Lesson #3: Flower Dissection Lab

Objectives: To prepare students for their study of pollination by understanding the purpose of flowers and to identify flower parts. To help instill a sense of appreciation and empathy for plants.

Introduction to Activity: Preserving plant diversity is essential to maintaining environmental health; its significance to the ecology of natural habitats cannot be overstated. This can be illustrated using the example of pollination. Plants cannot reproduce unless their flowers are pollinated, and most of them depend upon animals or insects to do the job. Likewise, many pollinating animals and insects depend upon the flowers they serve for their food. If plants cannot reproduce, they will eventually disappear, taking with them the living things that depend upon them for food and shelter. Your students will learn that for this critical ecological process to proceed as it should, it is essential that plant diversity be maintained.

Before being able to understand pollination and the essential role it plays in our world, students first have to know what a flower is and how it is designed for reproduction. Many middle school students know what a flower is, but they don't know what it is for.

In this activity, students will examine up-close a variety of flowers, and will see that flowers vary a great deal in their color, scent, and structure. This concept will be key to their understanding of the next activity, which illustrates that there is no typical flower and that flowers are specially designed for specific pollinators. Through flower dissection, students can also develop a greater appreciation for the beauty flowers bring to our world.

Materials Needed:

- scalpels
- dissecting trays (optional)
- a variety of cut flowers with easily distinguished male and female parts (You will want at least three different types of flowers for your students to dissect, and enough individual flowers of each that your students can work in pairs. Gladiolas, tulips, lilies, astrolomeria, snapdragons, and larkspurs are examples that can often be found in garden and flower shops. Lilies are large and easy to dissect, and they have a marvelous scent that your students will enjoy! Avoid composite flowers such as daisies and asters.)
- if possible, a variety of "odd" flowers that do not fit the classic mold (Good examples include Calla Lily, Bird-of-Paradise, and flowers from the composite or aster families.)
- a copy of the assignment "Pollination: Part One" and accompanying worksheet for each student (to be completed at home in preparation for lesson #4)

Note: Many flower and garden shops are willing to donate flowers for school labs if you contact them in advance. They often have certain hours and days when they discard flowers too spent to sell. These flowers are usually in perfectly good condition for the lab. You should tell the manager that you need flowers with obvious male and female parts, and suggest specific flowers in the store that meet the criteria. A manager may be willing to donate examples of odd flowers as well.

Activity:
Begin the activity by reviewing the male and female parts of a flower. It's helpful to have a diagram on the board. You will want to review the following points to reinforce what students learned in the reading "The Flower" and to prepare students for the lab:

- Plant reproduction is essential! With no plant reproduction, there can be no plants (and with no plants, there can be no habitat for animal and human life).
- Plants have to have their female egg cells fertilized by male sperm cells, but the plants can't walk around to find mates!
- Flowers have male and female parts. Most species have them on the same flower, while some have them on different flowers. Involve students by having them explain how the processes of pollination and fertilization take place by referring to the diagram on the board.
- There is no typical flower. Flowers come in a great variety of designs. This is especially evident if you look at "odd" or atypical flowers.

Explain to your students that they will be dissecting several different flowers in order to identify the various male and female parts and to observe some flower design examples. Hold up each of the plants being dissected and write their names on the board. Encourage your students to work carefully and slowly, and to notice the colors, scents, and textures of the flowers. When they do cross sections of the ovaries, challenge them to actually find the eggs. (In some plants, the eggs are so small they cannot be seen. In larger flowers, eggs can often be found.)

Pass out a "Flower Dissection Lab" sheet to each student. Have students get in pairs, and distribute the scalpels and dissection trays (if you are using them). The lab sheet is self-explanatory. Simply circulate around the room as the students work. Test their knowledge by asking them to show you the various parts of flowers. You might also point out interesting observations that they might have missed, for example how sticky the pollen and stigma are.

If you are able to obtain examples of "odd flowers," hold them up and identify each by name. Explain that there are a wide variety of flower designs; not all flowers have the "classic" design, with obvious male and female parts like the ones observed during flower dissection. Hopefully you have several samples of

each flower so that your students can circulate around the room to look at each one carefully. The “Strange and Unusual Flowers” sheet includes information about several “odd” flowers that you are likely to find in a garden store. Your students can use this sheet, or one that you adapt, as they observe each flower.

Wrap up the activity by reviewing the following points:

- By the end of this module, we want you to understand why plant conservation is important.
- Pollination is a vital ecological process; when humans disrupt it, plant species and the animals that are dependent on them disappear.
- To truly understand pollination, you have to know how the process of pollination works. This requires you to know what a flower is for and the parts of a flower. This is why you did this activity.
- The next activity will examine pollination in more depth.

At the end of the lab, pass out the assignment for the next class, “Pollination: Part One,” and its accompanying worksheet.

Flower Dissection Lab Sheet

Student Name: _____Class or Section: _____

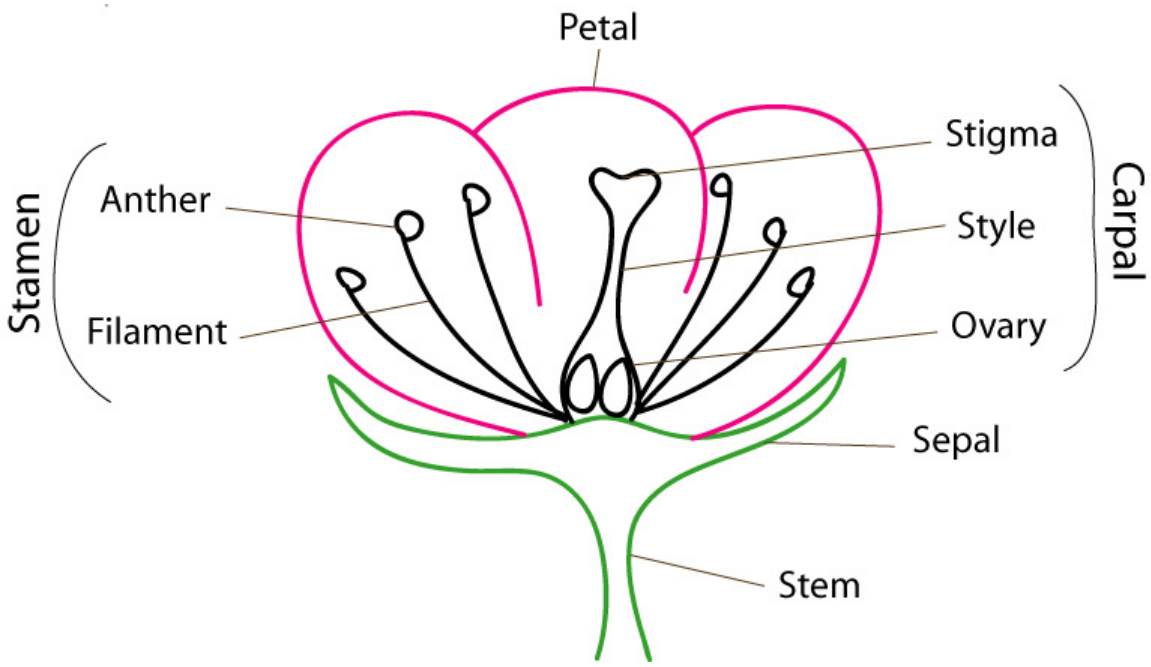
BACKGROUND INFORMATION

Stamen: Male part of the flower. Stamens surround the carpal, which is in the center.

1. Anther: part of the flower that produces pollen
2. Filament: part of the flower that holds up the anther

Carpal: Female part of the flower.

1. Stigma: sticky and wet, it is where the pollen lands.
2. Style: the part of the flower through which sperm cells travel to reach the plant's egg cells.
3. Ovary: part of the flower where plant cells are found.



DISSECTION OF FLOWER #1 Name of flower: _____

In the space below, please draw the carpal of this flower with the proper number of stamens around it. Notice whether the carpals or stamens are taller. Label the parts.

What color is the pollen on the anther? _____

What color is the pistil? _____

How many stamens are on one flower? _____

Describe the flower's scent, if any: _____

Is the stigma sticky? _____ If so, why do you think it would be sticky? _____
_____

Were you able to locate an egg cell in the ovary? _____

DISSECTION OF FLOWER #2 Name of flower: _____

In the space below, please draw the carpal of this flower with the proper number of stamens around it. Notice whether the carpals or stamens are taller. Label the parts.

What color is the pollen on the anther? _____

What color is the pistil? _____

How many stamens are on one flower? _____

Describe the flower's scent, if any: _____

Is the stigma sticky? _____ If so, why do you think it would be sticky? _____
_____

Were you able to locate an egg cell in the ovary? _____

DISSECTION OF FLOWER #3 Name of flower: _____

In the space below, please draw the carpal of this flower with the proper number of carpals around it. Notice whether the carpals or stamens are taller. Label the parts.

What color is the pollen on the anther? _____

What color is the pistil? _____

How many stamens are on one flower? _____

Describe the flower's scent, if any: _____

Is the stigma sticky? _____ If so, why do you think it would be sticky? _____
_____

Were you able to locate an egg cell in the ovary? _____

Strange and Unusual Flowers

In the room, you will see a variety of strange and unusual flowers. Please look at them carefully to try to identify the petals, carpals (stigmas and styles), and stamens (anthers and filaments). Notice the design of these flowers is quite different than the “classic” flower design you observed in the dissections. Look and enjoy, but please don’t tear the flowers apart so that others may enjoy them, too.

Photo: Jessica Merz

Calla Lily

- Notice what look like white petals. These are not actually petals at all; rather, they are adapted leaves.
- Look for a tall spike coming out of the white leaf (it is probably yellow). This is called a spadix. There are actually dozens of individual flowers on the spadix. The female carpals are small protrusions clustered at the bottom and they look different than the bumpy part of the upper spadix.
- The upper part of the spadix holds the stamens with their pollen. You may find that some of the pollen rubs off on your fingers if you touch the spadix.
- This single “flower” is actually a bouquet of flowers since it has many male and female parts.

Photo: bcanna

Composite Flowers (such as Daisies and Asters)

- Each single “flower” is actually a bouquet of many flowers!
- The inner circle contains dozens of carpals and stamens. Often, the female parts are clustered in the center of the flower, and the male stamens are concentrated around the carpals.
- If somebody asked you to get a bouquet of flowers, you could actually bring just one daisy and you would be meeting your obligation!

Photo: Glenn Wilson

Bird-of-Paradise Flower

- The African Bird-of-Paradise is designed specifically for sunbird pollinators. The long base of the flower is sturdy enough to support the weight of a bird landing on the end of the base.
- The orange and purple blooms unfurl from the “perch” one by one. The bird has to lean over and drink nectar held in a little purple cup at the base of the flower. When it does, it opens up two purple petals hiding long stamens. The sticky pollen rubs off on the bird.

Assignment: Pollination—Part One

As you have seen, flowers are the reproductive organs of plants. Sperm from the male parts of the flower joins with the eggs tucked away in the female parts, and seeds are the result. Without constant reproduction, plants would obviously dwindle and disappear, and human beings and millions of other living things would then die off, as well. Our continued existence on planet Earth depends upon plants reproducing successfully, year after year.

This may not be a comforting thought! After all, plants, as far as we know, are not aware they are reproducing at all. It's all just happening without their knowledge. In addition, plants have to overcome an obstacle that most animals do not: Whereas most animals can move around in search of mates, plants are usually stuck in one place. How, then, can their sperm cells continually find their way to the precise places (stigmas) on the correct flowers so that plants can reproduce themselves?

Photo: Vladislav Sabanov

The answer is the amazing process of pollination. Pollination is when pollen (the tiny grains containing sperm cells) travels from the anthers on flower stamens to the stigmas on female carpals. Only after this has happened can sperm cells begin their journeys to fertilize eggs and make seeds. The trick, therefore, to successful plant reproduction is getting a plant's pollen to land where it is supposed to: stigmas of the same species. This has to occur, even though pollen grains cannot travel on their own and parent plants cannot transport them, themselves.

Fortunately for our continued survival, plants have developed ways for other things in the environment (namely wind and animals) to carry their pollen for them. Indeed, flowers are designed to ensure successful pollination. Each flower's specific shape, color, and scent are not an accident. They represent the plant's specific strategy to arrange successful transport of its pollen so reproduction can take place. (Here, we are talking about wild flowers. Cultivated flowers, such as those we grow in gardens, look the way they do because we have bred them that way. We, not pollination strategy, are responsible for their appearance.)

For plants with both male and female parts on the same flower, which is true of most species of flowering plants, pollination might seem to be simple enough:

Just have the pollen from the anther fall onto the stigma of the carpal and pollinate yourself! Some plants do this, but generally it is a bad idea. A plant fertilizing itself makes seeds with only its own genes, and all of its offspring will be exactly alike (except for those that happen to mutate). In the long run, this will not help plants survive. Over time, species consisting of individuals with different abilities and characteristics cope better with environmental changes than species in which all the individuals are identical to each other. Thus, many plants go out of their way to prevent self-pollination. A flower's pollen may appear before or after its eggs are ready to be fertilized, for example. Or, it may even recognize its own pollen and prevent it from reaching its eggs, or even kill it if it lands on its own stigma.

And so, most plants choose cross-pollination; that is, pollination when only pollen and eggs from different flowers of the same species actually make seeds. With cross-pollination, each new plant gets a different combination of genes, so each one will show different combinations of characteristics. Environmental conditions can change, but hopefully, there will be some individuals that just happen to be suited to them and that can survive. But, how do plants get cross-pollination to happen?

Photo: Glenn Fleishman

Many flowers arrange for animals to carry their pollen for them, often resorting to bribery to get the job done! To bribe animals, flowers frequently provide food, either extra pollen or energy-rich, sugar-loaded liquid called nectar. Many different animals (birds, butterflies, bees, beetles, moths, and even bats) visit flowers to obtain food. Fortunately, these animals are sloppy eaters. In harvesting pollen and nectar, they get pollen all over themselves. Then, as they move from flower to flower, they unintentionally smear the pollen they have picked up onto each new flower they visit.

Other flowers rely on the wind to carry their pollen. In the United States, these plants include grasses and many of our trees, such as oaks, hickories, and maples. Wind-pollinated plants produce huge amounts of pollen grains, because the pollen lands on the correct flower stigmas purely by chance. These plants waste a great deal of pollen, because only a tiny percentage of pollen lands where it is supposed to. The rest lands everywhere the wind blows, covering our streets, cars, and homes with pollen powder. Some of this pollen even goes up our noses and into our eyes, causing some of us to suffer the sneezing and runny noses of hay fever. Wind-pollinated, not animal-pollinated, flowers are responsible for our misery.

And so, each wild flower has a specific pollination strategy. Its color, scent, and shape are all there to carry out that strategy successfully, not to please us human beings. Exactly how flower design matches pollination strategy is the subject of the next reading.

Glossary

Cultivated flowers: flowers raised by humans; many of these flowers have been specially bred for gardening

Cross-pollination: when pollen and eggs from different plants of the same species meet

Genes: found in the cell nucleus, where they are located on chromosomes; they contain hereditary information that determines thousands of characteristics (In a plant, these characteristics include flower color and shape, plant height, stem strength, drought tolerance, etc.)

Mutation: a change in a gene; such changes can cause harm, have no effect, or occasionally be helpful

Nectar: a sweet liquid secreted by the flowers of some plants and consumed by its pollinators

Pollination: a vital process in the reproduction of plants in which pollen from one flower is transferred to the female part of a flower of the same species

Self-pollination: when a flower's pollen lands on the female parts of the same flower. This can lead to the flower fertilizing itself

Worksheet: Pollination—Part One

Name: _____ **Class/Section:** _____

Questions:

1. What is the difference between:

   - Pollination and fertilization:

   - A sperm cell and a pollen grain:

   - Cross-pollination and self-pollination:

2. Why is it advantageous for a plant to be cross-pollinated, rather than self-pollinated?

Answer Sheet: Pollination—Part One

Name: _____ **Class/Section:** _____

Questions:

1. What is the difference between:

   - Pollination and fertilization:

     Pollination is the transferal of pollen from anther to stigma. Fertilization is the joining of plant sperm and egg to make a seed, after pollination has taken place.

   - A sperm cell and a pollen grain:

     Pollen grains hold sperm cells. When pollen grains land on the right stigmas, sperm cells leave the pollen and travel to the plant ovules to fertilize them and make seeds.

   - Cross-pollination and self-pollination:

     Self-pollination is a flower pollinating itself. Cross-pollination is different individual flowers pollinating each other.

2. Why is it advantageous for a plant to be cross-pollinated, rather than self-pollinated?

Self-pollinated flowers produce plants that are exactly alike. Over time, these plants find it difficult to adapt to changing environmental conditions. Cross-pollinated flowers produce plants that are more variable. These plants are different from each other, so when environmental conditions change, it is more likely that at least some of them will be able to adapt to them and survive.