

PURPOSE

To help develop understanding that most plants usually reproduce sexually. Students will learn the parts of the flower and the process of sexual reproduction in plants.

CONTEXT

According to Benchmarks, middle school is the time to "begin the study of genetic traits-what offspring get from parents." (*Benchmarks for Science Literacy*, p.108.) And, the introductory essay states that: "Direct observations of generational similarities and differences of at least some plants and animals are essential." (*Benchmarks for Science Literacy*, p.106.)

In earlier grades, students should have had some experience naming traits and classifying individuals with respect to those traits (e.g., eye color: brown). By the time they reach middle school, students should already have some idea about the types of things that animals and plants get or don't get from their parents, although this knowledge will continue to be refined throughout the study of heredity. Prior to doing this lesson, students should have an understanding of both sexual and asexual reproduction and how genetic information is passed from parent to offspring in both cases.

This is the first of two lessons about reproduction in plants. This lesson covers how most plants normally reproduce - sexually. The second Science NetLinks lesson in this series, Plants 2: Plant Propagation, teaches how plants can be forced to reproduce asexually.

This lesson is most appropriate for a 6th grade life science class. Parts of this lesson will be done individually, while other parts will be done in small groups. It will require access to the Internet.

PLANNING AHEAD

It is recommended that you read Lesson Plan 1 from [Plants and Animals: Partners in Pollination](#), from the Smithsonian In Your Classroom site, and background essay ahead of time. Also, you will need to make copies of Activity Pages 1A and 1B for the students.

MOTIVATION

Ask students if they know how humans and other animals pass on their traits to their offspring. The point of the discussion is not to have students discuss the mechanisms of genes and DNA in detail, but to make sure that students understand that in animals, traits are inherited from both parents.

Then, display several samples of the same type of plant. Each plant should be slightly different from the others. Ask students to describe how each one is similar and different.

For example, ask students:

- Are they the same height? Color? Shape?
Then ask students questions such as:

- Why do the plants not look exactly alike?
- Do you think the plants look like their parents?
- Do plants even have parents?

In early middle school, students tend to explain inheritance only in observable features; you may want to introduce other less obvious traits, such as tolerance for shade or drought and length of blooming season. Show students examples of plants with a variety of such traits.

It is also worth noting that elementary- and middle-school students may hold a much more restricted meaning than biologists do for the word "plant." They may not recognize that trees, vegetables, and grasses are all plants. (*Benchmarks for Science Literacy*, p. 341.)

During student discussions, try to help students expand on their definition of the word "plant." For example, if students make a general point about a common household plant, ask if this would also apply to grasses, trees, or vegetables.

Ask students to write down their ideas about how plants pass on traits to their offspring. Let them know that they will revisit these thoughts later in the lesson.

DEVELOPMENT

Have students go to the [Flower Parts](#), found at the Great Plant Escape website, to study why plants have flowers.

This page is designed for students, but does include some vocabulary that is not necessary. Be sure to emphasize the simple vocabulary.

Give each student a large piece of paper (12x18 works well). On the paper, have students draw and label the parts of the flower. They should identify the parts as being male or female as well as state the function of each part. Some students may already have covered this material in earlier grades. For these students, the activity can serve as a review.

Lead students in an in-depth discussion using these questions as a guide:

- In human reproduction, the mother provides half of the genes for an offspring in the form of an egg and the father provides the other half of the genes in the form of a sperm. What part of the plant serves as the "mother"? (pistil)
- What part of the plant contains the genes from the mother? (the ovules)
- What part of the plant serves as the "father"? (stamen)
- What do we usually call the sperm cell in the flower? (pollen grain)
- In human reproduction, the fertilized egg, or zygote, contains all of the genetic information for the baby to grow. What part of the plant forms after the pollen fertilizes the egg and contains all of the genetic information for the plant to grow? (seed)
- What are some ways that plants get their pollen to other plants?

After learning the parts of the flower and how the plant reproduces, have students do Lesson Plan 1 from [Plants and Animals: Partners in Pollination](#), found on the Smithsonian In Your Classroom website. This activity has the students simulate the process of pollination. As stated earlier, it is suggested that you download and read the background essay and lesson ahead of time. Upon completing this activity, ask these questions:

- What part of the flower does the cotton swab represent? Is it male or female? (stigma; female)
- What part of the insect collects the nectar? (proboscis)
- What parts of the insect may carry pollen? (bristles, legs and baskets, head)
- How does the insect benefit from this process? (it gets nectar for food)
- By what other mechanisms (other than insects) is pollen transported?
- How does the flower benefit from this process? (the pollen is transferred from the anther of one flower to the stigma of another)

Now have students look at what they wrote in the Motivation and refine their answers. Lead a discussion about what they changed and why.

ASSESSMENT

To evaluate this project, have students "dissect" a flower. Gladiolas work very well for this and can be purchased at any flower store (also, some funeral homes can donate these). Other flowers will work as well, just make sure the flowers are large enough to easily see the parts, and that they are not self-pollinating flowers. Have students carefully remove some of the petals and identify the parts inside.

Then, have students make labeling pins for each part. They can write the name of the structure on a small piece of masking tape, wrap the tape around the top of a straight pin and place the pin in through the flower part into a dissecting tray or a piece of corrugated cardboard. That way, you can easily assess if the students correctly identified each part.

In addition to labeling the parts, have students write answers to these questions:

- Describe the process of pollination by insects.
- How does this flower attract the insects that pollinate it?
- How does this plant discourage self-pollination? Why is this desirable?

EXTENSIONS

It is recommended that you follow this lesson with the second in this Science NetLinks series on plant reproduction, [Plants 2: Plant Propagation](#).

The rest of the Smithsonian's [Partners in Pollination](#) lessons would serve as great extensions to this lesson.

The University of Illinois Extension offers a set of lessons, [Breeding Plants as a Hobby](#), that directly relate to this topic.

[BEE SHORTAGE=FOOD CRISIS](#) is an article about the decline in honey bee populations, found on the Access Excellence website. Students could read the article and use their knowledge of how plants sexually reproduce to explain the crisis.