Chapter 2 Plants: From Cells to Systems

Materials

Please see the teaching notes for each activity for a list of the materials required. Please see page TR-31 for a summary of the materials required in this chapter and other chapters.

Advance Preparation

- Ensure microscopes or microviewers are in working order.
- Order or ensure availability of prepared slides of leaf cross sections.
- About one month before beginning the chapter, obtain potted plants from a local vendor or have students begin to bring plants.
- Gather celery, kidney or pinto beans, large and small clear plastic bags or resealable plastic containers, paper towels, measuring spoons, measuring cups, food colouring, scissors, 100 mL beakers, elastic bands.
- Students can review the Key Terms in Chapter 2 using **BLM 2-1 Chapter 2 Key Terms.**

In this chapter, students will learn to explain how plant cells specialize to form different kinds of plant tissues. This starting point connects students to the links between specialized cells, tissues, organs, and systems in plants. This foundation provides context for descriptions on how plant organs work together to meet the plant's needs as a life system. Students will relate this information to the Big Idea that plants are made of specialized cells, tissues, and organs that are organized into systems, and to the bigger idea that plants are essential for life on our planet and they must be studied and protected.

Using the Chapter Opener

- This is an excellent image for opening with a question such as, "What do you see is happening in this photo?" Students can be guided towards understanding that, although the tree is burned, a young sapling has found sufficient materials in the dead tree from which to set roots, extract minerals and some water, in order to grow and create structures such as stems and leaves. How is it able to create something from "nothing?"

Alternative Context

Plants produce many hormones that help them function homeostatically, responding to their environment and growth needs. But some of their hormones have human applications too. After studying one plant hormone, auxin, it was noted that it has a negative effect on plants from which it did not originate. Auxin stimulates growth in all directions in a plant. When auxin is applied as a herbicide to dicot pests such as dandelions and pigweed at a particular point in their development, it causes unrestricted growth in all directions, to the demise of the dicot. It does not affect the monocots that humans are trying to protect, namely lawn grasses and cereal crops.

Many municipalities are now banning the use of chemical herbicides to control weeds. It is easy to see that dandelions and crabgrasses are experiencing a resurgence. What can a homeowner do to cultivate a lawn of grass if desired?

Auxin is currently available to licensed farmers and can prove costly. However, there are alternatives available to homeowners who wish to control pests. One of those is corn gluten meal. A cheap by-product of the corn wet-milling process, it has shown positive results as a natural pre-emergence herbicide. Further studies have shown that some of the corn's proteins are showing the herbicide quality. Corn gluten meal works by preventing the germination of seeds. When applied at the right time, it can prevent the germination of crabgrass and dandelion plants, while the desired grass has already seeded and grown.

Have students test the effectiveness of corn gluten meal on a variety of seeds. Purchase the liquid or granulated form from the local nursery along with some varieties of seeds. Do not soak the seeds first. Put the seeds in soil, water them, and then immediately apply corn gluten meal to the soil as well. Students may also wish to vary the quantity of corn gluten meal. Don't forget to set up control pots where no corn gluten meal is added.

Activity 2-1 Observing Plant Growth (Student textbook page 55)

Pedagogical Purpose

It is important that students attempt to grow a plant for deeper appreciation and study throughout this chapter, but it is even more important that they begin the growth at the beginning of the chapter.

Planning	
Materials	Seeds (pinto or kidney; green beans or string beans will also work) Clear plastic bags or resealable plastic containers Paper towels Small container Water Soil **BLM 2-2 Observing Plant Growth** Make sure the seeds have been soaked overnight before class use; soak by placing in wet paper towel, adding enough water to cover the seeds in a container. Ensure that enough soil is available and it is of good potting quality. Have students set up an observation table on Day 1. Include space for written and pictorial observations.
Time	This activity is divided among days: Day 1, 15 minutes class time; Day 5, 30–40 minutes; Days 5 to 19, 15 minutes each day.
Safety	There should be no allergies, but ask anyway. Ensure soil is wet and not airborne particulate, which could aggravate sensitive lungs.

Background

It will take approximately five days for pinto or kidney seeds to germinate and, if grown correctly, they will continue to grow for 90 to 120 days to maturation. Plant the seedling/germinated seed at a depth of about 6 cm. Seed germination occurs when soil/planting media temperatures are above 10°C. Prolonged cool weather in the spring results in weak and disease-prone plants, as growth slows at temperatures below 20°C.

Activity Notes and Troubleshooting

- If possible, have students prepare their own set of seeds to ensure accountability.
- Have students label all of their materials and live seedlings. Students often mistake each other's plant for their own.
- Bean seeds do not need light to germinate.
- A paper towel works well to soften the seed coat without drowning them.
- Bean seeds have large seed leaves (cotyledons) to support their growth before the embryo's leaves emerge from the soil and begin photosynthesis. The seeds can and should be placed at a soil depth of about 6 cm.
- Use **BLM A-1 Making Observations and Inferences Checklist** to assess students' observations.

Additional Support

- DI This is an excellent activity for spatial, bodily-kinesthetic and naturalist learners.
- DI Consider having logical-mathematical learners graph the growth of the plant from Day 5 to Day 19.
- ELL Consider pairing students to help ELL students in the most appropriate way.
- Show students how to draw proper biological drawings using the Science Skills Toolkit 6, page 543.
- Students may wish to change some variables such as light, soil type, soil temperature and to test the outcomes; consider providing time to do this.
- Hand out **BLM 2-2 Observing Plant Growth** which scaffolds this process.

Answers

1. Example: Cells divided until there were too many to fit in the seed case.
2. Example: The cells grow and divide, then specialize into different parts of the plant
3. Example: The cells specialized, forming different parts of the plant. The roots gathered water and nutrients from the soil while the leaves gathered energy from the Sun and nutrients from the air. The stem transported nutrients to other parts of the plant.

Study Toolkit

Strategy	Page Reference	Additional Support
Interpreting Cross Sections	As students perform Activity 2-2 Inside a Leaf on page 62, have them visualize how the cross section is made.	Have students dissect a thick cactus leaf or piece of cardboard.
Comparing and Contrasting	After reading page 71, have students create a Venn diagram to compare and contrast *xylem* and *phloem.*	**BLM G-47 Venn Diagram** may help students get started.
Multiple Meanings	Before reading page 61, identify words with multiple meanings such as *cell, tissue,* and *sugar.* As a class, use existing understanding to infer the scientific meaning.	Refer students to the Study Toolkit Overview, in particular the Word Study section on page 561 of the student textbook.