



Be a Botanist

EDUCATOR GUIDE

Thank you for registering for the *Be a Botanist* field trip at New England Botanic Garden at Tower Hill. This guide provides an overview and introduction to the program. The optional pre- and post-visit activities on the following pages will support your students' learning during the program and will help to extend their knowledge beyond your trip. Prior to your visit you are not mandated to complete any specific lessons or units of study.

WHAT'S INSIDE

Vocabulary & Standards: Page 2

Pre-Visit Activity Guide: Page 3

Post-Visit Activity Guide: Page 4



Overview

During this guided program your students will get up close and personal with producers, consumers, and decomposers. Students will learn about the process of photosynthesis and understand the role plants play in the ecosystem as they tour the gardens and participate in hands-on activities and guided inquiry. We recommend you complete the pre- and post-visit activities on the following pages to enhance your visit and support the classroom integration of the concepts addressed during this program.

Throughout the 90-minute field trip, Teacher Naturalists will guide small working groups of no more than 15 students through the gardens and trails. Students will be encouraged to make observations, explore, and ask questions throughout. Each student will be provided with a hand lens, clipboard, and field notebook to use during their visit. Teacher Naturalists will engage students using stories, investigations, experiments, and games.

Learning Objectives

Students will...

- Learn that plants produce their own food through the process of photosynthesis.
- Recognize that energy moves between living organisms in an ecosystem.
- Categorize producers, consumers, and decomposers, identifying plants as primary producers.

Background

Plants are classified as primary producers and are the basis of all life on earth. Plants are unique in that they are able to harness energy from the sun to aid in creating their own food. Through the process of photosynthesis plants are able to convert water and carbon dioxide into glucose and oxygen with the sun's energy. This allows plants to grow and reproduce, creating food for primary consumers who then become food for secondary consumers, and then decomposers. All the food we eat comes from plants directly or indirectly, and was once energy from the sun. As a result of photosynthesis plants are also able to clean our air by converting carbon dioxide into oxygen.

Vocabulary

Ecosystem: an interconnected community of living and non-living factors and their physical environment.

Chlorophyll: a chemical in plants that absorbs light and is green in color.

Stomata: are tiny openings or pores on leaves and stems of plants, allowing gases to pass through. Through the stomata plants take in carbon dioxide and send out oxygen.

Photosynthesis: is the process of converting water and carbon dioxide into sugar (glucose) and oxygen using energy from the sun.

Food Chain: is the transfer of matter and energy in the form of food from one living thing to the next.

Food Web: is a group of food chains within an ecosystem.

Producer: is an organism that creates its own food using energy from the sun.

Consumer: is an organism that gets its energy from eating producers or other consumers.

Decomposer: is an organism that gets its energy from breaking down dead things.

Predator: is an organism that eats another organism called prey.

Herbivore: is a consumer that eats plants.

Carnivore: is a consumer that eats other animals.

Omnivore: is a consumer that eats both plants and animals.

**IN ALIGNMENT WITH THE 2016
MASSACHUSETTS SCIENCE AND
TECHNOLOGY/ENGINEERING
CURRICULUM FRAMEWORKS**

Standards

GRADE 5

- 5-LS1-1. Ask testable questions about the process by which plants use air, water, and energy from sunlight to produce sugars and plant materials needed for growth and reproduction.
- 5-LS2-1. Develop a model to describe the movement of matter among producers, consumers, decomposers, and the air, water, and soil in the environment to (a) show that plants produce sugars and plant materials, (b) show that animals can eat plants and/or other animals for food, and (c) show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil.

Pre-Visit Activity Guide

The following optional pre-visit activities and resources are designed to support the understanding of concepts that will be addressed during the Be a Botanist program.

WEB OF LIFE

Students will learn about the relationship between producers, consumers, and decomposers as they play the game 'Web of Life'.

MATERIALS

Computer
Printer
Flashcards

Yarn
Pencils
Art Supplies



Ask students to list plants and animals that can be found in Massachusetts. Introduce the words producer, primary, secondary, and tertiary consumers, and decomposers. Assign each student a species to learn more about. Where does it live, what does it eat, what eats it, and is it a producer, consumer or decomposer.

Instruct students to create an animal name tag for themselves using their research. On the front paste an image of the species, write the name, and classify it in a food chain. On the back list how it gets food and what eats it.

Have students wear their name tags and stand around the room. Explain that you are the sun and this ball of yarn represents the transfer of energy. Hold onto the string and pass the yarn ball to a plant. Ask the plant to hold onto the string with one hand and pass the yarn to something that eats it. Continue until you reach the end of the food chain. Pass the yarn back to the sun and start a new food chain. After making many food chains have the class look at the web they created. Discuss how food chains are interconnected, making a food web.

ADOPT A PLANT

Students will practice science and literacy skills as they conduct experiments and make observations about a classroom plant that the class adopts and cares for.

MATERIALS

Plant
Paper
Pencil
Stapler
Aluminum Foil



Bring a houseplant into your classroom and have your students name the plant and care for the plant, giving it water and sunlight. Over time, make hypotheses, conduct experiments, and collect data in student growing journals.

Each student will create a growing journal by folding several sheets of paper in half and securing them along the fold with a stapler. Give students time to label and decorate their growing journals. Have students draw a picture of the plant and make observations about what they notice. Try the experiment below and record your findings.

Question: Do plants need sunlight?

- Have students make hypotheses about what would happen if a plant's leaf doesn't get sunlight.
- Take aluminum foil and check to see if light can pass through the foil.
- Place foil over one leaf on the plant.
- Check back every few days to see what the leaf looks like.
- Record your findings: What is the size, shape, color, and texture? How does it look compared to the other leaves?
- Continue the experiment over the next month and discuss the results.

Brainstorm with students what other questions they have about this plant and think about ways you can conduct experiments to answer your new questions.

Post-Visit Activity Guide

The following optional post-visit activities and resources are designed to reinforce concepts that were addressed during the Be a Botanists program. We would love to see your students' work! Please share with us by mail or email us at youtheducation@nebg.org

CHLOROPHYLL DETECTIVES

Students will conduct a science experiment to identify chlorophyll containing parts of a plant and will practice the scientific method.

MATERIALS

Leaves
Acetone

Coffee Filters
Bowls & Rocks



Ask students what makes plants green. Review with students the process of photosynthesis from the Be a Botanist program. Explain: "Plants use sunlight to transfer water and carbon dioxide into sugar and oxygen. Plants absorb sunlight using the chlorophyll substance found in leaves, which is what turns the leaf green. Today you are going to extract chlorophyll from leaves to see which leaf is able to absorb the most sunlight."

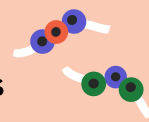
1. Collect fresh green leaves from outside and have students make hypotheses about which ones contain chlorophyll.
2. Place leaf in boiling hot water for 1 minute to make extracting the chlorophyll easier. Dry leaves with a paper towel.
3. Grind down a leaf using a bowl and a rock.
4. Put leaf pieces in a small bowl or test tube. Add a few ml of the acetone and then mix.
5. Cut coffee filter into strips and place a strip in the liquid. Wait 20 minutes.
6. Repeat steps 2-5 for all leaves and record the results. If a green stripe appears then this indicates chlorophyll is present. The darker the line the more chlorophyll is present.

MOLECULE MAKER

Students will build the chemical formula for photosynthesis to learn how plants use energy from the sun to change carbon dioxide & water into sugar and oxygen.

MATERIALS

Beads
Scissors
Pipe Cleaners



Ask students how plants make their own food. Review the process of photosynthesis, allowing students to reference their Be a Botanist notebooks. Work together to write the equation for photosynthesis on the board.

Water + Carbon Dioxide → Glucose + Oxygen

Introduce periodic table, elements, and molecules and ask students what elements make up the molecules of water and carbon dioxide. Write H_2O and CO_2 on the board and discuss the inputs and outputs.

Split students into small groups. Provide each group with scissors, 4 pipe cleaners, 6 red beads (carbon), 18 blue beads (oxygen), and 12 green beads (hydrogen). Have students cut the pipe cleaners into 12 three-inch pieces.

Ask students to string the beads onto the pipe cleaner to make 1 molecule of water and one molecule of carbon dioxide. Explain that plant takes in 6 water and 6 carbon dioxide molecules at a time, and ask each group to make 5 more of each molecule. Have students place all molecules in a bag (representing the leaf) and shake it in the sunlight.

Ask students to remove the molecules and rebuild them to form glucose on one large pipe cleaner. Give students the formula for glucose $C_6H_{12}O_6$. Ask students what elements are left and why, reviewing that plants recycle oxygen back into the atmosphere, which humans and animals both need to survive. NOTE: Atmospheric oxygen is represented as O_2 .