

Lab 1 inside plant cell

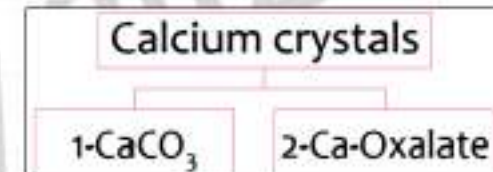
تشرح النبات العلمي First Year Biology 2025

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.



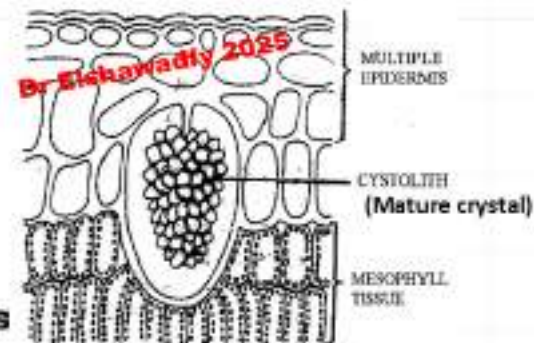
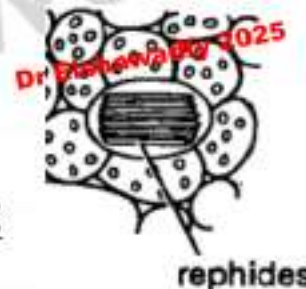
Tissues

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

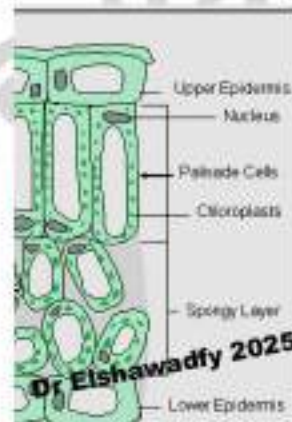
Lab 1

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

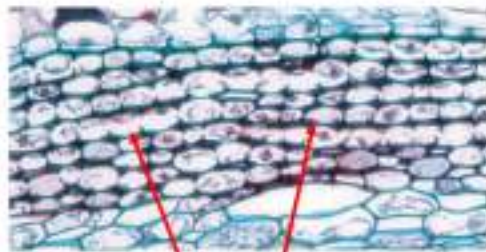


Storage parenchyma

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

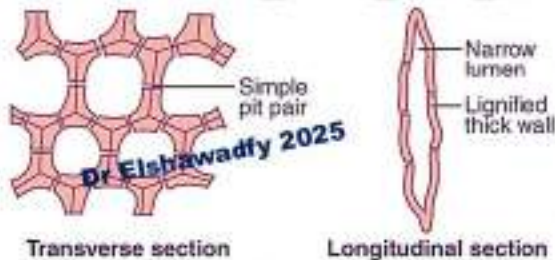
3-Sclerenchyma

- ❖ 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.

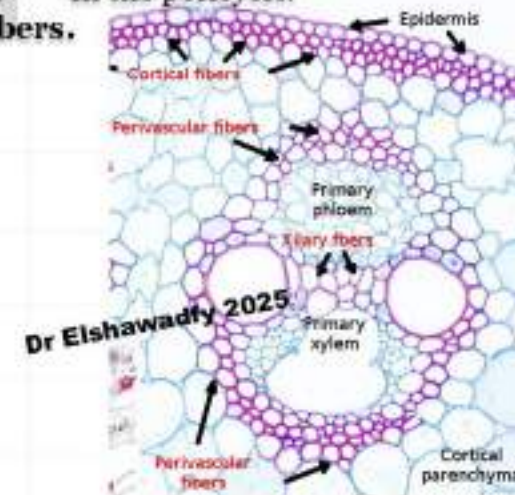
3- Cortical fibers.

In the cortex.

4- Pericyclic fibers.

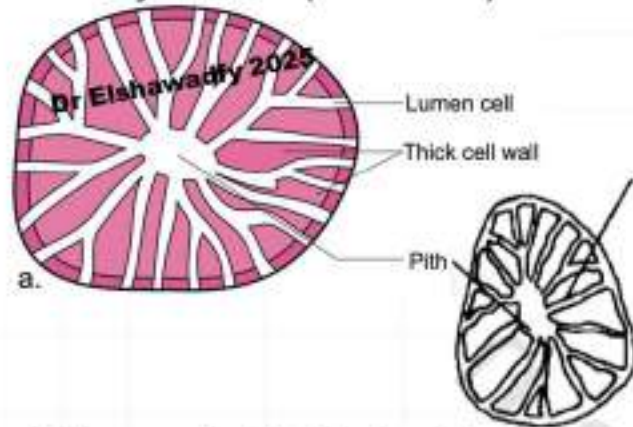
In the pericycle.

5- Bundle sheath fibers.

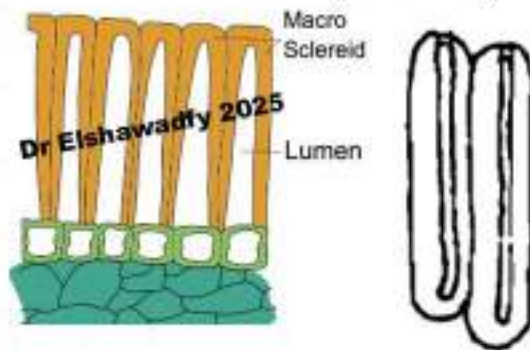


Lab 2

1-Brachysclereids (Stone cells)



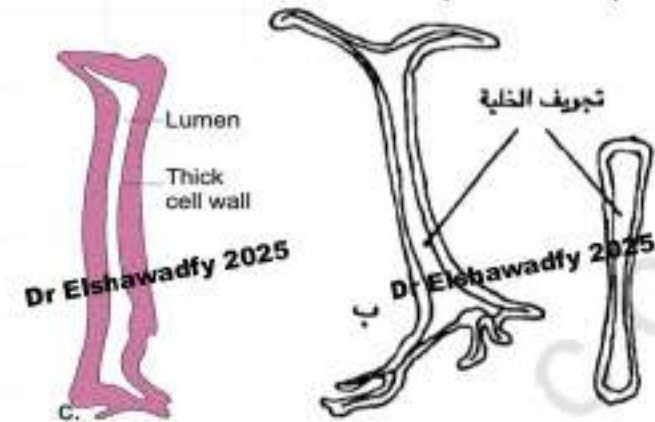
2- Macrosclereids (Rod cells)



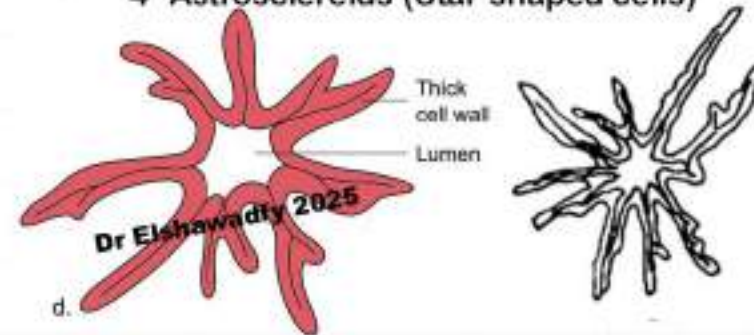
ii-Sclereids:

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:**

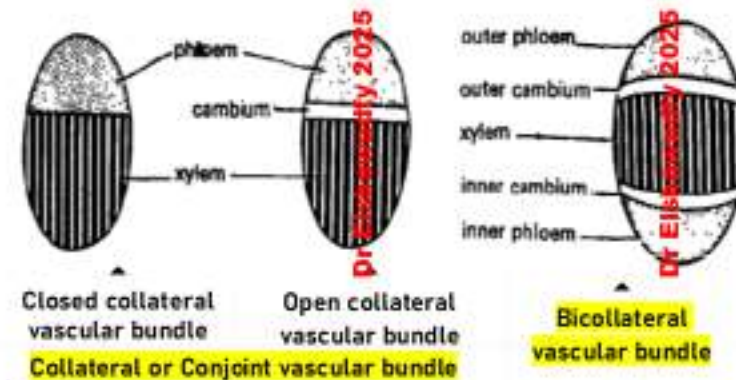
Cambium is absent in between phloem and xylem.

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:

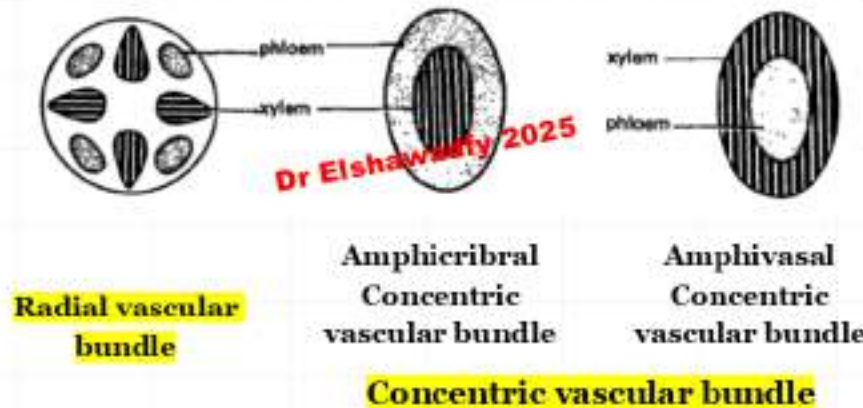
in which either phloem surrounds the xylem or xylem surrounds the phloem completely. On the basis of encircling, further divided into two types.

A. Amphivasal vascular bundle:

xylem completely surrounds phloem.

B. Amphicribal vascular bundle:

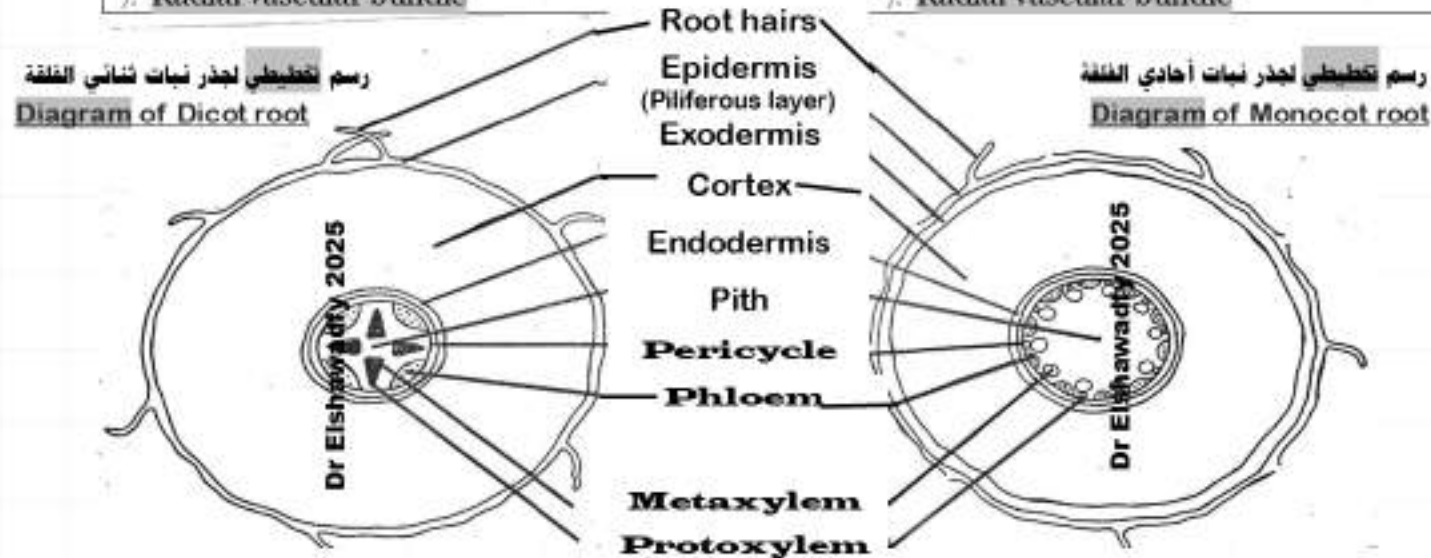
phloem completely surrounds xylem.



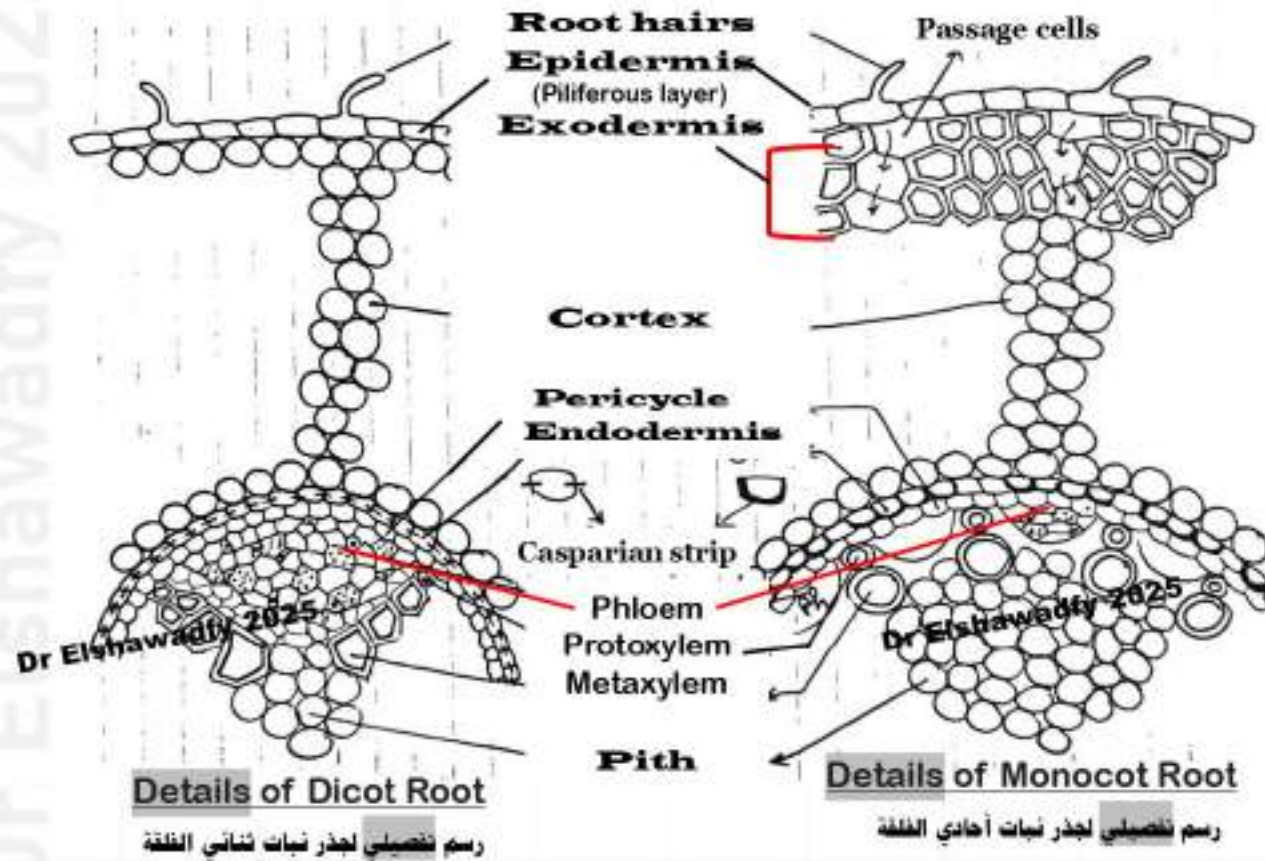
Lab 3

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

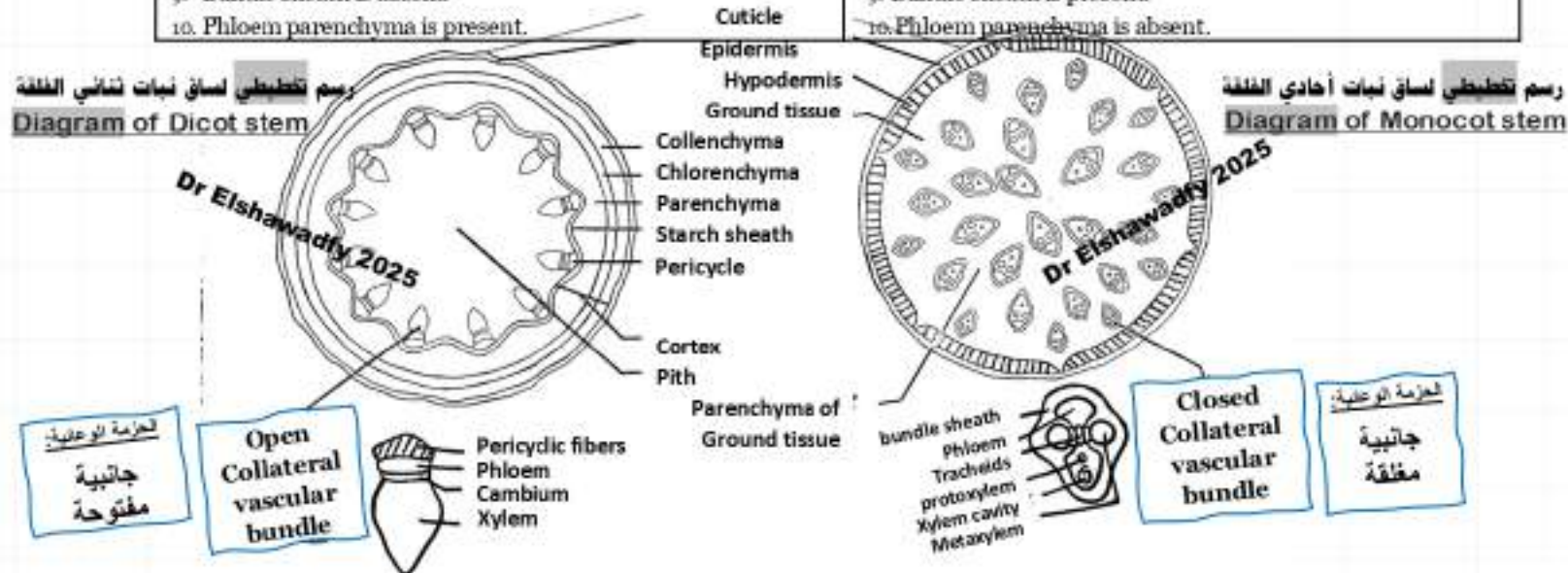


Lab 4



Lab 4

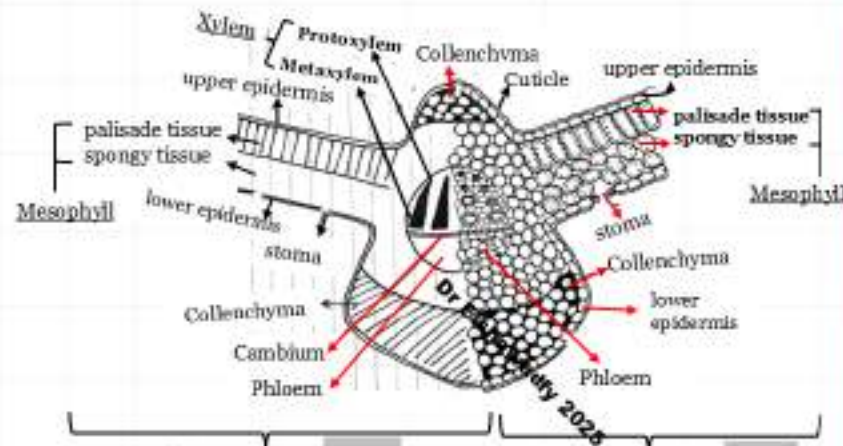
Dicot stem	Monocot stem
1. Hypodermis is of Collenchyma.	1. Hypodermis is of Sclerenchyma.
2. Ground tissue is differentiated into cortex, and pith.	2. Ground tissue is not differentiated (made of parenchyma).
3. Starch sheath is present.	3. Starch sheath is absent.
4. Medullary rays are present.	4.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



Differences between Dicot Leaf and Monocot Leaf

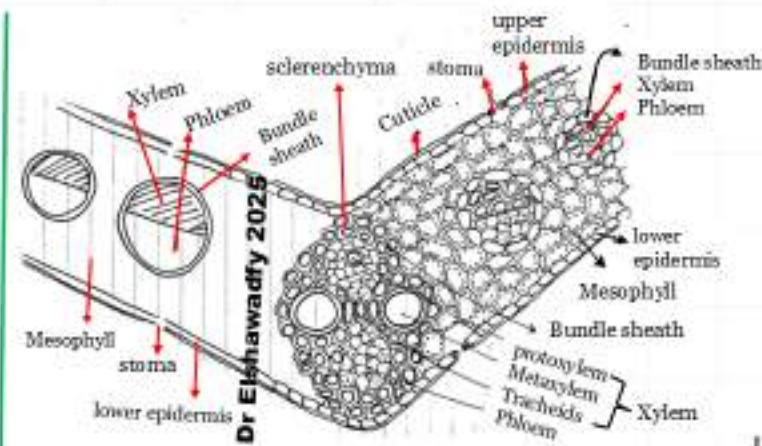
Lab 5 & Revision

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. Eishawadry 2024

**Bone-shaped sclereids
(Osteosclereids)**



Dr. Eishawadry 2024

Amphivasal concentric vascular bundle

Dr. Elshawadfy 2024



**Cystolith
(Ca-carbonate crystals)**

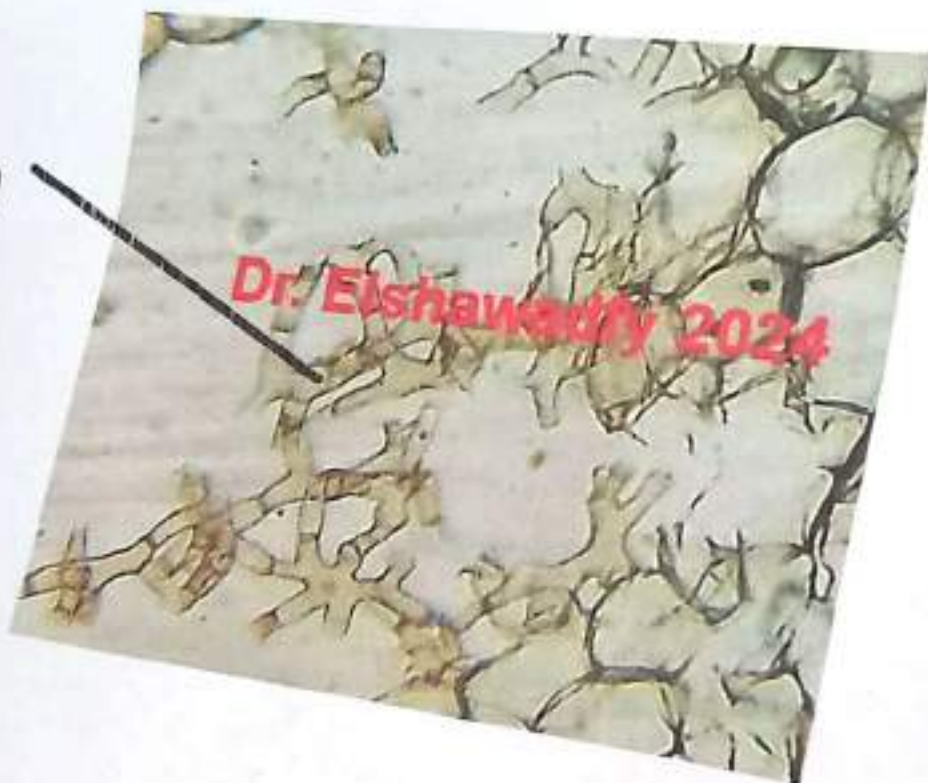


Dr. Elshawadfy 2024

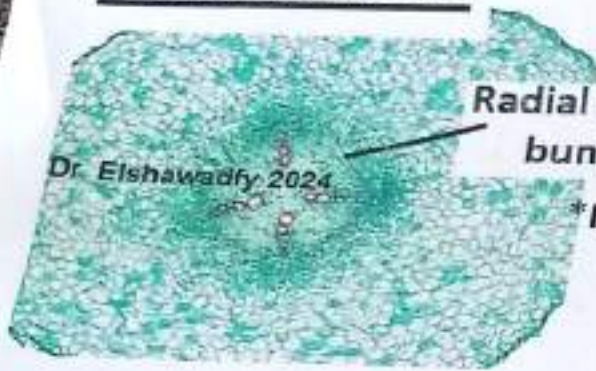


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**Stellate
parenchyma**



Diocot Root

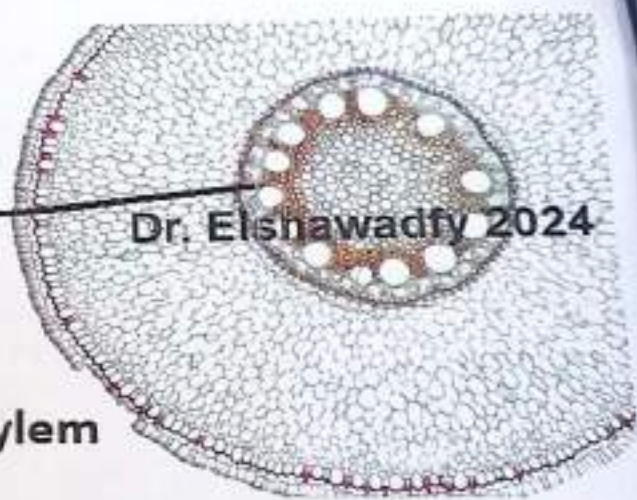
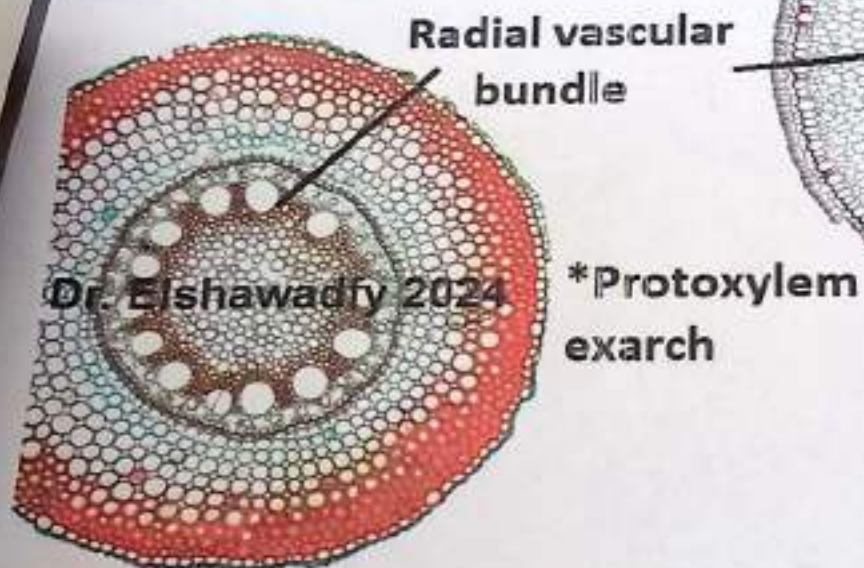


Radial vascular
bundle

*Protoxylem
exarch



Monocot Root



Retama stem



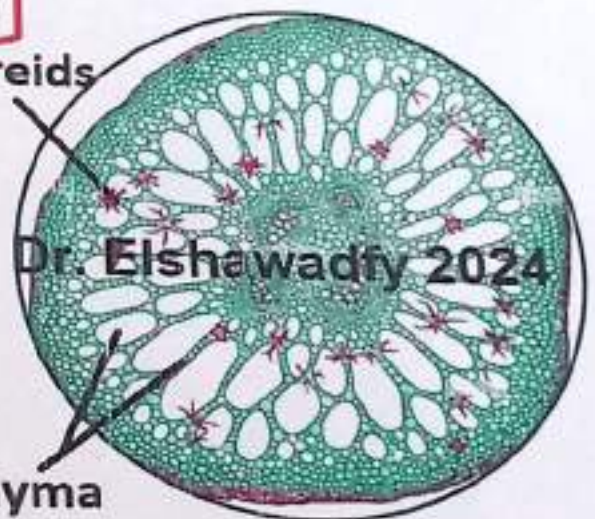
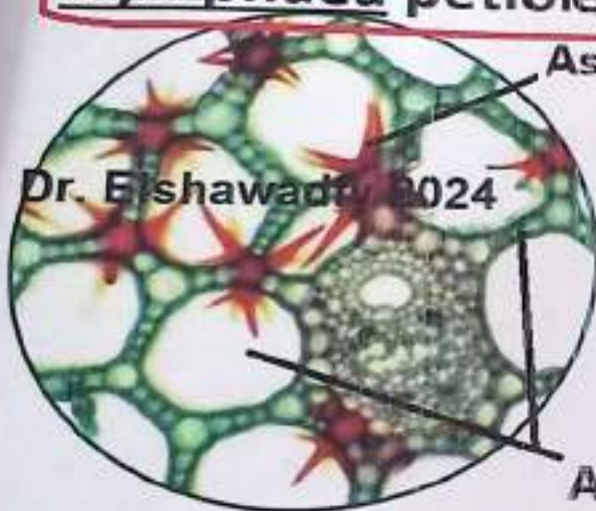
**Xerophyte
plant**



**Stone cells
(Brachysclereids)**

Hydrophyte plants

Nymphaea petiole/stem

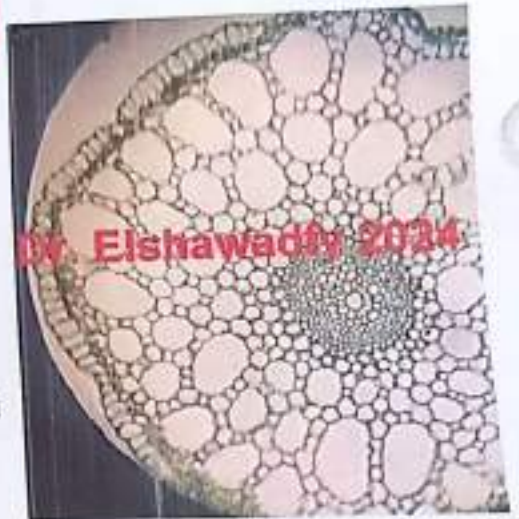
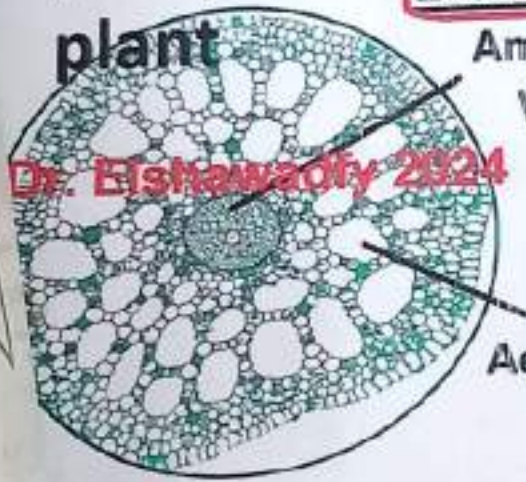


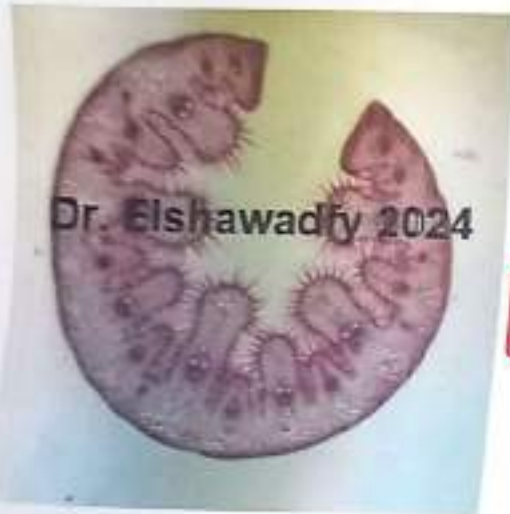
Hydrophyte
plant

Elodea stem

Amphicribal
Vascular
bundle

Aerenchyma





Xerophyte plant

Ammophila leaf

Dicot Leaf



Open collateral
vascular bundle

Chlorenchyma

Collenchyma



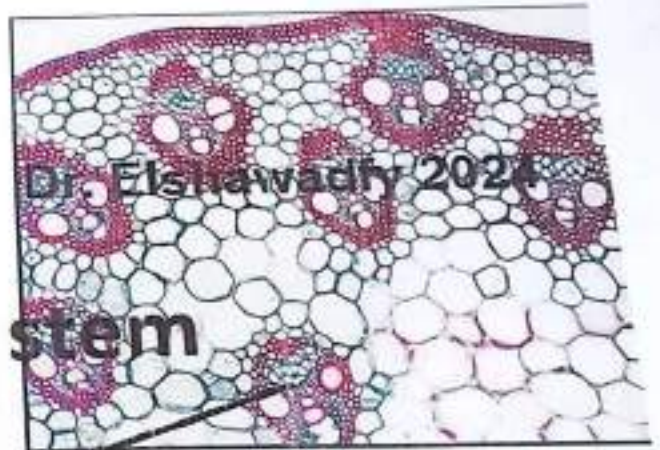


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Monocot stem

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)

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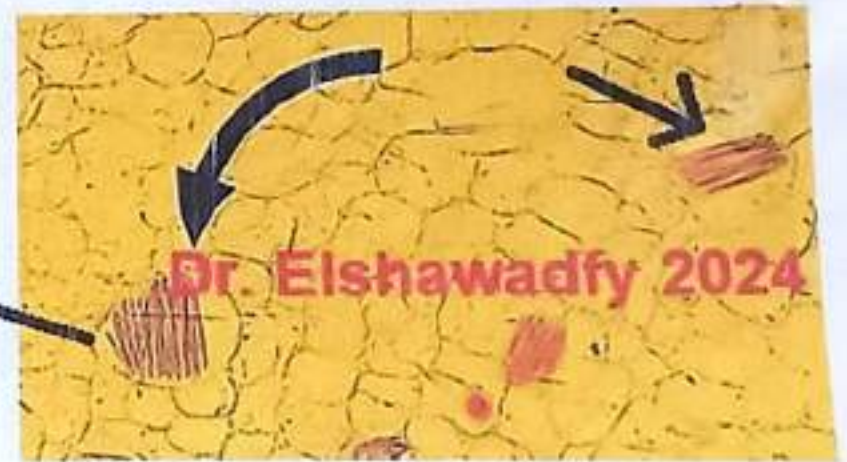
Monocot Leaf

Closed collateral
vascular bundle

Chlorenchyma (Mesophyll)



Raphides (Ca-oxalate crystals)

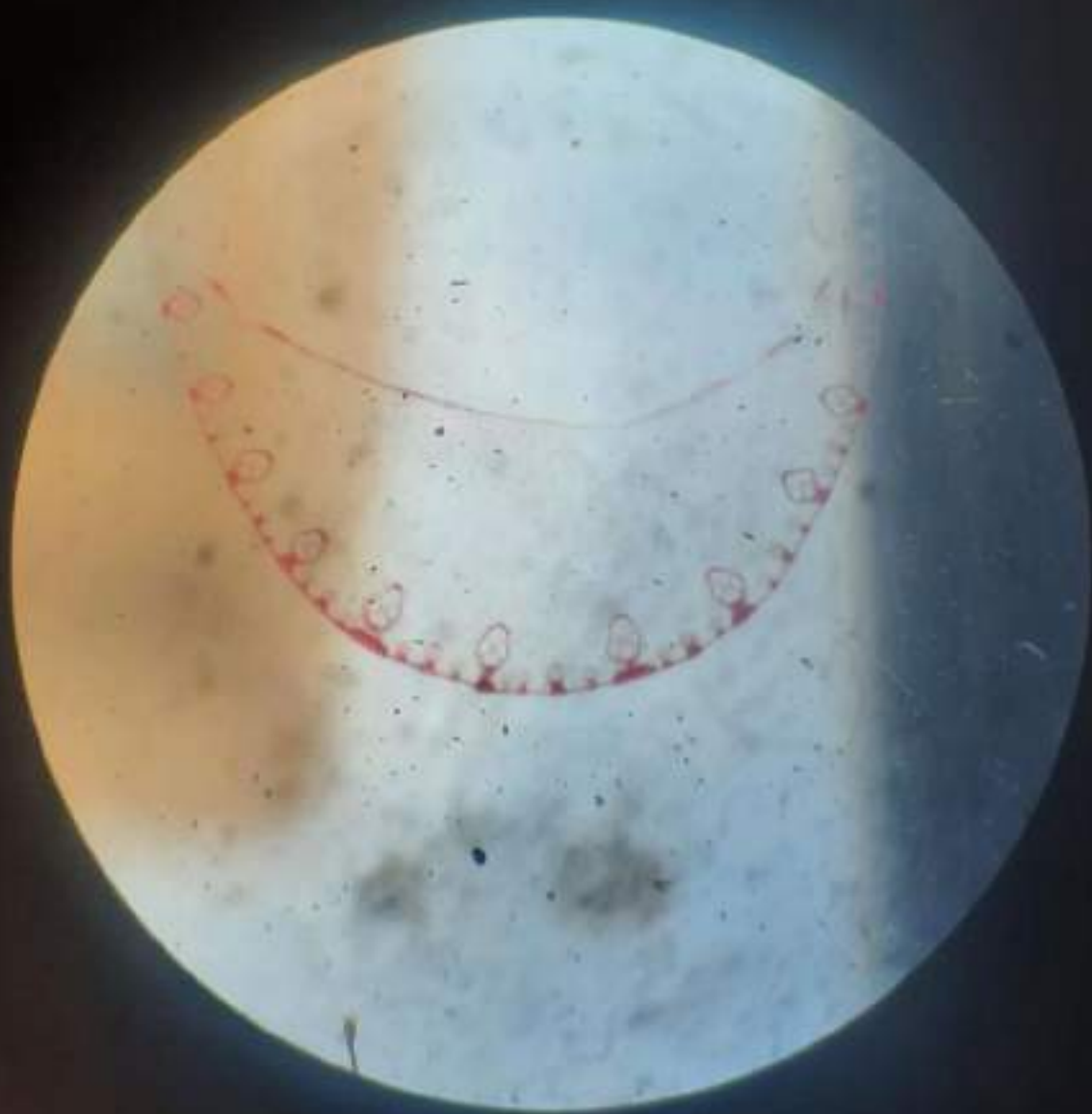




Dicot Leaf

[+ Chlorenchyma
+ open collateral v.B.]





Monocot Leaf

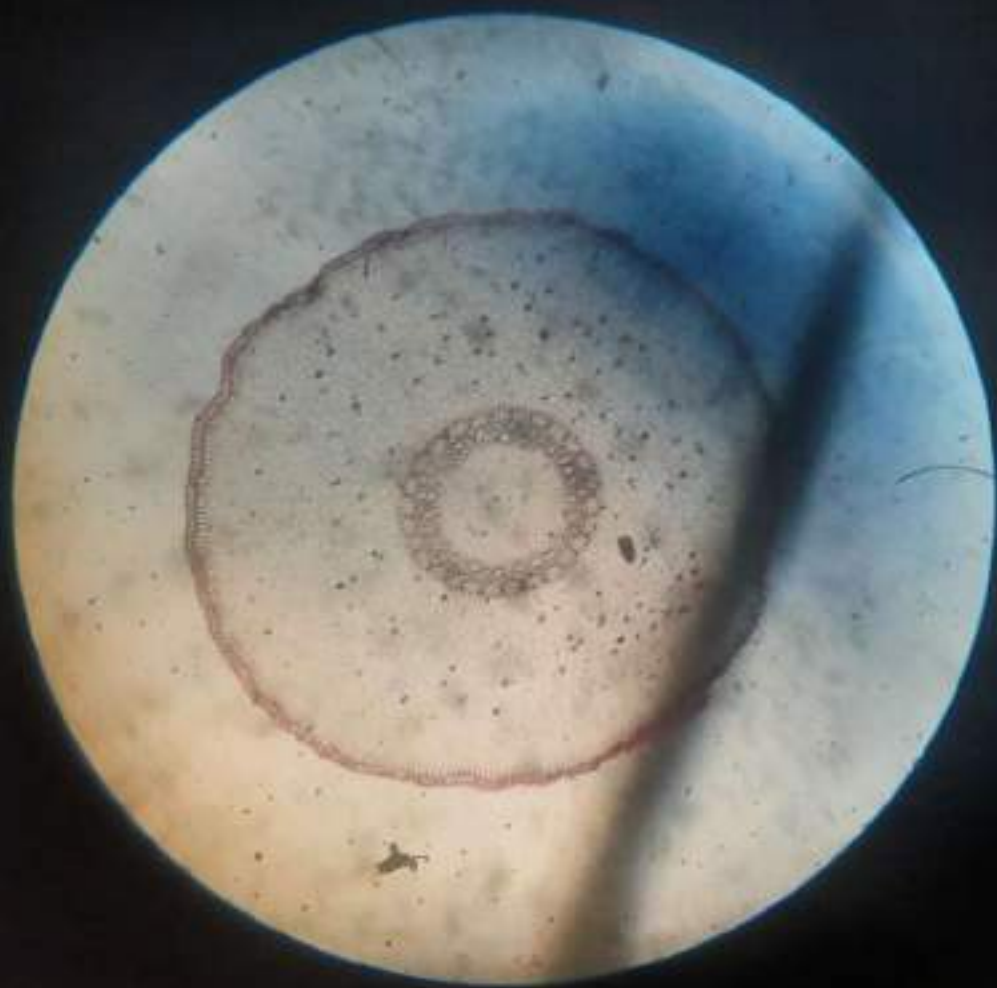
^{vein bundle}
[+ Closed Collateral V-B]





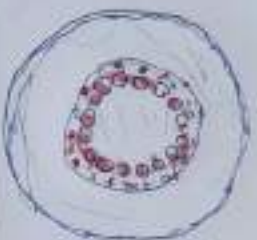
Monocot Stem
[+closed ^{scattered} collateral v-B]

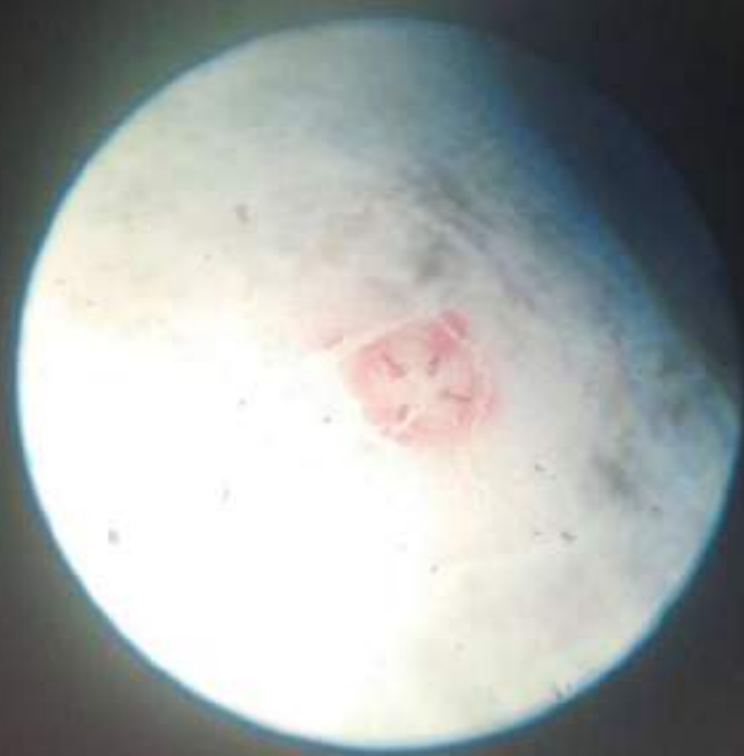




Monocot Root

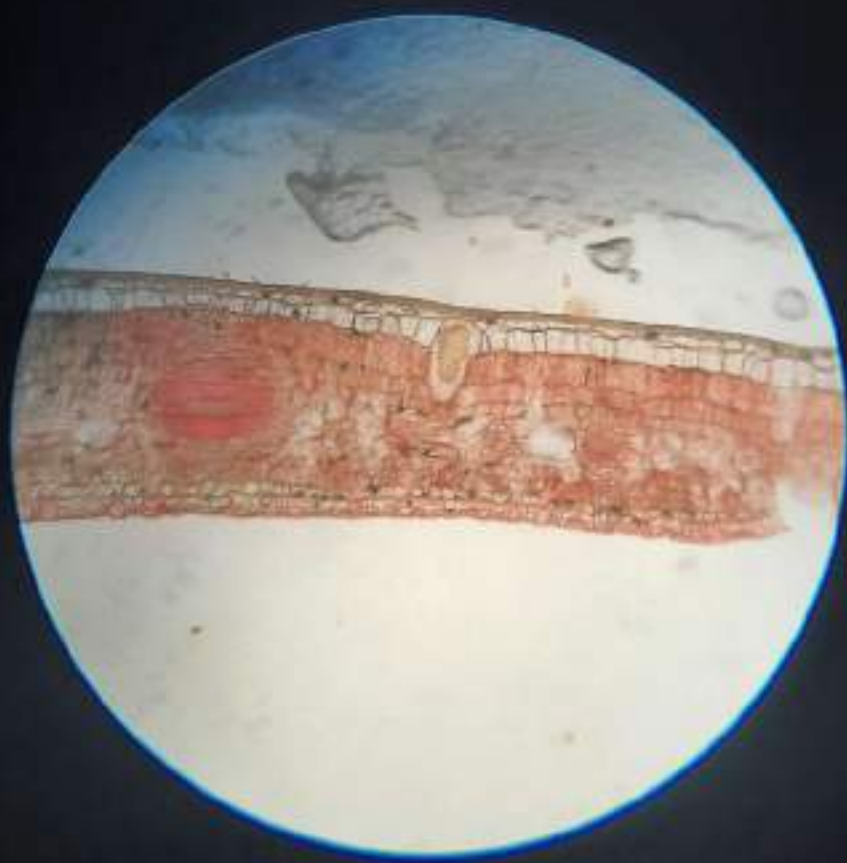
[+ Radial vascular bundles]





Dicot Root
{ + Radial vascular bundles }

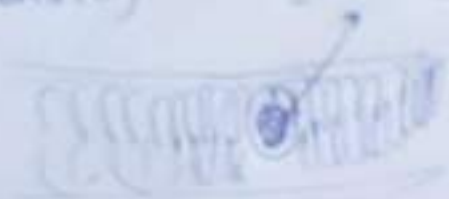


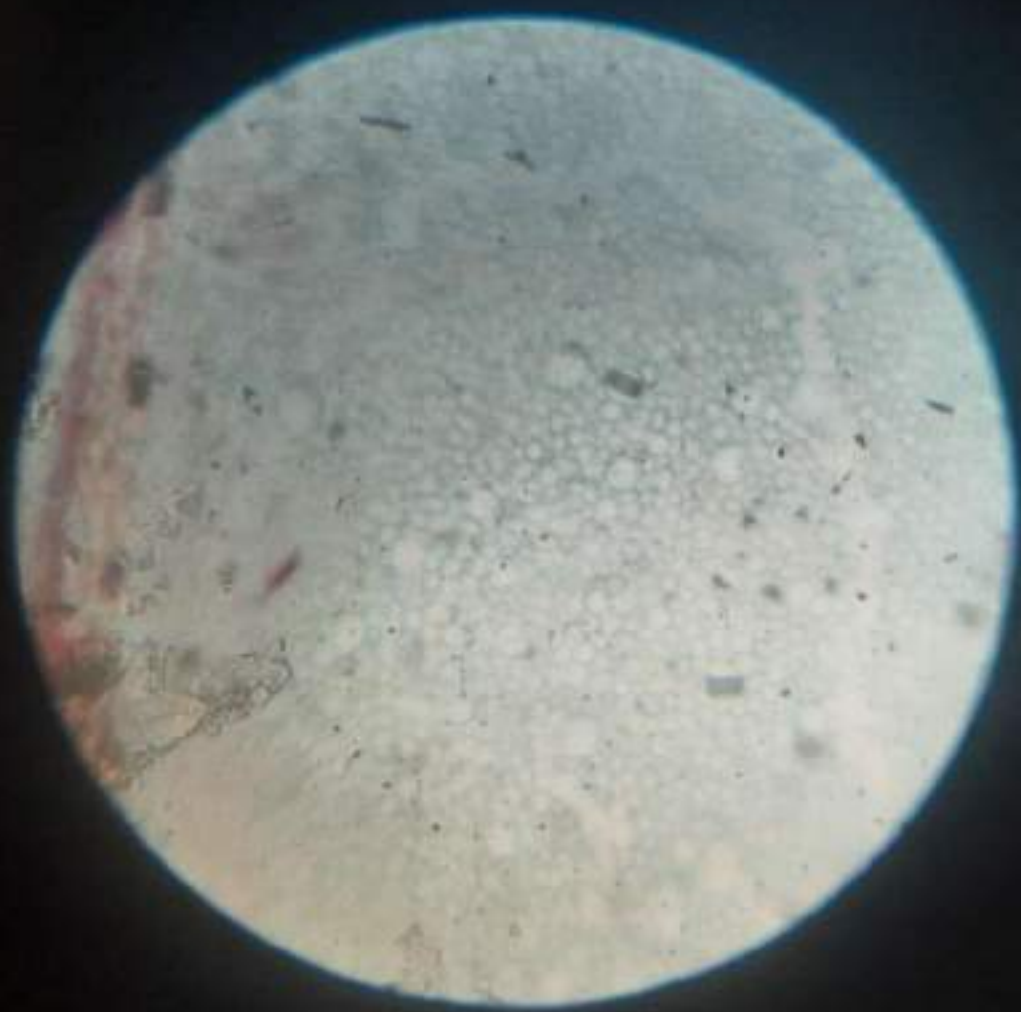


Cystolith

(Ca. Carbonate)

Calcium carbonate

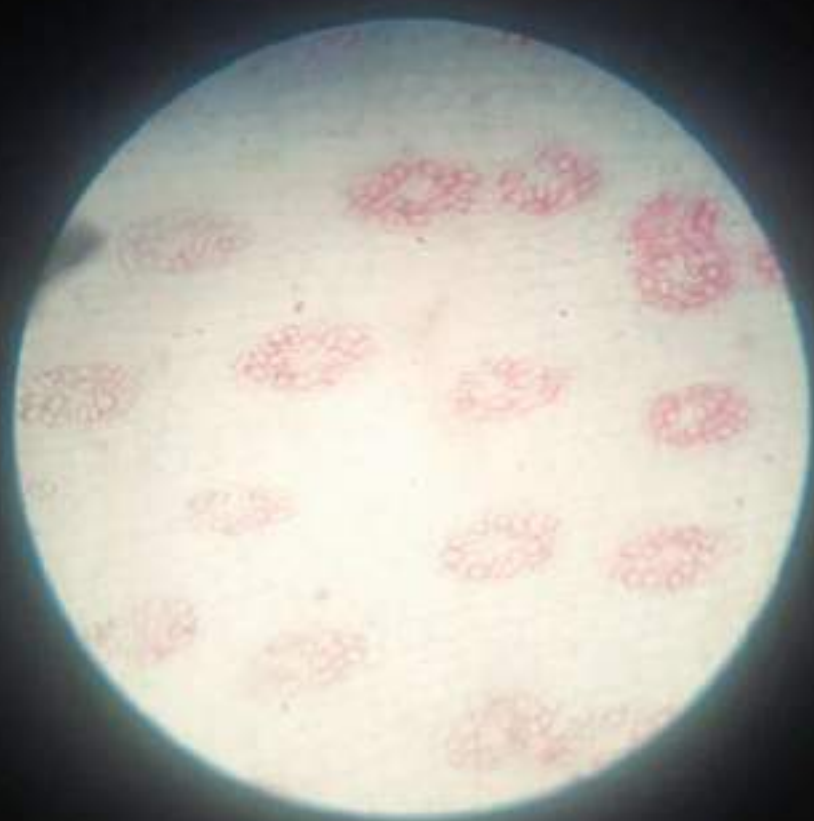




Raphides (Ca-oxalate)

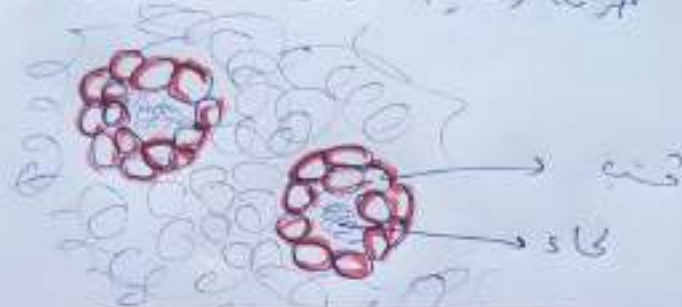


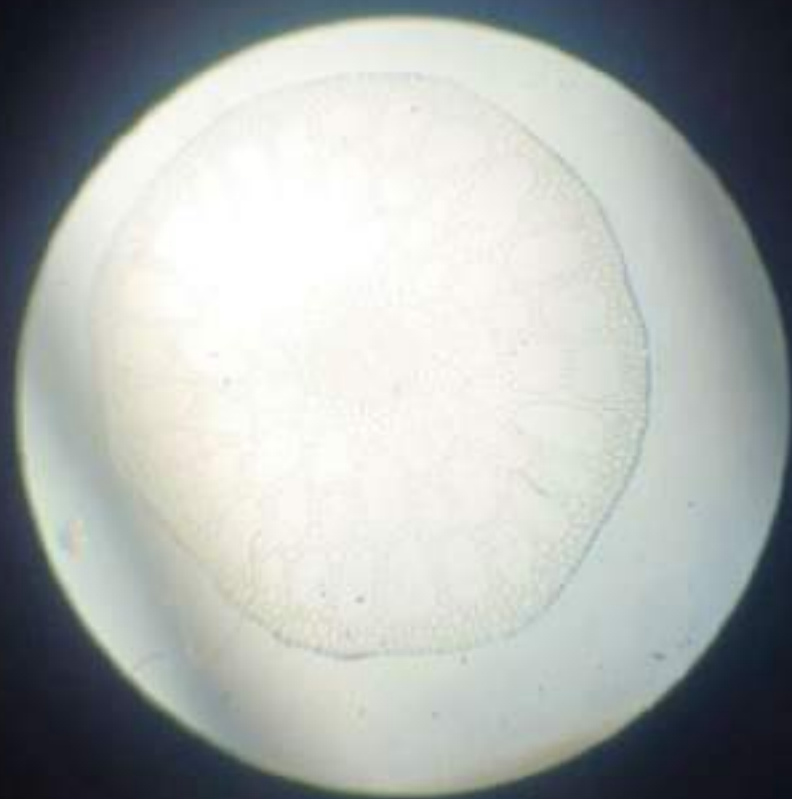
Calcium Oxalate



Amphivasal concentric v-B.

هزينة وعائية مركزية الكاس / حبيبات الحصى







Amphicribal concentric V.B.

حزبة متراكبة مركزية المتكسبة / منطقة الانقسام

[+ Aerenchyma]

بناشدا
قنوات





Bicollateral v. B.

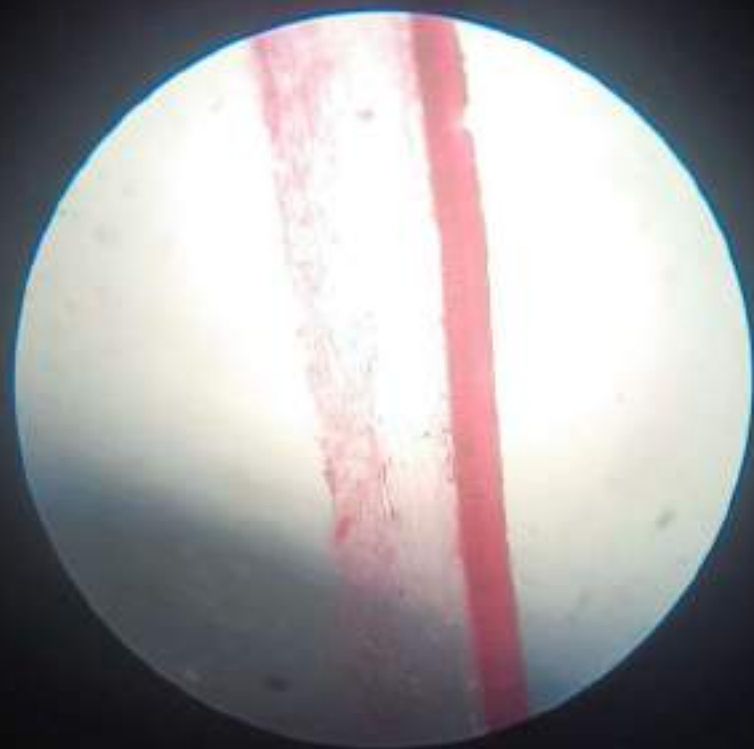
مناقض الجانب

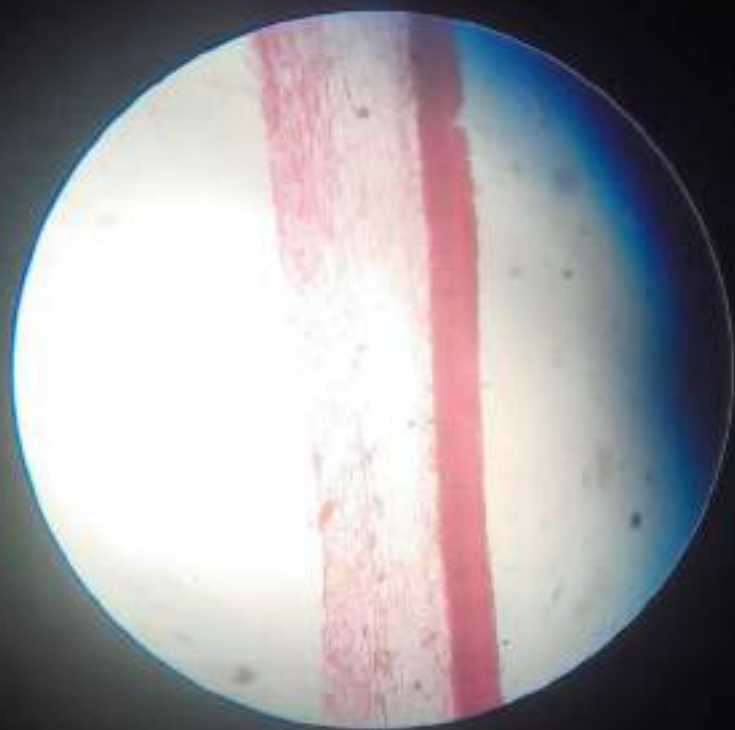




Osteoscleroides
(Bone-Cells)

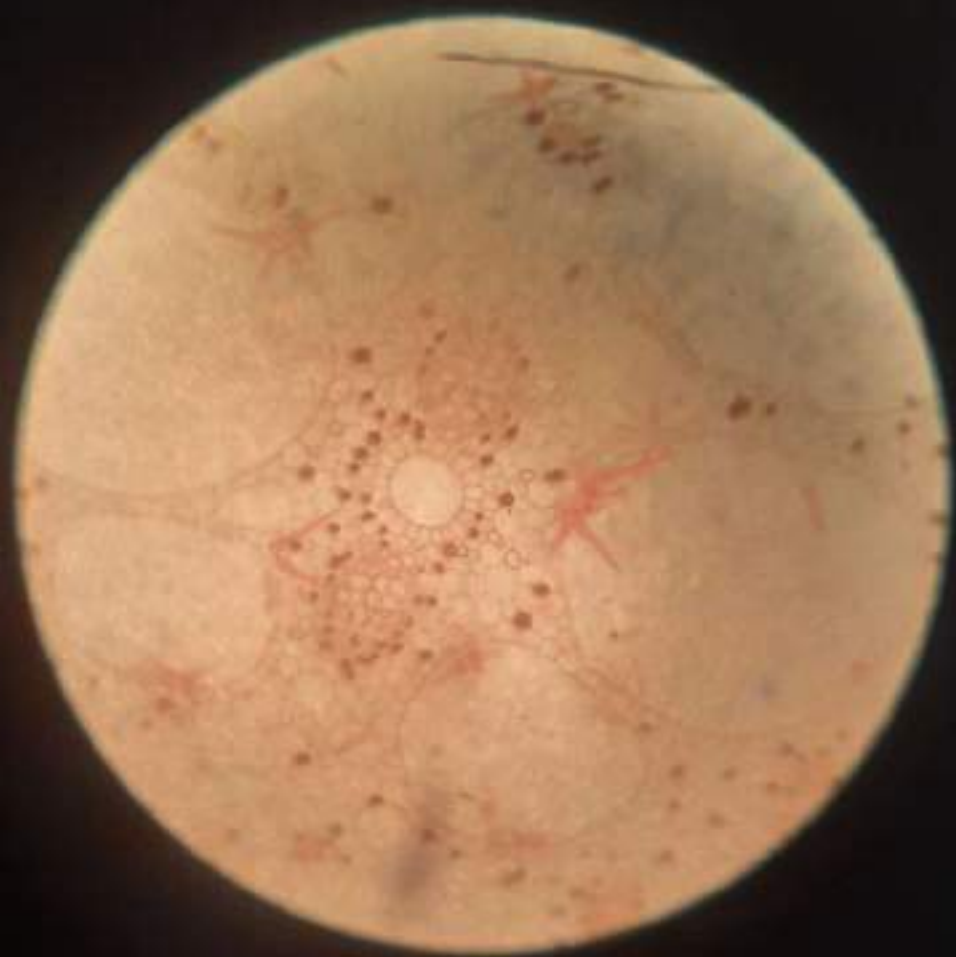






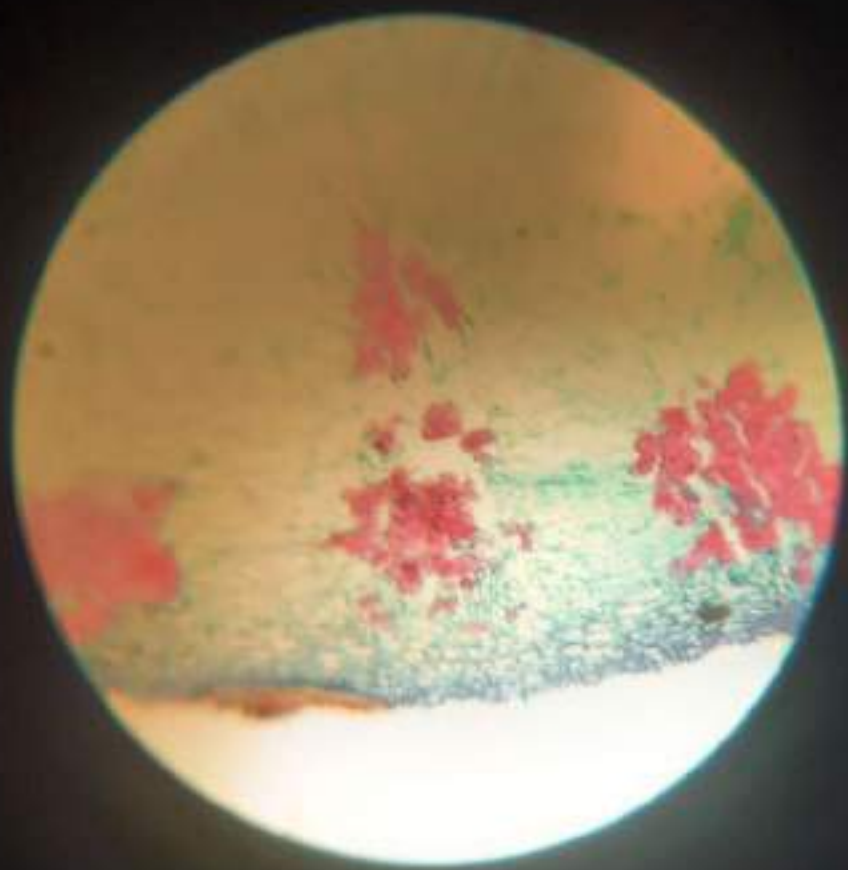
MacroSclereides
(Rod cells)





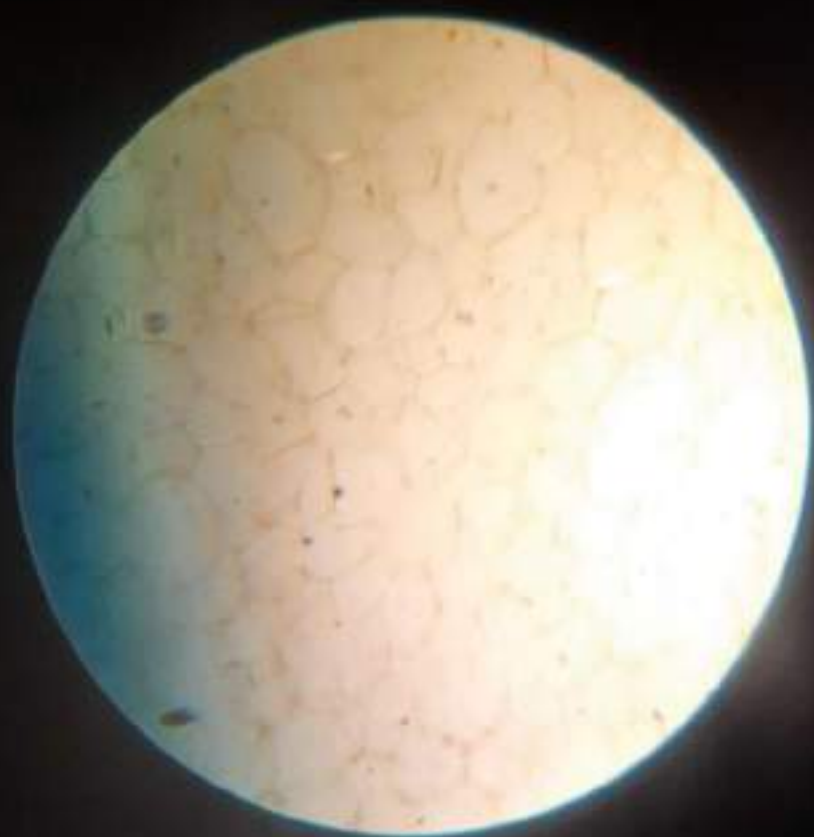
Astro sclereids
(star-shaped)





Brachy Sclereides
(Stone cells)



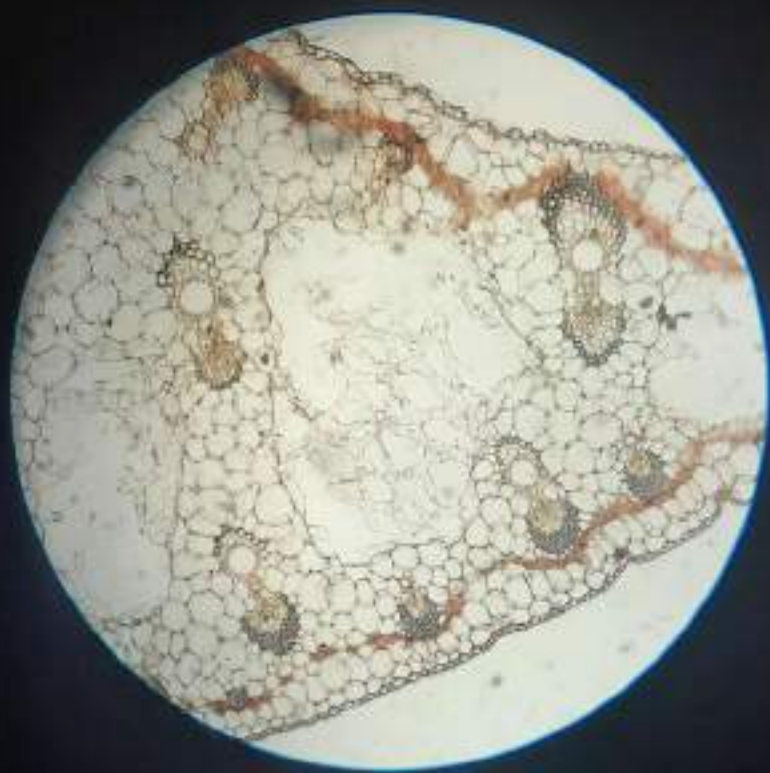


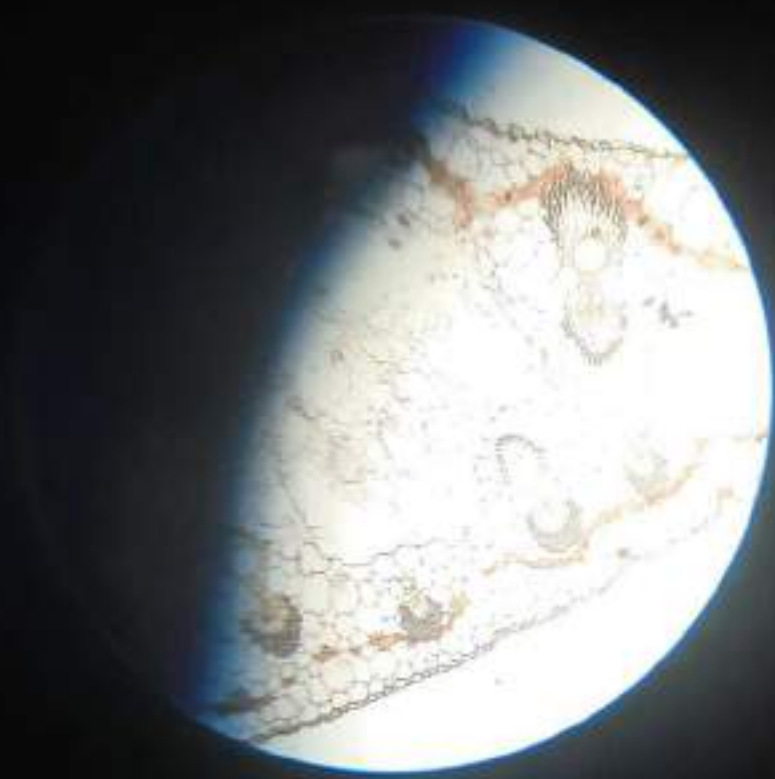
Polyhedral

Parenchyma

(20-1) 20-1 20-1 20-1



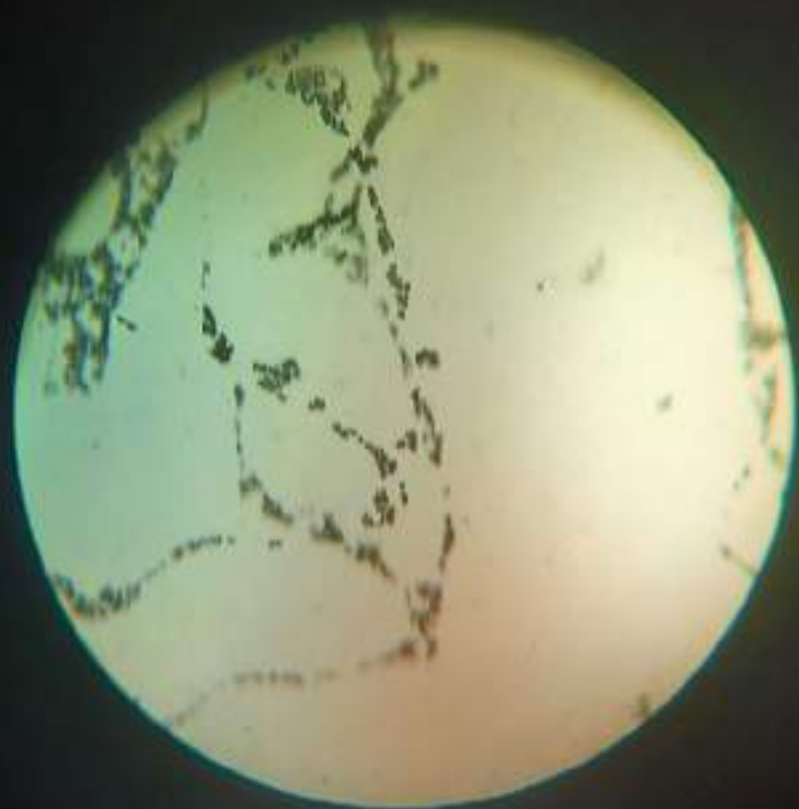




Stellate parenchyma

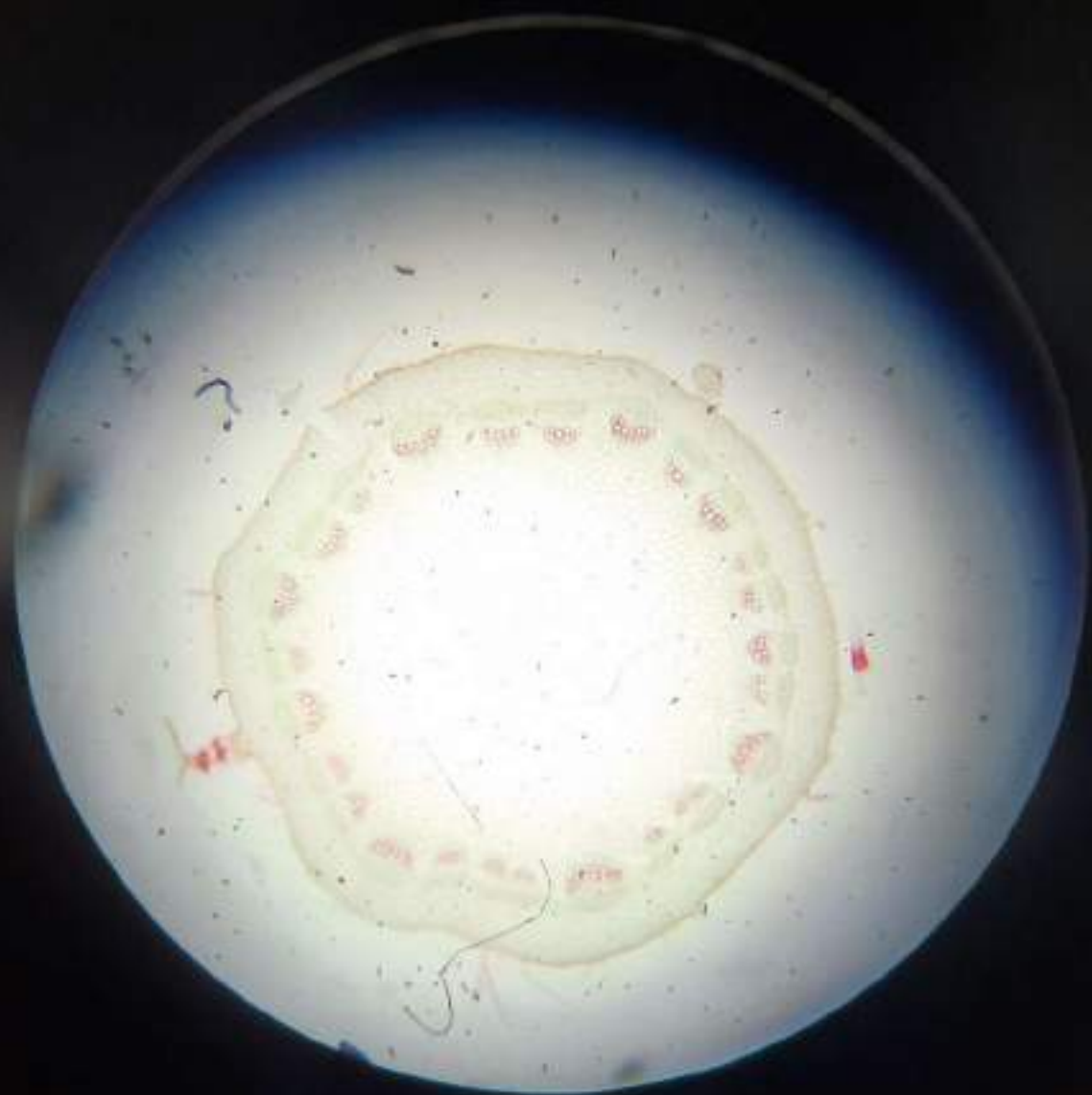


Radial cells

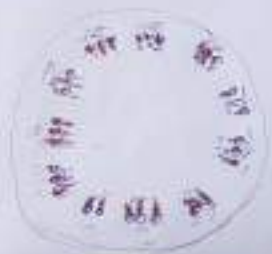


Starch grains





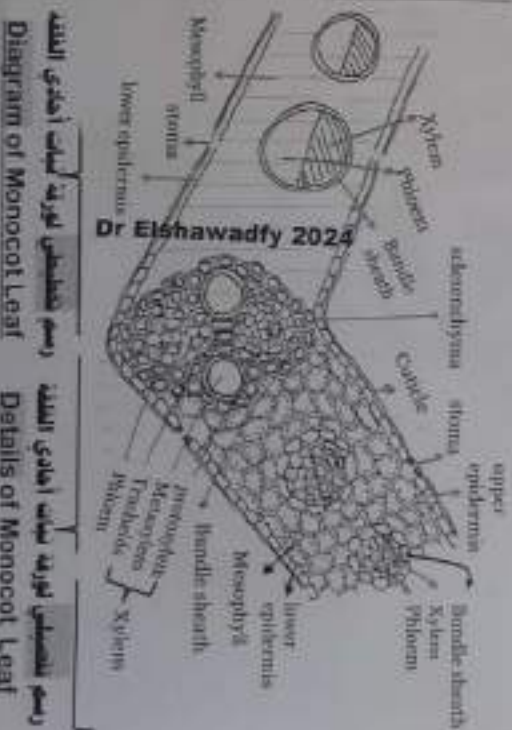
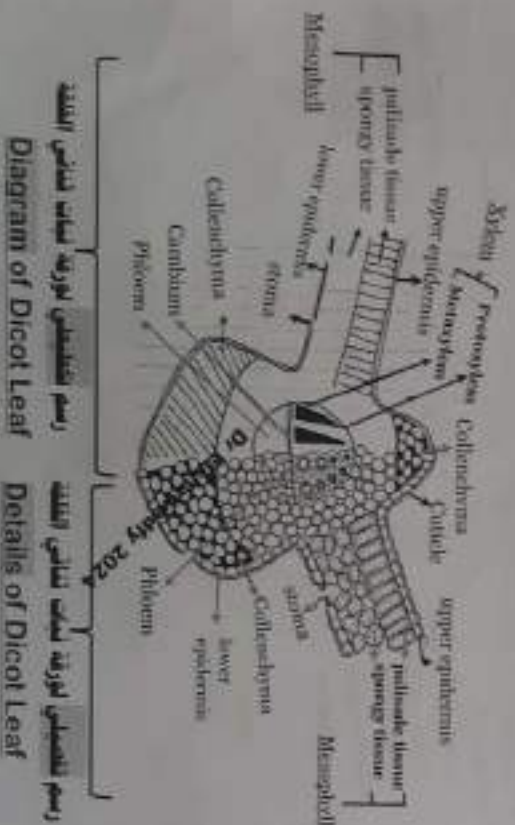
Dicot Stem
[+ Open collateral v.B.]



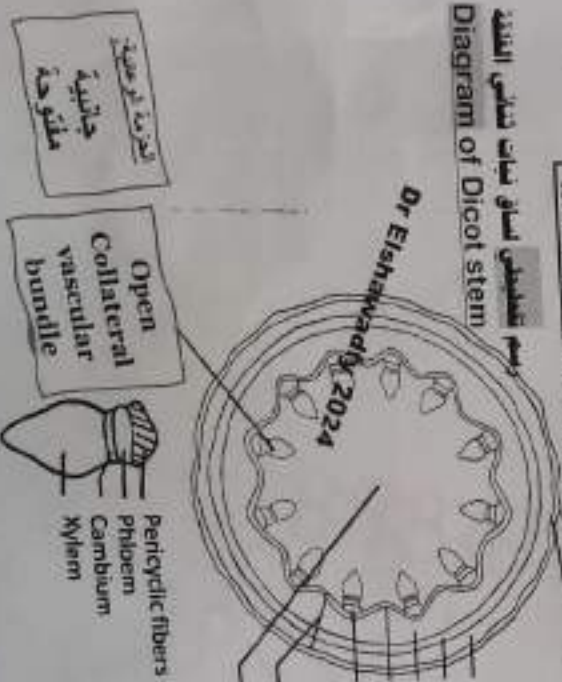
OPTIKA

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 التخطيطي لساق نبات ثنائي الفلقة
Diagram of Dicot stem



لحزمة الوعائية
جانبية
مفتوحة
Open
Collateral
vascular
bundle

Pericycle fibers
Phloem
Cambium
Xylem

Cuticle
Epidermis
Ground tissue
Collenchyma
Parenchyma
Sclerenchyma
Pericycle
Cortex
Pith

Parenchyma of
Ground tissue
bundle sheath
phloem
Tracheids
protoxylem
xylem cavity
Metaxylem

Closed
Collateral
vascular
bundle

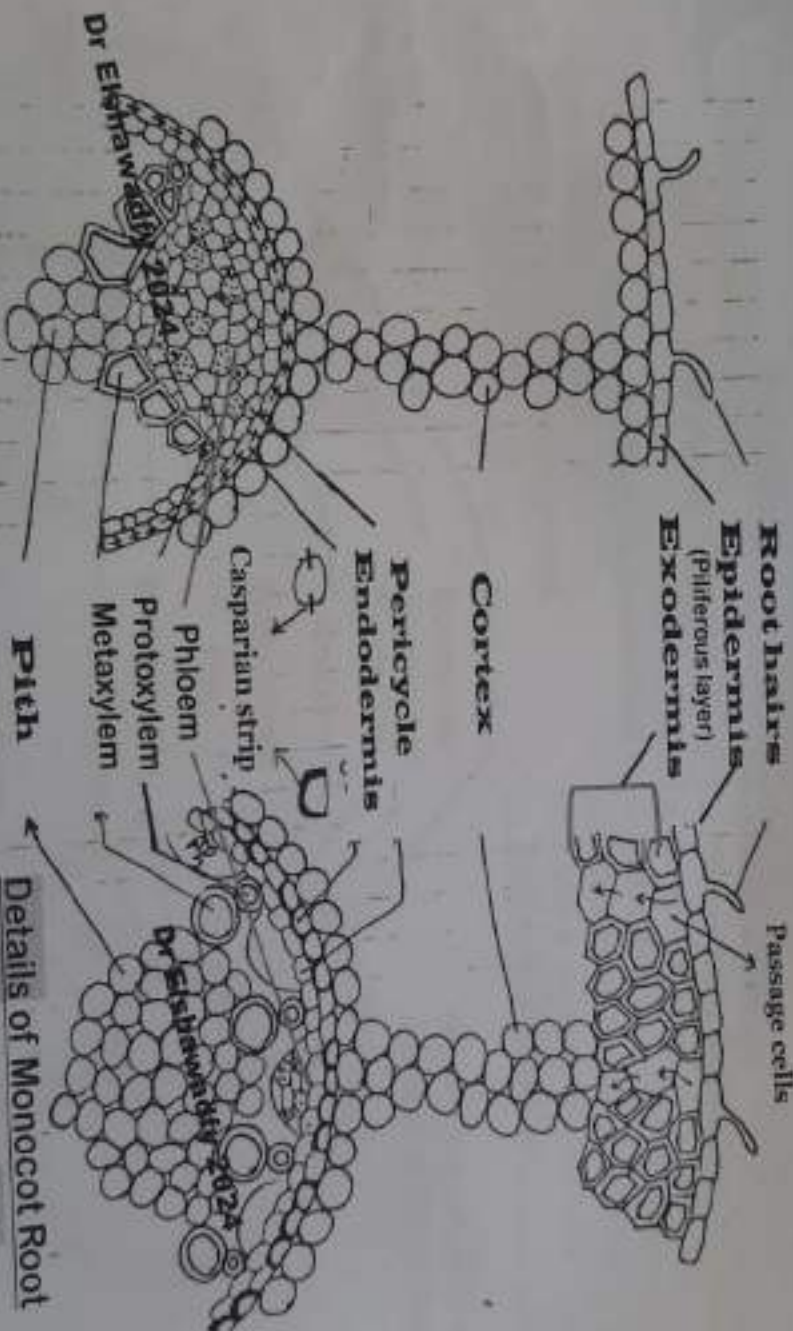
لحزمة الوعائية
جانبية
مغلقة

Dicot stem	Monocot stem
1. Hypodermis is of Collenchyma. 2. Ground tissue is differentiated into cortex, and pith. 3. Sclerenchyma 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. Sclerenchyma 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 التخطيطي لساق نبات أحادي الفلقة
Diagram of Monocot stem



(9)



Details of Dicot Root

Details of Monocot Root

رسم التفصيلي لجذر نبات شجاري السنة

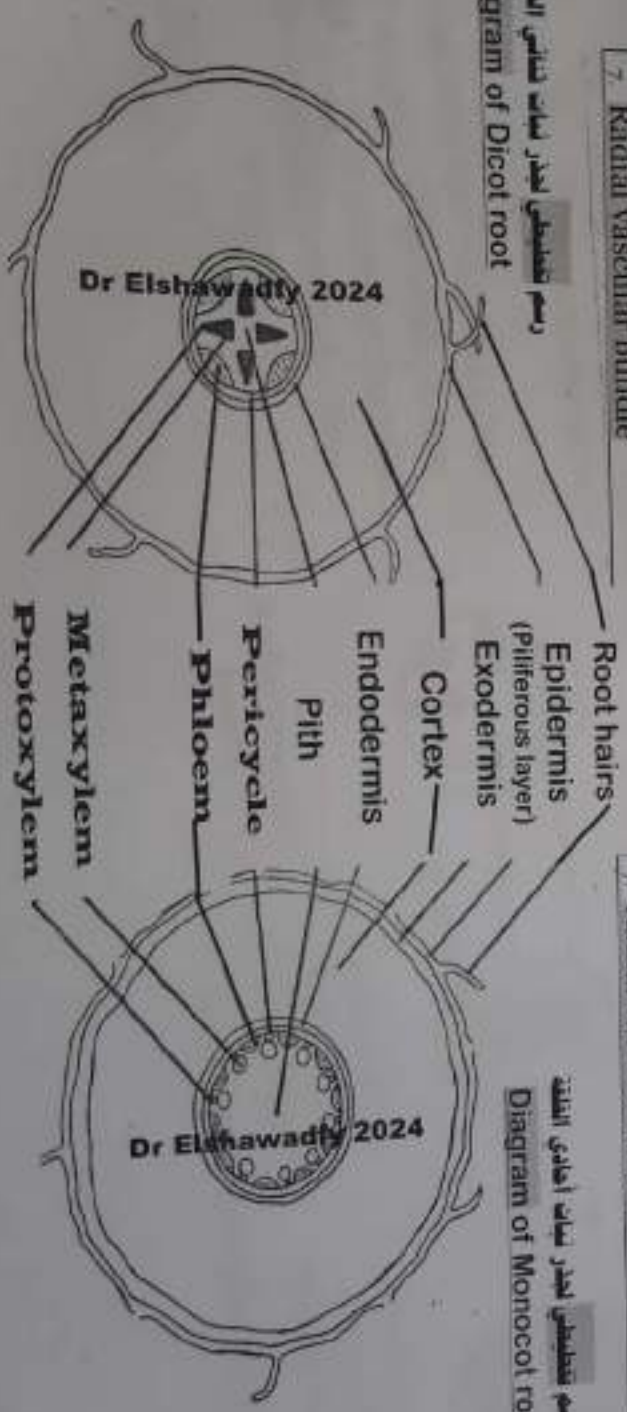
رسم التفصيلي لجذر نبات أحادي السنة

(8)

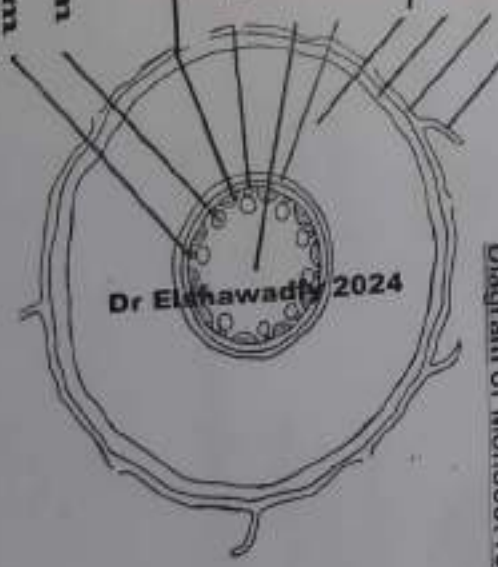
Differences between Dicot root and Monocot root

Dicot roots	Monocot roots
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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

رسم تخطيطي لجزر نبات ثنائي البتلة
Diagram of Dicot root



رسم تخطيطي لجزر نبات أحادي البتلة
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.



6

تسريح النبات

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.**

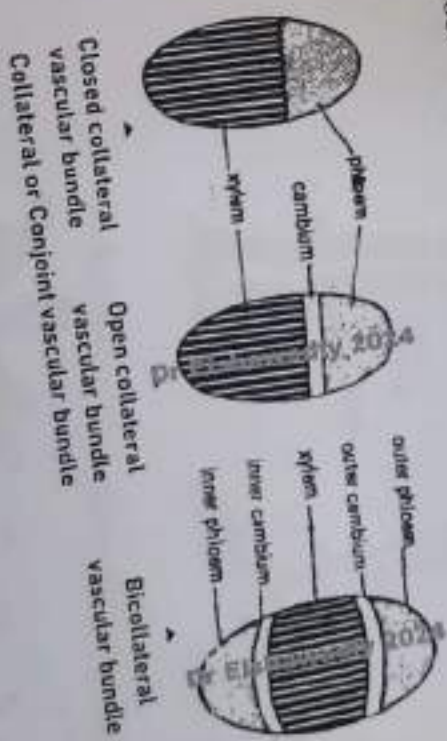
2. Bicollateral vascular bundle:

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.

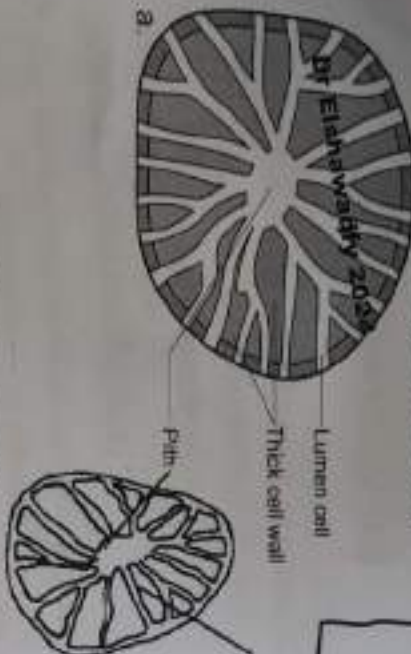
Inner cambium is present between the outer phloem and xylem.

Outer cambium is present between the outer phloem and xylem.

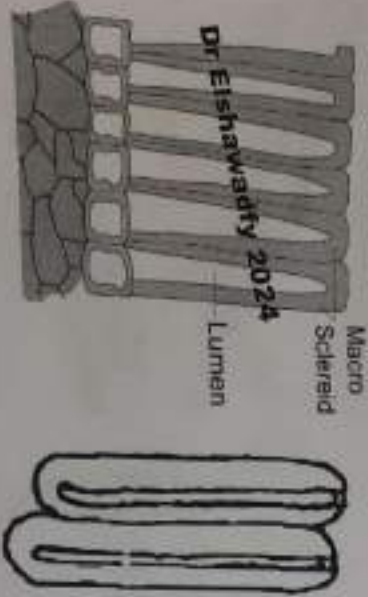


5

1- Brachysclereids (Stone cells)

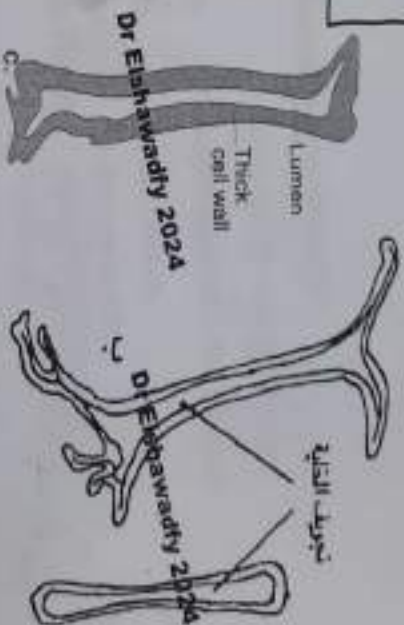


2- Macrosclereids (Rod cells)

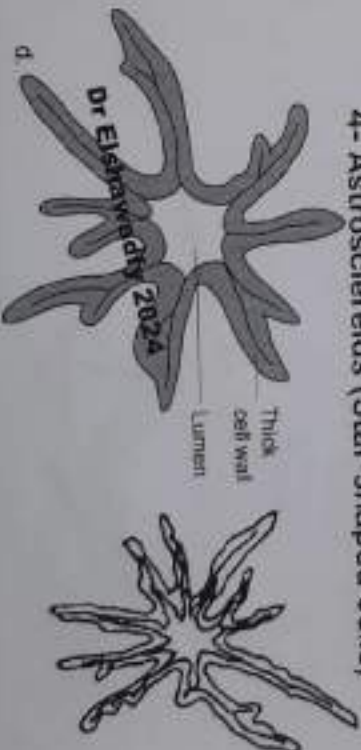


ii-Sclereids: 4 types

3- Osteosclereids (Bone cells)



4- Astrosclereids (Star-shaped cells)



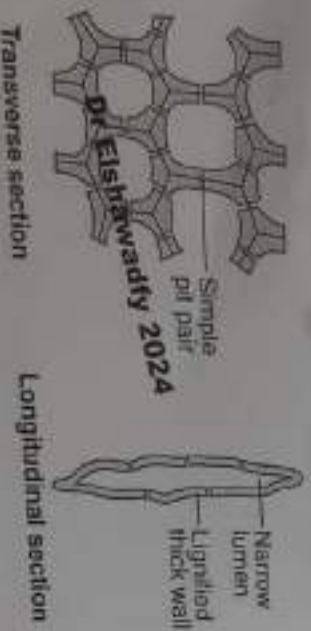
3-Sclerenchyma

- ❖ 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.**

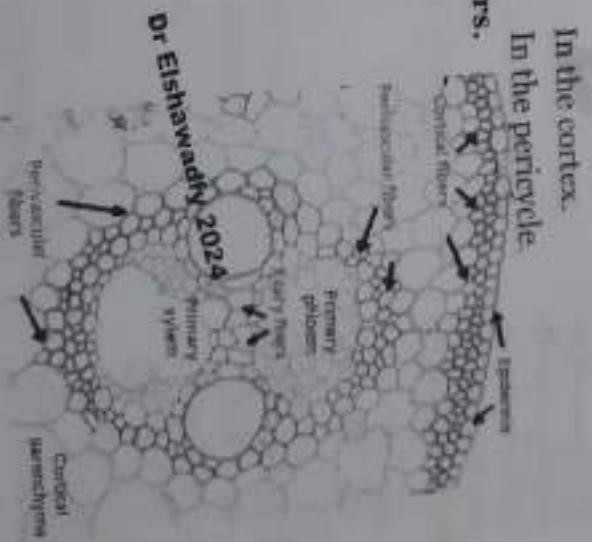
i) Fibers:



(4)

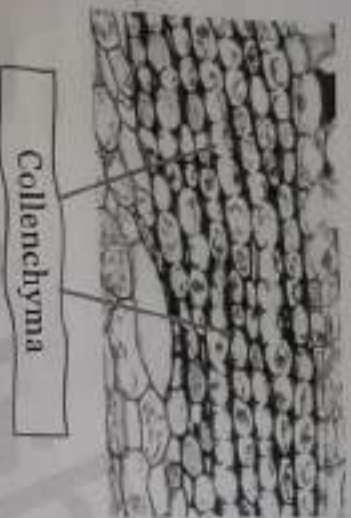
Types of fibers (based on position):

- 1- Xylem fibers. 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.



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.



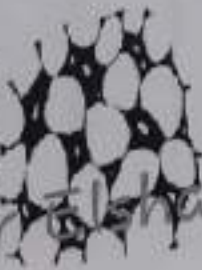
B) Lamellar collenchyma (Tangential):

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.



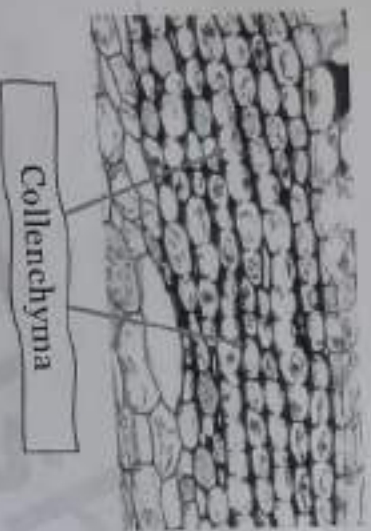
D) Annular collenchyma:

The cell walls are **uniformly thickened**.



2-Collenchyma

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



Types of Collenchyma:

There are 4 types:

A) Angular collenchyma:

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Inter cellular spaces absent.



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tangential walls, and
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Inter cellular spaces absent.



C) Lacunar collenchyma:

The Cell wall deposition occur on the walls
facing the intercellular spaces.
Inter cellular 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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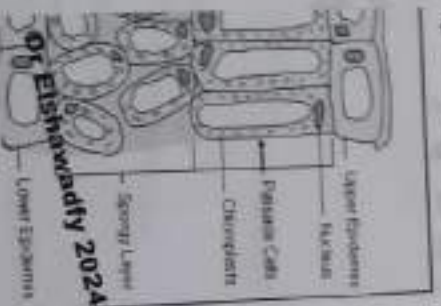
stellate-shape parenchyma

(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

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Aerenchyma



Starch grains

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Storage parenchyma

1) Aerenchyma collection
The cell walls are uniformly thickened

Non-Living Contents (محتوى الخلية غير الحية)

1- Crystals (بلورات)

A- Ca-Oxalate Crystals :

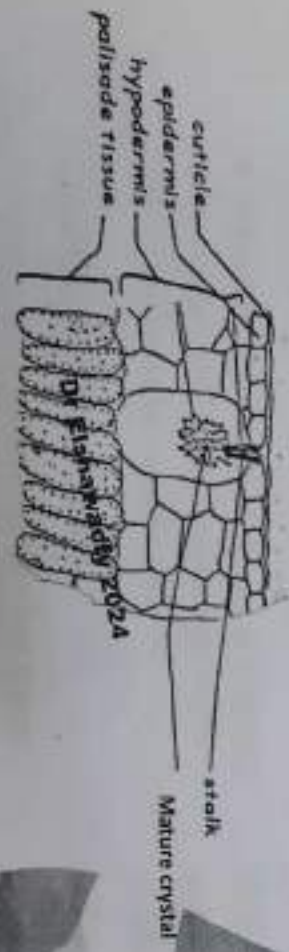
- 1- Raphides (رافيدز) :
- in Dracaena stem.
- it is thin elongated & occur in bundles.



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

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

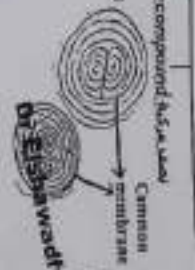
[T.S in Eicus elastica leaf]



2- Starch Grains (حببات النشا)

1- Potato starch grains :

simple, oblong, sometimes oval, with concentric lamellae, and a central hilum.



تسريح النبات

First Year Biology



Narrow lumen

Anatomy

1 Dicot leaf

2 Monocot leaf

3 Monocot Stem

4 Monocot root

5 Dicot root

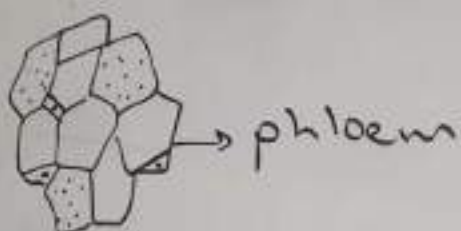
6 Cystolith

7 Sclerophides

8 Amphivasal Concentric V.B.

9 Amphicribal Concentric V.B.

10 Collateral 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