



Science Unit: *Plants and Ecosystems*

Lesson 3: *Plants Alive! How Plants Grow and Move Plantes vivantes!*

School Year: 2006/2007

Developed for: Queen Elizabeth Annex Elementary School, Vancouver School District

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Grade level: Presented to Grades 2 & 3, appropriate for Grades 1-4 with appropriate modifications. Présenté au niveau de la 2^e et 3^e année; approprié aux niveaux de la 1^{re} à la 4^e année en y apportant les modifications nécessaires.

Duration of lesson: 1 hour and 20 minutes

Objectives

1. Learn how plants move using growth (tropism).
2. Learn how certain plants can use rapid plant movement.
3. Apply scientific reasoning to a science activity.

Background

Plants, unlike animals, cannot move locations to respond to changing environments, but that doesn't mean that plants don't move! Though they are generally fixed to their location, they can move their parts in response to their environment. Plants can grow throughout their lifetime and this growth enables plants to move. A plant movement to respond to an environmental cue is called a tropism. For example, a plant that grows towards the light to maximize its exposure is exhibiting phototropism. A plant's roots continually respond to gravity by growing downwards (called geotropism or gravitotropism). A sunflower, whose flower head seems to follow the sun in its path across the sky is exhibiting heliotropism (or movement towards the sun). Besides these slow movement examples, plants can also have what is called rapid plant movement. This is the movement that occurs in certain plants very quickly. For example, the Venus flytrap closes its modified leaves quickly in response to an insect that lands on its leaves which are covered with sensitive hairs. Even though these hairs look like teeth, they actually tell the plant to snap shut when an insect lands upon them. They grow in areas where they can't get all of the nutrients they need from the soil, so they get them from bugs instead.

Vocabulary

<u>Word:</u>	Brief definition.
Tropism	Plant movement caused by an environmental cue.
Phototropism	Directional growth in response to a light source.
Geotropism/ gravitotropism	Movement or growth of the roots of a plant in response to gravity.
Rapid plant movement	A quick response of plant structures to a stimuli that occurs in certain plants.

Vocabulaire

<u>Mot:</u>	Brève définition.
Le tropisme	Mouvement de la plante cause par un changement dans son environnement.



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Le phototropisme	Croissance dans une direction en fonction d'une source de lumière.
Le géotropisme/ Le gravitotropisme	Mouvement ou croissance des racines de la plante en fonction de la gravité.
Un mouvement rapide de la plante	Une réponse rapide des structures chez certaines plantes à un stimuli.

Materials

For Demonstration/Activity 1:

- Bean seedling
- shoe box
- tape
- Black paint
- scissors / retractable utility knife / exacto knife

For Demonstration/Activity 2

- bean seed
- cork
- baby food jar (or other glass jar)
- cotton balls
- glue
- piece of stiff wire

For Activity 3

- small fish tank
- soil (70% peat or sphagnum moss and 30% perlite or coarse pumice)
- Venus flytrap

Matériaux

Pour la démonstration/ Activité 1

- une boîte de chaussures
- ciseaux/ exacto / couteau de service
- ruban adhésif
- jeune plant de haricot
- peinture noire

Pour la démonstration/ Activité 2

- graine de haricot
- un bouchon de liège
- un petit pot de nourriture pour bébé (ou autre petit pot de verre)
- boules de ouate
- colle
- pièce de fil métallique

Pour l'activité 3

- petit aquarium
- terre (70% tourbe ou mousse sphaigne et 30% perlite ou pierre grossière)
- dionée

In the Classroom

Introductory Discussion

1. HOOK: Tell the students a story about Bert. Ask them to think about the different things that Bert does in the story. (*The story*) Bert decided to go for a picnic. He brought his picnic basket full of food and sat under a tree to eat it. When he got chilly in the shade, he went to sit in the sun. After a while,



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the sun was setting and he was cold again so he put on his sweater that he brought in his bag. All of a sudden he noticed a squirrel rooting through his picnic basket so he shooed it away and moved the picnic basket onto his bicycle.

- What are the different actions that Bert did?
- Go through the list of actions that Bert did and think about how a plant would do each thing differently.
- Actions:

Bert (the Person)	Bert (the Plant)
Brought his own food	Gets nutrients from the soil and leaves; can grow roots deep into the soil to get nutrients
Moved into the sun to get warmed up	Phototropism: plants can grow toward the light
Put on his jacket when he got cold	Thermotropism: some plants curl up their leaves in cold weather
Shook the picnic basket away from the squirrel	Rapid plant movement: some plants shoot their seeds far away from themselves in response to touch as a defense against animals eating them

2. TO REVIEW:

- How adaptations have to be different in plants compared to animals
- How plants can move by growth (tropism)
- How plants can move quickly

3. SCIENCE ACTIVITY:

Demo/Activity 1: Plants and Light

By placing a bean seedling in a dark box with a single hole for light to enter, the plant should grow towards the light source. (Phototropism Experiment)

Demo/Activity 2: Roots and Gravity

Grow a bean in a jar on its side and then, once the root has grown out about a centimeter, flip the jar onto the other side (so that the root is pointing upwards). Watch the root grow the other direction (always down with gravity). (Geotropism Experiment)

Activity 3: Venus Flytrap Terrarium

Start a terrarium with Venus Flytraps in a fish tank to observe how it uses rapid movement in order to catch its food.

Activity 4: Plant Movement Game

Each student is a plant and must do the plant movement action that corresponds to each environmental cue called out. The last "plant" to do the right action each round is out.

4. SECURITY MEASURES:

- If Demo/Activity 1 is done by the students, use scissors (make sure that it is only the teacher that handles the utility or exacto knife)



Science Activity/Experiment

Activity/Demo 1: Plants and Light

Purpose of Experiment: To observe how plants will grow towards the light (phototropism).

Methods:

Set up before the lesson: You need to have bean seedlings grown in order to do this experiment. You can also buy seedlings pre-grown if you wish. If you are doing this experiment as a demo (as was done in our classroom), you must have steps 1-2 of the instructions completed.

Instructions

1. Place a shoe box on its side so that it is taller than it is wide.
2. Cut a hole on the bottom of one of the sides of the shoe box. Ensure the hole is approximately 30 cm long and 30 cm wide. You can paint the inside of the box with matte black paint to prevent reflected light inside the box. You can put the hole anywhere you wish on the box.
3. On the inside of the box, place a ruler going lengthwise.
4. Place a bean seedling in your box, mark down where the plant is on the ruler and seal it well with tape.
5. Place the open side near a window.
6. Have the students write down their hypotheses. (Questions to guide them: What do you think the plant will do? Why do you think the plant will do what you think it will?)
7. In 4-5 days open the box and have the students' note what has occurred. The stem should now be bending as the plant searches out the light source. (If you wish, have the students observe what is happening daily.

(See extension 1)

Activity/Demo 2: Roots and Gravity

Purpose of Experiment: To observe how the roots of a plant will grow with the force of gravity (gravitotropism or geotropism).

Methods:

Set up prior to experiment: Soak a bean for 24 hours prior to your experiment. If you are doing this experiment as a demo (as was done in our classroom), have steps 1-2 of the instructions done before the class.

Instructions

1. Glue a cork to the lid of a baby food jar. Push a piece of wire into the cork
2. Stick the soaked bean onto the wire (about halfway through the seed)
3. Add wet cotton to the jar and put the lid (with the bean attached) into the jar.
4. Let the root grow until it is about 1 cm in length.
5. Flip the jar over. Now the root is pointing upwards.
6. Have the students write down their predictions about what will happen to the root.
7. Over the next week, have the students observe what happens to the root.



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Activity 3: Venus Fly trap Terrarium

Purpose of Experiment: To observe a unique plant that displays rapid plant movement.

Methods:

Venus flytraps are relatively easy to grow. They need to grow in specific conditions:

- Bright light (but not direct sun)
- Warm, humid environment (like that created by a terrarium)
- Soil: 70% peat or sphagnum moss and 30% perlite or coarse pumice
- Let tap water sit in an open container for 24-48 hours before use (to rid the water of the chlorine which can be harmful to the plant) or use distilled water.
- May – October: keep soil damp, two –three insects per month
- November –April: dormant season, needs to be in a cooler place, plant will die back

Instructions

1. Using a 10 gallon fish tank, make a terrarium to house the Venus flytraps. Add the soil (needs to be acidic, see above type of soil) and the plants.
2. Check the soil regularly to make sure it is moist. The roots need a lot of moisture, but it doesn't have to be drenched.
3. Make sure that the terrarium stays humid and warm, but if it gets too much sun and the leaves seem to wilt, move it away from direct sunlight for part of the day.
4. Feed your plant 2-3 small insects (like houseflies) each month.

Optional Questions:

1. Do plants move? (yes!)
2. What is the scientific name for how plants move to respond to the environment? (tropism)
3. What is tropism? (how plants move to respond to the environment)
4. Which direction do roots always grow? (down)
5. Why do roots always grow down? (gravity)
6. What is the scientific name for roots growing with gravity? (gravitotropism)
7. Which direction do plants grow in response to light? (towards the light)
8. What is phototropism? (growing towards the light)
9. Give an example of rapid plant movement. (Venus Flytrap closing, exploding cucumber)
10. What is a carnivorous plant? (one that eats insects)
11. Name a carnivorous plant. (Pitcher plant, Sundew, Venus Flytrap)

Closure Discussion

Review the different ways that plants move. (*Play the Plant Movement Game, Activity 4*)

Activity 4: Plant Movement Game

Purpose of Experiment: As a closure activity, this will help recall the types of plant movements talked about in the lesson.

Instructions

1. Each student will be a plant that can make specific movements.



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2. One person (or the teacher) is the gardener. They will call out a specific environmental change, and the “plants” will have to do the corresponding movement. The last plant to do the movement doesn’t grow and can stand on the side.
3. The environmental cues and corresponding movements are:
 - a. Sun in the west: Arms pointing to the west (phototropism or heliotropism)
 - b. Sun in the east: Arm pointing to the east (phototropism or heliotropism)
 - c. Cold weather: Arms folded in across the chest (representing thermotropism, a plant that can curl its leaves in response to cold temperatures)
 - d. Hanging on: Grab a partner and link arms (Thigmotropism, or the movement of certain plants in response to touching something, like a vine on a trellis)
 - e. Seeds away!: Jump up and down and wave your hands around (rapid plant movement, certain plants will have their seed pods explode when touched, sending the seeds far from the parent plant)
 - f. Delicious bug: Clap your hands together in front of your body (rapid plant movement, students will mimic what happens in the case of a Venus flytrap)
4. You can make a poster with the cues and the movements if you wish to.

References

5. Burnie, David. 1991. How Nature Works: 100 Ways Parents and Kids Can Share the Secrets of Nature. Pages 38-51, The World of Plants and Fungi. Reader’s Digest Association Inc. ISBN: 0895773910
6. Les Enfants découvrent... les fleurs et les arbres. 1990. Time-Life Books B.V. (Traduction: Dominique Lablanche). Pages 6,7, 20,21,70,71.
7. Van Cleave, Janice. 1997. Guide to the Best Science Fair Projects. Pages 50-51. John Wiley & Sons, Inc. ISBN: 0471148024
8. <http://en.wikipedia.org/wiki/Tropism> Wikipedia, the free encyclopedia [Information about plant tropism]
9. http://en.wikipedia.org/wiki/Rapid_plant_movement Wikipedia, the free encyclopedia [Information about rapid plant movement].
10. <http://science.howstuffworks.com/venus-flytrap.htm> How Stuff Works. [Information about Venus flytraps]

Extension of Lesson Plan

1. (to Activity/Demo 1) Have the students’ design their own plant light boxes complete with obstacles for their bean plants to move around.
2. (to Activity/Demo 2) Grow a bean on a turntable. (The turntable makes gravity exert an outward force and you can observe how the roots grow outwards).
3. Observe a growing sunflower. The head of a sunflower appears to follow the sun in its movement across the sky (Heliotropism or phototropism). Students can observe this if they spot a sunflower in their neighbourhood or a public garden.