

Investigative Lab 22

How Do Plants Grow Up?

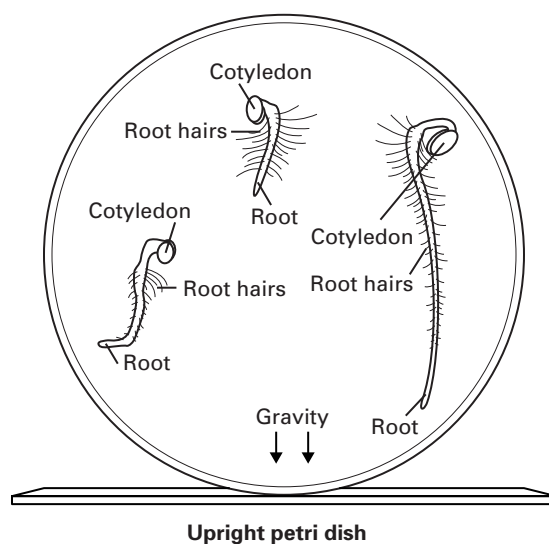
Exploring Gravitropism

Inquiry Challenge How do plants respond to gravity?

Lab Overview In this inquiry investigation you will explore how plants respond to gravity. You will develop and test your own hypotheses about the effects of gravity on young plant stems. Then you will perform an experiment of your own design using film canisters and seedlings.

Introduction Plant hormones cause chemical changes in certain cells in response to environmental factors such as light, wind, temperature, touch, and gravity. In the Prelab Activity you will examine a diagram of two-day-old radish seedlings grown in an upright petri dish. Note that the “leaves” you observe are the cotyledons or “seed leaves.” Based on your observations of root growth, you will make and test predictions about stem growth.

Prelab Activity Seedlings typically emerge from buried seeds that are not exposed to light. No matter what the position of the seed is, a healthy seedling’s root usually grows downward into the soil. Study the diagram below of two-day-old radish seedlings growing in an upright petri dish. The seedlings are held in place on a wet paper towel. Then answer the Prelab Questions on the next page.

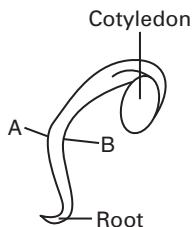


Prelab Questions

1. Record your observations below of the two-day-old seedlings in the diagram on the previous page.

2. An organism's response to gravity is called gravitropism. If an organism grows toward a source of gravity, it is exhibiting *positive gravitropism*. If an organism grows away from a source of gravity, it is exhibiting *negative gravitropism*. Which type of gravitropism do plant roots exhibit? Explain.

3. Examine the diagram below. As the root of this seedling bends, which side of the root is getting longer: the side labeled "A" or the side labeled "B"? Explain.



Materials

- black film canister
- marker
- heavy-duty paper towel
- scissors
- water
- transfer pipette
- Fast Plant™ or turnip seedlings

Procedure**Part A: Making a Prediction**

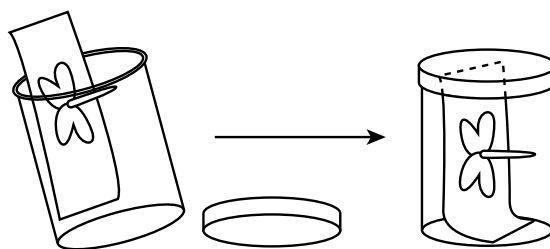
In the Prelab Activity you looked at how plant roots respond to gravity. Now you will make predictions about how young stems respond to gravity and perform an experiment to test the predictions. Discuss the following questions as a group.

1. Normally, as a seed germinates the young stem grows upward toward the light. But in what direction do you think young stems will grow in the dark? Could gravity also influence in which direction a stem grows? Record your thoughts below.

2. Make your prediction.
In the dark, a plant's stem will grow _____.

Part B: Observing Plant Stem Gravitropism

1. Use a marker to label the outside of the film canister's lid with your initials.
2. Use scissors to cut a 1-cm-wide strip of paper towel. Place the paper towel strip against the inside surface of a film canister. Use a pipette to add a few drops of water to the paper towel strip. Leave no more than a couple of extra drops of water on the bottom of the canister.
3. Gently pull the wet paper towel strip about halfway out of the canister. Then position the seedling so that the cotyledons are resting on the middle of the strip as shown below. The water will hold the seedling in place, and when the canister is upright, the young stem will be in a position parallel to the ground (horizontal). Note that the seedling does not have a root. Your teacher removed the root because it would make the seedling too heavy to stick to the paper towel.



4. Slide the paper towel strip and seedling into the canister. Snap on the lid. Place the canister in an area designated by your teacher.

5. The next day, open the film canister and observe the stem. Sketch the stem in the space below.

Do the results of this experiment support your prediction? Explain.

Part C: Designing Your Own Experiment



1. List two or three questions that you have in response to the results of Part B.

2. Design an experiment to answer one of your questions. Have your teacher approve your procedure before you start.

Question:

Hypothesis:

Name _____ Class _____ Date _____

Prediction:

Procedure:

Observations:

Analysis and Conclusions

- 1.** Why was it necessary to grow the plants in the dark for Part A?

- 2.** What type of gravitropism do plant stems exhibit? Explain.

- 3.** Discuss the results of your experiment in Part C. Did the results support your hypothesis? If not, revise your hypothesis and record it below.

Extension

What is the mechanism behind the ability of stems to bend in response to gravity? Most researchers believe that the plant hormone auxin may play a role. To demonstrate auxin's effect on stem growth, obtain another stem and cotyledons from your teacher. Place a small piece of wet paper towel in the lid of a film canister. Then place the cotyledons on the piece of paper towel. With a flat toothpick apply auxin paste to one side of the stem. **CAUTION:** *Wear goggles when working with the auxin paste.* Mark the paper towel on the side of the stem where you placed the auxin (see the diagram below). Place the film canister over the lid and allow the stem to sit at least overnight. Did the stem bend toward the side with the auxin paste or away from it? What does this tell you about the effect of auxin?

