

Lec. 1

Anatomy → علم التشريح

→ internal structure for plant.

→ cell: وحدة بناء جسم النبات

	Animal Cell	Plant cell
1) cell wall جدار خلوي	Absent	Present
2) chloroplast كلوروبلاست	//	//
3) Vacuole فجوة	If Present: small and many	single - large
4) centriol	Present	★ Absent in almost Plants ★ Present in lower plants

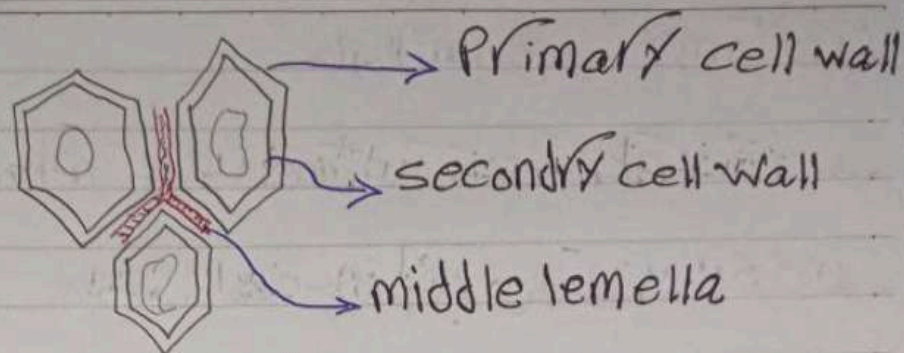
← الخلية حقيقية النواة = Eucaryote

II. The cell wall الجدار الخلوي

→ It consist of multiple layer

← تكون من عدة طبقات

★ كل خلية تتكون من طبقتين والطبقة الثالثة تختلف من نبات لآخر



A) **Primary cell wall**: composed of cellulose (سليلوز), hemicellulose, Pectin (بكتين).

* in all plant * it provides the strength and flexibility (الصلابة, المرونة).

B) **middle lamella**: المصفحة الوسطى

* it composed Pectins * in all plants

C) **secondary cell wall**: الجدار الثالث

* in some plant * inside primary cell wall

* it contains lignin (اللينين) * it provides strength

* **Function**: cell wall

- ★ Protection الحماية
- ★ Mechanical support دعم ميكانيكي
- ★ Regulate growth تنظيم النمو
- ★ Regulate diffusion تنظيم انتشار المواد
- ★ with stand Turgor pressure يقاوم ضغط التurgor

12] Plasma membrane: الغشاء البلازمي

* it consist of a lipid bilayer and proteins.

* it presents within cell wall.

* Function: Plasma membrane

* selective permeability / النفاذية الاختيارية

* Allow some materials to pass through and prevents others
* يسمح بمرور بعض المواد وتمنع الأخرى.

* Regulate

→ diffusion

→ facilitated diffusion

→ active transport

تنظيم عملية انتشار المواد

عملية انتشار

النقل النشط

3] Cytoplasm: السيتوبلازما

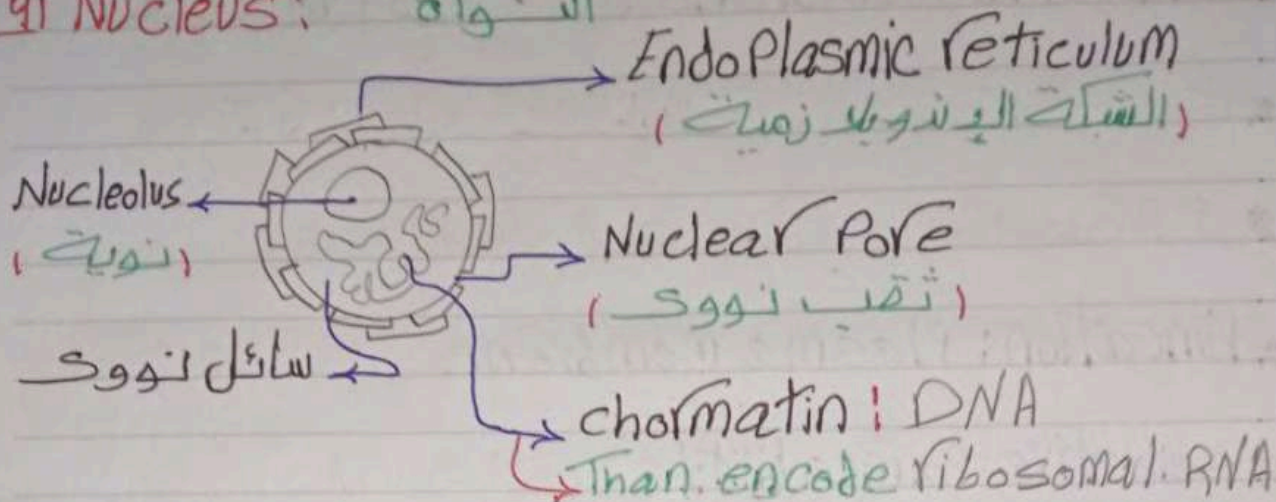
* it contains various organic and inorganic

← بها مواد عضوية وغير عضوية

(70:80%)

← الماء هو أكثر عنصرية

41 Nucleus: النواة



* Function: Nucleus

- * it controls all Activities.
- * Transferred hereditary characters.
- # تحمل الصفات الوراثية للأبناء.

51 Endoplasmic Reticulum: الشبكة الإندوبلازمية

"E R" * The ER may be

1. Smooth → S.ER , ناعية
2. Rough → R.ER , خشنة

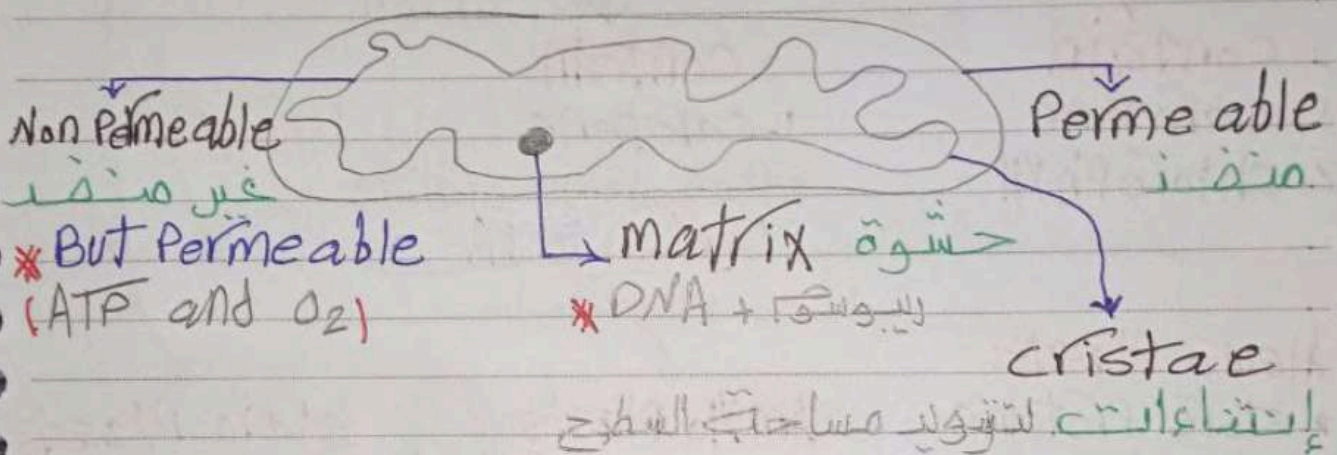
* Function: E R

- * it increase surface area within cytoplasm
- * it helps in translocation of metabolite نواتج الأيض
- * Rough: Protein synthesis تصنيع البروتين
- * Smooth: lipid and fat synthesis تصنيع الليبيد ودهون

* it plays an important role in cell wall formation and cell division

يساعد في تكوين جدار الخلية وانقسامها.

mitochondria: الميتوكوندريا



* function: mitochondria

* Aerobic respiration "تنفس هوائي"

* ATP → Power house of the cell.

Ribosomes: الريبوسومات

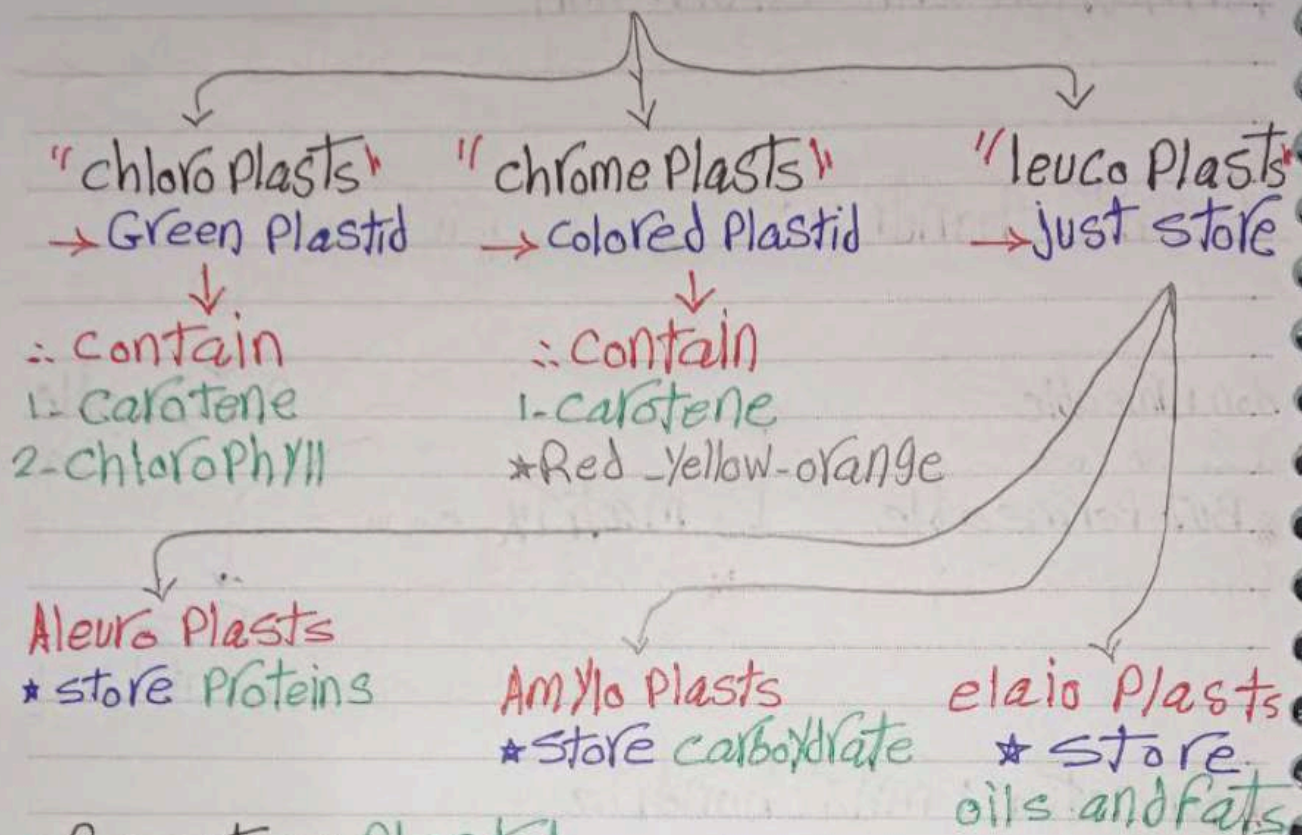
* composed of ribonucleic acid "rRNA" and "proteins"

* composed of Two subunits (تحت وحدة)

* The plant ribosomes are 80S

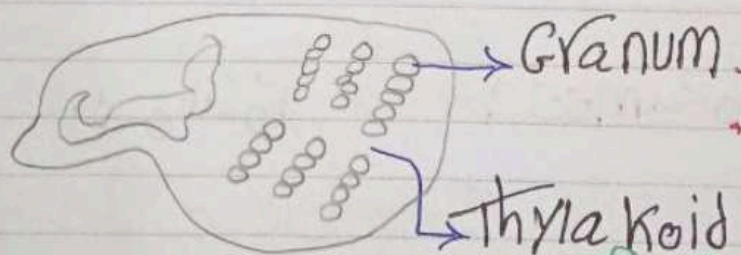
Plastid:

الكلستيد



* function: Plastid

* Photosynthesis "البناء الضوئي"



* كوار

* ع شكل الكوار

9 Golgi apparatus = Dictyosomes: جسم جولجي

← تشبه الأقراص ومرتبة في ألواح ومبططة (Flat) وحاظظ (sacs)

← يوجد بها حويصلات "micro vesicles"

* Function: Dictyosomes.

* Formation of glycoproteins and glycolipids.

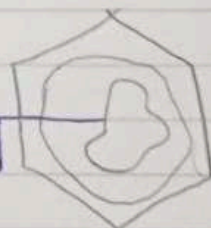
تكوين الجليكوبروتينات والجليكوليبيدات.

* secretion of cell wall materials

عملية الإفراز

10 Vacuole: الفجوة

Tono Plast "عشاء محيط بالفجوة"
"single membrane"



* Function: vacuole

* osmo regulation "تنظيم أسموزي" الماء، محتوي ملح

* digestive enzymes "إنزيمات هاضمية يمكنها تحليل"

* المكونات الأيضية (cytoplasmic components)

* والنواتج الأيضية (metabolites)

Lec: 2

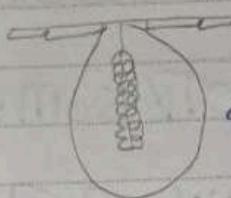
→ crystals - البلورات

~~Rephides~~ : Raphides 

* بلورات إبرية

1) Ca-oxalate: →

2) CaCO₃ : Cystolith



* حويصلة صخرية
عنفوس الخشب

* Tissues - الأنسجة

→ Group of cells have origin and form and function

→ Can be similar or dissimilar

* Meristematic Differentiation Mature « خلايا ناشئة »
* تمايز خلايا انشائية جنين

	meristematic cell	mature cell
Living - non living	* Living	* Living or non living
cell wall	* Thin - of cellulose	* thin or thick
Shape		* of cellulose, lignin
vacuoles	* isodimetric - round	* with specific shape
	- oval - polygonal	
vacuoles	* absent or very small	* Have large

	meristematic cell	mature cell
intercellular spaces	* may or may not be	* Present or absent
Cytoplasm	* ~~dilute~~ dense لزج	* dilute مخفف
cell division	* continue to divide throughout her life	* Stop divide Always or temporarily
store food	* doesn't store food	* may store food or not
Elastic مواد غير حية	* Absent	* present

→ classification of meristematic tissues

A] Based of Position.

1) Apical meristem

→ Growing tips of (roots, leaves, branches, stems)

→ increases plant length زيادة النبات في الطول

→ Terminal in stem - جنح

→ sub Terminal in root - جنر

2. intercalary meristem

→ increase plant length

→ Between mature meristem

3. lateral meristem

→ along side of stem and roots

→ increase plant width - عرض

E.x : cambium and cork cambium = Phellogen

← كامبيوم و كالك ← خشب و لحاء

B3 Based of function

1. Proto derm - بشرة أولية → epidermis - البشرة

2. Proto cambium - كامبيوم أولي → Xylem خشب Phloem لحاء

3. Ground meristem - مرستيم أساسي → Parenchyma, colenchyma, sclerenchyma

Based on origin

1. Pro-meristem - البرسيم الأول

→ Embryonic meristem ! النسيج الجنيني

→ gives Primary meristem

→ protoderm
→ Procambium
→ ground meristem

2. Primary meristem

→ derived from Pro-meristem

→ include apical meristem and intercalary meristem

→ it: Protoderm, Procambium, ground meristem

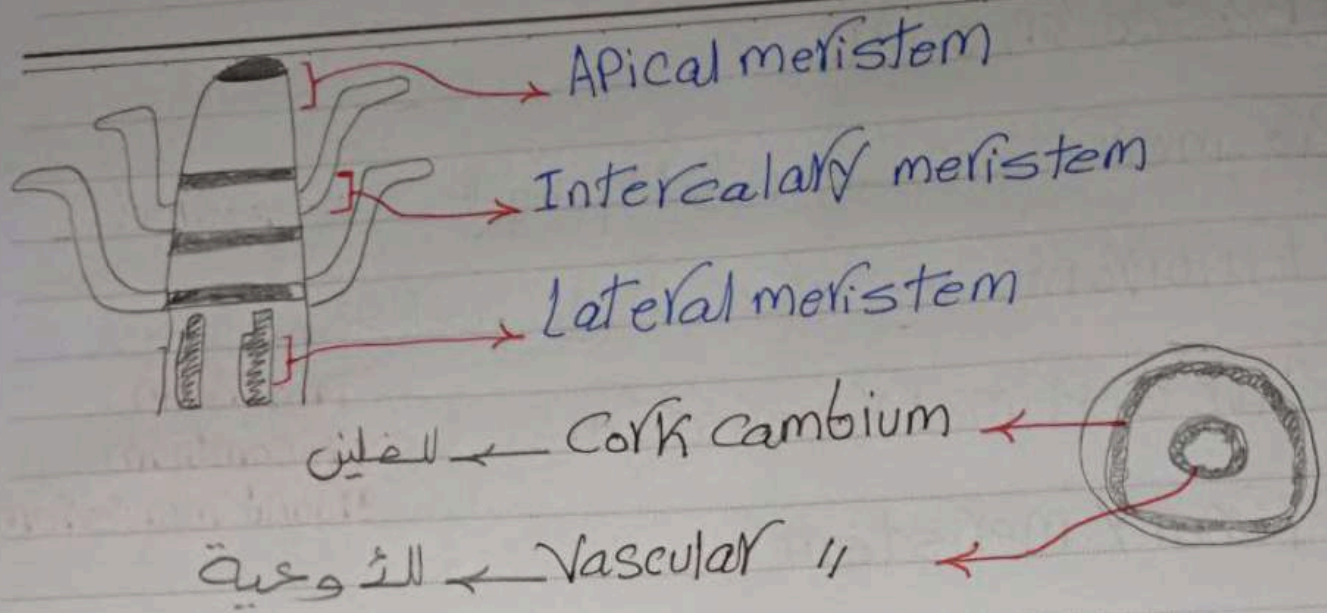
→ it responsible for primary growth in length

3. Secondary meristem

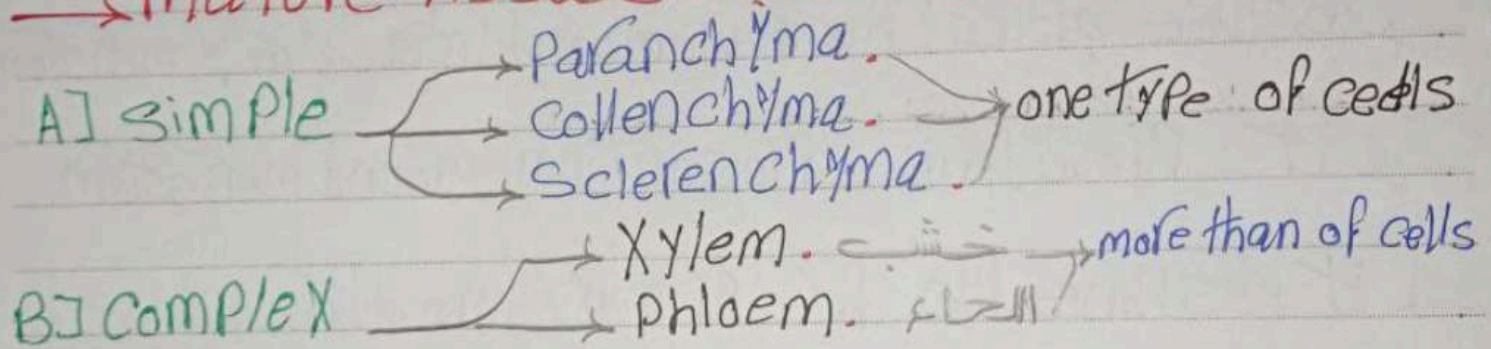
→ derived from Permanent like Parenchyma

→ it is cork cambium, vascular cambium → « وحاء »
« أفلين »

→ it responsible for secondary growth in width and thickness



→ mature tissues النسيجة الناضجة



* Parenchyma

- living, cell wall thin of cellulose > 90%
- Shape: Polyhedral مضاعفة, oval, spherical, rectangular, cylindrical, stellate

→ Types of Parenchyma: specialized

1) chlorenchyma: has chloroplasts: Photosynthesis

2) Aerenchyma: has intercellular spaces "Air space"

→ in aquatic plant and some land plant

→ help plant to float and exchange gases

3) storage parenchyma: store food.

→ tuberos stem and root store starch grains

← السيقان والجذور المحتوية تخزن حبوب النشا في خلاياها
البارانشيمية

∴ function:

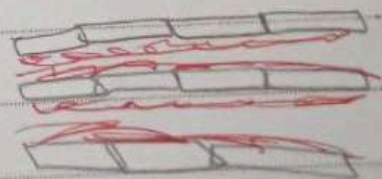
1) storage, photosynthesis, gas exchange, protection

* Collenchyma

→ living, cell wall thick of cellulose

→ Types of collenchyma

1) Lamellar collenchyma — ماس



2. Angular collenchyma - زاوي

→ Angles at the corners of cells



3. Annular Lacunar - حلقي
فجوي

→ The wall facing intercellular spaces

النوع الوحيد الذي به مسافات بينية



4. Annular collenchyma - حلقي

→ the cell wall are uniformly thick

خلايا الجدران سميكة بشكل متجانس



حلقه بنوعين

②

* Sclerenchyma →

→ non living, secondary cell wall, lignified

→ protection, mechanical support

Types of sclerenchyma

1) Sclereids 2) fibers

→ Function of Parenchyma:

- * Protection Σ Epidermis # الحماية
- * Storage # التخزين
- * Regeneration and wound heal # التجديد والتئام الجروح
- * Radial transport of water and solute # النقل الشعاعي للماء والمواد
- * Photosynthesis Σ chlorenchyma # البناء الضوئي
- * Gas exchange Σ aerenchyma # تبادل الغازات
- * Secretion # الإفرازات

→ Function of collenchyma:

- * it provides strength, elasticity, support # شدة ومرونة وحماية
- * Photosynthesis Σ collenchyma has chloroplasts # بناء ضوئي
- * it supports young stem and leaves.

→ Function of sclerenchyma:

- * Protection and mechanical support # حماية وتدعيم ميكانيكي

* Types of sclerenchyma: Based on origin, structure, function

→ sclerenchyma is divided into 2 types

1. sclereids

2. fibers

* Sclerenchyma: secondary meristem.

	★ sclereide	★ fibers
→ origin	★ from mature Parenchyma	★ from meristematic cells.
→ cell ending	★ Have blunts ends كغير حادة	★ with long tapered ends مدببة
→ shape	★ shorter cell of various shape	★ Elongated cells.
→ Pits	★ numerous عديدة	★ fewer
→ Aggregation	★ single or in loose groups	★ bundles groups
→	★ Not association with xylum or Phloem	★ found association with xylum or Phloem

→ Types of sclereide: based on shape and size.

- 1] Brachy sclereids (Stone cells) خلايا حجرية
 ★ with simple, Branched Pits [ramiform Pits]
 ★ found in some fruits Pear, guava, apple are gritty.



- 2] macro sclereids (Rod cells) عصوية 3] osteo sclereids (Bone cells) عظمية

- ★ Elongated
 ★ found in epidermis of some legume seeds.

★ توجد في البشرة لبغص بذور البقوليات

- ★ with dilated ends بنهايات متسعة
 ★ found in sub-epidermal layer of some legume seeds.

★ توجد في الطبقة تحت البشرة لبغص بذور البقوليات

→ macro sclereids and osteo sclereids form a thick waterproof layer of the seed coat of the certain legume that prevent desiccation and prevent herbivory

★ تشكل طبقة سمكها مقاومة للماء من أغلفة بذور البقوليات تمنع الجفاف

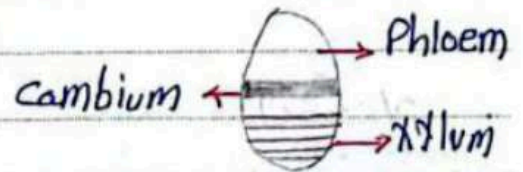
4] **Astro Sclereids** (star-shaped cells)

* in aquatic plants → in leaves

* often covered with calcium oxalate crystals

* branched irregularly

→ **Types of fibers**: based on Position

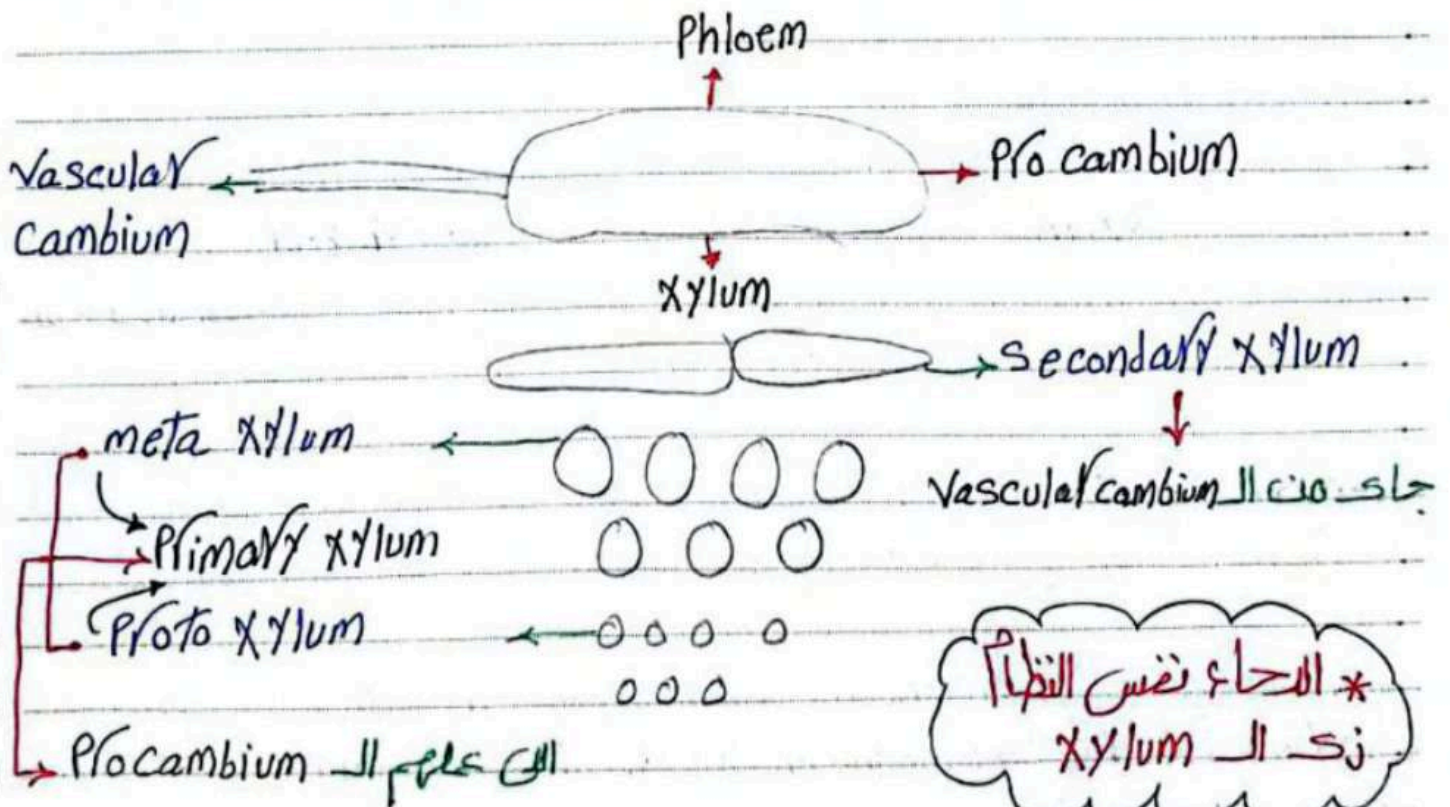


1] **Xylem fibers** with xylem

2] **Phloem** " with phloem

3] **Cortical** " in the cortex

4] **Pericycle fibers** = Peri vascular = Bundle sheath in the pericycle



→ **Xylem** is made up of 4 kinds of cells.

~~Tracheids~~

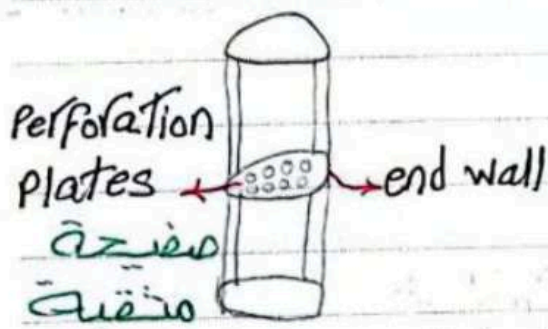
~~2/5~~

13 Tracheary elements — عناصر ناقلة

Vessels أوعية

★ conduction of water and mineral in flowering plants (Angiosperms)

→ Vessels tube elements.



★ Vessels tube elements have thick and lignified secondary cell wall
→ Lumen is wider than that of tracheids and fibers

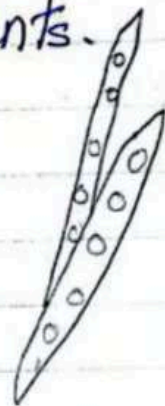
★ الكثر سمكا وأوسع تجويفا

→ ends is flat

end to end الخلايا مرقبة

Tracheids قصبيات

★ conduct of water and mineral in gymnosperm and seedless vascular plants.



★ Lumen is wider than fiber but less wider than vessels

→ cell with pointed cells

★ خلايا ذات نهايات مدببة

over lap each other الخلايا ←

23 Xylem fibers : ★ Elongation cell, with pointed ends.

★ thick lignified secondary wall.

★ mechanical support.

33 Xylum Parenchyma

- ★ Living, with thin or thick primary wall made up of cellulose
- ★ with simple pits نُقر
- ★ function → storage of food

∴ Xylum is made up of 4 kinds of cells

★ Tracheary elements → Vessels (1)
→ Tracheids (2)

★ Xylum fibers (3)

★ Xylum Parenchyma (4)

→ Phloem is composed of 4 kinds of cells.

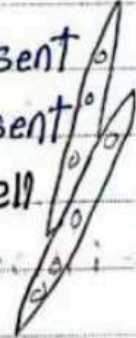
□ Sieve Elements — عناصر الغربال

sieve tube أنبوب الغربال

Sieve cells خلايا الغربال



- ★ Sieve plate is absent
- ★ Sieve area is present
- ★ with Albuminous cell



- ★ shorter.
- ★ it contains a lining layer of cytoplasm ∴ living.
- ★ they have thick primary wall.
- ends are flat.

→ توصيل المواد الغذائية في Gymnosperm and seedless vascular plants.

→ توصيل مواد الغذائية في Angiosperms

- ★ Longer.
- ends are pointed

23 Companion cells - الخلايا المرافقة

- * thin-walled, Elongation, Parenchyma cells.
- * Associated with the sieve elements.
- * have cytoplasm and nucleus.
- * connected to the sieve tubes through pits in lateral walls.
- * help the sieve tube in the conduction of food materials.

33 Phloem Parenchyma

- * living, with thin or thick primary wall
- * with simple Pits ^{نقر}
- * storage of food

43 Phloem Fibers

- * elongation cells, with pointed ~~pits~~ Pits
- * thick lignified secondary wall
- * mechanical support



1) collateral = conjoint V.B

- * xylem and phloem are arrangement at the same radius ^{نصف قطر}

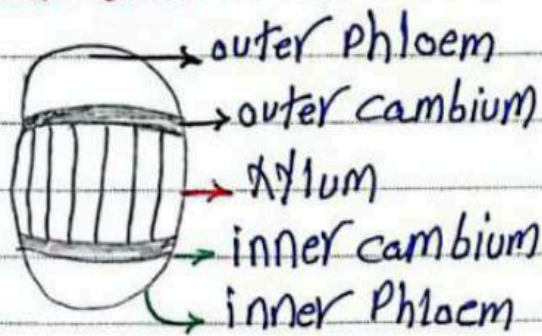
A) closed: cambium Absent between phloem and xylem: stem / leaves

↳ monocot

B) open: cambium is present: stem / leaf

↳ dicot

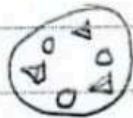
2) Bicolateral (V.S)



In Luffa

3) Radial (V.S) قشرية

* Xylem and Phloem are arranged in an alternate manner with each other



In Root

4) Concentric (V.S) مركزية

A) Amphivasal: Xylem completely surrounds Phloem. محيطة بالخشب

B) Amphicribal: Phloem " " " " Xylem. بالحذاء

الحفر - Pits

- * Pits are thin regions of the cell walls.
 - # هي مناطق رقيقة من جدران الخلايا.
- * Help the cell in communication.
 - # يسمح للخلية في التواصل.
- * Each pit has a cavity which separated by pit membrane.
 - # كل حفرة بها تجويف يسمى تجويف الحفرة الذي يُفصل بغشاء رقيق يسمى غشاء الحفرة.
- * Pit membrane → (middle lamella + Primary cell wall)
 - **Torus**: Thick, Primary wall
- Three Types of Pits.
 - Bordered Pits : الحفر المحددة
 - * The secondary cell wall may overarch the pit cavity forming a border.
 - # قد يغطي جدار الخلية الثانوي تجويف الحفرة مكونا حدودا.
 - * The remaining part of the pit membrane surrounding the Torus is called **margin**.
 - # الجزء الأخير المتبقى من غشاء الحفرة المحيط بالتورق يسمى الهامش.
 - * margin is thinner and very Porous.
 - # الهامش أرق ومسامي للغاية.

→ **Torus**: Regulates the movement of the water and ions.

→ **margo**: Allow the movement of the water and ions between cells.

* **Bordered pits** formed in vessels and some Tracheids.

تكون في الأوعية موبخض القصيبات الهوائية.

2] Simple Pits: الحفر البسيطة

* **Lack the borders**, formed in Parenchyma fibers and Scleroids cells. لا حدود لها، تكون في الخلايا البارانشيمية والألياف والخلايا الصلبة.

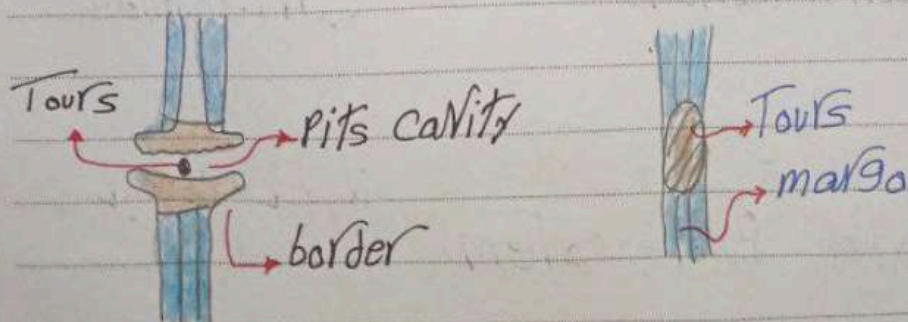
3] Half-bordered Pits: الحفريات الحدود النصفية

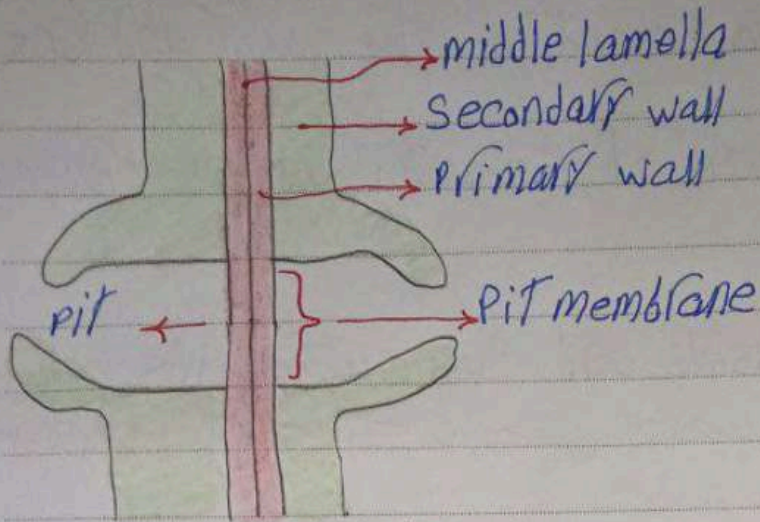
* **when a bordered pit is opposite to a simple pit.**

عندما يقابل الحفرة ذات الحدود حفرة بسيطة.

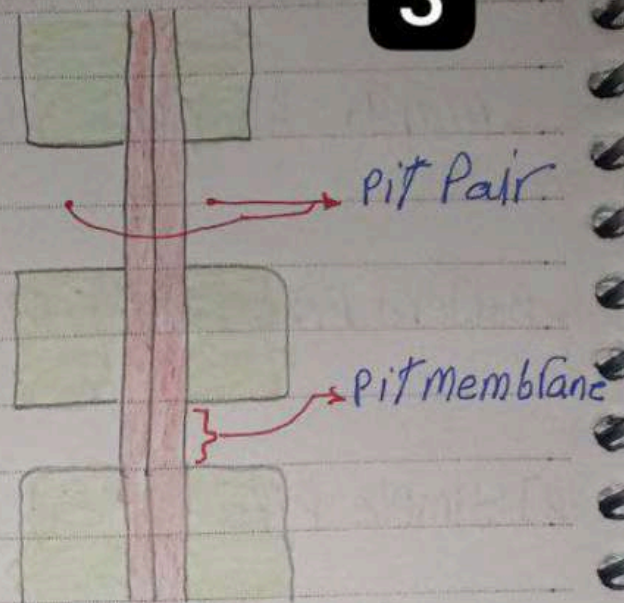
* **it is found when a parenchyma cell opposes a Tracheid or a Vessels.**

توجد عندما تقابل خلية من الخلايا البارانشيمية القصبة الهوائية أو الوعاء.



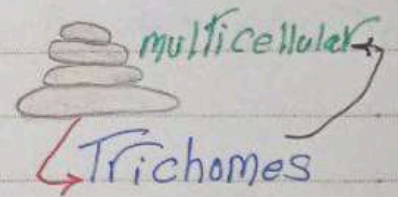
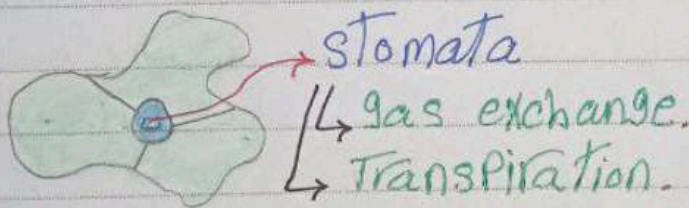
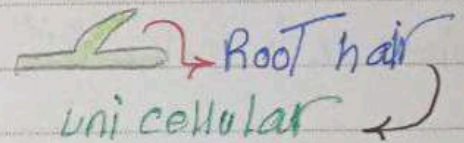
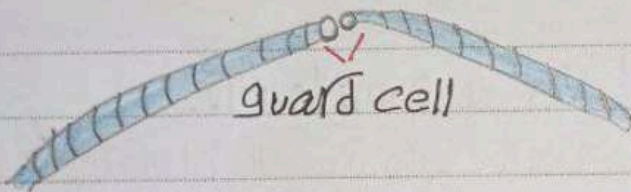


"Bordered pits"



"Simple pits"

→ Epidermal Tissue system.



Dicot and monocot of Root, stem
and leaf

وحدود بالتفصيل في الساتشن

← باقي الحاضرة

Root

Stem

Epidermis

- * Absorptive آبشده
- * stomata absent
- * cuticle absent
- * Hairs present, unicellular

- * Protective آبشده
- * stomata may be present
- * cuticle present
- * Hairs absent or present multicellular

V.B

- * V.B Radial
- * Proto Xylem exarch

- * V.B $\left\{ \begin{array}{l} \text{collateral} \\ \text{di collateral} \\ \text{concentric} \end{array} \right.$
- * Proto Xylem endarch



Exarch

proto xylem
over
meta xylem



Endoarch

proto xylem
under
meta xylem



mesarch

inside proto xylem

التشريح البيئي للنبات - Ecological Anatomy

الهيدروفائيات - Hydrophytes

1

«النباتات المائية»

* cuticle : Absent. البشرة غائبة

* Stomata : usually absent. الثغور غائبة

* Vascular tissues: Xylem is much reduced but Phloem is distinct. يتنمر قليل الخشب بشكل كبير ولكن اللحاء مميّن

* mechanical tissues: as sclerenchyma. are reduced or Absent

* Aerenchyma and air chambers: well developed.

2] mesophytes - العيزوفائيات «النباتات المعتدلة»

* cuticle: Thin

* Stomata: are exposed on leaf surface. تظهر الثغور على سطح الأوراق

* Vascular Tissues: Xylem and Phloem are well developed.

* mechanical Tissues: have Normal amount. مع كمية طبيعية

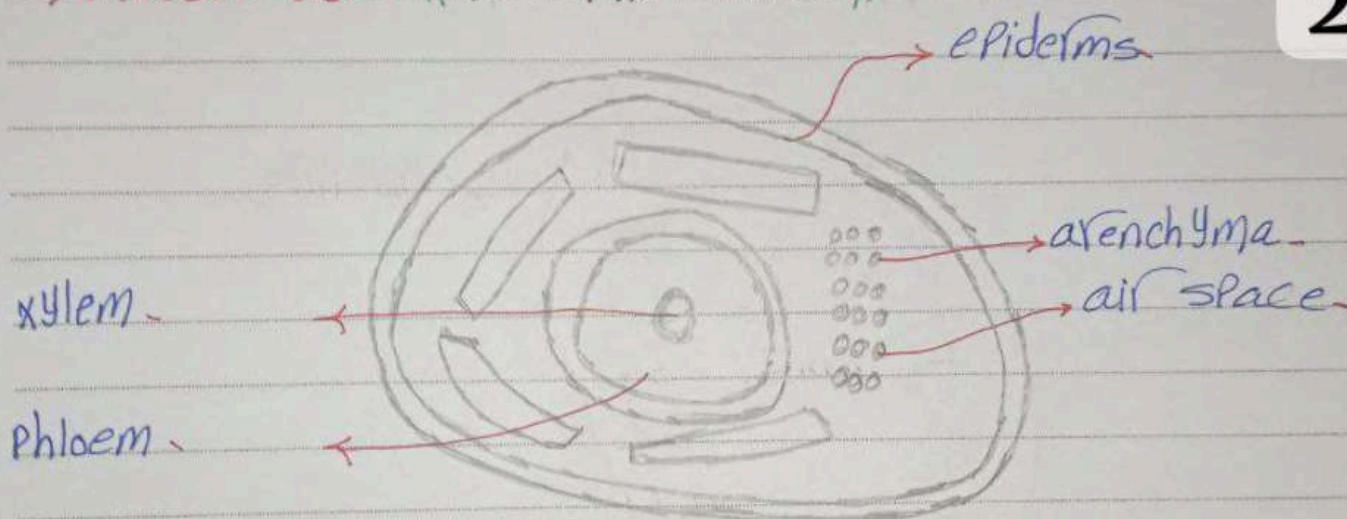
* Aerenchyma and air chambers: may present.

3] Xerophytes - الكسوفقيات « النباتات الصحراوية »

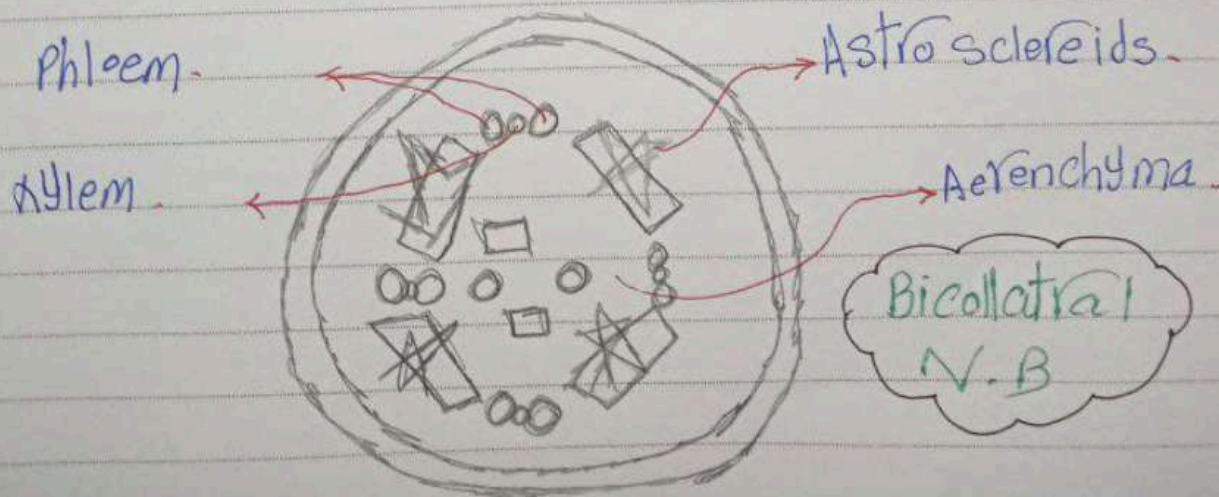
- * Cuticle: thick → To avoid loss of water.
- * Stomata: are very few and sunken and protected with hairs.
- * Vascular Tissues: Xylem and Phloem are well developed.
- * Mechanical Tissues: have a large amount of mechanical tissue.
- * Aerenchyma and air chambers: absent.

→ Elodea stem « Hydrophyte Plant »

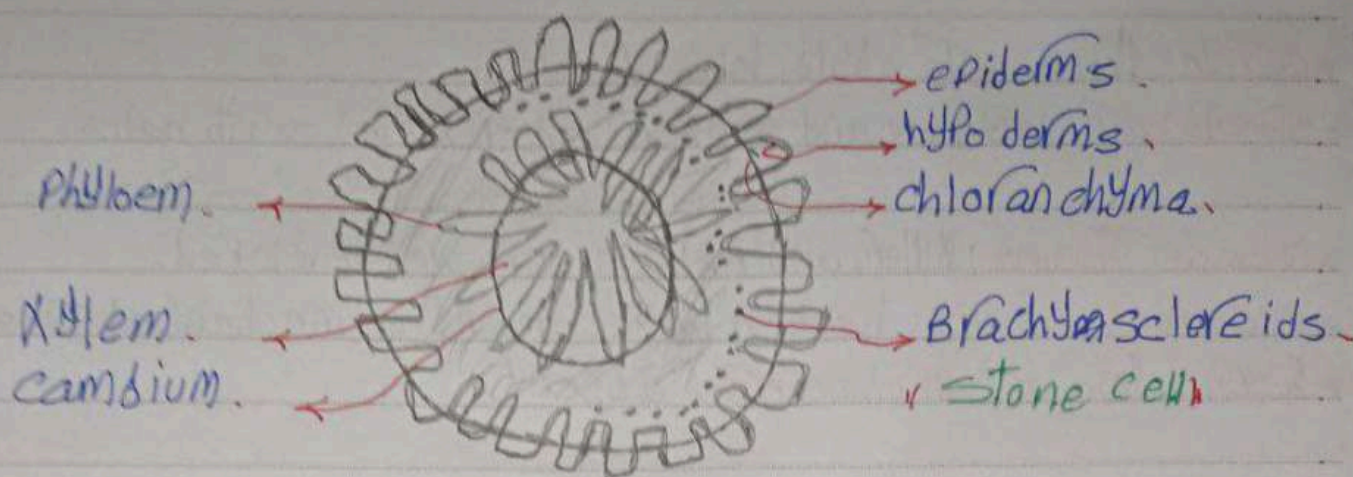
2



→ Nymphaea Petiole / stem « Hydrophyte Plant »



→ *Retama* stem (Xerophyte Plant)



→ *Ammophila* leaf (Xerophyte Plant)

