

Investigative Lab 20

Bees, Birds, and Botanists

Exploring Flower Structure and Adaptations

Question How do the parts of a flower attract pollinators and produce seeds?

Lab Overview In this investigation you will discover how flowers attract different types of animal pollinators. Then you will dissect a flower to observe reproductive structures and learn how they produce a seed.

Introduction Flowers, which are unique to angiosperms, function in reproduction. The flowers of many angiosperms have adapted in ways that attract pollinators (animals such as birds or insects that carry pollen between flowers). As a bird or insect feeds on a flower's nectar or pollen, pollen sticks to the animal. When the pollinator moves on to another plant of the same species, it pollinates the second plant. Pollination may lead to fertilization and the development of a new generation of plants.

In the Prelab Activity you will learn about the various features of flowers that attract hummingbirds and bees. During the investigation you will “think like a botanist” as you dissect flowers and examine the parts that are involved in pollination and the production of seeds.

Prelab Activity Study the table below. Then complete the activity on the next page.

Flower Feature	Hummingbirds	Bees
Shape	Hummingbirds prefer flowers with a tubular shape that fit their long, slender beaks.	Bees prefer cup-shaped flowers in which they can nestle while gathering pollen or nectar.
Color	Hummingbirds as well as many other birds, are most attracted to red flowers, but will also drink nectar from flowers with colors that contain red such as orange or pink.	Bees, as well as other insects, respond mostly to blue and yellow flowers. They cannot detect red.
Pattern	Hummingbirds respond to color and shape, rather than patterns.	Bees are attracted to flowers with “runway” lines or dashes that lead to the bee to pollen or nectar.
Scent	Hummingbirds have a limited sense of smell. Smell has little impact on food choice.	Bees have a strong sense of smell and are attracted to fragrant flowers.

Based on the information in the table on the previous page, use colored pencils to sketch a flower that you think would attract a hummingbird and a flower that you think would attract a bee.

Sketches:

Prelab Questions

1. Explain why you think the flower in your first sketch would attract hummingbirds.

2. Explain why you think the flower in your second sketch would attract bees.

3. Hummingbirds need to feed several times an hour. Flowers that attract hummingbirds typically contain a lot of nectar. This keeps the hummingbird at each flower longer before it moves on to another source. Flowers that attract nectar-feeding bees typically contain smaller amounts of nectar, and therefore a bee has to visit several flowers to obtain enough nectar. Explain how both adaptations lead to better chances of successful pollination.

Materials

- flowers of varying color, size, and scent
- large flower for dissection
- forceps (optional)
- scissors (optional)
- stereomicroscope (optional)

Procedure

Part A: Thinking Like a Hummingbird

CAUTION: *Notify your teacher of any plant or pollen allergies before starting this lab.* Compare your various flowers. (Remember to use your senses as a hummingbird would.) Which of these flowers do you think would most attract a hummingbird? Describe the flower and explain your prediction.

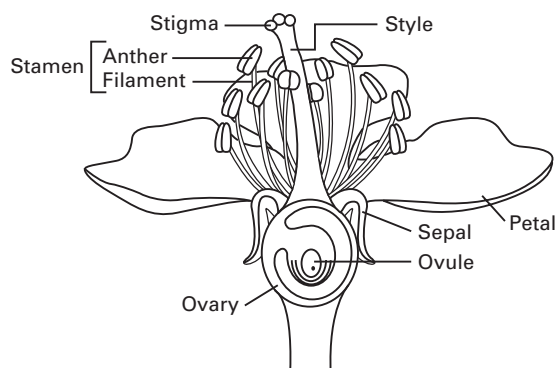
Part B: Thinking Like a Bee

Compare your various flowers. (Remember to use your senses as a bee would.) Which of these flowers do you think would most attract a bee? Describe the flower and explain your prediction.

Part C: Thinking Like a Botanist

One reason botanists study flower parts is that these structures help to classify flowers. The number of flower parts (petals or sepals) and their shape and position are key to flower classification. Botanists also ask questions about how pollination occurs in different flowers. They may study how a flower's shape aids in pollen from an anther becoming attached to a pollinator and then being transferred to another flower's stigma.

1. Your teacher will give you a large flower with prominent parts to study. Use the diagram of the generalized flower below to help you identify the parts in steps 2 and 3.



Cherry blossom

2. You may recall from Chapter 19 that angiosperms are classified in several evolutionary branches. Monocots and dicots are two groups of angiosperms. One way to recognize monocots is to count the number of sepals or petals. If this number is a multiple of three, the plant is a monocot. If the number is a multiple of four or five, and if the leaves contain branched veins, the plant is a dicot. If the flower does not fit the monocot or dicot description, it likely belongs in one of the other several groups of angiosperms. Observe your flower. Is it a monocot, dicot, or neither? Explain your classification below.

3. Flowers have structures with specialized shapes that allow sperm in pollen to reach the eggs in the ovaries. Follow the directions below to take the flower apart and identify its reproductive structures.
- a. Gently pull off the petals and set them aside. Look for the yellow, dusty pollen. (**CAUTION:** *You may want to wear goggles, gloves, and an apron for steps a and b. Pollen can irritate the eyes and some types of pollen may stain skin or clothing.*)
 - b. Identify a stamen. A stamen consists of a stalk called the filament and a structure at the tip called the anther. Pollen is produced in the anther. Sketch the stamen in the space below.

- c. The stigma, style and ovary make up the carpel—the female part of a plant. Identify the style and stigma. Look for a centralized stalk (the style) with a sticky end (the stigma). In most flower species, there is only one style. Pollen carried by pollinators or wind sticks to the stigma and absorbs fluid. Then a tube called the *pollen tube* grows from the stigma through the style, toward the ovary. A cell in the pollen divides, and two sperm nuclei travel down the pollen tube toward the ovary. Sketch the style in the space below.
- d. Remove the stigma and style from the flower and locate the ovary. Using forceps, or your thumbnails, pull open the ovary to observe the ovule or ovules. Each ovule contains an egg cell. If available, use a hand lens or stereomicroscope to observe the ovule(s). One sperm that travels down the pollen tube fertilizes the egg cell and forms a zygote. The other sperm fertilizes a large central cell in the ovule, which develops into a tissue called endosperm that nourishes the growing embryo. After this double fertilization takes place, the ovule develops into a seed with the embryo and endosperm inside. Sketch the ovary and ovule in the space below.

Analysis and Conclusions

1. Describe the structures you observed. Which structures are involved in the formation of male gametophytes? Which structures are involved in the formation of female gametophytes?

2. Through what part of the flower does the pollen tube grow?

3. If a flower has 8 ovules and the egg cell in each is fertilized, how many seeds will the flower produce?

4. Summarize the pathway of pollen from where it is produced to where it is deposited in another flower.

5. A bird watcher wants to attract more hummingbirds to a feeder. He decides to add fragrance to the hummingbirds' food supply. Do you think this will attract more hummingbirds to the feeder? Explain your response.

6. A woman wearing a blue and yellow dress and strong perfume attends a party outside on a warm summer day. What problem do you anticipate that she may encounter?

Extension

Based on the information you have learned in this lab, describe how you would design a hummingbird feeder. Describe in detail why you think your feeder would work. With your teacher's permission, build the feeder, place it in an approved location, and observe it to see if it attracts hummingbirds.