

## *INVESTIGATING XYLEM*

### **Basic description:**

Students investigate how water travels up the stem of vascular plants by using food colouring to stain the xylem of a number of different plants.

### **Source:**

Botany: 49 Science Fair Projects by Robert L. Bonnet and G. Daniel Keen, Tab Books Inc., 1989.

### **Curriculum connections:**

Plants: Anatomy, Growth, and Functions

#### **Overall Expectations**

- Describe the major processes and mechanisms by which plants grow, develop, and supply various products, including energy and nutrition, needed by other organisms.

#### **Specific Expectations**

Understanding Basic Concepts

- Describe the structure and function of the components of each of the leaf, the stem, and the root of a representative vascular plant (e.g., describe the path of water from the soil through the plant).
- Differentiate between monocot and dicot plants by observing and comparing the structure of their seeds and identifying vascular differences between plants.

Developing Skills of Inquiry and Communication

- Identify, using a microscope and models, the plant tissues in roots, stems, and leaves (e.g., use a microscope to identify tissues such as xylem and phloem throughout the plant).

### **Preparation time:**

Part One:

- Stem preparation: 15 minutes
- Standing time: overnight

Part Two

- Xylem investigation and final discussion: 45 minutes

### **Materials:**

- A number of cuttings from several different monocots and dicots
- Microscope
- Red or blue food colouring
- Small jars or glasses (enough for each group/individual)
- Table knives or scissors
- Water

**Preparation:** Gather together all necessary materials.

## Procedure:

This activity may be done as an individual or small group project.

### Part One – Stem Preparation

1. Provide each group/student with a jar. Instruct the students to place approximately 2.5 cm of water in the bottom of the jar and then stir a spoonful of food colouring into the water.
2. Provide each group/student with a number of cuttings from different monocots and dicots. The students should place their cuttings into their jar and let them sit overnight.

### Part 2 – Xylem Investigation

1. Ask your class to think about how water gets from the roots of a plant up to the stem and into the leaves. Introduce the term xylem. Explain how the organization of the xylem tubes differs between monocots and dicots.
2. Instruct your class to remove their cuttings from the coloured water. What has happened to the stems? Are there any other observable changes in the plants?
3. Provide each group with a microscope. If necessary, review microscope use and care at this time.
4. Demonstrate how to cut a thin cross-section off one of the cuttings. The students should place their cross-section under the microscope and observe. What do you see? Is the stem organized in concentric circles or in bundles or groups of tubes? Are the xylem tubes located throughout the cross-section or are they arranged in rings? Do you think your plant is a monocot or dicot?
5. Instruct your students to make a diagram of what they see.
6. Repeat steps #3-4 with the remaining cuttings.

### Follow-up and Discussion:

1. Create a chart displaying those plants that are monocots and those that are dicots. Even before looking at the cross-section under the microscope, could you predict which cuttings were monocots and which were dicots? How?
2. We know that the water travels up a plant through straw-like tubes called xylem but how does the water move upward against gravity? Lead a discussion on the topic of capillary action and transpiration (see Extension activity for teacher demonstration).
  - o Water travels up to the leaves from the roots via the xylem but how does the food that the plant makes in its leaves get down to the roots? Introduce the term phloem.

