



Science Unit: *Growing Plants*

Lesson 1: *Plant Reproduction*

School Year: 2007/2008
Developed for: Charles Dickens Elementary School, Vancouver School District
Developed by: Shona Ellis (scientist), Paula Naylor and Susan Garber (teachers)
Grade level: Presented to grades 3, 4, 5; appropriate for grades 2 – 7 with age appropriate modifications.
Duration of lesson: 2 hours
Notes: Lesson requires that students make daily observations of their germination chambers to determine if their predictions are true.

Objectives

1. Identify the reproductive structures of a plant (flowers, fruit, and seeds).
2. Learn the relationship between flowers and fruit.
3. Understand how (flowering) plants reproduce.
4. Observe and document the structure of a bean.
5. Set up germination chamber.

Background Information

People do not often make the connection between flower and fruit. Both are all about reproduction. To be able to look at the structure of a flower and actually see how it develops into fruit is a very powerful way of demonstrating this relationship. Ovaries, which contain eggs, will ultimately develop into the fruits, which contain the seeds. The ovary is often important in the dispersal of seeds. Some fruits have fleshy nutritious and delicious outer layers and are dispersed by animals, while others are dependent on wind and do not have succulent walls. The seed, which contains the embryo, must get to a place suitable for growth (enough light, moisture, and nutrients). The contents of the seed are protected by a resistant seed coat. Stored nutrients (in cotyledons or endosperm) are important for the embryo in its initial stages of growth. Germination in most seeds begins with the emergence of the embryonic root (radicle). As the root absorbs water, nutrients are transported from the cotyledons and growth of shoot and root occurs.

Vocabulary

<u>Cotyledon</u>	The first leaves developed in an embryo.
<u>Embryo</u>	Immature plant within a seed.
<u>Epicotyl</u>	In embryonic shoot above the point of attachment of the cotyledons.
<u>Germination</u>	The sprouting of a seed (or spore).
<u>Hilum</u>	Point of attachment of the seed to the placenta.
<u>Micropyle</u>	Pore through which the pollen tube enters the ovule, later in development this pore is where water is absorbed into the mature seed.
<u>Ovary</u>	The structure that houses the eggs in flowering plants.
<u>Petal</u>	Floral parts that are often important in attracting pollinators.
<u>Radicle</u>	Embryonic root.
<u>Seed</u>	Mature ovule, contains the embryo
<u>Seedling</u>	A young plant.



SCIENTIST IN RESIDENCE PROGRAM

<u>Sepal</u>	Outer row of floral parts that usually protect the flower bud.
<u>Stamen</u>	The pollen producing parts of a flower.
<u>Stigma</u>	Part of the pistil to which the pollen lands.
<u>Style</u>	Part of the pistil between the stigma and ovary.

Materials

- Assorted flowers (lilies) and fruits
- Tomato flowers and fruit
- Dissecting Microscopes
- handlenses
- Scarlet runner seeds (soaked overnight)
- Bean seedling (~2 weeks old)
- 1 clear plastic cup per students
- Paper towels
- Container of water

In the Classroom

Introductory Discussion

1. We begin by presenting a number of fruits and vegetables. As a group, we will categorize them as fruits or vegetables and then discuss the differences between them. (Hopefully students will recognize that fruits contain seeds and some “vegetables” are actually “fruit”.)
2. Additional questions to lead discussion:
 - What is the function of a fruit?
 - What is a seed? (include parts)
 - What is the function of a seed?
 - What is germination?
 - What does the seed need for germination to occur?
 - What are the main parts of a plant?
3. Overview of Activity:
 - a. Flower, fruit, and seed dissections
 - b. Setting up a germination chamber (scarlet runner beans) to examine and predict what will happen to the components of the seed during germination.
4. The primary focus of this lesson is for students to make observations (identify floral, fruit, and seed parts) and understand the relationship between the structures. Seeds will be dissected, parts identified and drawings made. Students will predict what the various components develop into in the “adult” plant.
5. Safety guidelines.



SCIENTIST IN RESIDENCE PROGRAM

Microscopes should be handled with care (do not use until one of the teachers has given you instructions)

6. All materials from today will go into a composting bin.

Science Activity/Experiment

Activity Title: Plant Reproduction: from flower to fruit, from seed to plant

Purpose of Activity: To understand the structures important in plant reproduction.

Methods and Instructions:

Set-up prior to experiment:

Soak scarlet runner beans (students can set this up as a class) – 100 beans in container(s) filled with water

Purchase flowers and fruits

Part 1 – Flower and Fruit Dissection

1. Each student will be given a lily flower. Together we will take it apart from the outside to the inside and identify the parts. The stamen and pistil will be examined closely (use of handlenses will be demonstrated) and their functions discussed. The importance of the ovary will be emphasized.
2. We will examine other examples of flowers (some with distinctive sepals). Even though flowers may look different from each other, they all basically have the same structure.
3. Tomato flowers and fruits will be distributed. Students will identify the part of the flower that become tomato fruit.
4. Examples of other fruits will be discussed (lily, cucumber, peppers, etc). Examine the fruit and identify associated floral parts (remnants of sepals and stamens are often present).
5. Clean-up

Part 2 – Bean Dissection and Germination (Activity Sheet)

1. Compare a dry seed with one that has been soaked overnight. Consider the function of the seed coat. What must happen for germination to commence? Examine the external structure of the seed. Identify the place where it was attached to the ovary (hilum) and hole through which water is absorbed (micropyle).
2. Peel the seed coat away from the embryo. Split the embryo in half. Examine and compare with the illustration on the worksheet (diagram with parts labeled: cotyledon, radicle, epicotyl) using a handlens.
3. Demonstrate: Take a stack of three paper towels. Fold in half longitudinally. Line a plastic cup with the paper towel. Add water to the cup until the paper towel is completely wet. There should be about a half inch of water left at the bottom of the cup. Tuck the bean(s)* between the paper towel and the glass.

Get each pair of students to make a germination chamber. The jars will be paced on the window sill and the germination documented.

4. Students' worksheets (to include diagrams, observations, predictions, etc.).



SCIENTIST IN RESIDENCE PROGRAM

Prediction: Ask students what will become of their bean in the germination chamber. What will happen to each component of the seed? What part of the embryo will emerge from the seed first?

Note* The beans may be set up in various ways in the germination chamber (e.g. the position of the radicle may be identified and may be placed in different orientations)....not sure yet what we will do and how many seeds each student will use.

Closure Discussion

1. What do you think will happen to the seed?
2. How will the root know to grow down?
3. Do all seeds store nutrients in cotyledons?
4. What do you think will happen to the cotyledons as the seedling develops?
5. Give examples we haven't seen today of edible fruits and seeds.

References (examples of the format to use for different types of references are below)

1. Griffiths, Anthony 1999. Kidscience: Real Science your Child Can Do APASE, Vancouver.
2. <<http://www.saburchill.com>> Open door Website (Ecole Active Bilingue Jeannine Manuel) Accessed January 8, 2008

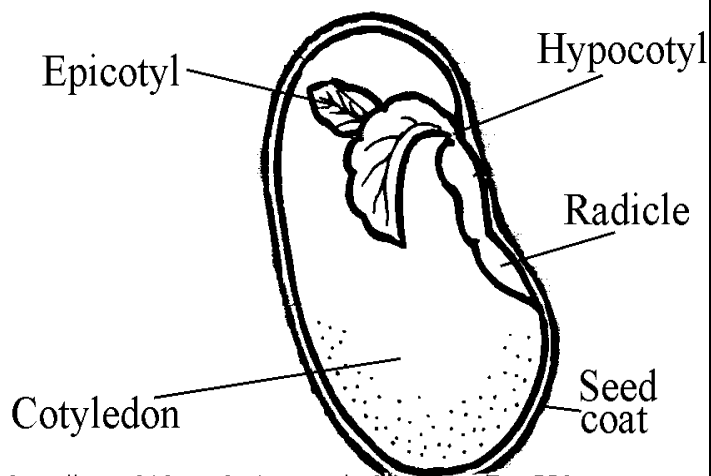
Extension of Lesson Plan

1. Students will make regular observations of the seeds in germination chambers. They will watch as the seeds germinate and the seedlings develop.

LESSON 1 – ACTIVITY SHEET

How does the soaked bean differ from an un-soaked bean?

Structure of the Bean:



<http://www.kidsgardening.com/onlinecourse/PartI5.htm>

What do you think is the function of the cotyledon?

Questions I have: