

Lab 1 inside plant cell

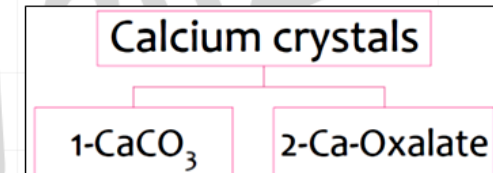
تشرح النبات
العملي
First Year Biology 2025

Mineral Crystals:

Crystals of various forms are present in the cells. They may occur singly or may accumulate together getting peculiar shapes.

Raphides are needle-shaped Calcium oxalate crystals.

Cystolith is a Calcium carbonate crystal formed as an internal outgrowth of cell wall and appears like cluster of Grapes.



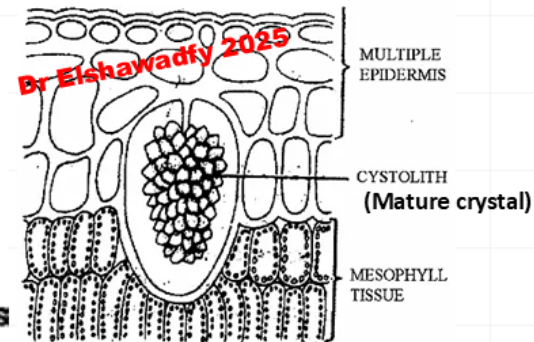
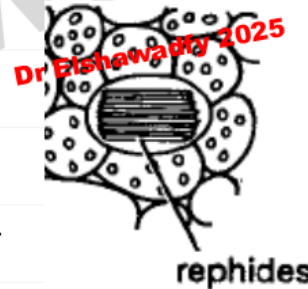
Tissues

Simple

- 1-Parenchyma
- 2-Collenchyma
- 3-Sclerenchyma

Complex

- 1-Xylem
- 2-Phloem



1-Parenchyma

Parenchyma is a living tissue with thin primary cell wall made up of cellulose.



Polyhedral parenchyma



stellate-shape parenchyma

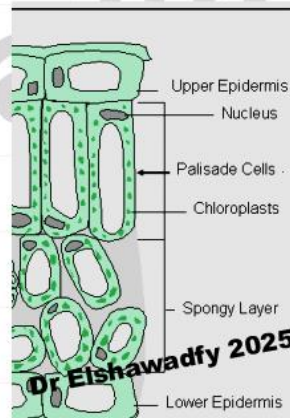
Lab 1

Specialized types of parenchyma

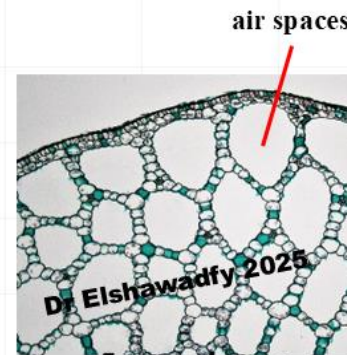
A) Chlorenchyma: It is parenchyma that has *chloroplasts* (green plastids). Function: photosynthesis.

B) Aerenchyma: It is parenchyma that has large intercellular spaces (air spaces). Function: exchange of gases.

C) Storage parenchyma: It is parenchyma that stores food (e.g., *tuberous stem and root store starch grains*).



Chlorenchyma



Aerenchyma

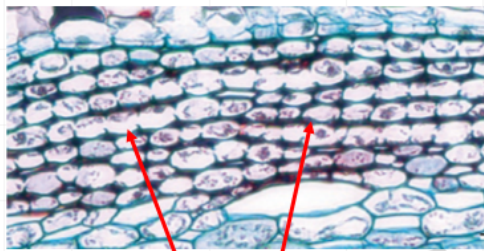


Storage parenchyma

Lab 1

2-Collenchyma

- ❖ Collenchyma is a living tissue.
- ❖ Cell wall is primary, thick, non-lignified.



Collenchyma

Types of Collenchyma:

There are 4 types:

A) Angular collenchyma:

The Cell wall deposition occur at their **angles**
Intercellular spaces absent.

B) Lamellar collenchyma (Tangential):

The cell wall deposition occur only on the **tangential walls**, and the radial walls are devoid of thickening.
Intercellular spaces absent.

C) Lacunar collenchyma:

The Cell wall deposition occur on the walls **facing the intercellular spaces**.
Intercellular spaces present.

D) Annular collenchyma:

The cell walls are **uniformly** thickened.



Lab 2

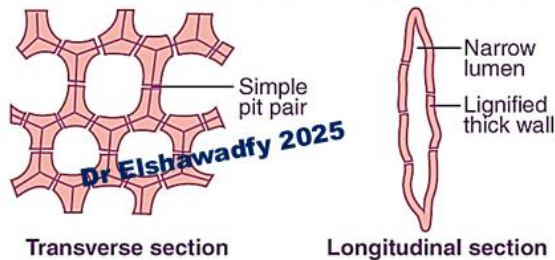
3-Sclerenchyma

- ❖ Sclerenchyma is a dead tissue, at maturity.
- ❖ The cells have lignified secondary walls.
- ❖ Sclerenchyma has simple pits.

Types of Sclerenchyma:

- Sclerenchyma is divided into two types:
sclereids and fibers.

i) Fibers:



Types of fibers (based on position):

1- Xylem fibers.

Associated with the xylem.

2- Phloem fibers.

Associated with the phloem.

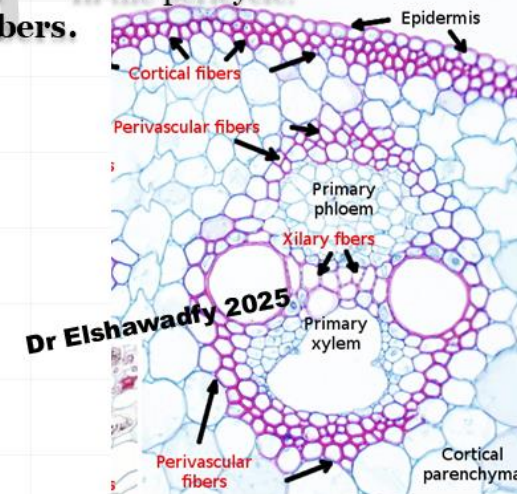
3- Cortical fibers.

In the cortex.

4- Pericyclic fibers.

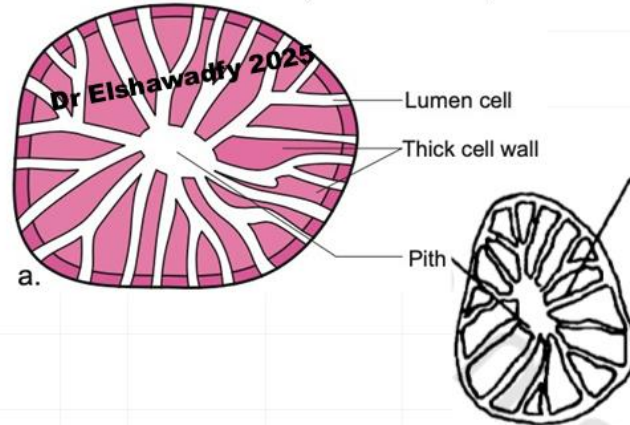
In the pericycle.

5- Bundle sheath fibers.

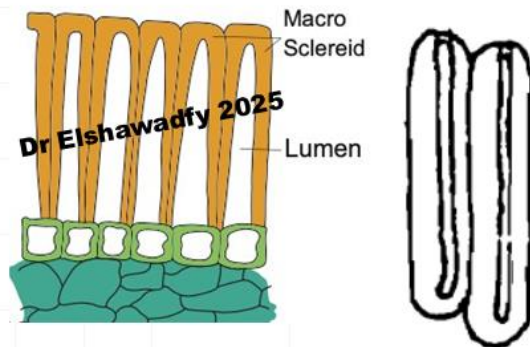


Lab 2

1-Brachysclereids (Stone cells)



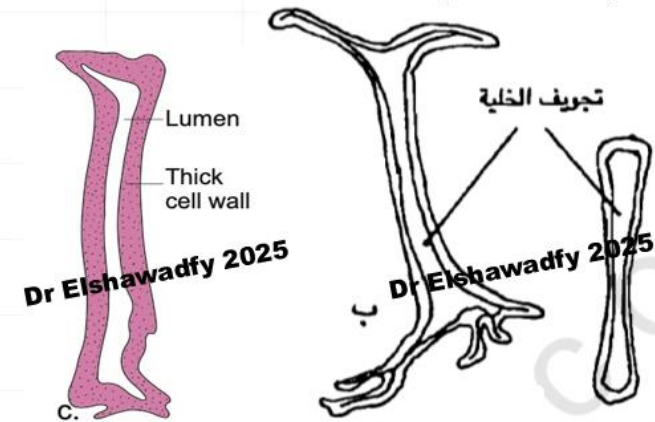
2- Macrosclereids (Rod cells)



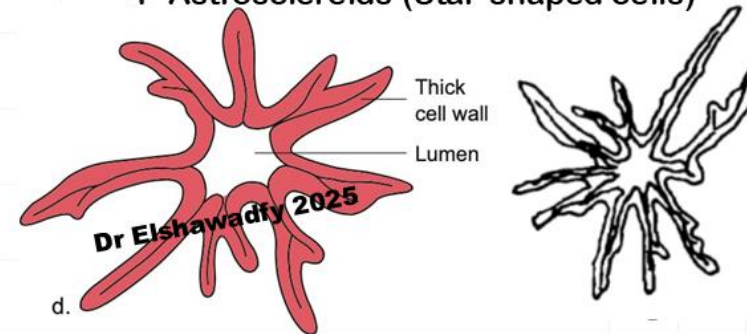
ii-Sclereids:

4 types

3- Osteosclercids (Bone cells)



4- Astrosclereids (Star-shaped cells)



Lab 3

Types of vascular bundles

1. Collateral or Conjoint vascular bundle:

In **stems** and **leaves**.

Xylem and phloem are arranged at the same radius, side by side.

There are two types of collateral vascular bundles:

a. **Closed collateral vascular bundle:**

Cambium is absent in between phloem and xylem.

Example: **monocot stem & monocot leaf**.

b. **Open collateral vascular bundle:**

Cambium is present in between phloem and xylem.

Example: **dicot stem & dicot leaf**.

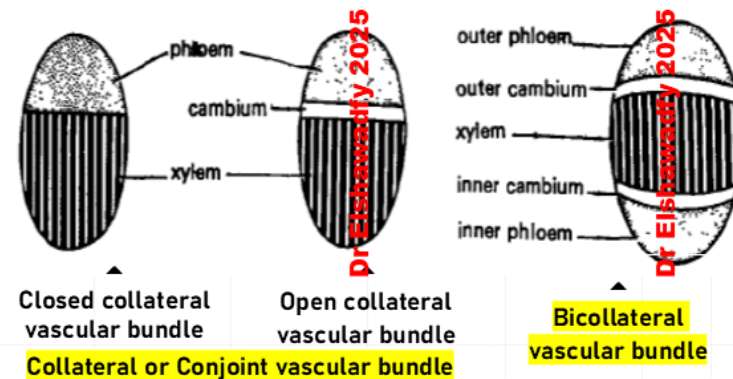
2. Bicollateral vascular bundle:

In which phloem situated on the outer and inner sides of the xylem.

There are 2 strips of cambium i.e. inner and outer cambium.

Inner cambium is present between inner phloem and xylem.

Outer cambium is present between the outer phloem and xylem.



Lab 3

3. Radial vascular bundle:

In roots, xylem and phloem are arranged in an alternate manner on different radii.

4. Concentric vascular bundle:

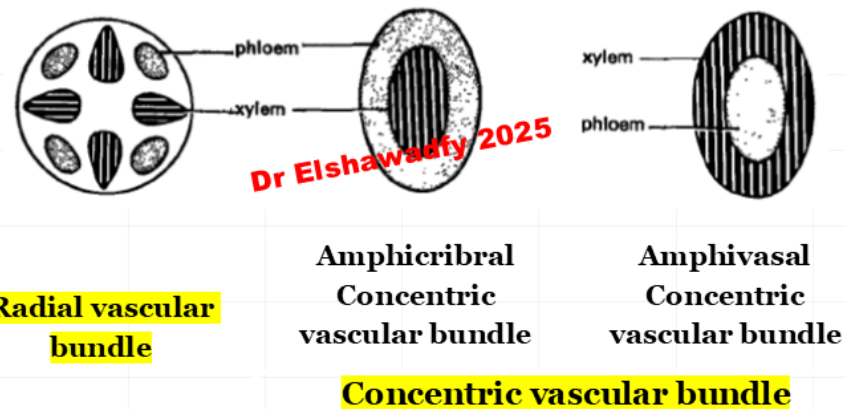
in which either phloem surrounds the xylem or xylem surrounds the phloem completely. On the basis of encircling, further divided into two types.

A. Amphivasal vascular bundle:

xylem completely surrounds phloem.

B. Amphicribal vascular bundle:

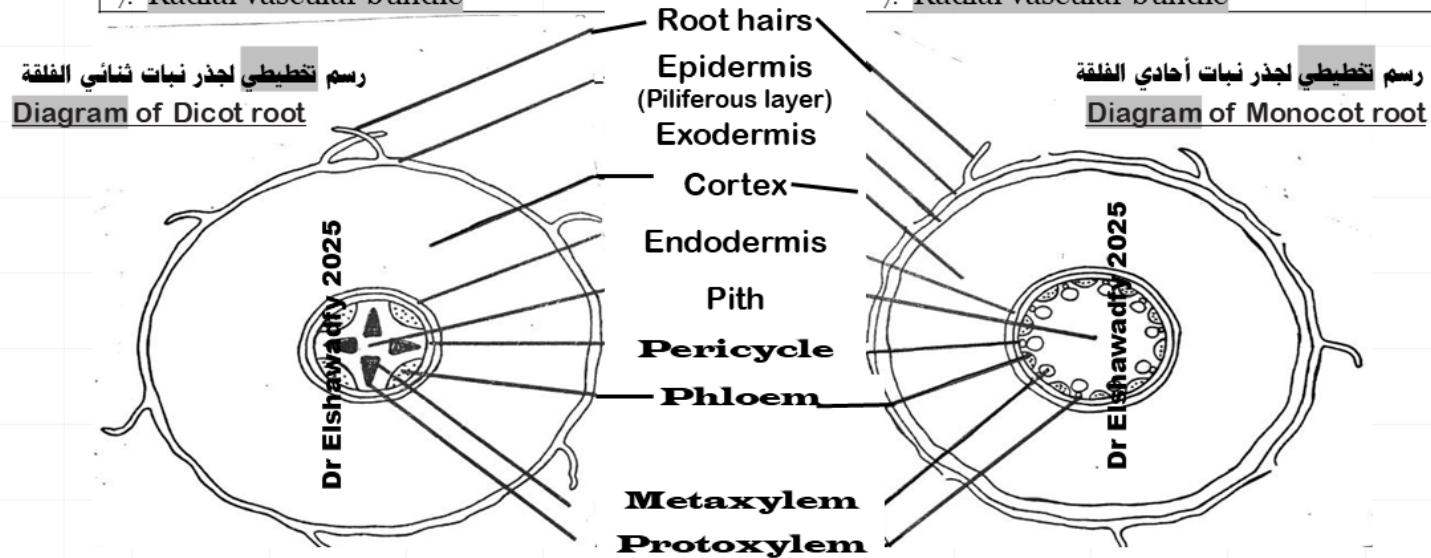
phloem completely surrounds xylem.



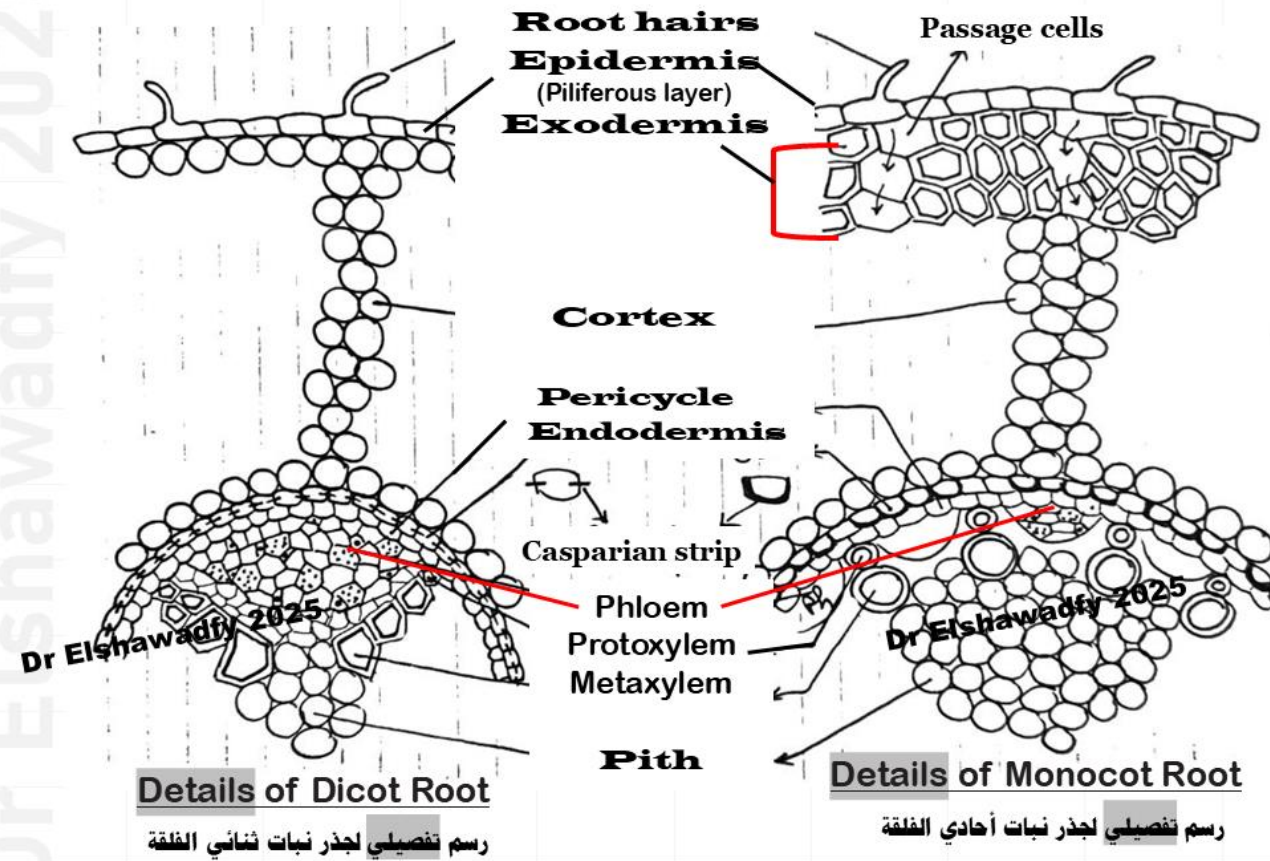
Lab 3

Differences between Dicot root and Monocot root

Dicot roots	Monocot roots
1. Xylem is usually tetrarch (2-8).	1. Xylem is polyarch (> 8).
2. Pith is usually narrow or absent.	2. Pith is usually large
3. Cortex is wide.	3. Cortex is narrow.
4. Metaxylem vessels are polygonal in cross section.	4. Metaxylem vessels are circular in cross section.
5. Hypodermis is of parenchyma.	5. Hypodermis is of sclerenchyma.
6. Secondary growth is generally present.	6. There is no secondary growth.
7. Radial vascular bundle	7. Radial vascular bundle



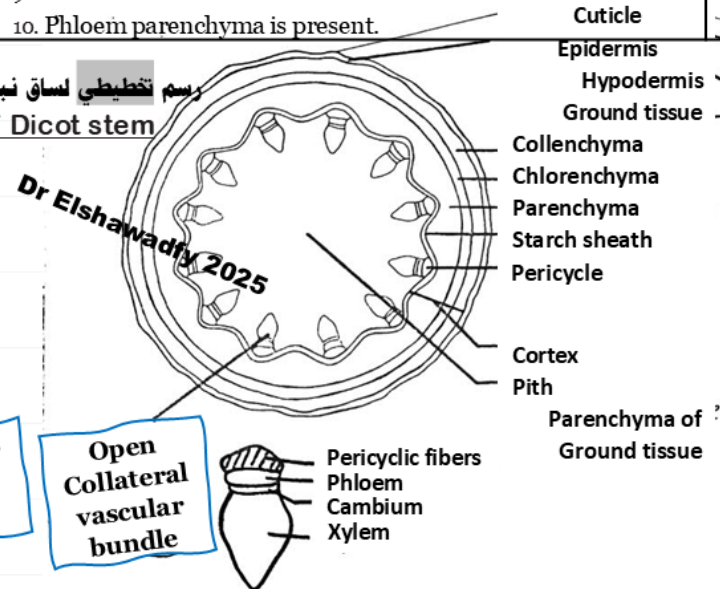
Lab 4



Lab 4

Dicot stem	Monocot stem
1. Hypodermis is of Collenchyma. 2. Ground tissue is differentiated into cortex, and pith. 3. Starch sheath is present. 4. Medullary rays are present. 5. Vascular bundles are open, collateral. 6. Vascular bundles are arranged in a ring. 7. Vessels are arranged in radial rows. 8. vessels are polygonal in cross section. 9. Bundle sheath is absent. 10. Phloem parenchyma is present.	1. Hypodermis is of Sclerenchyma. 2. Ground tissue is not differentiated (made of parenchyma). 3. Starch sheath is absent. 4. Medullary rays are absent. 5. Vascular bundles are closed, collateral. 6. Vascular bundles are scattered. 7. Vessels are arranged in V or Y shape. 8. vessels are circular in cross section 9. Bundle sheath is present. 10. Phloem parenchyma is absent.

رسم تخطيطي لساق نبات ثنائي الفلقة
Diagram of Dicot stem



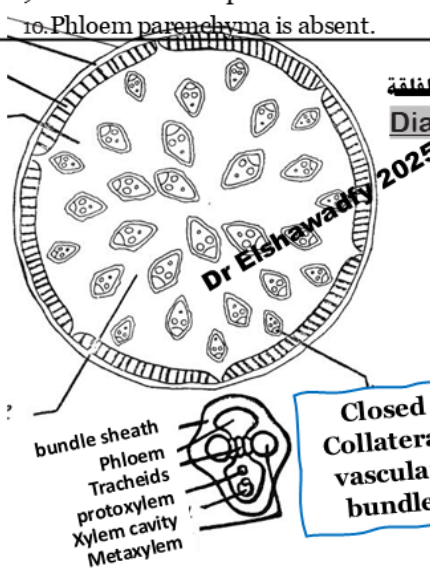
الحزمة الوعائية:
جانبية
مفتوحة

Open
Collateral
vascular
bundle



Pericyclic fibers
Phloem
Cambium
Xylem

رسم تخطيطي لساق نبات أحادي الفلقة
Diagram of Monocot stem



Closed
Collateral
vascular
bundle

الحزمة الوعائية:
جانبية
مغلقة

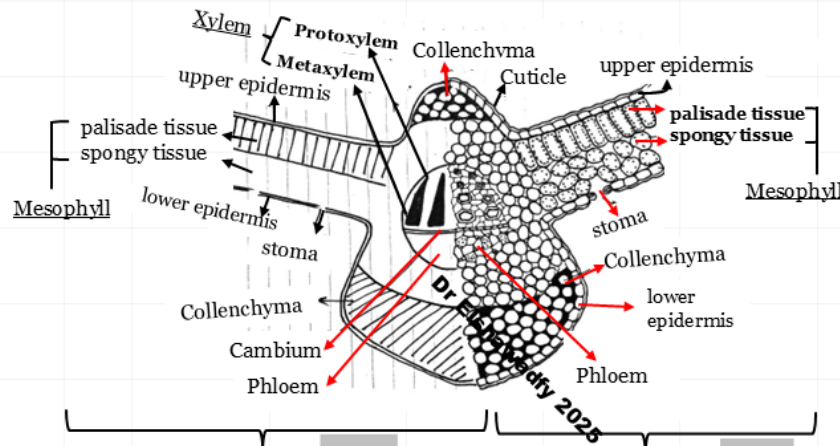
bundle sheath
Phloem
Tracheids
protoxylem
Xylem cavity
Metaxylem

Parenchyma of
Ground tissue

Differences between Dicot Leaf and Monocot Leaf

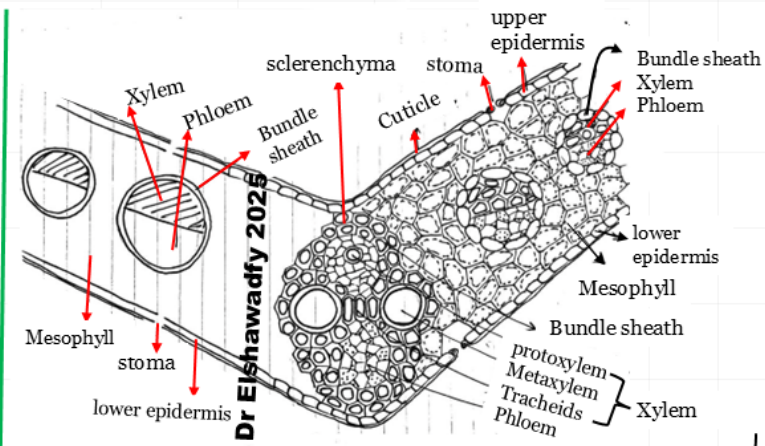
Lab 5 & Revision

Dicot Leaf	Monocot Leaf
1. Hypodermis at the midrib is of collenchyma.	1. Hypodermis at the midrib is of sclerenchyma.
2. Mesophyll is differentiated into: palisade and spongy tissues.	2. Mesophyll is not differentiated.
3. stomata are present only on the lower surface, or the lower surface has more stomata than the upper one.	3. stomata are present on both lower and upper surfaces.
4. Vascular bundles: open collateral.	4. Vascular bundles: closed collateral.
5. Bundle sheath: of parenchyma.	5. Bundle sheath: of sclerenchyma.
6. Vessels are arranged in radial rows.	6. Vessels are arranged in inverted V or Y shape.
7. Phloem parenchyma is present.	7. Phloem parenchyma is absent.



رسم تخطيطي لورقة نبات ثنائي الفلقة
Diagram of Dicot Leaf

رسم تفصيلي لورقة نبات ثنائي الفلقة
Details of Dicot Leaf



رسم تخطيطي لورقة نبات أحادي الفلقة
Diagram of Monocot Leaf

رسم تفصيلي لورقة نبات أحادي الفلقة
Details of Monocot Leaf

**Polyhedral
parenchyma**





Dr. Elshawadly 2024

**Bone-shaped sclereids
(Osteosclereids)**



Dr. Elshawadly 2024

Amphivasal concentric vascular bundle

Dr. Elshawadfy 2024



Cystolith (Ca-carbonate crystals)

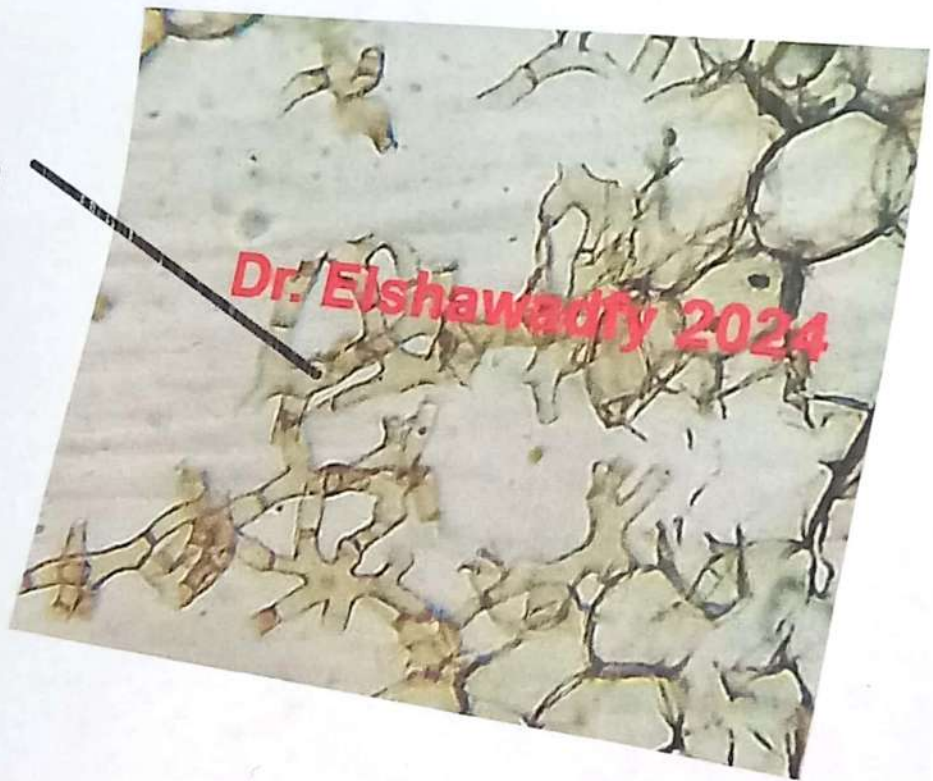


Dr. Elshawadfy 2024

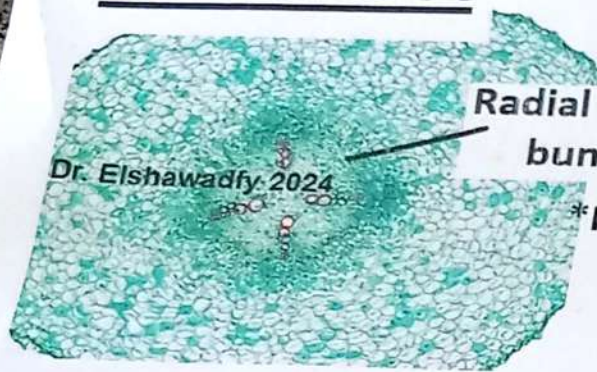


Dr. Elshawadfy 2024

**Stellate
parenchyma**



Diocot Root

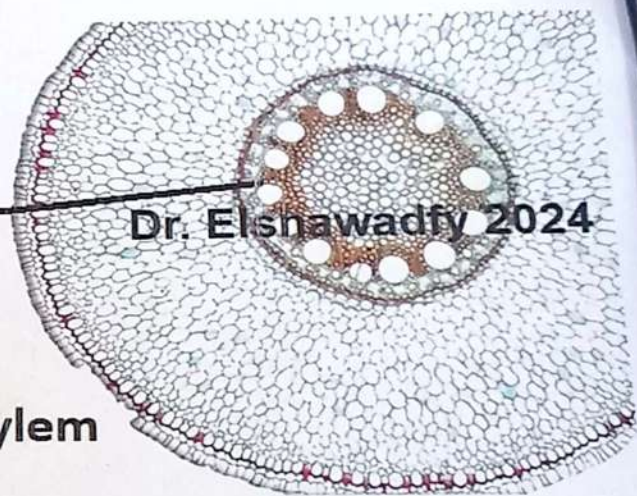
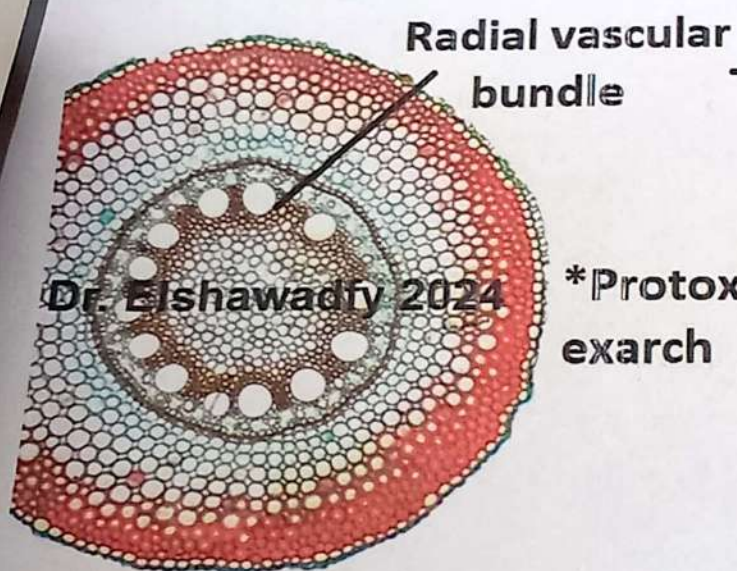


Radial vascular bundle

*Protoxylem exarch



Monocot Root



Retama stem



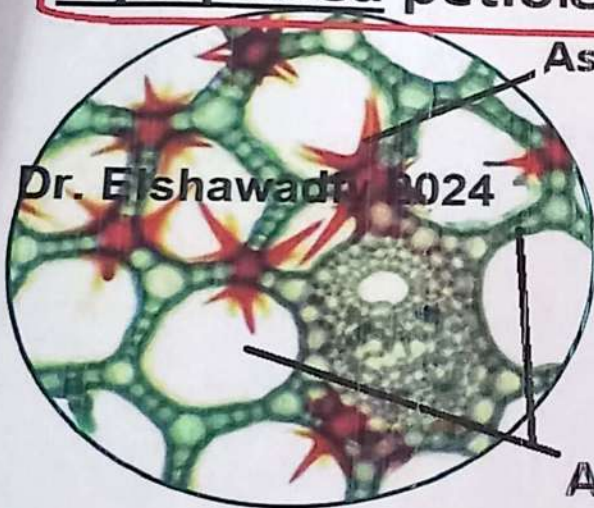
**Xerophyte
plant**



**Stone cells
(Brachysclereids)**

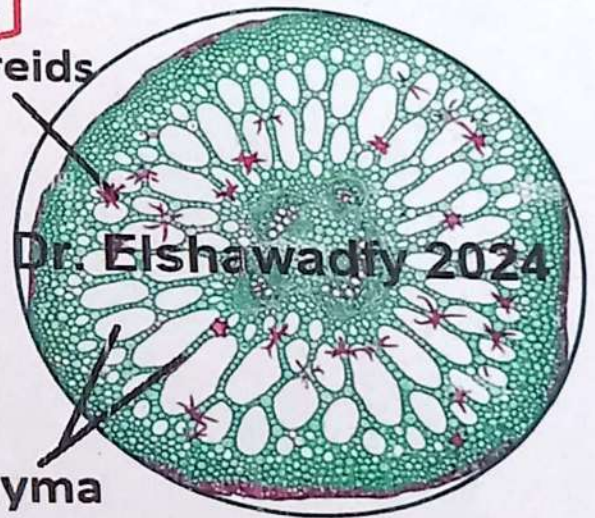
Hydrophyte plants

Nymphaea petiole/stem



Astrosclereids

Aerenchyma

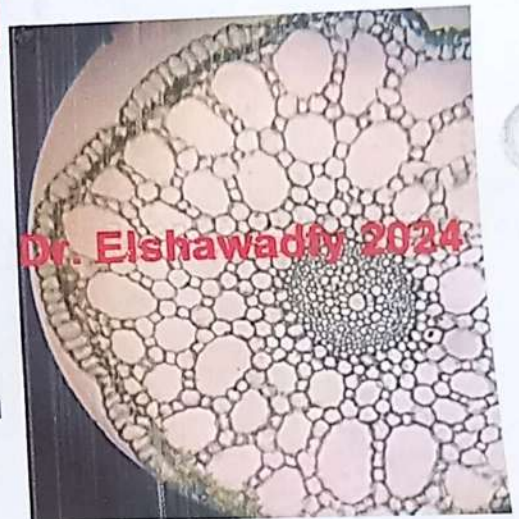
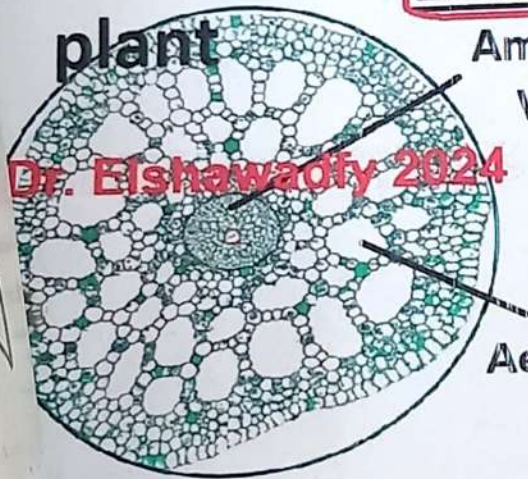


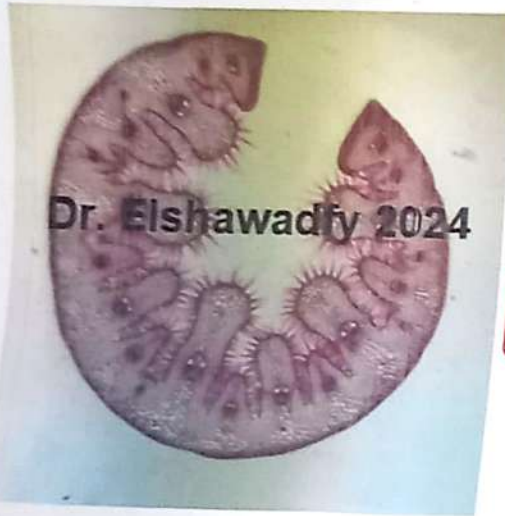
Hydrophyte
plant

Elodea stem

Amphicribal
Vascular
bundle

Aerenchyma





Xerophyte plant

Ammophila leaf

Dicot Leaf

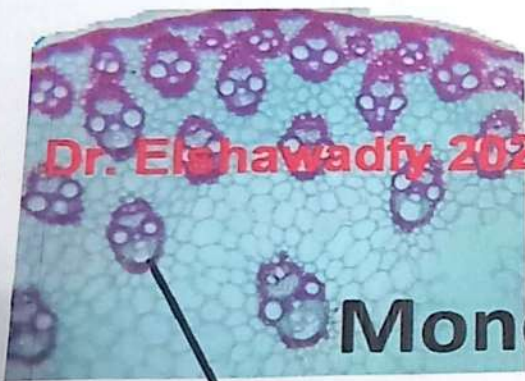


Chlorenchyma

Collenchyma

Open collateral
vascular bundle



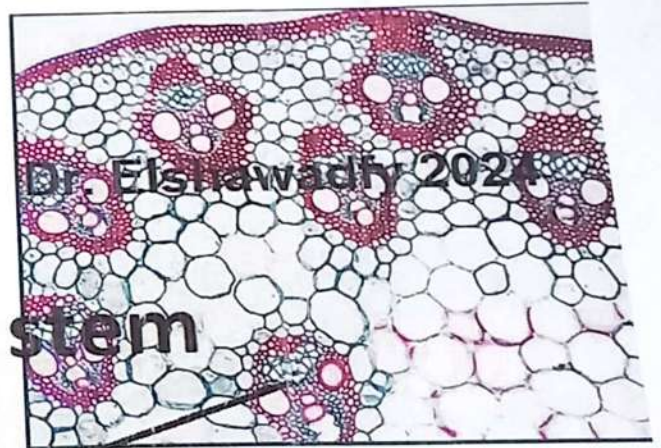


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Monocot stem

Closed collateral
vascular bundle

*endarch protoxylem



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*endarch
protoxylem

Open collateral vascular
bundle

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Dicot Stem

Bicollateral vascular bundle



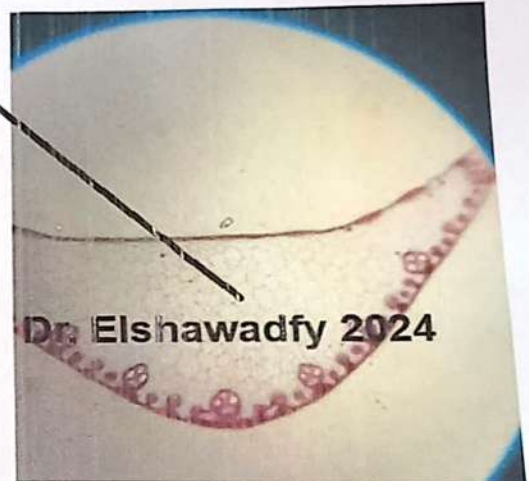
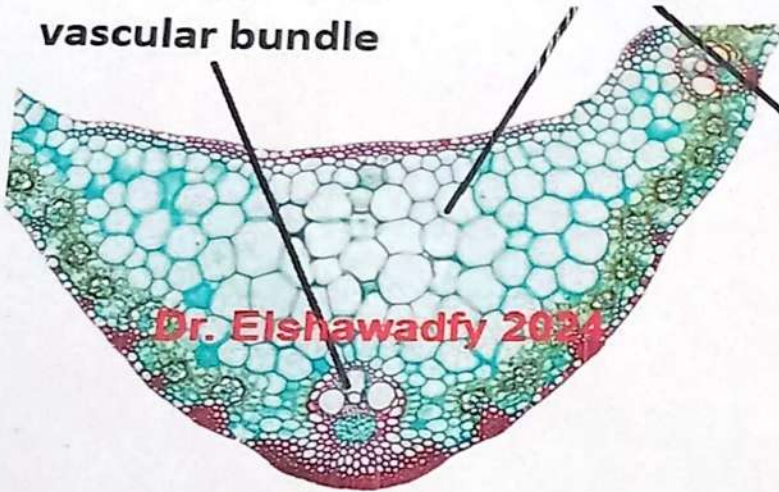
Rod-shaped sclereids (Macrosclereids)



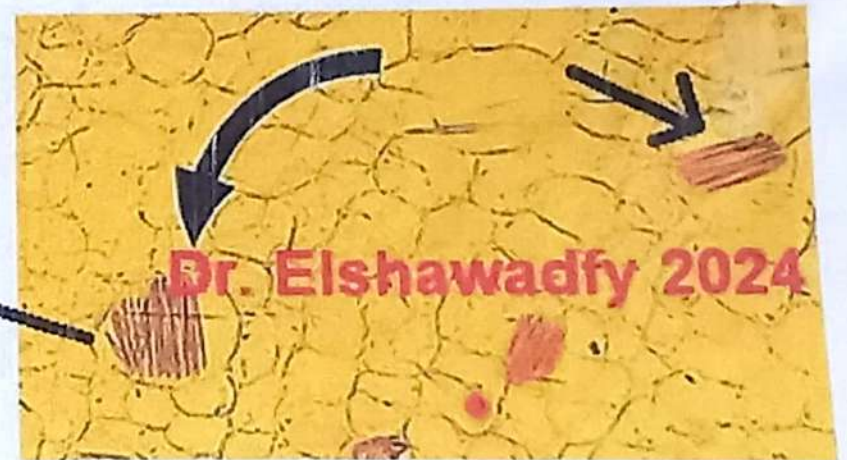
Monocot Leaf

Closed collateral
vascular bundle

Chlorenchyma (Mesophyll)



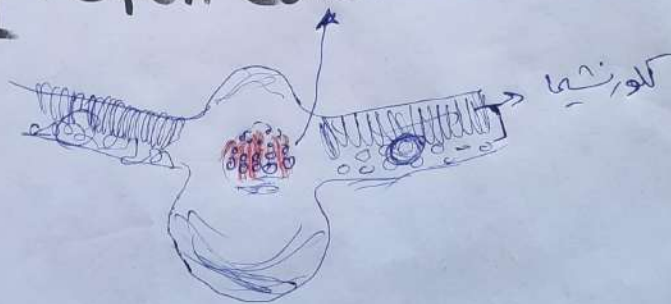
Raphides (Ca-oxalate crystals)





Dicot Leaf

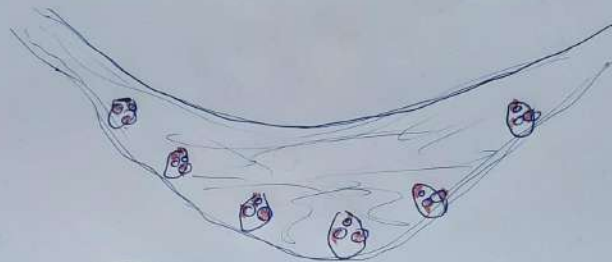
[+ Chlorenchyma
+ open collateral v.B.]





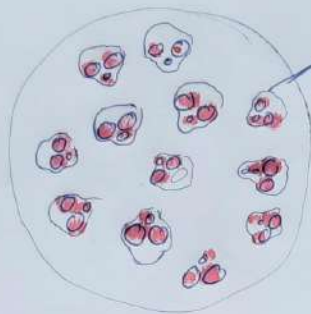
Monocot Leaf

^{آبہ کی پانچ}
[+ Closed Collateral V-B]

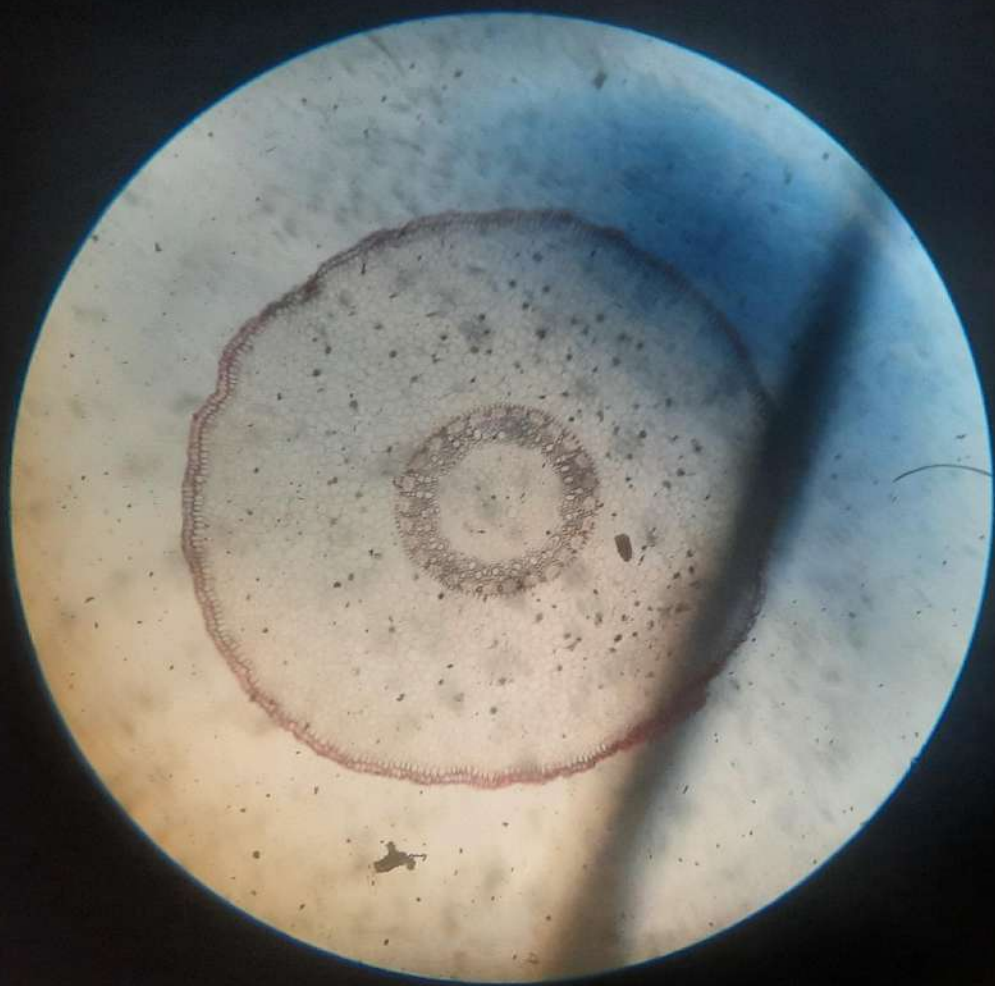




Monocot Stem
[+closed ^{آبہ بند} Collateral v-B]

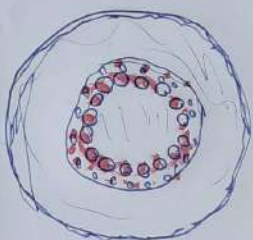


p.l.p.



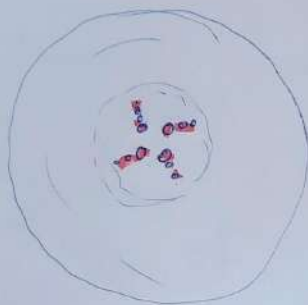
Monocot Root

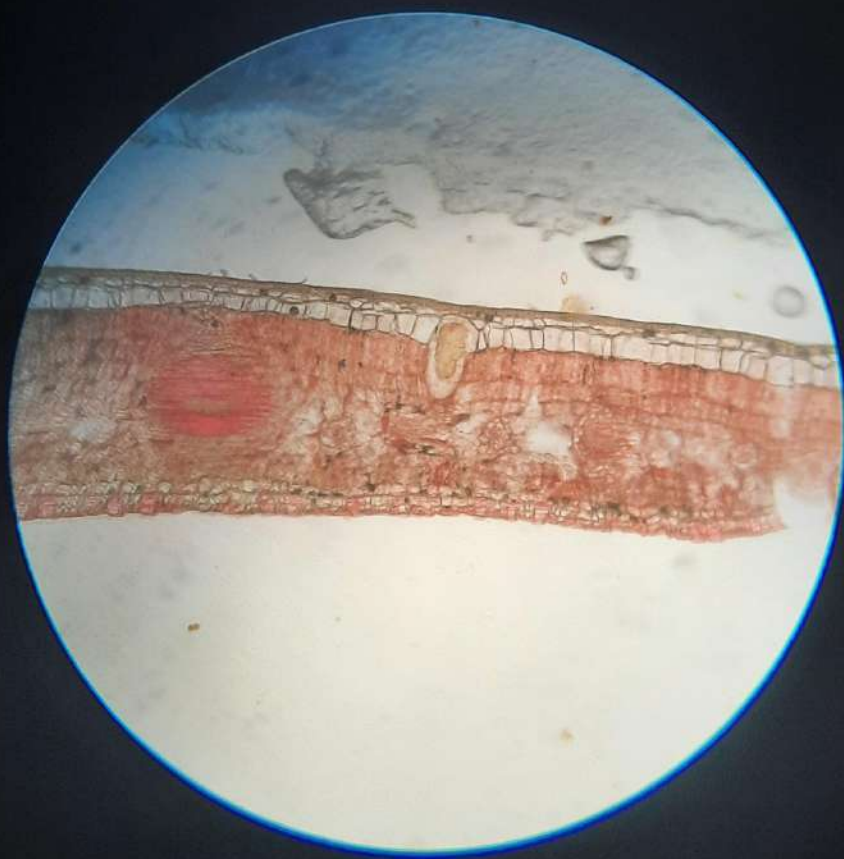
[+ Radial ^{vascular} bundles]





Dicot Root
{ + Radial ^{axial} vascular bundles }





Cystolith

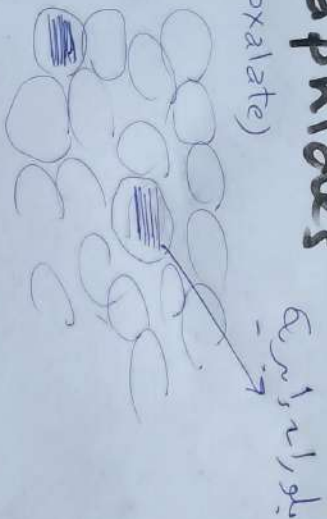
(Ca-carbonate)

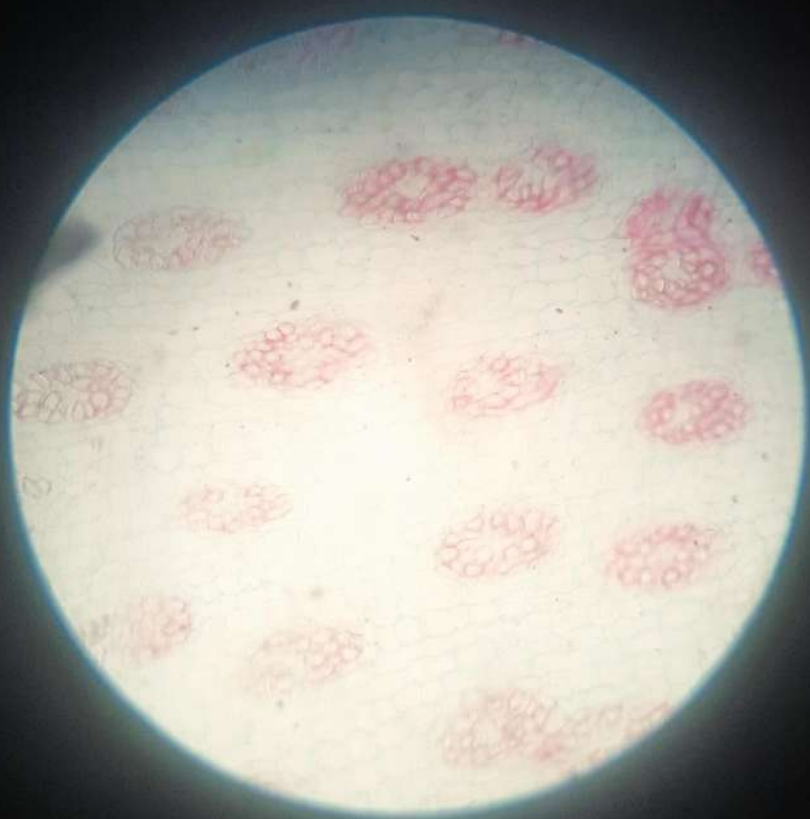
حويصة كربونية





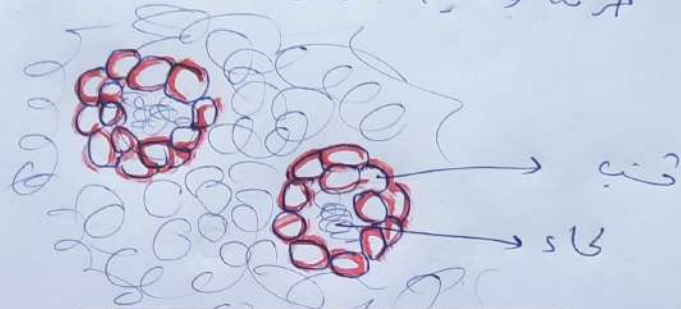
Raphides (Ca-oxalate)

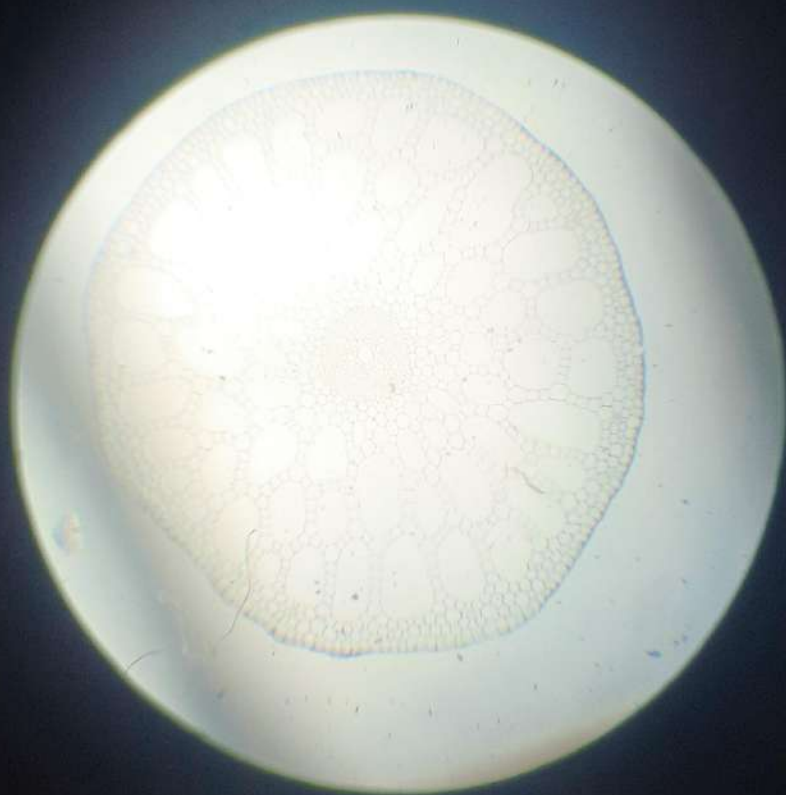




Amphivasal concentric v-B.

جزءة وعائية مركزية الماء / محيط الخشب







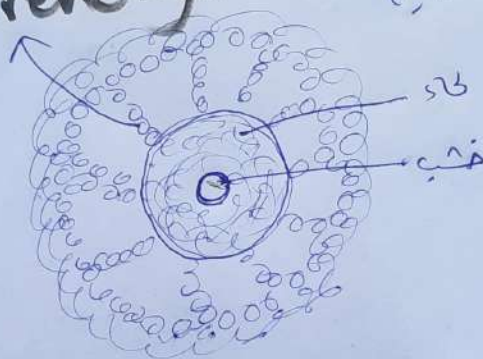
Amphicribal concentric V.B.

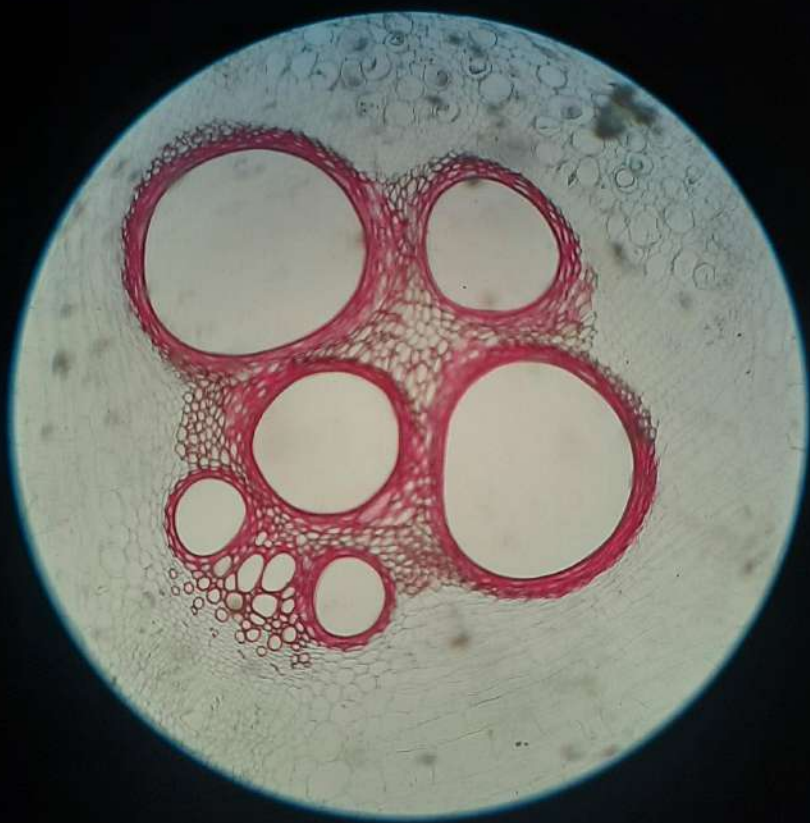
هزنة وعاية مركزية الحنية / مبطنة الكاء

[+

Aerenchyma

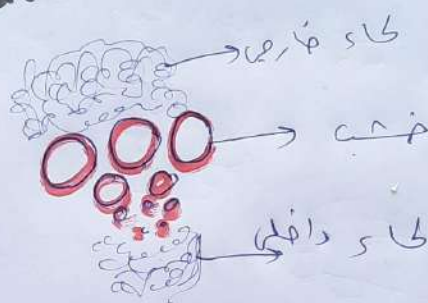
براشيا
هوائيه]





Bicollateral u. B.

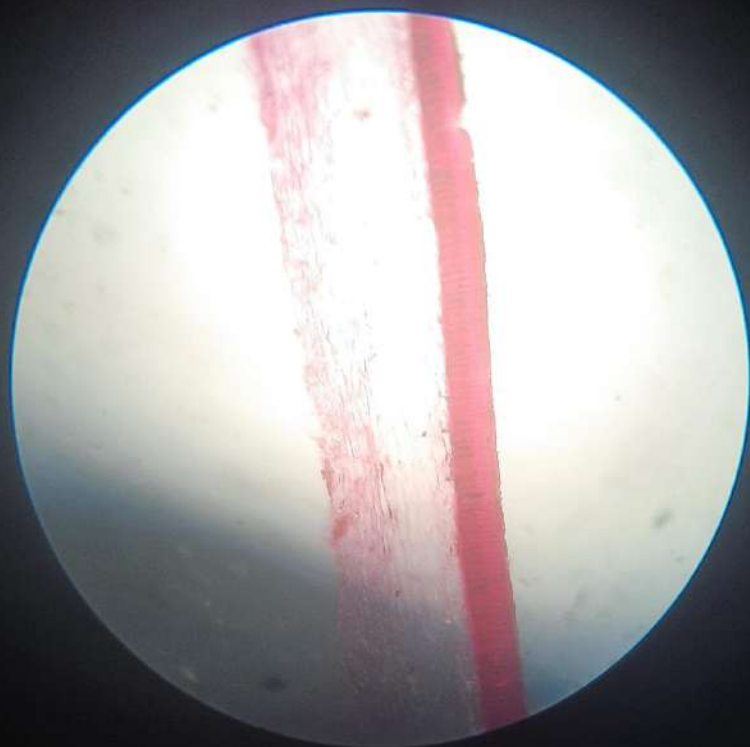
مناخ الجانبي

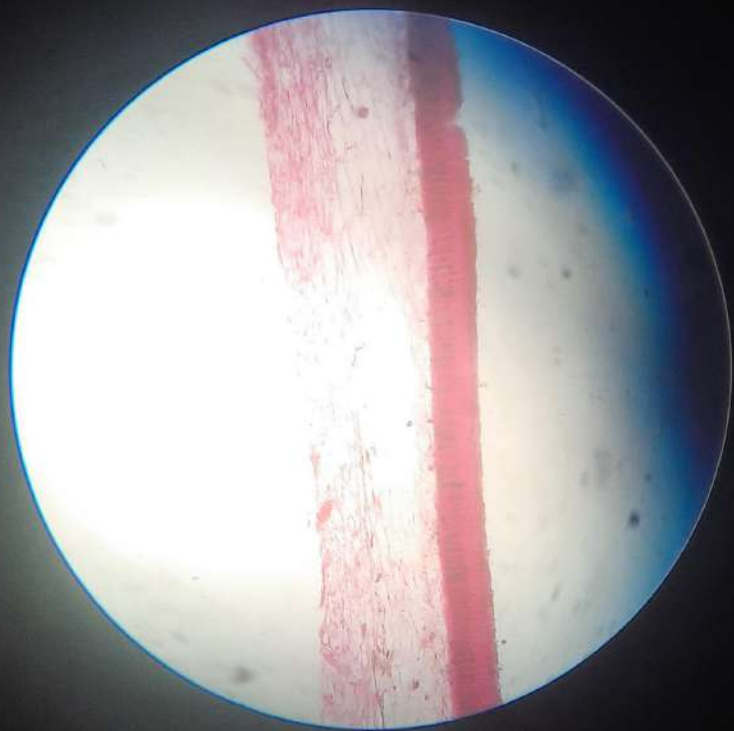




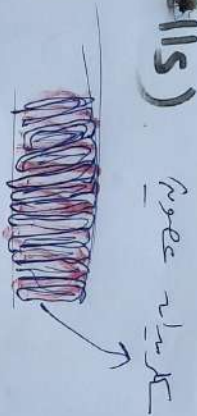
Osteoscleroides
(Bone-Cells)







Macroscleroides
(Rod cells)

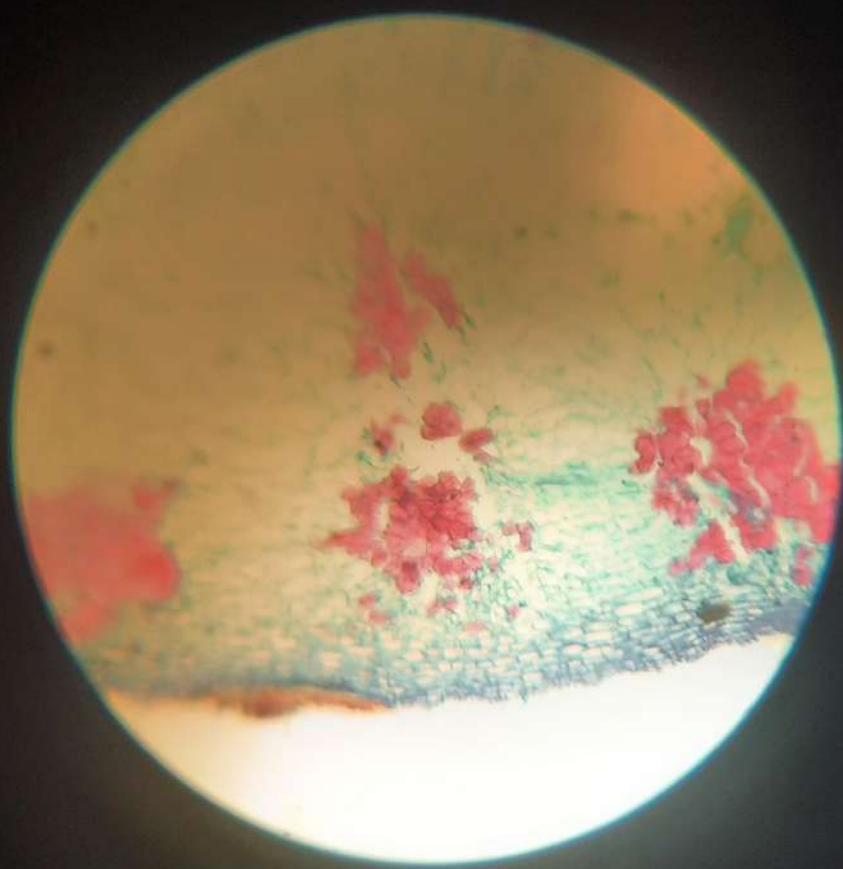




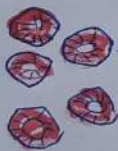
Astro sclereids
(star-shaped)

ستروكلريد

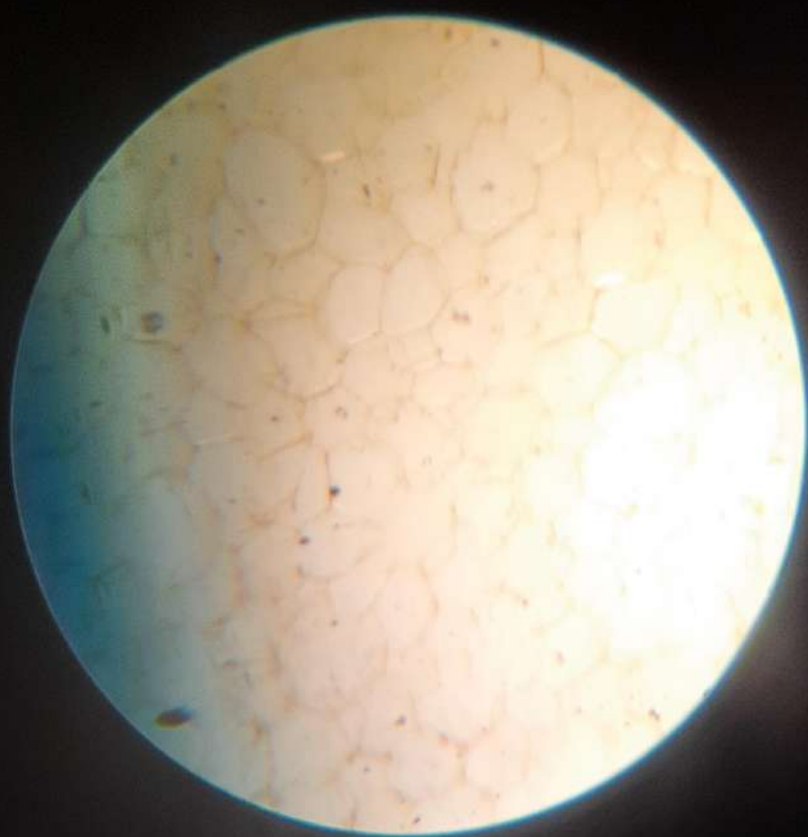




Brachy Sclereides
(Stone cells)

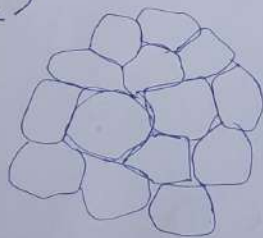


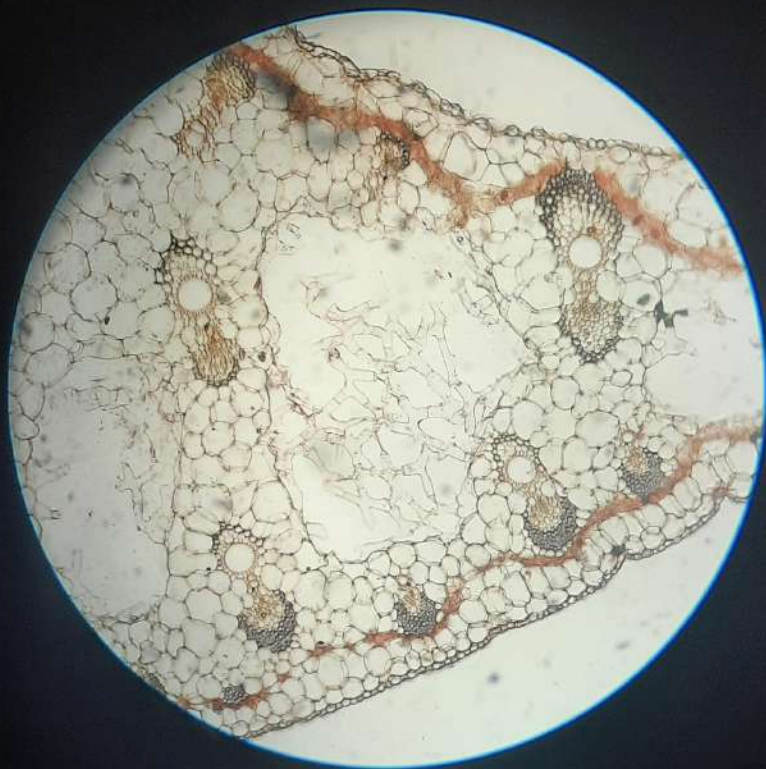
Brachy Sclereides



Polyhedral
(3D) cells

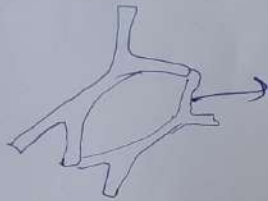
Parenchyma



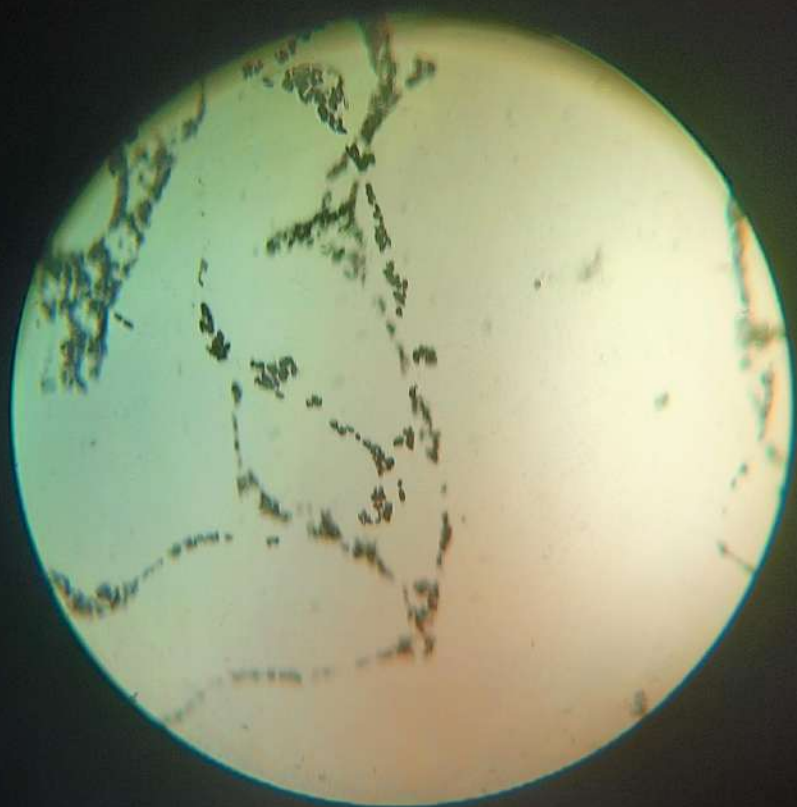




Stellate parenchyma



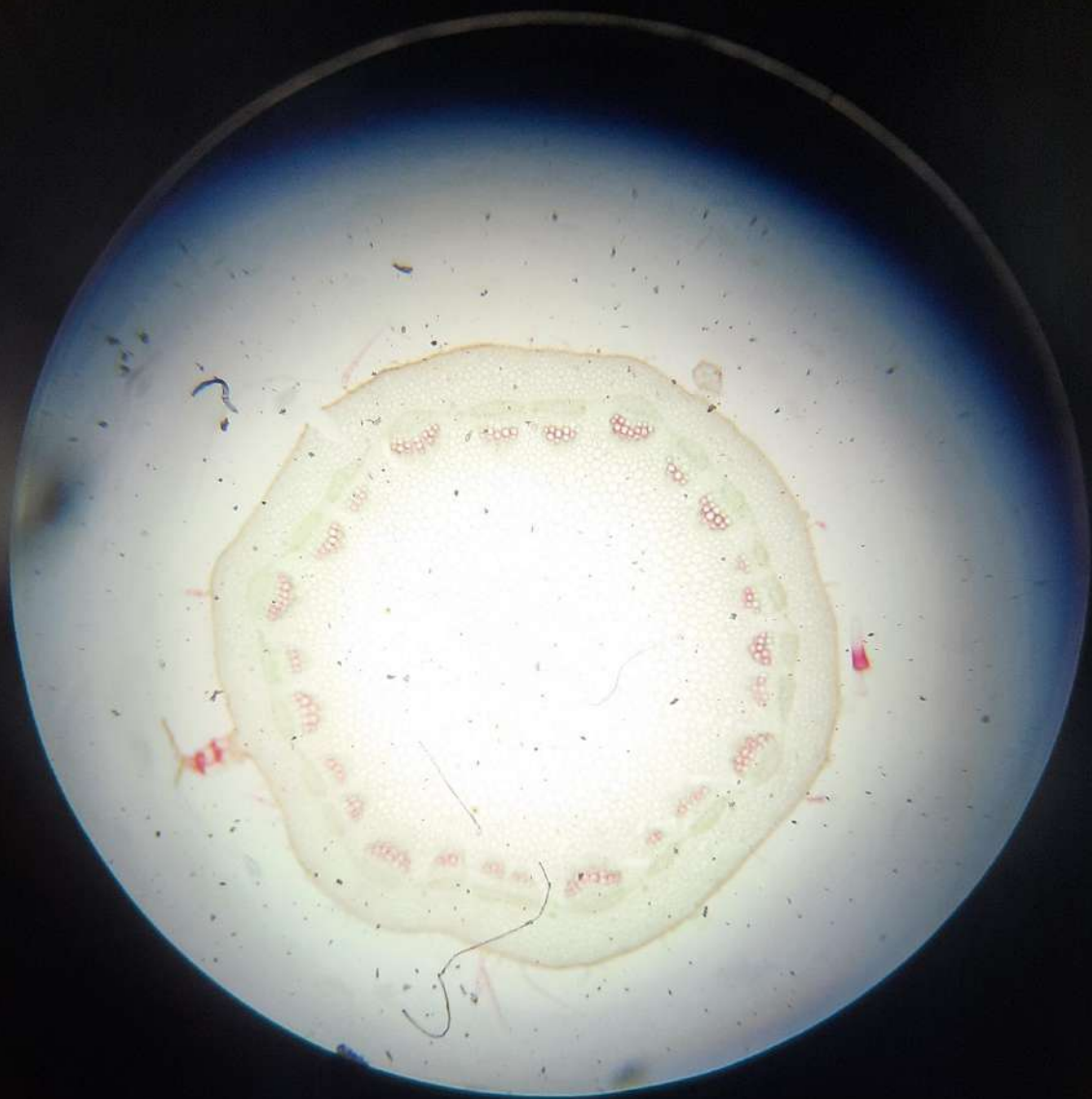
براقية



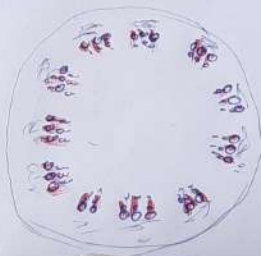
Starch grains



حبیبہ زینا



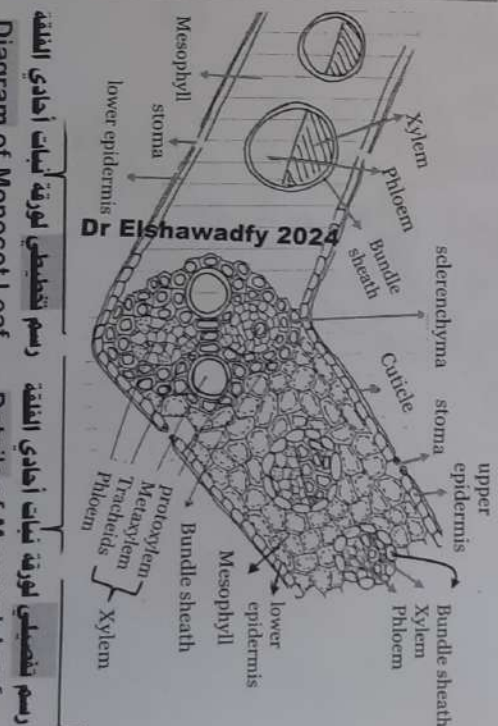
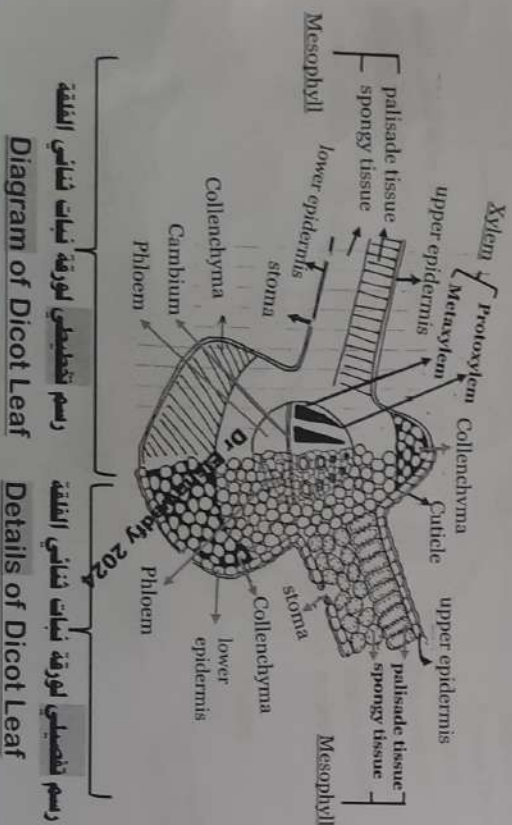
Dicot Stem
[+ Open collateral v.B.]



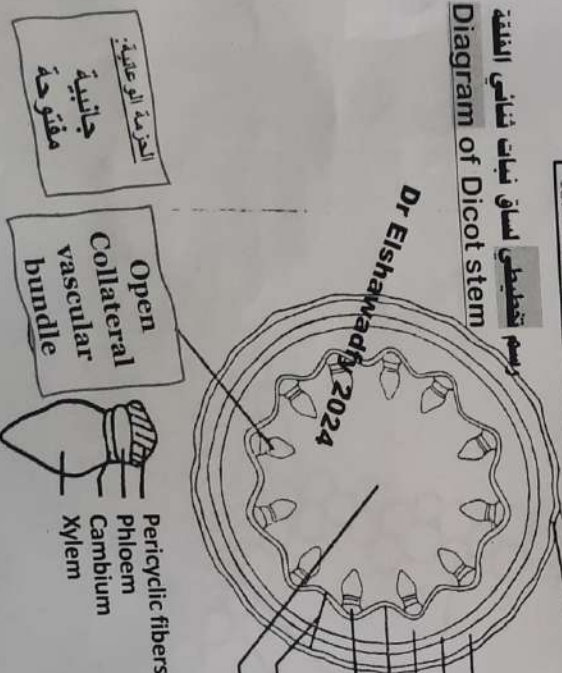
OPTIKA

Differences between Dicot Leaf and Monocot Leaf

Dicot Leaf	Monocot Leaf
1. Hypodermis at the midrib is of collenchyma. 2. Mesophyll is differentiated into: palisade and spongy tissues. 3. stomata are present only on the lower surface, or the lower surface has more stomata than the upper one. 4. Vascular bundles: open collateral. 5. Bundle sheath: of parenchyma. 6. Vessels are arranged in radial rows. 7. Phloem parenchyma is present.	1. Hypodermis at the midrib is of sclerenchyma. 2. Mesophyll is not differentiated. 3. stomata are present on both lower and upper surfaces. 4. Vascular bundles: closed collateral. 5. Bundle sheath: of sclerenchyma. 6. Vessels are arranged in inverted V or Y shape. 7. Phloem parenchyma is absent.



رسم تقاطعي لساق نبات ثنائي النبتة
Diagram of Dicot stem



Open
Collateral
vascular
bundle

Pericyclic fibers
Phloem
Cambium
Xylem

الجزء العلوي:
جانبية
مفتوحة

1. Hypodermis is of Collenchyma.
2. Ground tissue is differentiated into cortex, and pith.
3. Starch sheath is present.
4. Medullary rays are present.
5. Vascular bundles are open, collateral.
6. Vascular bundles are arranged in a ring.
7. Vessels are arranged in radial rows.
8. Vessels are polygonal in cross section.
9. Bundle sheath is absent.
10. Phloem parenchyma is present.

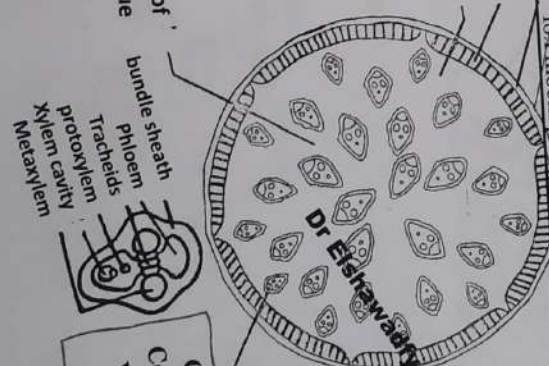
Cuticle
Epidermis
Hypodermis
Ground tissue

Collenchyma
Parenchyma
Starch sheath
Pericycle

Parenchyma of
Ground tissue

Cortex
Pith

رسم تقاطعي لساق نبات أحادي النبتة
Diagram of Monocot stem



Closed
Collateral
vascular
bundle

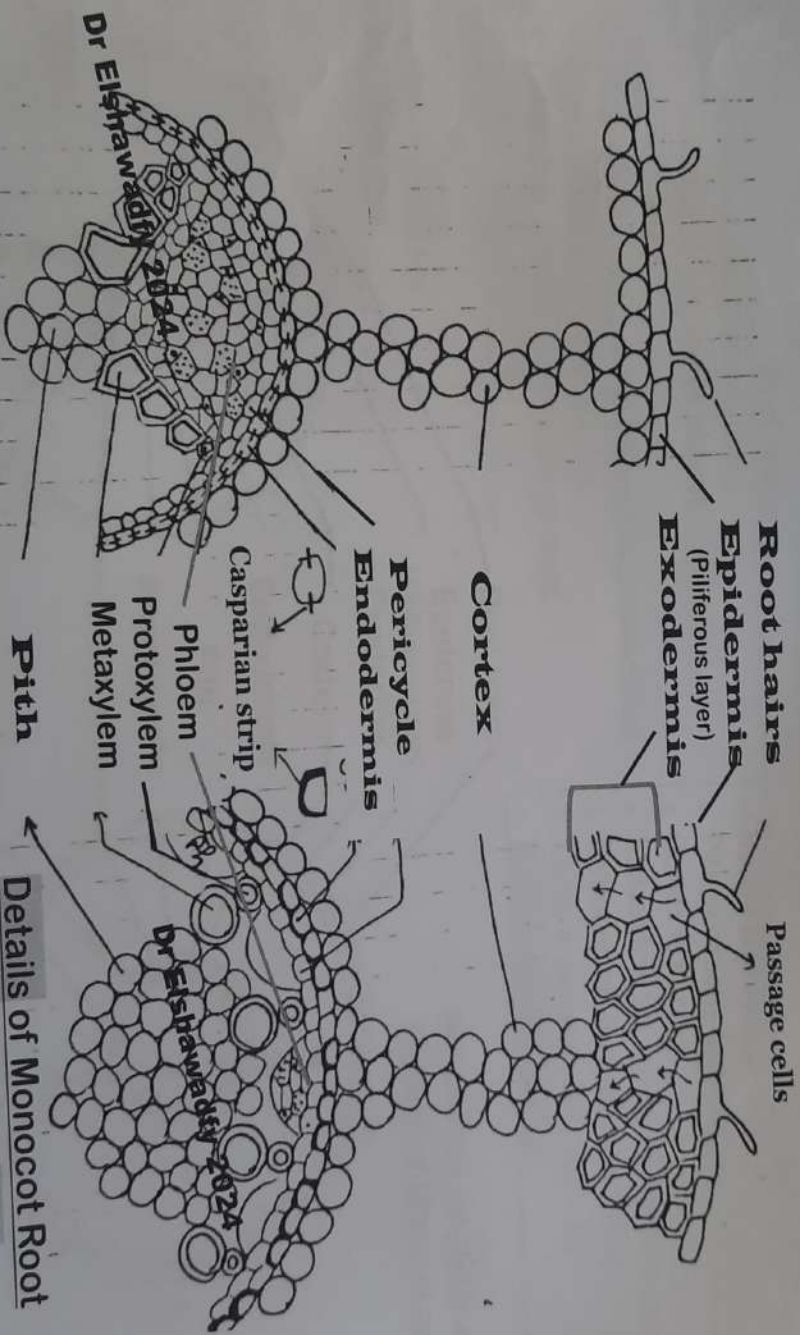
bundle sheath
phloem
Tracheids
protoxylem
xylem cavity
Metaxylem

الجزء العلوي:
جانبية
مغلقة

1. Hypodermis is of Sclerenchyma.
2. Ground tissue is not differentiated (made of parenchyma).
3. Starch sheath is absent.
4. Medullary rays are absent.
5. Vascular bundles are closed, collateral.
6. Vascular bundles are scattered.
7. Vessels are arranged in V or Y shape.
8. Vessels are circular in cross section.
9. Bundle sheath is present.
10. Phloem parenchyma is absent.

Monocot stem

(9)



Details of Dicot Root

Details of Monocot Root

رسم تفصيلي لجذر نبات ثنائي الناقطة

رسم تفصيلي لجذر نبات أحادي الناقطة

(8)

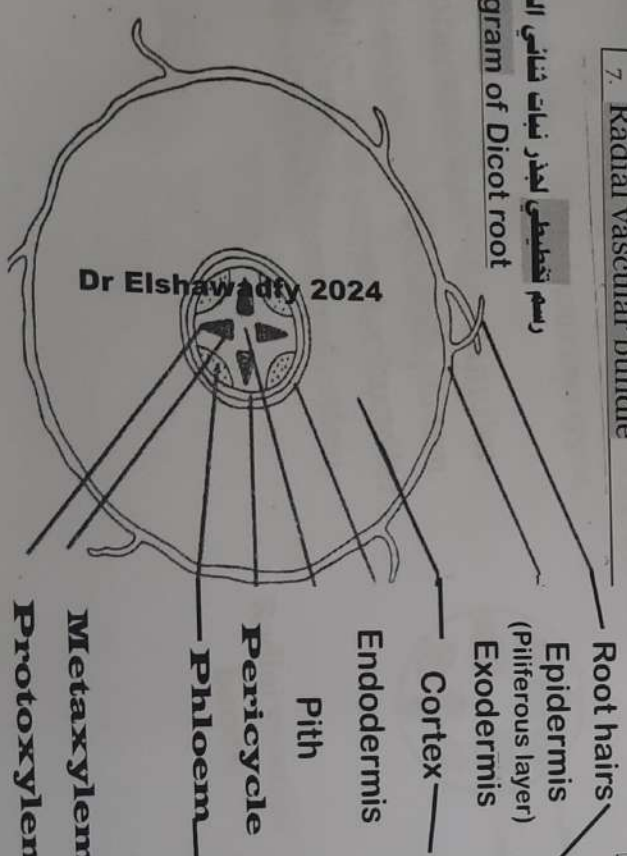
Differences between Dicot root and Monocot root

Dicot roots	Monocot roots
1. Xylem is usually tetrarch (2-8). 2. Pith is usually narrow or absent. 3. Cortex is wide. 4. Metaxylem vessels are polygonal in cross section. 5. Hypodermis is of parenchyma. 6. Secondary growth is generally present. 7. Radial vascular bundle	1. Xylem is polyarch (> 8). 2. Pith is usually large 3. Cortex is narrow. 4. Metaxylem vessels are circular in cross section. 5. Hypodermis is of sclerenchyma. 6. There is no secondary growth. 7. Radial vascular bundle

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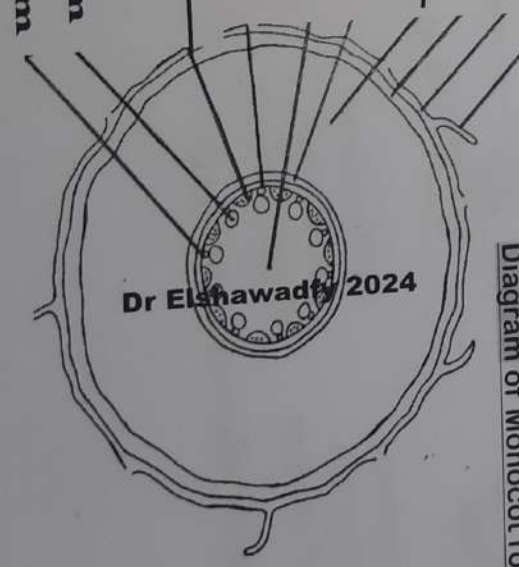
رسم تخطيطي لجذر نبات ثنائي النقة

Diagram of Dicot root



رسم تخطيطي لجذر نبات أحادي النقة

Diagram of Monocot root



(7)

3. **Radial vascular bundle:**

In roots, xylem and phloem are arranged in an alternate manner on different radii.

4. **Concentric vascular bundle:**

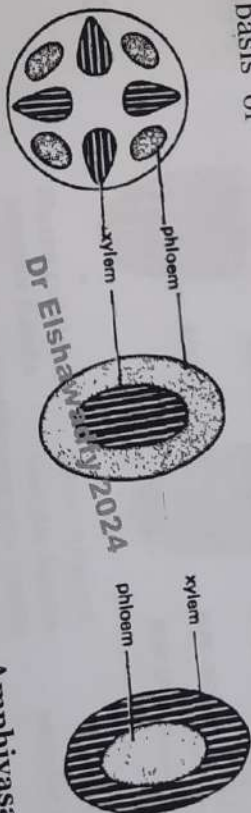
in which either phloem surrounds the xylem or xylem surrounds the phloem completely. On the basis of encircling, further divided into two types.

A. **Amphivasal vascular bundle:**

xylem completely surrounds phloem.

B. **Amphicribal vascular bundle:**

phloem completely surrounds xylem.



Radial vascular bundle

Amphicribal Concentric vascular bundle

Amphivasal Concentric vascular bundle

6

تسريح النبات العملي

Lab 3

Types of vascular bundles

1. Collateral or Conjoint vascular bundle:

In stems and leaves.

Xylem and phloem are arranged at the same radius, side by side.

There are two types of collateral vascular bundles:

a. **Closed collateral vascular bundle:**

Cambium is absent in between phloem and xylem.

Example: **monocot stem & monocot leaf.**

b. **Open collateral vascular bundle:**

Cambium is present in between phloem and xylem.

Example: **dicot stem & dicot leaf.**

Example: **dicot stem & dicot leaf.**

2. Bicollateral vascular bundle:

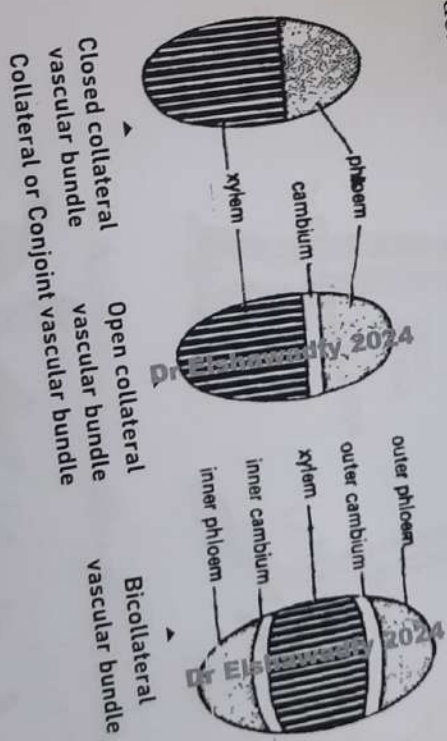
In which phloem situated on the outer and inner sides of the

xylem.

There are 2 strips of cambium i.e. inner and outer cambium.

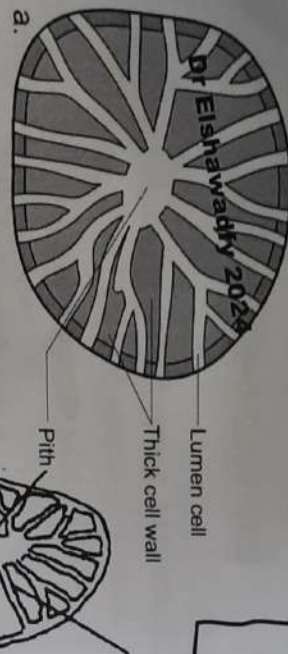
Inner cambium is present between inner phloem and xylem.

Outer cambium is present between the outer phloem and xylem.



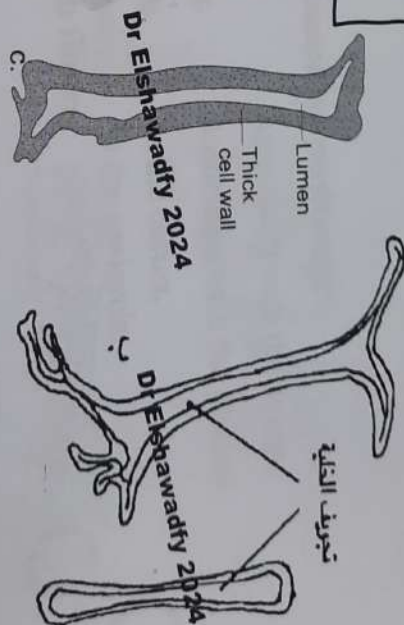
(5)

1- Brachysclereids (Stone cells)

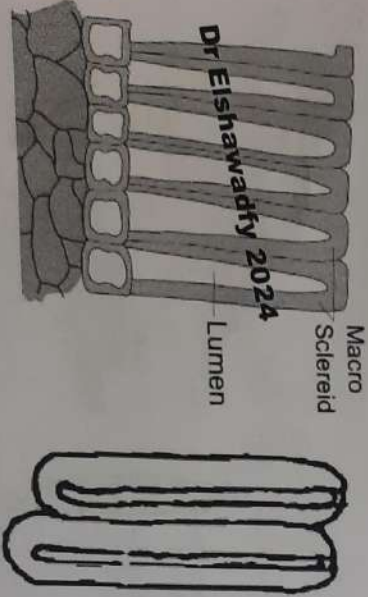


ii- Sclereids: 4 types

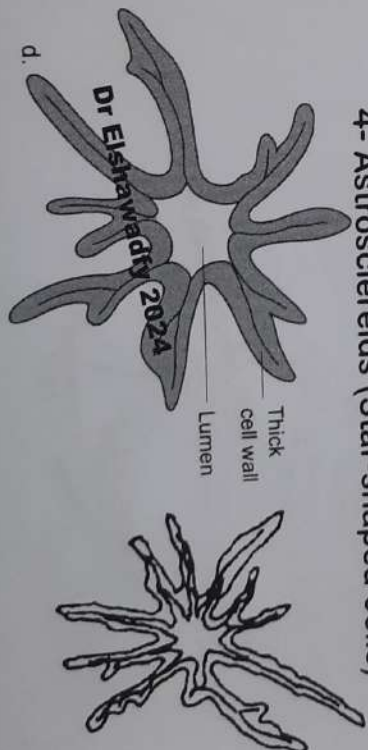
3- Osteosclereids (Bone cells)



2- Macrosclereids (Rod cells)



4- Astrosclereids (Star-shaped cells)



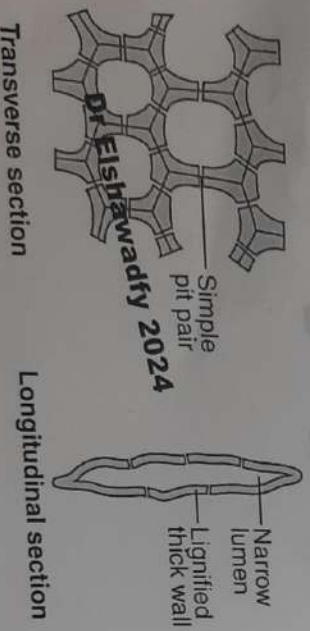
3-Sclerenchyma

- ❖ Sclerenchyma is a dead tissue, at maturity.
- ❖ The cells have lignified secondary walls.
- ❖ Sclerenchyma has simple pits.

Types of Sclerenchyma:

- Sclerenchyma is divided into two types:
sclereids and fibers.

i) Fibers:



(4)

Types of fibers (based on position):

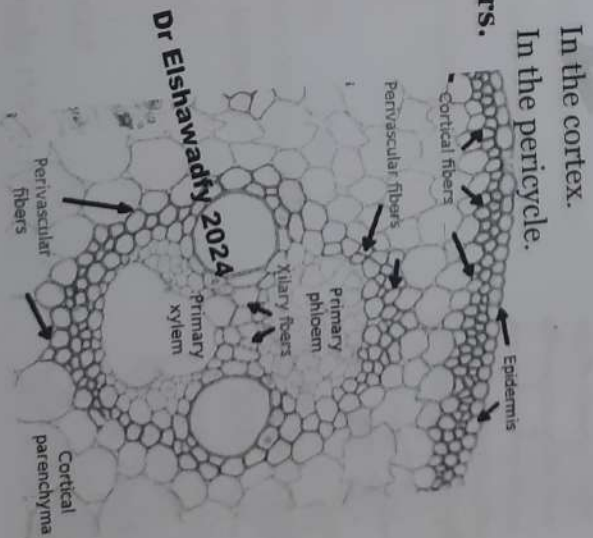
- 1- Xylem fibers.
- 2- Phloem fibers.
- 3- Cortical fibers.
- 4- Pericyclic fibers.
- 5- Bundle sheath fibers.

Associated with the xylem.

Associated with the phloem.

In the cortex.

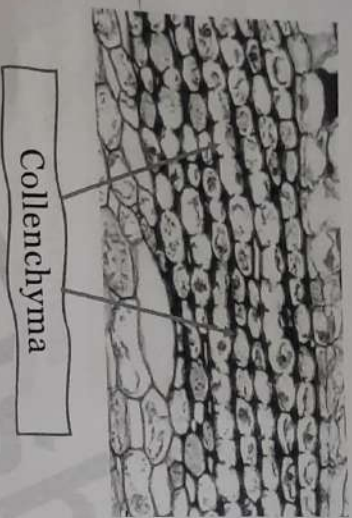
In the pericycle.



(3)

2-Collenchyma

- ❖ Collenchyma is a living tissue.
- ❖ Cell wall is primary, thick, non-lignified.



Types of Collenchyma:

There are 4 types:

A) Angular collenchyma:

The Cell wall deposition occur at their **angles**
Intercellular spaces absent.



B) Lamellar collenchyma (Tangential):

The cell wall deposition occur only on the **tangential walls**, and the radial walls are devoid of thickening.
Intercellular spaces absent.



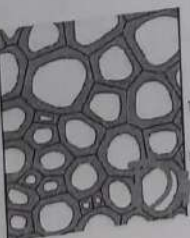
C) Lacunar collenchyma:

The Cell wall deposition occur on the walls **facing the intercellular spaces**.
Intercellular spaces present.



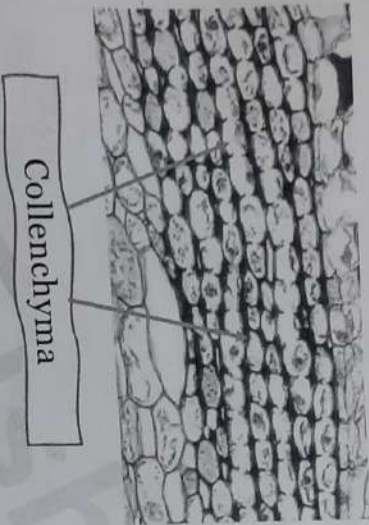
D) Annular collenchyma:

The cell walls are **uniformly thickened**.



2-Collenchyma

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Types of Collenchyma:

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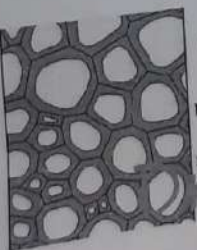
C) Lacunar collenchyma:

The Cell wall deposition occur on the walls **facing the intercellular spaces**.
Intercellular spaces present.



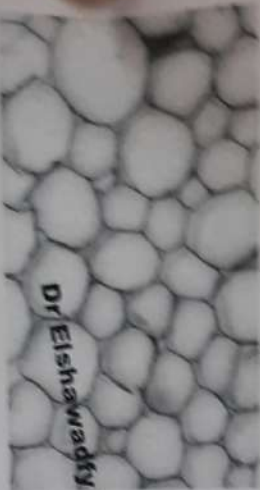
D) Annular collenchyma:

The cell walls are **uniformly thickened**.



1-Parenchyma

Parenchyma is a living tissue with thin primary cell wall made up of cellulose.



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Polyhedral parenchyma



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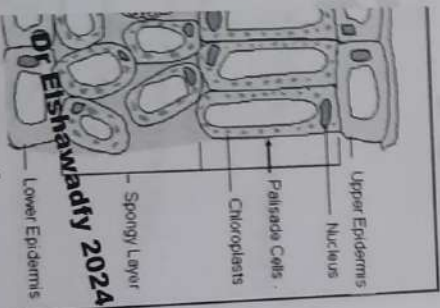
stellate-shape parenchyma

(2)

Lab 2

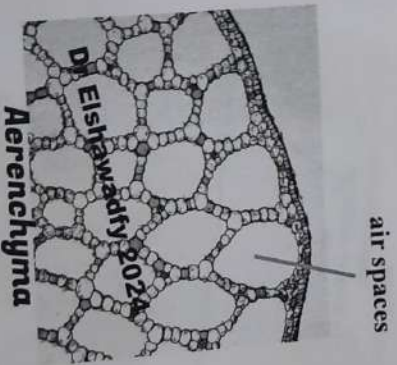
Specialized types of parenchyma

- A) Chlorenchyma:** It is parenchyma that has chloroplasts (green plastids). Function: photosynthesis.
- B) Aerenchyma:** It is parenchyma that has large intercellular spaces (air spaces). Function: exchange of gases.
- C) Storage parenchyma:** It is parenchyma that stores food (e.g., tuberous stem and root store starch grains).



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Chlorenchyma



air spaces

Aerenchyma



Starch grains

Storage parenchyma

D) Annular collenchyma
The cell walls are uniformly thickened

First 11

Non-Living Contents (مركبات غير الحية النباتية)

1- Crystals (بلورات)

A- Ca-Oxalate Crystals :

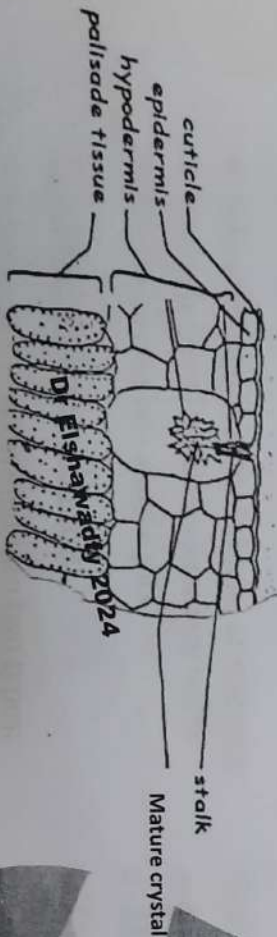
- 1- Raphides (الرافيدات) :
- in Dracaena stem.
- it is thin, elongated & occur in bundles.



B- Ca-Carbonate Crystal [= Cystolith (= حصى الكالسيوم)] :

- eg. in Eicus elastica leaf.
- it is an internal outgrowth of an epidermal cell.
- silica & Ca-carbonate crystals are deposited on a stalk

[T.S. in Eicus elastica leaf]

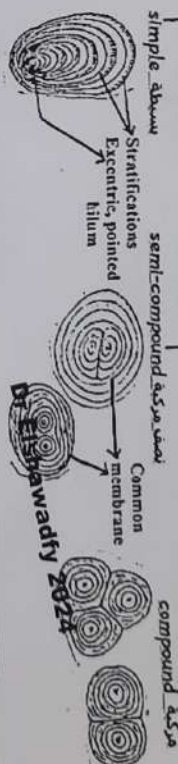


①

2- Starch Grains (حببات النشا)

1- Potato starch grains :

النشيد النشا من طين ذرية البطاطس ثم انضغطة في محلول اليود المحف و انحصرت تحت الميكروسكوب.



تسريح النبات

العلاج

First Year Biology



Narrow lumen

Eishawady 2024

Primary

Xiliary fibar

Primary



air spaces



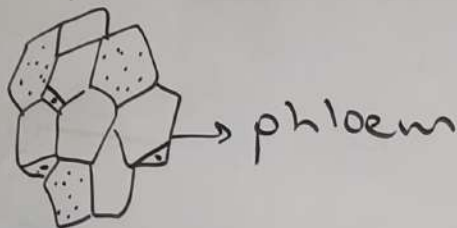
Narrow lumen



Narrow lumen

Anatomy

- 1 Dicot leaf
- 2 Monocot leaf
- 3 Monocot Stem
- 4 Monocot root
- 5 Dicot root
- 6 Cystolith
- 7 Raphides
- 8 Amphivasal Concentric V.B.
- 9 Amphicribal Concentric V.B.
- 10 Bicollateral V.B.



- 11 Osteo sclereids
- 12 Macro Sclereids
- 13 Dicot Stem
- 14 Astro sclereids
- 15 Brachy sclereids
- 16 Polyhedral Paren
- 17 Stellate
- 18 Starch grains