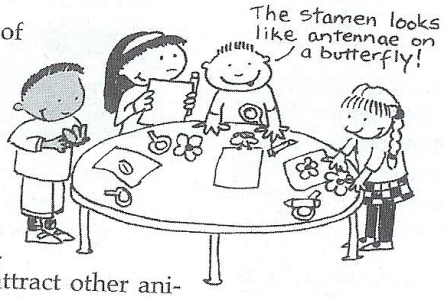
Flowery Investigations

Students dissect flowers to learn about flower structures and then read about pollination in *Life Lab Beat*.

Outcome

Students learn about the role of flowers in plant reproduction.



For the Teacher

We are attracted to flowers because we enjoy their fragrance and bright colors. In the natural world, though, flower scents and hues help attract other animals for a very specific purpose. Insects and other animals are attracted to feasts of nectar and pollen, and as they dine they assist the plants with reproduction. Seeds are the offspring of flowering plants, but in order for seeds to form, sexual reproduction has to occur. In plants, that requires the union of the male and female sex cells, which are found inside flowers. Pollen grains contain the male *sperm;* the female *eggs* are located in the base of the *pistil* in the *ovary* at the center of the flower.

Watch closely as a bee visits a flower. As it gathers food to take back to the hive, the bee brushes against the *stamens*, the male structures. At the tips of the stamens are the *anthers*, where pollen is produced. For reproduction to take place, the tip of a flower's female structure—the stigma of the pistil—must receive pollen. From there the male sperm is transferred to the ovule in the base of the pistil so that fertilization can occur. While the bee gets nectar or pollen from one flower, pollen catches on the tiny hairs covering its body. Pollination occurs when some rubs off onto the stigma of that flower or another flower the bee visits. Soon after, the flower begins to produce seeds.

In this activity, students are introduced to flower structure and to the process of pollination. In the next activity, they will build on this knowledge to explore the mutualistic relationship between pollinators and flowers. To help students learn about flower structure, encourage them to distinguish the various flower parts they see and to name these parts according to what they look like or do. Later you may give them the correct names.

Indoor

Time
60 minutes

Science Key
Life Science

Related Subjects
Art
Language Arts

Process Skills
Observing
Inferring

Materials

For the Class:
- Interactions bulletin board (begun in *Stakeout* activity)

For Each Group of 4:
- wax paper
- tweezers
- plastic knife
- magnifying lens
- 4 identical flowers (see Preparation)
- cotton swabs
- glue or tape

For Each Student:
- *Life Lab Beat*, pp. 60–61
- Field Log, pp. 57–58 (pp. 5–6)

Teacher to Teacher

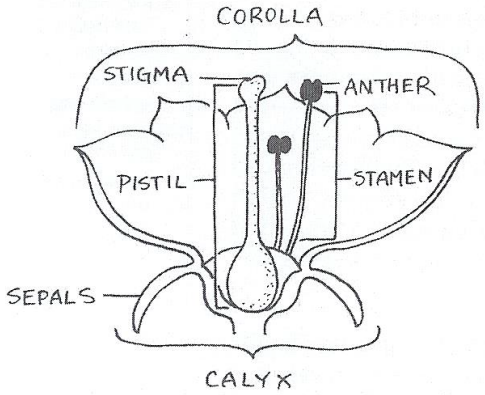
Flowers for this activity were easily found in fields, gardens, backyards, and might even possibly be donated by a local florist. Students started paying close attention to how different each flower is as they got physically closer to it and could really see the various parts of the flower. This is also a great bilingual Spanish lesson, as the Spanish terms for flower parts are Latin-based and very similar to the English terms used for the same parts.

—Olga O'Brien, Bayview School, Santa Cruz, CA

Preparation

Flowers can be divided into two categories: complete and incomplete. Complete flowers have both male and female reproductive parts; incomplete flowers have male *or* female parts. This is a result of the flower's coevolution with its pollination mechanism.

Find enough complete flowers such as lilies, geraniums, or mustard for the activity. If flowers are not abundant in the garden, you may ask students to bring in flowers from home or ask a florist to donate old flowers. Students will be more involved if they each have a flower, but pairs of students may share a flower if necessary.



Getting Started

Introduce the activity by eliciting student ideas about flowers and whether they interact with other living things.

What are flowers? How do flowers help a plant? Do you think flowers interact with other living things? Can you give some examples? Record students' ideas on the Interactions bulletin board.

Action

1. Divide the class into groups of four and give each student a flower to dissect.

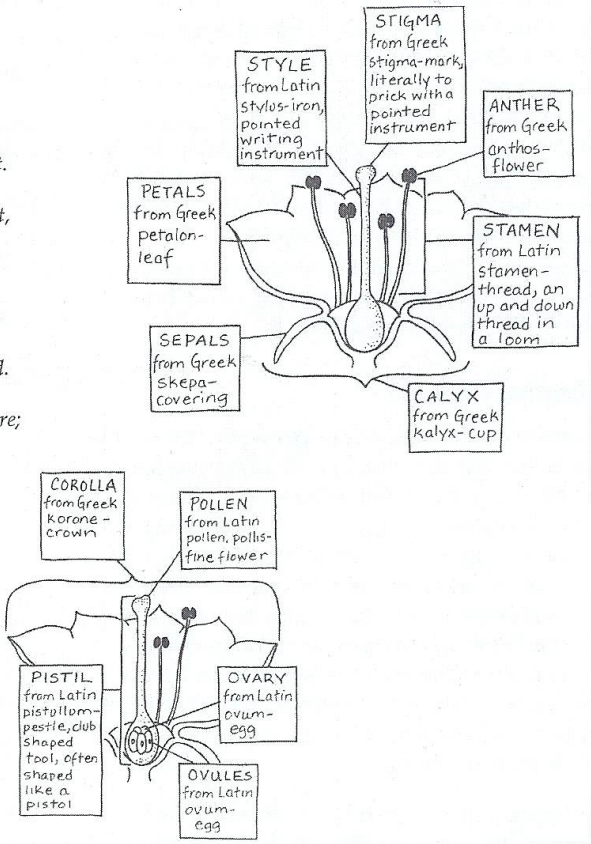
2. Have each group brainstorm how many different parts they see. Each student should draw a picture of their flower in the Field Log.

3. Before dissecting their flowers, involve students in carefully exploring their flower. They can use the hand lens to examine parts close up and use the cotton swab to see if parts rub off.

4. As they take apart their flower, students may glue or tape each part (or a sample if there are lots of identical parts) in the Field Log.

A Flower Poem

The calyx is the outside cup,
it holds the flower snugly up,
Its sepals have been woven stout
to keep the cold and dampness out.
The corolla is the colored part
that gladdens every childlike heart,
Its petals wave open in the breeze
to summon butterflies and bees.
The stamens next within the ring
their anthers set on magic spring,
These anthers store a generous mead
Of pollen, needed to make the seed.
The pistils in the center fare,
for they must have the greatest care;
Their stigmas catch the pollen bead
which turn the ovules into seed.
–Anonymous



5. Encourage students to talk in their groups about how each part might help the flower and to write their ideas in their Field Logs. Students should also give each part a descriptive name that they think is appropriate. For example, the sepals might be called Outside Green Covers.

6. Have students look especially for small depressions at the base of the petals that are filled with a sugary solution called nectar.

7. If students have different types of flowers, ask them to compare parts for similarities and differences.

8. When students finish their dissection and drawing, draw a simple flower on the chalkboard. Tell students the names botanists use for various flower parts. Show that many of the names come from a word that describes what the part looks like or what it does for the flower, just like the names students gave.

9. Read about pollination in the *Life Lab Beat* article, "Pollination Partnerships," pp. 60–61.

Assessment

Ask students the following questions to help them relate the flower structure they observed to what they read about pollination.

What parts did you find in your flower? Did you find anything resembling eggs or seeds? Are all our flowers the same in certain ways? How are they different? What do flowers do for the plant? What is pollination? (Pollination occurs when pollen is transferred from the anther to the pistil of that flower or another flower.) **Which plant parts are involved in pollination? If a bee helps pollinate a plant, is that an interaction?** (yes) **Which does the interaction help—the bee or the flower?**

Digging Deeper

- Use a simple plant press to preserve flowers from the garden and from field trips. Place flowers between sheets of paper towels or blotting paper. Stack several sheets of newspaper over the toweling and start another layer of towels, plants, and towels. Continue this layering, finishing with a layer of newspaper and making no more than three layers of plants. Sandwich the layers between two layers of cardboard or wood, and secure with bungee cords, rubber bands, or string.

- Collect pollen samples from different flowers by shaking each flower over a piece of black construction paper. If pollen does not shake loose, pull off the stamen and rub it on the paper. Examine the pollen grains through hand lenses and compare their shapes and colors. If a microscope is available at the Life Lab Center, mount and examine pollen grains at greater magnification.

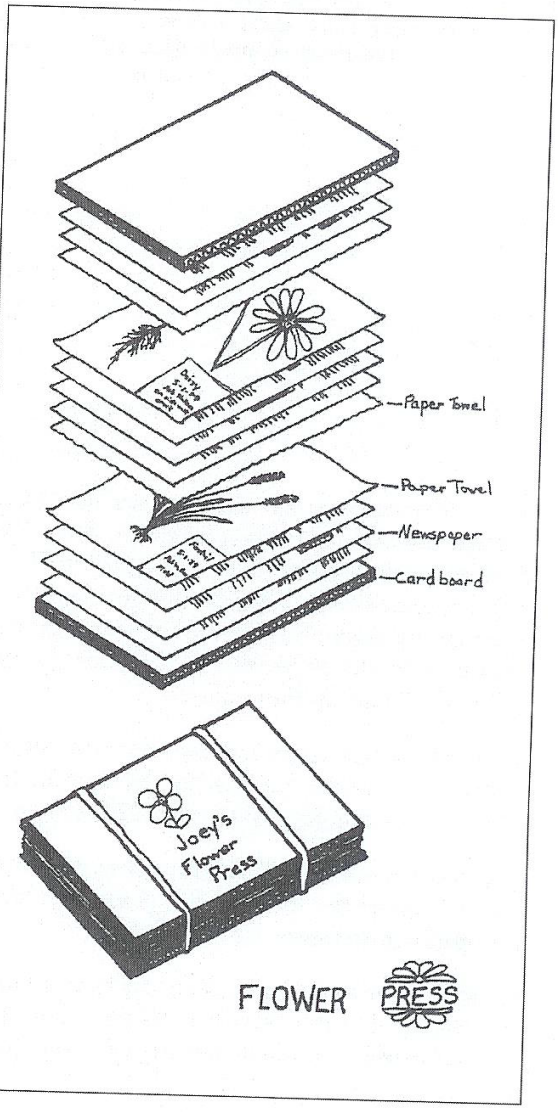
- Help students role-play the parts of a flower—stamens, pistils, petals, and sepals—as well as a pollinating insect. You don't need to have all the petals or stamens, just representative parts. Have students reenact the whole process of pollination. Writing a script and having a narrator makes this activity more coherent.

Teacher Reflections

- How well were students able to distinguish different flower parts?

- Would students benefit from more practice dissecting plant parts?

- Were students able to relate what they read about pollination to the flower parts they had observed?

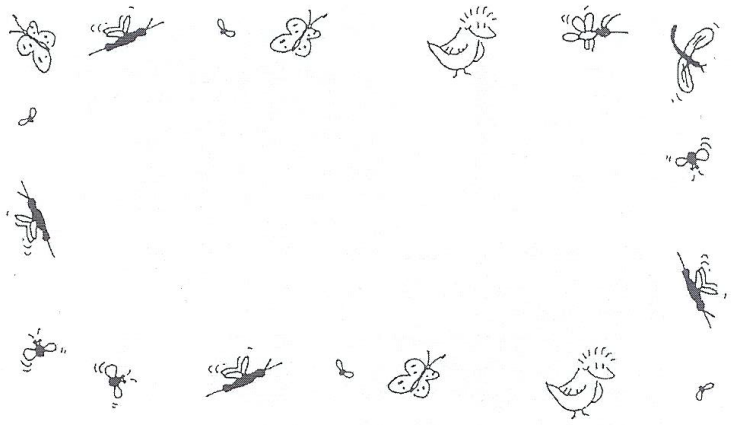


Flowery Investigations

Date _____

1. Attach each part of your flower to this page.
2. Invent a descriptive name for each of the parts and label them.
3. Briefly explain what you think each part does.

Now draw the roots of your legume in the box below.



Draw your magnified view of the nodules in the box to the right.

Open a nodule and draw what you see in the box to the left.

What do you think nodules are? _____

_____

Rule of Thumb

Date _____

The artist in the picture above is using the rule of thumb. It is an easy way to measure objects. Measuring this way is useful when an artist needs to know the size of the part of something compared with the whole. The rule of thumb is also useful if the objects are too far away to touch. Try this.

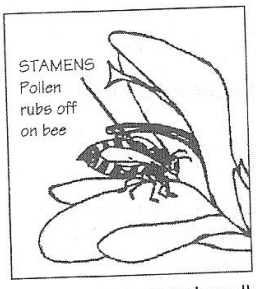
1. Choose a small plant that is close to you. With a pencil in your hand hold your arm straight.
2. Measure the plant. If it is, for example, a quarter of a pencil high, draw it that big at the bottom of the page.
3. Now choose a similar plant that is far away. Measure it by using your thumb on a pencil. Near the top of the box, draw the plant the same size as your measurement.

Flowery Investigations

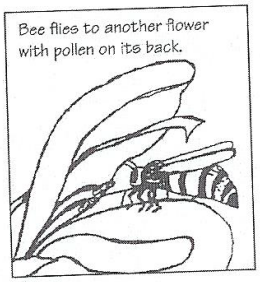
Date _____

Draw your flower on this page. Use your pencil and the rule of thumb to measure each part of the flower. Make sure each part is close to the right size and in the correct position.

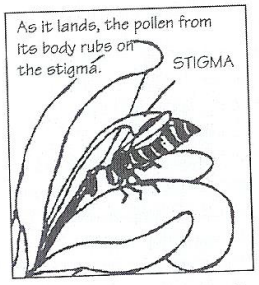
AMAZING ADAPTATIONS
Pollination Partnerships



Buzzz. Coming in for a landing! Bright markings on the flower petal guide Mrs. Bee to a landing. She follows the petals' markings toward the sweet nectar pool deep inside the flower. To get there, she has to squeeze past pollen-covered blobs.

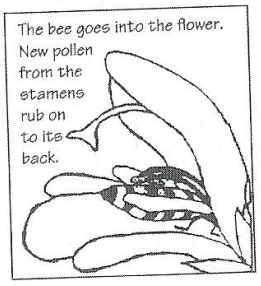


Whap! She's bopped on the head by a blob of pollen. She drinks up some nectar and backs out of the flower. Dusted with golden pollen grains, she flies to the next flower. As she works her way into the second flower, pollen from the first flower pollinates the second one. The pollination partnership has paid off!



All flowering plants need to be pollinated before they can make seeds. Each flower makes its own pollen. But most flowers need pollen from another flower of its own type to actually be pollinated. (That's where the bees and other pollinators come in.)

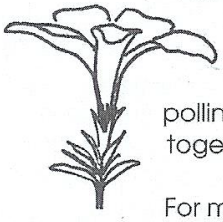
Look at a flower and you might only notice its bright petals or flashy sepals. But these are just the advertisements that attract the pollinators. The key parts for reproduction are the less flashy stamens and pistils.

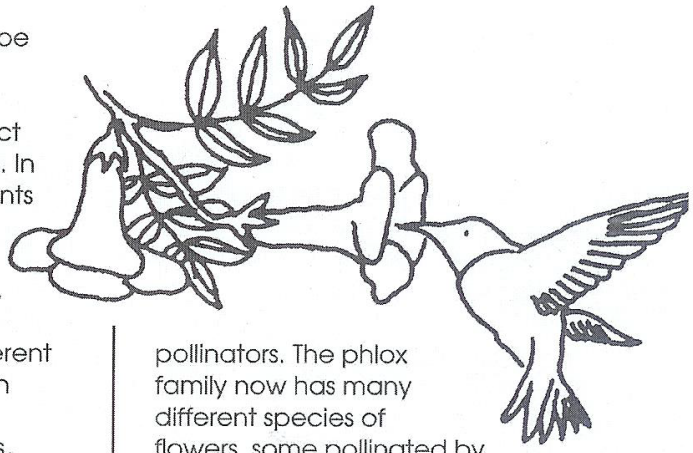


The wind was the first pollinator of ancient plants. It is still the main pollinator for many grasses, trees, and crops like corn. You may not think of these plants as having flowers, but look again! Think of the tassels on corn plants. These flowers are tiny and plain because they don't need to attract animal pollinators. Wind-pollinated plants make huge amounts of pollen to ensure that they get pollinated. At certain times of the year, the air is loaded with pollen from trees and grasses—just ask anyone who gets hay fever!

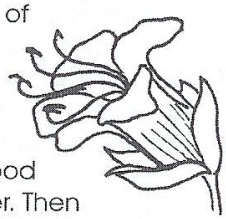
The first fossils of flowering plants date back to around 136 million years ago. Millions of years of evolution have formed some amazing pollination partnerships between certain flowering plants and the animals that pollinate them. Think about what a variety of flowers there are. Some are flashy and bright, some have fancy shapes, some

are simple but good smelling. Each type of flower attracts a certain kind of pollinator. Flowers vary because they have adapted to attract different pollinators. In fact, flowering plants and their pollinators evolved together, or *co-evolved.*





For millions of years, different animals have gotten food from certain flowers and, in return, have done the service of pollinating them. The flowers, meanwhile, adapted forms, colors, shapes, and smells to attract and feed only their most reliable pollinators. Neither the flower nor the pollinator made any of these adaptations on purpose, of course. A flower became more suited for a particular pollinator. The pollinator became more suited for getting food from that particular flower. Then both the flower and the pollinator passed these traits on to their next generations. This is how the pollination partnerships co-evolved by tiny steps over millions of years.



A great example of how pollinators and flowers co-evolved can be seen in the phlox flower family. Millions of years ago there was only a simple phlox flower that was pollinated by bees. Flowers that attract bees often smell sweet and can be purple, blue, yellow, or white (bees can't see red!). Some "bee" flowers have colored markings that guide bees to the nectar and pollen.

Over millions of years, different variations of this simple phlox flower evolved that attracted other pollinators. The phlox family now has many different species of flowers, some pollinated by moths and butterflies, some by hummingbirds, some by flies, some by beetles, and some even by bats.

The phlox family's "moth" flower is long and thin with the nectar hidden deep inside it. Moths have long tongues to reach nectar at the base of tubes. The moth flowers open at night when the moths are active. Their sweet smell and light color allow moths to find them in the dark.

Some of the phlox family flowers have evolved into a tube shape suitable for hummingbird pollination. "Hummingbird" flowers don't need to smell good because hummingbirds have a poor sense of smell. These flowers are often bright red or orange (remember, bees can't see red!). In Europe, where there aren't any hummingbirds, there also aren't any native orange or red tube-shaped flowers!