

Botany: Plant Dissection

Student Advanced Version

In this lab, we will learn about the structure and function of plants, and how plants are useful in our everyday lives.

Key Concepts:

- Plants have been on Earth for hundreds of millions of years!
- Most plants are made up of **roots, stems, leaves**, which are important for plant growth, and **flowers** and **fruits**, which are part of the plant reproductive system
- We use plants in almost every aspect of our lives, including **food, clothing, medicine**, and more
- Plants have different **adaptations** to help them to survive in different environments

Part 1: Growth

Generally speaking, a plant has two goals – to grow and to make more plants (reproduce). In order to grow, most plants need water, sunlight, and carbon dioxide (CO₂). There are several plant structures which help to gather these ingredients – the roots (which collect water), the stems (which transport water), and the leaves (which collect sunlight and CO₂).

Q1. The plant tissue in the stem which carries water from the roots to the leaves is called “xylem.” Running right next to the xylem is a second tissue, called phloem, which carries things in the opposite direction. What do you think it carries? Why?

Plants can sense the direction of the light and turn towards it, in order to maximize the amount of sunlight they absorb with their leaves. This process is called **phototropism**. “Photo” means “light” and “trop” means “to turn.”

Watch the videos “Cool corn phototropism” and “Sunflower solar tracking” located in the left-hand navigation bar at

<http://plantsinmotion.bio.indiana.edu/plantmotion/movements/tropism/tropisms.html>

Q2. Compare the seedlings at the beginning of the “cool corn phototropism” movie to the end. What has changed? Why?

Q3. Describe the leaves in the sunflower video. What characteristics do they have that allow them to capture the maximum amount of sunlight?

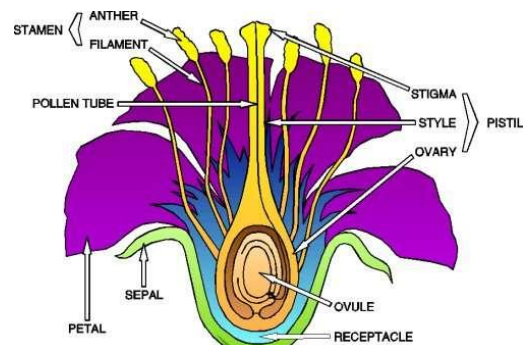
Q4. What kind of environment do you think sunflowers live in, based on the characteristics of these leaves?

Part 2: Reproduction

Just like a bird lays an egg to make a baby bird, most plants create seeds to make new plants.

Section 1: Flowers

Many plants use flowers as “seed factories.” Each flower has male and female parts - the female part in the middle (the **pistil**) grows and shelters the ovule, or egg, while the male parts along the outside (the **stamens**) produce pollen. When pollen and the ovule come together, a seed is formed! However, even though a single flower has both male and female parts, the seed is usually made with pollen from a *different* flower, not the one in which it’s grown.



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Q5. How does pollen move from flower to flower?

Q6. Why do you think that seeds are usually made from two different plants (ovule from one, but pollen from another)?

Over time, plants have evolved flowers that look very different from each other!

Using a hand lens, identify the following structures in three different flowers.

Type of Flower:	1.	2.	3.
Petals? (yes / no)			
Stamen? (yes / no)			
Pistil? (yes / no)			
Identify a Unique Feature			

Q7. Do all the flowers have the same basic parts?

Q8. Why do you think these flowers look so different from each other? What is the function of having unique traits?

Once a seed is created, it needs to be dispersed and planted. Just as plants need insects and animals in order to be pollinated, they also rely on them to disperse their seeds! Otherwise a plant would only ever grow in one, limited area. One way to make seeds more attractive to animals is to develop them into a “fruit.” This structure forms at the base of the flower, and expands as it fills with sugars and other nutrients to protect the developing seeds and appeal to passing animals.

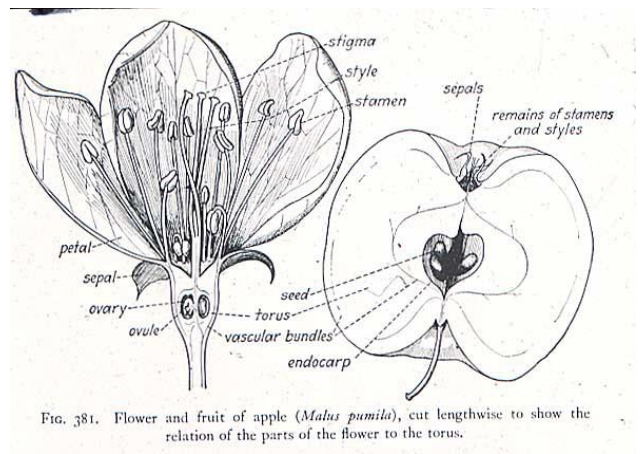


FIG. 381. Flower and fruit of apple (*Malus pumila*), cut lengthwise to show the relation of the parts of the flower to the torus.

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This is not the only way to disperse seeds, though. Plants can also envelope them in sticky or spiny coats (often called **burrs**), which will grab on to an animal’s fur (or your socks!) as it walks through a wooded or grassy area. Seeds can also be dispersed on the wind or by water.



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Q9. Can you think of an example of seeds that are dispersed by wind? Think about a popular weed...

Section 2: Seeds²

After the seed is dispersed and planted, it’s ready to sprout! Everything that the baby plant needs to grow is already there, packaged neatly into the seed.

Since the seed is completely in the dark underground, the plant inside (called the **embryo**) cannot use photosynthesis to make its own food. Instead, the seed contains an energy-rich, sugary substance called “**endosperm**” that the embryo uses in order to grow.

Q10. Chances are you’ve eaten the endosperm of a corn kernel (a seed) before. What is this called?

1. Your teacher will give you a dried bean and a bean that has been soaked in water.

Q11. Look at the two beans under a hand lens. Describe what differences you see (and feel!).

Q12. If you planted these two seeds, which do you think is more likely to sprout faster? Why?

2. Carefully remove the seed coat from the soaked bean with your fingers.
3. Gently pry apart the two halves of the bean.

Q13. Draw what you see inside the bean. Label the embryo and the endosperm.

Part 3: What parts of plants do we use?

We interact with plants and plant products every day, from food to clothing to the very oxygen that we breathe! But what parts of plants do we use?

1. Based on what we've learned about the different parts of plants, identify whether you think each item is a root, stem, leaf, flower, or fruit.

Use a plastic knife in order to see what's inside each specimen, if necessary. Be sure to cut neatly so that others can look at your work and make their own conclusions! Be sure to identify specific characteristics which support your answer.³

Given Name	Plant Part	Evidence

These items are all relatively easy to identify, since they go almost directly from the plant to the plate! However, many other plant products that we use have been processed so much, it's hard to tell what the plant originally looked like!

Q14. Can you identify the item in each picture below? Then draw a line connecting each plant with its corresponding finished product.

Plants



Products





Part 4: Unique Adaptations

We've talked a little bit about how root systems, leaves, flowers, and seeds can all look different depending on the environment where they grow. These differences are referred to as “**adaptations**.” Some plants, however, have developed extremely specialized adaptations in order to survive in specific environments!

1. Either demonstrate the closure of a Venus flytrap in real-time (if you have a live plant) or watch the “Venus flytrap” video from the left-hand navigation bar at <http://plantsinmotion.bio.indiana.edu/plantmotion/movements/nastic/nastic.html>
2. Watch the “Sensitive plant” video at the same site (including the “stronger stimulus” version found by scrolling down to the bottom of the description)

Q15. Why do you think these plants have these responses? Why are they beneficial?

Venus flytrap –

Sensitive plant (Mimosa) –

Q16. Look at the time scales for each of these reactions. Are they faster or slower than the phototropism response that we saw earlier? Why do you think this is?

3. As we saw earlier, plants often adapt to the day/night cycle by orienting their leaves. However, they can also adapt in other ways – watch the “Pulsing pumpkins” video at <http://plantsinmotion.bio.indiana.edu/plantmotion/movements/leafmovements/clocks.html>

Q17. Why is this growth cycle considered an adaptation? How does it benefit the plant?

Many years from now, you're a brilliant Plant Biologist who studies adaptations. One day you get a call - astronauts have been working hard to make Mars livable for humans, and they need your help to get plants to grow there! They've created an environment that is sunny, dry, windy, and full of insects that only come out at night. It's quite a challenge! Can you help them out and design a plant that will survive there?

Draw your plant (think about roots, stems, leaves, flowers (and pollinators), and seeds!) and describe how each part is adapted for this specific Martian environment. What unique features does it have to help it survive?

¹Smithsonian Department of Paleobiology <http://paleobiology.si.edu/geotime/main/htmlversion/>

²Adapted from "Seeds, Inside and Out" - <http://www.cas.muohio.edu/scienceforohio/Teacher/index.html>

³Adapted from "What Parts of a Plant Do We Eat?" - http://serendip.brynmawr.edu/sci_edu/waldron/