

Flight of the Pollinators

Description

Students learn about the process of pollination, the variety of pollinators involved, and the way both plants and pollinators benefit from the system of pollination. Then, students develop a simple model that mimics a pollinator and use it to demonstrate plant pollination.

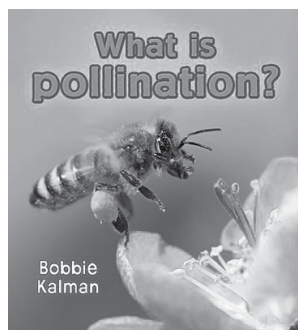
Suggested Grade Levels: K–2

LESSON OBJECTIVES Connecting to the Framework		
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Obtaining, Evaluating, and Communicating Information	LS2.A: Interdependent Relationships in Ecosystems ETS1.B: Developing Possible Solutions	Structure and Function Systems and System Models

Featured Picture Books



TITLE: *Flowers Are Calling*
AUTHOR: Rita Gray
ILLUSTRATOR: Kenard Pak
PUBLISHER: HMH Books for Young Readers
YEAR: 2015
GENRE: Narrative Information
SUMMARY: Beautiful artwork and poetry come together to introduce children to the wonders of pollination and the variety of pollinators.



TITLE: *What Is Pollination?*
AUTHOR: Bobbie Kalman
PUBLISHER: Crabtree
YEAR: 2011
GENRE: Non-Narrative Information
SUMMARY: Photographs, diagrams, and straightforward text introduce a variety of pollinators and explain the importance of pollination for both the plants and the pollinators.

Time Needed

This lesson will take several class periods. Suggested scheduling is as follows:

Day 1: Engage with *Flowers Are Calling* Read-Aloud and **Explore** with Look at a Flower—What Do You See?

Day 2: Explain with *What Is Pollination?* Read-Aloud

Day 3: Elaborate with Pollinator Model Design Challenge

Day 4: Evaluate with Pollination Presentations

Materials

For Look at a Flower—What Do You See? (per student or pair)

- Flower (Check with a local florist to get flowers he or she is ready to discard. A diverse selection is recommended so that students can see and smell a variety of flowers. Lilies, irises, daffodils, alstroemeria, tulips, or others with obvious pistils and stamens are best for this activity. Make sure that the flowers are mature so that the pistils and stamens are visible.)
- Hand lens
- Cotton swab
- Piece of clear tape

For Pollinator Model Design Challenge (per student)

- 1 acrylic glove (Magic brand works well)
- 5 Velcro dots (3/8 in. or 0.9 cm; just hooks, not loops)
- 5 multicolor acrylic pom-poms (0.19 in. or 5.0 mm size)
- 2 small paper cups
- A variety of supplies to build and decorate models, such as construction paper, pipe cleaners, googly eyes, coffee filters, scissors, tape, and glue

Student Pages

- Look at a Flower—What Do You See?
- What Is Pollination?
- Pollinator Model Design Challenge
- 4-3-2-1 Pollination Presentation Rubric
- STEM at Home

Background for Teachers

The Natural Resources Conservation Service estimates that 75% of the world's plants and about 35% of the world's crops depend on animals for pollination (NRCS 2016). Some scientists estimate that animal pollinators are responsible for one in every three bites of food we eat! *Pollination* is critical to the sexual reproduction of flowering plants. Most flowers have male and female parts. The *stamen* (male part) makes a powder called *pollen*. The *pistil* (female part) must receive pollen to make seeds. The pistil

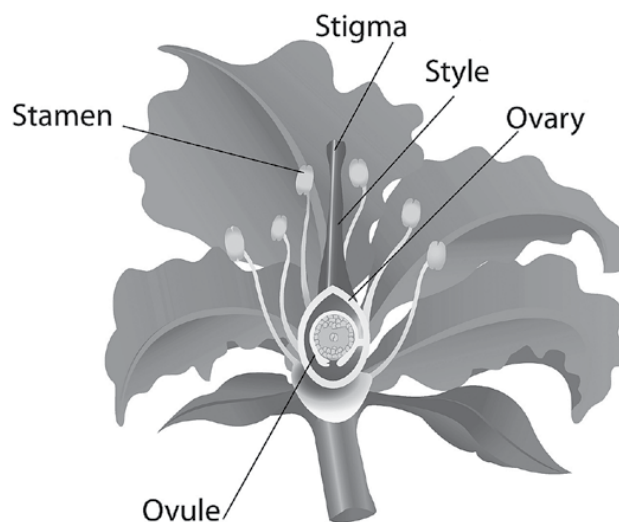
has three parts: the *stigma*, *style*, and *ovary*. When pollen from a stamen reaches a stigma, the flower has been *pollinated*. The pollen travels down the style to the ovary. Inside the ovary are *ovules*. After pollination, the flower's petals fall off, the ovaries become fruit, and the ovules become seeds.

There are different ways flowering plants are pollinated. Some flowers can *self-pollinate*, which means pollen from the stamen moves to the pistil of the same flower. Flowers that self-pollinate have male and female parts close together. Sunflowers are an example of a flower that can self-pollinate. *Wind pollination* occurs when the wind carries pollen from one flower to another. Flowers that are pollinated by the wind produce large amounts of tiny pollen grains, and much of the pollen does not make it to another flower. Wind-pollinated flowers are usually not fragrant and do not produce nectar, because they do not need to attract pollinators. Many trees and grasses are pollinated

by wind. *Cross-pollination* occurs when an animal moves pollen from one flower to another flower of the same species. Animals that move the pollen, such as insects, birds, and bats, are called *pollinators*. Pollinators visit flowers to find food. Many of them eat the nectar produced by flowers, and some pollinators, such as bees, even eat the pollen. In their quest for nectar, these animals get pollen stuck on their bodies. When the animals visit other flowers of the same species, some of the pollen falls off. Thus, the animals unknowingly become pollinators.

Scientists have discovered that many pollinators are in danger. Strong evidence shows a decline in both the numbers and the diversity of some pollinators, including bees, butterflies, bats, and hummingbirds. Pesticides, disease, habitat loss, invasive plants, and climate change are thought to be the primary reasons these vital organisms are disappearing. One of the most important pollinators, the honeybee, is experiencing colony collapse disorder (CCD). CCD is a syndrome characterized by a nearly abandoned colony that includes dead bee bodies and lacks adult worker bees but still has a live queen and, usually, immature bees and honey. No cause for CCD has been scientifically proven, but some evidence points to a combination of factors, including parasitic mites and the overuse of a certain type of pesticide.

Pollination is a key concept in understanding the interdependent relationships in ecosystems. In this lesson, students learn that plants depend on animals for pollination. This understanding is crucial to comprehending the impact of pollinators on our ecosystems. Students create a model to demonstrate their understanding of the process of pollination and the structures and functions of plants and animals that are part of the pollination system.



FLOWER DIAGRAM

engage

Flowers Are Calling Read-Aloud

Connecting to the Common Core

Reading: Informational Text

CRAFT AND STRUCTURE: K.5, 1.5, 2.5



Inferring

Show students the cover of *Flowers Are Calling* and introduce the author, Rita Gray, and the illustrator, Kenard Pak. *Ask*

- ? What do you think the title *Flowers Are Calling* means? Whom or what do you think the flowers are calling? (Answers will vary.)
- ? Do you notice any animals on the cover? (Students will likely notice the bee, butterfly, and hummingbird on the cover.)
- ? What do you notice about the colors and shapes of the flowers on the cover? (The flowers are different colors and shapes.)
- ? Why do you think flowers are different colors and shapes? (Answers will vary.)



Synthesizing

Tell students that, as you read, you would like them think about what the title *Flowers Are Calling* means. Read the book aloud, stopping after the page that says, “They’re calling some children to look again.” Then, *ask*

- ? Have your ideas changed about what the title *Flowers Are Calling* means? (Students should realize that the flowers are attracting different animals in different ways.)
- ? What animals were the flowers “calling” in the book? (butterfly, bumblebee, hummingbird, honeybee, beetle, bee fly, pollen wasp, moth, and bat)



OBSERVING FLOWER STRUCTURES IN OUR CLASSROOM

- ? What do all of these animals have in common? (They all fly, they are attracted to flowers, they eat nectar, etc.)
- ? Have you ever seen any of the animals in the book in the wild? (Answers will vary.)
- ? Why do animals visit flowers? (Animals eat the flowers’ nectar.)
- ? Why would flowers need to attract animals? (Answers will vary.)

explore

Look at a Flower—What Do You See?

Connecting to the Common Core

Reading: Informational Text

INTEGRATION OF KNOWLEDGE AND IDEAS: K.7, 1.7, 2.7



OBSERVING FLOWER STRUCTURES IN OUR SCHOOL-YARD



COLLECTING POLLEN

Give each student or pair of students a flower, a hand lens, and the Look at a Flower—What Do You See? student page. Have students draw a detailed sketch of the flower. (Students do not necessarily need to know the vocabulary associated with the different flower parts at this time.) Turn to pages 28–30, which are titled “Look at a Flower—What Do You See?” As you read the sections aloud, have students listen for what each characteristic has to do with “calling” animals to visit the flower. Point out the illustrations that accompany each section, and explain that the illustrator provided this art to help the reader better understand each characteristic. After reading each section, have students observe the colors, patterns, shape, and smell of their own flowers and fill in their observations in the table. (*Note:* Time of opening is not on the student page because that characteristic cannot be observed during class time. However, read the paragraph and discuss so that students know that time of open-

ing is also an important factor in attracting certain animals.) Later, you may want to take students outside to observe flower structures on flowering plants found in your school-yard. In this way, they can compare how the same flower structures may look different on different plants.

Tell students that the reason that the flowers were “calling” to the animals has to do with a special powdery substance inside of the flower. Tell students to look carefully to find the powder. When they find it, they should rub some off with a cotton swab and smear it in the box on the paper. Then, have students place a piece of clear tape over the powder to hold it in place. Tell students that, in the next part of the lesson, they will find out what this mysterious powder is and why it is so important. (Some students may know that the powder is called *pollen*, but assure them that there is much to learn about why it is there and what it does.)

explain

What Is Pollination? Read-Aloud

Connecting to the Common Core Language

VOCABULARY ACQUISITION AND USE: K.6, 1.6, 2.6



Cloze

Show students the cover of *What Is Pollination?* by Bobbie Kalman. Tell them this book can help them discover what that mysterious powder is and what it has to do with the flowers and the animals in *Flowers Are Calling*. Give students the What Is Pollination? student page. Directions for students are as follows:

1. Cut out the cards in the boxes.
2. Read the cloze paragraph, and fill in each blank with the card you think belongs there.
3. Listen carefully while your teacher reads the book *What Is Pollination?*
4. After reviewing the paragraph as a class, move the cards if necessary. Then, glue or tape them on the page.
5. On the back, draw a picture of what *pollination* means.

The paragraph should read as follows:

pollen is the fine powder at the center of most flowers. When it moves from one flower to another flower of the same kind, **pollination** takes place. Flowers must be pollinated to make **fruits** and **seeds**. Animals that carry pollen from one flower to another are called **pollinators**. They are not pollinating flowers on purpose. Most animals visit flowers because they are looking for **nectar**!

Connecting to the Common Core Reading: Informational Text

CRAFT AND STRUCTURE: K.5, 1.5, 2.5



Questioning

Ask

- ? Do pollinators *know* that they are helping the plants? (no)
- ? Why do pollinators visit flowers? (to get nectar or food for themselves)
- ? How do both the plants and pollinators benefit from pollination? (The plants get their pollen moved to other flowers, which allows them to make new plants, and the pollinators get food.)

Explain that pollinators and plants work together as a system. Systems in the natural world have parts that work together. For example, on page 11 of *What Is Pollination?*, students can see how the shape of a hummingbird's beak works with the shape of tubular flowers. On page 17, they can see how the furry body of a bumblebee works to carry sticky pollen produced by the plant.

On page 31, the author writes, "Each time you bite into an apple, pear, or vegetable, say a silent 'Thank you' to the pollinators that made it possible."

- ? Why should we thank pollinators? (If plants were not pollinated, fruits and vegetables would not grow.)
- ? Why are pollinators in danger? (People are building in wilderness areas, which causes animals, including pollinators, to lose their homes and food. Pesticides and diseases are killing many pollinating insects.)
- ? What can we do to help pollinators? (Tell people why pollinators are important. Grow native flowers at home or school. Plant a vegetable or other garden.)

elaborate

Pollinator Model Design Challenge

Tell students that you have a challenge for each of them—to design and build a model that helps demonstrate how pollinators move pollen from one place to another. They will be using the following materials to build their models:

- 5 small pom-poms to represent pollen (0.19 in. or 5 mm size)
- 2 small paper cups to represent two of the same type of flower
- 1 acrylic glove on which they can tape or glue the following materials to make their models (see photo):
 - 5 small Velcro dots to represent the structures on the pollinator that pollen sticks to
 - Other materials to add more structures and details to their model: construction paper, pipe cleaners, googly eyes, coffee filters, tape, and glue

Their models will need to transfer pom-poms (pollen) from one cup (flower) to the other cup (flower). They may decorate the cups (e.g., add petals) if they would like to make them look more like flowers.

Tell students that before they begin, you want to give them the opportunity to see some pollinators in action. Explain that you have a clip from a movie called *Wings of Life* that a filmmaker named Louis Schwartzberg made to teach people about pollination. Tell them that as they watch, you would like them to look for different types of pollinators, observe their different body parts, and watch how the pollinators interact with flowers. Show students the 4 min. clip from *Wings of Life* (see “Websites” section).



MODEL OF A POLLINATOR

Connecting to the Common Core Reading: Informational Text

KEY IDEAS AND DETAILS: K.1, 1.1, 2.1



Questioning

After watching the video, *ask*

- ? What pollinators were featured in the video? (hummingbirds, bees, butterflies, and bats)
- ? How did they get from flower to flower? (by flying)
- ? Why were these animals visiting the flowers? (to get nectar)
- ? What body parts help them get to the nectar (Wings help them fly to the flowers, hummingbirds' long beaks can go deep inside flowers, bats and butterflies have long tongues to slurp nectar, bees' bodies are small enough to go inside many flowers, etc.)

Then, give each student the Pollinator Model Design Challenge student page. Some suggestions for pollinators to model are a bee, wasp, butterfly, moth, fly, beetle, hummingbird, or bat. Have each student choose a pollinator to model and record it

on the paper, find a photograph of that pollinator online, print it out, and attach it to the page. (See “Websites” section for suggested pollinator photo galleries.) The photos will be used for reference as students make their models.

Next, they will describe how the real pollinator gets food from the flower and how the model pollinator will show this. They will also describe the parts of the real pollinator’s body that the pollen sticks to and how the model pollinator will show this. Finally, they will explain how both plants and pollinators benefit from their interaction and how humans benefit from pollination. Students will use the photo and this information to help them design and build their models.

evaluate

Pollination Presentations

Connecting to the Common Core Speaking and Listening

PRESENTATION OF KNOWLEDGE AND IDEAS: K.4, 1.4, 2.4



Synthesizing

After students have completed their models, pass out the 4-3-2-1 Pollination Presentation Rubric. Students should use the information from the Pollinator Model Design Challenge student page to help them with their presentations. You may consider having students present their models to an outside audience, such as a local park official or nature expert.

After giving students sufficient time to practice, you can have them take turns giving their presentations live or have them record videos of

their presentations. They must include the following information:

- A demonstration of how the pollinator moves pollen from one flower to another
- A description of the body parts that the pollinator uses to get food from the flower and the body parts that the pollen sticks to
- An explanation of how both plants and pollinators benefit from pollination
- An explanation of how humans benefit from pollination

They can also share what they might do to improve their models. Use the rubric to evaluate their presentations.

STEM at Home

Have students complete the “I learned that ...” and “My favorite part of the lesson was ...” portions of the STEM at Home student page as a reflection on their learning. They may choose to do the following at-home activity with an adult helper and share their results with the class. If students do not have access to the internet or these materials at home, you may choose to have them complete this activity at school.

“At home, we can watch a video together called ‘RoboBees to the Rescue’ about how **roboticists**, or engineers who design robots, at Harvard University are designing a robotic bee to pollinate plants.”



Search “RoboBees to the Rescue” on pbslearningmedia.org to find the video at www.pbslearningmedia.org/resource/arct14.sci.nvrobee/robobees-to-the-rescue.

“After we watch the video, we can design our own robot that is based on a different pollinator, such as a butterfly, hummingbird, beetle, moth, or bat.”

For Further Exploration

This section is provided to help you encourage your students to use the science and engineering practices in a more student-directed format. This box lists questions and challenges related to the lesson that students may select to research, investigate, or innovate. Students may also use the questions as examples to help them generate their own questions. After selecting one of the questions in the box or formulating their own questions, students can individually or collaboratively make predictions, design investigations or surveys to test their predictions, collect evidence, devise explanations, design solutions, or examine related resources. They can communicate their findings through a science notebook, at a poster session or gallery walk, or by producing a media project.

Research

Have students brainstorm researchable questions:

- ? What kinds of plants would attract pollinators to your yard or school-yard?
- ? Which crops in our area depend on pollinators?
- ? Which pollinators are in danger, and what can we do to help?

Investigate

Have students brainstorm testable questions to be solved through science or math:

- ? What are some common pollinators that visit our school-yard?
- ? How many of the foods that I eat in a day require animal pollinators? (Keep a tally of how many times you eat vegetables, fruits, or nuts—or foods made using those products—in a day.)
- ? Which plants seem to attract the most pollinators in our school-yard?

Innovate

Have students brainstorm problems to be solved through engineering:

- ? Can we build a feeder to attract hummingbirds to our school-yard?
- ? Can we design a flower garden (either on a plot of land or in pots) to attract butterflies?
- ? Can we design a vegetable garden (either on a plot of land or in pots) to help pollinators?

Reference

NRCS (Natural Resources Conservation Service). 2016. Insects and pollinators. U.S. Department of Agriculture. www.nrcs.usda.gov/wps/portal/nrcs/main/national/plantsanimals/pollinate.

Websites

National Geographic “Gold Dusters” Pollinator Photo Gallery
<http://ngm.nationalgeographic.com/2011/03/pollinators/moffett-photography>

Penn State University Entomology Department:
Pollinator Image Gallery

<http://ento.psu.edu/pollinators/image-galleries>

U.S. Department of Agriculture: “Be a Friend to Pollinators” (brochure)

www.nrcs.usda.gov/wps/portal/nrcs/detail/national/plantsanimals/pollinate/?cid=stelprdb1142431

Wings of Life (Video Clip: The Beauty of Pollination)

<http://video.disney.com/watch/the-beauty-of-pollination-wings-of-life-4da84833e06fd54fff590f49>

More Books to Read

Bersani, S. 2015. *Achoo! Why pollen counts*. Mount Pleasant, SC: Arbordale Publishing.

Summary: A cute storyline about a baby black bear that is allergic to pollen not only teaches readers about pollen allergies but also explains how vital this fine powder is to the animals and plants in the forest.

Konicek-Moran, R., and K. Konicek-Moran. 2016. *From flower to fruit*. Arlington, VA: NSTA Press.

Summary: Rich illustrations and an engaging narrative draw the reader into the world of botany. The book introduces the parts of a flower, the process of pollination, and the production of fruit. It includes activities and background information for parents and teachers.

Rich, S. 2014. *Mrs. Carter's butterfly garden*. Arlington, VA: NSTA Press.

Summary: In this story of how former First Lady Rosalynn Carter started a front-yard project that grew into a butterfly-friendly trail through her hometown of Plains, Georgia, students will learn why having welcoming spaces for butterflies is good for people and how to create their own butterfly gardens at home or school.

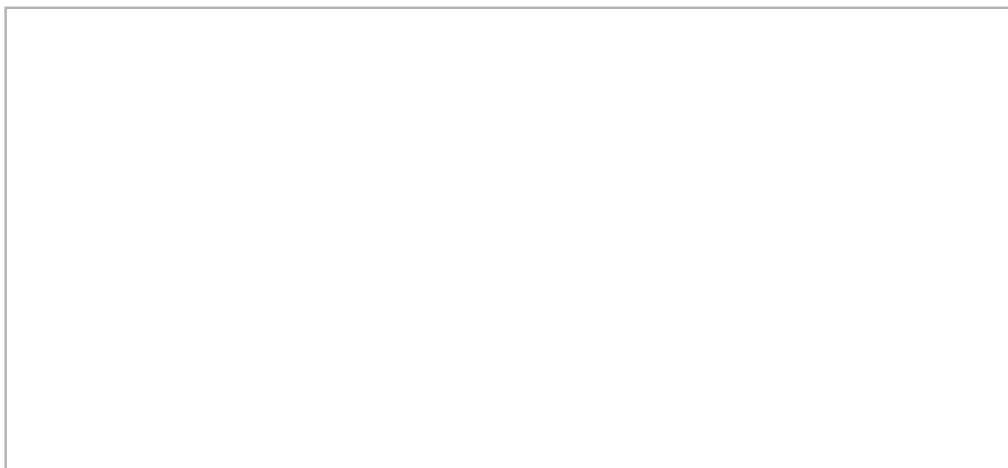
Slade, S. 2011. *What if there were no bees? A book about the grassland ecosystem*. North Mankato, MN: Picture Window Books.

Summary: Part of the *Food Chain Reactions* series, this book highlights the importance of bees to the ecosystem. By addressing the question "What if there were no bees?," the reader learns these insects are a keystone species because many other species would likely become extinct without them.

Name: _____

Look at a Flower— What Do You See?

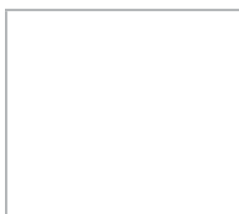
1. Observe the flower carefully. Draw a picture that shows its shape, colors, patterns, and parts.



2. Listen as your teacher reads about each characteristic of a flower, then record the observations for your flower.

Characteristic	Observation
Color	
Pattern	
Shape	
Smell	

3. Look for the powdery substance in the center of your flower. Use a cotton swab to smear some in the box below and tape it in place.



Name: _____

What Is Pollination?

_____ is the fine powder at the center of most flowers. When it moves from one flower to another flower of the same kind, _____ takes place. Flowers must be pollinated to make _____ and _____. Animals that carry pollen from one flower to another are called _____. They are not pollinating flowers on purpose. Most animals visit flowers because they are looking for _____!

Directions: Cut out the cards below and place them in the paragraph above. Then, listen as your teacher reads the book *What Is Pollination?*

fruits	pollen	nectar
pollination	seeds	pollinators

Name: _____

Pollinator Model Design Challenge

Challenge: Design a model of a pollinator that can be used to demonstrate how it moves pollen from one flower to another while getting food.

Directions: Choose a real pollinator as an inspiration for your model. Then, design your model using the materials provided.

Real Pollinator	Model Pollinator
Name and photo	Labeled sketch
How does the pollinator get food from the flower?	How will your model show this?
What parts of the pollinator's body does the pollen stick to?	How will your model show this?

1. How do both plants and pollinators benefit from pollination?

Plants get _____

Pollinators get _____

2. How do humans benefit from pollination?

Name: _____

4~3~2~1

Pollination Presentation Rubric

Demonstrate the model of a pollinator that you designed. Your presentation should include the following:

4 Points: A demonstration of how your model pollinator moves pollen from one flower to another

4 3 2 1 0

3 Points: A description of the body parts that your model pollinator uses to get food from the flower and the body parts that the pollen sticks to

3 2 1 0

2 Points: An explanation of how both plants and pollinators benefit from pollination

2 1 0

1 Point: An explanation of how humans benefit from pollination

1 0

Score: _____/10

Name: _____

STEM at Home

Dear _____,

At school, we have been learning about **pollinators**, or animals that move pollen from one flower to another.

I learned that: _____

My favorite part of the lesson was: _____

At home, we can watch a video together called “RoboBees to the Rescue” about how **roboticists**, or engineers who design robots, at Harvard University are designing a robotic bee to pollinate plants.



Search “RoboBees to the Rescue” on ***pbslearningmedia.org*** to find the video at ***www.pbslearningmedia.org/resource/arct14.sci.nvroabee/robobees-to-the-rescue***.

After we watch the video, we can design our own robot that is based on a different pollinator, such as a butterfly, hummingbird, beetle, moth, or bat.

Sketch of Real Pollinator	Sketch of Robot Pollinator