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Gymnosperms And Angiosperms

3.Gymnosperms

Gymnosperms are the first of two kinds of true seed-bearing plants called spermatophytes،and **the word "gymnosperm" means "naked seeds"** because their seeds do not exist within chambers such as fruits or nuts.

This group includes the plants known as conifers, as well as the cycads and ginkgo trees.

Ginkgo biloba, or the ginkgo tree, is a special example.

These trees first evolved in the early Jurassic period, more than 270 million years ago, and they have changed relatively little since then, so they're known as "living fossils"and were some of the first gymnosperms on the planet.

The ginkgo trees we're familiar with today are the last extant, or still living species of their kind.

As is true for all vascular plants, with gymnosperms, the diploid sporophyte is the dominant generation، or the generation that we're most aware of seeing.

However, the gametophytes in spermatophytes or seed-bearing plants are much smaller and less distinct than all of the other gametophytes we've discussed.

When a gymnosperm sporophyte like a pine tree becomes sexually mature, it develops two types:

1.Meiosis occurs within the male cones in order to create male gametophytes, which are sometimes referred to as "pollen grains" though the gametophyte is actually inside the grain،protected by sporopollenin in the pollen wall.

2.Meiosis also occurs within the female cones to create female gametophytes within structures called ovules.

Pollination is the process of moving pollen from the male cones to the female cones for fertilization.

But there are some novel features to gymnosperm fertilization which gave them an immense evolutionary advantage over other existing plants.

With gymnosperms, pollination is sometimes facilitated by water, but more often by wind، which was a brand new mechanism, and this had an important result.

Plants no longer required a body of water nearby within which to transfer sperm to achieve fertilization.

Where earlier plants like bryophytes and lycophytes were all relegated to very a small distance from some body of water, suddenly gymnosperms with their incredible seeds were not tethered in the same way, and for the first time in the history of the planet, forests full of large trees could suddenly stretch out over vast expanses of dry terrain.

Getting back to pollination, once the pollen has successfully arrived at the female cone، some of it will enter the cone, gaining access to the ovule.

Now there are two primary methods of fertilization in gymnosperms.

Cycads and Gingkos have motile sperm that can swim directly to the egg within the ovule.

Conifers, however, have sperm with no flagellum.

Thus, an outgrowth called a pollen tube will form, through which the generative cell in the pollen will travel to encounter the female gametophyte.

The generative cell splits into two sperm nuclei, and one of these will fuse with the egg, while the other degenerates.

After fertilization of the egg, we have a diploid zygote, which will eventually become a new sporophyte.

This then divides by mitosis to form the embryo, just like in animals.

A mature gymnosperm seed is made up of the embryo, the remains of the female gametophyte which functions as a food supply, and the seed coat.

No fruit surrounds the seed, which is why scientists refer to this plant group as having naked seeds.

While we outlined this whole process in a rather abbreviated manner, it actually takes around three years for the male and female gametophytes to be

produced and brought together ،and for mature seeds to then form from fertilized ovules.

Once a gymnosperm seed is ready to be dispersed, the female cone will open up to allow for dispersal to occur.

These seeds offer numerous advantages over the spores of predecessors, as seeds offer more protection, nourishment, and can remain dormant for extended periods of time before germinating, which is when it begins to develop into a plant.

And of course as we said, with seeded plants, the seeds can be carried very far by the wind، enabling these plants to spread over large distances.

The evolution of gymnosperms transformed the face of the Earth, as the land was not covered by forests until these plants came along.

4.Angiosperms

Angiosperms are the second kind of true seed-bearing plants called spermatophytes, and they are **also known as "flowering plants".**

If you were to imagine a flower, any type of flower you can think of, you are almost certainly envisioning an angiosperm.

Even though gymnosperms also technically have flowers, the angiosperms have a much broader diversity of more obvious flowering structures.

And although angiosperm plants demonstrate an incredible diversity of flowers, the basic structure of a flower remains the same regardless of species.

We went over flower structure in a previous tutorial, but let's briefly review.

The sepals

The small green leaf-like structures between the flower and the stem are called sepals.

The sepals cover the flower and protect it when it's still a bud before it blooms، and after a flower opens, the sepals help provide the flower with structure and stability.

The petals

The petals are usually the most colorful parts of a flower, and also often the most specialized structures.

Petals are often brightly colored to attract animals that facilitate the process of pollination، or the movement of pollen between flowers, an evolutionary strategy that is largely responsible for the reproductive success of this plant group.

Instead of relying on wind to bring pollen to the right place by chance, angiosperms became able to manipulate other organisms into carrying out highly targeted delivery.

These pollinating animals can include insects, birds, and bats.

Many flower petals even have stripes that act as a "runway" to direct pollinating insects to their centers, and some of these runways are only visible in the UV spectrum، which is visible to most insects.

Other flower petals are shaped in such a way so as to attract or exclude certain pollinators، like these tube-shaped trumpet flowers that can only be pollinated by moths with very long tongues.

But the sepals and petals are just the structures surrounding the important reproductive parts of the flower.

While gymnosperms have separate male and female cones, most angiosperms have both male and female reproductive organs in the same flower structure.

The male reproductive structures

In this situation, the male reproductive structures are called stamens, and the female reproductive structures are called pistils.

Stamens

The filament supports the anther, or pollen head.

The anther is where pollen is produced and released, and the filament is often long enough that the anther sits above the top of the pistil to allow for self-

fertilization when pollen falls down off of the anthers and onto the top of the pistil, although most angiosperms employ mechanisms to favor cross-pollination to enhance genetic variability.

The female reproductive structure

The pistil, which is the female reproductive structure in a flower, also consists of several parts:

The stigma is the top of the pistil, which is often very sticky in order to collect pollen deposited upon it by either the wind, pollinating animals, or gravity.

The style is a long, tube-like structure that supports the stigma.

When the flower is pollinated, the pollen tube grows down through the style.

While the pollen tube is growing, the generative cell in the pollen splits into two sperm cells.

At the bottom of the style is **the ovary**, where the female gametophytes grow, which will become the egg cells.

Now unlike fertilization in gymnosperms, both of these sperm cells play an important role in angiosperms, and because of this we refer to the process of fertilization in angiosperms as double fertilization.

The way this works is that one sperm cell fertilizes the egg, which generates the diploid zygote that will become the new sporophyte, just as we would expect.

But the second sperm cell will fuse with two extra cell nuclei that accompany the egg cell.

This triploid structure produces something called the endosperm, which will become part of the resulting seed, providing nutrition for the zygote as it grows into an embryo.

After double fertilization generates the zygote and endosperm, the ovary surrounding the zygote swells into a protective coating called a pericarp, which most of us know of as a fruit.

This is a major difference from the naked seeds of gymnosperms.

The fruit

Angiosperm fruits come in a huge variety of shapes and sizes, and the shape is usually specialized for the kind of seed dispersal a plant relies on.

The kind of seed dispersal

1.For instance, bright red berries will attract the attention of birds, who will then ingest the berries and carry the seeds for miles before depositing them with their fecal material.

2.Other angiosperm pericarps become tough nuts that squirrels will bury in the ground.

3.Some angiosperm fruits even grow with lots of hooks on the outside, like this burdock، which can hitch a ride on the fur of passing animals.

The main thing these different fruits have in common is that they protect the seeds inside them, while helping move the seed to a new location.

Flowering plants are the most diverse group of plants in the world, with more than 250,000 species estimated to exist.

Angiosperms can grow as trees, shrubs, or herbaceous plants, and many scientists would also consider them to be the most successful group of plants on Earth, given the incredible strategies they employ in their reproduction.

Wishing you the best of luck

Engr. Maissoun Ziadeh

Vocabulary - Lecture 7 مفردات المحاضرة السّابعة - ١

Gymnosperms	عريانات البذور	To Achieve	لتحقيق
Angiosperms	مغلّفات البذور	Relegated	تقييد
Seed-bearing	حاملة البذور	Tethered	مقيّدة
Spermatophytes	النّباتات البذريّة	Stretch	امتدّت
Naked seeds	البذور العارية	Vast Expanses	مساحات شاسعة
Chambers	غرف – حجرات	Dry Terrain	أراضي جافة
Conifers	المخروطيات	Motile Sperm	نطاف متحركة
Evolved	تطورت	Flagellum	سوط
Jurassic Period	العصر الجوراسي	Pollen Tube	أنبوب اللقاح
Living Fossils	الأحفوريات الحيّة	Generative Cell	الخلية التوالدية
Diploid Sporophyte	نبات ثنائي الصيغة	Encounter	يقابل - يلتقي
Dominant	مهيمن	Splits	تنقسم
Generation	جيل	Nuclei	نوى
Sexually Mature	ناضجة جنسياً	Fuse	تندمج
Meiosis	الانقسام الاختزالي	Degenerates	تتحلل
Referred	يُشار إليها	Embryo	الجنين
Pollen Grains	حبوب اللقاح	Abbreviated	مختصر
Fertilization	الإخصاب	Dispersed	منتشر
Novel Features	مزايا جديدة	Dispersal	الانتشار

Vocabulary - Lecture 7 مفردات المحاضرة السّابعة -٢

Protection	حماية	Filament	الخيط
Nourishment	تغذية	Pistil	المدقّة
Dormant	سكون – سبات	Employ	تستخدم
Germinating	الإنبات	Cross-Pollination	التلقيح المتبادل
Enabling	تُمكّن	To Enhance	لتحسين - لتعزيز
Envisioning	تتصور – تتخيل	Stigma	الميسم
Bud	برعم	Sticky	لزج
Blooms	تزهر	Deposited	تتوضع
Stability	الثبات – الصلابة	Style	القلم
Specialized	تخصصاً	Ovary	المبيض
Attract	تجذب	Endosperm	السويداء
Manipulate	تؤثّر		يتضخم
Stripes	خطوط	Pericarp	القشرة (ثمرة الفاكهة)
The UV Spectrum	مطياف الأشعة فوق البنفسجية	Ingest	يبتلع
Visible	مرئي	Fecal	برازيّ
Exclude	تستبعد	Bury	يدفن
Trumpet	بوق	Hooks	خطافات
Moths	البعوض	Estimated	مقدّرة
Reproductive	التكاثرية	Shrubs	شجيرات
Stamens	الأسدية	Consider	يُعتبر