

GARFIELD PARK
CONSERVATORY
ALLIANCE 

POLLINATION

LESSON PLAN



The Birds and the Bees

TEACHER INFORMATION

Focus: Pollination and plant reproduction; intended for grades 6-8

Lesson Duration: 75 Minutes

Objective: SWBAT investigate how pollination works and how plants and pollinators rely on each other for survival.

NGSS Standards: MS-LS1-4, MS-LS1-5, MS-LS2-1, MS-LS2-2

Vocabulary: Anther, filament, stamen, pollen, stigma, style (pollen tube), carpel (pistil), egg, ovule, ovary, seed, fruit, co-evolution; Optional: petal, sepal, receptacle

Materials: Flowers (lilies work well), dissecting materials, plant diagrams, bacteria reproducing video, gallery walk materials, powdered doughnuts, paper towels

Advance Prep: Make sure copies are made, doughnuts are set up, gallery walk is prepared, flower dissection is ready (it might be helpful to dissect a flower on your own first)

TEACHER BACKGROUND

The flowers of angiosperms (flowering plants) contain both male and female anatomy with both male and female gametes. The stamen, which contains the anther and the filament, is the male anatomy. The pollen, which contains the sperm, is produced in the anther. The stigma, style (pollen tube), ovule, and ovary are all the female anatomy. The eggs are produced and contained in the ovule. When pollinators, such as bees, visit a flower for its nectar, the bees inadvertently brush up against the anthers of the flower, picking up pollen. When the bees then travel to a different flower for more nectar, they (also inadvertently) deposit that pollen onto the new flower—we can now say that this new flower has been pollinated. When the pollen is on the stigma, it will travel down the pollen tube into the ovule, where it can fertilize the eggs. Fertilized eggs become seeds. In order to protect the seeds, the ovary of the flower will become fleshy and meaty—this is what we know as fruit!

Birds, bees, butterflies, and flies are some of the world's most common pollinators. Pollinators are attracted to the flowers of a particular plant (usually through scent and/or attractive visual color). It is important to recognize that pollinators are not actually interested in pollinating plants—they are actually only interested in the flowers' nectar. Plants and their pollinators co-evolve; in other words, pollinators evolve better ways to access the nectar from the plant, while the plant evolves better ways of exposing its pollen to its pollinators.

ENGAGE – 5 MIN

- Show video of a bacteria reproducing. Have students describe what they notice and jot down differences between how the bacteria reproduce and how people reproduce. <https://www.youtube.com/watch?v=DY9DNWcqxl4> (start playing at 40s).
 - The bacteria in the video are reproducing asexually (1 parent, offspring are identical to parent), while people reproduce sexually (2 parents, offspring are genetically different from parent). Are plants more similar to bacteria or people in how they reproduce?

EXPLORE – 15 MIN

- What do you already know about how plants reproduce?
- The first crucial step for most plant reproduction is pollination.
 - Have students do the Donut Pollination activity.

EXPLAIN – 15 MIN

- After bees and insects inadvertently pick up pollen, when they fly to a different flower, what happens?
 - Show students a diagram of plant reproductive anatomy. Which parts do you think are male? Which parts do you think are female? Have students label their own diagrams.
 - Show students Flowering Plant Life Cycle Diagram
- Show pollination between 2 flowers: take the pollen from the anther of one flower and put it on the stigma of the other flower.
 - How do you think the sperm in the pollen can fertilize the egg, which is contained in the ovule?
 - When the pollen, which contains the male gametes (sperm) lands on the stigma, it travels down the pollen tube down to the ovule, where it fertilizes the female gametes (eggs). The fertilized egg(s) now becomes the seed(s) and the ovaries become the fruit—the fleshy meat protects the developing seeds! Dissect the flower and show students the path the pollen takes. Have students trace the path of the pollen and label where fertilization happens on their diagrams.
 - **Optional:** Have your students dissect flowers of their own!

EXTEND – 30 MIN

- How do pollinators know which flowers to go to? What strategies do flowers have to attract the most pollinators?
 - Flowers can be particular colors or give off particular scents to attract pollinators, or grow in a shape that fits with the pollinator (i.e. hibiscus and hummingbird)
 - Students will participate in the Plant-Pollinator Stories gallery walk, filling out the template as they go.

EVALUATE – 10 MIN

- How does pollination work? What happens after pollination?
- How does the pollinator benefit by pollination? How does the plant benefit?
- Students will complete exit ticket.

RESOURCES

Bacteria reproduction video (begin at 40s): <https://www.youtube.com/watch?v=DY9DNWcqxI4>

Doughnut Pollination Activity

Plant Parts Diagram

Flowering Plant Life Cycle Diagram: <https://www.filamentlearning.com/sites/all/themes/bootstrap/filament/img/reach-for-the-sun/curriculum/RFS-Lesson-3.png>

Plant-Pollinator Stories Gallery Walk

Exit Ticket

Supplement this lesson plan with a visit to the Garfield Park Conservatory, where you can learn about different pollination stories and see these plants firsthand, with the help of our amazing resources! Register your group at <https://garfieldconservatory.org/group-visits/school-field-trips/>.

Name:

Date:



Donut Pollination



Lab Activity:

In this activity, you will be a pollinator. Instead of pollinating flowers, you will be pollinating donuts!

Materials:

- 1 powdered donut
- 2 plates (1 for each donut)
- 1 plain donut

Directions:

Step 1: Make sure you have a powdered donut and a plain donut in front of you.

Step 2: Put your hands behind your back.

Step 3: Take a bite of your powdered donut without using your hands!

Step 4: Without wiping your mouth, take a bite of your plain donut...still don't use your hands!

Step 5: Look at your plain donut! What happened?

Questions:

1. What do you observe about your plain donut?

2. Let's compare this exercise to how actual pollination works with insects and flowers. Draw lines to match what happens in real pollination with what happened in this donut activity!

- | | |
|---|--|
| a. Pollen | e. You! |
| b. Pollinator | f. The powdered donut |
| c. The first flower visited by the pollinator | g. The plain donut |
| d. The second flower visited by the pollinator | h. The powder from the powdered donut |

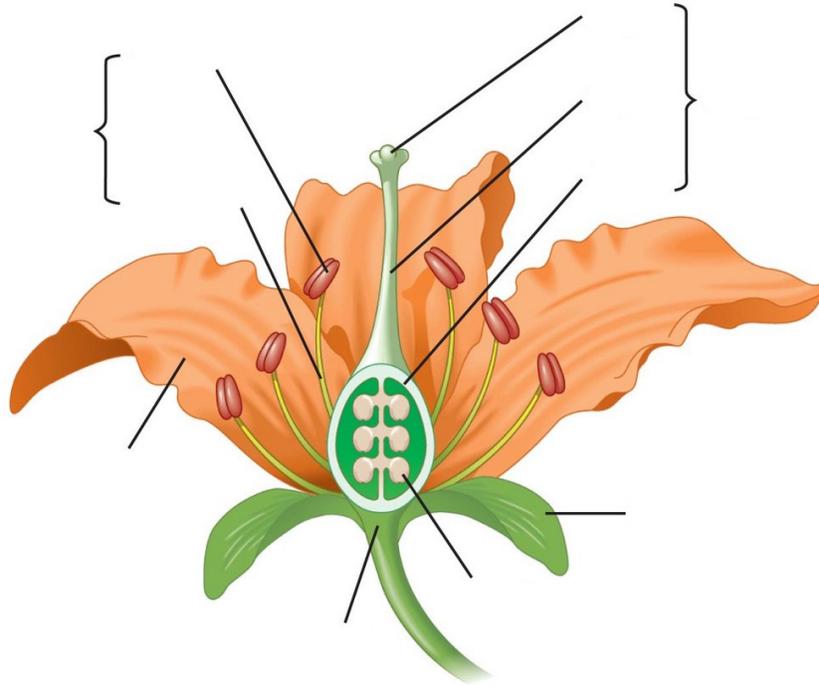
3. Why do pollinators visit flowers? (Hint: it is not so that they can pick up pollen to spread around to other flowers!)

Name: _____

Date: _____

Parts of a Flower

Label the diagram below and then write down what happens in each plant part!



Stamen: _____

Anther: _____

Filament: _____

Carpel (Pistil): _____

Stigma: _____

Style (Pollen Tube): _____

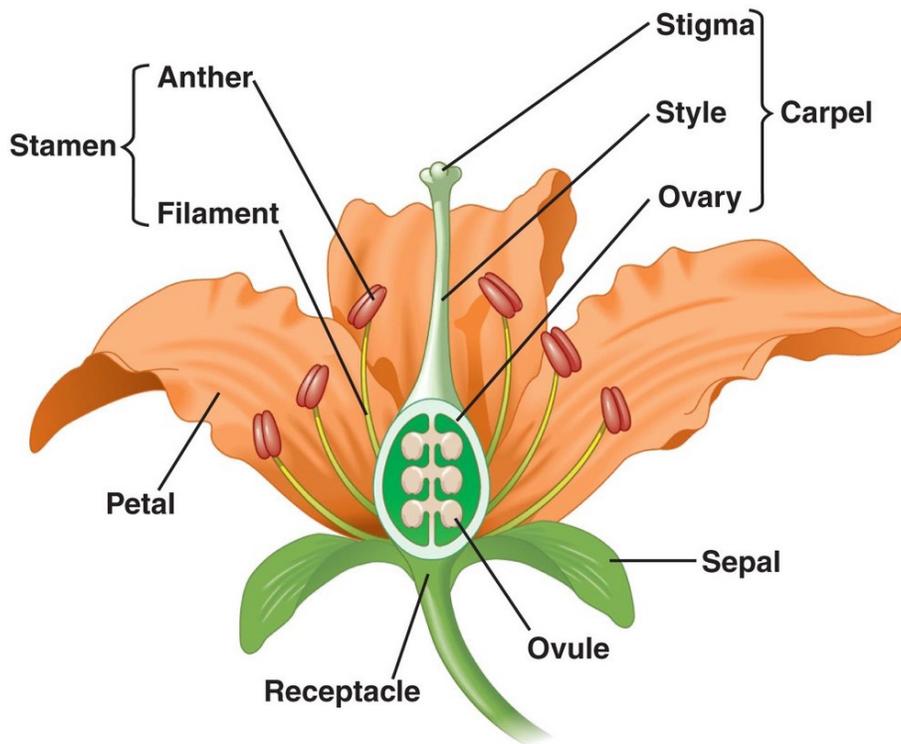
Ovary: _____

Petal: _____

Sepal: _____

Receptacle: _____

Teacher Key



Stamen: the male reproductive organ of a flower, consists of the anther and the filament

Anther: where the pollen is produced

Filament: supports the anther, holds up the anther

Carpel (pistil): the female reproductive organ of a flower, consists of the stigma, style, ovary, and ovules

Stigma: where the pollen lands

Style (pollen tube): connects the stigma to the ovary, how pollen travels from the stigma to the ovary

Ovary: where fertilization happens

Ovule: the part of the ovary where the eggs are; when eggs are fertilized, the ovule becomes the seed

Petal: the part of the flower that often attracts pollinators with its bright color(s)

Sepal: a leaf-like part of the flower that protects a new flower bud

Receptacle: a part of the plant from which all flower parts grow

Vanilla Vine



The *Melipona* bee is the only pollinator of the vanilla vine. *Melipona* bees live in Mexico near vanilla vines so they can be close by to get vanilla flower nectar. The plant's flowers only bloom for one day—since the *Melipona* bee lives close to vanilla, the plant “knows” the bee will be there to pollinate its flowers! When humans first tried to grow vanilla outside of Mexico, they did not succeed because there were no *Melipona* bees to pollinate the flowers. The only way to pollinate the vanilla vine outside of Mexico is by hand. This is a very delicate process that takes a lot of work, which is why vanilla is so expensive at the grocery store!

Chocolate Tree



The midge is the pollinator of the chocolate tree. This very tiny insect (nicknamed "no-see-um") is the only insect that has evolved to reach the nectar inside the complex, small chocolate tree flowers. Furthermore, they are most active at dusk and dawn, which is exactly when the flowers of the chocolate tree are in bloom. Finally, the flowers on the chocolate tree grow directly on the trunk of the tree so that the midges, which mostly live on the ground, do not have to travel as far to pollinate the flowers.

Hanging Lobster Claw



The lobster claw is a sneaky plant! It does not constantly produce nectar for pollinators. Instead, it only makes pollen at certain times for hummingbirds, the pollinator. Once a hummingbird drinks nectar from one hanging lobster claw, it will guard that plant from other hummingbirds while it waits for the plant to produce more nectar. These hummingbirds are extremely territorial, but the hummingbird's reliance on the plant's nectar ensures that the hanging lobster claw will be pollinated.

Gardenia



The gardenia's flowers are extremely fragrant, which serves to attract its main pollinator: moths. In fact, the gardenia smells even sweeter at night, which is when moths are the most active! The flowers are also a bright white color, which is attractive to moths. Additionally, moths are the perfect size for the gardenia's leaves, making it easy for moths to land on the plant to drink nectar.

Calabash Tree



The flowers of the calabash tree only bloom at night. They do this because bats, which are nocturnal, are the primary pollinators of the calabash tree! The flowers are cup-shaped, which is a good shape for the bats; if the flowers were long and tubular, the bats would not be able to reach the nectar. Finally, the calabash flowers emit a stinky smell...fortunately, bats are attracted to that stench!

Name:

Date:

Plant Pollinator Stories

We know that pollinators help plants by spreading plant pollen from one plant to another. We also know that plants help pollinators by giving them nectar to drink! Plants and pollinators have adapted, or co-evolved, to make the most of this partnership. Learn about some examples of this by completing your gallery walk! Take notes in the table below. Then, come to the Garfield Park Conservatory so you can see these plants for yourself!

Plant	Pollinator	What does the plant do to make sure it gets pollinated by its pollinator (shape, color, smell, or something else)?	How has the pollinator adapted to make sure it gets enough nectar (i.e. visits flowers at a certain time, has a body part that is shaped in a particular way)?

Which plant-pollinator relationship do you think is most interesting? Why?

Name:

Date:

Exit Ticket

Questions:

1. How does pollination work and what happens next? Order the statements below:

- ___ The pollen from the first flower falls off the pollinator onto the stigma of the second flower.
- ___ A pollinator goes to drink nectar at a flower.
- ___ The pollinator goes to drink nectar from a different flower.
- ___ The pollen fertilizes the eggs in the ovules.
- ___ New seeds can grow!
- ___ Pollen sticks to the pollinator as it is drinking nectar.
- ___ The pollen travels from the stigma down the style (pollen tube) to the ovules, which are in the ovary.

2. Explain the following statement using an example: Pollination is helpful for both the plant and the pollinator.
