

TOWER HILL

BOTANIC GARDEN



BE A BOTANIST

Teacher Guide

OVERVIEW

Thank you for registering for the *Be a Botanist* field trip. During this guided program your students will observe plants of all shapes and sizes. Students will gain a deeper understanding of the process of photosynthesis and the reproductive parts of a plant and their function. We recommend you complete the pre- and post-visit activities on the following pages to enhance your visit and support the 3rd to 5th grade classroom integration of the concepts addressed during this program. Please note all programs are 90 minutes in length and will take place outdoors in rain or shine over areas of rough, uneven terrain. Please ensure students are dressed appropriately.

LEARNING OBJECTIVES

- Students will be able to identify the basic needs of a plant and will understand the role each plant part plays in growth and reproduction.
- Students will understand how plants use air, water, and energy from the sun to produce food.
- Students will understand that plants are primary producers upon which all other life is dependent.

NARRATIVE

Plants are living things that require, soil, water, air, nutrients, and sunlight to survive. Most plants start out as a seed but not all seeds are the same and not all living things have the same lifecycle. Plants have roots, a stem, leaves, flowers and fruit. Each of these parts plays an important role in the growth and reproduction of the plant. Plants are able to make their own food through a process called *photosynthesis*. Plants are classified as *primary producers* and are the basis of all life on earth. The food we eat comes from plants, either directly or indirectly, and was once energy from the sun.

During the trip Teacher Naturalists will guide small working groups of 10 to 15 students to two to three different plant habitats; cultivated garden, aquatic, forest, and meadow. Students will be encouraged to make observations, explore, investigate, and ask questions throughout. Each student will be provided with a hand lens, clipboard, and data sheet to use during their visit. Teacher Naturalists will challenge students to become scientists by using scientific instruments, collecting data, and exploring the world of botany. During the field trip Teacher Naturalists will engage students in the following teaching points using a combination of stories, investigations, experiments, and games.

- Each part of the plant plays an important role in its lifecycle. Plants have roots, stems, leaves, flowers, and fruits that are used to take in water, air, and nutrients, aid in reproduction, and produce food for the plant.
- Plants are able to use sunlight, carbon dioxide and water to produce their own food in a process called *photosynthesis*.
- Plants are *primary producers* and are the basis of the food web. The food we eat was once energy from the sun.

STANDARDS

All programs are designed to align with state and NGS standards. The *Be a Botanist* field trip program addresses the following Massachusetts Science and Technology/Engineering Curriculum Standards.

Grade 3

- 3-LS1-1. Use simple graphical representations to show that different types of organisms have unique and diverse life cycles. Describe that all organisms have birth, growth, reproduction, and death in common but there are a variety of ways in which these happen.

Grade 4

- 4-LS1-1. Construct an argument that animals and plants have internal and external structures that support their survival, growth, behavior, and reproduction.

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-PS3-1. Use a model to describe that the food animals digest (a) contains energy that was once energy from the sun, and (b) provides energy and nutrients for life processes, including body repair, growth, motion, body warmth, and reproduction.

VOCABULARY

Students will be introduced to the following vocabulary words during the program. Reviewing these terms beforehand will serve to enhance the group's experience during your visit.

- **Seed:** The first part in the lifecycle of a plant
 - **Stem:** Part of a plant which gives support and moves water, nutrients and sugars through the plant
 - **Leaf:** Part of the plant that contains chlorophyll and makes food for the plant
 - **Root:** Part of a plant that grows underground, holds the plant in place, and takes in water and nutrients
 - **Flower:** Part of the plant that is often colorful and makes seeds so new plants can grow
 - **Fruit:** Part of the plant that contains the seeds
 - **Pistil:** The female part of the flower where seeds grow
 - **Stamen:** The male part of the flower that makes and stores pollen
 - **Pollen:** Yellow powder found in the stamen of the plant
 - **Photosynthesis:** Process where plants use sunlight, water and carbon dioxide to make their own food
 - **Chlorophyll:** Green matter in leaves and stems of plants that helps make food for the plant
 - **Stomata:** Small opening in the leaf or stem where gas and water come in and go out
 - **Producer:** A living thing able to get energy by making its own food
 - **Consumer:** A living thing that gets energy from eating another living thing
 - **Decomposer:** A living thing that gets energy from breaking down other things that were once alive
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Pre & Post Activity Guide

The following pre- and post-visit activity ideas and recommended resources are designed to support the 3rd to 5th grade classroom integration of the concepts addressed in the *Be a Botanist* program. In order to complete the post-activities we recommend you collect students' *Be a Botanist* Field Notebooks upon departure from the site. We love to see your students' work and continued learning experiences. Please send any drawings, photos, poems and other examples of student work to the Manager of Youth Education at 11 French Drive, P.O. Box 598, Boylston MA, 01505.

PRE-VISIT ACTIVITIES

Plant Parts

Students will identify and explore the function of different plant parts through models and artwork.

Materials:

- Coffee stirrers
- Straws
- Green sponge squares
- Cardboard
- Glue
- Tissue paper

Lead a discussion about the different parts of a plant; what are they and is their role in the lifecycle of a plant? Use diagrams, live plants or models to engage students in hands-on observation. Prompt students to think abstractly by turning and talking to their neighbors to brainstorm a list of every day materials that mimic these parts and their functions. Examples could include tiny straws to represent roots sucking up water and nutrients, a thick straw to represent a stem, absorbent material to represent leaves absorbing light from the sun and colorful paper to represent flower petals attracting pollinators.

Provide students with a selection of materials to create their own 2D or 3D functioning plant model. Students should label each part and write a sentence about how this represents the same part on a live plant.

Plant Growth Journal

Students will practice math and literacy skills to reinforce their understanding of a plants' lifecycle.

Materials:

- Lima beans
- Ziploc bags
- Paper towels
- Halved paper
- Stapler
- Sharpie

Provide each student with 5-10 pieces of halved paper. Have students staple together to create a journal and allow a few minutes to decorate. Review and have students draw and label the lifecycle of a lima bean on the inside cover of their journals.

Provide each student with a Ziploc bag, a lima bean and a paper towel square. Have students loosely fold the paper towel around their bean and use a spray bottle to moisten the towel. Place inside the Ziploc bag and hang the beans in a sunny window. Lead a class discussion about what will happen to the bean and have students record their hypotheses in their journals. Check in on the experiment daily or weekly. Encourage students to become scientists by recording observations, creating scientific drawings and taking measurements as their plants grow. Additionally, students may plant different seeds in order to compare and contrast plant growth between species.

***Extension:** Soak additional beans overnight and

provide each student with a bean to dissect. Lead the dissection and challenge students to find the seed coat, baby leaf, baby root and food storage area. For upper grades, introduce the terms *cotyledon*, *epicotyl*, *hypocotyl*, and *radicle*. Have students draw and label each part in their journals. Explore how each of these parts helps the plant grow.

POST-VISIT ACTIVITIES

Chlorophyll Detectives

Students will identify chlorophyll containing parts of a plant and will practice the scientific method.

Materials:

- Acetone
- Garden weeds
- Coffee filters
- Medium rocks & bowls

Ask students to communicate why plants are green. Explain that plant cells are filled with something called *chlorophyll* which makes them look green. Review the process of photosynthesis from the *Be a Botanist* program and explain that chlorophyll is the substance in leaves which absorbs sunlight and uses it along with water and carbon dioxide to make food for the plant. Collect flowering weeds from the schoolyard or local green space and have students work in groups to divide their plant material into the following groups: roots, petals, stems, fruit (if applicable), leaves, and seeds. Using a rock and bowl, have students grind up the plant material (separately) to access the inside of the cells. Have students carefully pour a little bit of acetone into each bowl of material and dip the end of a coffee filter strip into the liquid. Have students record the process of the experiment step by step and make a hypothesis.

After 20 minutes, look to see if a green stripe has appeared on the filter paper. This indicates chlorophyll is present. Discuss which parts of the plant contain chlorophyll; was this surprising? Have students revisit their hypotheses and record their results.

Pollination Role Play

Students will deepen their understanding of the process of pollination through dramatic play.

As a group review the function and the parts of a flower discussed during the *Be a Botanist* program. To begin, build a flower using students to act out each part. Ask for a volunteer to be the pistil. They should stand straight and tall in the center of the 'flower'. Ask for 3-4 volunteers to be the stamen; they should stand, creating a circle around the pistil. Have 4-5 volunteers to be the petals; they should stand surrounding the stamens facing outward. Next direct the petals to create a bud put putting their arms in the air and leaning backward. At the count of 3, and the word "bloom", the petals should open their arms out straight in front; the flower is ready to be pollinated!

Ask for a volunteer to be the bee and 'buzz' over to the flower. Review what the flower gives to the bee and have the bee reach into the flower to sip some nectar. The bee should then gently bump against the stamens, getting pollen all over its body. Have students communicate how the pollen on the bee's body fertilizes the plant. Explain that once the plant has been fertilized, the petals and stamens are no longer need. Have these parts fall (carefully) to the ground. The pistil however, does have a job. It is the part of the flower that becomes the fruit! Have the pistil pretend to grow into a fruit and discuss what happens next; does the cycle end?

EDUCATOR RESOURCES

- *Project Learning Tree* by The American Forest Foundation
- *Growing Food (LiFE 1)* by Pamela A. Koch, Angela Calabrese Barton & Isobel R. Contento

RECOMMENDED BOOKS

- *Botanicum: Welcome to the Museum* by Kathy Willis
 - *Science Concepts: Photosynthesis* by Alvin Silverstein, Virginia Silverstein & Laura Silverstein Nunn
 - *Plant* by David Burnie
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For more information, contact the Youth Education Manager at 508.869.6111 or youtheducation@towerhillbg.org