

PLANT ANATOMY

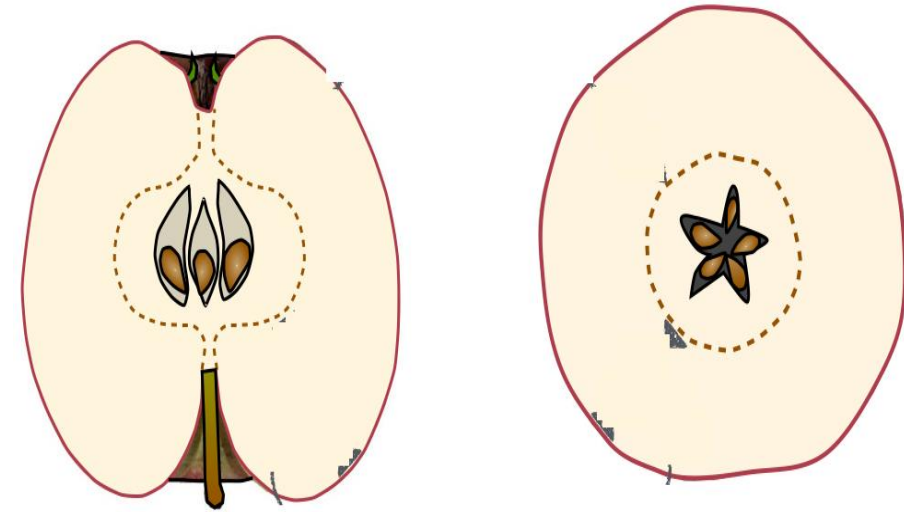
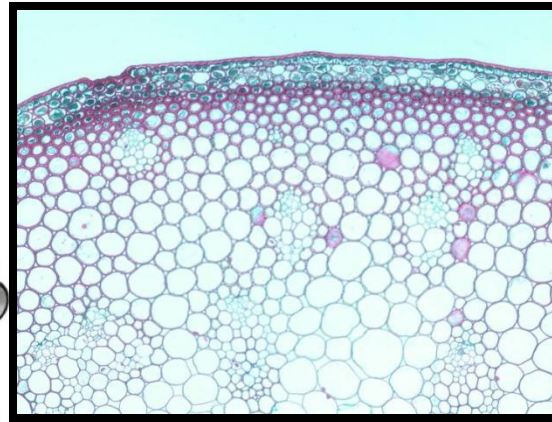
PLANT TISSUES AND ORGANS

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

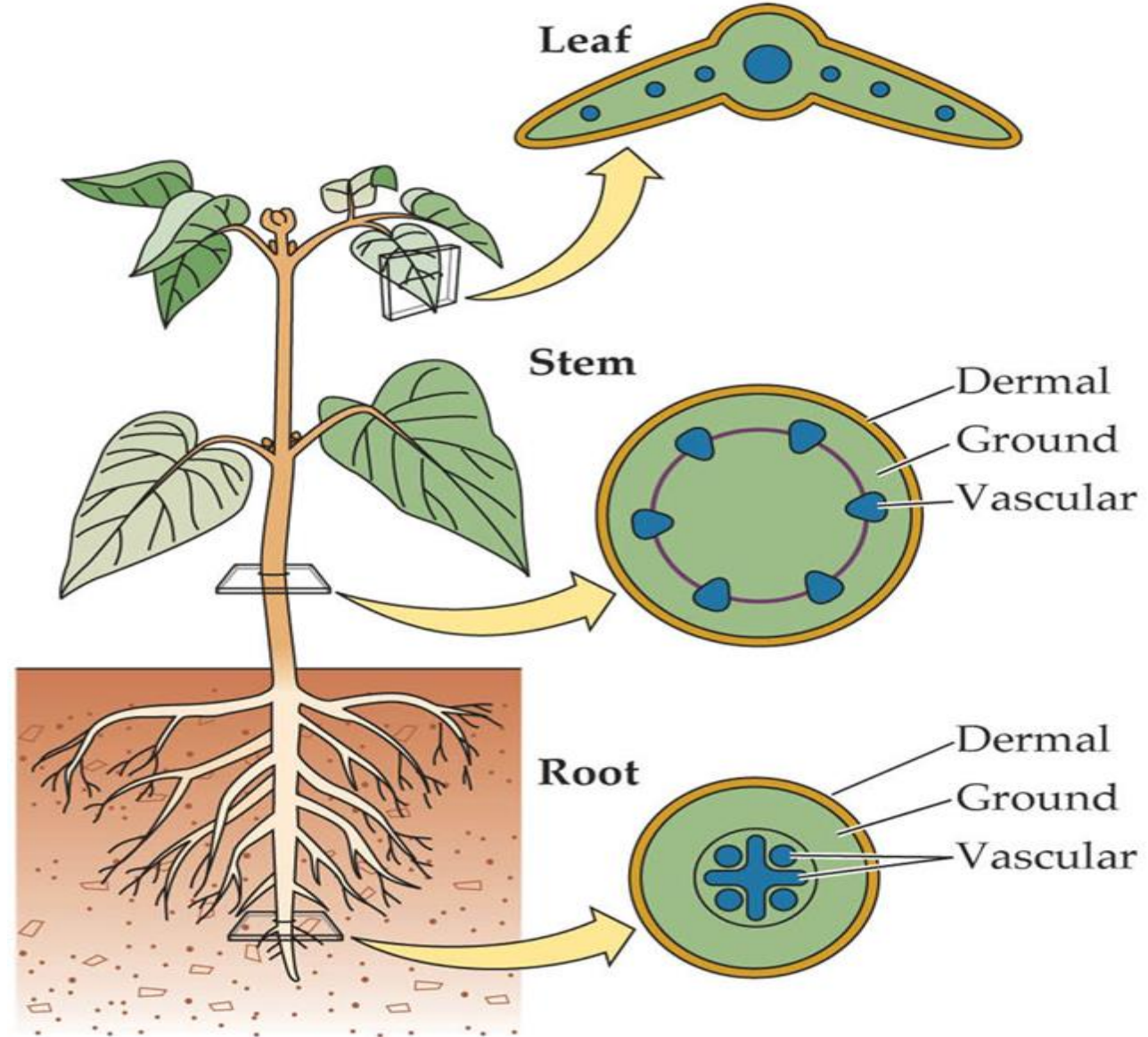
2. Vascular tissue system

النظام النسيجي الوقائي

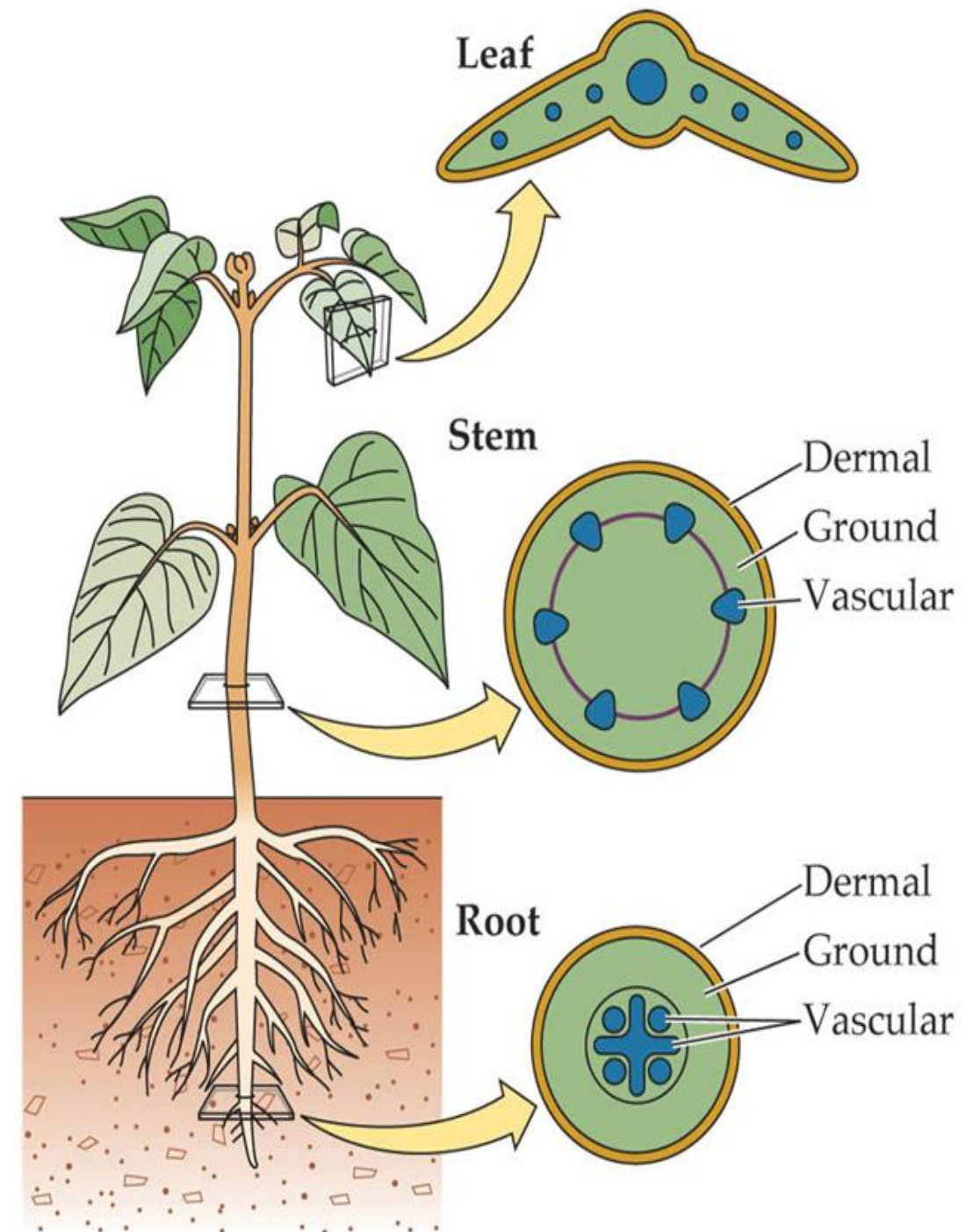
3. Dermal tissue system

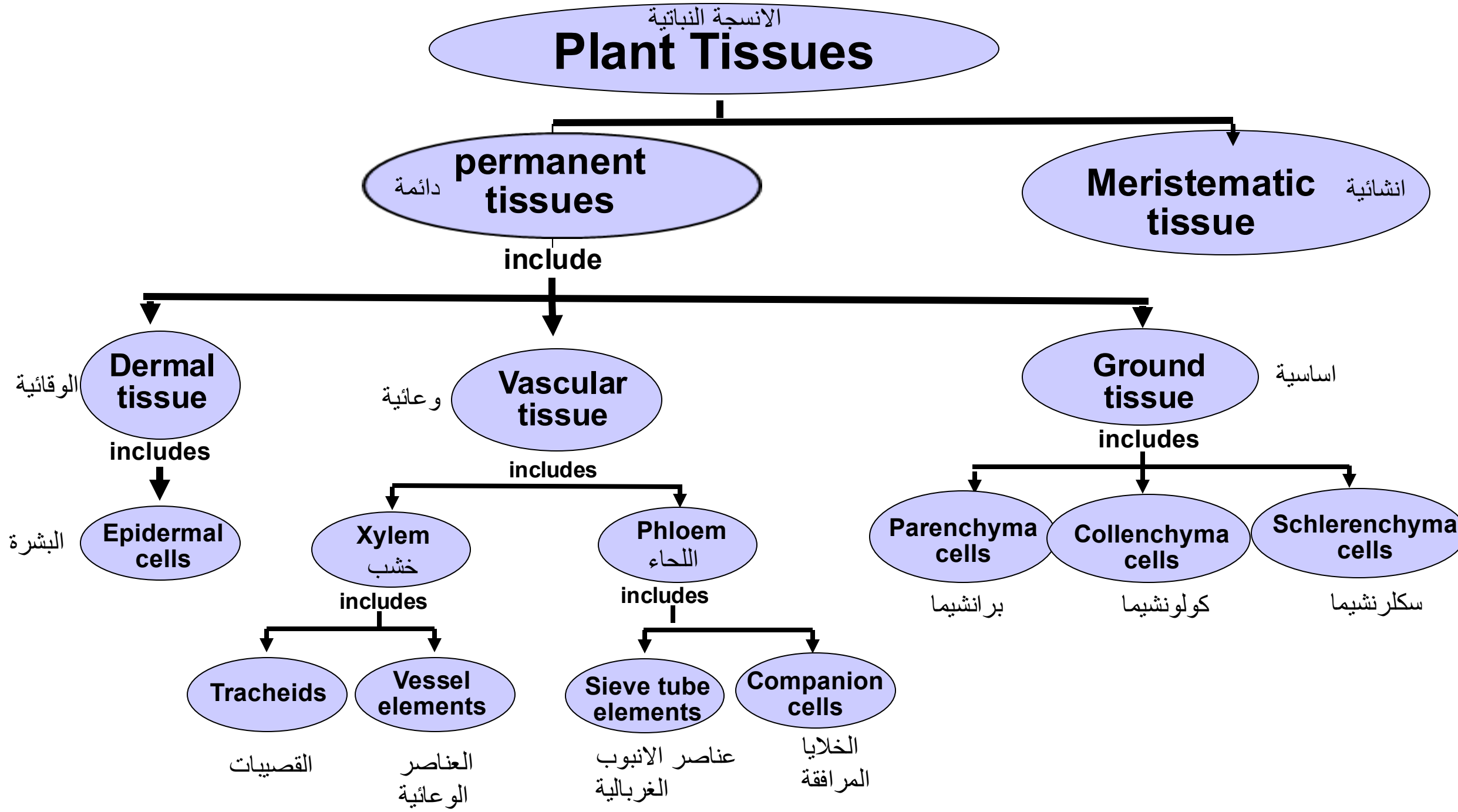
النظام النسيجي الانشائي

**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 and phloem are **complex tissues**; they are composed of a number of different cell types.
خشب اللحاء نسيج معقد
- 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**





Dermal Tissue

- **Dermal** tissue covers the plant **body**.

تغطي جسم النبات

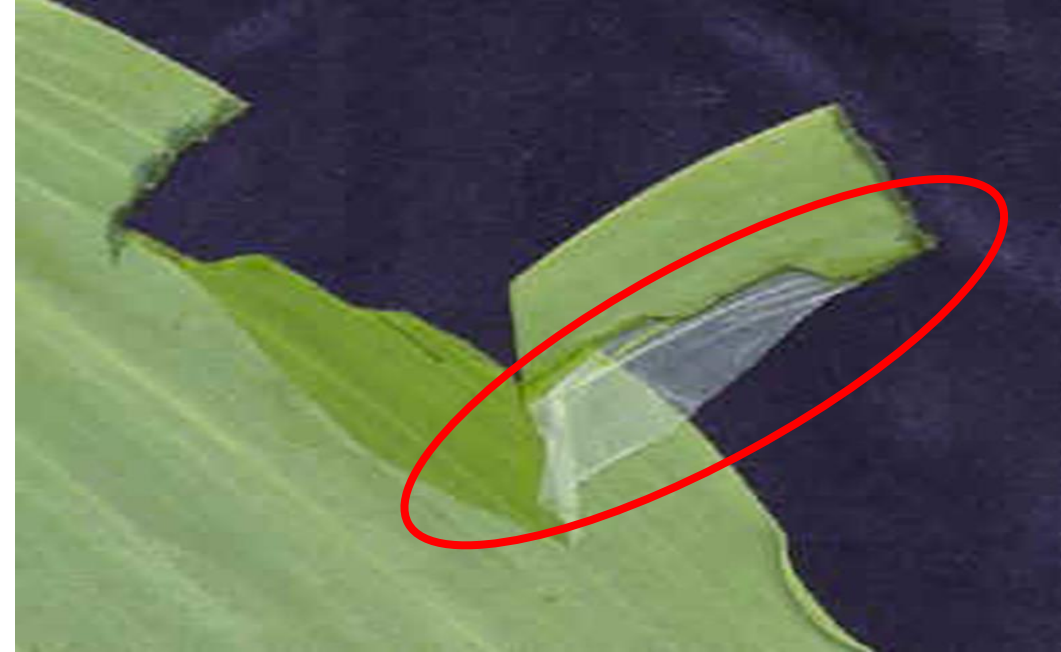
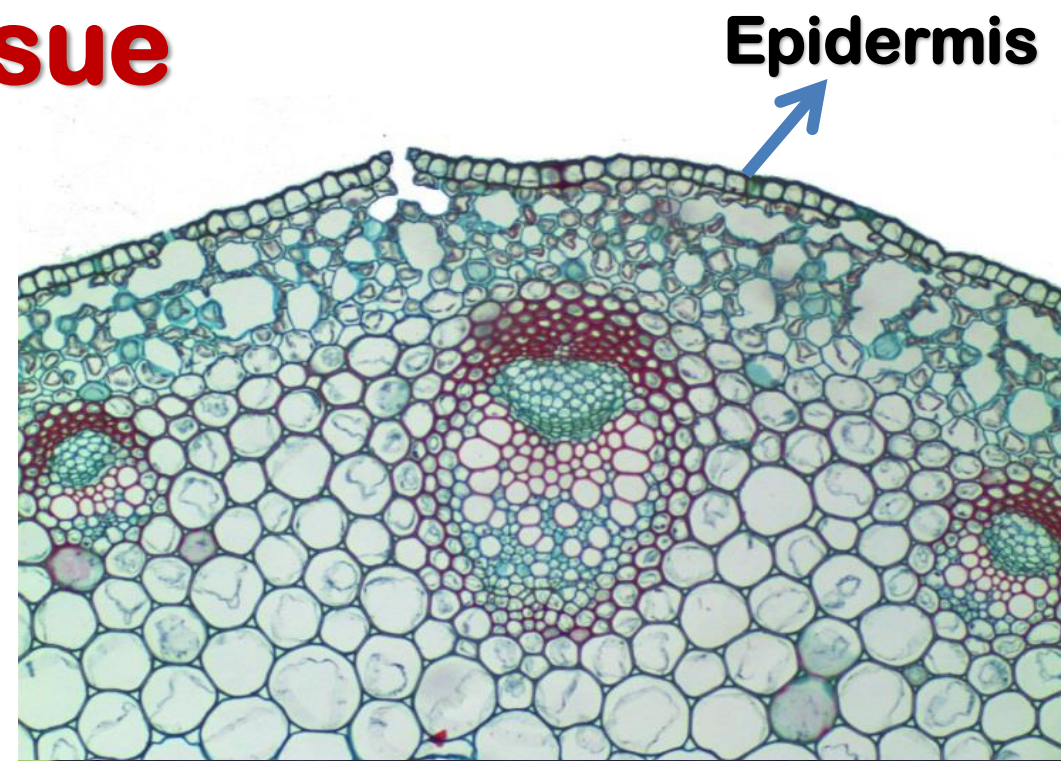
- **Dermal** tissue consists of **epidermis**

البشرة

- **Epidermis** is made of **parenchyma** cells in a **single layer**

- Epidermis on stem and leaves ^{النتح} prevents **water loss** by **transpiration**

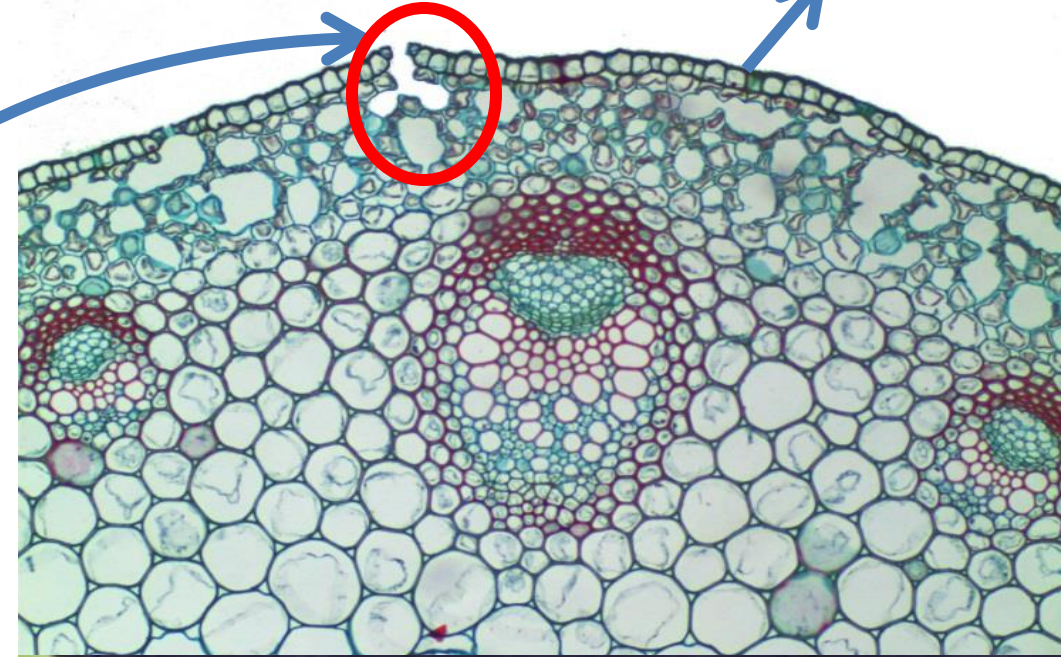
- Epidermis produces a ^{شمع} **waxy** material called **cuticle** ^{الادمة}



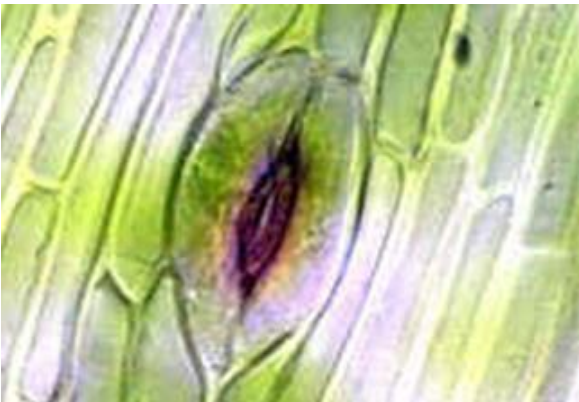
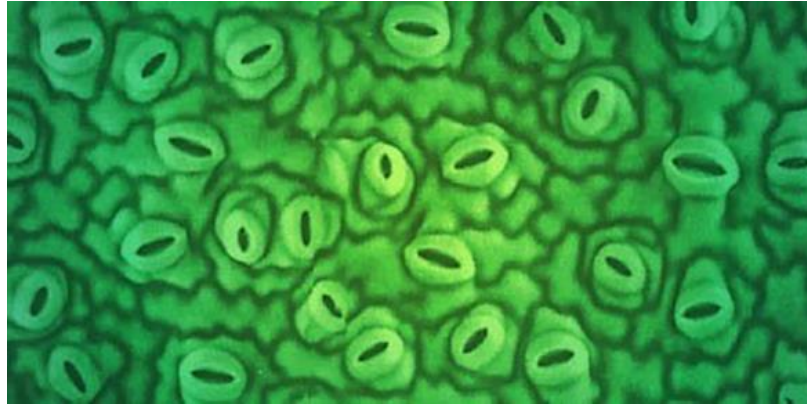
Dermal Tissue - Stomata

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

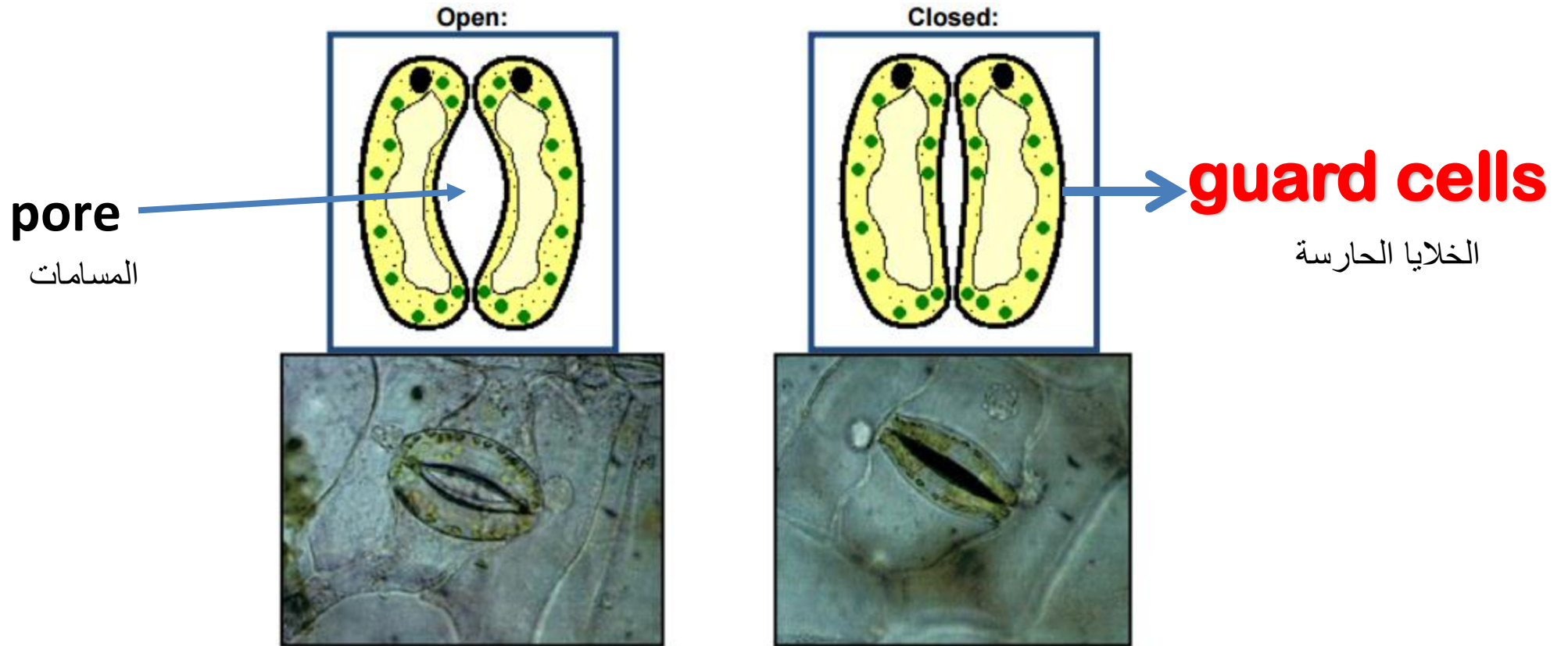
Epidermis



Stomata



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**

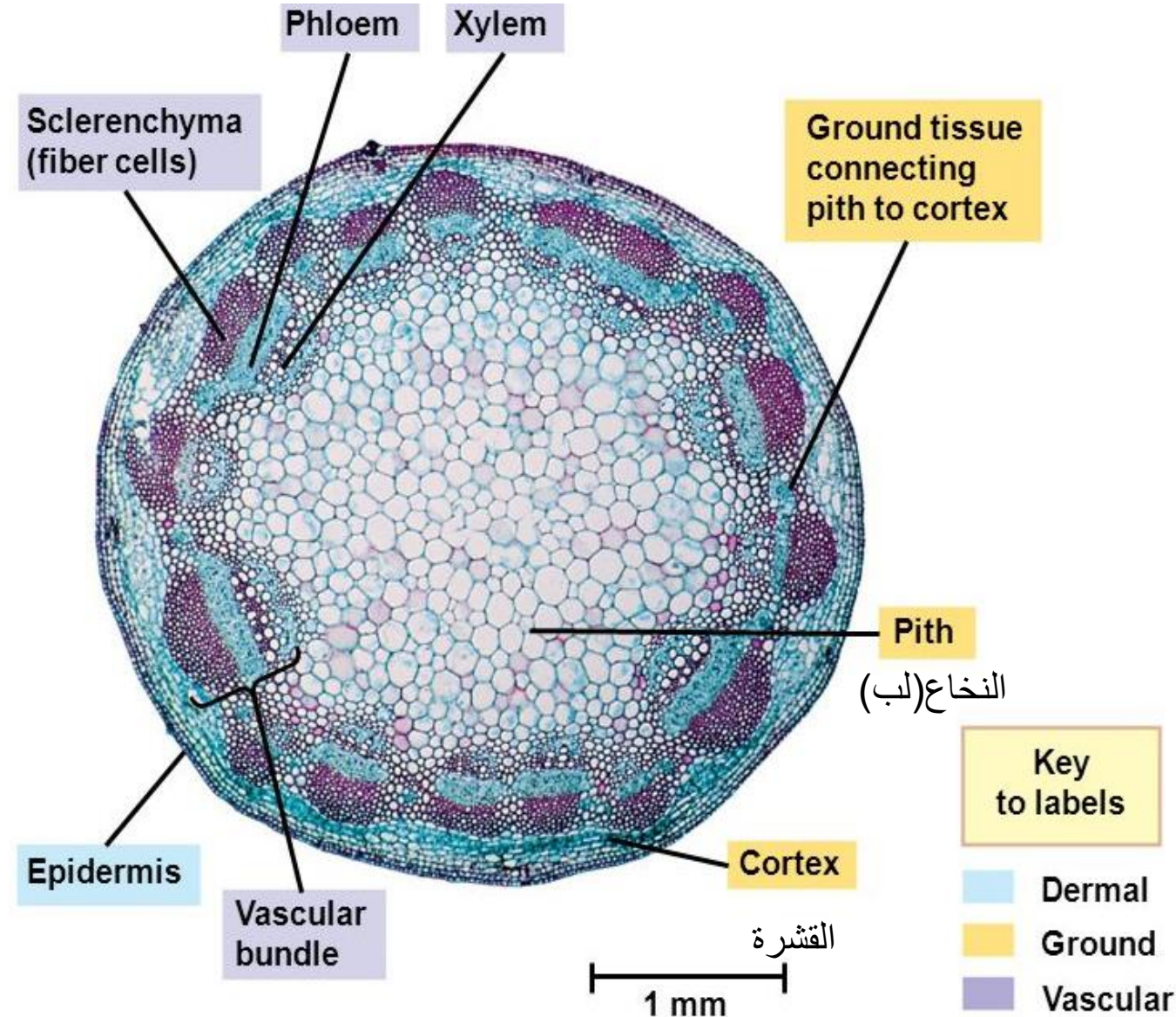
اساسية Ground Tissue

- The **ground** tissue of plants includes all tissues that are neither dermal nor vascular
- **Ground tissue functions** primarily in storage, support, photosynthesis, and the production of defensive and attractant substances (oils and toxins).

تشمل جميع الانسجة التي لا تصنف ضمن الانسجة الوعائية او الوعائية

- There are three **types** of ground tissue:

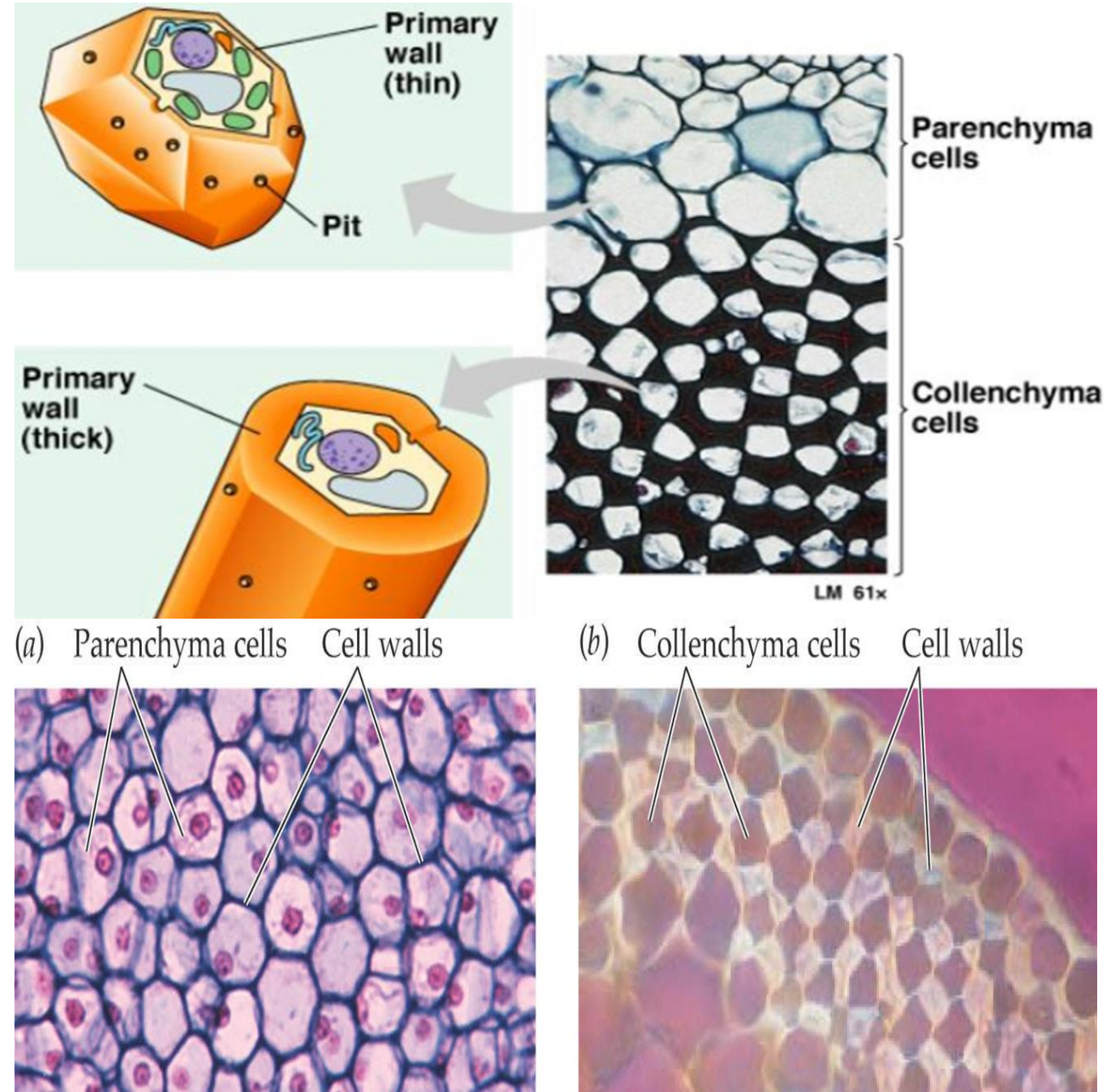
1. Parenchyma cells
2. Collenchyma cells
3. Sclerenchyma cells



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

Types of Ground Tissue

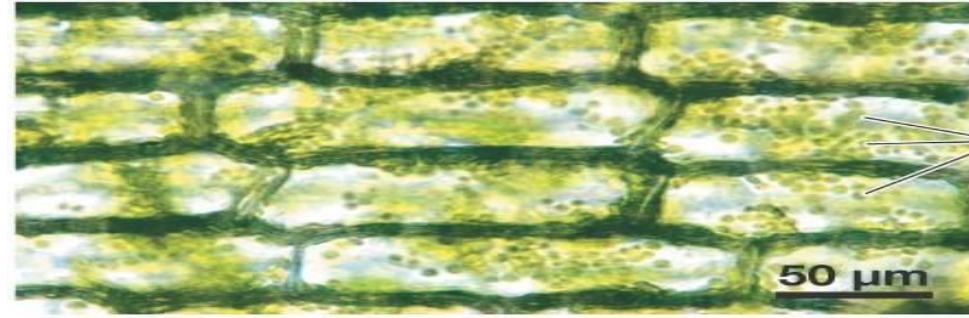
- **Parenchyma** cells usually have **thin primary walls and large central vacuoles**. Parenchyma forms the "filler" tissue in the soft parts of plants.
- **Collenchyma** cells usually have **primary walls that are thick in the corners**. Collenchyma provides **extra structural support**.
- **Sclerenchyma** cells have **thick lignified secondary walls**. Sclerenchyma provides the **main structural support to a plant**.



■ Parenchyma cells

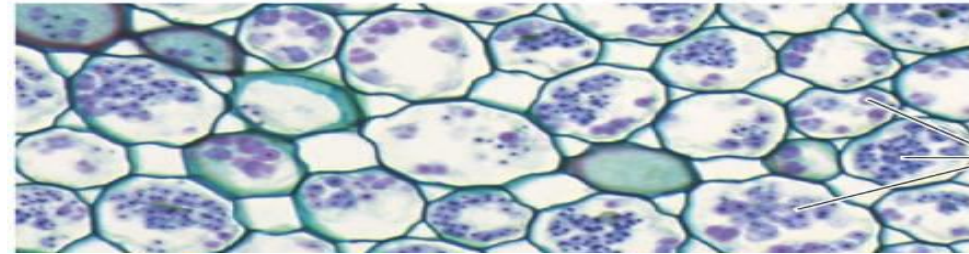
- The **photosynthetic** cells in leaves or stems are parenchyma cells filled with chloroplasts. These cells are called **chlorenchyma** cells.
- Some parenchyma cells **store** lipids or starch (potatoes).

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



Chloroplasts

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

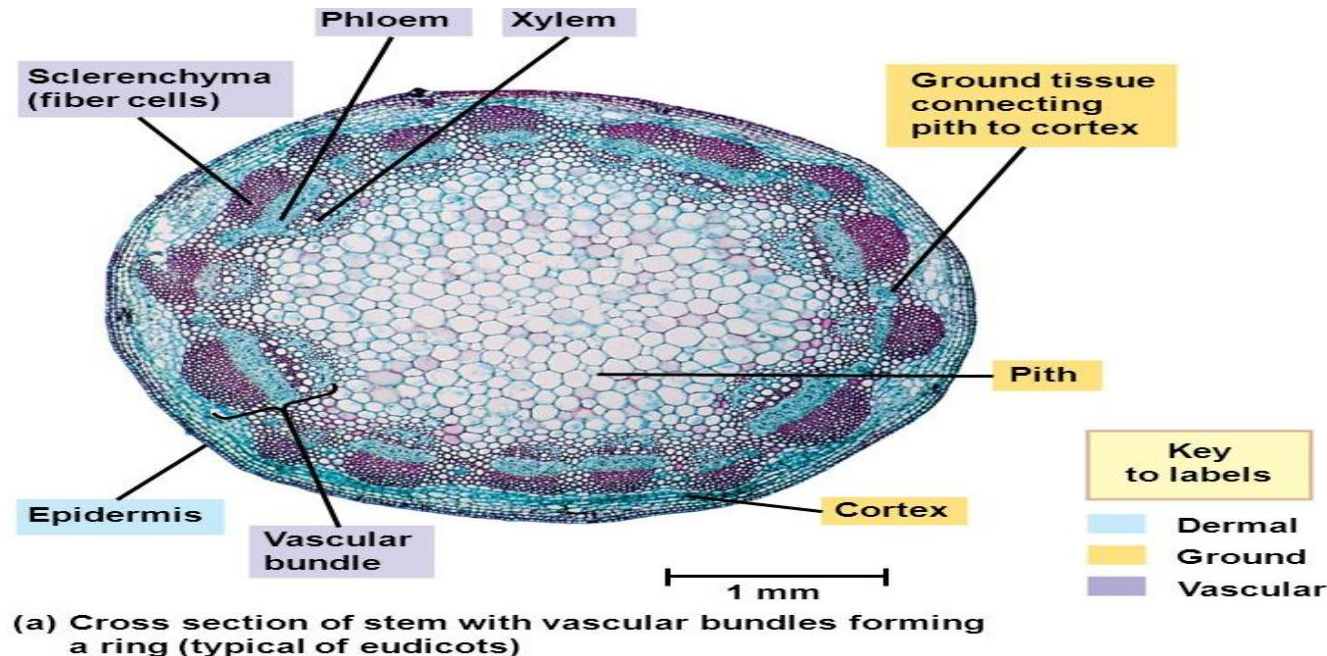


Starch granules

■ Collenchyma cells

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

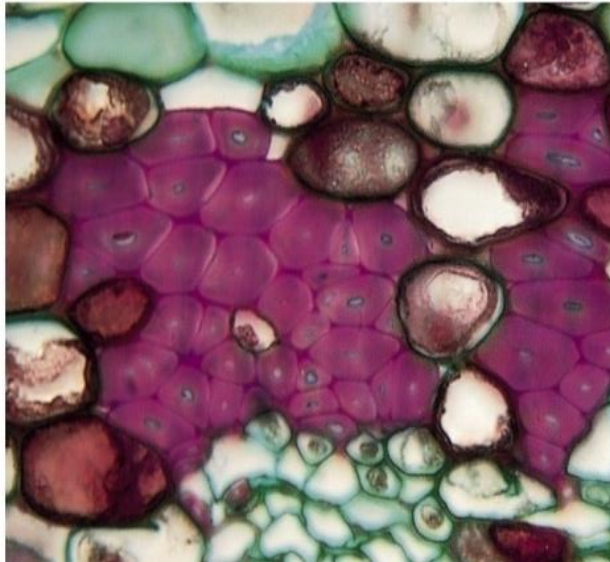
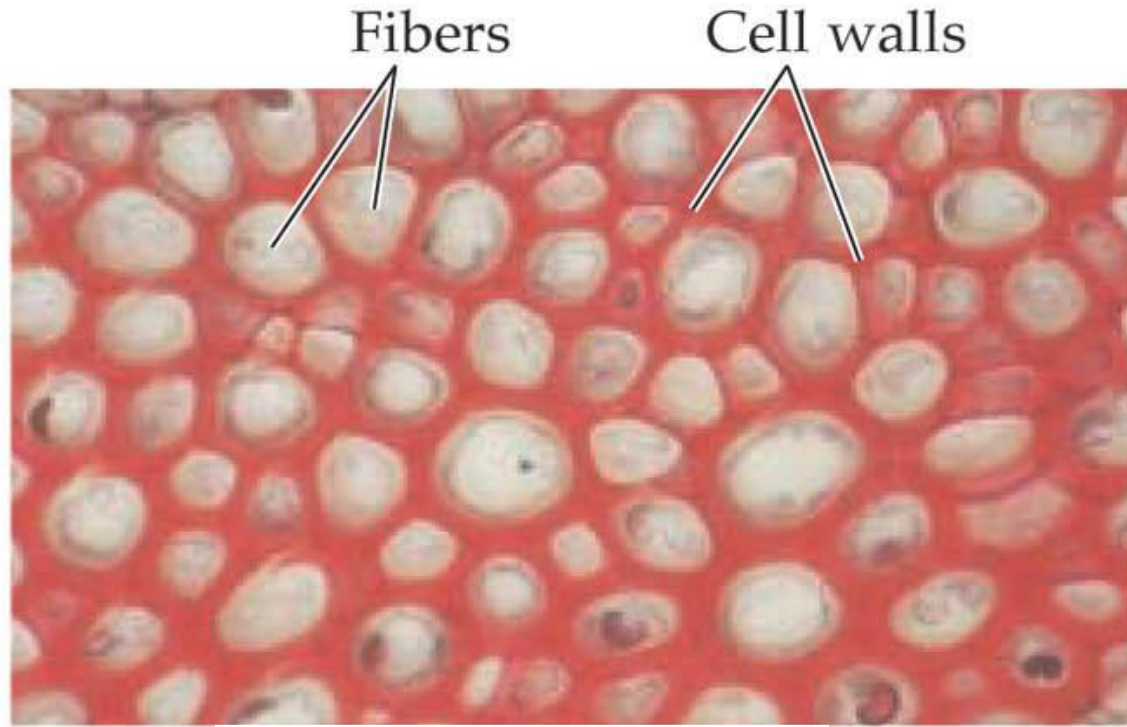
النخاع (لب) القشرة



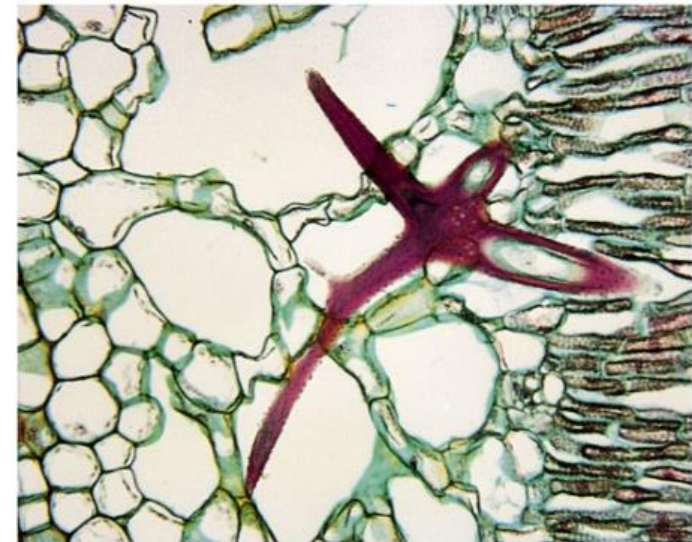
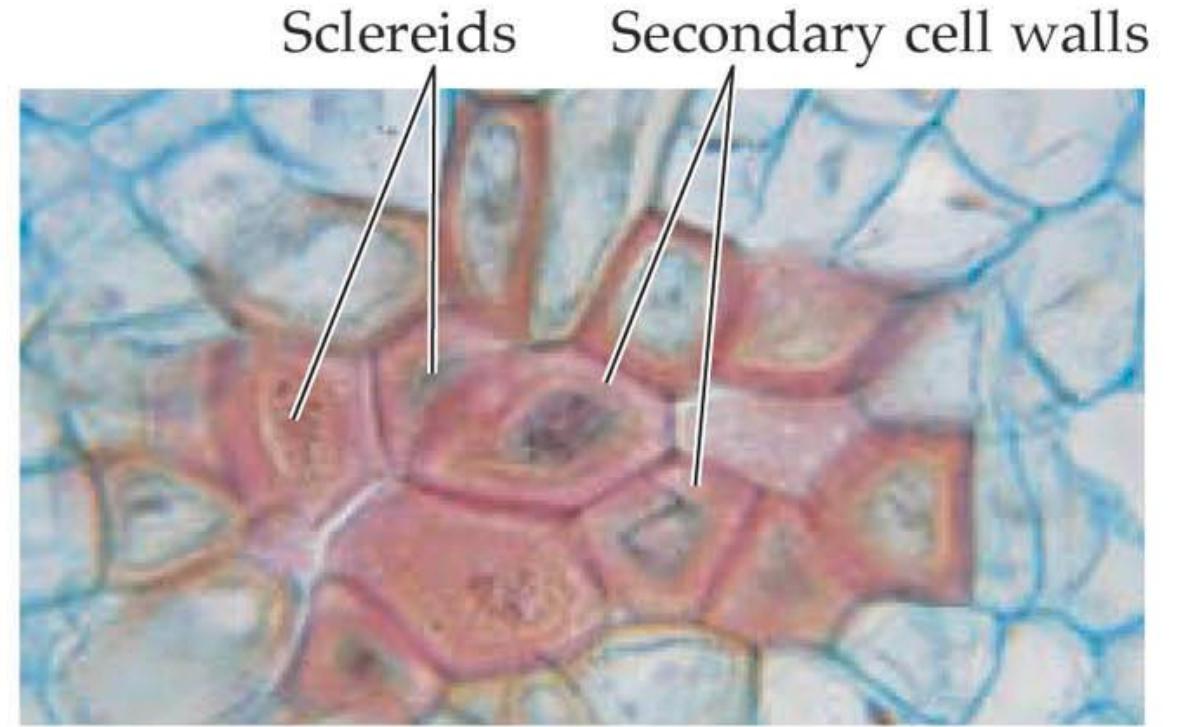
(a) Cross section of stem with vascular bundles forming a ring (typical of eudicots)

- **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 give them their gritty texture.)^{تركيب ذو طبيعة رملية حبيبية} They are often referred to as “stone cells”^{خلايا حجرية}.

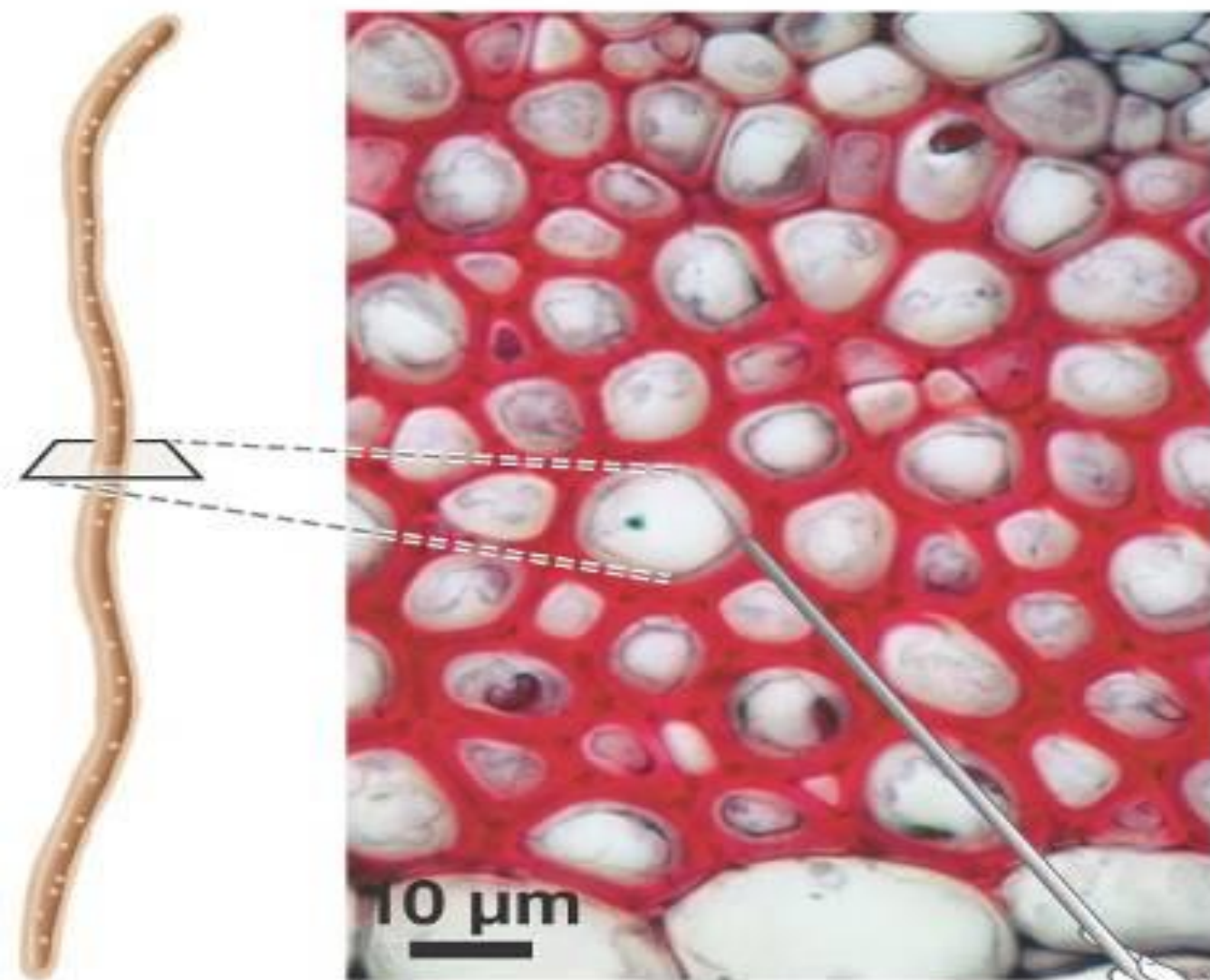
(c) Sclerenchyma:



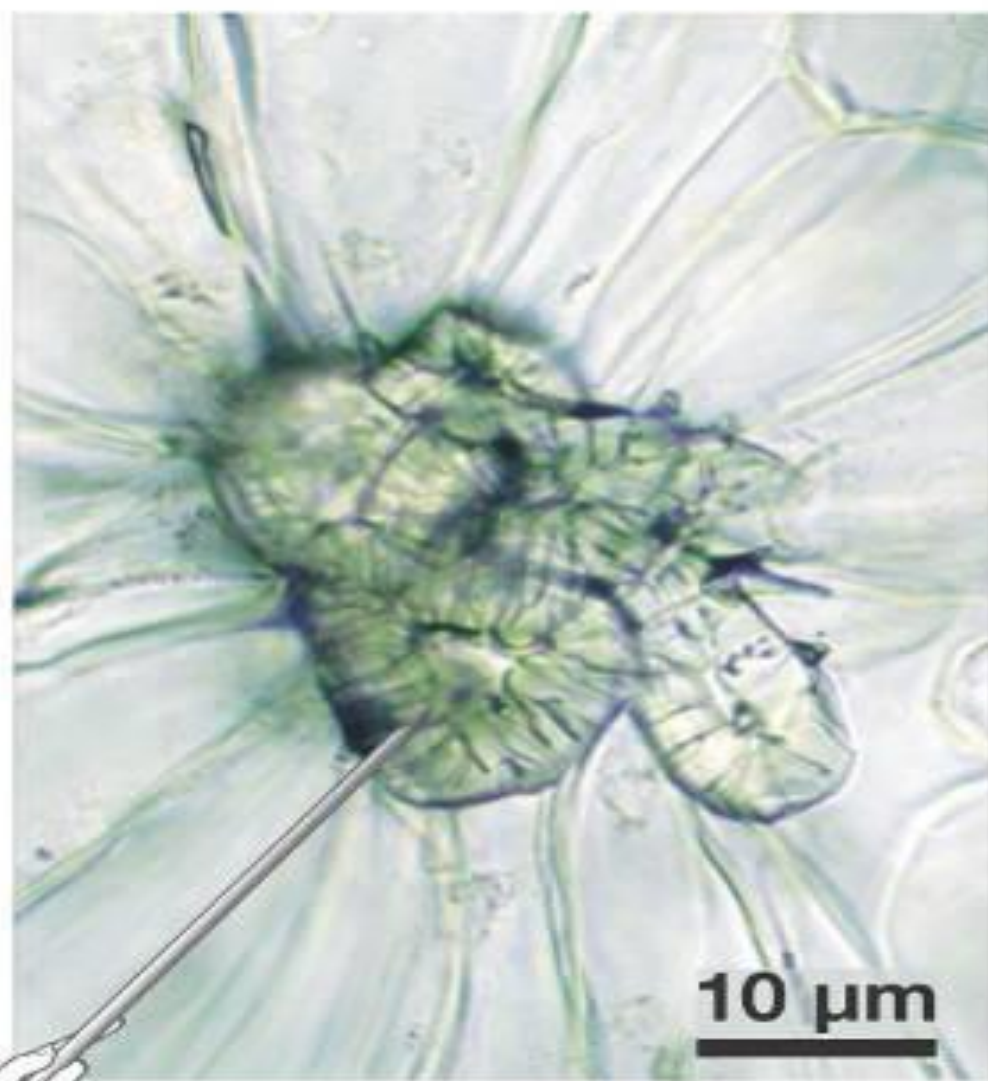
(d) Sclerenchyma:



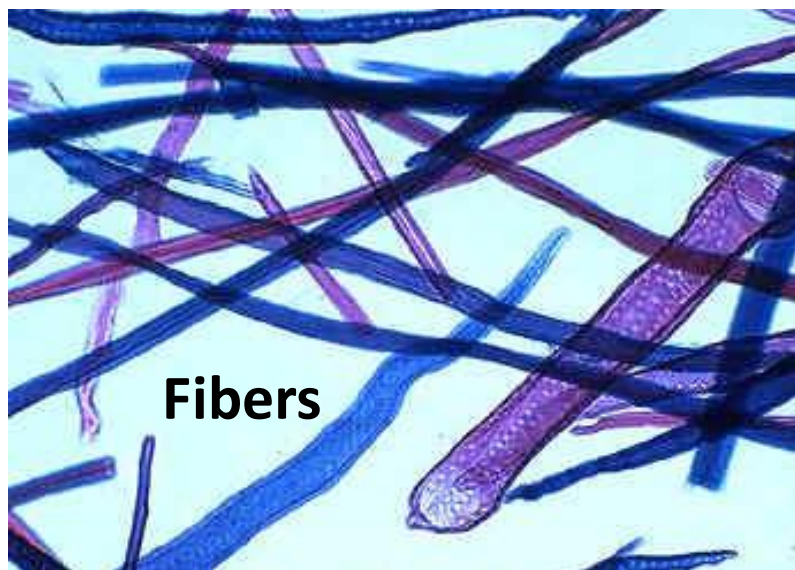
(a) Fibers



(b) Sclereids

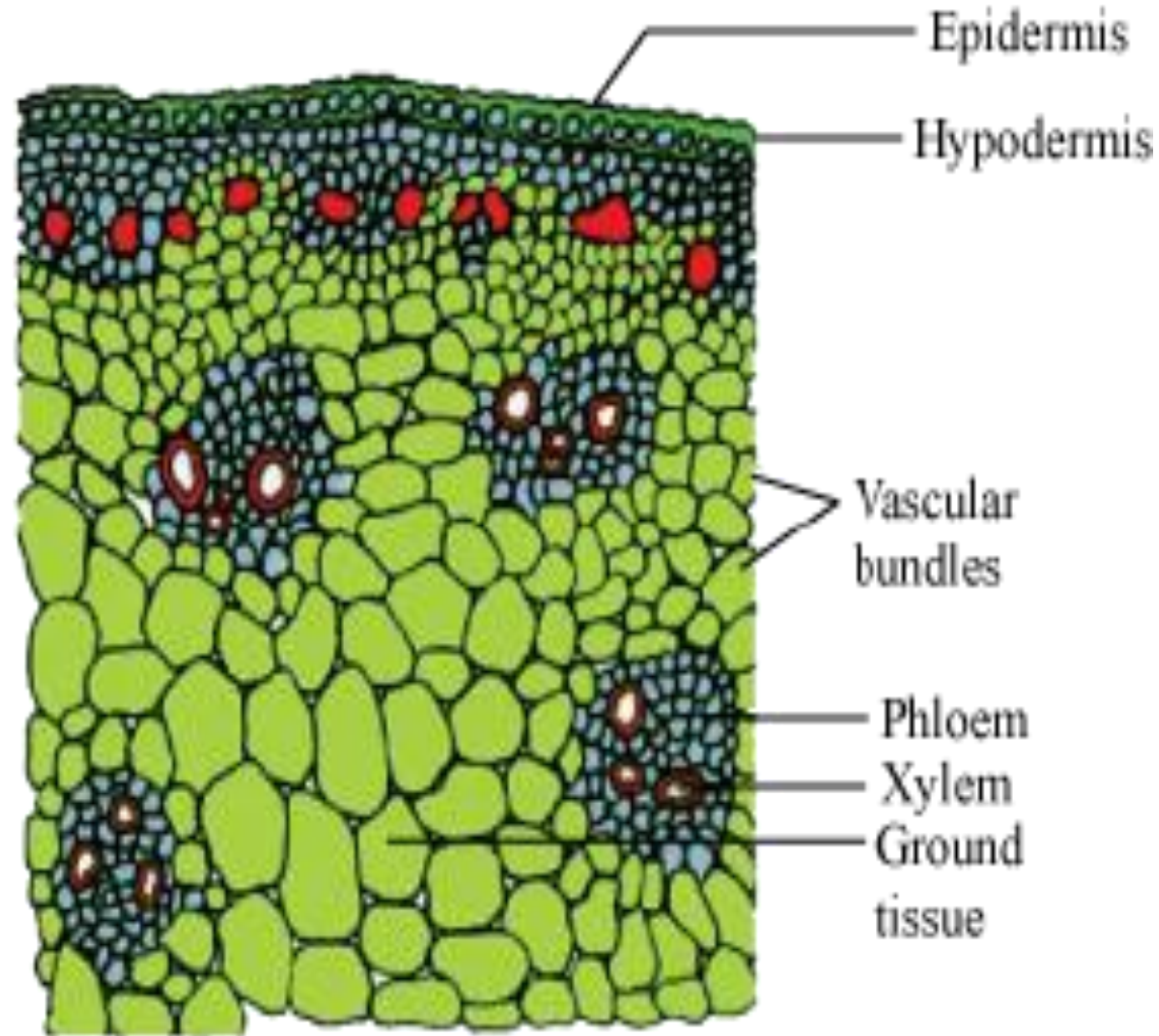


Thick secondary cell walls

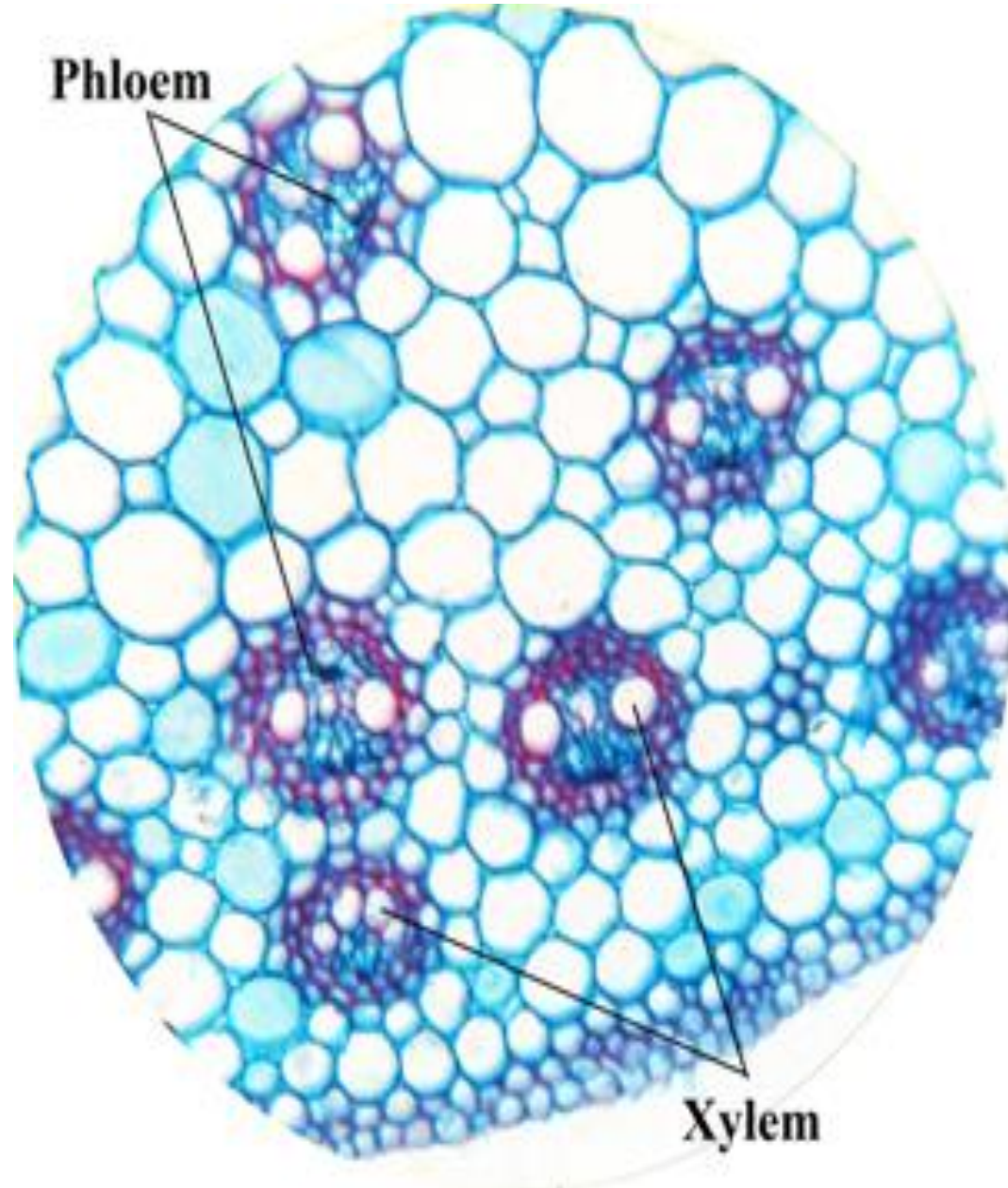


Vascular Tissue

- 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}

- 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

Phloem ^{اللحاء}

- 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

Xylem

خشب

dead cells →
**water-conducting
cells of xylem**

Vessel elements

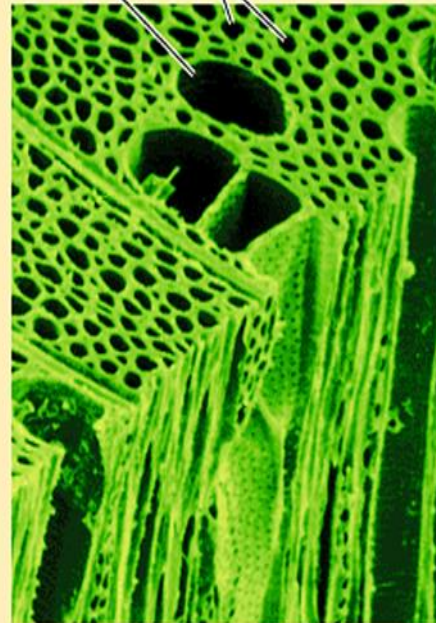
العناصر
الوعائية

Vessel
element

(b) Vessel elements
with partially
perforated end walls

Pits

Vessel Tracheids 100 μ m



(c) Tracheids and vessels (colorized SEM)



القسييات

tracheids



(a) Tracheids

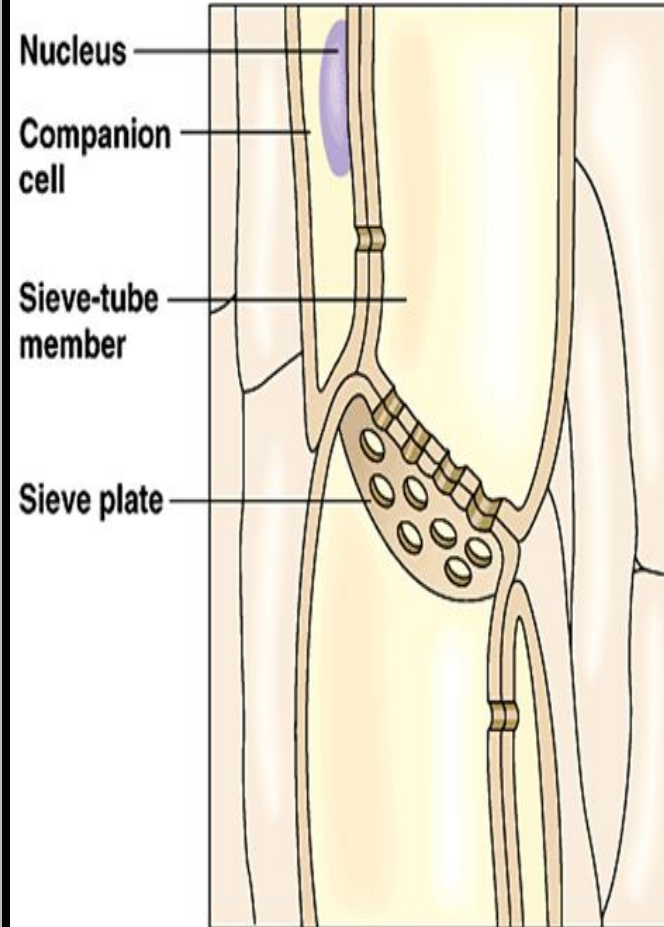
Phloem

اللحاء

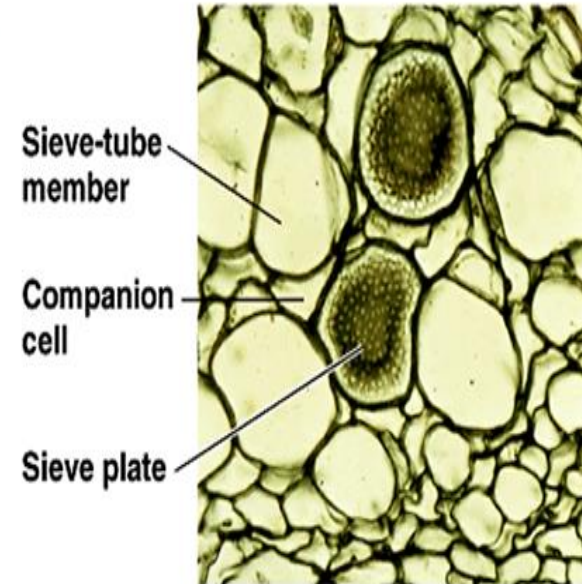
عناصر الانبوب الغربالية

الخلايا المرافقة

■ **sieve tube elements & companion cells**



(a) Longitudinal view



100 μ m

(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
3. **Lateral meristem** زيادة الطول بين العقد
Increase diameter زيادة المحيط

