A Plant Primer: What do flower parts tell us about plants?

Introduction (~5 minutes)

Parts of our bodies have different jobs, and the same is true of plants.

For each of the survival tasks listed in the table below, identify which plant part you think does that job.

There may be several answers for each task. It is okay if you are unsure of some items.

The word bank below shows some structures you might want to choose from.

Word Bank:

- Stems
- Roots
- Leaves

- Fruits
- Flowers
- Seeds

Task Needed for Plant Survival	**What Plant Structure (or Structures) Do This Task?**
Absorb water and nutrients from the soil	
Absorb carbon dioxide gas from the atmosphere	
Gather light energy	
Reproduce	
Attract pollinators	
Distribute seeds	
Support other plant parts	

Explore 1 (~20 minutes)

Explore 1 Materials List

- A fresh flower from a florist or grocery store, preferably an *Alstroemeria* flower (Peruvian lily), lily, or tulip. Avoid mums, daisies, roses, asters, and irises.
- Tweezers or forceps
- Toothpick or wooden skewer
- Hand lens (magnifying glass or jeweler's loupe)
- Sharp blade and a responsible adult's help

We might think first of flowers as gifts. Humans give flowers to show concern or affection. To plants, flowers are reproductive parts.

Most flowers produce gametes that will mature into sperm and egg. Each gamete has a mixed half of the parent's genes. When the two gametes are combined, a new plant with a unique mixture of the parents' genes is made. This is called two-gamete or sexual reproduction.

Many plants can also reproduce asexually. If you take a cutting from one plant and place it in water, it can sprout roots. This new plant's genes will be an unchanged match to its parents' genes.

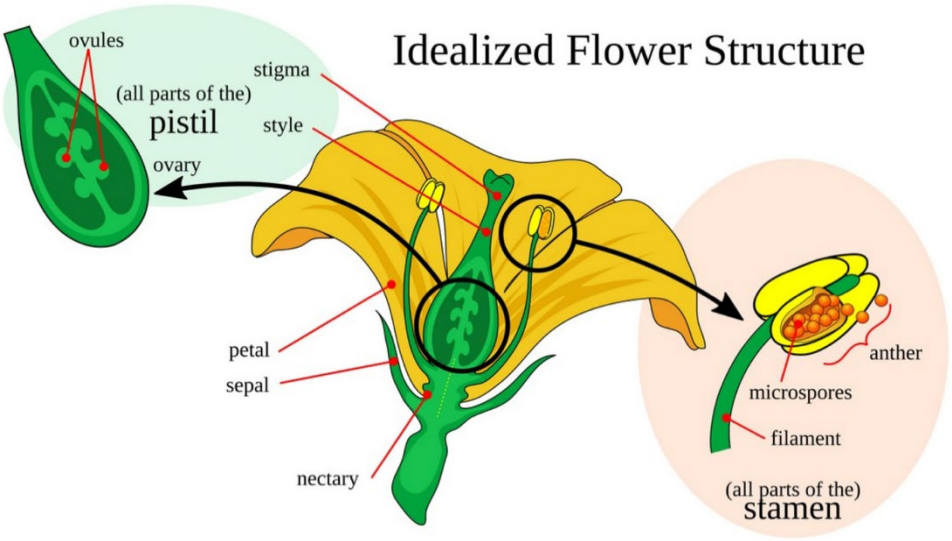
All plants reproduce with two gametes, but not all plants do so with flowers. Only plants called angiosperms produce flowers. We refer to this group as "flowering plants." To explore how plants use flowers to reproduce, let's take a flower apart!

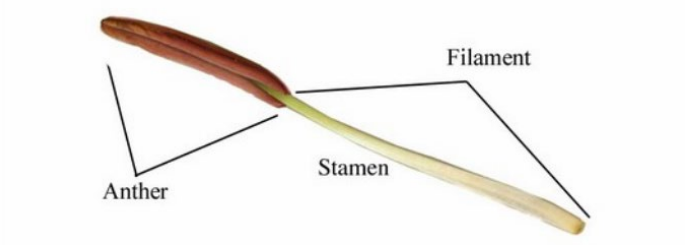
Read through the following passages. As you read, gently pull your flower apart. Start from the outside and work toward the center, using your tweezers, hand lens, and toothpick as tools. Use the images on the next two pages to guide you.

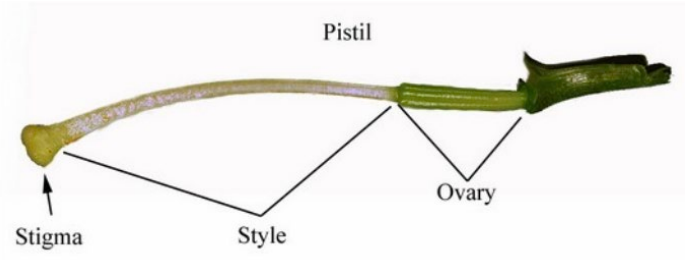
Angiosperms use flowers to reproduce sexually. Most flowers sit inside a green basin made of thick, modified leaves called sepals. Flower petals are found just inside the sepals. If you cannot tell the difference between flower petals and sepals, they are called tepals.

Petal traits like bright colors and exotic scents attract pollinators. Some flowers also have nectaries to attract pollinators. These pockets at the base of the petals produce sweet nectar. Flowers with nectaries often have tube-shaped flowers.

Do you think your flower has a nectary? How do you know?







As you move inward from the petals, you will find the flower's reproductive organs. Perfect flowers have both male and female reproductive organs. Imperfect flowers have one or the other.

In flowers, the male organs are the filament and anther. Together these form the stamen.

The anther is responsible for making pollen, and it is held high by the filament.

How many anthers does your flower have?

Pollination is the transfer of pollen from the anther to the stigma. The stigma is the top of the female part of the flower. You can find it as a sticky platform in the center of the flower.

How did you find the stigma in your flower?

The stigma is held up high in the flower's basin. This is where pollination is most likely. The stigma is supported by a thin stalk called the style. At the bottom of the style, in the bottom of the flower, is the ovary. Together, the stigma, style, and ovary are called the pistil.

How does the pistil in your flower compare to the diagram?

With an adult's help, use a blade to gently cut open the ovary. Inside, you can see ovules.

When a pollen grain lands on the stigma, it forms a microscopic pollen tube and moves through the style and to the ovary. Near the bottom of the ovary, the pollen grain divides into two sperm cells. The sperm cells move

into the ovary's entrance. Fertilization occurs the moment a sperm cell unites with an ovule's egg cell.

What do you see inside the ovary?

A fertilized ovule will mature into a seed, or a baby plant. The surrounding ovary will mature into a fruit. Fruits have many adaptations to help better disperse seeds.

Some have air-catching tufts for wind-dispersal (think of a dandelion). Others taste delicious, encouraging animals to eat the fruit. Later they will poop out the seeds in a new location, complete with a dose of fertilizer!

What plants can you think of that produce delicious fruit?

In nearly every species, offspring survive better if the two parents are not genetically similar.

Perfect flowers can self-pollinate, but many species with perfect flowers have ways to discourage it. Filament or style length are two of many factors that make self-pollination less likely.

How easy or difficult was it to find these structures in your flower? Why do you think that was?

Explain 1 (~10 minutes)

For each flower part that you just looked at, match its function below.

Plant Structure	Function
1. Petals	Sticky platform that catches pollen

Plant Structure	Function
2. Sepals	Holds the stigma up at a height likely to catch pollen from different flowers
3. Filament	Attracts pollinators
4. Anther	Matures into a seed that can begin the next generation
5. Stigma	Produces pollen
6. Style	Protects the flower before it opens
7. Ovary	Holds the anther up at a height most likely to effectively transfer pollen
8. Ovule	Produces ovules, matures into the fruit
9. Pollen	Produces sperm after successful travel through the stigma and style

Pollination occurs when pollen is transferred to a flower's stigma, but fertilization cannot happen until pollen matures into sperm.

Compare the event of fertilization in plants with what you know about the same event in animals. What do they have in common? What is different?

Explore 2 (~40 minutes)

Explore 2 Materials List

- White school glue
- Small brush (like a watercolor paint brush)
- 40x jeweler's loupe
- Leaves of various types (ask a parent before you clip off leaves from houseplants)
- Water dropper

- White Styrofoam™ plate
- Cell phone light

Flowers are not the only parts of plants that help them survive. Leaves are important too!

Carbon dioxide gas enters the plant through tiny pores called stomata. There are usually more of these on the bottom of a leaf.

Stomata can open and close with the help of hotdog-shaped "guard" cells on either side of the hole. The guard cells inflate and deflate with water. If water is scarce, stomata will close to prevent water loss through transpiration. They have to be open sometimes, though! The plant needs carbon dioxide to make food.

Photosynthesis takes place in leaves, where carbon dioxide and water combine to make sugar. The energy to make sugar comes from light captured by the leaves' green pigment, chlorophyll.

Have you ever put a thin layer of school glue on your fingertip, let it dry, and then peeled it off to see your fingerprint? (If you haven’t, try it! It’s so cool!). In this activity, you are going to do the same thing to the underside of a leaf. When you peel the thin layer of glue off the leaf, it will show you stomata and their guard cells.

Gather one leaf from up to 6 different plants. Note what type of plant each leaf came from.

After you have gathered your leaves, think about the plants you collected them from. Do some research if you can.

What are the habitats to which they are adapted? (Many houseplants are tropical!)

If you want to learn more about the natural habitats of common houseplants, check this out: Here's What Your Favorite Houseplants Look Like in the Wild.

What do you think their stomata and guard cells will look like? Do you think they will change based on their native habitats?

Sketch what you predict the stomata and guard cells will look like from each houseplant. Label each leaf type.

With the paint brush, paint a very thin layer of glue on the undersides of your leaves. If you have collected a pine needle, try to paint a thin spiral of glue going up the needle.

Let the glue dry.

Once dry, gently peel the layer of glue off each leaf. Keep your leaf peels organized so you do not get them mixed up. You need to know which peel came from which plant.

Place the cell phone, with the light on and pointing up, on a table. Put the Styrofoam™ plate upside down over the light.

Drop 2–3 drops of water on the Styrofoam™ plate, and then place one of your leaf peels in the water. Place another 2–3 drops of water on top of the leaf peel.

With your loupe held close to your eye, move your head close to your leaf peel until it is in focus. Then scan it, looking for those hotdog-shaped cells on either side of a hole.

Once you find a stoma, sketch it! Also make note of how many stomata there are per area. It's okay if this is a relative measurement like "not many," "some," or "a lot."

Explain 2 (~5 minutes)

Evaluate your hypotheses by comparing your sketches with your predictions. Did the stomata you observed differ in any way? If so, how?

Why do you think stomata are different in different plants?

Extend (~35 minutes)

Extend Materials List

- Device with the iNaturalist app
- Access to the Simple Key for Plant Identification

Scientists have studied plants and animals for a long time. They have recorded the diversity of plants and animals around the world.

They have even preserved plants and animals in museum collections. The Chicago Field Museum holds one such archive of Earth's biodiversity through time and space.

Every specimen in the collection has notes. The notes show the exact date and place of collection and who collected it. These collections are important. They allow scientists to compare modern plants and animals with those of the past. They allow us to see humans' impact on the Earth's biodiversity.

Are you ready to add to a great natural history collection? You can record the plant diversity you see around you on iNaturalist.

Choose a place to go for a nature walk with a responsible adult. It should be away from lawns and landscaping. This can be a community trail, the edge of a farm field, or in a nature park.

Before you start your walk, open the iNaturalist app and have the Go Botany key open on your device's browser.

Keep an eye out for non-landscaping plants. We often call these plants "weeds," but these are the ones you want to record. They may be native plants, and they show the biodiversity in your community!

Once you find a plant, use the Go Botany key to identify it. Start with the Simple Key for Plant Identification. You can use the advanced tool later if you need it. (As you identify plants, you will need to look at the plant parts you have just learned. This is a great way to apply what you know!)

Once you have identified your plant, open the iNaturalist app and record it. Continue to document plants along your walk or wherever you go. The more specimens you record, the more you are contributing to biodiversity research. If you find a plant you cannot identify, experts in iNaturalist can also help you.


Common Violet


Common Milkweed


Field Pennycress

Joe-Pye Weed

Trout Lily

Wild Ginger

Reflect (~10 minutes)

At the beginning of this exercise, you completed a table similar to the one below. Now, complete this table again, using all that you have learned.

It's possible for the same structure to match more than one task, but most structures will have one best match.

Task Needed for Plant Survival	**What Plant Structure Does this Task?**
Absorb water and nutrients from the soil	
Absorb carbon dioxide gas from the atmosphere	
Gather light energy	
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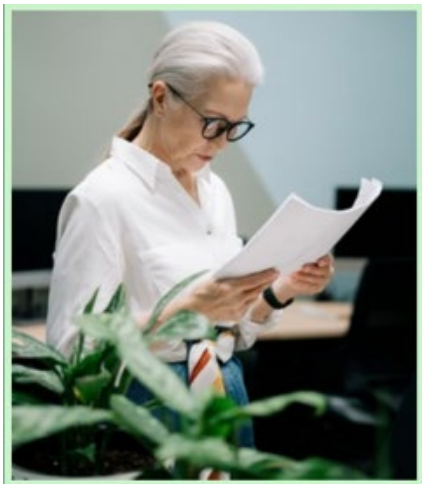
Attract pollinators	
Distribute seeds	
Support other plant parts	

What kinds of questions can scientists answer using databases like iNaturalist?

What else do you think you learned by doing these activities?



Career Connection: Plant Taxonomist

Plant taxonomists figure out how different plants are related to each other. They search for patterns between species and between regions. They often compare the DNA of present-day plants and plant specimens from natural history museums.

Most taxonomists earn a doctoral degree. This is usually after they complete a bachelor’s degree in biology or biochemistry. Earning the bachelor's degree lets them gain lab experience.

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