

BOTANY, PLANT PHYSIOLOGY AND PLANT GROWTH

Lesson 3: PLANT PARTS AND FUNCTIONS

Overview and Stems

PART 1

I. LESSON DESCRIPTION

Students attend a presentation on plant anatomy and physiology, with a focus on stems, then participate in some identification exercises with normal stems and modified stems. *Estimated time requirement for this lesson is 65 minutes.*

Curriculum Standards: Minnesota Academic Standards in Science, Minnesota Department of Education, 5-24-10, Grades 9-12:

- 9.4.1.2.4 “Explain the function and importance of cell organelles for prokaryotic and/or eukaryotic cells as related to the basic cell processes of respiration, photosynthesis, protein synthesis and cell reproduction.”

National Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards, National Council for Agricultural Education, 2009:

- Natural Resource Systems (NRS):
 - NRS.01.02.01.a. Describe morphological characteristics used to identify trees and other woody plants.
- Plant Systems (PS):
 - PS.01.02.03.a. Identify the components and the functions of plant stems.

As an intricate scaffold, stems and branches increase surface area for photosynthesis.

Student Learning Objectives: After this class, students will be able to:

- (1) Name the three main parts of a plant and their functions.
- (2) Name the three main parts of the cross-section of a trunk.
- (3) Describe four types of below-ground stem modifications.

Instructional Methods: Informal Lecture w/PowerPoint and Classroom Learning Activity

Instructional Materials & Resources:

- Collect enough raw vegetables to distribute at least one type to each student: asparagus spears, small onions, garlic bulbs with all cloves intact, whole ginger, small white potatoes, small sweet potatoes, yams, cauliflower sections, Jerusalem artichokes (or sunchokes) in season, and OPTIONAL gladiolus and cyclamen corms if available at this time in the nursery.

- Some cuttings of plant material demonstrating prominent nodes, such as begonias. Consider bringing enough to distribute to groups of about 6 six students.
- Optional: If you can easily find some cross-sections of thick branches, or better yet, a slice of a small trunk, bring to class to examine the growth rings.

II. LESSON PLAN

Introduction

Legend:

Text in normal face - Represents teacher's words.

Text in italic face - Represents suggestions for the teacher.

Interest Approach:

- QUESTION: In your mind picture the summer landscape and note the varying heights of tree trunks and stems of shrubs. Then walk into a fantasy landscape where tree leaves grow directly from their roots: trunks and stems are absent from all plant life in this landscape. Is the fantasy landscape an improvement over the real one, or has it disappointed you?
- ANTICIPATED RESPONSES: The landscape is boring, there are far fewer leaves, etc. (*Entertain responses for 1 or 2 minutes, until you feel the students see the importance of stems and trunks.*)

Use PowerPoint slide 1 to illustrate this point/motivate learning.

Relevancy:

- In this lesson we'll see that trunks and stems provide support for the leaves, which are the chief structures of photosynthesis; stems raise the leaves toward their source of energy. Equally important, trunks and stems conduct water, carbohydrates, minerals and other materials throughout the plant.

Learning Objectives:

- After this class, you will be able to:
 - (1) Name the three main parts of a plant and their functions.
 - (2) Name the three main parts of the cross-section of a trunk/stem.
 - (3) Describe four types of below-ground stem modifications.

Instructional Methods

Lecture: 20 minutes estimated

- Present the PowerPoint file *03_Stems_powerpoint.ppt*, according to the narration script file, *03_Stems_powerscript.doc*.

Learning Activity: “Stem Lab” – 40 minutes estimated

- Now that you’re experts in stems, let’s see if you can identify various forms of stem tissue.
- *Distribute cuttings you collected, so each group of about 6 students has one cutting. Ask them to locate the nodes, and to describe the variations in internode distances. Ask them where roots will emerge if they plant the cuttings.*
- Next, we’ll classify some of the more unusual types of stems.
- *Divide the class into two teams, assign a captain of each team, and have the captains pass out at least one raw vegetable to each student. Name the teams if you like, e.g. the French Fries versus the Onion Rings, or the Lilies versus the Tulips.*
- I’m going to call out a category of stem, and if your vegetable is a member of that category, give it to your team captain. Captains do not have to accept the item if they think the vegetable does not fit the category. The winner will be the team with the most correct matches.
- *Calling out each category one by one, “bulb”, “tuber”, etc., ask students to give their captain an example of the following: a bulb (onion or garlic, which is a compound bulb), a tuber (Jerusalem artichoke or sunchoke, yam, or white potato but not the sweet potato), an above-ground stem (asparagus or cauliflower), a rhizome (ginger), a tuberous root but not a tuber (sweet potato), and OPTIONAL corm (gladiolus or cyclamen). Repeat the cycle until all items are identified.*
- *Tally the score and congratulate the winning team.*

Summary:

- With the new knowledge and skills, you developed, you can:
 1. Distinguish the three main parts of a plant and their functions; on that simple platform, you’ll be able to apply much more learning about plants.
 2. Understand the importance of the conducting system within the stem, and the need to protect it as you learn various maintenance procedures.
 3. Recognize the nodes of a stem, whether above-ground or below-ground, as locations to consider for pruning and propagation.
- Take a new look at the stems and trunks you encounter every day. Is a trunk healthy or does it suffer from many pruning wounds? Does a stem bear the plant’s weight properly or does it need to be shortened to make it bushier? Observe the beauty in the variety of bark textures. Especially in winter, you can appreciate the variety of patterns formed by trunks, branches, and twigs.

In the next lesson, we'll turn our attention to leaves as factories of photosynthesis, and patterns of beauty.

OPTIONAL ACTIVITIES

- If the school has a garden or greenhouse, then you can schedule some field time in exploring the same topics raised in the presentation.
- If you have access to a microscope, examine some of the nodes on the branches, and nodes on vegetables having below-ground stem modifications.
- Assign students some field study to record circumference of various trees.
- Propagate some of the vegetables that you brought to class, e.g. plant the onion in some soil, or cut up the white potato into individual sections each having eyes. Maybe you can find a clear container with drainage holes, and you can plant the vegetable in soil near the wall of the container, so you can watch the extension of roots and shoots. Consider growing some bulbs half-submerged in water and pebbles in a non-porous saucer, in the way that nurseries force daffodils to bloom over the winter months; watch the shoots grow, and occasionally remove a few pebbles to monitor the formation of roots.
- Ask students to identify gardens they admire, and then interview the owners about their favorite trees with unusual bark.

RESOURCES

Books:

- *Biology of Plants*, Seventh Edition (December 17, 2004), by Peter H. Raven, Ray F. Evert, Susan E. Eichhorn. Publisher: W. H. Freeman; Hardcover: 944 pages. ISBN: 0716710072
- Comprehensive book on botany.

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