

## Photo Description



This image shows a bee collecting pollen and nectar from a bright red flower with yellow stamens. The bee's body is covered with pollen grains, which stick to its fuzzy body as it moves from flower to flower. The flower provides food for the bee, while the bee helps the flower reproduce by moving pollen between plants.

## Scientific Phenomena

**Anchoring Phenomenon:** Pollination through a symbiotic relationship between a bee and a flowering plant.

**Why It's Happening:** Bees visit flowers to collect nectar (a sweet liquid) and pollen (a protein-rich food source) for energy and nutrition. As the bee moves around inside the flower gathering food, pollen grains stick to the tiny hairs covering its body. When the bee visits the next flower, some of this pollen rubs off onto that flower's stigma (female part), allowing the flower to be fertilized so it can make seeds and reproduce. This is a mutually beneficial relationship: the flower gets pollinated (allowing reproduction), and the bee gets food. Neither organism could thrive as well without the other.

## Core Science Concepts

- Symbiosis and Mutualism:** A bee and a flowering plant have a symbiotic relationship where both organisms benefit. The bee gets food (nectar and pollen), and the plant gets help reproducing through pollination.
- Adaptation and Structure-Function Relationship:** Bees have specialized body structures (fuzzy bodies, long tongues, pollen baskets on hind legs) that are perfectly adapted for collecting pollen and nectar. Flowers have bright colors, sweet nectar, and pollen that attract bees.
- Plant Reproduction:** Flowering plants depend on pollinators like bees to transfer pollen between flowers so that seeds can develop and new plants can grow.
- Organism Interactions in Ecosystems:** Bees and flowering plants are connected as part of larger food webs and ecosystems. When bees visit flowers, they interact with and depend on each other for survival.

### Pedagogical Tip:

When teaching pollination to Fourth Graders, use the phrase "pollen taxi service" to help students remember that bees carry pollen from flower to flower. You can have students act out the bee's role with yarn "pollen" stuck to their clothing as they move between paper flowers to make the concept physically memorable and concrete.

### UDL Suggestions:

To support diverse learners: Provide a labeled diagram of a bee and flower with key structures color-coded. Offer both verbal explanations and visual models. Allow students to manipulate flower and bee models to demonstrate pollination. For students needing challenge, ask them to research different pollinators (butterflies, hummingbirds, bats) and compare their adaptations.

## Zoom In / Zoom Out

### ### Zoom In: Microscopic Level

At the microscopic scale, pollen grains are tiny structures with specific shapes and textures that allow them to stick to a bee's fuzzy body hairs through static electricity and physical contact. Inside the flower, the pollen must reach the stigma and travel down the style to the ovary, where fertilization occurs at the cellular level, allowing seeds to develop.

### ### Zoom Out: Ecosystem Level

Zooming out, bees and flowering plants are part of interconnected ecosystems where pollination supports entire food chains. When plants produce seeds and fruits because of pollination, these become food for birds, squirrels, and other animals. Bees themselves are food for birds and other predators. The loss of bees would dramatically impact plant reproduction and the survival of many organisms that depend on seeds, fruits, and the plants themselves for survival.

## Discussion Questions

1. Why do you think the bee's body is so fuzzy compared to other insects? How does this help both the bee and the flower? (Bloom's: Analyze | DOK: 2)
2. What would happen to the flowers in a garden if there were no bees to visit them? (Bloom's: Evaluate | DOK: 3)
3. How is the relationship between a bee and a flower different from a predator eating prey? (Bloom's: Compare | DOK: 3)
4. If you were a bee, how would you know which flowers have the best nectar and pollen to eat? What information would your senses give you? (Bloom's: Apply | DOK: 2)

## Potential Student Misconceptions

1. Misconception: "Bees are just stealing pollen from flowers; it's not helpful to the flower."  
Clarification: Bees are actually helping flowers! While bees collect pollen for food, they accidentally move pollen between flowers. This pollination is essential for the flower to make seeds and create new plants. It's a fair trade: the bee gets food, the flower gets to reproduce.
2. Misconception: "All bees are the same, and only honeybees pollinate flowers."  
Clarification: There are thousands of species of bees, including bumblebees, mason bees, and carpenter bees. Many different types of bees pollinate flowers, and some plants are pollinated by butterflies, moths, hummingbirds, bats, and even wind. Different pollinators have different body shapes and behaviors.
3. Misconception: "Flowers make pollen just for bees to eat."  
Clarification: Flowers make pollen as part of their reproduction process (pollen contains male cells needed to make seeds). Bees eating pollen is actually a "side effect," but it works out well because bees help move the pollen around!

## Extension Activities

1. Bee Body Exploration: Provide students with close-up images or videos of bee bodies, and have them use hand lenses to observe the fuzzy texture of cotton balls or yarn representing bee hair. Students can stick small beads (representing pollen grains) to the fuzzy material and then transfer them to a paper flower, observing how easily the "pollen" transfers. Discuss how this demonstrates the bee's adaptation for pollination.

2. Flower Dissection and Observation: Have students carefully take apart a large, simple flower (like a tulip or lily) and identify the different parts: petals, stamens (where pollen is made), stigma, style, and ovary. They can observe and sketch these structures, then use a magnifying glass to look at pollen grains. Create a labeled diagram together showing how pollen moves from the stamen to the stigma during pollination.
3. Pollinator Hunt and Data Collection: Take students outside to observe and count different pollinators visiting flowers in a garden or natural area. Students can create a tally chart showing which types of pollinators they observe (bees, butterflies, etc.) and which flowers they visit most often. Back in the classroom, graph the data and discuss patterns. Why do certain pollinators visit certain flowers?

### Cross-Curricular Ideas

1. Mathematics: Have students collect data on the number of flowers visited by a bee in a set time period (using a video or observation chart). Create bar graphs comparing different pollinators' flower-visiting rates. Calculate how many flowers a bee might visit in a day (extension thinking).
2. English Language Arts: Read aloud a picture book about bees and flowers (see resources). Have students write a short narrative story from the perspective of a bee visiting flowers, describing what the bee sees, smells, tastes, and feels. Students can illustrate their stories and create a class book.
3. Art: Students create a large mural or diorama showing a garden ecosystem with flowers, bees, and other pollinators. They can use mixed media (paint, tissue paper, collage) to make flowers colorful and textured, and use craft materials to create three-dimensional bees and other insects.
4. Social Studies: Discuss how different cultures use honey, beeswax, and other bee products. Research where bees are found around the world and how different regions depend on pollinators for food crops (apples, almonds, cucumbers, etc.). Create a world map showing important pollinator regions.

### STEM Career Connection

1. Beekeeper/Apiarist: A beekeeper cares for colonies of honeybees, manages their hives, and harvests honey and beeswax. Beekeepers work outdoors and must understand bee behavior and health. They help support pollination for crops and gardens. Average Salary: \$48,000–\$65,000 per year
2. Plant Biologist or Botanist: A botanist studies plants, including how they grow, reproduce, and interact with pollinators. They might work in gardens, greenhouses, universities, or research labs. Botanists help us understand how to grow better crops and protect plant species. Average Salary: \$62,000–\$78,000 per year
3. Agricultural Scientist: Agricultural scientists study how crops grow and how pollinators and other organisms help plants thrive. They work to improve farming practices and develop new varieties of plants that produce more food. Some agricultural scientists specialize in helping protect endangered pollinator species. Average Salary: \$65,000–\$82,000 per year

### NGSS Connections

- 4-LS1-1: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 4-LS1.A - Structure and Function
  - Structure and Function

4-LS1-2: Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

- 4-LS1.B - Growth and Development of Organisms
- Cause and Effect

Additional Related DCIs:

- 4-LS1.D - Information Processing (bees sense flower colors, scents, and nectar, then respond by visiting)

### Science Vocabulary

- \* Pollination: The process of moving pollen from one flower to another so that plants can make seeds.
- \* Pollen: Tiny yellow or orange powder made by flowers that contains the male cells needed to make seeds.
- \* Nectar: A sweet liquid made by flowers that bees collect as food for energy.
- \* Symbiosis: A relationship between two different living things where they live together and interact (can be helpful or harmful).
- \* Adaptation: A special body part or behavior that helps an organism survive and thrive in its environment.
- \* Pollinator: An animal that carries pollen from flower to flower, such as a bee, butterfly, or hummingbird.

### External Resources

Children's Books:

- The Bee Tree by Patricia Polacco – A story about a grandfather who teaches his granddaughter about bees and their importance to nature through a magical adventure.
- Bee by David Adler (All Aboard Reading series) – A factual picture book that explains how bees live, work together, and pollinate flowers.
- Honeybees by Shelley Rotner and Sheila Kelly – A photo-illustrated book showing the life cycle of honeybees and their relationship with flowers and humans.

---

End of Lesson Analysis