

Blossoms - **Pollination Saying it with Flowers**

[MUSIC PLAYING]

NAOMI: Hello, my name is Naomi Volain. I'm a botany teacher at Springfield Central High School in Springfield, Massachusetts. Today, I'm working with the MIT BLOSSOMS program. Ironically, the name of the program is the same as the topic I'm speaking about today-- flowers.

Today I'm at the Wellesley College Botanic Gardens and greenhouses in Wellesley, Massachusetts home of a wonderfully diverse collection of plants from all over the world. In this BLOSSOMS lesson, surrounded by all these lush and beautiful plants, you'll explore how the pollination of flowers assures that plants reproduce.

So think about flowers. Flowers are everywhere. They color our world. They're important for us humans both emotionally and symbolically. Roses show deep love, congratulations, or an apology.

Flowers from the backdrop of our lives adding texture and appeal to what we see. Whether it's on clothing, paper, in art, in movies, jewelery-- flowers are connected to culture and the ceremonies of important life events.

There are more than a quarter million different species of flowering plants in the world. And flowers can be strange and wonderful. Moon flowers are white as the moon appears and bloom only at night, closing during the day, as does night blooming cereus with flowers that open and bloom only for one night.

Titan arum is the world's largest flower and is almost 10 feet in height. Due to its horrible smell of rotten flesh, it's also known as corpse flower. Sunflower buds follow the sun in the movement called heliotropism. Once the sunflower opens, it points to the east where the sun rises. And the sunflower is really made of hundreds of flowers arranged together in a circle.

A corn stalk has both male and female flowers. And dandelions are considered weeds. But the flowers and its leaves are a good source of vitamins A and C, and iron, calcium and potassium. Aren't flowers amazing and beautiful? Why do they appeal to us so much? And why when we think of plants, we think of flowers?

Do flowers play another role in the life of a plant? Let's see what you know and think about with flowers. Your teacher has colored clay. We're inviting you to design and make a flower that has all the different parts to it. Think about what you know.

Don't just think about making your flower pretty. Think about all the different parts that a flower might need to reproduce. Consider that a plant, a flower, is sessile. It can't get up and move around to find a mate. What is it you should include in your model to make sure that that flower can reproduce?

So how did you do? Were your flowers beautiful, eye popping, colorful? Did you include petals or stems or leaves as part of your flower? Did you include any other parts? Because there are other parts that are essential for a flower to reproduce. Consider leaves, stems, roots, seeds, and fruits-- these are plant organs in a plant classification called the angiosperms.

We say a plant is a flower. That's because the flower itself is so vivid and appealing. That's right. A flower is the reproductive, or sexual, organ of plants. And pollination is the process of reproduction.

Compare your clay flower with basic pollination anatomy. The stem that supports the flower up is called the peduncle, which is one of the best science words in the world. The peduncle can hold one flower or more flowers together.

An inflorescence is a bunch of flowers in a specific arrangement that comes off of one or more peduncles. The sepals are leaves that surround the petals. Their job is to protect the petals. The petals are usually colorful and usually the most noticeable part of the flower. The female part of the flower is the pistil. Pollen is male plant sperm. It comes to the male part of the flower called the stamen.

The point of contact between the male and female parts of a flower is incredibly important if the plant is going to have babies. And seeds are plant babies. The stigma is the part of the pistil that has to have contact with the plant sperm or pollen.

It has to contact the pollen in order for the flower to make a seed. In pollination, pollen from the stamen contacts the stigma. The pollen travels down the pistil to the ovule. The ovule is fertilized. And a seed is produced.

Take a look at this clay flower model of a lily. Here's the stamen. The filament holds up the anther where the pollen is. The pistil is three parts-- the stigma, style, and ovary. And here are the petals, which our eyes are drawn to when we see a flower. Outside the petals are the sepals. Holding it all together is the receptacle. Now, take a look at a real lily or other flower.

Does your flower include all the parts needed for flower pollination? Or if your flower is complete, is there any way the flower could be changed or rearranged? Now, add any flower parts that might have been missing. Use the labelled flower diagram to guide your design.

Welcome back. Did your flower model include all the different parts needed for pollination? Remember that the stamen, the male part of the flower, has to contact the stigma, the female part of the flower, in order for pollination to be successful. In addition to that, the position of the flowers, the environment or circumstances that around the flowers, can also impact how or if pollination will happen. Pollination occurs in four ways-- with self-pollination, animal contact, wind, and water.

A flower can pollinate itself. The pollen can drop from one flower to the next on the same plant using gravity to accomplish pollination. The pollen can also drop from the anther, or stamen, to the stigma on the same flower.

With male and female parts on the same plant, this is a very convenient way for the plants to pollinate itself as an adaptation for finding a mate. Peas, soybeans, and potatoes are examples of plants that self-pollinate. The flowers on these humble vegetables share this skill with the more glamorous orchids, passion flowers, and sunflowers.

Flowers can be pollinated by animals. Many flowers contain sweet nectar inside their petals or have a fragrance, which attracts insects, birds and even bats. The hungry animals sip the nectar. But they're fuzzy, feathery, furry, or hairy bodies brush against the flower's pollen.

The pollen is attached. And then it touches the female stigma on another flower. The animal becomes the accidental matchmaker for two or more plants as the flowers pollinate it to produce seeds for the next generation.

Animals that pollinate flowers include bees, beetles, wasps, moths, and butterflies. Sometimes parents will use the expression the birds and bees as a euphemism to teaching their children about reproduction. But it's actually the birds and bees that serve as pollinators for flowers. Other unusual animal pollinators include

bats, lemurs of Madagascar, and honey possums of Australia. Scientists are even doing field studies to learn if giraffes are pollinators for the acacia tree.

Another way a flower can be pollinated is by the wind. Wind-pollinated plants are usually duller to look at because they do not invest in resources that attract pollinating organisms such as showy flowers, nectars, or scent. A breeze or gust of wind moves the pollen from one flower to another flower. Plants that rely on the wind for pollination generally have numerous flowers and release lots of pollen. This helps assure that the pollen will be more likely to land on another flower.

Many of the world's most important crop plants are wind-pollinated. These include wheat, rice, corn, rye, barley and oats. In water pollination, floating pollen contacts another flower to pollinate it. Aquatic plants such as pond weeds are pollinated this way. But only 2% of flowers are pollinated by this process of hydrophily, meaning water loving. The water acts as a form of transit for the pollen, bringing it to the next flower.

Flower inflorescences are the arrangement of flowers or a flower on the flower's stem, the peduncle. The flower inflorescences can be clustered and take a variety of poses and positions. How they are positioned may have to do with how they are pollinated. Scientists are studying how different inflorescences can support pollination by the way that the flowers branch, the relative size, and which ones open first.

The endpoint of pollination is a seed, which is a baby plant in its own protected package. And a seed can be planted. It can germinate and grow and then produce plants with flowers and seeds that will ensure survival for the next generation. The seed goes on to germinate, which is commonly called sprouting. And then a new plant grows.

In this activity, we're going to go beyond the flower models and take a look at some real flowers. There are eight flowers for you to look at. Which part of those flowers support pollination? How will pollination happen for those flowers? What type of pollination will occur?

The flowers that you examined during activity were so different, weren't they? You saw short petals, long stamens-- different sized leaves and stems. If you saw multiple peduncles, they're really called pedicels with little flowers coming off of each one. And how your flower was shaped or arranged has to do with the type of pollination that will occur best for that flower.

Remember, the pollen from one flower must get to the pistil, the female part of the flower for pollination. If the stamen and pistil are inside the flower's petals, it's most likely that these types of flowers are animal-pollinated. If the stamen and pistil are open, they're likely to be wind-pollinated, but can also be pollinated by animals for gravity.

Plants must find a way to make sure they can reproduce and survive. The plants that do this most effectively fit their environment, ensuring that their baby plants will have the same traits and survive. Plants, especially orchids, have evolved some pretty cool tricks to attract pollinators.

There's the bee orchid that tricks its pollinator, the bee, into thinking the orchid is its mate by producing a scent to mimic the female bees or two of the world stinkiest is plant's, *Rafflesia arnoldii* and *Amorphophallus titanum*, smell like stinky, dead bodies to attract the flies they need for pollination. And finally, *Phalaenopsis*, also known as the moth orchid, hangs its moth-like blooms from the tree branch.

When the wind blows, it flutters like a moth. And real moths fraternize with it, eventually collecting pollen packets and transferring them to other blooms. This tricky method of pollination is known as deceit pollination. Pollination is essential for many of the foods that we eat. Hives of honeybees are placed in orchards and farmland, pollinating apples, grapes blueberries and many more successfully.

The USDA estimates that one bite of three of the foods that we eat is reliant on pollination. And that up to \$15 billion is at stake for the food that we eat. Colony collapse disorder is a mysterious phenomenon in which the number of honey bees is greatly reduced. This, of course, can impact the number and type of crops that can be grown.

According to the Harvard School of Public Health, the reason this colony collapse is happening is because of pesticides. The negative part of pollination is the large amount of pollen that can be produced by plant's flowers. It can cause sneezing, congestion, and a lot of allergies. You may be suffering from pollination.

In the next activity, the teacher will be showing you some pictures. Look at them and see what the main object is in the picture.

What did you see in the pictures? Did you see a car, a building, or a person? If you did, you may have a condition called plant blindness. This is when people simply don't notice the plants that are around them.

Maybe you're zoo chauvinists where you may prefer animals over plants. The issue is you may see things without noticing them-- notably plants. When plants are in the same picture as another subject, it's often the plants that don't get noticed, even though they are seen. Botanists and scientists are alarmed that people can be plant blind. When people don't notice plants, they fail to realize their importance.

Here at the Wellesley College Botanic Garden and Greenhouses, there's no way not to see plants. The garden's evoke the plant's roles in beauty, nature, science, and food. You may be near another botanic garden-- a park, a forest, or a farm. Go visit and see the plants. Even plants growing in sidewalk cracks are worth seeing.

Although we've been talking about pollination, the real topic is survival. Without plants, there would be no humans. We couldn't survive. And without plants most of the organisms on Earth would not survive. For example, animals rely on plants for food. Or they rely on other animals that eat plants.

Think about a hamburger. The bun is made out of flour, which is made from wheat, a plant, which has little flowers called florets. The burger is from a cow, which eats grass and corn. Grass and corn are plants with flowers-- so no pollination, no plants, no hamburger. Flowers are biological tools that keep us alive.

Although the practical purpose of this lesson is for you to learn about flowers, the background purpose is for you to learn to appreciate plants and their role in flower, and nature, and beauty in human expression and everything that they represent all around us. The pollination of flowers is so important because it assures that plants reproduce. When pollination happens, a seed is made.

Growing the seed means more plants grow, providing us with food and beauty. Pollination is the process that assures that more plants are born. I hope you've enjoyed this lesson as much as I have enjoyed presenting it. Now I encourage you to do your own scientific investigation. Get some seeds, the products of pollination, and plant them in different soils, different environments, or however you see them. I think you'll be amazed at how a plant grows.

Thanks so much for tuning in and watching, and, hopefully, using my lesson on pollination. I chose this topic because there's so much to it. Students can be fascinated by flowers. They are really drawn into them. I think it's a good way to bring science to them in a macro way. You're not looking at cells very small. And this is very, very tangible for them.

The other part of this is that they remember because they do some of the science. They're building the models. They are looking at the real flowers. They're looking at pictures. Another piece of it is the literacy aspect because the vocabulary is so strange and wonderful the names of the inflorescences, the peduncle, the raceme, the spike, to get them speaking in the language of flower can be really rich.

It's interesting when you do this to just step back and listen to them talk. And they figure it out all by themselves. One thing you might consider doing is to have them draw the flowers when they have that opportunity and label them. That helps them to remember it and gets drawn into it even more.

It's helpful if the students have some background in biology. But where I am, there's not a lot of botany-- no plant science being taught in the biology curriculum. Here's a place where you could extend even further and get them planting some seeds, the products of pollination, to make that come alive.

Students get really excited about planting seeds. Many students have never planted a seed, ever. So it's a really, again, another exciting way to introduce them to plants and the reproduction of plants.

These here are seed bombs. And this is a potential project to follow up on this lesson with. These are soil worm castings-- clay powder-- mint-- and a number of seeds that pollinators will be attracted to. So there's recipes online. I'll get you the link. But you students can make these little balls you put them in an oven or leave them out to dry and then simply take them and toss them out into the ground where they dissolve and ultimately germinate and bloom and then pollinate.

So it's a great hands-on tool, a lot of fun, and a lot of potential for the future for having them see flowers grow. Thank you for using this lesson. I hope it goes well for you. Please let me know if there's anything that you changed or tweaked or found a better way of doing that. And leave your comments on the BLOSSOMS web page. I'd love to know if you did anything differently. And I hope to improve the lesson as I go along as well.

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