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Do Plants Need Light?

The Science of Food: Activity 3

Nancy Moreno, PhD.
Barbara Tharp, MS.

Center for
Educational Outreach

Baylor College of Medicine

BioEd Online

Do Plants Need Light?

This activity's objectives are aligned with the National Science Education Standards, specifically those related to Science as Inquiry and Physical Science. In this activity, students will learn about plant growth and development by growing a plant in class and conducting an experiment that demonstrates the importance of light to plants.

The following science concepts are addressed.

- Plants require light, water, air and soil to grow.
- Light is necessary for the production of new plant material.

Student Worksheets
Student pages in the teacher's guide are provided in English and in Spanish.

Reference

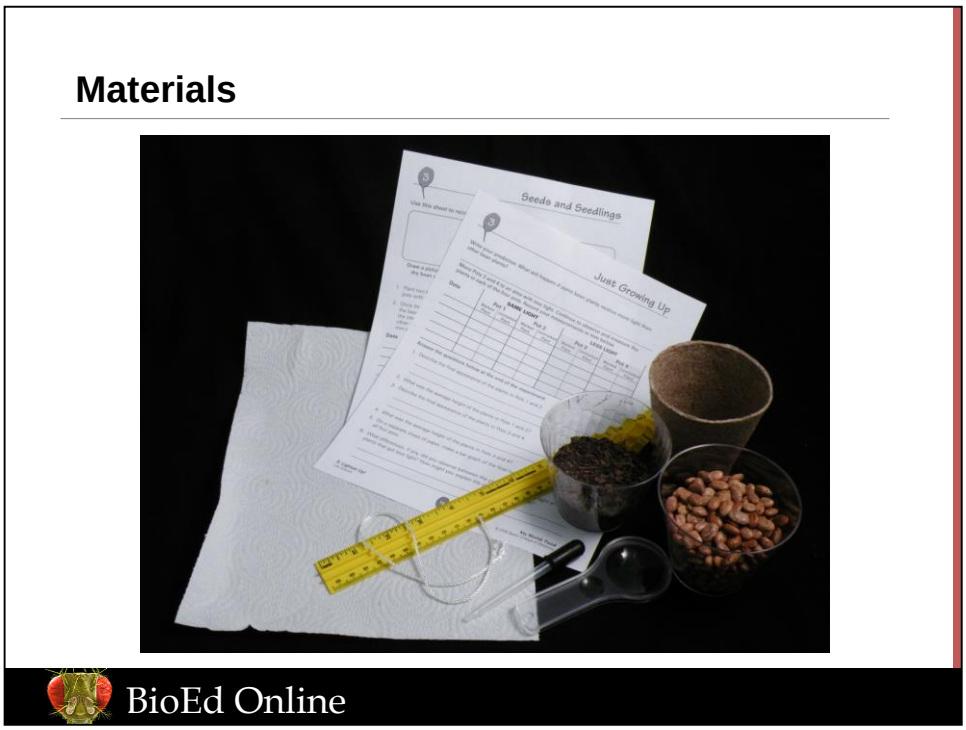
Moreno N., and B. Tharp. (2011). *The Science of Food: Teacher's Guide.* Fourth edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference

Photo courtesy if the National Science Foundation\Jeff King. http://www.nsf.gov/

Key Words

food, plants, light, water, air, soil, photosynthesis, sunlight,



Materials

The following materials will be required to conduct this activity.

- 12 soaked bean seeds
- 4 dry bean seeds
- 4 hand lenses (magnifiers)
- 4 peat pots (3-in. size) or disposable cups
- 4 pieces of string or yarn (each approx. 6 in. long)
- 4 sheets of paper towels or paper plates
- 2 cups of moistened soil
- Dispensing bottle (2-oz size), or dropper
- Metric ruler
- Copies of “Seeds and Seedlings” and “Just Growing Up” student sheets

Per Student

- Crayons or colored markers
- Sheet of white paper

Setup

Overnight, soak enough bean seeds in a container of water to provide at least 12

soaked seeds for each group of students. Each group also will need at least 4 dry bean seeds.

Place the soil in a plastic bag or container and add water until it is damp. Let the moistened soil sit in the unsealed bag for at least 1/2 hour before using.

As an alternative to peat pots, use disposable plastic or foam cups (punch one or more drainage holes in the bottom of each cup). After students have planted their seeds, set the pots/cups on plastic or foil trays near a light source.

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Image Reference

Photo by Christopher Burnett © Baylor College of Medicine.

Key Words

materials needed, materials list,

Science Safety Considerations

Students always must think about safety when conducting science investigations. This slide may be used to review safety with your class prior to beginning the activity.

Safety first!

•Always school district and school science laboratory safety guidelines.

•Have a clear understanding of the investigation in advance.

•Practice any investigation with which you are not familiar before conducting it with the class.

•Make sure appropriate safety equipment, such as safety goggles, is available.

•Continually monitor the area where the investigation is being conducted.

Safety Note. Be certain the work area is well ventilated and have students wear protective eyewear. Do not use alcohol near an open flame.

References

1.Dean R., M. Dean, and L. Motz. (2003). *Safety in the Elementary Science Classroom*. National Science Teachers Association.

2.Moreno N., and B. Tharp. (2011). *The Science of Food Teacher's Guide*. Fourth edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this

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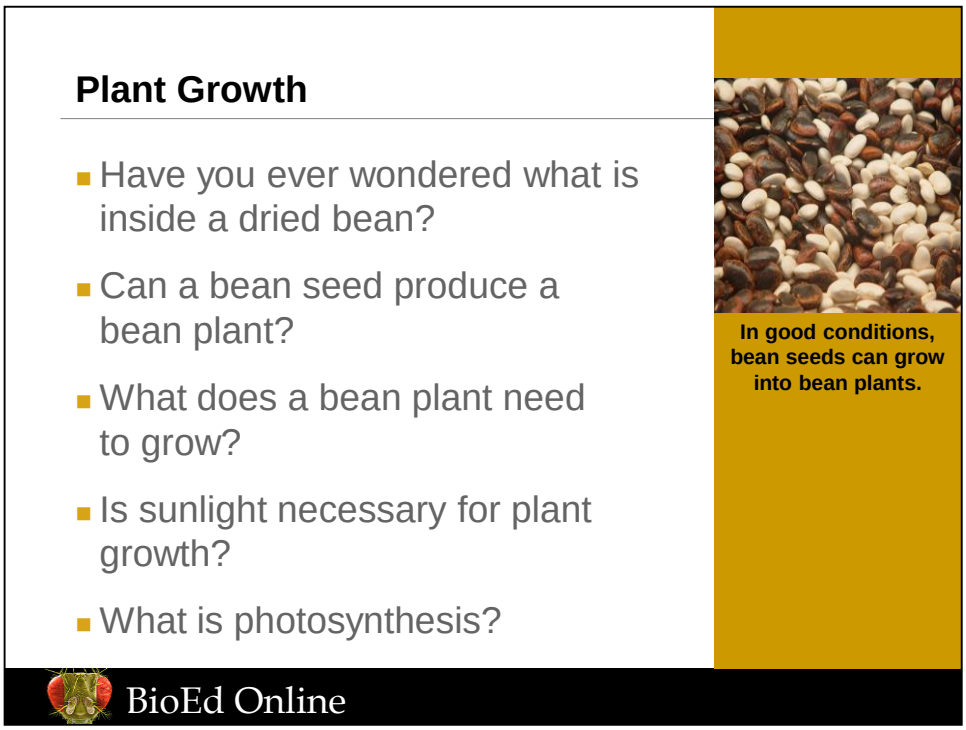
Key Words

science, classroom, safety, lab, laboratory, rules, safety signs,



Plant Growth

Begin by asking students if they have ever wondered what is inside a dried bean. Then ask, *Can a bean seed produce a bean plant? What things does a bean seed need to grow into a plant?* Lead a discussion about the essential elements of plant growth (light, water, soil). Encourage students to think about the components of soil that allow plants to grow. Follow up by asking, *Is sunlight necessary for plant growth? What is photosynthesis?* Tell students that they will investigate how light effects plant growth by growing a bean plant in light and dark conditions.

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Image Reference

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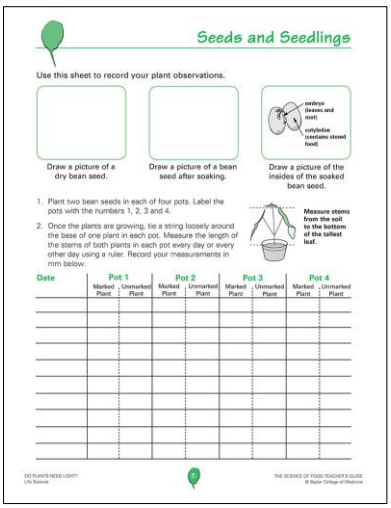
http://commons.wikimedia.org/wiki/File:Phaseolus_Beans.jpg

Key Words

plant, plant growth, bean, seed, sunlight, light, photosynthesis,

Session 1: Observing Dry Seeds

- Use a magnifier to view dry and soaked bean seeds.
- On your “Seeds and Seedlings” worksheet, draw the seeds and describe the appearance of each seed.



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Session 1: Observing Dry Seeds

In this activity, students will observe the process of a bean seed growing into a bean plant. They will compare and contrast a dry bean seed with one that has been soaked in water. They will plant soaked bean seeds and monitor their growth under different light conditions. By the end of the activity, students will have discovered that light is essential for plant growth.

Give each student a dry bean and a magnifier. Have students use their magnifiers to observe the bean seeds. Then, have students draw their seeds on the “Seeds and Seedlings” sheet. Make sure that each student is able to observe the seed coat and the dark indentation on one side of the seed, from where the new plant will emerge.

Before planting, give each student a soaked seed (on a paper towel) for observation. Students should compare the soaked seed to the dry seed one they had seen previously. Ask, *How is the soaked seed similar to the dry one? How are the two seeds different?*

Have students remove the “skin” (seed coat) and spread apart the pieces of the tiny plant inside. They will be able to identify the cotyledons (seed leaves), other tiny leaves and the beginnings of what will become the plant root.

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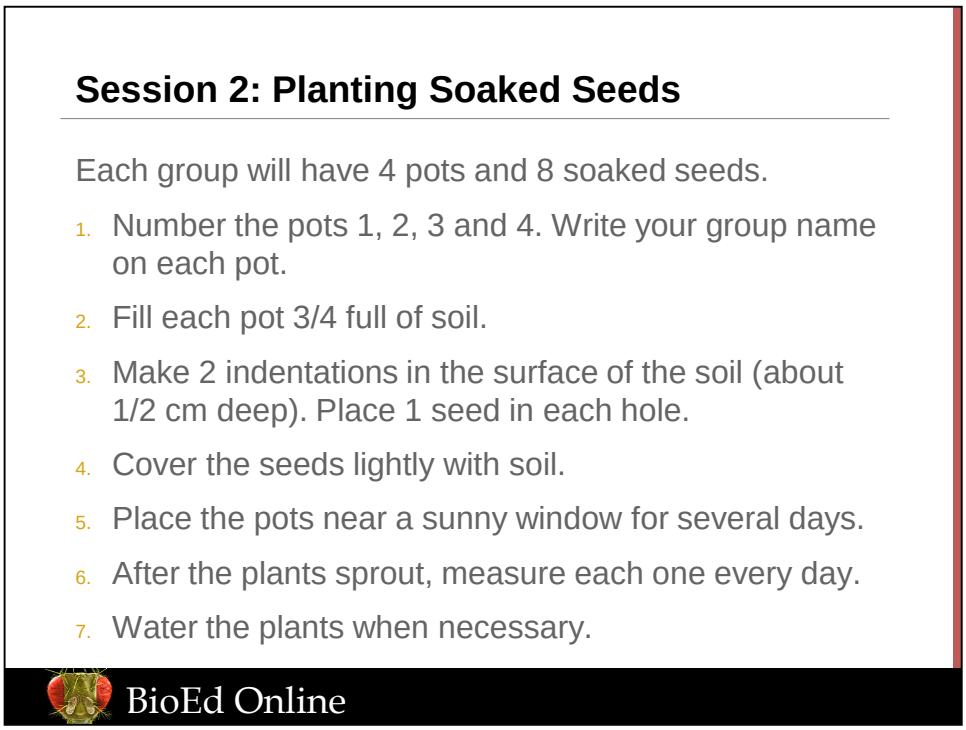
Image Reference

Illustrations by M.S. Young © Baylor College of Medicine.

Key Words
lesson, experiment, plant, seed, seeds, seedlings, observation, seed coat, cotyledons,

Do Plants Need Light? © Baylor College of Medicine.



Session 2: Planting Soaked Seeds

Have Materials Managers pick up 4 pots and 8 soaked seeds from a central location in the classroom. Direct each group to select a name and write it on each pot. They should number their pots "1," "2," "3" and "4."

Have groups fill their pots about 3/4 full of soil. Direct the students to make two indentations (about 1/2 cm deep) in the surface of the soil and then place one seed in each hole. Have students cover the seeds lightly with soil. When each group has four labeled pots, with two seeds in each pot, have students place their pots on trays near a bright, sunny window or under a fluorescent light.

Over the next several days. . . .

Once the seeds sprout, have students "mark" one of the two plants in each pot by loosely tying a piece of string around its base. (This will enable students to tell the plants apart when making measurements. If one plant dies, students should continue to measure the remaining plant.) Have students measure both plants in each pot every day, or at least every other day, and record the length of the plant stems (in cm) on their Seeds and Seedlings pages. Have students water their plants every day or two with a squirt bottle. The soil should be kept moist but not wet.

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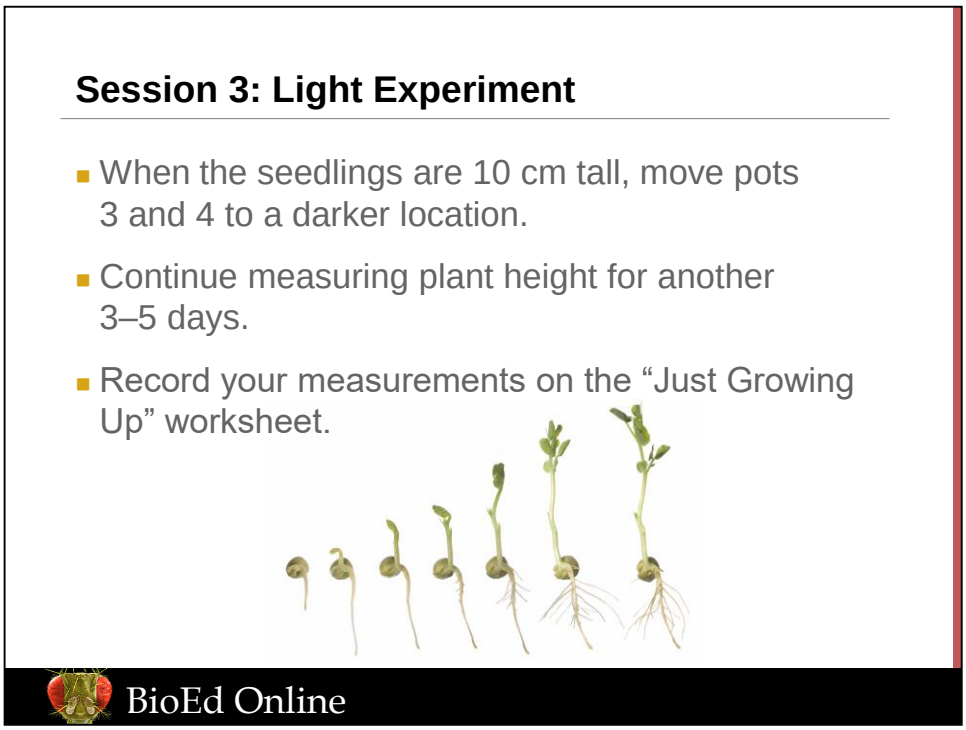
Key Words
lesson, experiment, plants, seeds, soil, dirt, sun, sunny, sprout, water,



Session 3: Light Experiment

When most of the seedlings are approximately 10 cm tall, explain to students that they will now investigate the effect of light on bean plant growth. Ask, *What do you think will happen if we give some of the plants less light?*

Have each group move pots 3 and 4 to a new location, away from windows or a light source (you may want to select the back of the classroom or a dark corner). Ask, *Do you think the plants moved to this new place will receive as much light as the others? Why or why not? What do you think will happen to the plants that receive less light?*

Have students discuss and predict possible outcomes. Students should continue to measure their plants for another 3–5 days and record the measurements on their “Just Growing Up” sheets.

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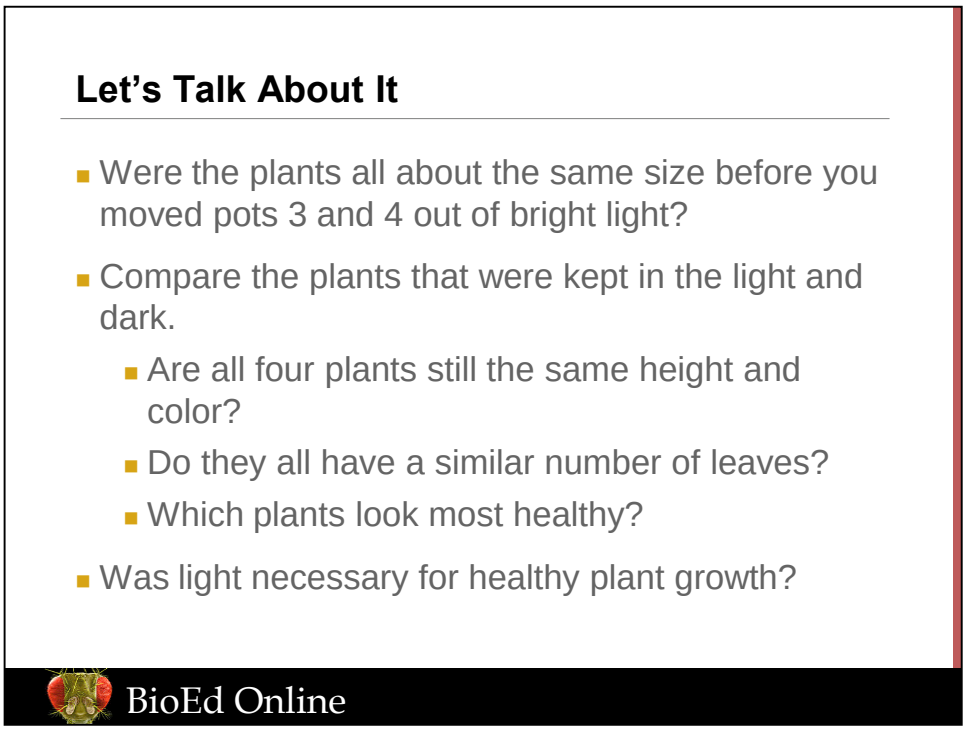
Image Reference
Microsoft Office Clip Art.

Key Words
lesson, experiment, plant, light, seed, seedlings, dark, darkness



Let's Talk About It

In this activity, students conducted an experiment with bean plants grown in the classroom, through which they discovered that light is necessary for healthy plant growth. Have students complete the remaining questions on the "Just Growing Up" sheet. Then, discuss students' results as a class. Students should be able to conclude that any observed differences between the two groups of plants resulted from the difference in available light.

Ask, *Were the plants all about the same size before you moved pots 3 and 4 out of the bright light? Are all the plants still the same size? Why do you think that is so? Are there any differences other than size?* Help students to conclude that differences in growth (plants with less light will have grown less or will have developed tall, narrow stems) and color (the plants with less light will be lighter green) were caused by the differences in the availability of light.

Ask, *What is the only thing that was different about the two sets of pots?* (Only the amount of light changed; all other aspects of the experiment—water, soil, seedlings, pots, planting method—were unchanged for both groups.) Ask, *Where do you think the plants in pots 1 and 2 got the materials and energy to produce more stems and leaves? What were the plants in pots 3 and 4 missing? What do you think would happen if we put the plants in pots 3 and 4 back in the light?*

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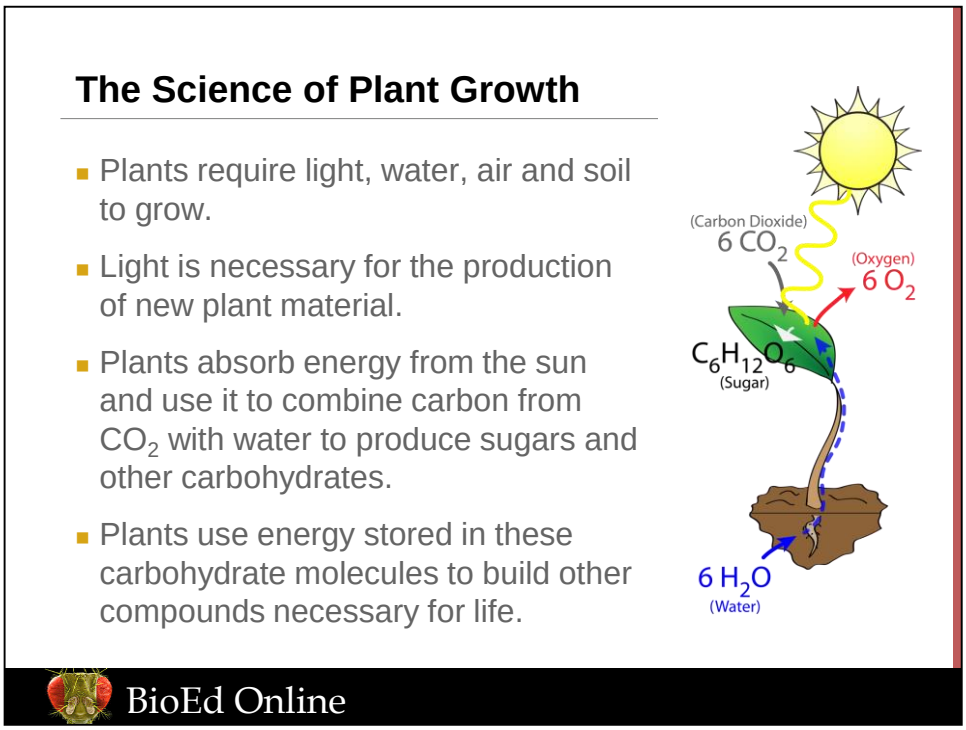
Key Words
lesson, experiment, food, plants, light, leaf, leaves, soil, healthy,



The Science of Plant Growth

Students observed the following properties of plant growth and development in this activity.

- **Plants require light, water, air and soil to grow**. Only producers, such as green plants, are able to make the molecules needed for life from simple compounds in the air, soil and water. Almost all producers use energy from the sun to make food through the process of photosynthesis. During photosynthesis, light energy is trapped and transformed into chemical energy that can be used by cells. Green plants need only water (H_2O) and carbon dioxide (CO_2) in the presence of light to manufacture sugar molecules and other carbohydrates, such as starch. Plants use the energy held in carbohydrates to fuel chemical reactions and to make other molecules that are necessary for life.

- **Light is necessary for the production of new plant material**. During photosynthesis, producers absorb energy from the sun and use it to combine carbon from carbon dioxide with water to make sugars and other carbohydrates. Through this amazing process, light energy from the sun is converted into chemical energy stored in the bonds between atoms that hold molecules together. Plants use energy stored in these molecules to build other compounds necessary for life.

Factoid: Plants growing in dark conditions sometimes develop tall spindly stems. This process, called etiolation, occurs when plants use their energy to grow upward in search of light.

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Image Reference

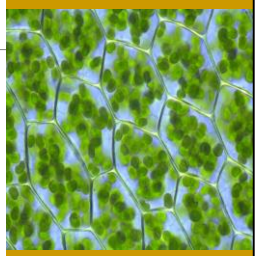
Illustration by Christopher Burnett © Baylor College of Medicine.

Key Words

plants, light, water, air, soil, dirt,

Extensions

- Rinse away the soil and compare the final masses (in grams) of the plants in pots 1–2 vs. those in pots 3–4.
- Conduct the same activity with corn seeds and compare the results.
- Use paper chromatography to observe chlorophyll. To do this, stir crushed fresh leaves in rubbing alcohol. Insert the tip of a coffee filter paper into the alcohol and wait 30 minutes.



Within plant cells, photosynthesis takes place in specialized structures called chloroplasts (shown in green).

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Extensions

•Have students rinse away the soil and compare the final masses (in grams) of the plants in pots 1–2 vs. those in pots 3–4.

•As an alternative investigation, conduct the same activity with corn seeds (a monocot), and compare the results.

•Help students to "see" chlorophyll, the pigments essential for converting light energy into chemical energy (food molecules), by placing a handful of crushed fresh leaves (any kind) into a clear container filled with about 2 cm of rubbing alcohol. Stir the mixture briefly and insert the tip of a strip of coffee filter paper into the alcohol. The chlorophyll pigments will travel up the paper strip and form a green band that will be visible after about 1/2 hour. This method of separating chemicals in solution is known as paper chromatography.

•Within plant cells, photosynthesis takes place in specialized structures known as chloroplasts. Scientists believe that chloroplasts originated as free-living photosynthetic bacteria that became introduced into the cells of other organisms. A square millimeter of leaf may contain as many as 500,000 chloroplasts!

Reference

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Image Reference

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http://commons.wikimedia.org/wiki/File:Plagiomnium_affine_laminazellen.jpeg

Key Words

lesson, experiment, extension, plants, soil, grams, mass, paper chromatography, chlorophyll,