كلية العلوم

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Overview of Plant Classification- Vascular and Nonvascular

The word “plant” refer to essentially any living organism that carries out photosynthesis.

But I’m sure we can all agree that there’s a world of difference between various photosynthetic organisms like algae ،mosses, grasses, and trees.

So how do we organize and classify plants?

If we start at the beginning of the evolutionary history of plants, we can look at algae.

Algae is a term we use to describe a large group of photosynthetic organisms that are not actually all related to one another.

Many organisms that are sometimes referred to as algae, like cyanobacteria and diatoms ،don’t really resemble the things we normally think of as plants.

In fact, cyanobacteria don’t qualify as plants at all, because they’re unicellular prokaryotes, where plants are multicellular eukaryotes.

Similarly, diatoms, like other protists, although they are eukaryotic ،are also unicellular and therefore lack the structure we normally associate with plants ، so they’re classified totally separately, and referred to as plant-like protists . red, green, and brown, and they are all capable of photosynthesis.

But if you look at a **seaweed** ،it has blades that look like leaves, a stipe that looks like a stem, and holdfasts that look like roots.

So due to these and many other morphological and genetic similarities ،we can see that certain kinds of algae must be the ancestors of the land plants we’re more familiar with, and it is the case that true plants started to develop on land around 500 million years ago .

There are two different major groups of true plants.

These are vascular and nonvascular plants .

Nonvascular plants are usually small and relatively simple in their structure.

This is because they lack the xylem and phloem vascular tissues .

Without vascular tissues, these simple plants have no way to transport water and nutrients long distances through their bodies, so they don't have long stems or complicated structures .

Nonvascular plants also don't have roots, but instead hold onto their substrate using tiny hairs called rhizoids.

As you might expect, since their structures and reproduction are much less complicated, nonvascular plants are much older on the evolutionary timeline than vascular plants.

Some examples of nonvascular land plants are mosses, liverworts, and hornworts .

On the other hand, the more complex and more recently-evolved vascular plants have complex structures.

Vascular plants have xylem and phloem, which facilitate the transport of water and nutrients through a plant's body, allowing it to grow very large .

These vascular tissues also allow for more complex structures like roots, long stems ،and branches.

Examples of vascular plants include ferns, conifers, and flowering plants .

Nonvascular plants

Let's now zoom in on the nonvascular plants, which we can refer to as bryophytes, so that we can better understand them.

The bryophyte group mosses, liverworts, and hornworts.

While distinct, all three of these types of plants have enough characteristics in common that we can talk about them together.

Bryophytes are very sensitive to moisture, as they don't have a vascular system to bring water up from deep in the soil.

You'll usually find bryophytes living in cool, moist places, like how moss grows on tree bark in dense forests or on rocks next to streams.

However, they don't need to be completely submerged in water, giving them an evolutionary advantage over algae and other plant ancestors, so these were the first types of plants to ever exist outside of some body of water.

If we also look at a liverwort, we can really begin to understand the variety that exists within the bryophyte group.

For example, the rhizoids in mosses are multicellular, while only unicellular in liverworts and hornworts.

Some liverworts are parasitic, while mosses are not.

And there are a number of other subtle differences in their structure and organization.

Bryophytes, like essentially all plants, go through sexual reproduction.

Plants demonstrate **heteromorphy**, or a quality in which they have two genetically and morphologically distinct generations that alternate.

The two plant generations are a haploid gametophyte and a diploid sporophyte.

Haploid refers to any cell with a single set of chromosomes, like our sperm and egg gametes, and diploid refers to cells with two full sets of chromosomes, like all of our normal somatic cells.

In fact, with bryophytes, the haploid gametophyte is the dominant generation, or the generation that we're most aware of seeing.

The entire thallus or "body" of this moss is the haploid gametophyte.

vascular plants

The first type of these we will examine are called:

1. lycophytes, or club mosses:

To be clear, even though they have "moss" in their name, lycophytes are vascular plants, unlike the nonvascular mosses and other bryophytic plants we just discussed.

In fact, lycophytes are the oldest living type of vascular plant.

But modern lycophytes are usually small and grow close to the ground in the forest understory, or as epiphytes, which means small plants that grow on other larger plants.

In either case, lycophytes hold themselves to their substrate with rhizomes. The above-ground portion of the plant usually has dichotomous branching, meaning the branches fork in two at each intersection.

But instead of the more complex leaves of more recently-evolved vascular plants, lycophyte branches bear the small predecessors of leaves, called microphylls.

One major difference between lycophytes and the bryophytes they evolved from is that with lycophytes, the diploid sporophyte is the dominant generation, or the generation that we're most aware of seeing, rather than the haploid gametophyte.

The top of the sporophyte develops into a **strobilus**, which is a structure that looks kind of like a pinecone.

The strobilus is where meiosis happens and the spores develop.

Interestingly, **club moss spores** are good for more than just producing more club mosses.

Humans have discovered a wide range of uses for the spores because of their high fat content, which causes them to be both hydrophobic and flammable.

1. In the early days of photography, club moss spores or "lycopodium powder" were used to create the flash needed to take pictures.

2.Lycopodium powder, sometimes referred to as "vegetable sulfur" has also been used in fireworks and magic tricks because of its explosive properties.

3. It has been used as a coating on pills and latex gloves, again due to its hydrophobic properties.

Lycophyte spores are quite fascinating, but there is another group of vascular plants that reproduces via spores, so let's move forward and talk about those next

2. Ferns

Ferns are more advanced vascular plants than those we've discussed previously, because they are the first to have true roots and stems.

Most fern species grow as small or medium-sized herbaceous plants, meaning no woody stems above the ground, but larger tree ferns can be up to 25 meters tall, the smaller herbaceous ferns can grow as epiphytes.

In ferns, like lycophytes, the diploid sporophyte is the dominant generation, or the generation that we're most aware of seeing.

If you look at the back or undersides of the megaphylls on a fern sporophyte, you'll often see small brown or black dots in neat rows.

These brown dots are **sori**, or groups of sporangia where the haploid spores are produced through meiosis.

Many people eat parts of ferns, but it's important to properly identify the fern species first because some are poisonous.

Once established, many fern sporophytes are perennial, meaning they will grow in the same spot year after year without having to alternate with the gametophyte generation.

Additionally, many fern sporophytes are able to engage in a different form of reproduction called vegetative reproduction, which entails propagating new plants via rhizomes growing in the soil.

This reproductive strategy has caused a few species, like bracken fern, to become aggressive weeds in some disturbed areas.

Wishing you the best of luck

Engr. Maissoun Ziadeh

Vocabulary - Lecture 6

مفردات المحاضرة السّادسة

Overview	ملخص	haploid gametophyte	مشيجة أحادية الصيغة الصبغية
Classification	التّصنيف	diploid sporophyte.	نبات بوغي ثنائي الصبيغية
Vascular	النّباتات الوعائيّة	somatic cells	خلايا جسدية
Nonvascular	النّباتات اللاوعائيّة	lycophytes	النباتات الصولجانية (الصنوبريات الأرضية)
carries out	تقوم بتنفيذ	forest understory	فرشة تحت الغابة
describe	يصف	dichotomous	ثنائي التّفرع
resemble	تُشابه	bear	تحمل
prokaryotes	بدائيّات النوى	predecessors	أسلاف
eukaryotes	حقيقيات النوى	pinecone	مخروط الصنوبر
unicellular	وحيدات خلية	meiosis	الانقسام الاختزالي
multicellular	متعدّدات خلايا	hydrophobic	كارهة للماء
protists	الطّلائعيات	flammable	قابلة للاشتعال
capable	قادر على	fireworks	الألعاب النّارية
seaweed	الأعشاب البحرية	explosive	مادة متفجّرة
blades	شفرات – أنصال	coating on pill	أغلفة حبوب الدواء
stipe		latex gloves	قفازات اللاتكس
holdfasts	أوتاد	megaphylls	الأضلع الضخمة
similarities	التشابهات	black dots	نقاط سوداء
substrate	ركائز - دعائم	neat rows	صفوف مرتبة
rhizoids	الجذمور	sori	تجمعات بوغية
mosses	الحزازيات	poisonous	سامّة
liverworts, and hornworts		Once established	بمجرّد استقرارها (بمكان ما)
evolved	متطور	perennial	معمّرة
ferns	السراخس	spot	بقعة – منطقة
conifers	المخروطيات	to engage	تستخدم
parasitic	طفيلي	vegetative reproduction	التكاثر الخضري
subtle	متقنة – دقيقة	entails	يتضمن
demonstrate	يتظاهر	propagating	التكاثر