Petal Attraction

The following activity is adapted from the curriculum guide *GrowLab: Classroom Activities for Indoor Gardens and Grow Lights*. This curriculum brings plant-based explorations to life through 46 lesson plans and hundreds of extension activity ideas that spark students' curiosity about plants and invite them to think and act like scientists.

Overview: Students invent models of flowers and then create advertisements to illustrate how their new flowers attract pollinators.

Grade Level/Range: Grades 3-6

Objectives: Students will learn:

- The purpose of a flower is to attract pollinators to ensure seed production
- Why different pollinators are attracted to different types of flowers
- How flowers have adapted over time to attract pollinators

Time: 1 hour

Materials:

- Magazine advertisements
- Drawing paper and supplies
- Miscellaneous craft supplies and natural materials (e.g. tissue paper, sticks, pipe cleaners, foil, etc.)

Background Information: For plants to form seeds, pollen from the male parts of a flower (stamens formed from filaments holding pollen-producing anthers) must reach the female part (pistil formed from stigma, style, and ovary) of the same or a different flower, a process called pollination. Some plants simply toss their pollen grains out on the wind in large numbers, hoping that some will land by chance where needed. Other kinds of plants take a more targeted approach by using living creatures to carry their pollen from flower to flower. As the pollinators visit flowers in search of nectar and pollen for nourishment, pollen grains dust their bodies. The pollen then brushes onto the female parts of the next flower they investigate, inadvertently pollinating it in the process.

Although bees are the best known and most wide-spread pollinators, other kinds of animals, including wasps, beetles, flies, birds, and bats act as pollinators for various kinds of flowers. Over hundreds and thousands of years, many flowers and pollinators have coevolved and developed special relationships. A pollinator capable of detecting certain colors or scents or possessing structures that best fit certain flowers passes these advantages on to its offspring. Over many generations these traits have become well established in pollinator populations. Meanwhile flowers have also evolved, giving rise to specific characteristics or adaptations that suit particular pollinators.

To compete for the attention of pollinators, flowers have evolved ingenious methods to entice creatures to their sugar-filled nectar and protein- and vitamin-rich pollen. In exchange, the unsuspecting creatures unintentionally act as pollen-carrying liaisons between blooms that would otherwise never touch. The amazing diversity of flowers results from their unique adaptations to lure a range of pollinators (or to ensure that wind or, more rarely, water carries pollen). Every aspect of a flower, from the designs on its petals to the timing of its bloom, is vital to the process. Below are some examples of flower characteristics that attract some common pollinators:

Pollinator Flower Preferences

Pollinators	Flower Preferences
Bees **Did you know?** There are about 4,000 species of native bees in the U.S. ranging in length from less than one eighth of an inch to more than one inch. Most of these bees are solitary nesters. Unlike the non-native (but now naturalized) hive-building honeybees, solitary native bees have no hive to defend and are unlikely to sting!	Yellow, blue, purple flowers. There are hundreds of types of bees that come in a variety of sizes and have a range of flower preferences. They can't see red, but are attracted to some red flowers, such as bee balm, that reflect ultraviolet light. Small bees, which have short tongues, prefer packed clusters of tiny flowers (e.g., marigold, daisy, butterfly weed, aromatic herbs.
Butterflies	Red, orange, yellow, pink, blue flowers. They need to land before feeding, so prefer flat-topped flower clusters (e.g., Joe Pye weed, calendula, butterfly weed, yarrow, daisy) in a sunny location. They also need plants as food sources for caterpillars, their larval stage, and places to lay eggs. These include milkweed, aster, lupine, thistle, fennel, violets, hollyhock, black-eyed Susan.
Moths	Light-colored flowers that open at dusk such as evening primrose.
Pollinating beetles	They prefer wide-open flowers, such as aster, sunflower, rose, and butterfly weed.
Flies	Green, white, or cream flowers. They have short tongues, so prefer simple-bowl shapes.
Hummingbirds	Red, orange, purple/red tubular flowers with lots of nectar (e.g., honeysuckle, sage, fuchsia, jewelweed, fireweed, cardinal flower, bee balm, nasturtium, century plant). No landing areas are needed since they hover while feeding.
Bats (Pollinating bats are found primarily in the Southwest)	Large, light-colored, night-blooming flowers with strong fruity odor (e.g., many types of cacti).

Laying the Groundwork:

Display some magazine advertisements with popular slogans and engaging photos. Have students work in pairs to discuss the following questions: *At what type of audience/person do you think each advertisement is aimed? What does the advertiser do to grab the reader's attention and interest (e.g., claims to make them happier or healthier or uses colorful pictures)? How do television advertisements do similar things?*

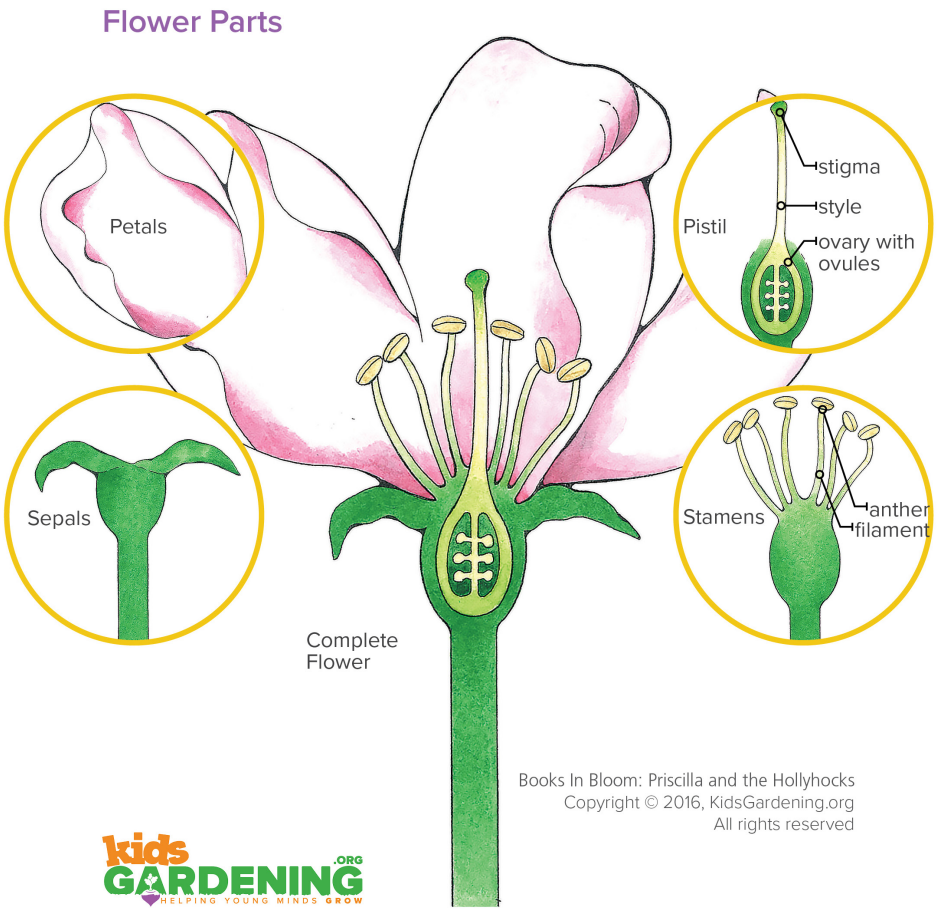
As a class, discuss some of the students' ideas. Then ask: *What do you think this discussion has to do with our study of flowers? What do you think flowers and these advertisers have in common? Who is the flower's "audience"?*

Reveal that many flowers are really brilliant advertisers, luring pollinators who inadvertently transfer pollen from one flower to another. Highlight that many flowers have specific colors, shapes, mechanism, or smells to attract specific pollinators. Ask: *What types of "advertising" have you observed in flowers?*

Exploration:

1. Have students work in small groups to "invent" models of fictitious flowers. All models must:
   - consist of unique petals, pollen, pistils, and stamens (the basic parts of all flowers)
   - be made of recycled classroom or natural materials
   - be a minimum of 6 inches in diameter

   Beyond these characteristics, you can allow your young gardeners imaginations to run wild, or you can prompt them with additional parameters by having them pick from a pre-determined objective such as:
   - Invent a flower that might entice an unsuspecting human to pollinate it.
   - Invent a flower that can pollinate itself with the help of gravity.
   - Invent a flower that could easily be pollinated by the wind.
   - Invent a flower that will make a pollinator think it's approaching a fellow insect.
   - Invent a flower that would force bees to follow a particular route in and out, touching the anthers and stigma on its way.
   - Invent a flower that would attract a pollinator with a long beak.
   - Invent a flower with an anther that can easily be "tripped" and sprung by an insect, releasing pollen.
2. Have groups decide how to present their flower inventions to the class. They might choose a spokesperson or make a creative group presentation. Encourage the class to guess the purpose of the different structures of each invented flower.
3. If time allows, also ask them to create a model of a specific pollinator that might be adapted to pollinating their particular flower.



Making Connections: Possible discussion questions:

- Why are some stigmas sticky?
- Can you guess why some petals have designs such as spots or stripes?
- What do you think would happen if...
  - ... bees and other insects couldn't detect color?
  - ... motor oil were splashed on a flower's stigma?
  - ... pesticides that are toxic to bees were sprayed on plants?
- Do you think bees or plants benefit more during pollination? (This is a good question for debate, with no right answer!)

Branching Out:

Further explore real flowers and ask students to hypothesize how they might attract pollinators. You can collect samples from your garden or possibly ask for donations from a local florist. Have students identify the flower parts and then compare each structure on the different flowers. Allow students to develop their own theories and then research the correct answer online (if you got the flowers from a florist) or give them time to use their observation skills in the garden (if they were picked from the garden) to find out who is visiting the different types of flowers.

Write an editorial for National Pollinating magazine from a pollinator concerned about pesticide use. First research how pesticides can affect pollinators.

Write and illustrate a description of a flower-of-the-future. Describe how this flower would be adapted to specific conditions and means of pollination.

Ask students to identify and compare flowers that they suspect are wind-pollinated with those that are pollinated by birds or insects. Ask, *What leads you to suspect wind pollination? What differences do you notice between wind- and animal-pollinated flowers?*