

# Lesson Six: POLLINATION

*This lesson provides students with an opportunity to explore further the Plant-animal relationship that exists in pollination. By dissecting flowers, students will gain an understanding of the parts of the flower and the process of pollination.*

## Part I. LESSON OVERVIEW

### A. Learning Objectives

Upon completion of this lesson students will be able to:

- Identify the major parts of flowers: petals, stamen and pistil.
- Explain how pollen moves from the stamen of one flower to the pistil of another, and why this process is necessary for flower reproduction.
- Describe the role that bees and other pollinators play in the pollination process.

### B. Correlation to State and National Standards and Guidelines

[See chart](#)

### C. Textbook Compatibility

[See chart](#)

### D. Materials

- Dissecting pans-1 per pair
- Hand lens-1 per pair
- Forceps-1 per pair
- Lillies-1 per pair
- Petri dish-1 per pair
- Transparency (or large visual) of a flower and its parts
- Video: *Microcosmos*

### E. Advance Preparation

You will need to order flowers in advance for this lesson. If you explain the EcoTeam to local businesses, they may consider donating flowers or selling them to you at a reduced rate. We have not experimented with growing our own, although we hope to do this within the next year. When you order the flowers, be sure to remind the florist that you are using the flowers to teach elementary students about the different parts of a flower involved in pollination. Often florists will remove anthers from

flowers, as pollen stains clothing (be careful!). You do not want the florist to remove any part of the flower!

If necessary, communicate with the classroom teacher prior to the lesson about audiovisual equipment to make sure that a TV and VCR will be available.

## F. Key Vocabulary

<b>PETAL</b>	The colorful part of a flower.
<b>PISTIL</b>	The part of the flower that catches pollen and holds seeds.
<b>STAMEN</b>	The part of the flower that makes pollen.
<b>POLLEN</b>	Tiny grains of yellow or orange dust that combine with a flower's eggs to make new plants.
<b>POLLINATION</b>	The movement of pollen from stamen to pistil by animals or wind.

## G. References

Brewer, Richard. *The Science of Ecology*, 2<sup>nd</sup> ed. Ft. Worth: Saunders College Publishing/Harcourt Brace College Publishers 1994, 224, 251-257.

Campbell, Neil A. *Biology*, 4<sup>th</sup> ed. Menlo Park, CA: The Benjamin/Cummings Publishing Company, Inc., 1996, 729-733.

Miller, G. Tyler. *Living in the Environment*, 10<sup>th</sup> ed. Belmont, CA: Wadsworth Publishing Company, 1998, 119-121, 184.

Nahban, Gary P. & Stephen L. Buchmann. *The Forgotten Pollinators*. Washington, D.C.: Island Press, 1996.

## PHASE II: LEARNING CYCLE APPLICATION

### Phase One: Exploration (E)

1. Introduce the lesson and explain the exploration activity to the class. For example:

*You will work in-groups of two or three to dissect flowers. Your task is to gently dissect the flower and group similar flower parts together. Follow the directions in your journal sheet very carefully!*

2. Divide children into groups and designate a place for each group to work.
3. Hand out materials: forceps, hand lenses, loose sheets of paper, tin dissecting trays and lilies.
4. Allow student-centered exploration for 20 minutes. Circulate through the classroom to answer questions or to help guide exploration if necessary. As the children are exploring, visit each group. Open the base of the pistil lengthwise to reveal the flower's eggs. The eggs are very small. The students will need to look very closely with their hand lenses in order to see the eggs.

5. Remind students to record their observations in their journals.
6. Collect supplies from the children and ask them to return to their seats.

## Phase Two: Concept Introduction (CI)

1. Discuss the exploration activity with the class define terms. Begin by reviewing the observations and responses the students recorded in their journals.
2. Define PETALS. *Petals are the colorful part of the flower that attracts animals.*
3. Next, define PISTIL. *The pistil is the part of the flower that catches pollen and holds seeds.*
4. Define POLLEN. *Pollen are the tiny grains of yellow or orange dust that combine with flowers' eggs to make new plants.*
5. Define STAMEN. *A stamen is the part of the flower that makes pollen.*
6. Define POLLINATION. *Pollination is the movement of pollen from a stamen to a pistil by animals or wind.*
7. Show the video clip from “Microcosmos”. Narrate the events that appear on the video. Be sure to note how the flower takes an active role in pollination by attracting the insect and by tapping the insect with the anther as nectar is extracted.
8. Explain the pollination activity:

*Today you and your partner will do a fun role-play called ‘Design Your Own Flower’! You and your partner will take turns pretending that one of you is a flower and the other a pollinator. The ‘flower’ will interview the ‘pollinator’ asking him/ her the four questions that appear on the journal sheet:*

- *What is your favorite color?*
- *What is your favorite shape?*
- *What smells good to you?*
- *What is your favorite fruit or vegetable to eat?*

*You will use this information to design yourself (the flower) in a way that will make your partner (the pollinator) want to come visit you. After you interview each other, draw flowers based on the interview answers. Then you will need to write a description of the flower you designed telling why it will attract your partner and help you pollinate! After you are done, we will present our drawings and descriptions to the class so we can share your wonderful creativity with each other.*

9. Circulate through the classroom to answer questions and help as need. You may need to ask questions to stimulate students in the writing exercise.
10. Allow adequate time for the students to develop their flower designs and then begin presentations.
11. Encourage the children to present their drawings and descriptions to the class by telling each child how great their design is. It is important to remember that some children may be anxious about speaking in front of their peers. Don’t force these children to present, but remember to positively reinforce the good work they did and remind them that if they change their mind and want to share their work with

the class to let you know (often children will gain confidence after they see some of their classmates do a presentation).

## Phase Three: Concept Application (CA)

*EcoTeam Application Lesson and Roots & Shoots Service-Learning Project*, please see corresponding sections of website.

# PART III. BACKGROUND INFORMATION FOR FACILITATOR

## A. General

Flowers are the reproductive structures of ANGIOSPERM SPOROPHYTES. The four floral organs from the outside of the flower to the inside are the SEPALS, PETALS, STAMENS, and CARPELS.

These floral organs are arranged in four whorls and attached to the end of a modified stem. Sepals and petals are the non-reproductive organs of a flower. The sepals of most flowers are usually green and have a leaf-like appearance. Sepals function to enclose and protect a floral bud before it opens. Petals are generally brightly colored. Brightly colored petals advertise the flower to pollinators such as insects and hummingbirds.

Stamens and carpels are the reproductive parts of flowers. Stamens are composed of a stalk-like structure called a FILAMENT and a terminal structure called an ANTHHER. Pollen grains (male GAMETOPHYTES) develop in chambers within the anther. The carpel has a slender neck called a STYLE. The style leads to the ovary located at the base of the carpel. One or more ovules develop with the ovary. In turn, egg-containing embryo sacs (FEMALE GAMETOPHYTES) develop with the ovules. Flowers may have a single carpel or multiple carpels. The flowers the students dissect in this lesson have a single carpel. Sticky stigma at the tip of the carpel serve as a landing platform for pollen.

POLLINATION occurs when pollen grains are released from anthers, carried by animals or wind and stick to the stigmas at the tips of carpels. Pollen then grows down into the embryo sacs located in the ovules, resulting in the fertilization of eggs. The fertilized egg eventually develops into a seed. The entire ovary simultaneously develops into a fruit that (depending on the species) contains one or more seeds. Animals and wind disperse seeds, sometimes considerable distances from their source plants. If seeds are deposited in fertile soil, the seeds will germinate and grow into seedlings and a new generation of flowering plants continues.

Floral variations have evolved during 130 million years of angiosperm history. Over the course of this history and in some flowers, one or more of the four basic floral organs—sepals, petals, stamens, and carpels, has been eliminated. Plant biologists distinguish between these varieties. COMPLETE FLOWERS are equipped with all four organs whereas INCOMPLETE FLOWERS lack one or more of the floral parts. A flower that has stamens and carpels is referred to as a PERFECT FLOWER, even if it is lacking sepals or petals. Incomplete flowers missing stamens or carpels are termed IMPERFECT FLOWERS.

## B. Humans and Pollination

Pollination is one of nature's services often taken for granted. Pollinators are essential to maintaining plant populations around the world. Of the approximately 240,000 species of flowering plants worldwide, animals pollinate nearly 220,000. The remaining plants rely on water or wind. In addition, about two-thirds of the crops grown on the planet rely on animal assistance for pollinating their flowers.

According to Stephen Buchmann, co-author of *The Forgotten Pollinators*, “Every third bite of food we eat, our clothing—cotton and flax—plus many beverages and some medicine come directly from the pollinating activities of these animals.”

### **C. Environmental Citizenship**

Native and managed European honeybee colonies provide pollination services to many of North America’s crops. Due to diseases, pesticides, and habitat loss, European honeybee colonies that pollinate US agricultural crops have declined as much as 50 percent. It is difficult to calculate the monetary costs of nature’s services such as pollination, however annual losses may run as high as \$5.7 billion-\$8.3 billion. To date, no technological fix exists that can replace pollinators.

In addition to disease, pesticides (that kill beneficial insects as well as agricultural pests), and habitat loss are human-caused problems for plants. Many pollinators such as bats, birds, and butterflies migrate long distances. As they travel, these pollinators depend on nectar-producing flowers. In turn, bats, birds, and bees increase genetic mixing, seed set and reproduction of native plants along NECTAR CORRIDORS. Habitat fragmentation due to human development disrupts nectar corridors and may affect the ability of certain pollinators to survive their migration.

Taking a stand for pollinators doesn’t require a lot of time or money. Thoughtful gardening can assist bees, butterflies, birds, and other pollinators. Home gardeners can cut back on pesticide use, plant native and nectar-filled wildflowers adapted to the local climate and soil, and provide and protect nesting sites. Flowers that provide a succession of blooms from spring through fall will provide a consistent safe haven for pollinators. This can even be done in a small window box. If you have more room, you might consider creating a food source for young pollinators and a place to overwinter for eggs and larvae.