

Flower Power

Wyoming Science

Objectives:

- Students will investigate variations and similarities in plants grown from seeds of a parent plant.
- Students will contrast inherited traits with traits and behaviors that are not inherited but may be learned or induced by environmental factors.
- Students will have an understanding of plant pollination processes.

Background:

Have you ever walked through a flower garden and noticed the many different sizes, shapes, colors and textures of the blossoms? The flower on a plant is not just for us to look at, smell and enjoy, it is vital to its survival.

Not only does a flower contain the parts necessary for reproduction, it also is very flashy about advertising its rich supply of nectar and pollen. Flowers trade sweet nectar and protein-rich pollen in return for the service that insects and other creatures perform: pollination. Pollination is simply the transfer of pollen grains from an anther to a stigma. Virtually all grains, fruits, vegetables, wildflowers, and trees must be pollinated and fertilized to produce seed or fruit, and pollination is vital for the production of critically important agricultural crops, including corn, wheat, rice, apples, oranges, tomatoes and squash.

For many plants, the production of seeds that will grow depends on the transfer of pollen from one flower to another flower of the same kind. These kind of plants are referred to as cross-pollinators. Most pollination occurs when insects or animals brush against the pollen-bearing parts of a flower and pick up pollen. When the creature goes to another flower for more food, some of the pollen from the first flower sticks to the second flower. In this way, flowers are pollinated.

In general, pollinators are attracted to plants that offer an abundance of food. Different insects are attracted to different types of flowers depending on color, scent, and size. Honey bees see higher colors of the human visible spectrum plus ultraviolet and tend to prefer blue, purple and yellow flowers that have a sweet scent. Butterflies are attracted to orange, yellow, pink and blue flowers that have a large landing pad. Moths are active at night, requiring flowers that are open and providing nectar at night. Large, white flowers are particularly easy for moths to see at night.

Insects are not just pollinating flowers for fun. Many



Standards

Science

Life Systems:

1.2, 1.3, 1.4, 1.5, 1.6

Science As Inquiry:

2.1, 2.2, 2.3, 2.4

Materials

Activity 1

- Cut flowers, (see note pg 2) one for each student
- 5-gallon bucket
- Scissors
- Straight pins (5 or 6 each student)
- Piece of cardboard for each student
- "Flower Power" worksheet for each student or transparency for a classroom activity
- Small labels
- Written directions for each scout
- "Honey, I'd Love to Dance", one for each team
- Materials for Activity #2 on page 4

Estimated Time

2 (60) Minute Activities

Grades 5-6

materials

Activity 1

- Three colors of glitter (bright colors work best)
- Black pipe cleaners) 3" section for each student bent into an L-shape
- Newspaper
- Bag of treats for each team
- Written directions for each scout
- "Honey, I'd Love to Dance", one for each team

notes:

Contact a local florist and ask for the flowers that will be thrown out) Make sure you have a variety of colors, sizes and forms of flowers. Look for flowers that exhibit easily identifiable parts such as lilies, wild roses, columbines, irises, petunias, snapdragons, and sunflowers.

of them are gathering nectar from the flowers to use as food. Honey bees have lots of little hairs on their body. Pollen sticks to the hairs while the bees are visiting the flowers. A furry bee moving around inside the flower picks up a lot of pollen. After getting pollen on their body hairs, the bees move it to a special area on their hind legs called pollen baskets. Foraging bees returning to the hive often have bright yellow or greenish balls of pollen hanging from these pollen baskets. Honey bees mix the pollen with some nectar to form a mixture called beebread that is protein rich food used to feed larvae.

Although insects are responsible for the majority of pollen being transferred, pollination occurs in other ways. Creatures other than insects seeking nectar, like birds and bats, can also transfer pollen. Wind and water are other sources of pollination.

When the pollen grains that have been transferred to the stigma germinate, a pollen tube is sent down to release sex cells to fertilize the ovules. After fertilization, the ovules become seeds, and the ovary wall becomes the fruit.

So does every plant depend on an insect or other creature to assist in its pollination? No. Some plants are self-pollinators, which means; the pollination occurs within the same flower. The resulting seeds and the plants they produce are genetically identical to the parent. This isn't true with cross-pollinated plants. They are the offspring of two different parents. So the fruit or offspring may not resemble either parent. You can't tell by looking at a plant if it is self or cross pollinating.

Horticulturists, someone who grows plants, or plant breeders experiment with important crops to cross-pollinate for desired genetic traits. Plant scientists have discovered that many plants use a form of both self and cross-pollination. Also, that plants which are typically known for self-pollination will have larger fruit if the pollen is "set" by a pollinator. Take a look below at some familiar fruits to see how they are pollinated. Don't forget that some may be in both categories.

SELF-POLLINATED

Tomatoes
Squash/Pumpkins
Corn
Beans
Barley
Cotton
Peaches
Pears
Soybeans
Wheat
Oats

CROSS-POLLINATED

Apples
Squash/Pumpkins
Cantaloupe
Cucumber
Watermelon
Grapes
Pears
Peppers
Plums
Soybeans
Strawberries

Activity Procedures:

Activity 1

Flower Dissection:

1. Collect flowers in advance and store in water. Dissect a few flowers and label the parts beforehand.
2. Discuss the background information with your class. Write the cross and self pollinated plant list on the chalkboard. Explain to your students that they are going to examine, dissect and label the parts of the flower associated with pollination and seed formation.
3. Give each student a copy of “Flower Power” worksheet, some straight pins and a piece of cardboard. Have 6-7 pairs of scissors located centrally in the classroom.
4. Instruct the students to first label the flower parts on the “Flower Power” worksheet using the “Glossary of Flower Parts”. You could also do this section as a class by making a transparency of the “Flower Power” worksheet.
5. Show your students the previously dissected flowers. Explain that flower dissection requires precision and a “light touch”, rough handling of the flower will destroy the parts which need to be labeled. Give each student a flower. Have the students carefully dissect the flower and pin the parts onto the cardboard. Tell them to use the “Flower Power” worksheet as a reference, students then label each flower part pinned to the cardboard.
6. Have your students predict which kind of pollinators may visit their flower based on the color of the petals, shape and texture of the flower and the size. (More information in the background)
7. Have your students predict the size and shape of the seeds that may be produced by the flower. Can they really predict how a seed will look based on how the flower looks? (No)
8. Following the activity, have your students answer the following questions.

Questions for Investigation:

- Are some flowers easier to dissect than others?
- Were some parts easier to identify than others?
- Did every flower contain pollen? Why or why not?
- What could a farmer or gardener do to ensure good pollination of his/her crops? (avoid spraying insecticide during times of pollination, place the bees in a central place, hope for good weather)
- How would your lifestyle be different without pollination? (your food varieties would be limited, you wouldn't wear cotton clothing, our homes wouldn't be made of wooden products)

vocabulary:

- *inherit*
- *pollination*
- *trait*
- *pollinate*
- *style*
- *anther*
- *stigma*
- *filament*
- *ovary*
- *sepal*
- *style*
- *dissect*
- *germinate*
- *fertilize*

notes:

Activity 2

Pollination

1. Divide the class into teams of 3-4 students.
2. Give each team the following supplies:
 - * Newspaper to cover work area
 - * 3" sections of pipe cleaners (one for each student)
 - * A small pile of each color of glitter, placed at least 12" apart- label them A, B, & C.
 - * A sheet of paper to list their observations
3. Tell the students that they are going to become pollinators.
4. The glitter represents the pollen on the anthers of a flower and pipe cleaner represents the hairy legs or body of an insect pollinator.
5. Have the students place the bristles of the L-shaped pipe cleaners in color "A" of glitter and then into color "B" of glitter. Have them record their observations.
6. Have the students remove the glitter from the "legs" of their insect. Have them record their observations. They should also record their observations of what has happen in the piles of glitter.
7. Allow the students to "pollinate" and record their observations. Have them invent and compare different methods of moving pollen with the insect leg. Explain to them that flowers must receive pollen from the same kind of flower to make seeds or fruit.
8. Next, have the students blow on the color "A" pile in the direction of the color "C" pile.
 - * What happens to pile "C"?
 - * Is there as much color "A" mixed in with color "C" as there is "A" mixed with "B"?
 - * Which method wasted more glitter (pollen)?
9. Have the students list other ways they could imitate pollination.
10. As a class, discuss the results of their observations.

The Bee Dance

This activity needs lots of room. Try it outside!

1. Ask students how humans communicate non-verbally (body language, hand signals, facial expressions). Have a few demonstrate in a charades-type manner.
2. Review "Honey, I'd Love To Dance." Review the messages bees communicate through their dances. Review both dances and what each movement means. Explain that they now have the opportunity to find food (treat bags) and to communicate its whereabouts to fellow team members.
3. Divide the class into teams of 4-5 depending upon class size.

4. Have each team choose a scout (the bee that will originally find the food source and communicate its whereabouts through bee dances to the team members).
5. Give each scout written directions to a different treat bag and send the scouts out to find them. Do not let the other students witness their search.
6. When the scouts return, have them communicate the direction and distance of the treat bag to their team members using either the round dance or the waggle dance. No verbal or “human” body language allowed!
7. Once all the teams have found their reward, follow-up with a class discussion about the ease or difficulty of communicating through dance. Is it difficult to judge distance without a tape measurer or other tools? Do they believe honey bees are intelligent creatures?

Questions for Investigation:

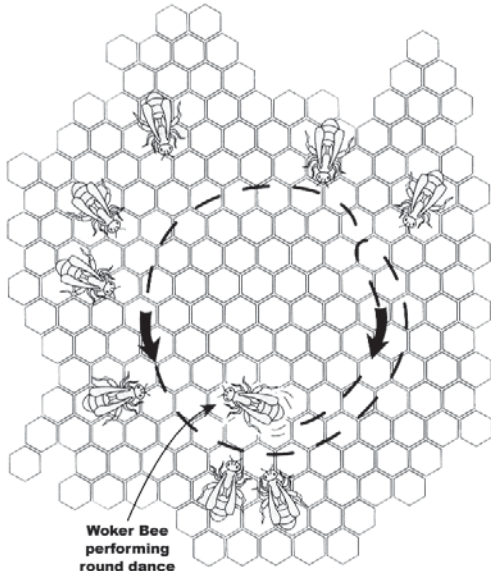
1. Do you think that bee dances are instinctual or learned behaviors?
2. What other instinctual behaviors do insects have that are critical to their survival? (i.e.: they can smell pheromones to mating and communication; fly towards the light or away from it)



notes:

Honey, I'd Love to Dance!

Honey bees communicate with each other by dancing. There are several bee dances, but the most common are the round dance and the waggle dance.



Worker Bee performing round dance

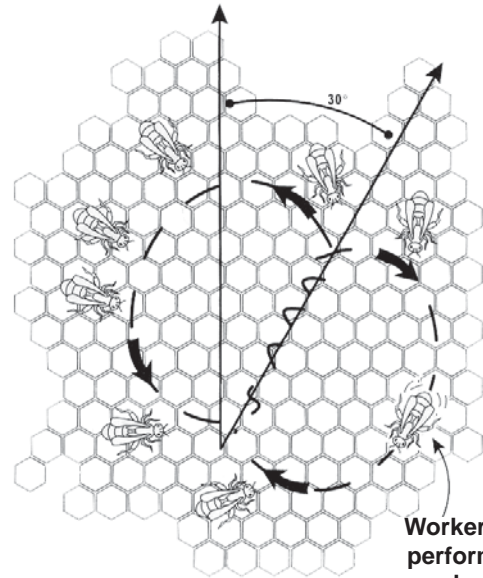
Round Dance

When food is close to the hive (less than 100 yards), a worker bee performs the round dance. She goes round and round, first one way and then the other. The round dance does not show the exact location of the flowers so fellow worker bees must fly out in many directions looking for them.

Waggle Dance

If the flowers are more than 100 yards away from the hive, the returning bee performs the waggle dance. The bee

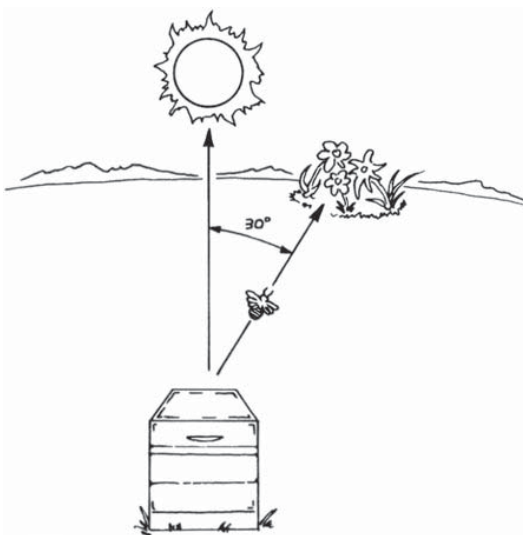
dances a half circle in one direction, turns, and runs straight while wagging her abdomen. Then she dances a half circle in the other direction. These two half circles form a figure eight.



Worker Bee performing waggle dance

If the food is in the same direction as the sun, the central run of the dance is straight up the comb. If the food is to the left or the right of the sun, the bee alters the direction of the dance by the correct amount to the left or right of the upright line.

The distance between the hive and the food is communicated by the speed of the dance and the buzzing sound made by the dancing bee. The faster the worker dances, the closer the food. The waggle dance shows both location and distance of the flowers, so the bees know where to fly.



Flower Power

Using the "Glossary of Flower Parts," label the following parts of a flower.



Glossary of Flower Parts:

Anther-- the bright sac that produces and contains the pollen grains.

Filament-- the stalk that supports the anther.

Ovary-- the base of the female portion of the flower containing the seeds.

Petals-- the colorful, thin structures that surround the pollination parts of the flower.

Pollen grains-- the powdery particles that contain the male portions of the flower; also a nutritious, protein-rich food for bees.

Sepal-- commonly green, leaflike structures that protect the bud prior to opening.

Stigma-- sticky surface where the pollen lands and germinates.

Style-- the narrow region of the pistil between the stigma and the ovary.