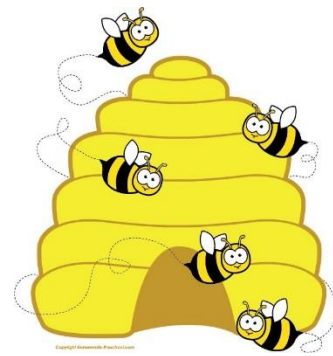


## Lesson: The Buzz on Bees

**Environmental Literacy Question:** How have humans affected the Chesapeake Bay and its watershed?

**Topic/Essential Questions:** How do the structures of plants help them survive in their habitats? How do the structures of animals help them survive in their habitats?



**Unit/Lesson Sequence:** One of two lessons in the “Pollinators/Structures for Survival” module.

### Content Standards:

- **Environmental Literacy**
  1. A.1 Identify an environmental issue.
  5. B.1.f Recognize and explain that activities and technology of the human species have a major impact on other species in many ways.
  8. F.1 Apply knowledge and skills to investigate and implement personal and collective decisions and actions on an individual, local community, national, and global levels in order to achieve sustainability.
- **Science**
  3. D.1.b Explain that the characteristics of an organism affect its ability to survive and reproduce.
  - 3.4. F.1.a. Identify and describe the interactions of organisms present in a habitat
  - 6.4. B.1. Recognize and describe that people in Maryland depend on, change, and are affected by the environment.

### Length of Lesson:

Overnight Program: 60 minutes

Day Program: 45 minutes

**Student Learning Outcome:** The student will be able to explain the importance of bees to all living things, explain how plants and animals have structures for mutual success, and describe the positive and negative impacts of human activities on the bee population.

### Knowledge of the Learner:

- Prerequisite knowledge, skills, and processes: Basic understanding that bees are pollinators and also make honey from nectar in flower. Knowledge of basic flower parts, including petals, pollen, and stem. Students should be able to listen to instruction and follow directions.
- Student needs, interests, and previous learning: These will be identified in the Engage phase of this lesson.
- Conceptual difficulties: Understanding that honey bees and other pollinators have an enormous impact on the ecosystem; working with others to solve problems.
- Differentiation: Students are in fourth grade with a diversity of backgrounds and skill levels. In this lesson, students will use a variety of learning styles. Auditory learners will benefit from oral presentations, kinesthetic learners will benefit from the games and microscopes, and visual learners will benefit from observing the hives inside and outside.

## Knowledge of Content:

### Vocabulary:

Drone	Worker	Comb	Queen	Proboscis	Brood
Hive	Nectar	Cell	Honey	Pesticides	Mutualism
Pistil	Stamen	Pollen	Petal	Stem	

### Materials:

Observation hive	Bee Cards	Hive Box
1 or 2 Pipettes	Wooden Flowers	Green food coloring
Water	Clear plastic cups	Bucket with 35 lbs. of sand
Prism Microscopes	Toothpicks	Flashlights
Prepared pollen slides	Alstroemeria flowers	Plastic slides

### Supplements:

- A: Bee Cards – Members of the Colony
- B: Bee Issues
- C: Proper use of a Prism Microscope
- D: Parts of a Flower/Vocabulary
- E. Human vs Bee eyes

## Lesson Setup:

- Inside the bee room:
  - The wooden panels should be on either side the hives so that bees are not visible and the instructional cards 2, 5, 8, 10, and 12 ready.
- Outside:
  - Set up wooden flower stands on one side of the field, each one with a cup of water. Place a drop of the green food coloring in one of the cups (this represents pesticides sprayed on the flower). Place an empty cup with a black “fill” line on a hive box (about 15 feet from wooden flowers). Leave a pipette next to the empty cup. **\*NOTE: For larger groups, set up an empty cup with two pipettes.\***
  - For dissecting the flower and viewing through microscopes:
    - Set up the prism microscopes. Students will be in pairs for this activity, so have one microscope available for every two students. There should be a flashlight next to each microscope.
    - **OVERNIGHT GROUPS:** Obtain a flower for each pair of students. Have toothpicks, plastic slides, and white index cards prepared to insert any pollen or other parts of the flower that students want to observe.
    - **DAY GROUPS:** Carefully insert prepared slides onto the prism microscopes. These are pre-setup so that students are not handling the glass slides. Students will rotate around all the microscopes to view the different pollen spores.

## Instructional Delivery:

### Engage:

#### Relay Race and Discussion (8 minutes)

This game is played in the Main Field, Location #4 on Site Map.

Instructions on how to play:

- Explain that every student is a worker bee during this game. Workers bees need to collect enough nectar (water) from the flower cups to fill their team's cup to the line. That line represents the amount of honey they will need to survive winter. Explain that they only have a limited amount of time to get as much nectar as possible.
- Divide the group in half, line them up on either side of the hive box.
  - Explain to students: Two at a time, workers will collect nectar with their **proboscis** (pipette), [a tubular tongue that extracts nectar].
    - Go to flower, squeeze pipette, and stick it into water, release. At this point, water will be inside pipette. Carefully run it back so the water does not leak out.
  - Bring nectar back to the "hive" (cup with line).
  - On their return, pass the pipette to the next student in their line.
  - Tell them: "Remember: It is not a competition between the two lines, because you are working together to benefit the whole hive."
- Once the instructions are clear, let the students play.
  - Total playing time: 3 minutes
  - Once all the students have had a chance to run the relay or sufficient time is up, congratulate the group on collecting their nectar.

Post-Game Discussion:

- Ask: "Did you fill up the cup to the line? Would the honey you made be enough for all of you to survive the entire winter?"
  - Tell them "It takes **35 pounds** of honey for a small hive to survive winter!"
    - At this point, have students carefully lift the bucket full of sand by the handle in order to feel how heavy it is.
- Most likely the water they collected will have a green tint to it. Ask: "Did you notice that some of the nectar looked different as you were bringing it back to the hive?" *Yes, it's green.*
  - Tell them: "Unfortunately all the nectar you collected is bad, because you got nectar from a flower that was sprayed with pesticides.
  - Ask: "What are pesticides and why are they used?" *Pesticides are certain chemicals we use to spray our crops and other plants to keep certain insects from eating them up.*
  - Tell them: "Pesticides were added to the plants to keep other insects away, but it got into the hive and now bees are getting sick and dying. The overall bee population of the world has been declining in recent years as a result of pesticide use."

### Explore

#### Dissect a Flower and Microscopes (15 - 25 minutes)

\*If you are here for an overnight program, start with the mutualism discussion, then do the flower dissection, then the microscopes. If you are here with a day program, start with the mutualism discussion, then proceed to viewing the prepared slides.\*

Mutualism Discussion (5 minutes)

- Hold up a bunch of Alstroemeria flowers. Ask: “Do you think there is anything about this flower that would make a bee want to come to it?” Students might say: *It’s pretty, it smells good, it’s colorful.*
  - Tell them: “There is! Bees see flowers differently than humans. Flowers are pretty to us, but they attract bees in a different way. Bees see more colors on the UV light scale which makes the colors present on this flower POP!”
- Show pictures of flowers: human vs bee eyes (**Supplement E**)
- Ask: “Why do you think it is important for a flower to look ‘better’ to a bee?”
  - Tell them: “The brighter colors of a flower that only a bee can see draws them to the particular area of nectar. That is why the center of the flower, where bees find nectar, is highlighted. Sometimes the flower also has ‘runways’, lines that point to the center.”
  - “This is important because when the bee goes to the flower to extract nectar, their bodies pick up pollen, which they then carry to the next flower they go to. Transferring pollen leads to pollination.”
  - Vocabulary: “This is called **mutualism**. Mutualism is when two organisms work together to get what they both need. The flower has bright colors, which attracts the bees. The bees get nectar from the flowers, but also transfers pollen to the next flower they go, resulting in pollination. A pollinated plant will turn into the fruits and vegetables that humans and animals enjoy.”

#### Flower Dissection (12 minutes) **For OVERNIGHT programs only**

##### Set up

- Have materials set up at an outside table (inclement weather: use tables in bee room).
- Have students get together in pairs
  - Give them 2 (two) toothpicks and 1 (one) Alstroemeria flower per pair. They will be sharing one microscope and one “Part of a Flower/Vocabulary” card.

##### Viewing the flower

- Instruct students to look down on the top of the flower.
  - Ask: “What parts of the flower can you identify?” *This should include the stem, petals, and pollen.*
  - Ask: “If you were a bee, what about this flower would attract you to it?” *This might include being bright or having runways.*
- Pass out one pair of blue glasses per group of students. Instruct them to view the flowers through the glasses.
  - Ask: “Do you notice any differences?” *Colors will look brighter.*
  - (Give students no more than 1 minute each to wear the glasses)

##### Identification

- Help students identify the rest of the flower using the vocabulary provided on cards. Using the real flower, have them point out:
  - the anthers (where pollen is stored)
  - the pistil (center stalk that receives the pollen from another plant that was transferred by pollinators)
  - the ovaries (these are located below the pistil, on the inside)

##### Pollination Explanation

- Tell students: “These three parts are very important during the act of pollination.”

- Explain pollination, use flower cards to help: “Pollinators such as bees travel from flower to flower, collecting nectar for honey production and transferring pollen. The pollen from the anthers of one flower get transferred to the pistil of another flower, which in turn creates a fruit or vegetable.

#### Dissection (about 8 minutes)

- Instruct students to lay the flower on its side. First, have students remove the anthers and view them under the microscope on a plastic slide. Pollen should be visible; if not, the students can slice open the anther to find pollen.
- Second, pick off the petals to expose the inner parts of the flower. Students can place one petal on the microscopes in order to view their interesting cell structure.
- Third, instruct students to use a toothpick and slice open the bottom of the flower so that the inner ovaries are visible. Students can place this entire area under the microscopes. Tell them that a fertilized ovary will eventually be the fruits and vegetables they eat.

#### Viewing Prepared Slides (10 minutes) **For DAY programs only**

- Have 4 microscopes set up and have Pollen of Lily, Tulip Pollen, Sunflower Pollen, and Pine Tree Pollen slides inserted into them.
- Students will be in pairs and will rotate around the microscope stations.
- Using the Parts of Flower/Vocabulary cards (**Supplement D**), quickly explain the notion of pollination [*Pollinators such as bees travel from flower to flower, collecting nectar for honey production and transferring pollen. The pollen from the anthers of one flower get transferred to the pistil of another flower, which in turn creates a fruit or vegetable.*]

#### **Explain (6 minutes)**

- Take group into the bee room.
- Ask, “Why are bees important to humans and animals?” *Honey bees pollinate plants that humans and animals use as a food source. Honey bees also produce honey that some animals use as a food source.*
- Discuss why humans keep bees.
  - Tell them: “Bee-keepers have hives that they can transport to farms and orchards in order for the bees to pollinate the crops and trees. Bees and other pollinators are essential for the pollination of many fruits and vegetables that humans and animals enjoy.”
- Review the types of bees that will be found in the observation hive using the numbered bee instructional cards. Tell the students we will be looking for:
  - Worker bees (card 2)
  - Drone bees (card 10)
  - Queen bees (card 5)
  - Brood and Honey (card 8)

Also review the purpose of a beekeeper (card 12)

#### **Elaborate (9 minutes)**

Open the observation hive and look at the bees. Spend no more than 5 minutes viewing these hives. Have the students notice:

- What type of bees are the majority? *Most of the bees are workers.*
- What are the workers bringing to the hive? *Nectar and pollen*