

Green Thumb

Introduction

A tiny seed that fits in the palm of your hand holds the blueprint for all the characteristics of a plant or very large tree. How does this process begin? What are some of the first characteristics to become visible? What do these characteristics tell us about what type of plant the seed will become? This activity will explore some of the first visible traits of a seedling and what they reveal about the plant.

Concepts

- Monocots
- Germination
- Dicots
- Observation

Background

Seeds are defined as the fertilized ovules of female plants. Seeds may be found inside fruits, flowers, pods, and roots of plants depending on the particular species. Almost every plant begins its life cycle as a seed, making seeds essential to life as we know it on Earth. One of the most notable qualities of seeds is their ability to remain dormant for extended periods of time. When a seed becomes exposed to water, it absorbs the water and swells causing the enzymes within the seed to begin to function, bringing the seed out of dormancy. This marks the beginning of the germination process.

Cotyledons are parts of a seed composed of nutritious tissue called endosperm which is comprised of starch, lipids (oils) and proteins. For this reason, many seeds have nutritional value to animals, including humans. The cotyledons provide food to a germinating plant until it is able to produce food on its own.

Plant species are classified into two major groups—monocotyledons and dicotyledons, commonly shortened to *monocots* and *dicots*. Plant species with one cotyledon are called monocotyledons (mono = one). Plant species with two cotyledons are called dicotyledons or dicots (di = two). In addition to the number of cotyledons, there are several other differences in the morphology, or physical features, of these two types of plants. The veins in the leaves are typically the easiest way to distinguish between monocots and dicots when observing plants. For characteristic traits of each classification see Figure 1.









	Monocots	Dicots
Leaves	Parallel veins 	Branching veins 
Roots	Fibrous 	Tap root 
Seeds	Single cotyledon 	Double cotyledon 
Flowers	Petals in multiples of 3 	Petals in multiples of 4 or 5 

Figure 1. Monocots vs. Dicots

Materials

Cotton balls, 5	Marker, permanent
Cups or beakers, 250-mL, 6	Masking tape, 6"
Forceps	Seeds, Unknown 1–5, 4 of each
Glove, polyethylene	Water, tap

Safety Precautions

Wash hands thoroughly with soap and water before leaving the laboratory.

Pre-Lab Preparation

Label five cups or beakers with masking tape labeled “Unknown 1,” “Unknown 2,” “Unknown 3,” “Unknown 4,” and “Unknown 5.” Fill the cups or beakers approximately half full with the seeds corresponding to each unknown. Place the cups in a central location since all students will need to obtain the seeds.

Procedure

1. Use a permanent marker to label the fingers of a glove 1–5 starting with the thumb (1) and continuing to the pinky (5).
2. Take the glove to the location in the room where the cups containing the unknown seeds are placed.
3. While one student holds the glove open, have another student count out four seeds from the cup labeled “Unknown 1” and drop them into the thumb of the glove.
4. This will be repeated for unknown seeds 2–5—four seeds into each finger of the glove labeled with the same number as the seed.
5. Fill a cup or beaker with 150–200 mL of tap water.
6. Saturate a cotton ball using forceps. Soak the cotton ball for about 10 seconds in the water, then remove it from the water and squeeze the cotton ball with the forceps a couple of times to remove excess moisture.
7. Have one student hold the glove open wide while another drops the cotton ball into the finger labeled with a “1” on the glove.
8. Repeat steps 6 and 7 for the remaining four fingers of the glove.
9. Fold the glove so that the opening is now pointing downward.
10. Provide masking tape for securing the the upper part of the glove to the window. See Figure 2.
11. Observe the seeds and germinating plants over the next several days and differentiate which plants are monocots and which are dicots, using Figure 1 as a guide.

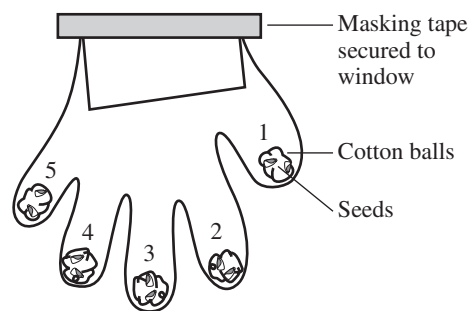


Figure 2.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures, and review all federal, state and local regulations that may apply, before proceeding. At the end of the activity, the gloves containing the plants and cotton balls may be transplanted into soil or placed in the trash according to Flinn Suggested Disposal Method #26a.

Tips

- Setting up the Green Thumb will require a 50-minute class period. The seedlings will then be observed two more times over the following week requiring only a couple minutes. The last day of observation (Day 7) will require about 10–15 minutes as students will need to look at the root and leaf structures. After students have completed the activity, you may wish to tell them the type of plant for each unknown.
- Have students transplant the young plants into small pots and continue to observe the ongoing plant life cycle throughout the semester.
- Seeds we found to work well are radish, marigold, grass, barley, and wheat.
- Have students first record their observations on the day the seeds are added to the glove, then the third, fifth, and seventh days. This schedule may be modified by a day or two dependant on the laboratory schedule. By the seventh day, students should be able to identify whether the plant is a monocot or dicot. Southern exposure is optimal for growth. If available, adhere gloves to a window facing south. However, if southern exposure is not available, the week is exceptionally rainy, the window is very cold, or any other factors happen to limit the amount of sunlight and the rate of growth, allow students an extra day or two for final observations.
- This lab is available as a Super Value Kit (enough materials provided for five classes of 30) from Flinn Scientific, Growing Glove, Catalog No. FB1807.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation

Constancy, change, and measurement

Content Standards: Grades 5–8

Content Standard C: Life Science, structure and function in living systems

Content Standards: Grades 9–12

Content Standard C: Life Science, organization in living systems

Materials for *Green Thumb* are available from Flinn Scientific, Inc.

Catalog No.	Description
SE1032	Gloves, Polyethylene
FB0680	Cotton Balls, 300 pkg.
AB1439	Radish Seeds, 1 oz
AB1426	Barley Seeds, 1 oz
FB0582	Wheat Seeds, 1 oz
FB1629	Marigold Seeds, 1 oz
FB0577	Grass Seeds, 4 oz
FB1807	Growing Glove—Student Laboratory Kit, Super Value Kit

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.