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# POLLINATION BUZZ



A well-rounded STEM program should include a wide range of activities that appeal to all the different interests and abilities of young people. With this in mind, a little art has been added to this STEM Gem activity to turn it into a STEAM Gem.

**SPRING IS IN THE AIR AND THIS ACTIVITY TAKES ITS CUE FROM NATURE AND INVOLVES CONSTRUCTION OF A BEE TO USE FOR MODELING HOW POLLINATION WORKS.** Young people will learn some vital biology while making an art project that they can take home to share with their families.

## WHAT IS POLLINATION?

Pollen is a very fine powdery substance with a yellowish color that is made by flowers. It holds part of the DNA needed to make seeds to grow new plants. Most flowers require cross-pollination for new seeds to grow, in which the pollen has to travel from one flower to another flower. Some plants rely on the wind for cross-pollination, but most plants depend on animals. Some animals like to eat the pollen and the nectar that flowers produce. Brightly colored petals and scent attract these animals to the flowers. Birds, mammals or reptiles can be pollinators, but most pollinators are insects. One insect in particular, the bee, has evolved along with flowers to be a world-class pollinator. Bees are highly specialized pollination agents, with behavioral and physical modifications that enhance pollination.



### TO BEE OR NOT TO BEE?

Bees, members of the Apidae family, are flying insects that collect nectar and pollen. There are almost 20,000 known species of bees and there are many differences between them. Some bees make honey and some do not. Some can sting, while others cannot. Bees range in size from a tiny stingless species whose workers are less than 0.08 inches long, to the largest species, a leafcutter bee, whose females can attain a length on 1.54 inches. They are found on every continent except Antarctica and in every habitat on the planet that contains some type of flowering plant.

One of the most fascinating things about bees is the way they live. Bees form colonies comprised of as many as 500,000 bees. Most colonies begin with a single queen bee. The colony begins to grow as the queen lays eggs. The young bees become either drones or workers. Drones are the males of the colony and tend to the needs of the queen bee. The workers collect food and defend the colony from threats, such as animals looking for honey. Workers collect pollen from flowers to make honey for the young bees to feed on and to be used as a food source in winter.

A bee's body is made up of three parts: a head, a thorax and an abdomen. A pair of large, compound eyes are on its head. Between and above these, are three small simple eyes (ocelli), which provide the bee information about light intensity and help it navigate using the sun. A bee's head also has two large antennae that house large numbers of sense organs that detect touch, smell, taste, and sound. A bee's sight and sense of smell help it find the flowers that contain the pollen needed for collection. A bee's mouthparts are adapted for both chewing pollen and sucking nectar. The former is eaten primarily as an energy source and the latter primarily for protein and other nutrients. A bee's thorax has three segments, each with a pair of robust legs, and a pair of membranous wings on the hind two segments. In many species, the hind legs include a flattened section with incurving hairs to hold pollen. Finally, the big yellow and black abdomen, that makes bees so distinctive, contains all the main organs and in a few species, a stinger that a bee will use when protecting the hive.

### WHY ARE HONEYBEES BENEFICIAL TO HUMANS?

Many of the foods we eat would be in short supply without the existence of honeybees. Pollination is a necessary step in the reproduction of flowering plants. Because of this, flowers are designed to attract pollinators, such as bees, with their colors and strong scents. Although other insects contribute to the pollination of crops, no other insect provides as much pollination as the honeybee.

Eighty-seven of the world's 115 most important food crops require pollination to produce fruits, nuts and seeds. They account for a third of the \$3 trillion worth of agricultural produce sold each year. These crops provide 35% of the calories we consume yearly and most of the vitamins, minerals and antioxidants. Honeybees are used to pollinate apples, almonds, avocados, bananas, blackberries, blueberries, cabbages, citrus fruits, cocoa, coffee, cranberries, currants, kiwis, peaches, peas, peppers, plums, pumpkins, raspberries, sesame seeds, soybeans, strawberries, squash, sugar cane, sunflowers, tea, tomatoes and zucchini. Approximately 1.5 million beehives are rented every year to North American farmers to help pollinate their crops.

## SCIENCE talk

### BEE

A flying insect of the Apidae family that collects nectar and pollen.

### FLOWER

The part of a plant that produces seeds.

### POLLEN

Fine dust produced by flowering plants that contains the genetic material needed by the plant to reproduce.

### POLLINATION

The transfer of pollen from one flower to another so the plant can reproduce and make seeds.

## engage



### Who likes honey?

*(Young people's choice)*



### What insect makes honey?

*(Bees – specifically seven species of bees known as honeybees)*



### What do you know about bees?

*(Young people's choice and might include: insects, yellow and black coloring, can sting, make honey, eat pollen, live in colonies, have compound eyes, can navigate using the sun)*

# what YOU WILL NEED

## FOR THE GROUP:

- ❗ **Bright-colored construction paper for flower cutouts** (see *Before You Begin*)
- ❗ **Cardstock for Bee Bodies handout** (see *Before You Begin*)
- ❗ **Paper for Bee Wings handout** (see *Before You Begin*)
- ❗ **Glitter or powdered paint, 1 oz. of at least 3 different colors**
- ❗ **Paper to be used as table covering**
- ❗ **Wax paper**
- ❗ **Markers**
- ❗ **Scissors**
- ❗ **Tape**

## FOR EACH CHILD:

- ❗ **1 craft stick**
- ❗ **1 straw**
- ❗ **1 10-inch length of elastic string**
- ❗ **2 black pipe cleaners**
- ❗ **1 Velcro® hook-and-loop fastener**



## & before YOU BEGIN

Invite young people to help prepare each of the following materials.

1. Cut out flower shapes from bright-colored construction paper. Make one flower cutout for every 10 young people. Pour a different color of glitter or powdered paint in the center of each flower to represent pollen. Place the flowers around the work area with paper under them to protect the work area from spills.
2. Cut the pipe cleaners in half.
3. Cut the elastic string into 10-inch pieces.
4. Make one copy of the Bee Body handout (located at the end of this document) for every five young people and roughly cut out each body.
5. Make one copy of the Bee Wing handout (located at the end of this document) for every five young people and roughly cut out each set of wings.
6. Cut one piece of wax paper that is slightly bigger than one set of bee wings or every five young people.

## EXPLORE & EXPERIMENT

- ❶ **Have each young person gather a bee body shape**, cut it out, and use markers to color the stripes yellow.
- ❷ **Have each young person gather a set of paper wings and a piece of wax paper.** Instruct young people to cut out a set of wax paper wings by holding the wing template and the wax paper together and carefully cutting around the wing template. If this is too difficult for young people, have them use a permanent marker to trace an outline of the wing template onto the wax paper before cutting out.
- ❸ **Have each young person gather a craft stick and four pieces of pipe cleaner.** Encourage each young person to write his or her name on one side of the craft stick.
- ❹ **Ask the group how many legs a bee has.** Explain that bees are insects and all insects have six legs. All insects also have three body parts: a head, a thorax where the legs and wings attach, and an abdomen that holds all the insect's major organs.



## EXPLORE & EXPERIMENT (continued...)

- 5 **Have young people wrap three of the pipe-cleaner pieces** around their craft sticks to create six legs.
- 6 **Instruct each young person to create antennae** with his or her fourth piece of pipe cleaner by wrapping the pipe cleaner around his or her craft stick just above the legs, where the head of the bee is.
- 7 **Have young people use tape to attach a bee body** on the top of their craft sticks near the legs.
- 8 **Instruct young people to tape the wax-paper bee wings** at the top of the bee body near the head.
- 9 **Provide each young person with a piece of elastic string** and have him or her tie it near the middle of the bee so it is somewhat balanced when the bee is held by the string.
- 10 **Have each young person gather a Velcro® fastener** and adhere the loop side (soft side) to the underside of his or her bee, near where the stinger is.
- 11 **Ask the group what they think is the purpose of the Velcro® fastener.** The Velcro® fastener is used to represent the fuzzy, hairy abdomen of a bee.
- 12 **Have each young person gather a straw** and tie the free end of the elastic string to one end of the straw. The straw will serve as a handle to “fly” the bee.
- 13 **Explain to the group that pollen is a fine dust produced by flowering plants** that contains the genetic material needed by the plant to reproduce. Also share that bees have evolved in partnership with flowers. Flowers provide food for bees and, in return, bees spread pollen from flower to flower so the plants can make seeds to grow new plants.
- 14 **Divide young people into small groups of three or four.** Encourage them to “fly” their bees from flower to flower, so the Velcro® fastener on the bottom of the bees dips into each color of “pollen”.
- 15 **After a few minutes, gather the group together and discuss what they observed as they “flew” their bees from flower to flower.** Ask if any of the “pollen” from one flower mixed with the “pollen” from another. Some of the powdered paint should stick to the bees as they land on a flower. When they “fly” to the next flower, some of that powdered paint should fall off and mix with the powdered paint of another flower. The powdered paint colors will quickly start to mix.
- 16 **Ask the group why they think flowers have evolved to make tasty bee snacks.** Explain that bees and flowers form a symbiotic relationship and they depend on one another. Bees spread pollen so flowers can make new seeds and in return, bees get free food.
- 17 **Explain that bees are well adapted for gathering pollen from flowering plants.** When a bee lands on a flower, it moistens its forelegs with its tongue and brushes the pollen that has collected on its head and body to its hind legs. Then the bee combs, presses, and compacts the pollen into a special pollen basket on its hind legs called a corbicula. Once the corbicula is packed with enough pollen, the bee returns to its hive and deposits the pollen. Just like the bees made during this activity, a bee’s abdomen is fuzzy. As it flies from one flower to another, pollen constantly sticks and falls off it to start the process of making new seeds for the next generation of plants.



# make THE CONNECTION

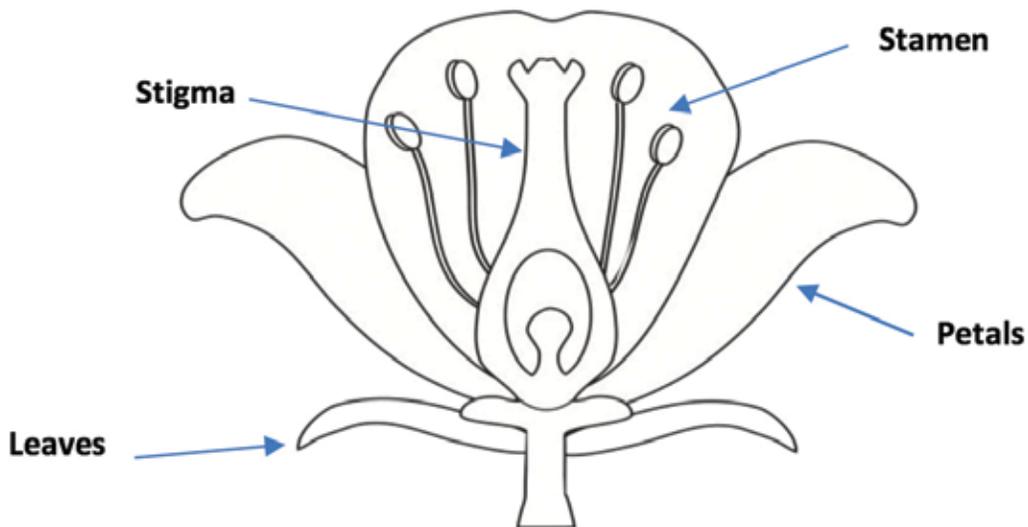
## ASK YOUNG PEOPLE: WHY DO YOU THINK BEES ARE IMPORTANT?

Share with young people that 87 of the world's 115 most important food crops require pollination to produce fruits, nuts and seeds. Invite the group to research and create a list of all the foods they eat that grow as a direct result of bee pollination. Encourage each young person to draw a poster to highlight all the foods that would disappear if bees no longer existed.



## EXTEND & EVALUATE

Bring fresh-cut flowers and have young people explore them closely as if they were a bee looking for pollen. Have young people examine a single flower and remove some of its petals to look for the sticky, central part called the stigma. The stigma is sticky and catches pollen from visiting bees. The stigma is surrounded by delicate stalks with big heads, called stamens. The stamens are the part of the flower that contain pollen. Have each young person draw a picture of the parts of the flower he or she observed and label the parts.



BEE BODIES



**BEE WINGS**

