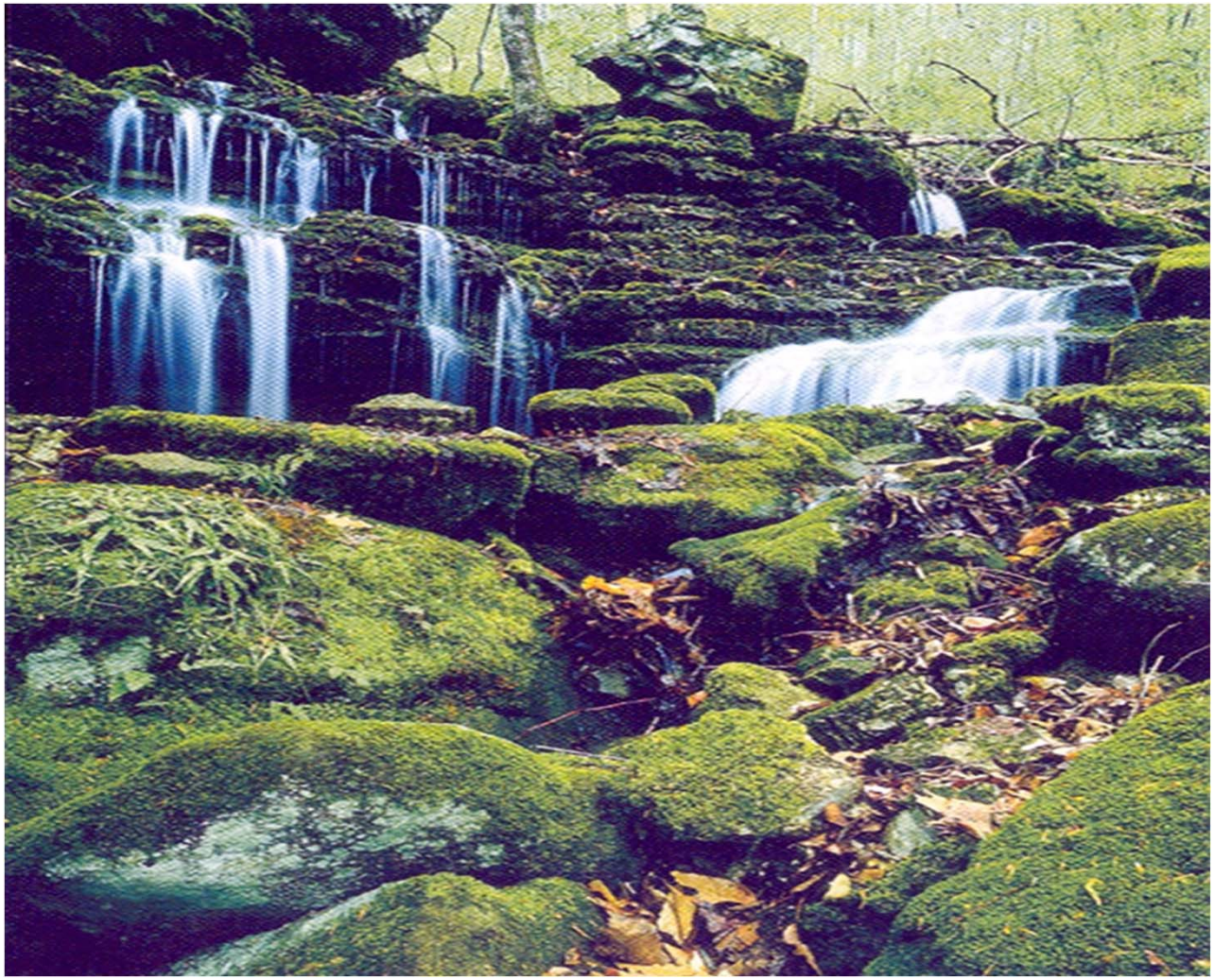
Plant Cladogram

Relationships among the various groups of plants



BRYOPHYTES

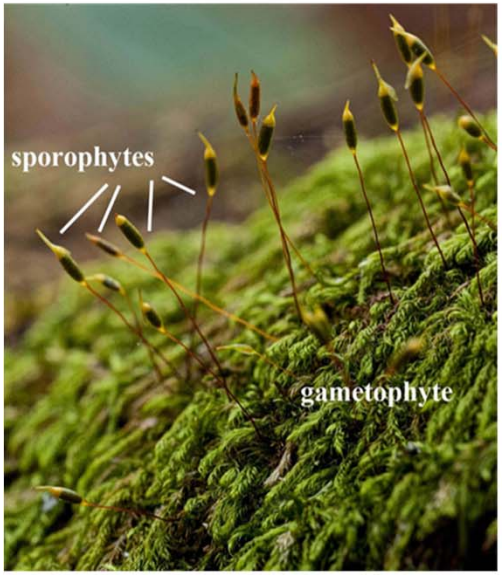
- Do not have vascular tissue for support or conduction of water & mineral and food.
- Require a constantly moist environment
- Cells must be in direct contact with moisture
- Sperm must swim to egg through water droplets



Classes of Bryophytes

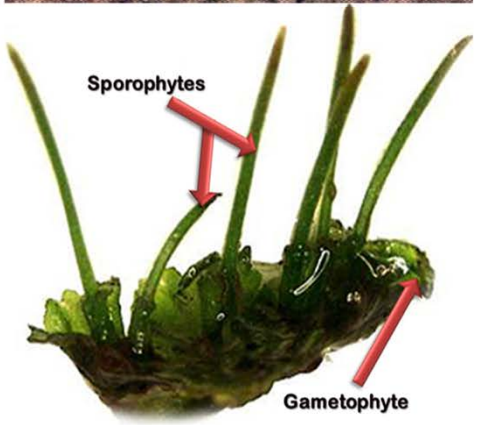
- **Gametophyte** (n) is **dominant** phase of life cycle
- **Sporophyte** (2n) phase of life cycle is **small**

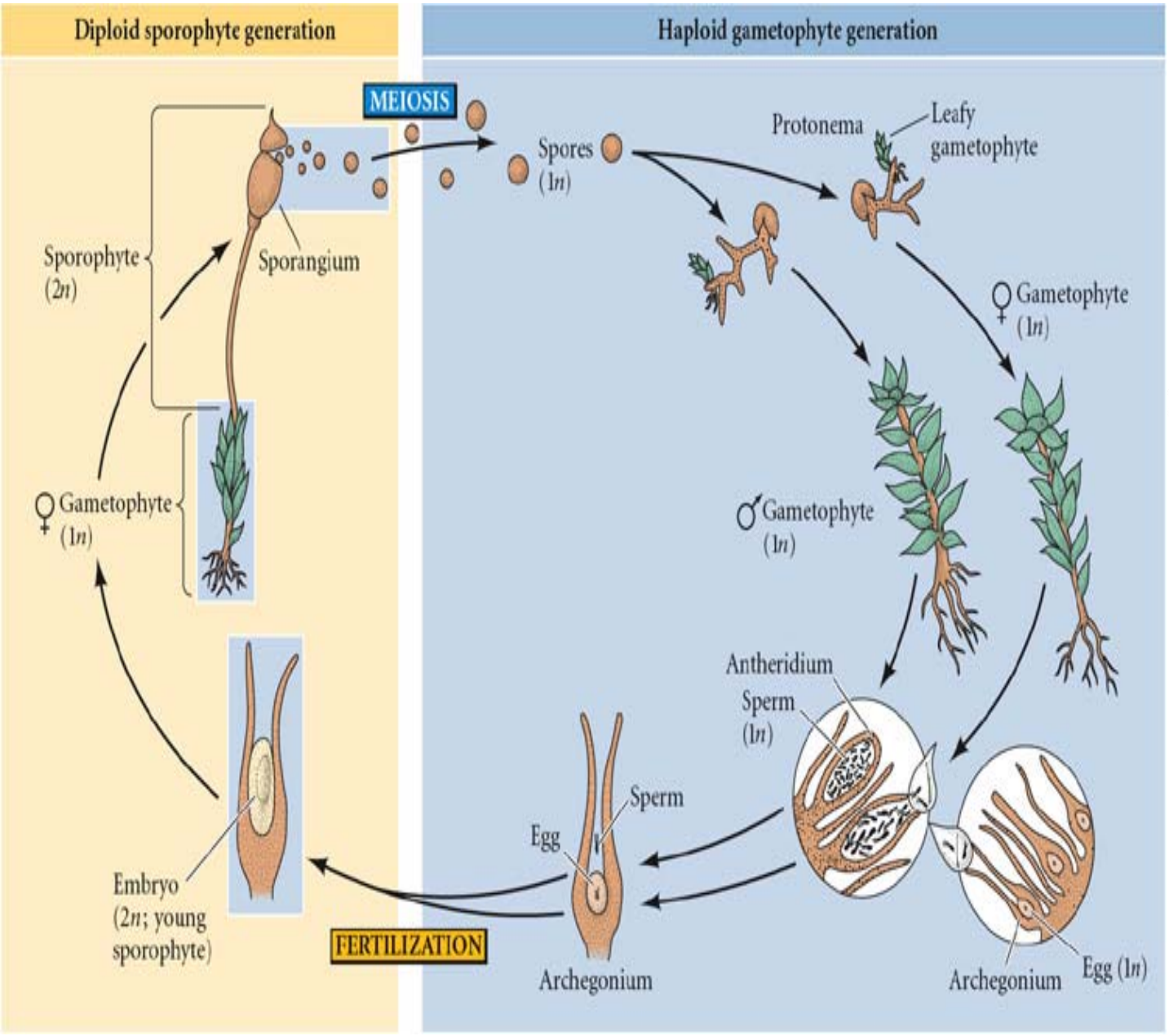
1- Bryophyta
(Moss)
Funaria Sp.
الحزازيات القائمة
مثل نبات الفيوناريا



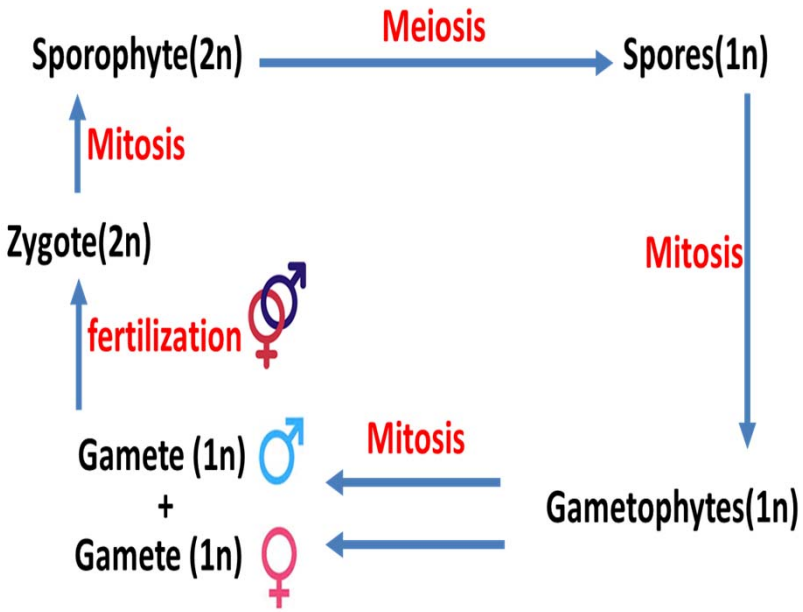
2- Hepatophyta
(Liverwort)
Marchantia, Riccia
حزازيات كبدية منبطحة
مثل اجناس الماركنتيا والريشيا

3- Anthocerophyta
(Hornworts)
Anthoceros sp.
الحزازيات الكبدية القرناء
مثل نبات الأنثوسيروس





Simplified Lifecycle of a Moss (Bryophytes)



- **Gametophyte** (n) is **dominant** phase of life cycle
- **Sporophyte** (2n) phase of life cycle is **small**

PTERIDOPHYTA

أوراقها عريضة تسمى الأوراق السرخسية

- **Broad leaves called fronds**

وريقاتها ريشية مركبة

- **Leaflets called pinnae**

تتشكل اكياس بوغية تسمى على الجانب السفلي من الورقة السرخسية

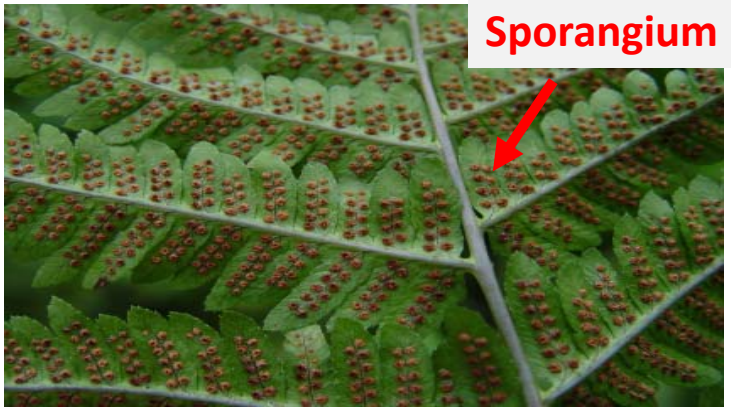
- **Sporangium are formed on the underside of the fronds.**
- **Unfolding fronds are called fiddleheads.**

تسمى الورقة السرخسية الغير منبسطة "رأس الكمان"

- **Spores are dispersed by the wind.**

تنشر وتفرق الجراثيم بواسطة الرياح

- **Sporangium produces spores.**



Frond containing spores at lower surface

Classes of Pteridophyte

(1) Psilophyta (whisk ferns) Psilotum Sp.

النباتات السليوتية
مثل نبات السيلوتم

(2) Lycophyta (Spike Mosses) *lycopodium Sp.*

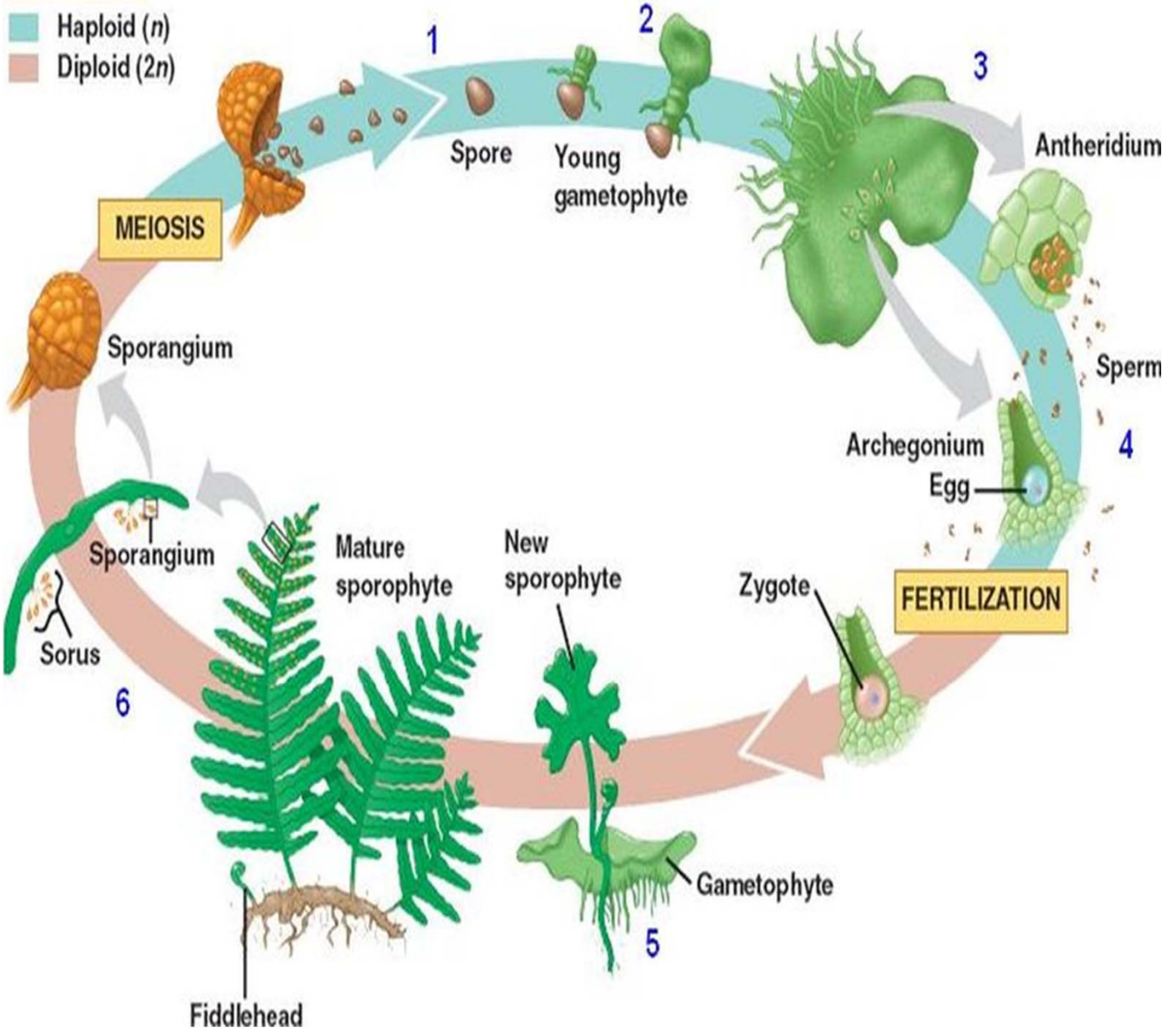
النباتات الليكوبودية
مثل نبات ليكوبديوم

(3) Sphenophyta (Horsetails)

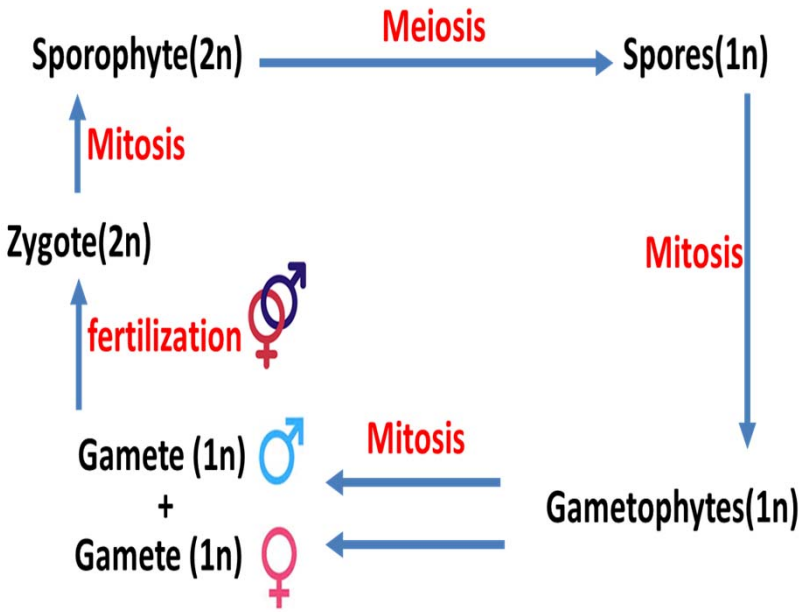
النباتات الأسفينية
جنس: ذيل الحصان

(4) Pterophyta (True ferns)

النباتات السراخسية



Simplified Lifecycle of a Pteris (Pteridophyta)



- **Sporophyte** (2n) is **dominant** phase of life cycle
- **Gametophyte** (1n) phase of life cycle is **small**

Plant systematics (part 2)

The Plant Kingdom
Kingdom Plantae

Non-Vascular Plants
Bryophytes

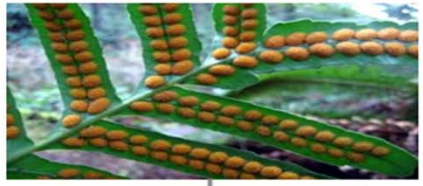
Liverworts
Marchantiophyta

Hornworts
Anthocerotophyta

Mosses
Bryophyta

Vascular Plants
Tracheophytes

Spore-Producing Plants
Pteridophyte



Seed-Producing Plants
Spermatophytes

Club Mosses
Lycopodiophyta

Horsetails
Equisetophyta

Ferns
Pteridophyta

Non-Flowering Plants
Gymnosperms

Flowering Plants
Angiosperms

Conifers
Pinophyta

Cycads
Cycadophyta

Ginkgo
Ginkgophyta

Plants With One Seed Leaves
Monocotyledon (Monocots)

Plants With Two Seed Leaves
Dicotyledon (Dicots)

Seed producing plants

- **Major adaptations**
  - **Pollen (male gametophyte)**
  - **Seeds (embryonic plant)**

  (male and female gametophyte are greatly reduced in size)
- **Two types**
  - **Gymnosperms (lack flowers, naked seeds)**
  - **Angiosperms (flowering plants, seeds enclosed in fruits)**

النباتات المنتجة للبذور (البذرية)
التكيفات الرئيسية
حبوب اللقاح (الأمشاج الذكرية)
البذور (النباتات الجنينية)
(الأمشاج الذكرية والإنثوية مختزلة في حجم إلى حد كبير)
وهي نوعين
عاريات البذور (ليس لها ازهار والبذور عارية)
كاسيات البذور (نباتات زهرة والبذور مغلقة في الثمار)

GYMNOSPERMS

- **Root, stem, leaf: present**
- **Well developed vascular tissue**
- **No true flower and fruits**
- **Reproductive structures called as Cones** مخاريط
- **Example: *Cycas, Pinus, Taxys, Gnetum***

Gymnosperms

- *Gymnos* means naked, *sperm* means seed: gymnosperm = naked seeds
- Gymnosperms have seeds with no covering (ie: a fruit or a seed coat). They bear woody cones that hold the seeds.
- There are 700 living species placed into four divisions: Conifers, Cycads, Ginkgos, and Gnetales

GYMNOPSERMS

Cycadophyta (Cycads) السيكادية

أوراق كبيرة تشبه اوراق السرخسيات

- **Large fernlike leaves**

النباتات ذكور أو إناث

- **Plants are either males or females**

النباتات تنتج الأمشاج في مخاريط كبيرة

- **Plants produce gametes in large strobilus**

GYMNOPSERMS
GINKGOPHYTA (*Ginkgo biloba)* النباتات الجنجوية

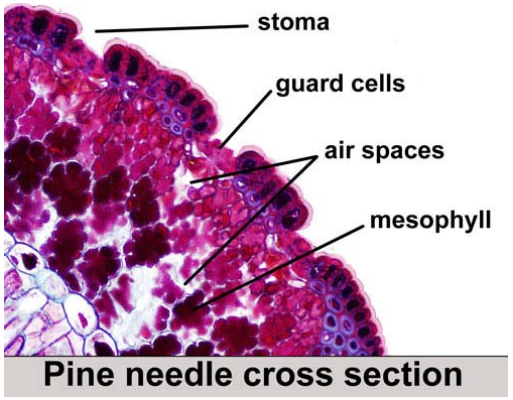
- **Only one species in present day** يوجد نوع واحد فقط في الوقت الحاضر
- **Bear male and female cones on separate plants.** المخاريط الذكرية والإنثوية محمولة على نباتات منفصلة.
- **Male produces pollen in strobilus-like cones.** الذكر تنتج حبوب اللقاح في مخاريط اعضاء مخروطية الشكل.
- **Female bears seed which develop a fleshy outer covering** الأنثى يحمل البذور التي تتطور خارج الغطاء اللحمي
- **Plants are resistant to air pollution** النباتات مقاومة لتلوث الهواء

GYMNOPSERMS النباتات المخروطية

Coniferophyta
(Cone-bearing trees)

- **Cone bearing** تحمل مخروط
- **needles with thick waxy covering** الأوراق الإبرية مغطاة بغطاء شمعي سميك
- **Stomata in cavities below surface** الثغور في تجاويف تحت سطح
  البذور محمولة على أسطح المخاريط
- **Seeds are carried on the surfaces of cones**
- **Evergreen and adapted to cold and dry habitats**

دائمة الخضرة وتكيفت مع البيئات الباردة والجافة



Pine needle cross section

Male & Female cones

GYMNOPSERMS

Gnetophyta النباتات النتومية

There are three genera:

نيتم وهو نبات متسلق استوائي

1. ***Gnetum*** **: A tropical climbing plant**

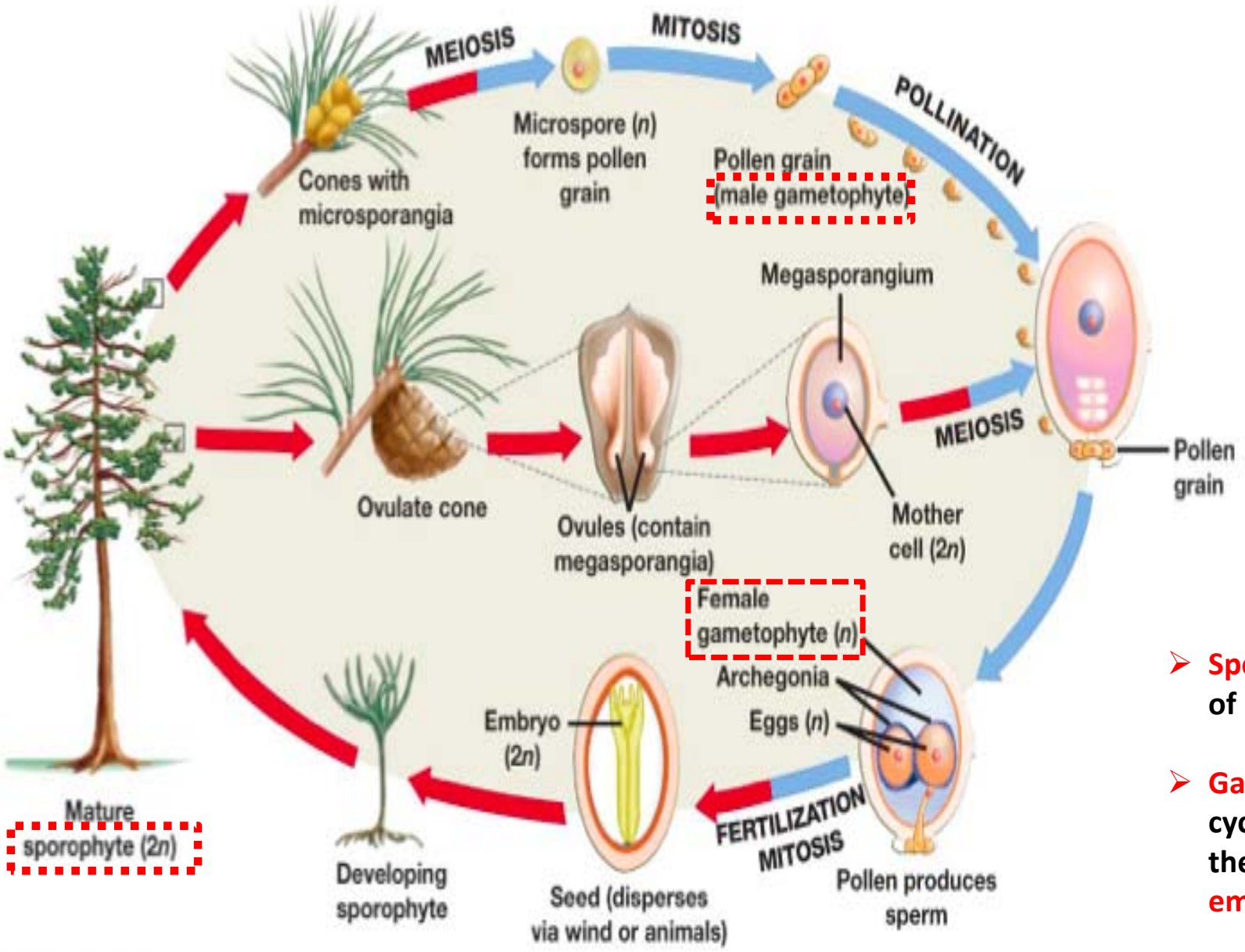
الإيفيدرا (النباتات شبه شجيرية)

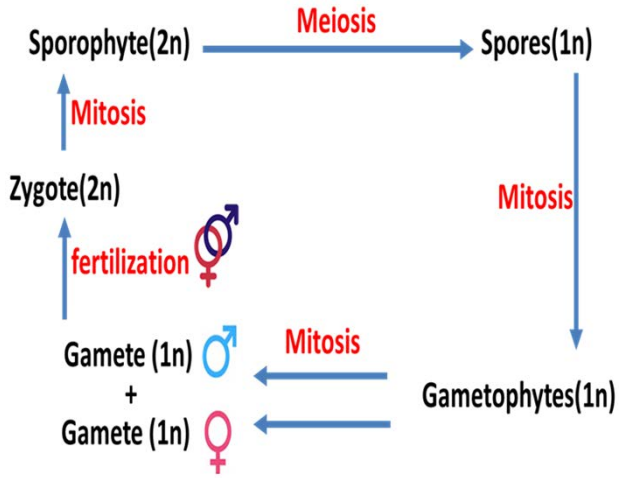
2. ***Ephedra*** **(Shrub-like plants)**

لويتشيا يعيش بالصحراء له جذر درني كبير). له اثنتين من الأورق فقط وربما يعيش 100 سنة.

3. ***Welwitschia*** **(Desert dweller with large tuberous root). Has only two leaves and may live 1000 yr.**

Alternation of Generations in Gymnosperms

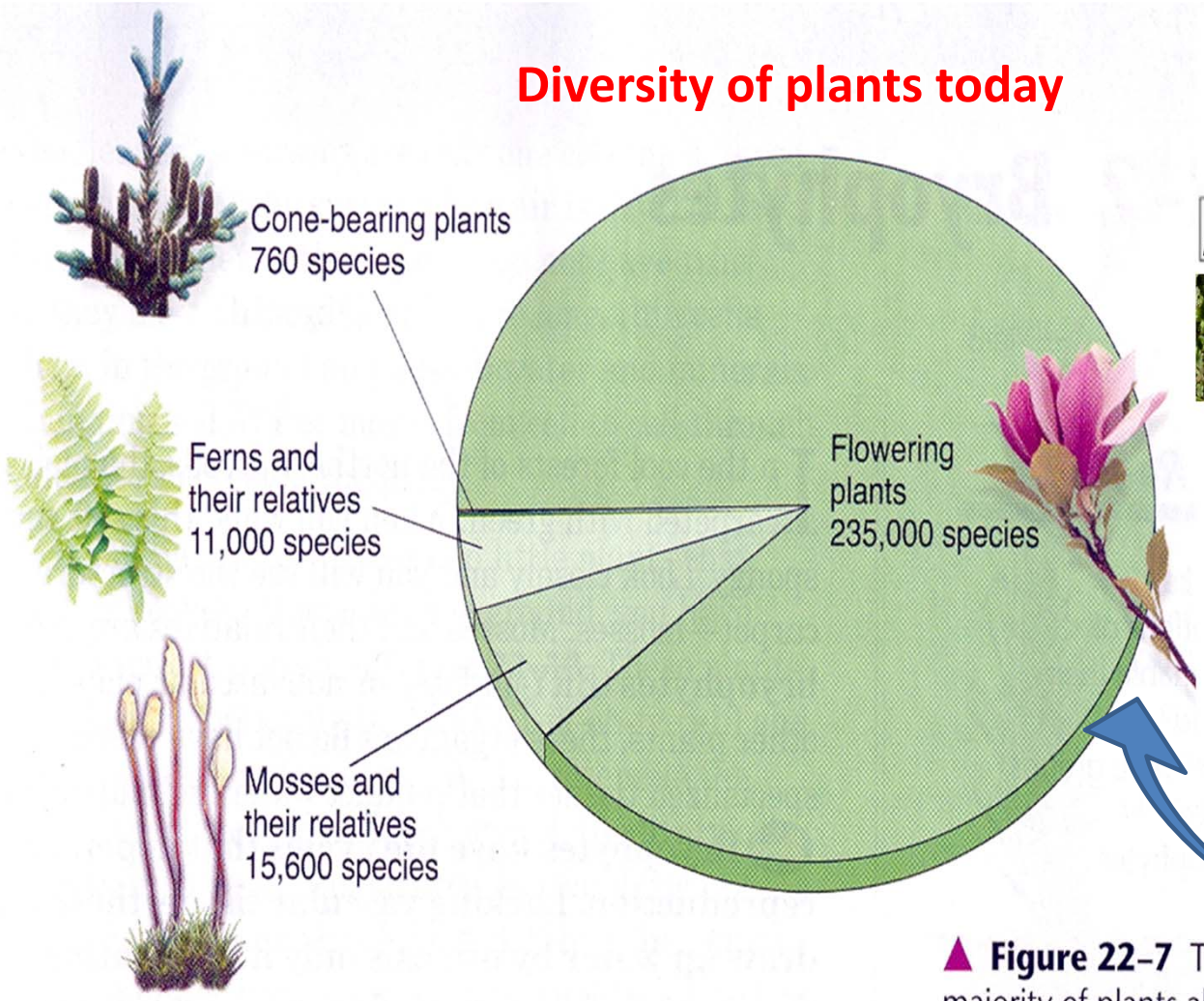


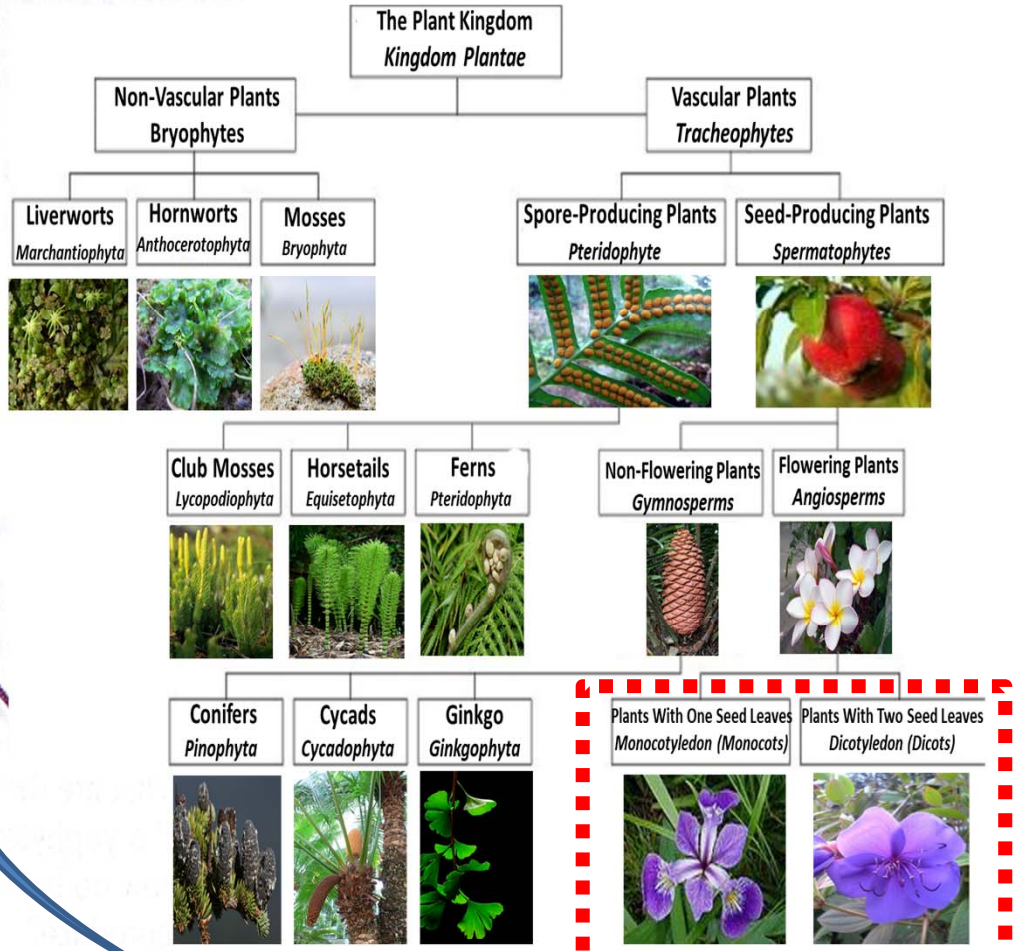


- **Sporophyte** (2n) is **dominant** phase of life cycle
- **Gametophyte** (1n) phase of life cycle is **very small,** represented by the germinated **pollen** and the **embryo** in sac.

Angiospermae
(Anthophyta – flowering plants)

Diversity of plants today



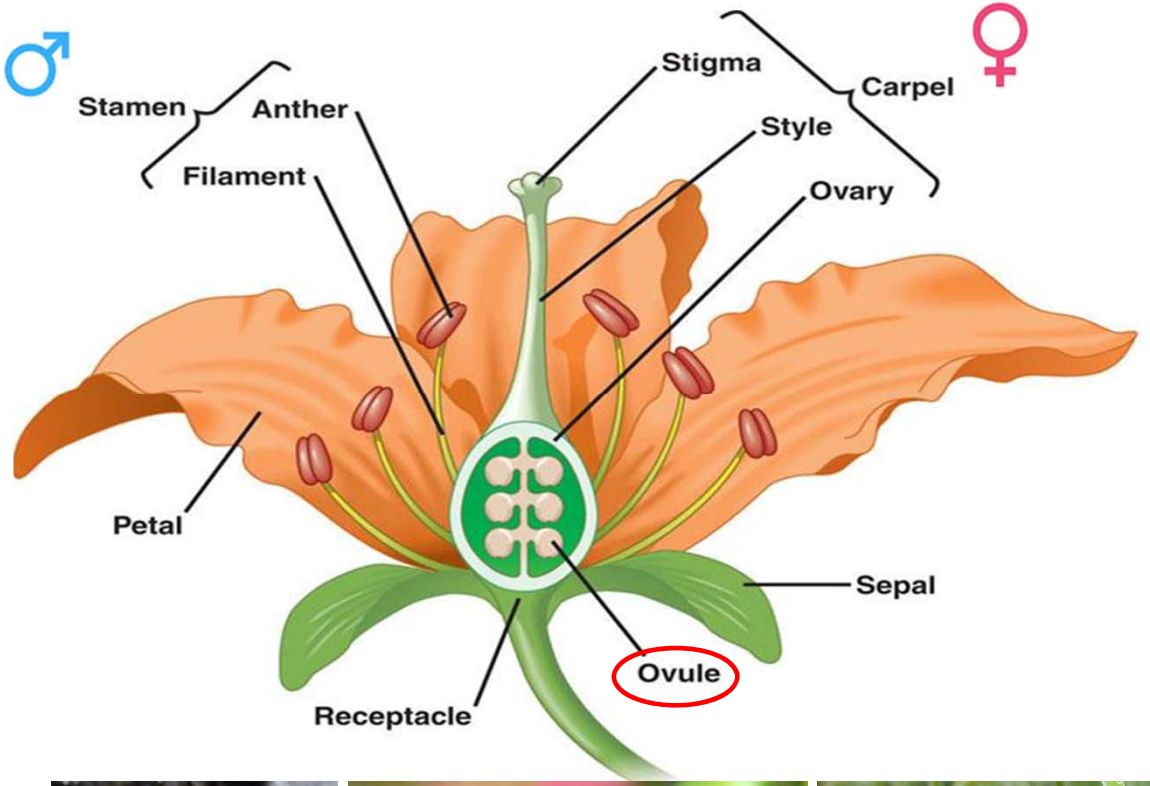


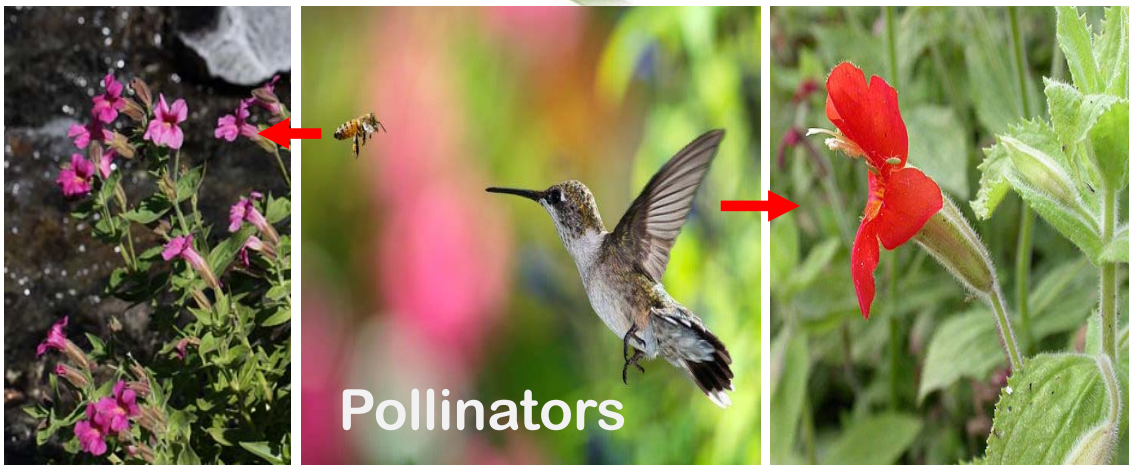
▲ **Figure 22–7** The great majority of plants alive today are angiosperms, which are also known as flowering plants. **Interpreting Graphics** *What is the second largest group of plants?*

Angiospermae

(Anthophyta – flowering plants)

- Angiosperms all produce flowers containing the sexual reproduction structures.
- The angiosperms (*angios*=covered, *sperm* = seed) produce fruits and seeds.
- There are presently 235,000 known living flowering plants species.
- Flowers, ovaries, pollinators (insects, etc.)





النورات (الحامل الزهري)

Inflorescence types

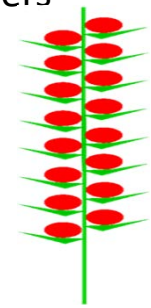
- **An inflorescence is an arrangement of one or more flowers on a floral axis.**

1 **Simple** :
One flower at the tip of a stem

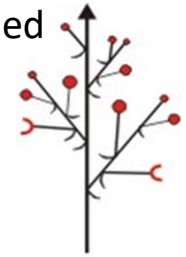
2 **Compound**:
Two or more flowers in every inflorescence

عنقودية Raceme:
Unbranched, with pedicellate flowers

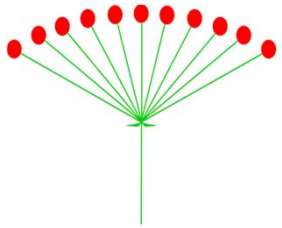
سنبلة Spike:
A Simple raceme with sessile flowers



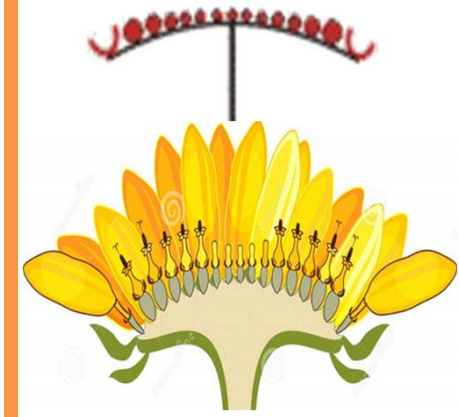
دالية Panicle:
A compound raceme, branches are themselves branched



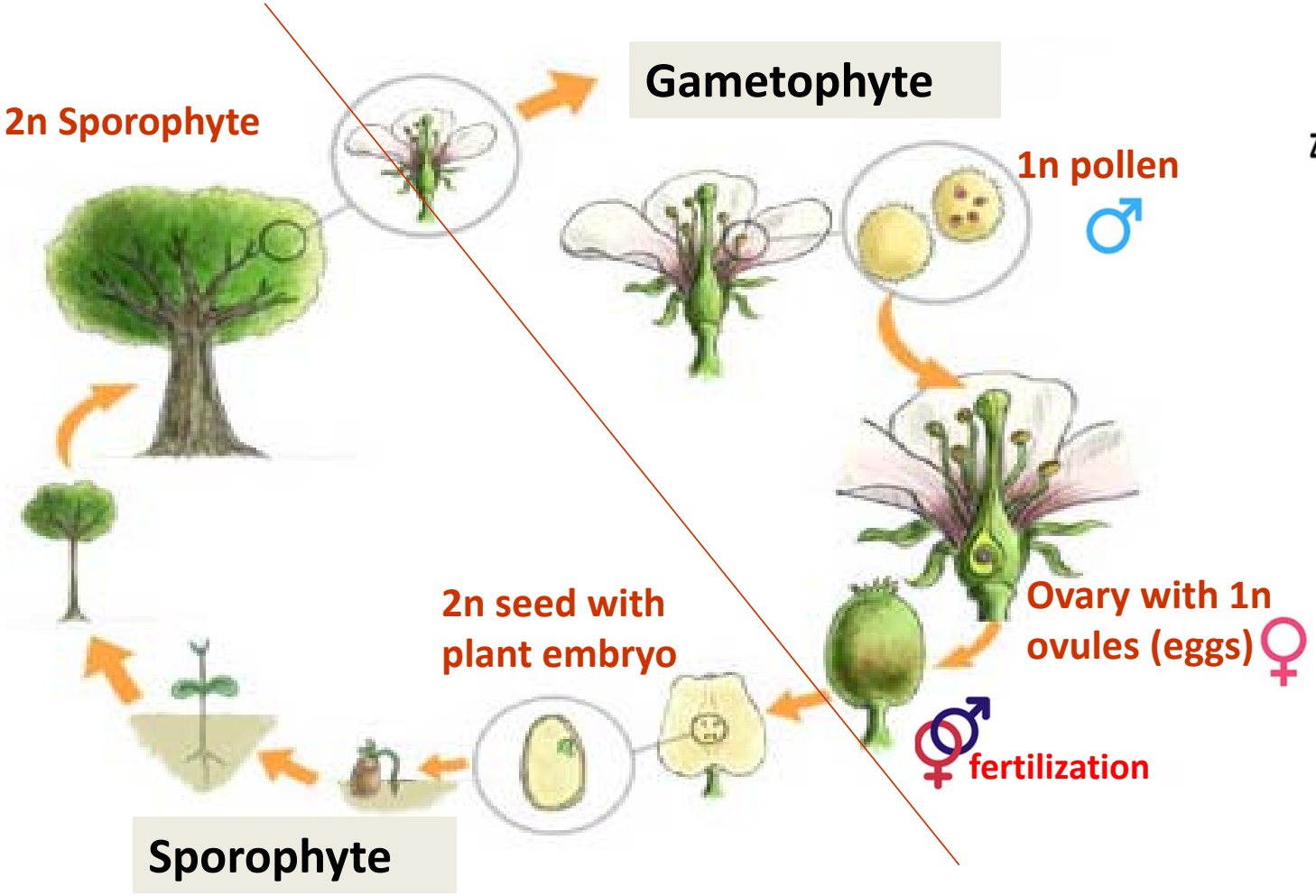
خيمية Umbel:
a raceme in which all pedicels arise from a common point.

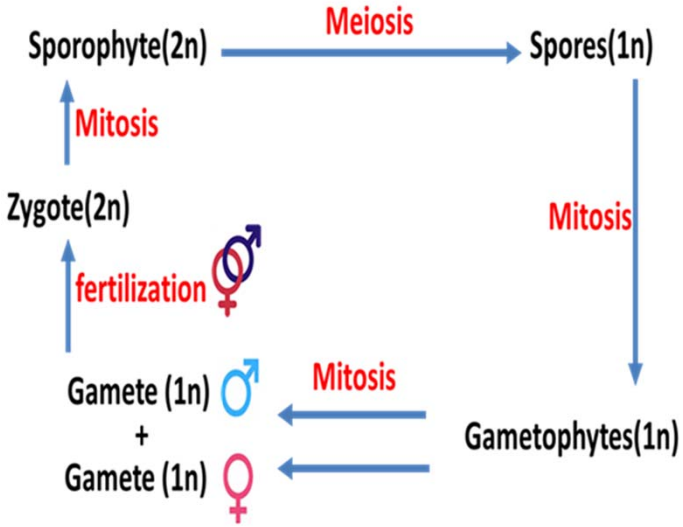


رأسية Head:
A contracted raceme, with sessile flowers that are borne on an enlarged head.



Alternation of Generations





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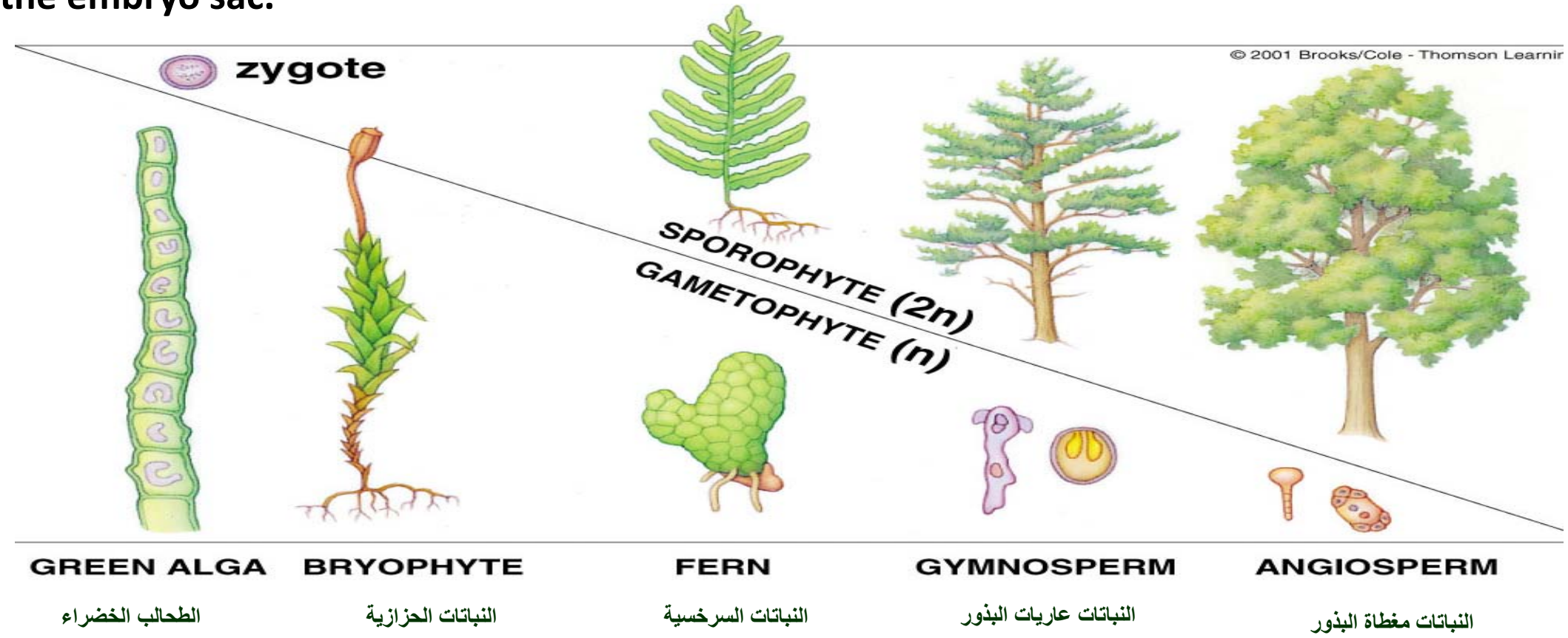
- **Gametophyte** (1n) phase of life cycle is **very small,** represented by the germinated **pollen** and the **embryo** in sac.

Switch to Sporophyte Dominance

In the seed plants, the sporophyte phase is more prominent than the gametophyte, and the gametophytes are very reduced in size and are represented by the germinated pollen and the embryo sac.



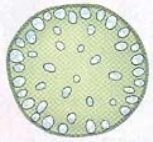
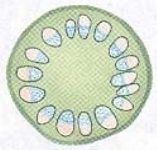
Seed Dispersal

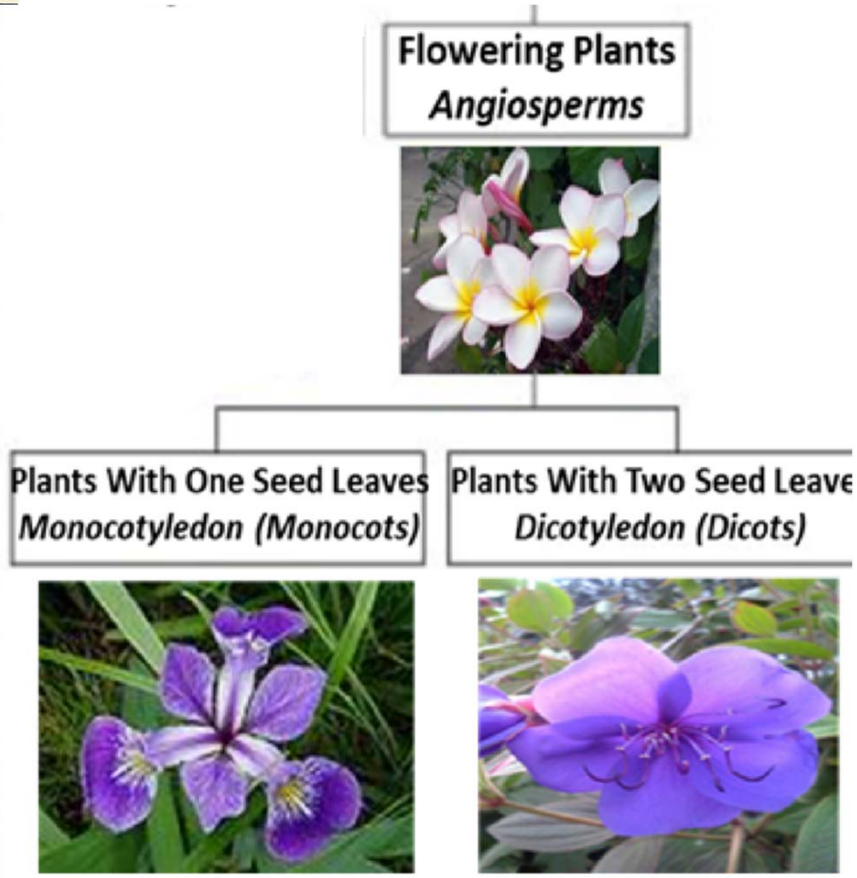
Water

Winds

Animals

Characteristics of Monocots and Dicots

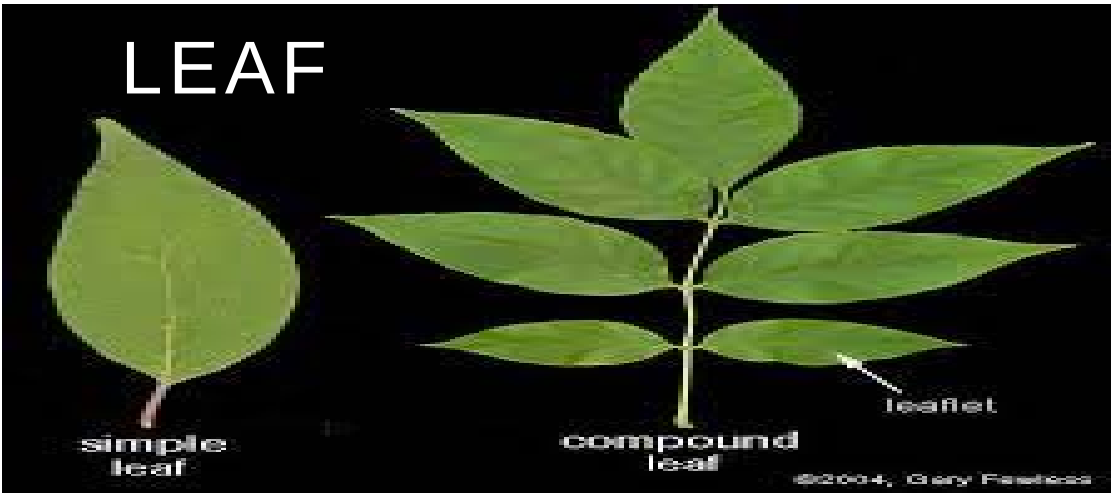
	Monocots	Dicots
Seeds	Single cotyledon 	Two cotyledons 
Leaves	Parallel veins 	Branched veins 
Flowers	Floral parts often in multiples of 3 	Floral parts often in multiples of 4 or 5 
Stems	Vascular bundles scattered throughout stem 	Vascular bundles arranged in a ring 
Roots	Fibrous roots 	Taproot 



Habit of plant

Herb. A usually low, soft or coarse plant with annual aboveground stems.
Shrub. A much-branched woody perennial plant usually without a single trunk.
Tree. A tall, woody perennial plant usually with a single trunk.
Vine *or* Liana. An elongate, weak-stemmed, often climbing annual or perennial plant, with herbaceous or woody texture.

shrubs



There are large number of terminology leaf based on:

- Margin حافة
- Apex القمة
- Base القاعدة
- Venation التعرق
- Arrangement ترتيب
- Petiole العنق
- Modifications تحورات

Types of Roots

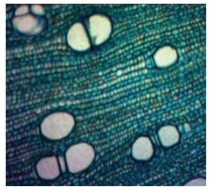
PLANT SYSTEMATICS

Karl von Linne (1707-1778)

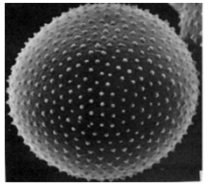
- Taxonomy: The science of classification.
- Plant taxonomy: The science of classification of plants.
- Swedish botanist Carolus Linnaeus introduced **Binomial Nomenclature**.
- **Binomial nomenclature =** Uses two Latin words to indicate the genus and the species. The first word is the genus and the second word is the species. (Scientific name)
- Example- the botanical name of dates is *Phoenix dactylifera*

Morphology to Molecules

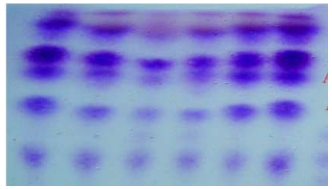
Morphology



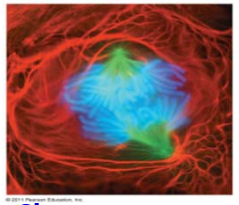
Anatomy



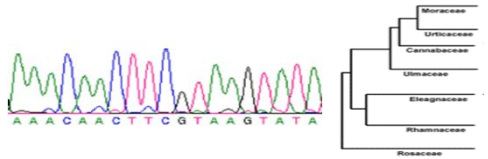
Pollen



Chemistry



Chromosomes

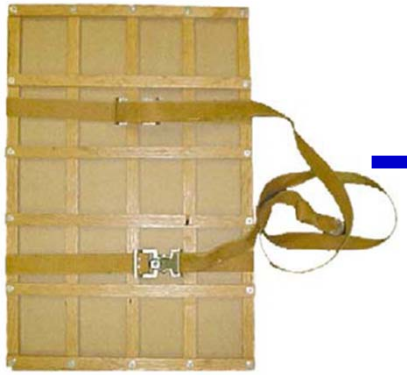


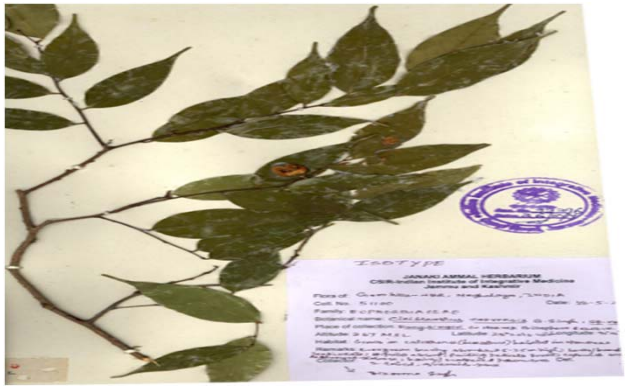
DNA / Molecular taxonomy

Plant collecting and Documentation

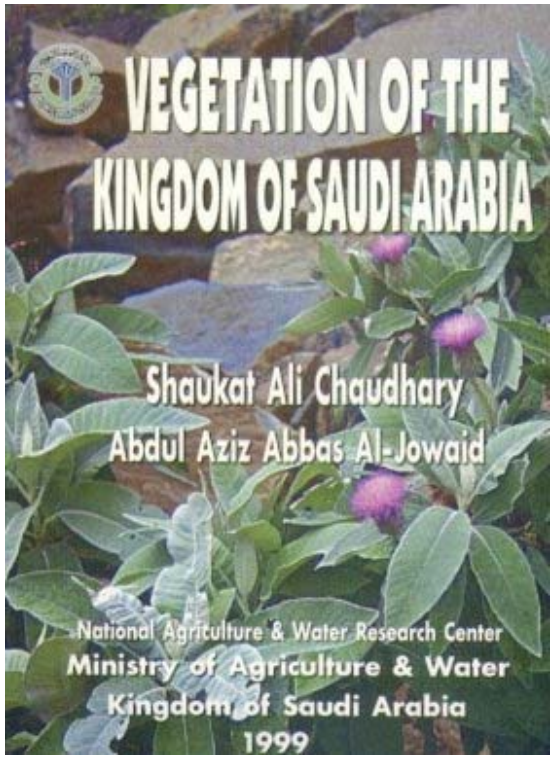
- A **HERBARIUM** is a collection of dried plants systematically named and arranged for ready reference and study.

- To make a herbarium specimen, the plant is collected, and notes are made about it. The plant is then pressed until dry between blotters that absorb moisture and mounted onto a herbarium sheet with a suitable label.

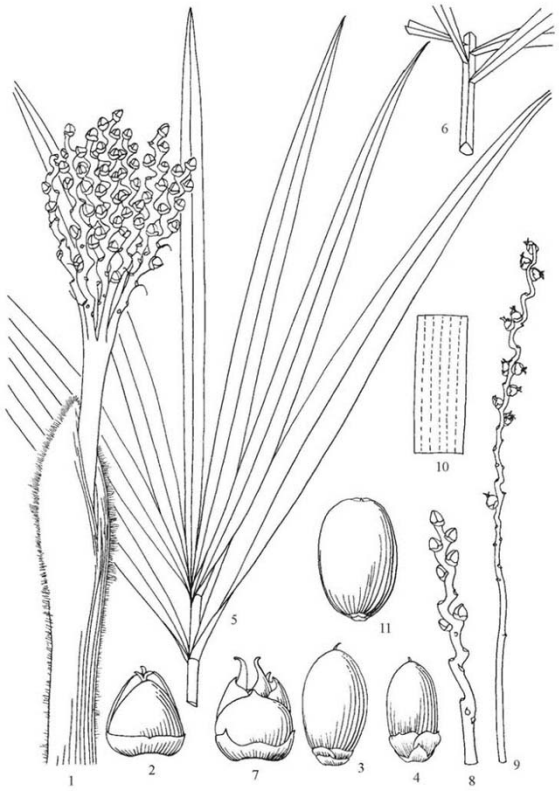




The FLORA is the main Resources of Taxonomic Information



Flora = it is the documentation of plants occurring in a particular region.



Description of plant need taxonomic terminology

Phoenix dactylifera Linnaeus, Sp. Pl. 2: 1188. 1753.

Stems solitary or clustered and then with few shoots, to 30 m tall, to 50 cm in diam., rough with persistent, diamond-shaped leaf bases. Leaves 3-5 m; sheath and petiole to 1 m; rachis 1-2 m; acanthophylls many per side of rachis; pinnae to 200 per side of rachis, linear, irregularly arranged and spreading in different planes; middle pinnae to 40 × 2 cm. Male inflorescences erect, to 1 m, with many rachillae, these ca. 30 cm; female inflorescences erect, becoming pendulous, to 2 m, with to 150 rachillae, these to 40 cm. Fruits variable in shape, usually oblong, to 7 × 3 cm, brown or black; endosperm homogeneous.

Plant Ecology

ECOLOGY

The study of living organisms in relation to their habits and habitats.

دراسة العلاقات بين الكائنات الحية فيما يتعلق بعاداتهم و مواطنهم .

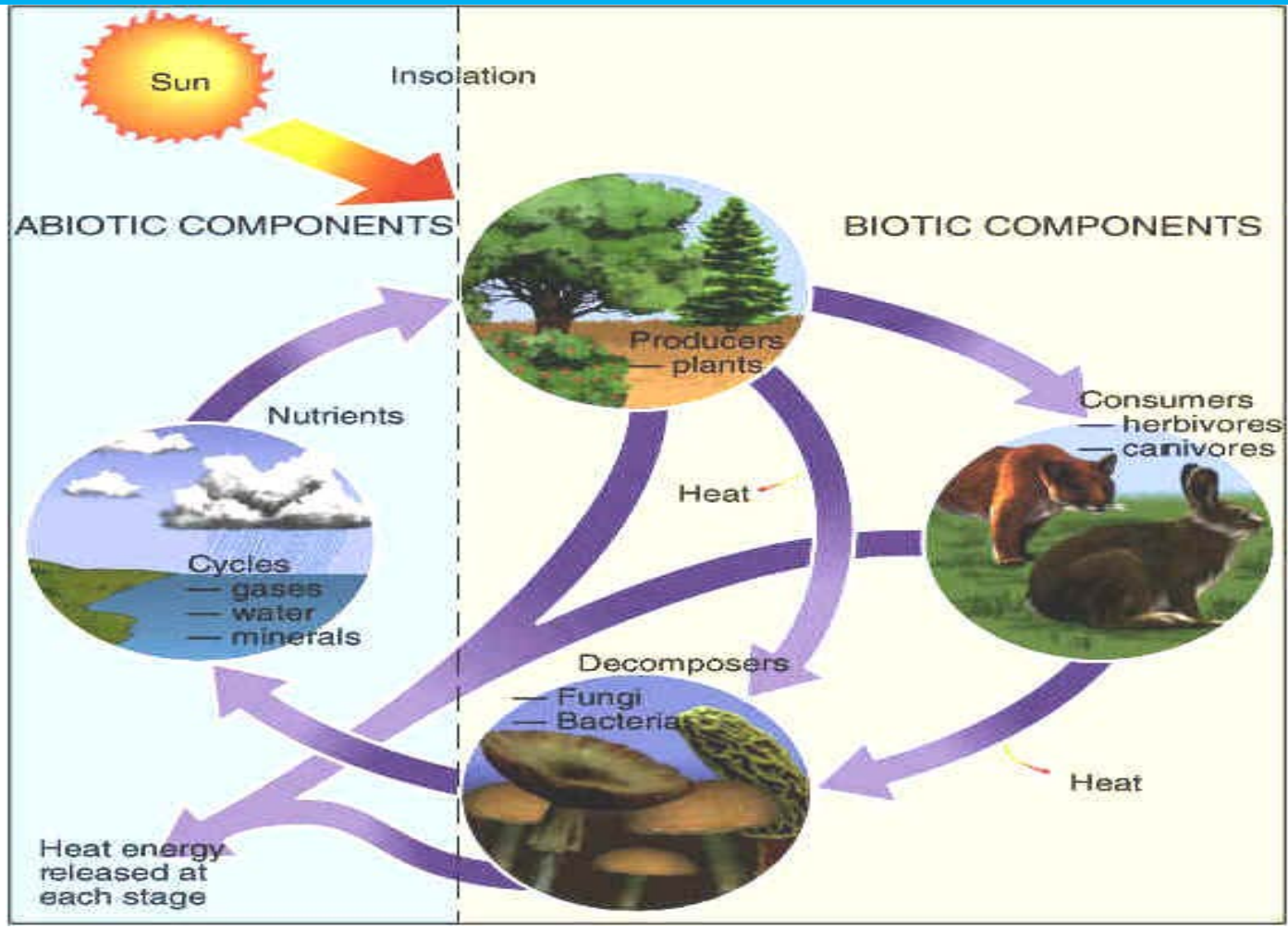
HABITAT
The zone in which the organism (plants and animals) lives and where it can find food, shelter, protection and mates for reproduction.

HABIT:
Aspects of behavior or structure

ENVIRONMENT

Environment is the interactions among the abiotic (physical and chemical) and biological component

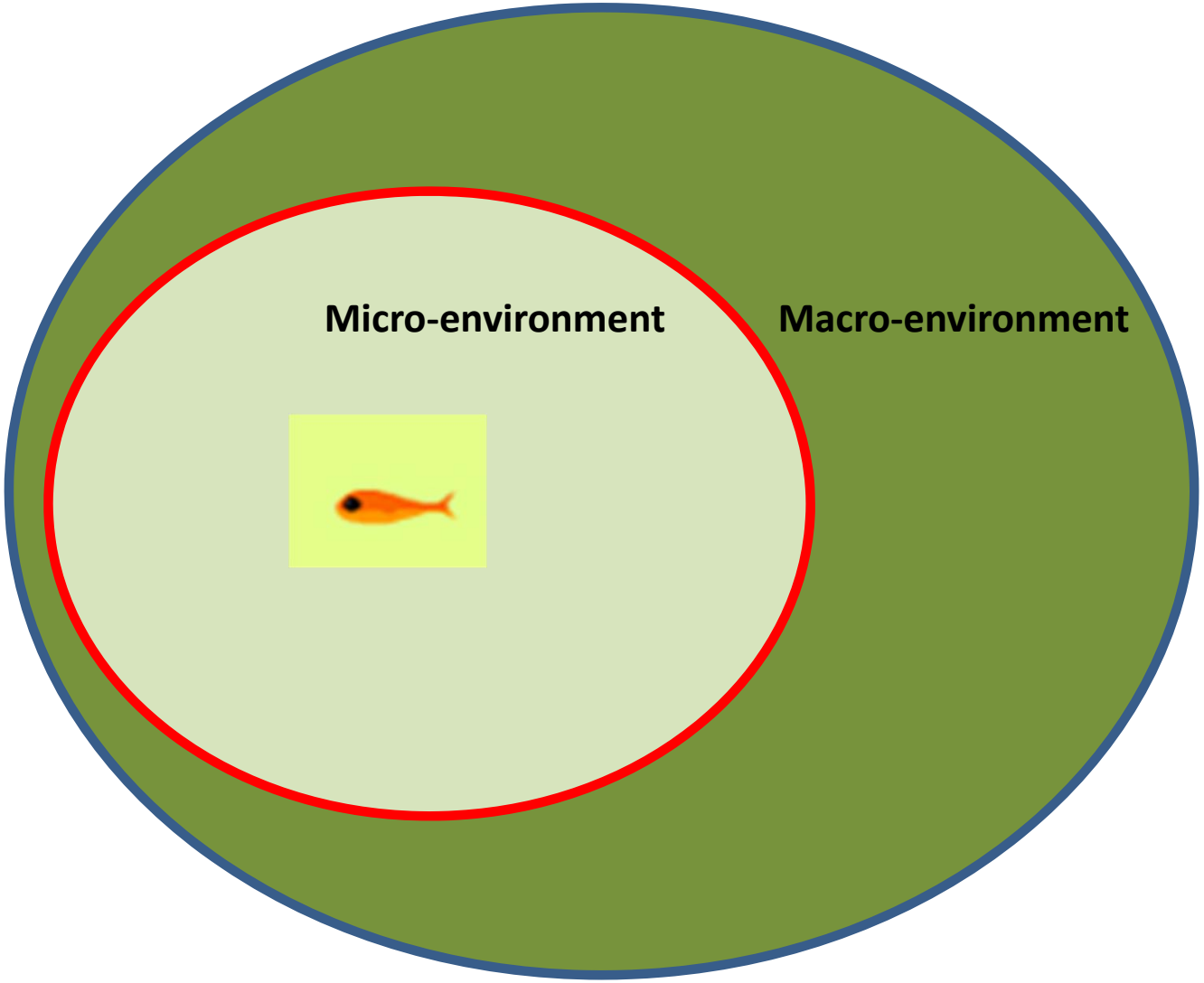
- **Environmental science is an interdisciplinary academic field that integrates physical, biological and information sciences (including ecology, biology, physics, chemistry, zoology, mineralogy, oceanology, soil science, geology, atmospheric science) to the study of the environment, and the solution of environmental problems.**



Environment

- **Macro-environment (prevailing regional climate)**
  البيئة كبيرة (المناخ الإقليمي السائد)

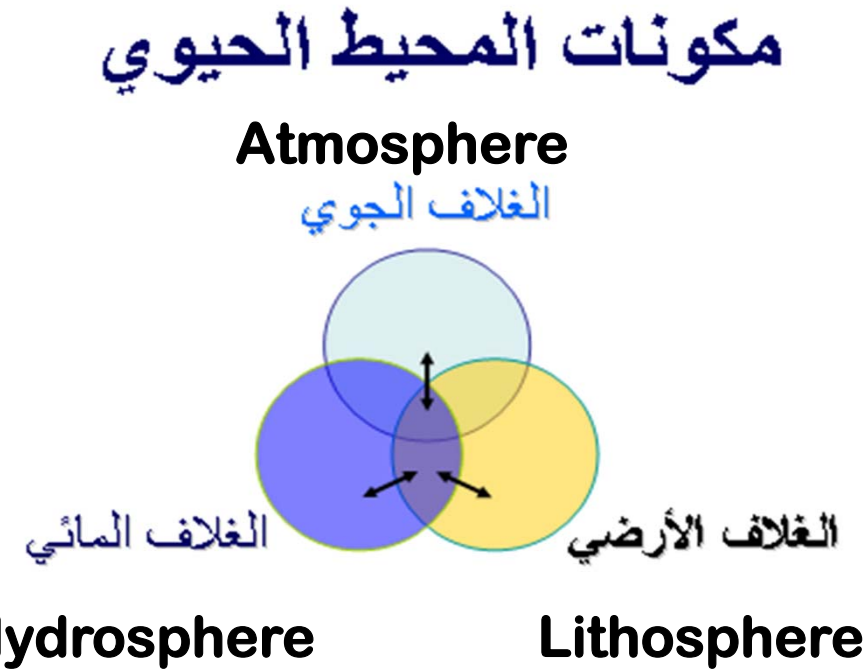
- **Micro-environment (close to an organism to be influenced by it)**
  بيئة صغيرة (قريبة من كائن حي تتأثر به)



Biosphere (sphere of life)

Total portion of lithosphere, hydrosphere and atmosphere that supports the life of organisms.

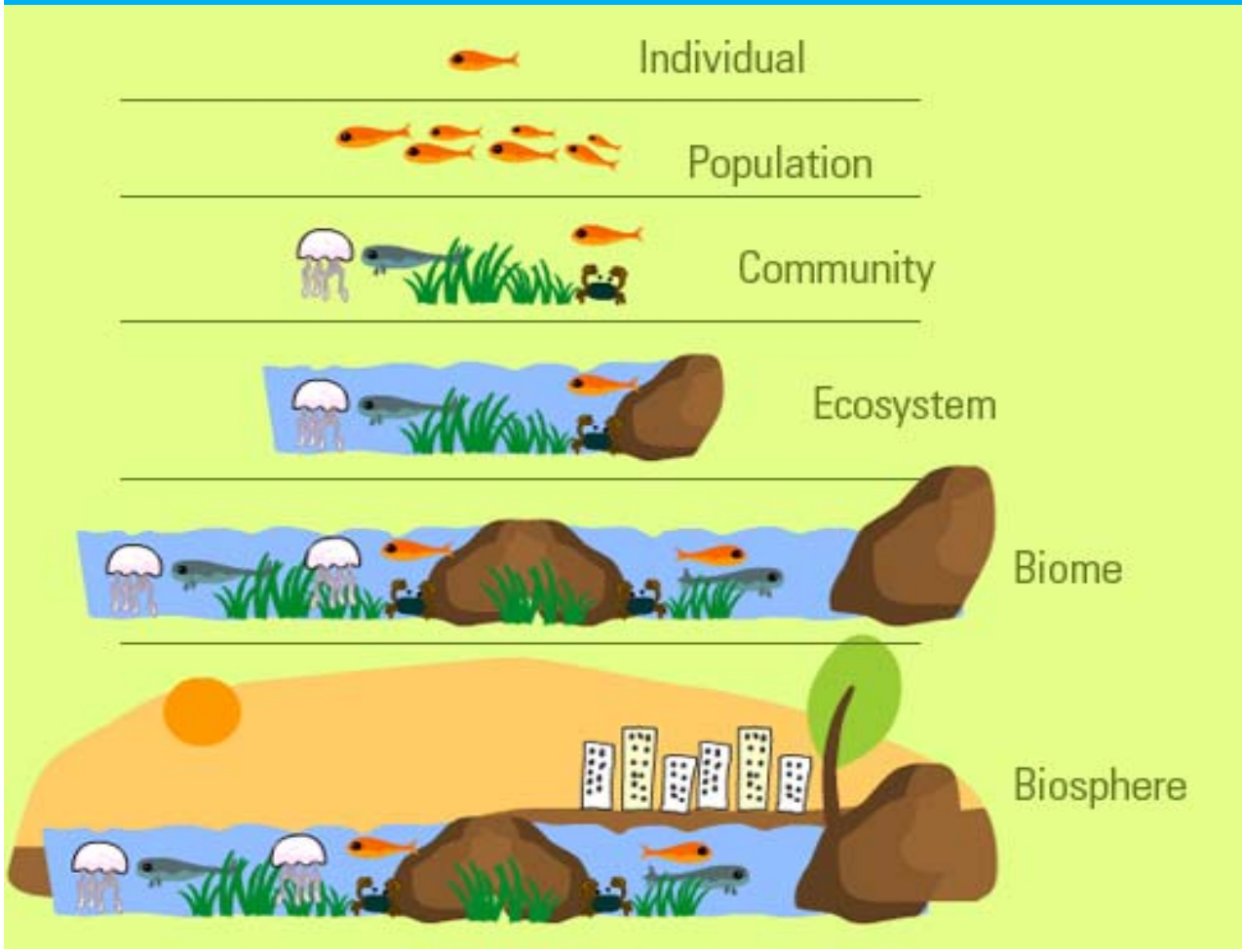
الجزء الكلي من الغلاف الصخري والغلاف المائي والغلاف الجوي الذي يدعم حياة الكائنات الحية.



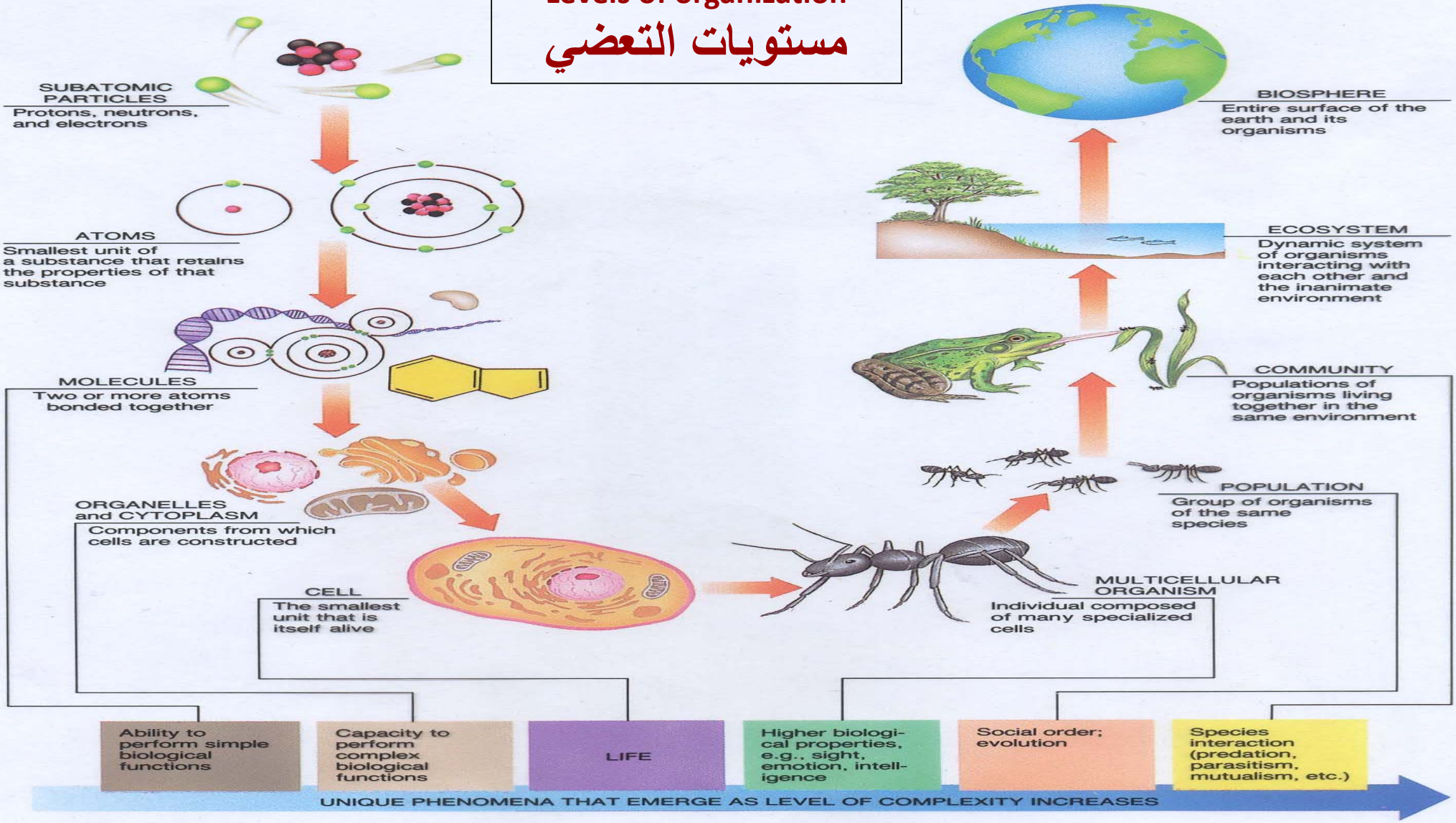
In ecology, the levels of organization include:

- **Individuals** - the fundamental functional units.
- **Populations** - members of the same species co-occurring in space and time and sharing the same resources.
- **Communities** - populations of organisms living together in the same environment.
- **Ecosystems** – Dynamic systems of organisms interacting with each other and their environment.
- **Biomes** - regional ecosystem types with similar communities.

Levels of organization in Ecology



Levels of organization
مستويات التعضي



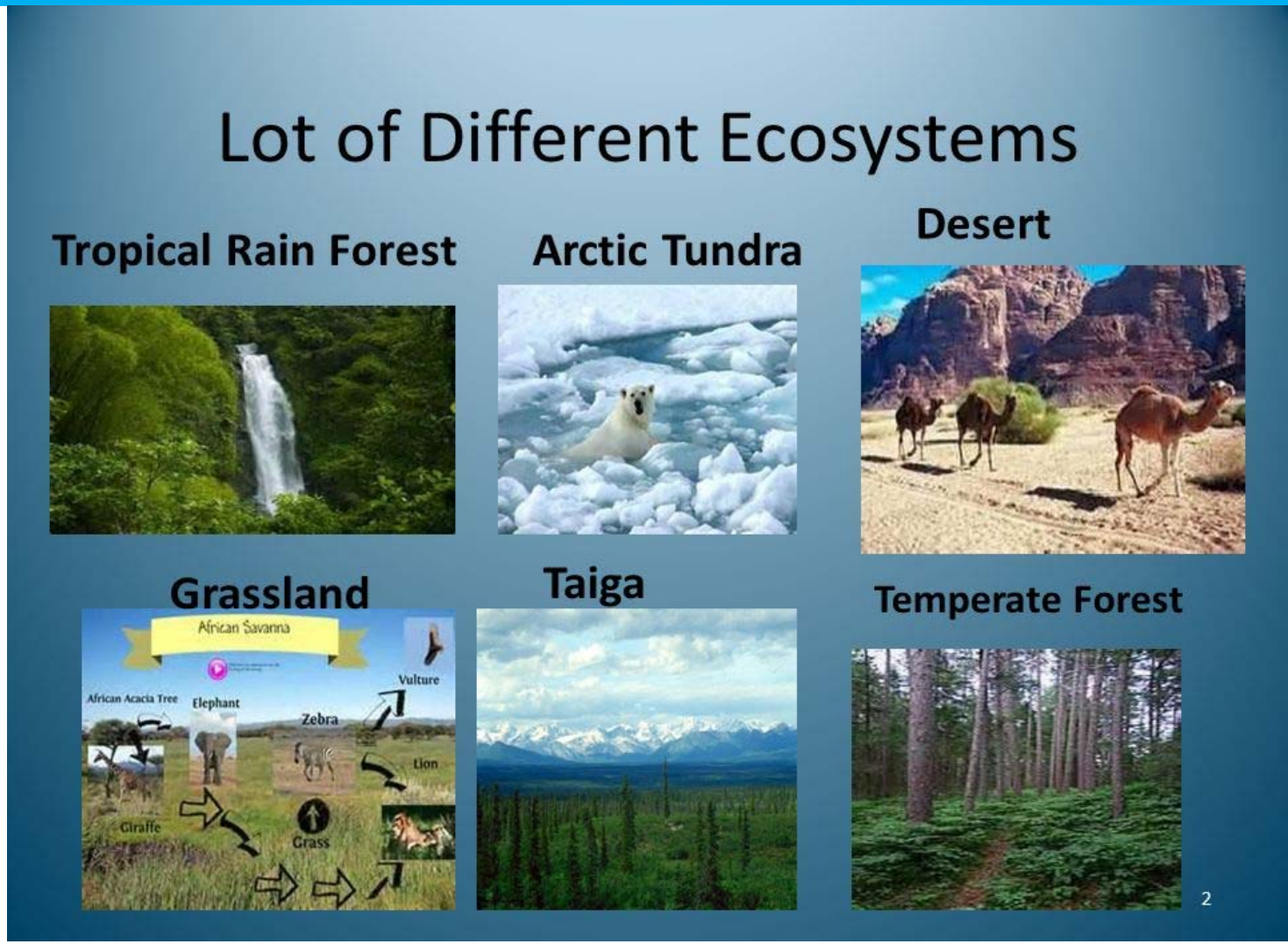
ECOSYSTEM

- **All organisms along with physical environment in a single location.**

جميع الكائنات الحية وبيئتها المادية الموجودة في مكان واحد

- **Various ecosystems make up the largest life unit called biosphere.**

النظم البيئية المختلفة تشكل وحدة الحياة الأكبرالتي يسمى المحيط الحيوي



Structure of Ecosystem

1. Abiotic components

- **Energy** - solar energy
- **Physical factors** - temperature, light, wind, etc.
- **Chemicals** - inorganic substances (oxygen, carbon, etc.) and organic substances (carbohydrates, proteins, etc.)

2. Biotic components

- **Producers** - green plants (autotrophs)
- **Consumers** - animals (heterotrophs)

  -**Herbivores** (primary consumers)

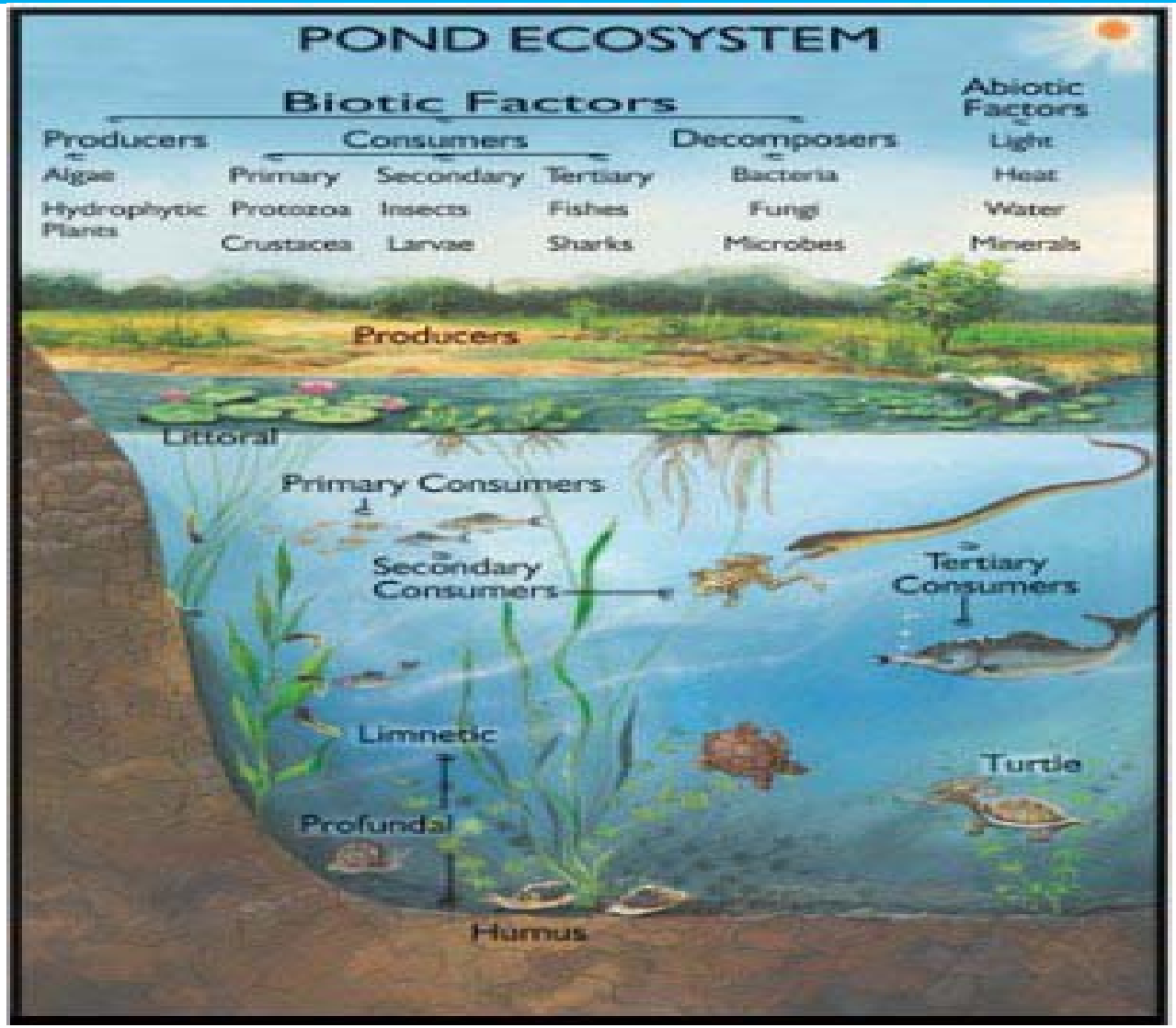
  -**Carnivores** (primary, secondary, tertiary, etc. consumers)

  -**Omnivores** (generalists)-can feed on both plants and animals.

  -**Scavengers** (top carnivores)-utilize the dead remains of animals

3. Decomposers (saprotrophs)

bacteria and fungi



Food Chain السلسلة الغذائية

- **A linear energy and chemical flow through organisms.**

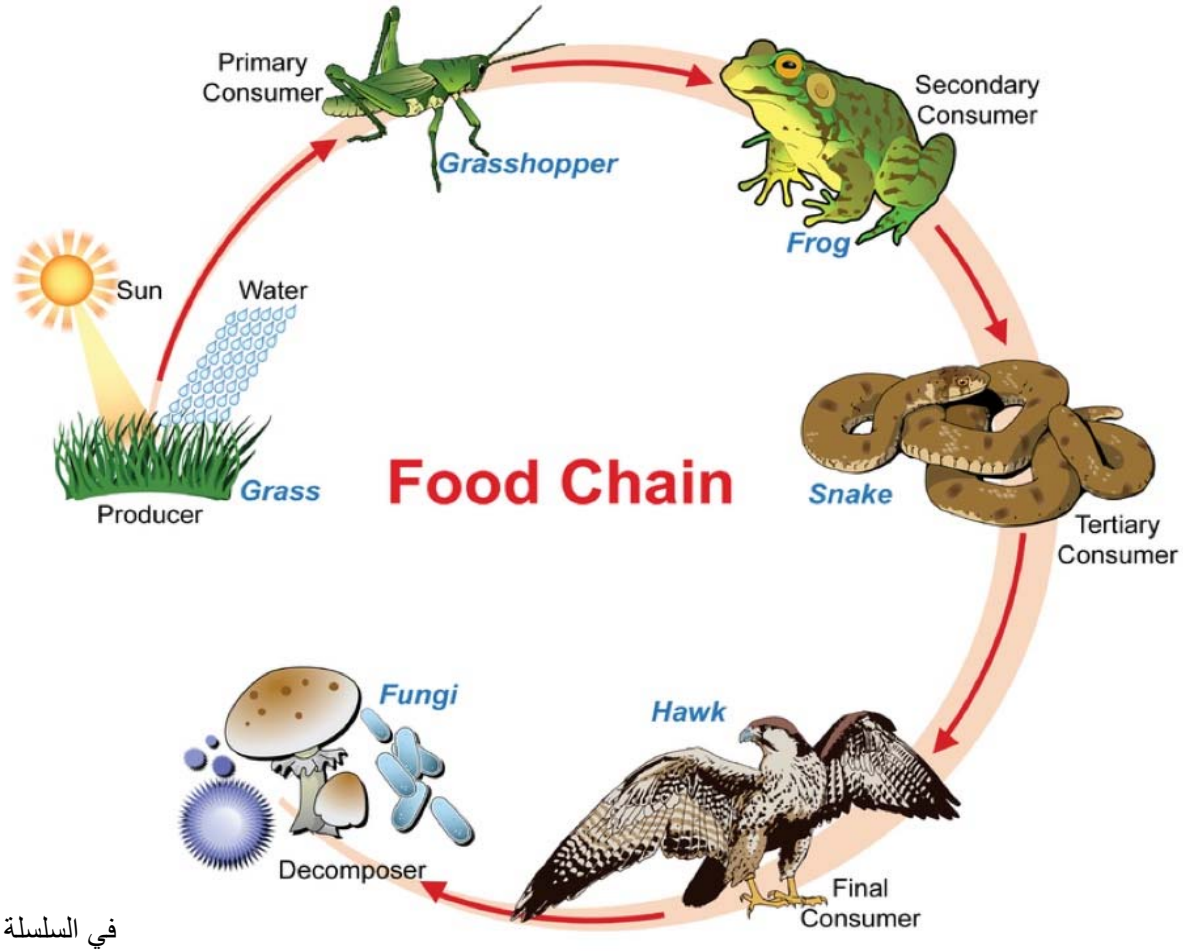
الطاقة الخطية وتدفق المواد الكيميائية من خلال الكائنات الحية

- **In food chain, there is transfer of food from one trophic (feeding) level reaches to the other trophic level (who eats whom?).**

انتقال المواد الغذائية من مستوى غذائي ليصل إلى مستوى غذائي الآخر

- **In the classical food chain: Plants are eaten only by primary consumers primary consumers are eaten by secondary consumers, secondary consumers are eaten by tertiary consumers, and so forth.**

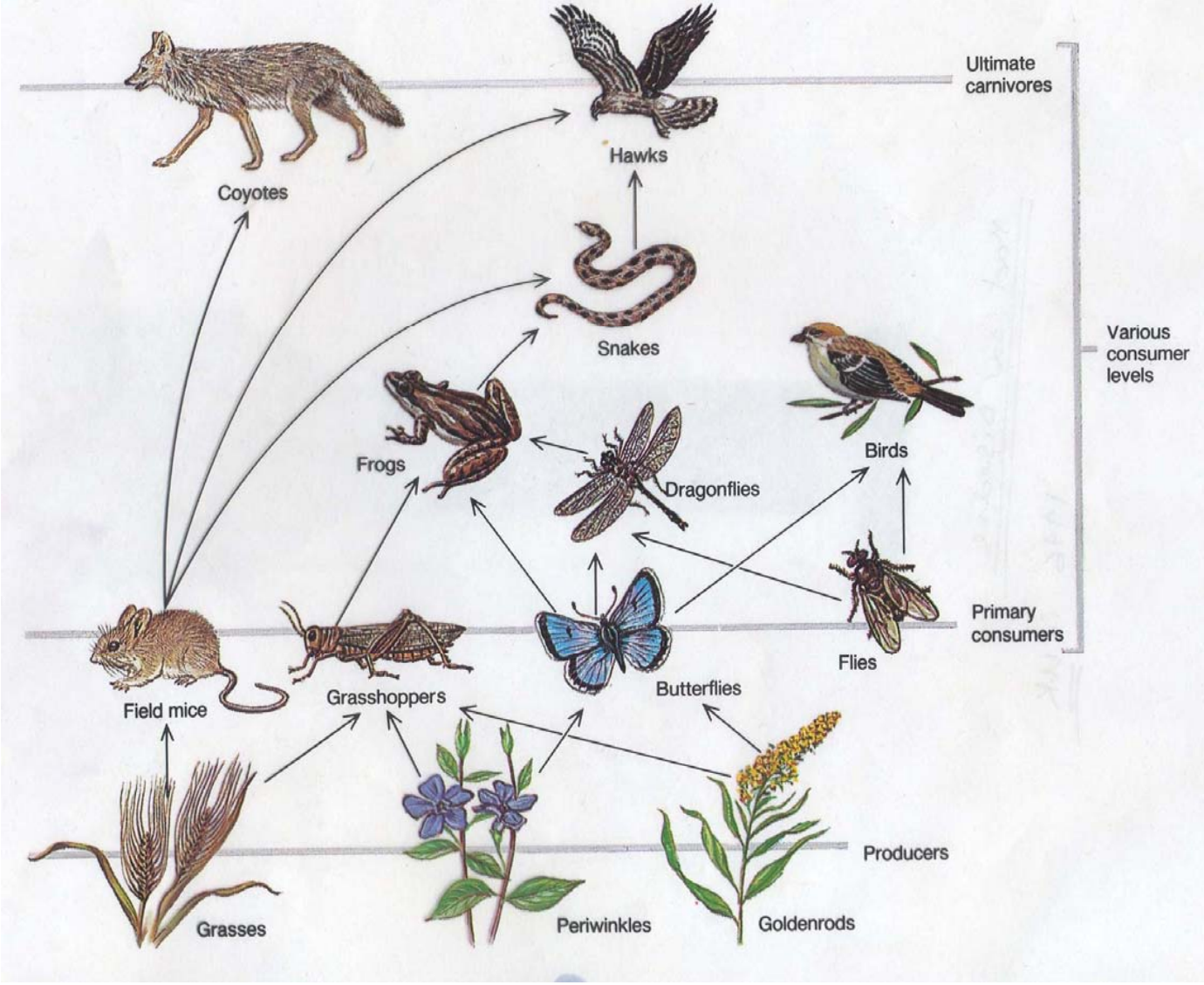
في السلسلة الغذائية التقليدية التي تؤكل النباتات فقط من قبل المستهلكات الأساسية و تؤكل المستهلكات الأساسية من قبل المستهلكات الثانوية وتؤكل المستهلكات الثانوية من قبل المستهلكات العليا وهكذا.



Food Web الشبكة الغذائية

- The natural interconnection of food chains is called as food web

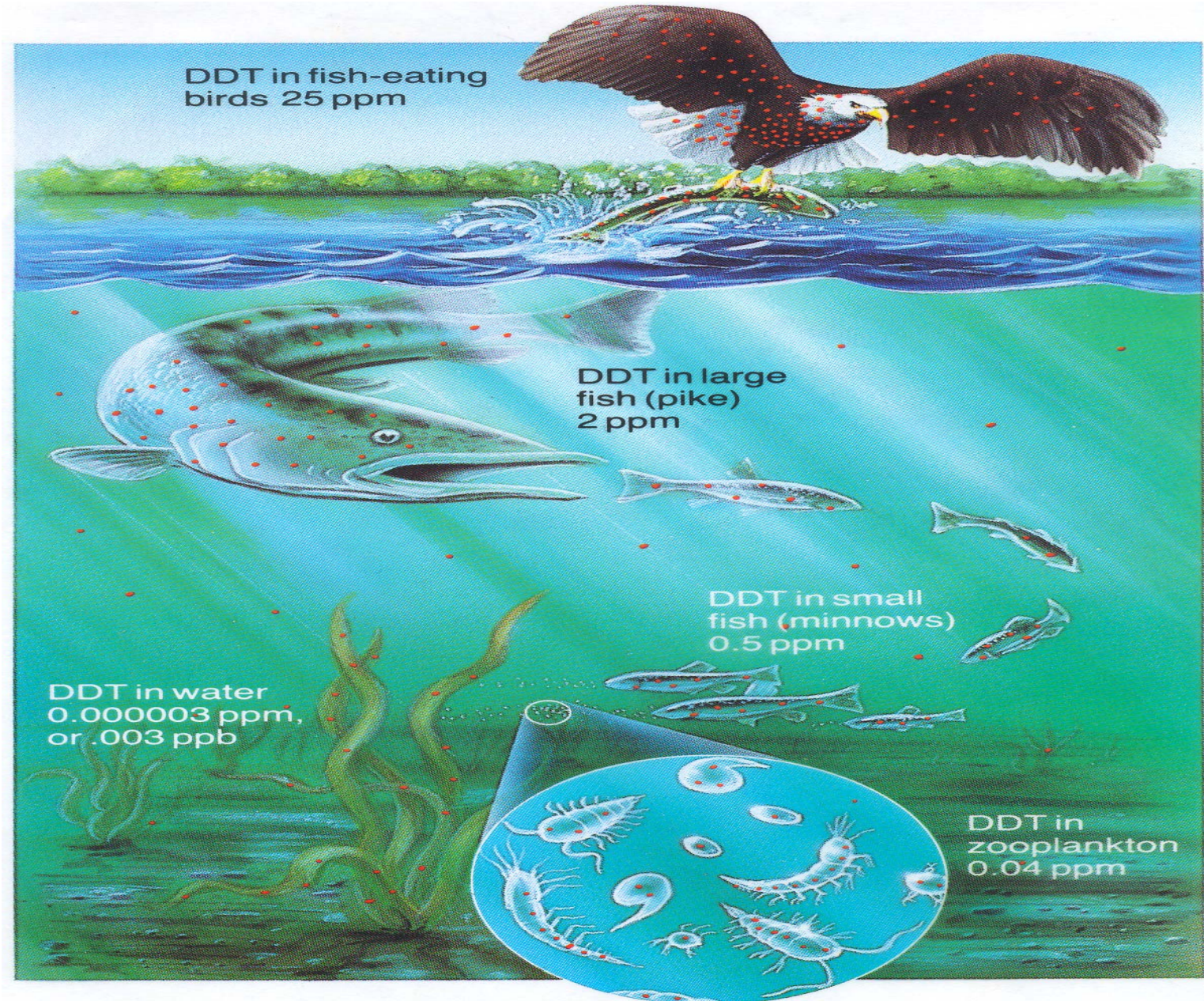
- A given organism may obtain nourishment from many different trophic levels and thus gives rise to a complex and interconnected series of energy transfers.



Food chain

and

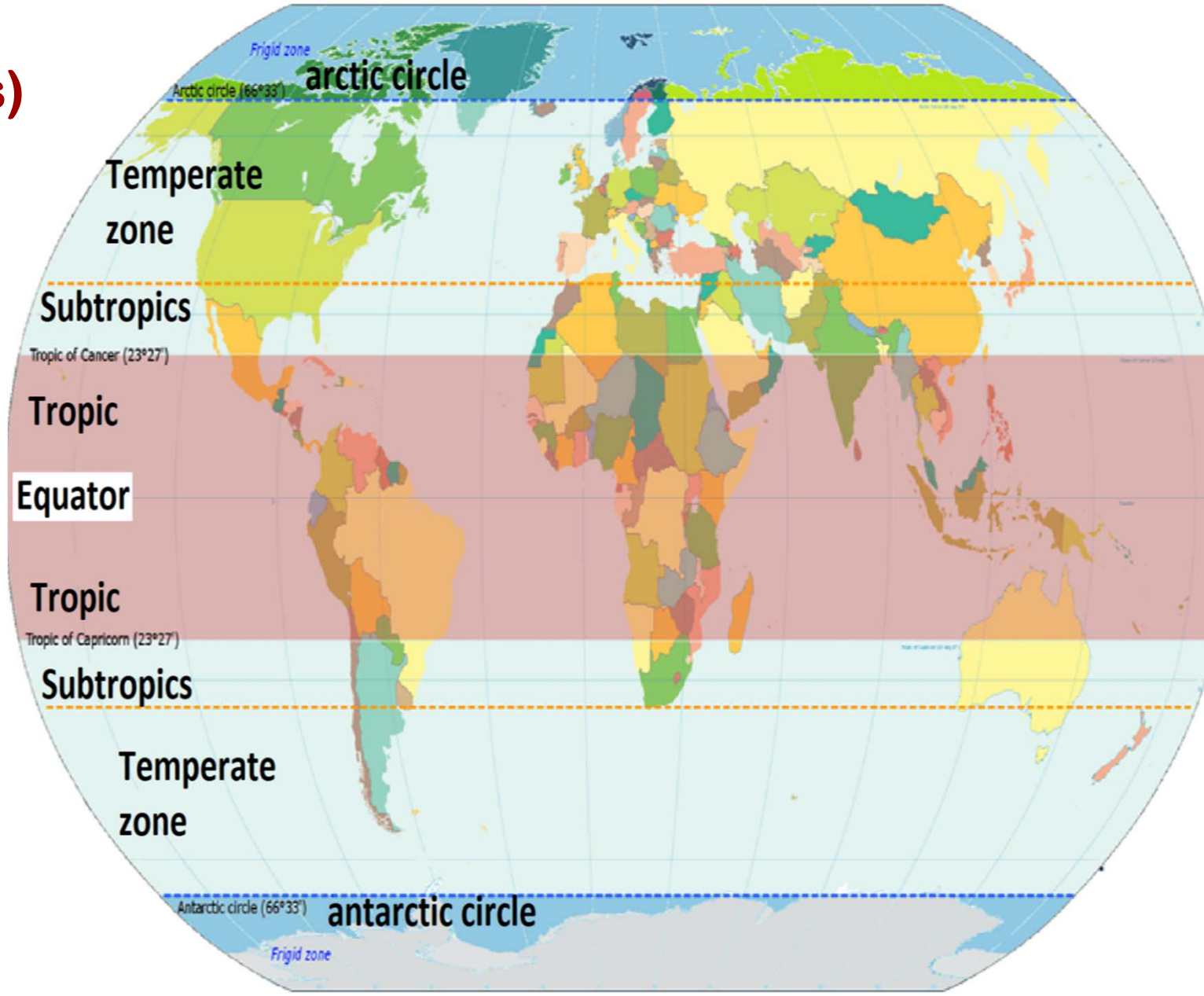
pollutant accumulation



المناطق الحياتية (النطاقات الحياتية)

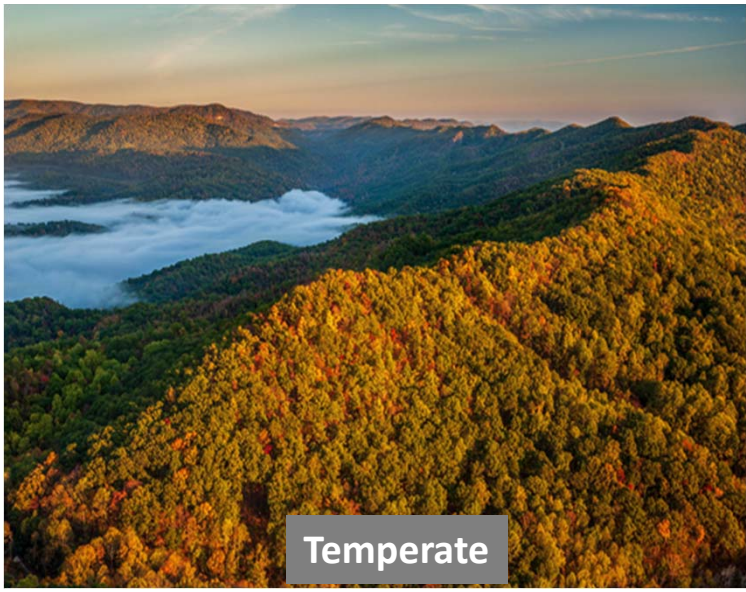
Zonobiomes (Biomes)

1. **Equatorial diurnal climate**
   المناطق المدارية
2. **Tropical**
   المناطق الاستوائية
3. **Subtropical (Desert)**
   المناطق تحت الاستوائية (الصحراء)
4. **Mediterranean**
   مناطق البحر المتوسط
5. **Warm temperate**
   المناطق المعتدلة الدافئة
6. **Temperate**
   المناطق المعتدلة
7. **Arid temperate (Continental)**
   المناطق المعتدلة الجافة (المناخ القاري)
8. **Cold temperate**
   المناطق المعتدلة الباردة
9. **Arctic (Tundra)**
   المناطق القطبية (التندرا)




Equatorial diurnal climate


Mediterranean


Temperate


Subtropical


Arctic (Tundra)


Desert

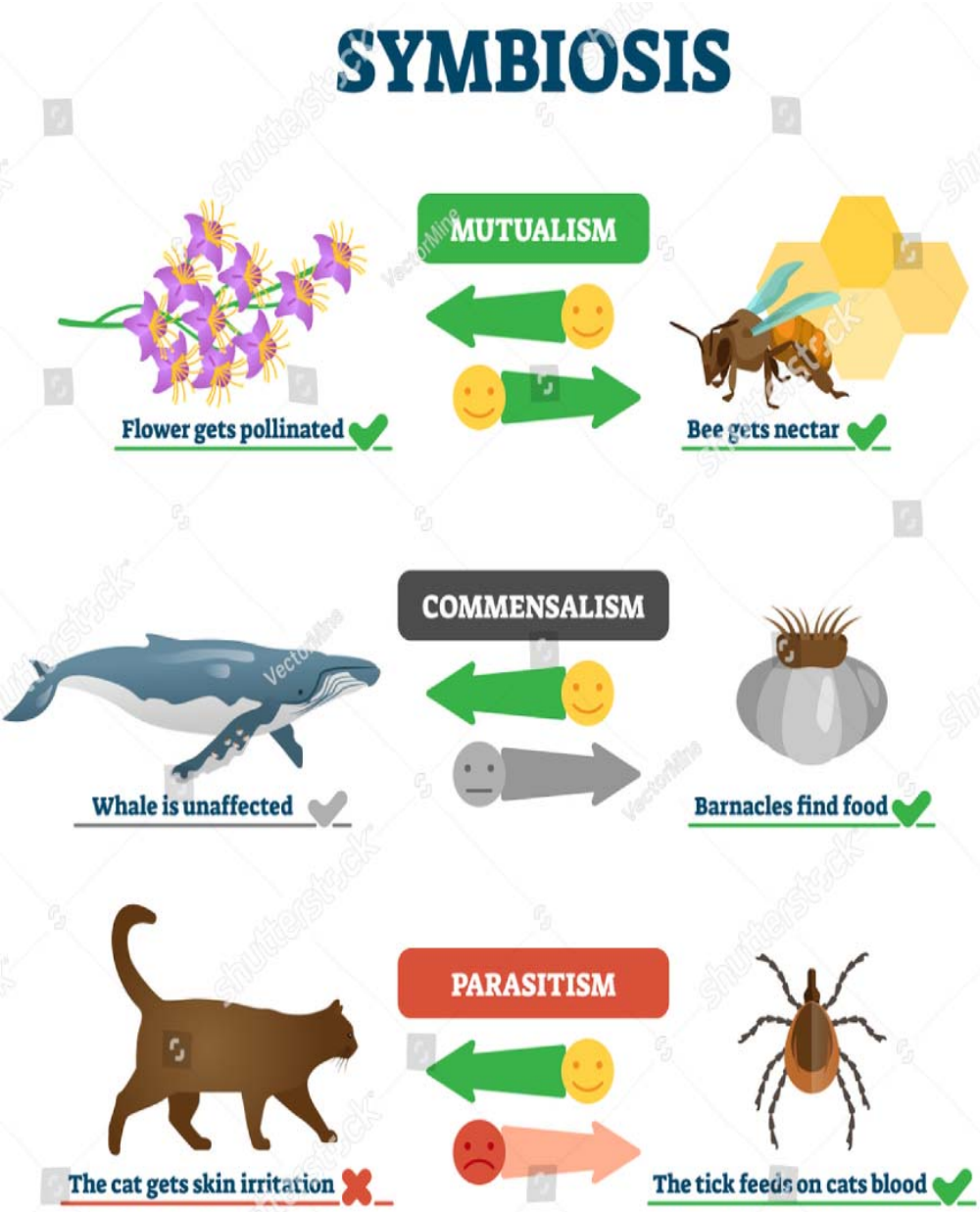
Amensalism:

An interaction between two populations in which **one is not affected** and the **other is negatively affected**.

التضاد: التفاعل بين اثنين من الكائنات احدهم لا يتأثر والآخر يتأثر سلبا.

Allelopathy التضاد البيوكيميائي

- The production of biomolecules by one plant species which can inhibit the germination and/or growth of other plant species (Rizvi et al. 1992)



Symbiosis: An interaction in which both species are positively influenced as a result of their co-occurrence (happy and strong together). **التكافل**: هي العلاقة التي يتأثر فيها كلا النوعين إيجابيا.

Mutualism: An interaction in which each member derives a positive benefit and also provides a portion of the cost of the interaction.

تبادل المنافع والمصالح (التعايش أو التقايض): وهي علاقة يحصل كل عضو فيها على فائدة إيجابية من الأخر.

Commensalism: An interaction between two populations in which one is not affected and the other is positively affected.

المشاركة: التفاعل بين اثنين من الكائنات واحد لا يتأثر والآخر يتأثر إيجابيا.

Parasitism: An interaction in which an organism serves as a food source (host) for other organisms (parasites) that commonly are much smaller in size, ultimately results in the death of, or detriment to, the host organism.

التطفل: وهو التفاعل الذي يخدم كائن حي كمصدر للغذاء (المضيف) للكائنات الحية الأخرى (الطفيليات) التي هي عادة أصغر حجما ويؤدي في نهاية المطاف إلى وفاة أو إضرار الكائن المضيف.

Predation:

An interaction in which one living organism serves as a food source for another organism; one positively (predator) affected and the other is negatively (prey) affected.

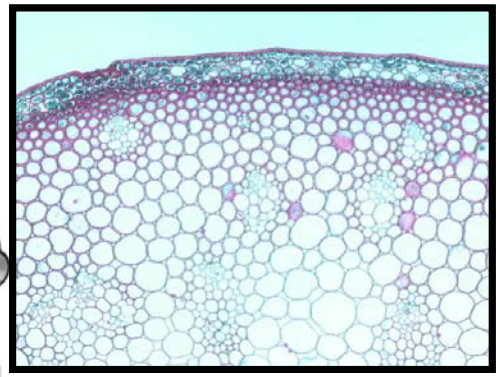
الافتراس: وهو التفاعل الذي يخدم احد الكائنات الحية كمصدر للغذاء لكائن آخر. احدهم يتأثر إيجابي (المفترس) والآخر يتأثر سلبي (الفريسة) المتضررة.

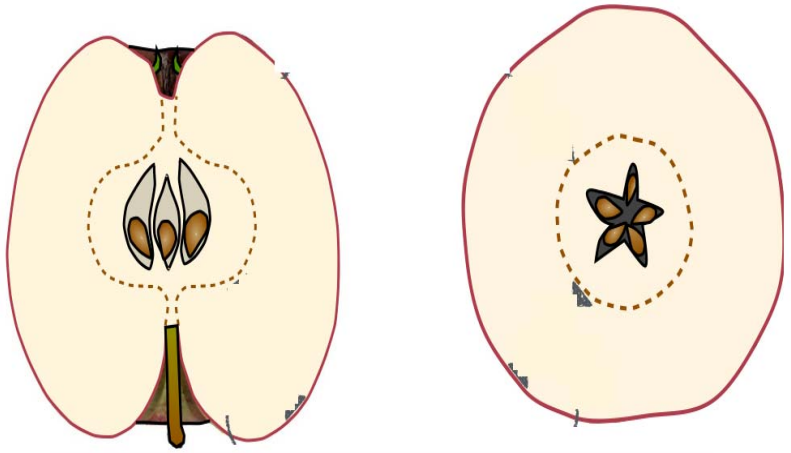
PLANT ANATOMY

PLANT TISSUES AND ORGANS

PLANT ANATOMY
(Study of internal structure of plant)

Microscope





L.S ----Longitudinal section .
T.S ------ Transverse section .

قطاع طولي
أو
قطاع عرضي

Plant Tissue

(Group of cells having similar structure and function is called as tissue)

النسيج النباتي هو مجموعة خلايا تمتلك وظائف وتراكيب متشابهة

Tissue Systems

There are four plant tissue systems:

النظام النسيجي الاساسية

1. Ground tissue system

النظام النسيجي الوعائي

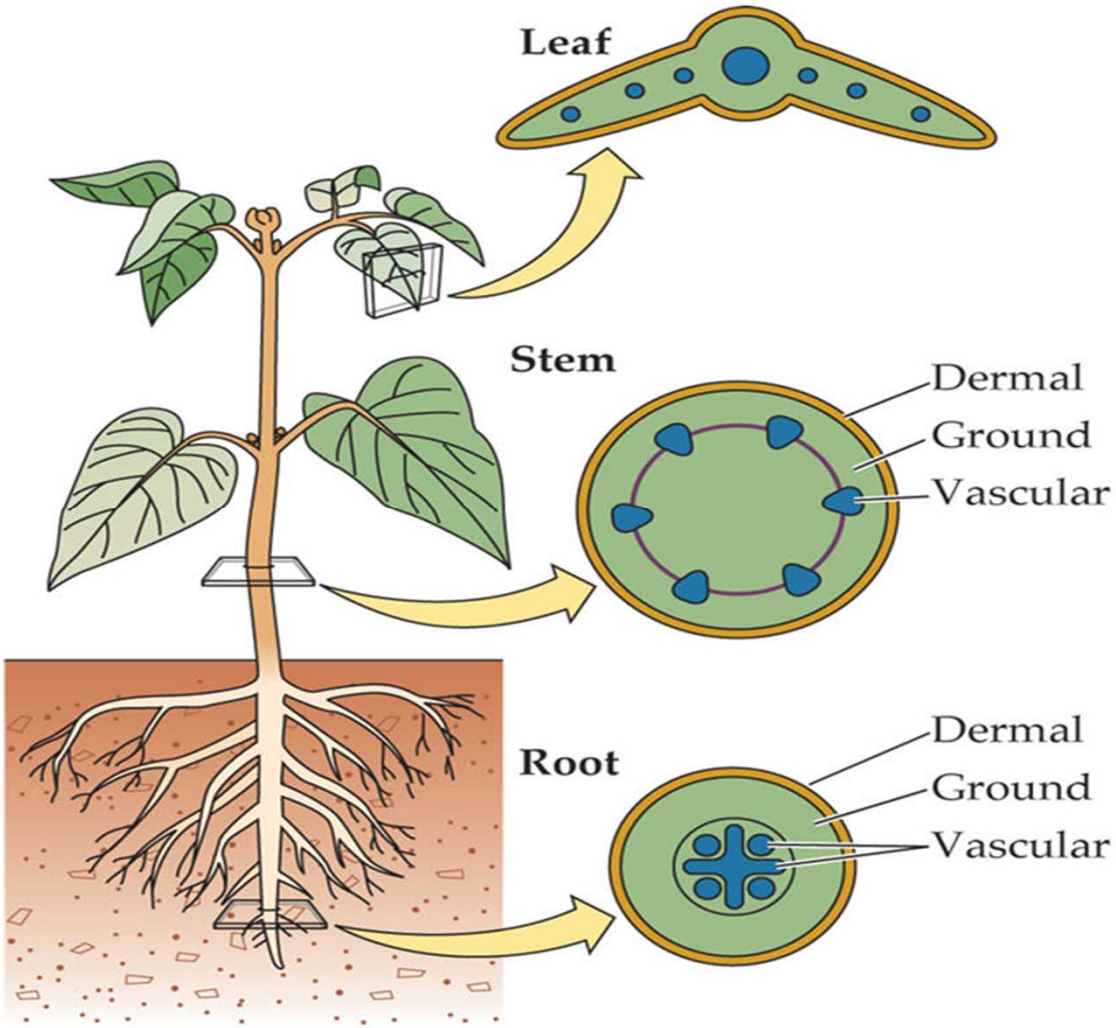
2. Vascular tissue system

النظام النسيجي الوقائي

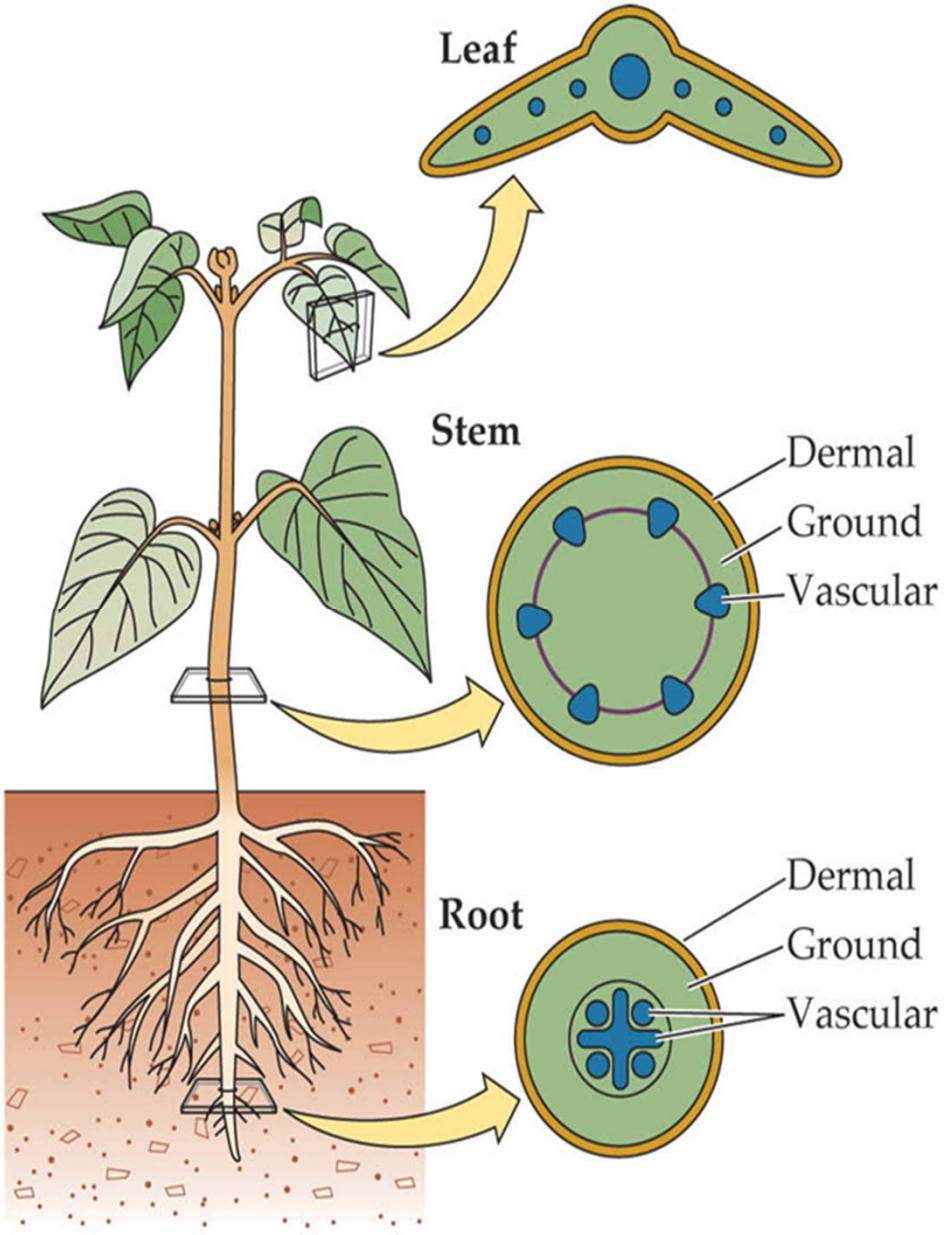
3. Dermal tissue system

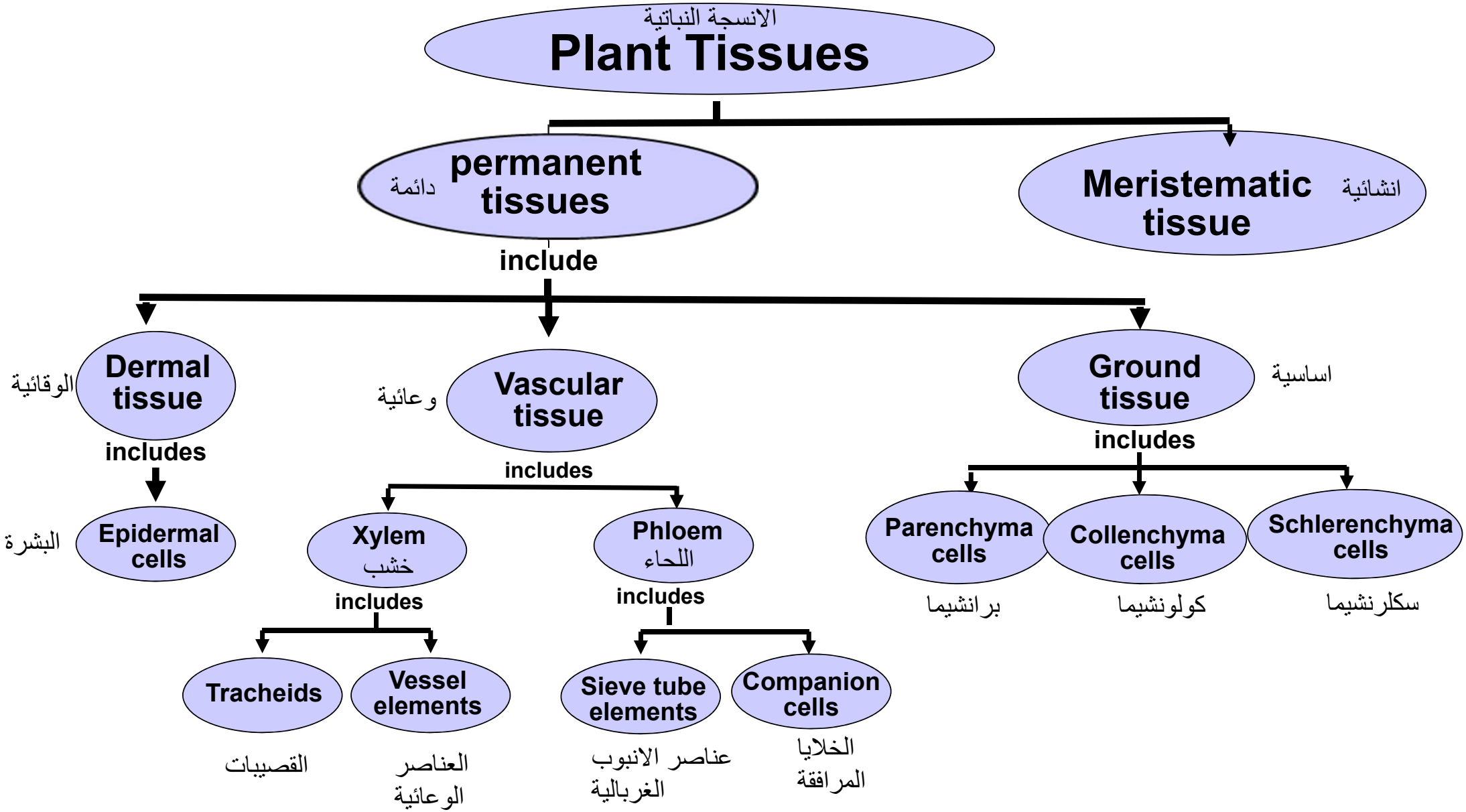
النظام النسيجي الانشائي

4. Meristematic tissue system (dividing tissue)



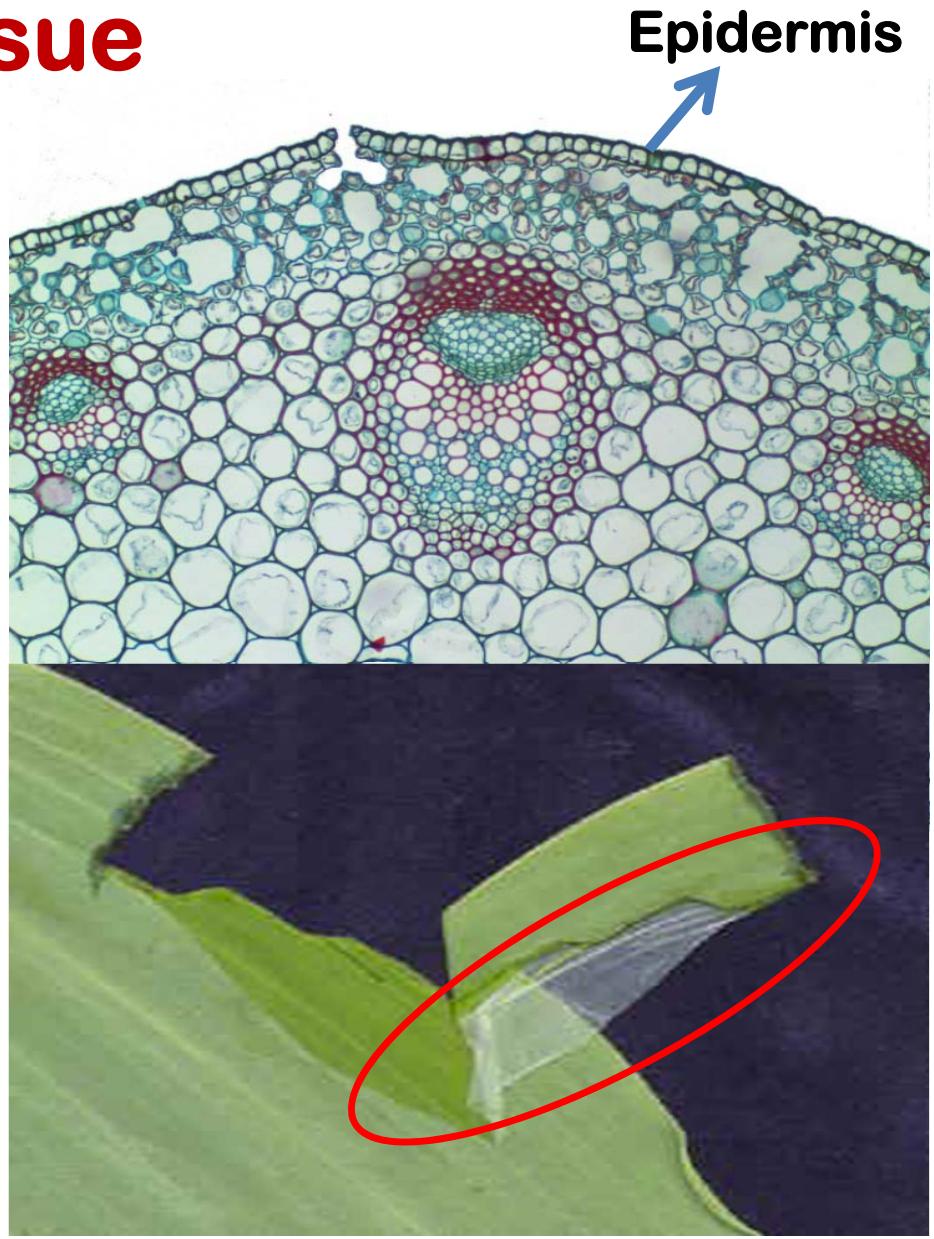
- A **tissue** is an organization of cells that work together as a functional unit.
- Parenchyma cells make up parenchyma tissue, which is a **simple tissue**. نسيج بسيط
- Xylem (خشب) and phloem (اللحاء) are **complex tissues** (نسيج معقد); they are composed of a number of different cell types.
- Tissues are grouped into **tissue systems** that extend throughout the body of the plant to form the various organs of the plant.
- There are three plant **tissue systems**:
  - *vascular tissue*
  - *dermal tissue*
  - *ground tissue*




الانسجة النباتية
Plant Tissues
permanent tissues
دائمة
Meristematic tissue
انشائية
include
Dermal tissue
الوقائية
includes
Epidermal cells
البشرة
Vascular tissue
وعائية
includes
Xylem
خشب
Phloem
اللحاء
includes
includes
Tracheids
Vessel elements
Sieve tube elements
Companion cells
القصيبات
العناصر الوعائية
عناصر الانبوب الغربالية
الخلايا المرافقة
Ground tissue
اساسية
includes
Parenchyma cells
Collenchyma cells
Schlerenchyma cells
برانشيما
كولونشيما
سكلرنشيما

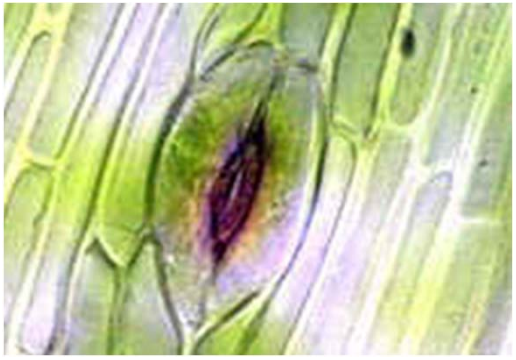
Dermal Tissue

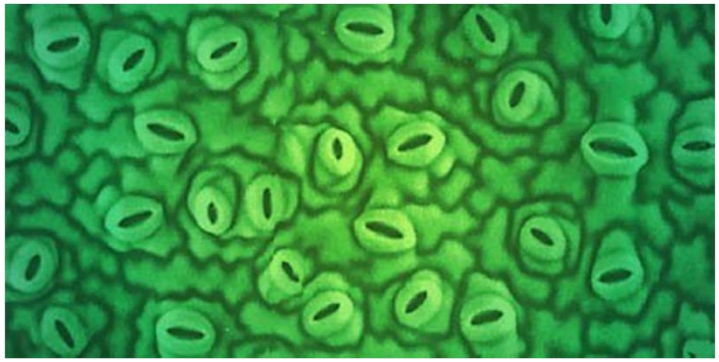
- **Dermal** tissue covers the plant **body**.
  تغطي جسم النبات
- **Dermal** tissue consists of **epidermis**
  البشرة
- **Epidermis** is made of **parenchyma** cells in a **single layer**
- Epidermis on stem and leaves prevents **water loss** by **transpiration**
  النتح
- Epidermis produces a **waxy** material called **cuticle**
  شمع
  الادمة

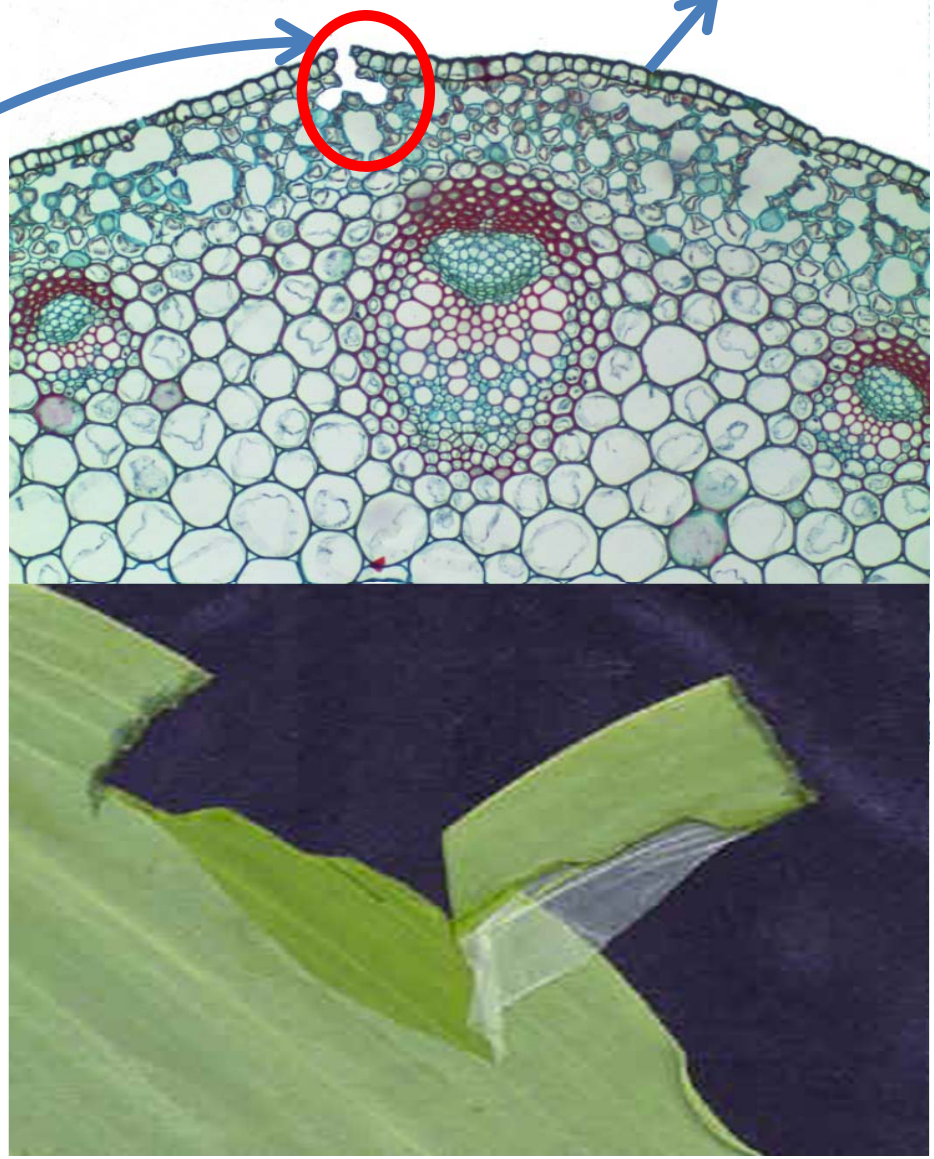


Dermal Tissue - Stomata

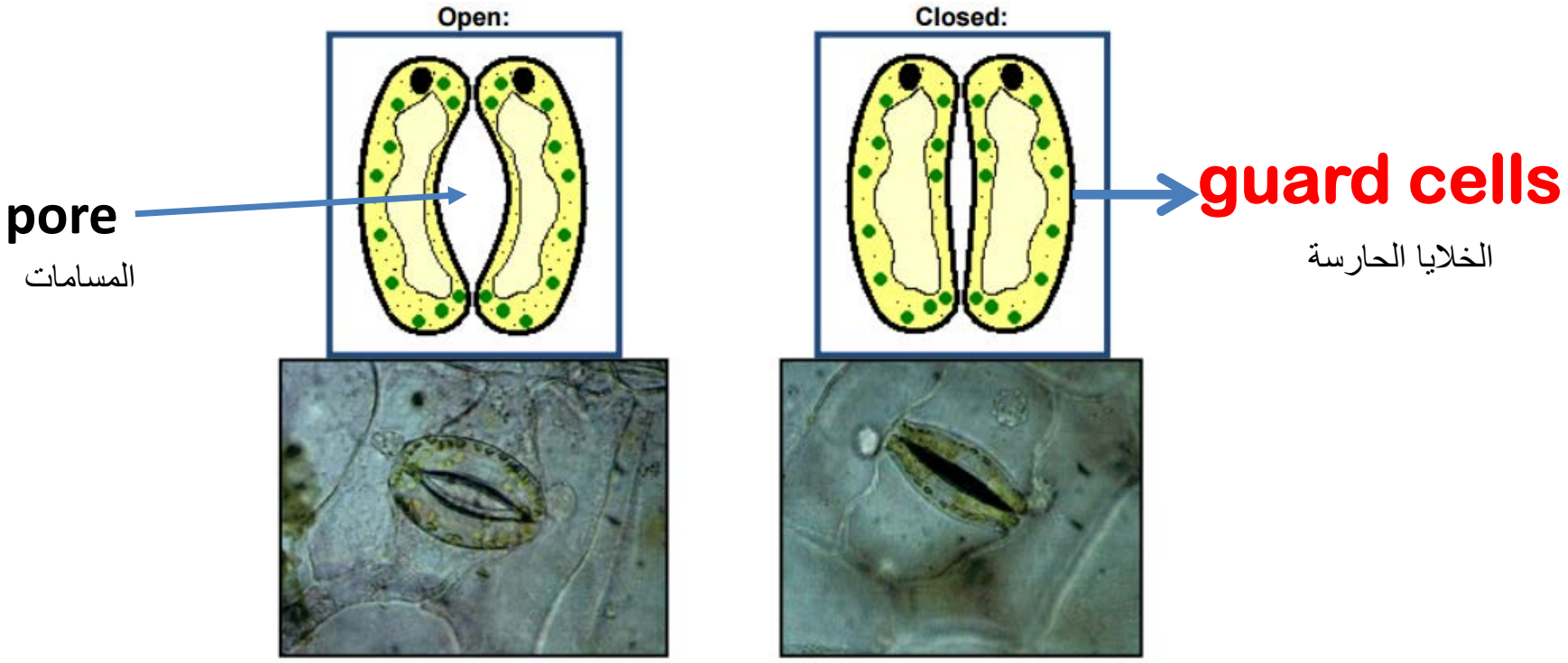
- Openings in the epidermis on the underside of a leaf where gases are exchanged are called **stomata**. الثغور







Dermal Tissue - Stomata

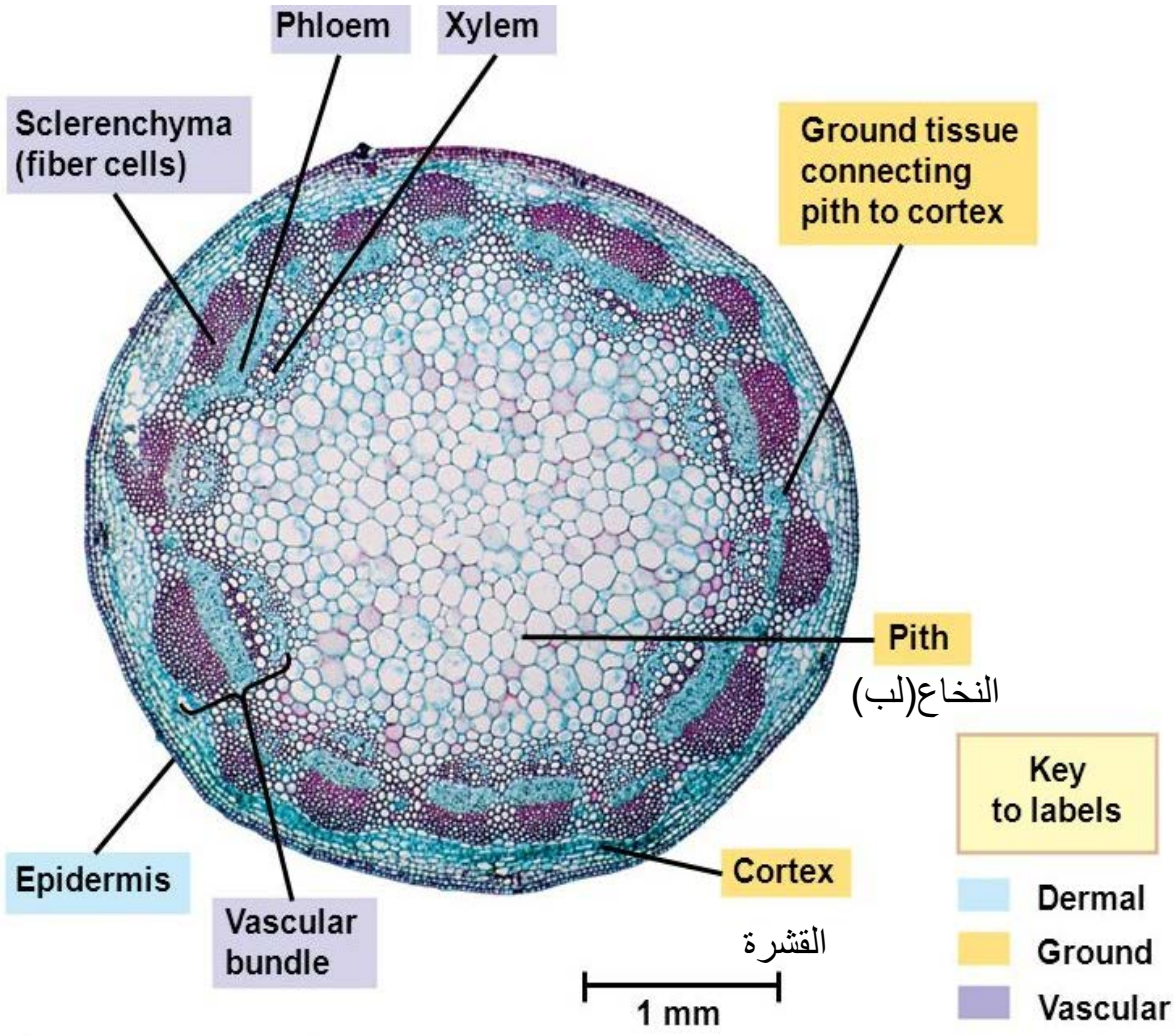


Sausage-shaped guard cells are found on each side of the stoma to help *open and close the pore* to prevent water loss

Ground Tissue اساسية

- The ground tissue of plants includes all tissues that are neither dermal nor vascular
  تشمل جميع الانسجة التي لا تصنف ضمن الانسجة الوقائية او الوعائية
- Ground tissue functions primarily in storage, support, photosynthesis, and the production of defensive and attractant substances (oils and toxins).
  انتاج المواد الدفاعية او الجاذبة
- There are three types of ground tissue:

1. Parenchyma cells
2. Collenchyma cells
3. Sclerenchyma cells



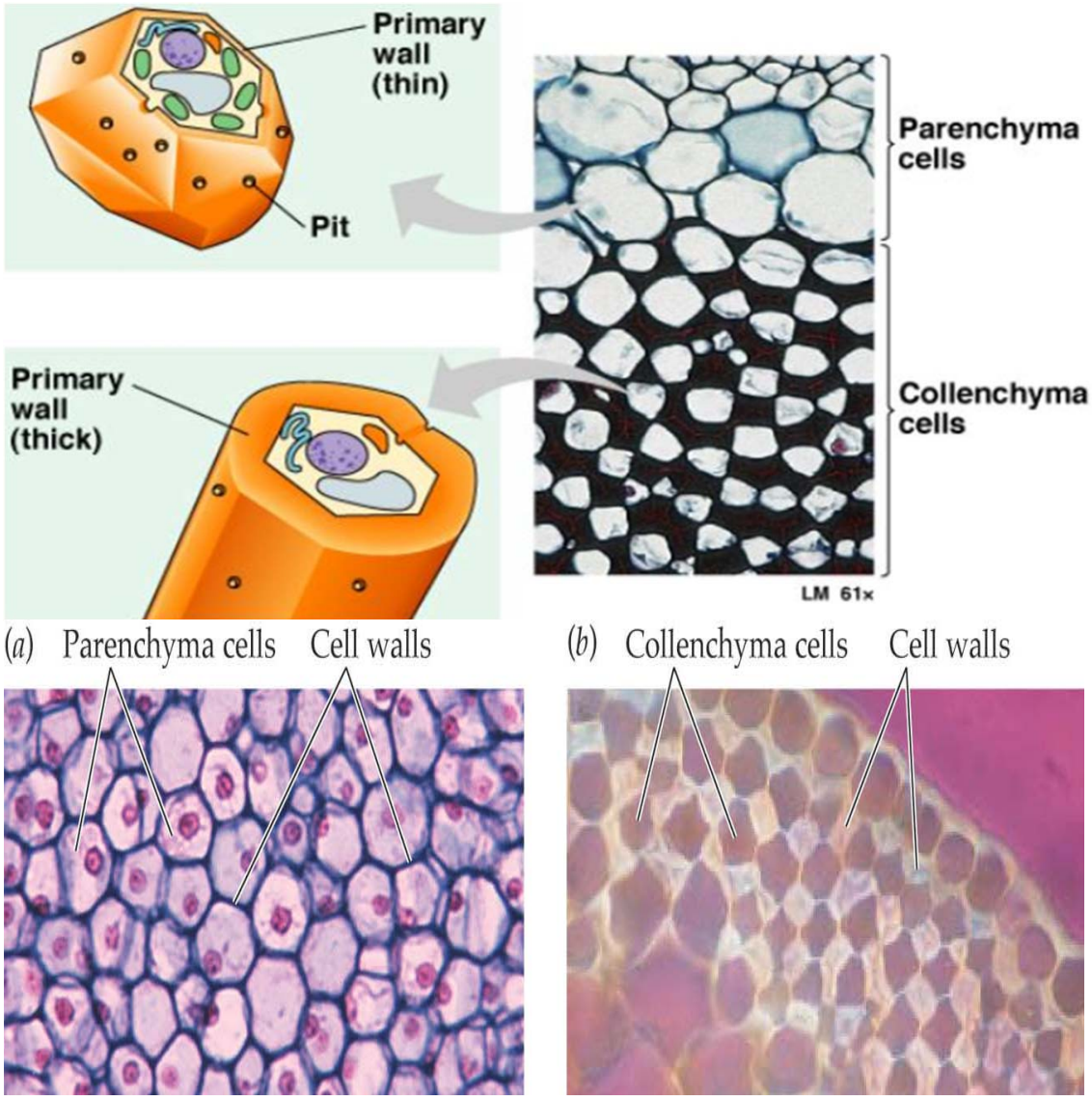
(a) Cross section of stem with vascular bundles forming a ring (typical of eudicots)

Types of Ground Tissue

- **Parenchyma** cells usually have **thin primary walls and large central vacuoles**. Parenchyma forms the **"filler" tissue in the soft parts of plants**.

- **Collenchyma** cells usually have **primary walls that are thick in the corners**. Collenchyma provides **extra structural support**.

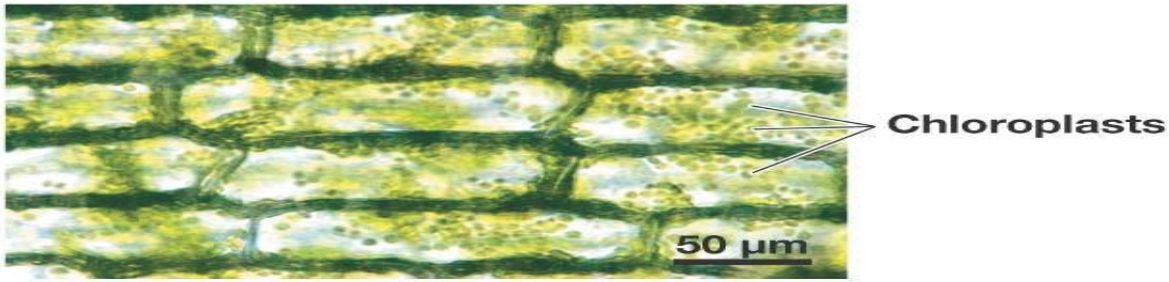
- **Sclerenchyma** cells have **thick lignified secondary walls**. Sclerenchyma provides the **main structural support to a plant**.



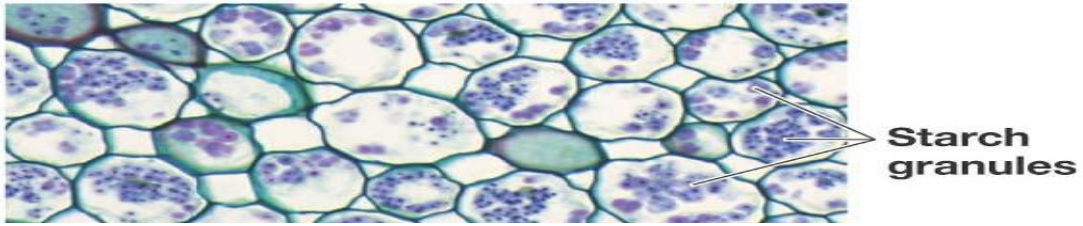
- **Parenchyma cells**

- The photosynthetic cells in leaves or stems are parenchyma cells filled with chloroplasts. These cells are called *chlorenchyma* cells.
- Some parenchyma cells store lipids or starch (potatoes).

(a) In leaves, parenchyma cells function in photosynthesis and gas exchange.

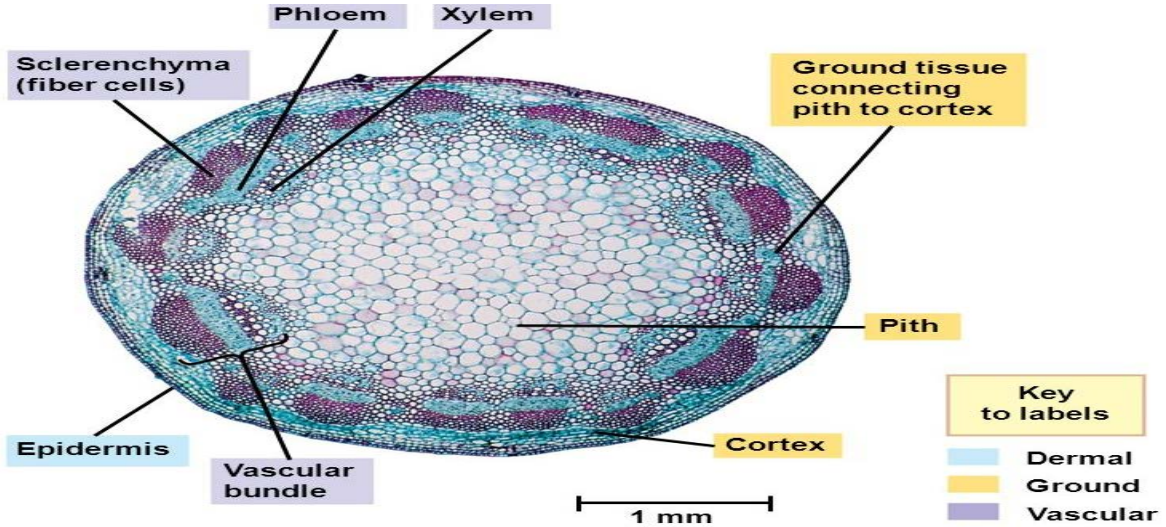


(b) In roots, parenchyma cells function in carbohydrate storage.



- ***Collenchyma*** **cells**

- Collenchyma cells provide support to leaf petioles, non woody stems, and growing organs.
- These cell types compose the cortex (القشرة) and pith (النخاع)(لب) tissues of the root and stems.



(a) Cross section of stem with vascular bundles forming a ring (typical of eudicots)

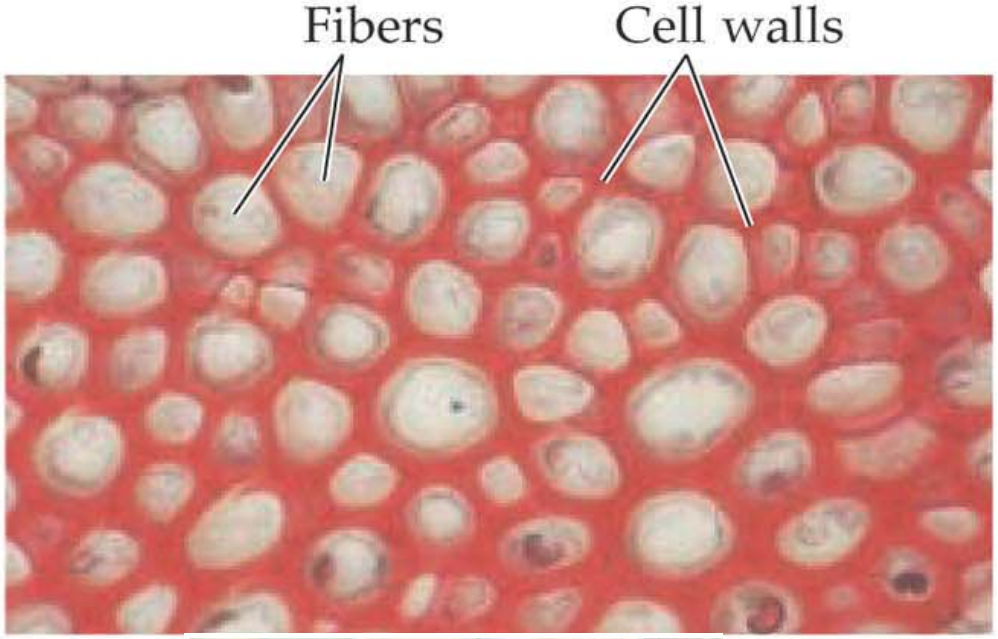
- ***Sclerenchyma*** **cells are the main supporting cells of a plant. They have a thick secondary cell wall that contains a substance called lignin (اللجنين), a component of wood. Therefore they are found in woody plants (النباتات الخشبية).**

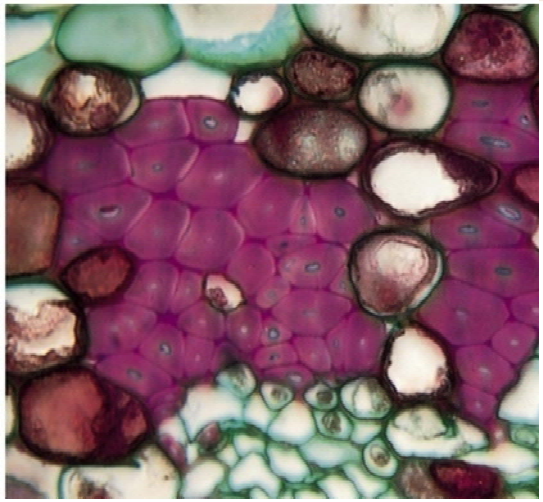
- **There are two types of sclerenchyma cells: elongated fibers (ألياف) and variously shaped sclereids (السكلريد).**

1. **Fibers often organize into bundles.**

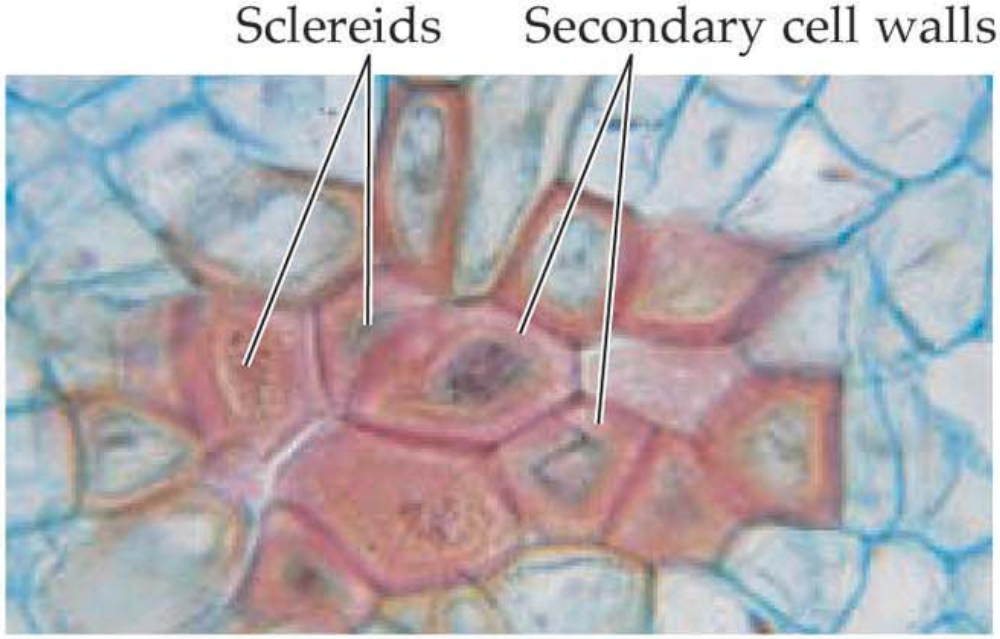
2. **Sclereids may be make pack together very densely. (Sclereids are found in fruits such as pears and are what given them their gritty texture (تركيب ذو طبيعة رملية حبيبية).) They are often referred to as "stone cells" (خلايا حجرية).**

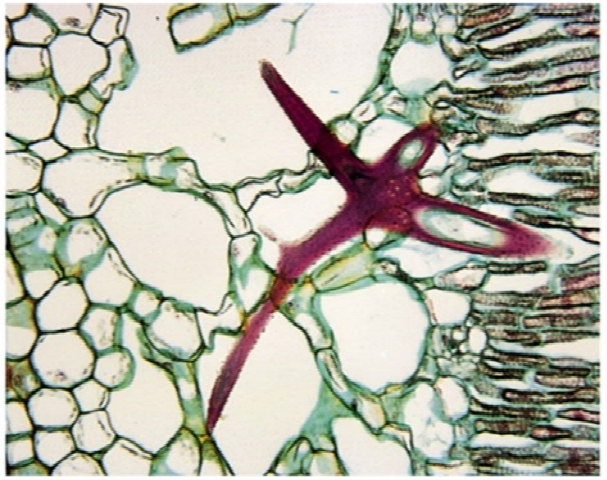
(*c*) Sclerenchyma:





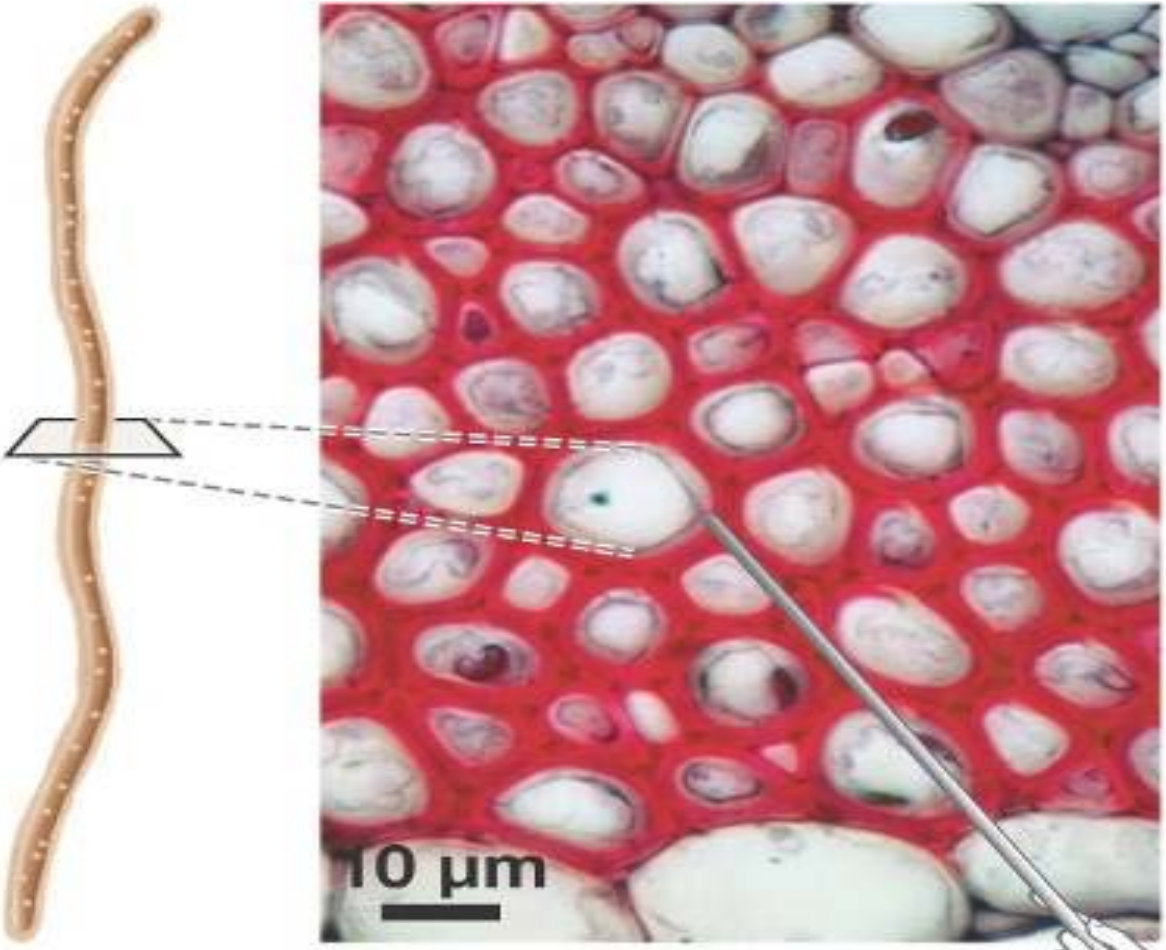
(*d*) Sclerenchyma:

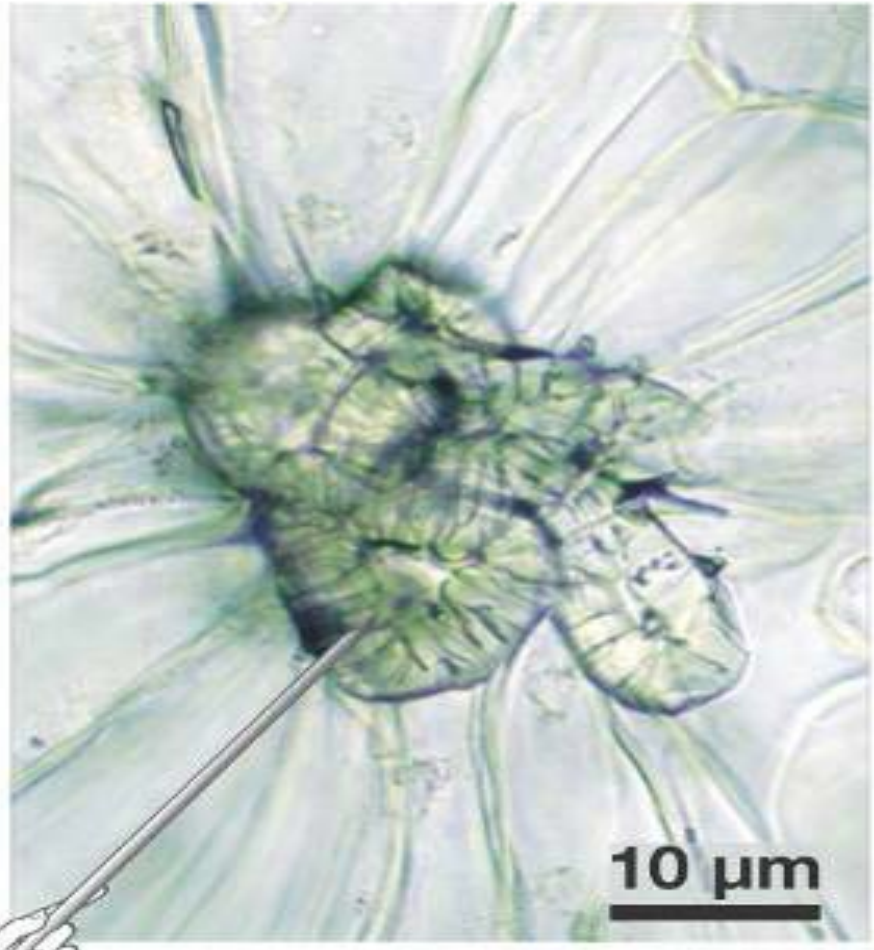




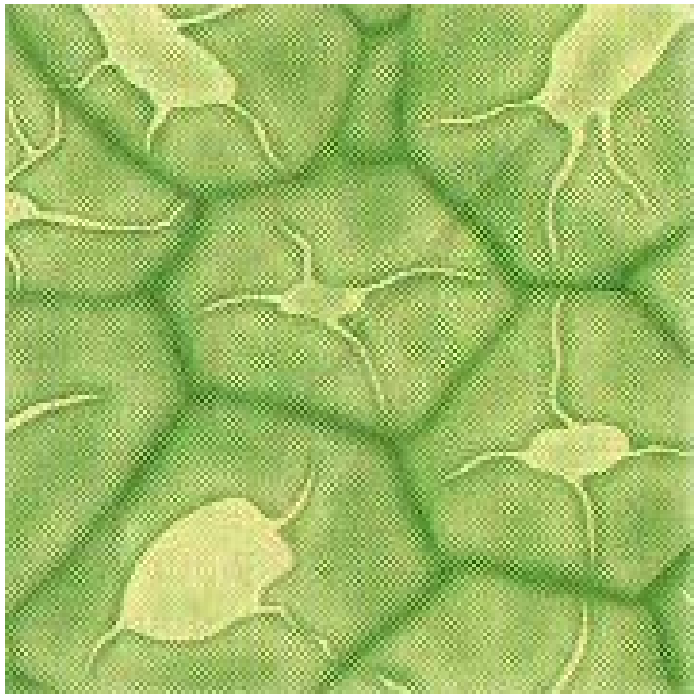
(a) Fibers

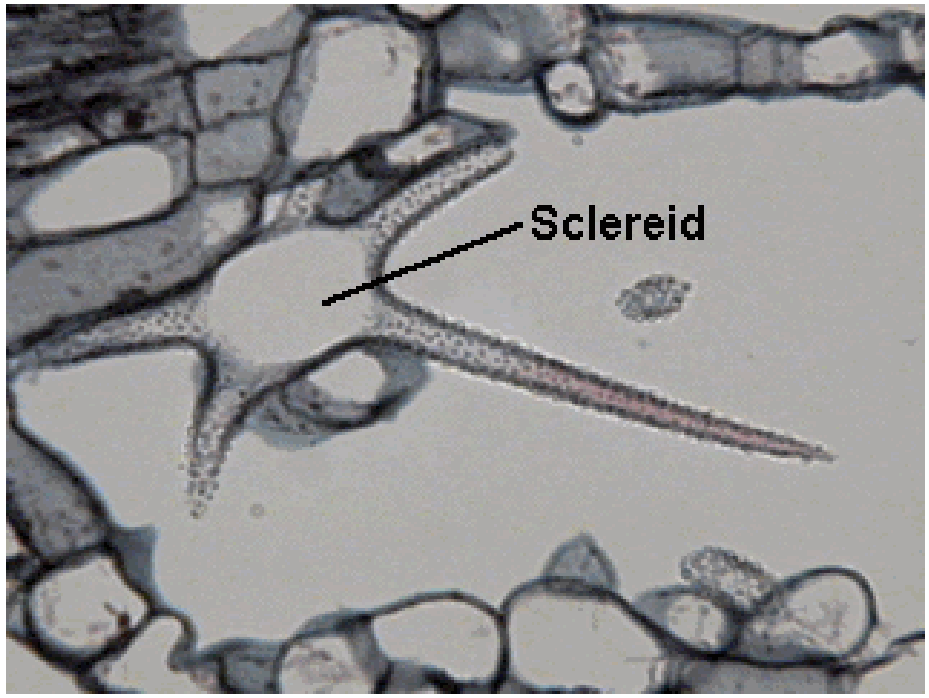
(b) Sclereids

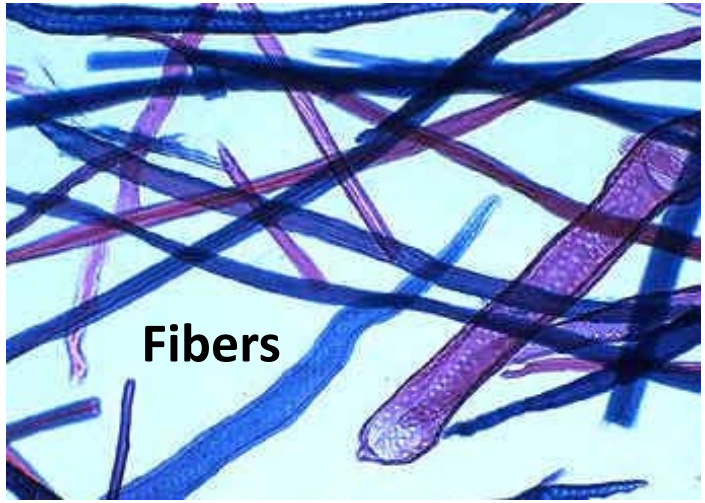




Thick secondary cell walls

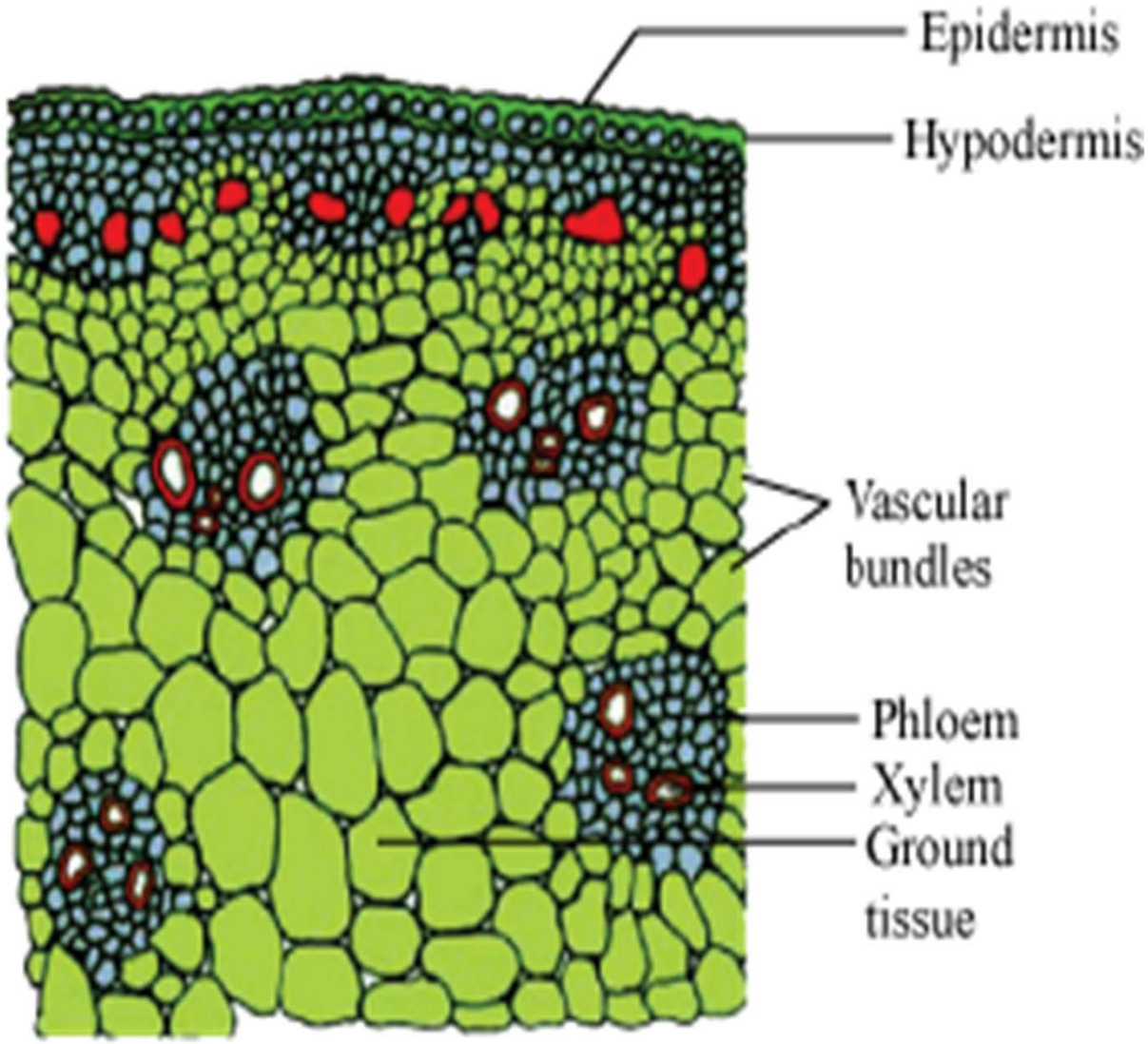



Sclereid

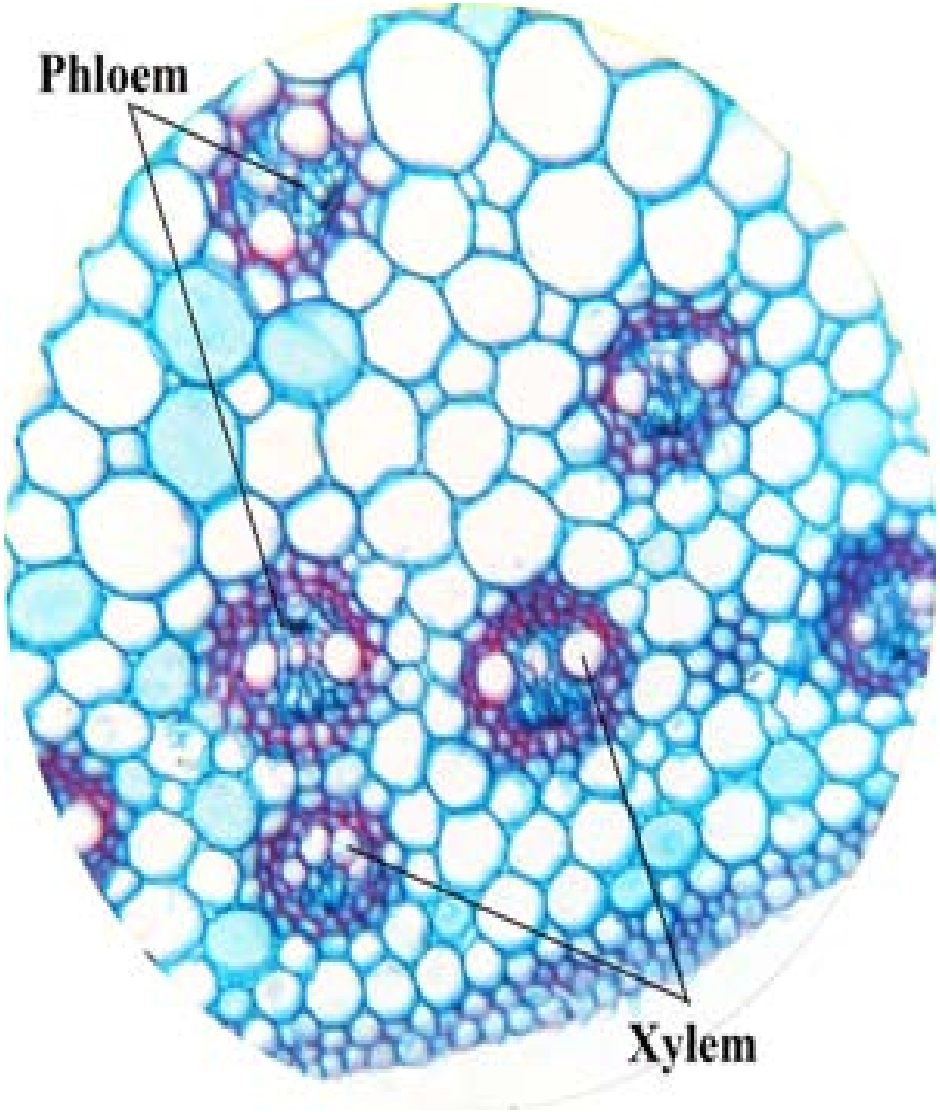

Fibers

Vascular Tissue

- The vascular tissue system includes the xylem and phloem.
  الخشب اللحاء
- The vascular tissue system is the conductive or “plumbing” system of the plant.
  نظام ضخ و رفع
- The phloem transports carbohydrates from leaves to other parts of the plant
- The xylem distributes water and mineral ions taken up by the roots to the stem and leaves.



Vascular Tissue

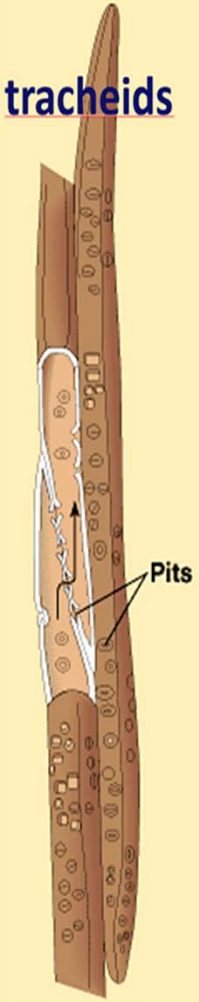


Xylem الخشب	Phloem اللحاء
• Composed of dead cells • Cells are made of thick cell walls • Found in wood • Carries water and nutrients • Transports materials up the stem...capillary action (like a straw) • Helps support the stem	• Composed of living cells • Cells don't have thick cell walls • Found in bark اللحاء • Carries food (sugar-sap) • Transports materials up and down the stem (like an elevator) • Does not support the stem

Vascular Tissue

القصيبات

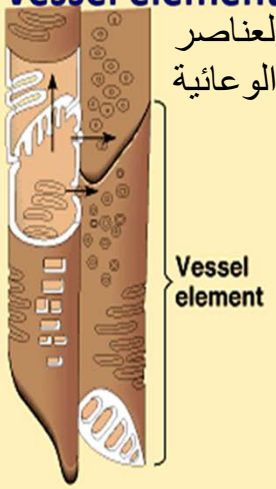
tracheids



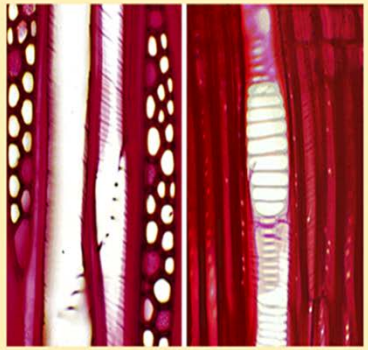
(a)Tracheids

Vessel elements

العناصر الوعائية



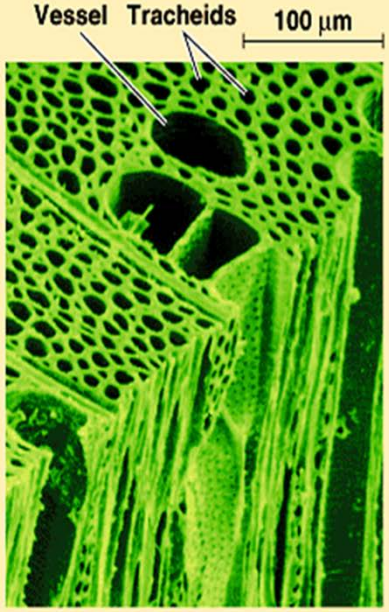
(b)Vessel elements with partially perforated end walls



Xylem

خشب

dead cells → water-conducting cells of xylem



(c)Tracheids and vessels (colorized SEM)

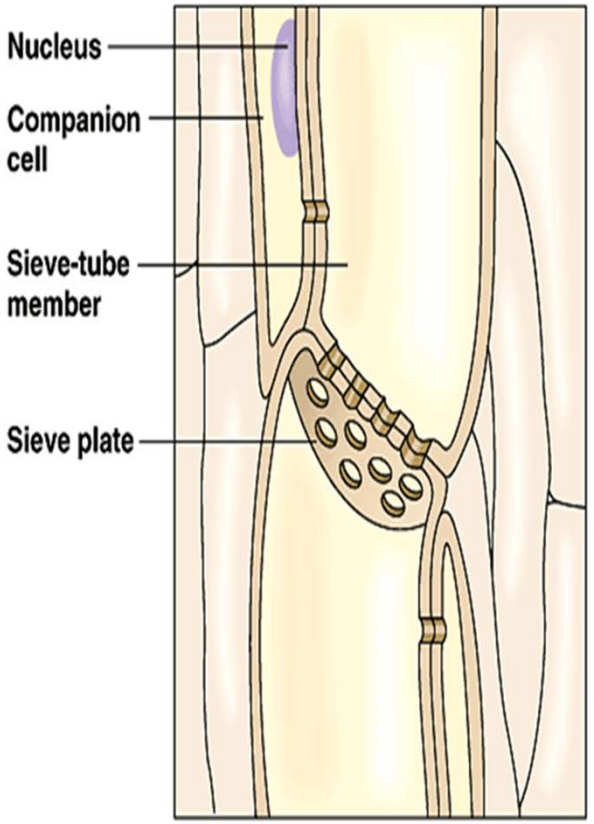
Phloem

اللحاء

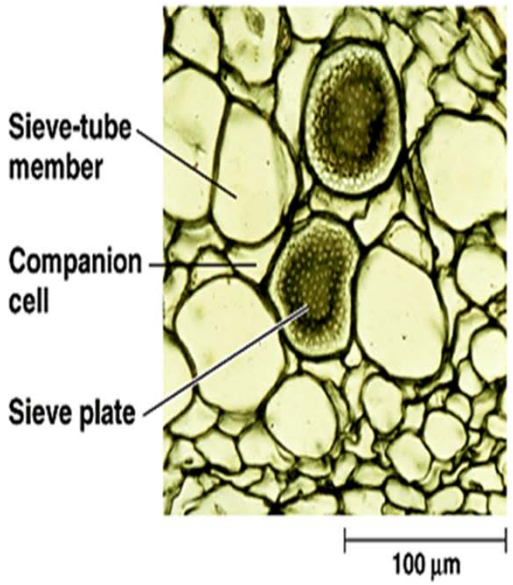
عناصر الانبوب الغربالية

الخلايا المرافقة

- sieve tube elements & companion cells



(a) Longitudinal view



(b) Transverse section (LM)

Meristems

- The Meristems or Meristematic cells are dividing cell.
- The Meristems are found in zones of the plant where growth take place.
- There are 3 main types of meristematic tissue in vascular seed plants :

1. **Apical meristem** زيادة الطول عند القمم
   Increase length at tips
2. **Intercalary meristem**
   Increase length between nodes زيادة الطول بين العقد
3. **Lateral meristem**
   Increase diameter
   زيادة المحيط