كلية العلوم

القسم : علم الحياة

السنة : الرابعة

المادة : بيولوجيا نباتية

المحاضرة : الثانية/نظري/ د.ميسون

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Plant cells

Plants are living organisms, so like any other organism on the planet, we know that they must be made of cells.

And more importantly, plants are rather large multicellular organisms, so we should say they are made specifically of eukaryotic cells, just as all multicellular organisms are.

Eukaryotic cells have a variety of organelles inside, and most of these organelles are quite similar whether the cells belong to plants or animals.

But we can identify plant cells very easily under a microscope because they have a few key differences.

These would include the presence of chloroplasts, a central vacuole, and a cell wall, all of which are structures that are absent in animal cells.

Let's name the different types of plant cells and describe them now.

1. meristematic cells

First, there are the cells that plants use to grow.

These are called meristematic cells, and they're very much like the stem cells we have in our own bodies. Plant meristematic cells are characterized by certain properties:

1- Meristematic cells are undifferentiated, or without a specific job assigned to them when they are first created through mitosis, So, when meristematic cells divide and replicate, they can produce daughter cells belonging to any other kind of plant cell.

2- Meristematic cells don't get used up, so they can continue dividing and helping the plant grow indefinitely. and this is the important difference between meristematic cells in plants and stem cells in animals

3- Meristematic cells can be found at the tips of the roots, and at the tips of the shoots, this means meristematic cells allow the roots of a plant to grow deeper into the soil and the branches of a plant to grow taller into the air.

2. parenchyma cells

The second type of plant cells, parenchyma cells, do most of the work within a plant, being that they're a sort of general-use cell.

1- Some Parenchyma cells are responsible for most of the photosynthesis that occurs, but they also do most of the energy and nutrient storage for the plant, as well as much of the nutrient transport.

2- They have thin walls, no specialized structure, and come in a variety of shapes to support their diverse functions.

3- In leaves, parenchyma cells form the two layers of mesophyll where photosynthesis and gas exchange take place.

4- In roots and seeds, parenchyma cells are responsible for storing starch, fat, and water.

5- Parenchyma cells also make up most of the structure of a fruit.

6- They create new structures to heal areas where a plant has been wounded.

3. Collenchyma cells

Collenchyma cells are a kind of back-up system for the plant, that provide flexible support, especially in young, growing parts of the plant.

1- These cells can contribute to photosynthesis and nutrient storage.

2- The most important job for collenchyma cells is providing flexible structure to the plant.

3- Collenchyma are long cells that have thickened cell walls, meaning that when they're in a group, they act to make that part of the plant stiffer.

4- Even though collenchyma cells are pretty stiff in their structure, they're also very flexible and able to grow and change as the plant grows.

You've probably eaten collenchyma cells before. In fact, the "strings" in celery are collenchyma cells.

4. sclerenchyma cells

1- Sclerenchyma have thickened cell walls like the collenchyma.

2- Sclerenchyma cells are dead and found in parts of the plant that are no longer growing.

3- They provide the most support for the plant by creating woody tissue in stems and trunks.

Sclerenchyma cell walls contain lots of cellulose and lignin, which are both complex biopolymers that are difficult to break down, so they last a long time.

Plant Tissues

Cells are the building blocks of life, but cells are usually organized into tissues, and these tissues will often be organized into organs, and this is true of plants just as it is for animals .

Plants have three main types of tissues, and all these tissues are comprised of the plant cells we discussed in the previous tutorial, so let's go through these types of tissue now .

1. Ground tissue

Ground tissues make up most of plant's body, it's broken up into three subgroups based on cell type, those are the parenchyma, the collenchyma ,and the sclerenchyma, which we just learned about.

a- **Ground parenchyma tissue** is the most common tissue in a plant. It appears in a variety of locations and does many jobs .

Function of parenchyma tissue

1- Parenchyma tissue is responsible for the photosynthetic layer in leaves called the mesophyll, where the plant performs gas exchange and creates sugars, making its own food.

2- Parenchyma tissue is also how a plant stores excess energy in the form of starches ,which are complex polysaccharides.

3- It also takes on the role of growing to cover wounds and replace other tissues lost through physical trauma or disease.

Location of parenchyma tissue in the plant

1- Starch-filled parenchyma tissue can be found in a plant's roots.

2- It makes up most of a seed so that the starches can feed the embryonic plant until it's able to photosynthesize on its own.

3- It is so prevalent throughout a plant.

b- ground collenchyma tissue and ground sclerenchyma tissue

They are also composed of cells by the same names. As we now know, both collenchyma cells and sclerenchyma cells have thick cell walls made of cellulose, and in some cases, lignin , which provide structure for a plant. Therefore, ground collenchyma and ground sclerenchyma tissues can be found throughout a plant, wherever structural support is most important .

2. dermal tissues

On the external surface of a plant, we can find dermal tissues.

This name makes sense because " dermal" is a word that relates to the skin or exterior of a living organism, so these tissues essentially form a sort of "skin" for the plant .

A plant's skin is called **the epidermis**, and it's a layer of cells only one cell thick. Most of these cells don't have chloroplasts or other specialized organelles, they primarily serve as a protective layer to shield the more important tissues beneath .

As extra protection, most epidermal tissues secrete a waxy substance called **cuticle** that prevents excess water from escaping the plant and protects the plant from invasion by pathogens like fungi and bacteria. This cuticle is one of the main evolutionary advantages that land plants exhibit over their aquatic ancestors.

A plant also needs some openings in the epidermis in order to let water and gases travel in and out, to maximize the surface area available for material exchange, these openings are called **stomata**.

A specialized epidermal cell called **guard cells** are utilized to cover the stomata. These curved cells appear in pairs on either side of a stoma and work together to open or close the stoma as needed by the plant.

The function of guard cells is especially important for plants living in very dry areas that need to keep water from evaporating away during the day, so the stomata will often remain closed until the sun goes down .

The periderm is a thicker layer of dead cells that can provide greater protection to the inner layers of the plant than the epidermis, but it's a less active tissue which doesn't really grow, though it still allows for limited gas exchange .

3. Vascular tissues

The final group of plant tissues is not actually present in all kinds of plants .

Vascular tissues are the main characteristic that separates vascular plants, like trees ,from nonvascular plants, like mosses.

Vascular tissue is what allowed the ancestors of modern plants to abandon their reliance on living in or near water sources, meaning that we can now find plants in almost every environment on Earth, regardless of how dry they seem.

Vascular tissue can be further broken down into two types, xylem and phloem.

1- Xylem is a vascular tissue made of dead cells called tracheids and vessel elements .

These are both elongated cells whose walls are strengthened with lignin, the substance that makes woody plants so stiff and strong.

Xylem is the vascular tissue responsible for transporting water and mineral nutrients upwards. The roots of a plant absorb water and minerals from the soil.

The xylem then allows these substances to move up and throughout the plant due to the cohesive and adhesive properties of water, in this case referred to as capillary action .

At the top of a plant, excess water is released through the stomatal openings in the leaves by a process called **transpiration**, which occurs when water exiting a plant's leaves evaporates into the air.

The mechanism of transpiration promotes further **capillary action** in the xylem, meaning that water will continue flowing up through the plant even though the xylem cells are dead .

2- Phloem, and it's composed of living cells called companion cells and sieve cells.

Phloem tissue is responsible for transporting the sugars produced through photosynthesis in the leaves to all of the other parts of the plant .

Phloem transport depends on pressure flow **(mass flow),** not gravity, where sugars move from high-pressure areas (leaves) to low-pressure areas (other parts of the plant).

Now that we understand plant cells and tissues, we can move on to explore how these components are organized into organs such as roots, stems, and leaves.

Wishing you the best of luck

Dr. Maissoun Ziadeh

Vocabulary - Lecture2 مفردات المحاضرة الثّانية

Organisms	الكائنات الحية	Tissues	أنسجة
Multicellular	متعدد الخلايا	Organize	تُنظّم
Eukaryotic cells	خلايا حقيقيات النوى	Structure	بُنية- هيكل
Microscope	مجهر	Comprised of	تتألف من
Key Differences	الاختلافات الرئيسية	Ground Tissue	النّسج الأساسية
Presence	وجود	Broken up	تنقسم إلى
Chloroplasts	البلاستيدات الخضراء	Common	شائع
Central Vacuole	فجوة مركزية	Location	موقع
Cell Wall	جدار الخلية	Performs	يُنفّذ
Meristematic	جنينية - إنشائية	Variety	متنوّع
Characterized	تتصف	Gas Exchange	التّبادل الغازي
Stem cells	الخلايا الجذعية	Creates	يُصنّع
Undifferentiated	غير متمايزة	Stores	مخازن
Divide and Replicate	تنقسم وتتضاعف	Excess Energy	طاقة فائضة
Belonging	تنتمي	Starch	النّشاء
Used up	تنتهي - تستنفذ	Feed	يُغذّي
Indefinitely	إلى أجل غير مسمى	Embryonic	الجنيني
Tips	أطراف - نهايات	Prevalent	منتشر
Shoots	المجموع الخضري	Wounds	الجروح
Responsible	مسؤولة	Disease	مرض
Photosynthesis	التمثيل الضوئي	Sorts	أنواع
Nutrient Storage	تخزين المغذيات	Pathogens	مسببات الأمراض
Specialized	متخصص	Composed of	تتألّف من
Shapes	الأشكال	Dermal	جلدي
Diverse	متنوع	Exterior	خارجي
Take Place	تحدث	Epidermis	البشرة
Starch	نشاء	Specialized	متخصص
Create	تنتج - تُصنّع	Organelles	العضيّات
To heal	للشفاء	Primarily	بالدرجة الأولى
Wounded	جُرح	Protective	حماية
Back-up System	نظام داعم	Layer	طبقة
Flexible	مرن	Shield	تحمي
Stiffer	أصلب	Secrete	تفرز
Celery	الكرفس	Waxy Substance	مادة شمعية
Biopolymers	البوليمرات الحيوية	Cuticle	بشرة متصلبة (كيوتيكل)

Invasion	الإصابة	Properties	خصائص
Evolutionary Advantages	مزايا تطوريّة	Transpiration	النتح
Pathogens	مسببات الأمراض	Mechanism	آليّة
Exhibit	تُبديها- تُظهرها	Promotes	تُعزّز
Ancestors	أسلاف	Capillary Action	الخاصيّة الشّعرية
Stomata	الثّغور	Companion cells	الخلايا المرافقة
Guard Cells	الخلايا الحارسة	Sieve cells	الخلايا الغربالية
Utilized	تستخدم	Pressure flow	تدفّق الضّغط
Curved	المنحنية	Mass flow	تدفّق الكتلة
Appear In Pairs	تظهر في أزواج	Gravity	الجاذبية
Dry Areas	المناطق الجافة	Organized	تتنظّم- تترتّب
Periderm	الأدمة المحيطية	Organs	أعضاء
Vascular	الوعائي		
Characteristic	صفة مميزة		
Separates	تفرّق - تميّز		
Mosses	الحزازيّات		
Shrubs	الشجيرات		
Abandon	تخلّى		
Reliance	الاعتماد		
Regardless	بغضّ النّظر		
Xylem	نسيج الخشب		
Phloem	نسيج اللحاء		
Tracheids	أوعية- قصبات		
Vessel	وعاء نسغي		
Responsible	مسؤول		
Transporting	نقل		
Absorb	يمتص		
Cohesive	التماسك		
Adhesive	الالتصاق		