

POLLEN NATION LESSON

DRIVING QUESTION: HOW DOES POLLEN WORK?

Recommended Grades: K – 6; Adaptations for 7 – 12.

<i>Classroom or Center Activities</i>	<i>Outside or Larger Space Activities</i>	<i>Technology-Based Activities</i>	<i>Stem-to-Go Take Home</i>	<i>Field Work and/or Natural Area Needed</i>
X	X	X	X	X

Materials: Fresh flowers, roses or Alstroemerea “Peruvian lilies”, scissors, tissue, dropping pipet, five small and three medium pompoms, 1 pipe cleaner cut into three sections, 1 square of medical gauze, four small beads, two googly eyes, a small piece of yarn, string, or piece of pipe cleaner, glue gun or tacky glue, buttons, cupcake liners, corn starch, corn meal, water, plastic condiment containers, water, paper towels. (Optional) glitter,

Participant activity: 30 minutes for each activity for approximately a total of 3.5 hours.

Objectives:

1. Identify parts of a simple flower.
2. Explain the symbiotic relationship between pollinators and plants.
3. Model the transfer of pollen by pollinators.
4. Analyze pollen count graphs to determine risk of allergy complications.
5. Explain the concepts of symbiosis and parasitism.
6. Observe patterns of flower use based on color and type of pollinator.

STEM Skills

- S:** Dissect a simple flower.
- T:** Evaluate textures for transferring materials.
- E:** Create a model of bee anatomy and pollination processes.
- M:** Analyze a graph to determine risk of “hay fever” allergy complications.

Teacher Tips: Pollen Nation

Plan ahead: To obtain flowers for dissection, grocery store floral departments may offer wilting flowers at a discount, especially after holiday dissection. Parents/grandparents with gardens may donate blooms. Alstroemerea “Peruvian Lilies” tend to last a long time. Note: Dandelions and clover will not work for this.

Total prep: < 15 minutes to make copies and assemble materials

Safety: For participants who may have bee allergies or pollen allergies, check with your program’s policies on allergies and epi-pens. To reduce the possibility of gluten allergies, we have used corn starch and corn meal to simulate pollen instead of flour. If hot glue guns are too risky, tacky glue may be substituted.

Sensory Integration Issues: For participants with fine motorskills challenges, simplify the craft by using a pompom as the bee. Roll a plain pompom in a cupcake liner containing cornstarch. Then dab the pompom into a cupcake liner with yellow cornmeal to simulate pollen transfer. The blending of the pollen demonstrates cross-pollination, or transfer of pollen from one flower to another.

Cost: Minimal, <\$2 per person.

What else do I need? Paper towels/rags.

Clean Up: Hands, equipment, and surfaces can be washed with soap and water.

POLLEN NATION LESSON

1. Print it out:
 - a. Print out the student sheets for the Parts 1 – 5: Flower dissection, Build a Bee, Make a Flower; Pollinatebee craft, flower craft, and graphing.
 - b. Print out STEM To-GO
2. Activate prior knowledge: Ask participants questions: what do you know about bees?
 - a. How many different kinds of bees are there? Go to this website link to find out how many are in NC.
<https://www.insectidentification.org/insects-by-type-and-region.asp?thisState=North+Carolina&thisType=Bee%2C+Ant%2C+Wasp+and+Similar>
 - b. Distribute the handout of a bee and identify the body parts.
 - c. Insects: 6 jointed legs, three body parts, two compound eyes, and three ocellus eyes to see in the dark, long tongue, 2 pairs of wings.
 - d. Many people are afraid of bees. To make bees less of a fear trigger, you can begin with the STEM TO-GO activity that has a grocery list of foods that rely on pollinators like bees. It could also be fun to select a snack based around a “Thank the Bees” theme for whatever food from the list that you try at snack.
<https://pollinator.org/list-of-pollinated-food>
3. Procedure:



- a. Flower Dissection: First, look at the top view of the flower. Compare the structures to the diagram. Using scissors, cut a cross-section through the flower as if you are opening it. Prompt participants to describe specifics. Can they locate the pistil in the center? How do the anthers compare with the pistil? What color is the pollen? What is the texture inside of the pistil? Is it sticky?
 - Here is the pollen
 - Here are 6 anthers, three mature and three smaller ones. The stamen is the tube supporting the anther
 - Petals
 - Note the shorter and plain pistil, with the stigma, style and ovary. Feel the sticky nectar.
 - Ovary and ovules
 - Sepal

- b. Build a Bee: Bees are insects, which means they have three pairs of jointed legs and three body parts: head, thorax, and abdomen, and two pairs of wings. Although most people have heard about honeybees, which live in organized groups called colonies, many species of bees are solitary. All bees sip nectar from

their proboscis, or tongue. Bees also eat the pollen that attaches to them as they move from plant to plant in search of nectar.



- i. Make the abdomen: Use the bulb part of the dropping pipet as the base to rest a large pom-pom as the abdomen. The front of the bee is the long narrow tube is the proboscis or tongue that the bee uses to sip nectar.



- ii. Make the legs: Cut one pipe cleaner into three sections. Bend them in half. Thread them through a pony bead. Place the pony bead in front of the abdomen, on the underside of the pipet and twist each pipe cleaner around the tube. Use a hot glue gun to secure the legs. Bend the pipe cleaners so there are three legs on each side of the pipet.



- iii. Make the thorax: Glue another pom-pom in front of the abdomen to be the thorax.



- iv. Make the wings: Take one piece of rectangular gauze and cut it into an X shape. Trim the edges to be rounded. Twist the gauze into an X shape so that there are two pairs of wings. Glue the center twist onto the thorax.



- v. Make the head: In front of the wings and abdomen, add the third pom-pom. Bees have five eyes. On the top of the head, glue three pony beads into a triangle shape, so that there is a pair of eyes and then one in the front of the pair. Each bead is an Ocellus, and these ocelli eyes are used to see in the dark and navigate the hive. On two googly eyes, one on each side of the head. These are the compound eyes that bees use to see in the daylight. Add the antennae. Take a small piece of thread, yarn, or a pipe cleaner and fold it into a V. Glue the point of the V right below the eyes. These are the Antennae. Trim the proboscis so that the bee's tongue is in proportion, about as long as the head and thorax.

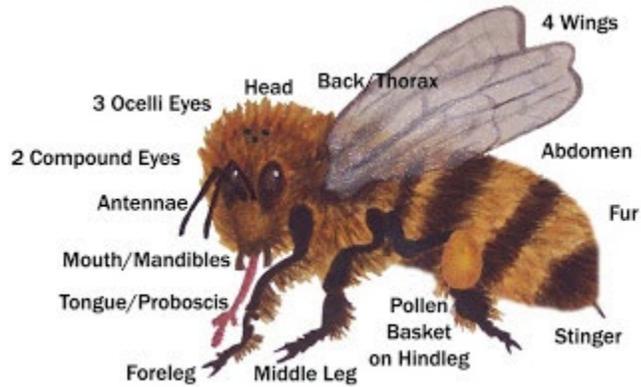


Image taken from: <http://bee-magic.blogspot.com/2010/06/parts-of-bee-body.html>

c. Make the flower



- i. Make a flower by using a plastic condiment container, a cupcake liner, a button, scissors, and small pompoms.
- ii. The outside clear plastic cup that protects the flower represents the sepal.
- iii. Trim and shape five or six petals into the sides of the cupcake liner.
- iv. Then cut a hole in the bottom of it just large enough to be covered up by a button. Glue the button on the center of the bottom of the flower. That is the Stigma.



- v. Roll three to five small pompoms into corn meal or corn starch. Glue these anthers to the inside of the "flower" around the stigma. Make sure that the pollen forms a heavy dust.



- vi. Add a small amount of water in the bottom of the condiment cup to represent the nectar. If you want to simulate parasitic trachea mites, add a fleck or two of glitter.
- vii. Float the cupcake liner in the water.

- d. Part 4 Pollinate: Use the dropping pipet to try to pull water through the opening in the button. This simulates the bee's proboscis sipping nectar from inside the pistil. If you have used the glitter to simulate trachea mites, how many of the bees have glitter inside them? Those bees may die from this parasite.



4. Data Collection:
 - a. How does the “fur” or setae of a bee help transfer pollen?
 - b. For flowers who cannot use wind for pollination, and who rely on help, what might happen if their pollinator becomes extinct?
5. Collaboration:
 - a. In the STEM To-Go, compile Pollinator Hike data to infer clues about pollinations. For instance bees are said to have preferences for certain colors, specifically blue and purple flowers. What does your data show?
 - b. In STEM To-Go, the Waggle Dance offers an opportunity for team work and non-verbal communication.
6. Data Analysis:
 - a. Which texture is easier for the bees to transfer, the finer grained corn starch or the coarser grained corn meal?
 - b. Which part of the bee transferred more pollen, the soft pompoms or the bristly legs?
 - c. Part 5 Graph your Sneezing Potential: Based on the Pollen Counts graphs, identify the dates on which allergy sufferers were most at risk from pollen in the air.
7. Extensions: Multiple Flowers: Instead of dissecting one type of flower, choose a variety of simple flowers. Can participants identify the structures in different types of flowers? Look for weeds along the edges of sidewalks, roads, and parking lots. Which ones are simple flowers? Which ones are compound? Dandelions, clovers, and marigolds will not work with our diagram, but tulips, lilies, and roses do. How does the dissection of a plant compare with the drawing of the plant parts? Do all flowers have the same number of petals? Of anthers?
8. Resources and adaptations
 - a. For K – 2: For the flower dissection, make sure participants know which way to cut vertically otherwise they may just cut the flower off the sepal. For the craft, either use a plain pompom or make a simplified version of a bee. Print the picture of the bee, use white glue to glue on pompoms on the body. Cut petals out on two cupcake liners. Place corn starch in one liner and corn meal in the other. Skip the water component. Prompt participants to press the pompom into one flower, then into the other flower. Note the pollen transfer. Part 5, the pollen count graph, is likely too intense. From STEM To-Go, The Waggle Dance likely would be a lot of fun, but participants might need a teacher to prompt taking turns for which participant finds a flower and which person dances. It might be helpful to draw a waggle dance pattern for students to trace and dance along.
 - b. For 3 – 5: This age group may need tacky glue instead of hot glue guns. Glue the pompoms to a popsicle stick instead of a dropping pipet. Allow time for the glue to dry. Skip the water component. Fill one cupcake liner with corn starch and a second cupcake liner with corn meal. Then dip the bees inside to transfer pollen from flower to flower.
 - c. For 6 – 8: Put a small amount of water in the bottom of the condiment container with a few flecks of glitter. The bee should slurp the nectar through the opening in the button, and may get a trachea mite, if the bee is not careful. Trachea mites eat the bees’ blood and block the bees’ airways, which makes it difficult for them to breathe and fly.
 - d. For 7 – 12: Make sure to look at the air quality pollen count graph. Another project is to review the types of bees and their host plants for NC. Provide assorted craft supplies to build a model of the bee and its host plant. A great bee matching game with full colored illustrations, ready to laminate, and NC specific!
http://ecoipm.org/wp-content/uploads/plans_bee_matching_game.pdf.

STUDENT HANDOUT: POLLEN NATION

DRIVING QUESTION: HOW DOES POLLEN WORK?

Flowers are the reproductive parts of plants that turn into fruits and seeds to grow new plants. Pollen is the powdery substance on the stamen, or male part of the plant, but pollen needs to get inside the pistil to reproduce. Pollinators carry sticky pollen dust from one plant to the next while they search for nectar and pollen. Without pollinators, we would not have fruits, like blueberries and apples. The picture on the left is the cross section or side view cut open. The picture on the right is the top view of the flower looking down inside it.

Part 1: Flower Dissection

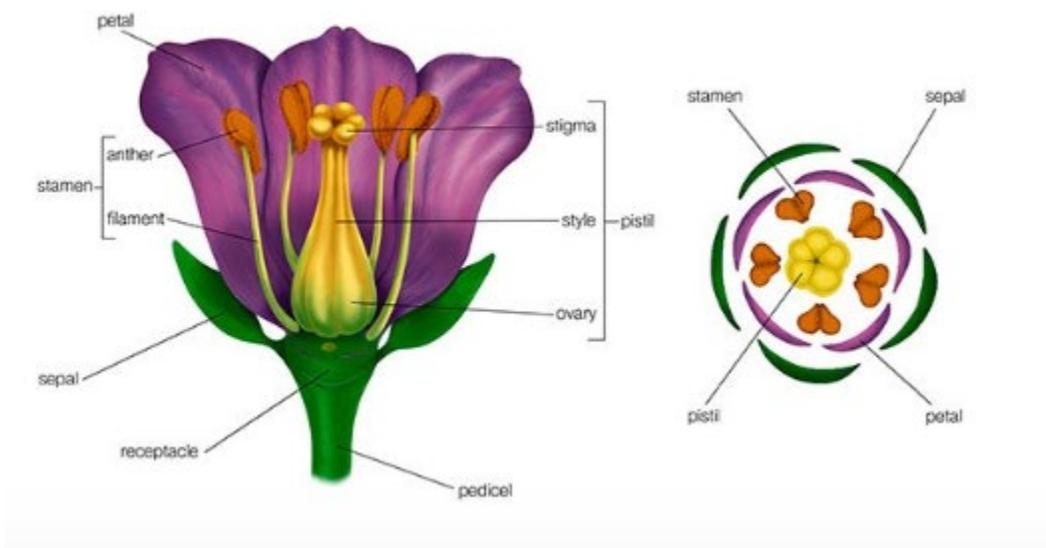


Image from: <https://www.natgeokids.com/za/discover/science/nature/the-life-cycle-of-flowering-plants/>

1. Look at the top view of your plant. Identify the sepal, which is the top of the stem that surrounds the flower, the petals of the flower, and the stamen with pollen and the pistil with the long tube of nectar at the bottom.
2. Carefully, with scissors, cut your flower in half from the stem to see inside. Draw and label what you see.

STUDENT HANDOUT: POLLEN NATION

Part 2: Build a Bee

Bees are insects, which means they have three pairs of jointed legs and three body parts: head, thorax, and abdomen. Although most people have heard about honeybees, which live in organized groups called colonies, many species of bees are solitary. All bees sip nectar from their proboscis, or tongue. But bees also eat the pollen that attaches to them as they move from plant to plant.

1. Make the abdomen: Use the bulb part of the dropping pipet as the base to rest a large pompom as the abdomen. The front of the bee is the long narrow tube is the proboscis or tongue that the bee uses to sip nectar.
2. Make the legs: Cut one pipe cleaner into three sections. Bend them in half. Thread them through a pony bead. Place the pony bead in front of the abdomen, on the underside of the pipet and twist each pipe cleaner around the tube. Use a hot glue gun to secure the legs. Bend them so that there are three legs on each side of the pipet.
3. Make the thorax: Glue another pompom in front of the abdomen to be the thorax.
4. Make the wings: Take one piece of rectangular gauze and cut it into an X shape. Trim the edges to be rounded. Twist the gauze into an X shape so that there are two pairs of wings. Glue the center twist onto the thorax.
5. Make the Head: In front of the wings and abdomen, add the third pompom.
6. Bees have five eyes. On the top of the head, glue three pony beads into a triangle shape, so that there is a pair of eyes and then one in the front of the pair. Each bead is an Ocellus, and these ocelli eyes are used to see in the dark and navigate the hive. On two google eyes, one on each side of the head. These are the compound eyes that bees use to see in the daylight.
7. Make the antennae. Take a small piece of thread, yarn, or a pipe cleaner and fold it into a V. Glue the point of the V right below the eyes. These are the Antennae.
8. Trim the proboscis so that the bee's tongue is in proportion, about as long as the head and thorax.
9. Using medical gauze, twist two sets of wings and secure them onto the thorax of the bee. Glue the end of the pipet onto the bulb to represent the stinger.
10. (Optional) Add a tiny bit of cotton or small pompom on the pair of back legs to be pollen baskets.

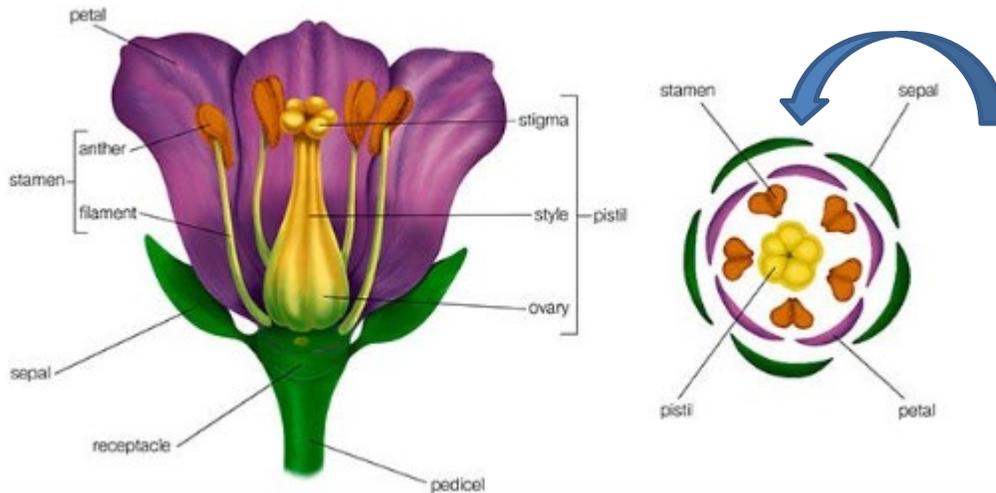


Image taken from: <http://bee-magic.blogspot.com/2010/06/parts-of-bee-body.html>

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Part 3: Make a Flower

While your bee is drying, build a model of a flower to demonstrate how a pollinator transfers pollen from one plant to another. Make sure you look at the top view of your flower. This is what you will recreate in your model. You will need: a plastic condiment container, a cupcake liner, a button, scissors, and small pompoms.



1. Sepal: The outside clear plastic cup that protects the flower represents the sepal.
2. Petals: Use scissors to shape the cupcake liner into five or six petals.
3. Pistil: Then cut a hole in the bottom center of the cupcake liner so that it just large enough to be covered up by a button. Glue the button on the center of the bottom of the flower.

4. Anthers: Roll three to five small pompoms into corn meal or corn starch. Glue these anthers surrounding the button (to the inside of the “flower” around the Stigma. Make sure that the pollen forms a heavy dust on the inside of the cupcake liner.
5. Nectar: Add the nectar by filling a small amount of water into the condiment container (sepal). (Optional) Add a few pieces of glitter to simulate trachea mites.
6. Assemble the flower: Carefully place the petal structures so that it floats on top of the nectar. Compare the top view of your flower model to the drawing on the right.

Part 4: Pollinate

1. Fly to the flower. Use the tip of the dropping pipet to try to pull water through the opening in the button. This simulates the bee’s proboscis sipping nectar from inside the pistil.
2. If you have used the glitter to simulate trachea mites, how many of the bees may die from this parasite?
3. Visit many flowers, some with corn starch and some with corn meal. Can you see both colors of pollen on your bee? This process simulates cross-pollination.
4. Which pollen transfers easier -the fine corn starch or coarse yellow corn meal? Which part of the bee transfers pollen easier - the fine, fluffy pompom or the bristly pipe cleaners?

Think about It:

Flowering plants and pollinators have a symbiotic relationship, which means each organism benefits from the relationship.

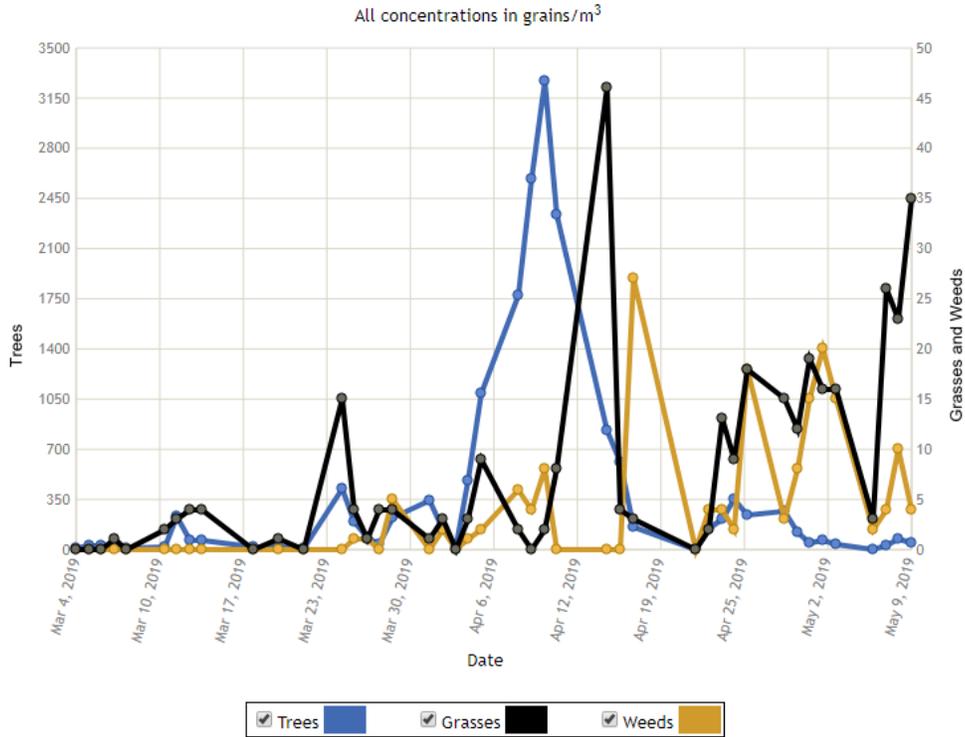
1. How do plants benefit from bees? How do bees benefit from plants? For plants who rely on pollinators, what happens if that pollinator becomes extinct?
2. Pesticides are chemicals used to kill insects that harm plants. How might pesticide use harm bees and plants?

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Part 5: Graph Your Sneeze Potential

Pollen is the male genetic material of a plant. Some trees, grasses, and weeds use wind to transport pollen. The pollen that we see on cars and in yellow clouds in the air is usually pollen from pine trees. Much of the pollen in the air is too small for us to see. For some people, pollen causes **allergies**, called hay fever. If people are allergic to pollen, then their body's immune system thinks that they are under attack from the pollen, like a germ. The person's body releases **histamines**, which then trigger symptoms of **sneezing**, runny nose, and red, itchy watery eyes, and sometimes asthma, which can make breathing difficult. The **NC Department of Environmental Quality** monitors air quality for air pollution and for this naturally occurring pollen. Use the Pollen Count Graph to answer questions about pollen.

Year to Date Pollen Concentrations Observed in Raleigh, NC
 (See Latest Available Data Report)



1. How many different types of pollen does DEQ monitor?
2. During which weeks would a person who has hay fever be most likely to feel sick?
3. Challenge: If pollen counts tend to be highest on warm, dry, windy days, what might you infer about the weather in Raleigh around April 20th?