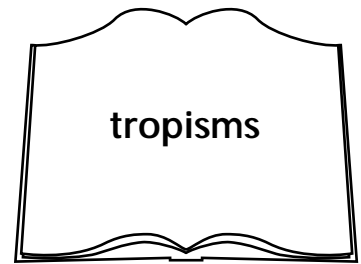


Geotropism



Do roots always grow down? In this activity, you will see how germinating seeds respond to gravity.

Tropisms are plant movements or responses to a variety of growing conditions. **Geotropism** is a plant's response to gravity. (*Geo* is a prefix that means "earth.") Positive geotropism takes place when the roots grow toward the Earth. Negative geotropism takes place when the stems grow away from the Earth.



Words to Know



Safety Precautions

Adult supervision necessary. Please click on the whistle to view the safety guidelines. Do not eat the beans.

WHAT YOU NEED

- adult partner
- 4 lima, bush, pinto, or navy bean seeds from a seed packet*
- super glue or any non-water soluble glue
- sponge
- zipper plastic bag
- scissors
- turkey baster
- thumbtack
- water
- permanent marker

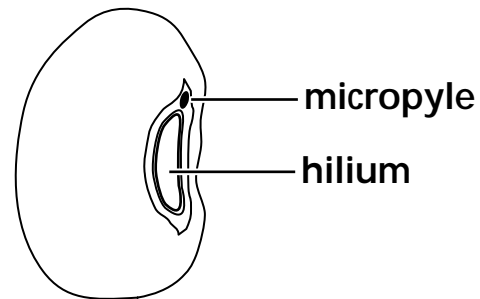
* see Hints

WHAT YOU DO

Predict which way the roots will grow.

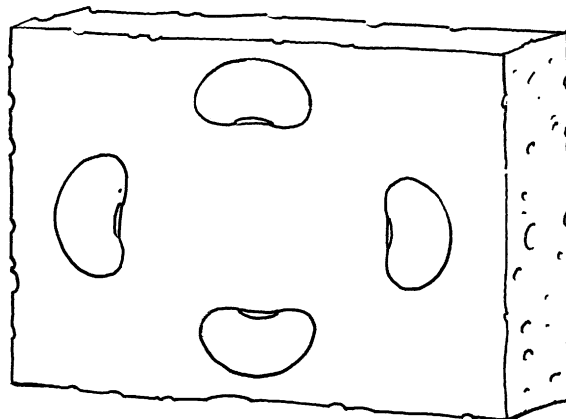
Examine the seeds. **Identify** the hilum (the point

at which the seed was attached to the pod it grew in).



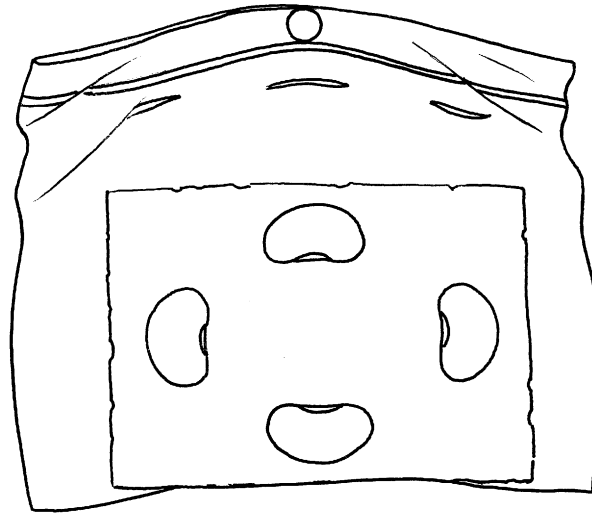
ADULT PREPARATION

Secure each bean onto the sponge as shown on the diagram using super glue or another non-water soluble glue. Make sure the hilum is pointed as shown on the diagram.



ACTIVITY

1. Use the marker to **label** the bag as if it were a clock: 3, 6, 9, 12.
2. **Cut** several small slits in the zipper bag using the scissors.
3. **Moisten** the sponge. **Insert** the sponge with the beans into the zipper bag. **Zip** the bag.
4. Use the thumbtack to **tack** the bag to the wall.



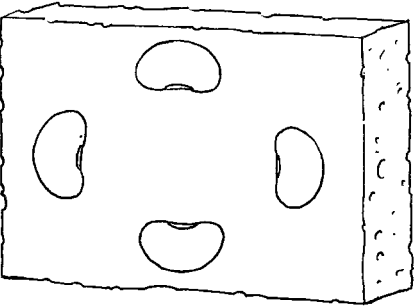
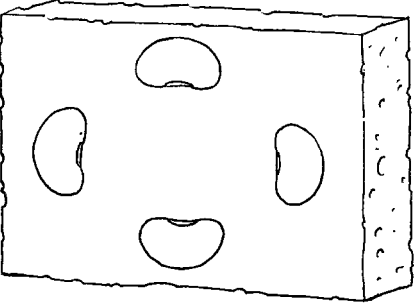
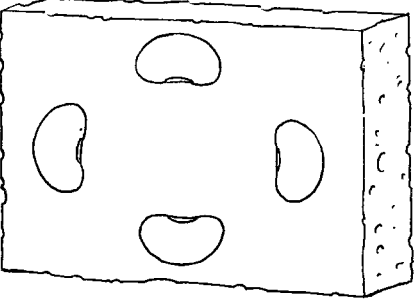
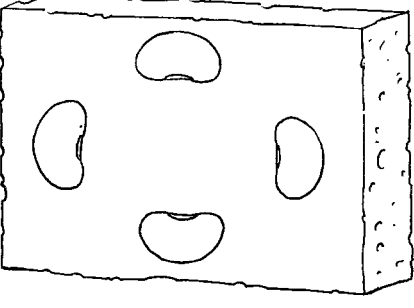
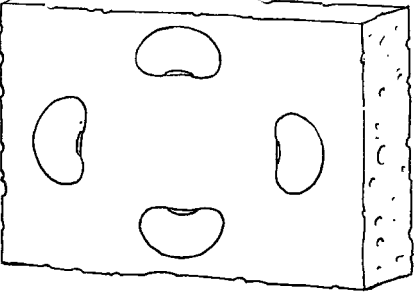
5. **Make** a daily observation for 5 days. Using the data table provided, **draw** the orientation of the roots to the seed.
6. **Water** the seeds daily. Use the baster to **drop** water through the small slits in the bag onto the sponge.

OBSERVATIONS

1. In what direction did the root grow when the seed was planted at 12 o'clock? In what direction did the root grow when the seed was planted at 9 o'clock? At 6 o'clock? At 3 o'clock?
2. What adjustments did some of the seeds have to make in order for the root structures to grow?
3. What was one of the reasons that the roots grew in the direction that you observed?
4. Are the roots of the plant positively or negatively geotropic? Use your data to explain your answer.
5. Do roots always grow down?

OUR FINDINGS

Click on the above link to see what we found.

| GEOTROPISM DATA TABLE | |
|------------------------------|--------------------------------------------------------------------------------------|
| Day 1 |  |
| Day 2 |  |
| Day 3 |  |
| Day 4 |  |
| Day 5 |  |

Our Findings

3. LIFE SCIENCES

3.6 GEOTROPISM

1. The seed's position initially determined the direction of the root. The root of the bean planted at 12 o'clock initially grew down. The root of the bean planted at 6 o'clock initially grew up. The root of the beans at 3 o'clock and 9 o'clock initially grew horizontally. However, all roots soon started to grow in a downward direction.

2. The roots of the seed in the 6 o'clock position arched over the seed itself in order to grow in their normal (downward) direction. The roots of the seeds in the 3 and 9 o'clock positions bent downward in order to grow correctly. The roots of the seed in the 12 o'clock position grew directly downward, with no bending.

3. Gravity is the cause of positive geotropism.

4. Plant roots are positively geotropic. This means they grow toward the center of the Earth.

5. Yes. Regardless of the position of the seed, the root will always grow down.

SAFETY GUIDELINES

Special Safety Note To Experimenters

Some activities in this book have special safety rules to follow. The special rules are on the page with that activity. But even if every safety rule in the world is included with an experiment, you have to know how to be safe when doing it. So it's very important that you read, copy, and follow the Everyday Safety Rules that follow.

Sometimes science experiments can be dangerous. Things can spill, break, or even catch fire. You have to know what to do. . . fast. So be prepared. Read the directions for each experiment carefully, and follow any special safety rules listed with it, then be careful.

Always follow common-sense safety rules like NEVER RUN WITH SCISSORS IN YOUR HAND or BE CAREFUL WITH HOT THINGS! You already know a lot of common-sense safety rules. . . so remember to follow them, and have fun!

Everyday Safety Rules

PREPARE

- Clear off your work space.
- Read all directions.
- Know what problems might happen, and be prepared.

PROTECT YOURSELF

- Follow directions step-by-step.
- Do just one experiment at a time.
- Locate exits, fire extinguisher, eye wash, and first-aid kit before you start. Ask an adult to show you how to use a fire extinguisher.
- Be sure there's fresh air in the room.
- Wear an apron and safety goggles.
- Don't wear contact lenses, have bare feet, or wear very loose clothing.
- Keep work space and floor clean.
- Clean up spills immediately,

- Don't drink or eat around the experiment work space.
- Don't eat or drink any stuff tested, unless a grown-up says it's OK.

USE EQUIPMENT CAREFULLY

- Don't set up equipment too near the edge of your work space.
- Be cautious when using pointed or sharp instruments, like scissors, screwdrivers, or knives.
- Unplug any electric device by pulling out the plug, not pulling on the cord.
- Use only low-voltage batteries, like those used in flashlights or smaller.
- Be careful when using chairs or step-stools.

USING CHEMICALS

- Have an adult help you with all experiments requiring chemicals.
- Don't inhale or taste chemicals.
- Read all labels carefully.
- Label all chemicals.
- Wear goggles, apron, and gloves so chemicals don't touch your skin.
- Wash hands before and after using solutions.
- Wipe up spills thoroughly.

HEATING THINGS

- Wear goggles, apron, and gloves when boiling water.
- Use safety tongs and heat-resistant mitten or hot pads.
- Never leave heated things unattended.
- Turn off hot plates and oven burners when you're finished.
- Keep flammable things away from heat and flames.
- Have a fire extinguisher ready.

IN THE FIELD

- Never go on a field trip alone: follow the Buddy System.
- Tell a responsible grown-up where you're going.
- Know the area and be aware of dangers, like poisonous plants and deep water
- Dress for the weather conditions.