Gravitropism

Grades: K - 6 ***Time: 2 - 3 weeks***

Lesson summary:

In this project, you'll explore why roots grow straight down. How do roots grow when the direction of gravity changes? Do you think you can "trick" roots to grow in a different direction?

What's the big idea?

- How do plants know which way is up or down?

Outcomes or purpose:

- Plant roots always grow straight down in response to gravity.

Teacher background:

Ever wonder why roots always grow down in the ground? When you plant a seed, it somehow knows that the roots need to grow downwards and the shoots upwards.
The job of a root is to supply water and minerals to the rest of the plant. To do this, roots need to grow down into the ground to find the water and minerals that the rest of the plant needs to survive. How do roots know which way is up or down?

When seedlings were grown on the International Space Station (ISS), astronauts found that instead of growing down, the roots grew in all directions! What is different about the ISS, is that there is no gravity in space. However, we have a force called gravity here on Earth. It's the reason that when you drop something, like a ball or a pencil, the object falls to the ground.
This experiment shows that plants can somehow sense gravity. We call this ability gravitropism. The first part of the word "gravi" means gravity and "tropism", the second part, is a Greek word that means turn. In other words, turning towards gravity.

So, how do plant roots sense gravity? The reason is due to special cells at the tips of each root that direct growth towards gravity's pull. Just like the word gravitropism, roots turn toward gravity.
In this experiment, you will be turning the seedling every few days. No matter which way you turn the seedling, the roots will always grow down. By the end of this experiment, you should have plant roots that look like stair steps!

Lastly, if we simply do nothing, the banana peel will still decompose. It is bacteria that decomposes organic matter like our banana peel. Bacteria are microscopic living organisms that can be found everywhere. There are many types of bacteria but beneficial bacteria help in decomposition and in fermenting foods such as kombucha, kimchi, sauerkraut or yogurt. When bacteria are exposed to light and air, many - but not all - of the bacteria will die, so decomposition is slower. In this experiment, the banana peel is placed in a warm, dark environment with little air where bacteria thrive, so the banana peel will decompose faster than one exposed to light and air.

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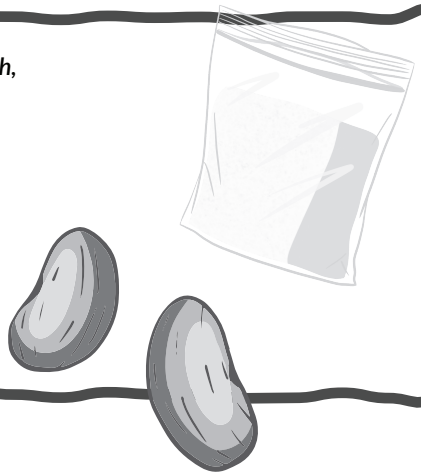
Materials needed:

You can use either CD jewel cases (with one clear side) or plastic ziploc sandwich bags to hold the seeds in this project. If using the CD jewel cases, a bit of plasticine helps to keep the case upright. If using plastic ziploc sandwich bags, simply pin the bags to a bulletin board using thumb tacks or tape them to the wall.

- **Plastic CD jewel cases**
- **Plasticine**

OR

- **Plastic Ziplock sandwich bags**
- **Stapler**
- **Thumb tacks or tape**
- **Fast growing seeds** *(radish, cherry tomato seeds, basil)*
- **Paper Towels**
- **Scissors**
- **Spray bottle with water**
- **Notebook**
- **Pencil**



Step by step instructions:

1. Explain the experiment to the students. Ask them to guess which way the plant roots will grow when the direction of gravity changes. They can record their guesses in their notebooks.

2. To set up the experiment using a ***CD jewel case***:

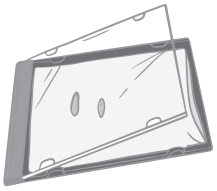
   A. Cut a folded piece of paper towel so that it fits inside the CD jewel case.

   B. Open the paper towel and place 2 or 3 seeds on the paper towel.

   C. Spray with water to moisten the paper towel.

   D. Carefully place the paper towel inside the CD jewel case and close the lid.

   E. Set the CD jewel case upright and use bits of plasticine to keep the case from falling over.



3. To set up the experiment using a ***plastic Ziplock bags***:

   A. Cut a folded piece of paper towel so that it fits inside the plastic ziploc bag.

   B. Open the paper towel and place 2 or 3 seeds on the paper towel.

   C. Before you moisten the paper towel, it helps to place 3 staples around the seeds to hold them in place. Now you may spray with water to moisten the paper towel.

   D. Carefully place the paper towel inside the plastic bag and close the ziploc.

   E. Pin the prepared sandwich bag on to a bulletin board or tape it to a wall.

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4. The seeds may need several days to sprout.

5. Check the experiment every day to make sure the paper towel is still damp. Spray some water on it when necessary.

6. As the seedling roots begin to grow, note the direction of growth.

7. When the roots are about 1 - 2 cm long, turn the CD jewel case or plastic bag clockwise 90 degrees. Secure with plasticine or thumbtacks. Make a note about which direction the roots will grow next.

8. Continue to check the experiment daily. Draw a picture of the roots' progress in your notebook.

9. After the roots grow another 1 - 2 cm, this time, turn the holder counter-clockwise 90 degrees.

10. Continue to check the direction of root growth and sketch the results in your notebook.

11. Repeat steps 7 - 9 a few more times. Remember to alternate turning the experiment clockwise and then counterclockwise.

12. What happened to your roots? Was your guess correct?

Discussion questions

- What happened to your roots each time you turned the experiment?
- What happened to your shoots each time you turned the experiment?
- Can you think of an explanation for this?

Expand the learning:

- Can you think of different ways to test this cool type of science? Do you think, for example, that only roots experience this sort of gravitropism? What about the stem, leaves or flowers on a plant?