Unit: The Characteristics of Life

Lesson Plan 7: Characteristic 4: Organisms Reproduce

Objective(s):

Students will be able to:

- Define key terms (reproduction, sexual, asexual)
- Explain the difference between sexual and asexual reproduction

Materials:

- Video from Discovery Education: (Subscription Required)
  Biology: The Science of Life: Making New Life: The Basics of Reproduction. United Learning. 2001. Discovery Education. 15 December 2009. <http://streaming.discoveryeducation.com/>.

Anticipatory Set:

The fourth characteristic of all living organisms is that organisms reproduce. We will explore the two ways organisms are able to reproduce and create offspring.

Lesson:

I. PowerPoint presentation
   Have students take notes.
II. Video

Lab Activity:

Bean Lab; observe how plants use seeds to reproduce.

Evaluation:

- Lab observations
- Quiz on vocabulary

Characteristics and Classification of Organisms
Part 6

Characteristic 4:
Organisms reproduce

Genesis 1:11 (KJV)
"And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth, and it was so."

Reproduction- the ability of an organism to multiply and create offspring

Asexual Reproduction- the ability of an organism to multiply and create offspring with its own DNA

Sexual Reproduction- the ability of an organism to create offspring with a member of its own species (and combined DNA).

Bean Lab

Supplies

- kidney beans from grocery store
- Ziploc baggies
- paper towels
- elastic bands
- masking tape
- bottled water
- forceps
- cardboard
- spray bottle
- water
- stapler
- scissors

Procedures

1. Soak 10-15 kidney beans in lukewarm (not hot) water for 30 to 60 minutes.

2. Beans are a form of seed. The beans we are using here are dicotyledons, which means that each bean consists of two halves or two cotyledons. Separate a seed that has been soaked into its two cotyledons, with your finger if possible or with a razor blade if necessary. Draw and describe the cotyledons (seed halves).

3. Do you see the young germinating plant growing between the cotyledons? Where is it located? What parts are present? Use a magnifying glass if necessary to see it clearly. Draw and describe the tiny plant and its relation to the cotyledons.

Drawing 1: Cotyledon and Germinating Plant

4. Label a pint-sized baggy with your group's name and the date, using a masking tape label.

5. Put about one inch of bottled water (or other good quality water) into the bottom of the baggy.

6. Insert two paper towels into the baggy so that they are immersed in the water at the bottom. They should fully cover the inside of one side of the baggy and extend over the top so as to be conducive to evaporation and water flow.

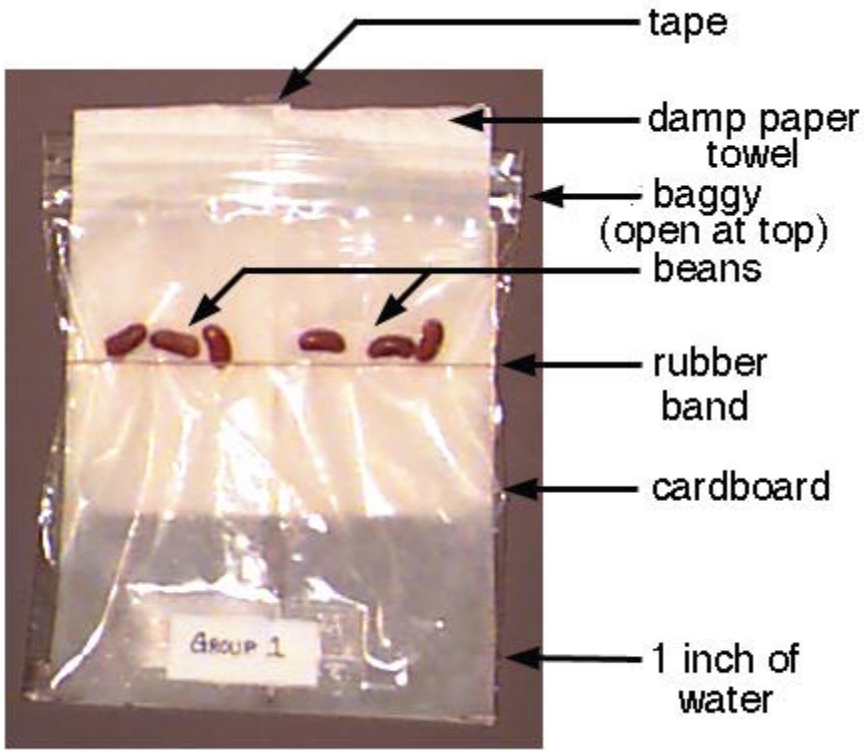
7. Cut a piece of sturdy cardboard so it is the size of the baggy.

8. Place cardboard outside of the baggy, on the back of it, and hold it in place with an elastic band around both the baggy and cardboard, about an inch below the lip of the baggy.

9. Using forceps rather than your fingers to reduce contamination, place six kidney beans (that have been soaked for 30 t0 60 minutes in lukewarm water) inside the top of the baggy, resting on the lip formed by the elastic band. The baggy should be open at the top for good airflow. This is important.

10. Place the baggies in the well-lit area determined by your instructor. We tack ours to a bulletin board near a window.

Figure 1. Photograph of Beans in Baggy



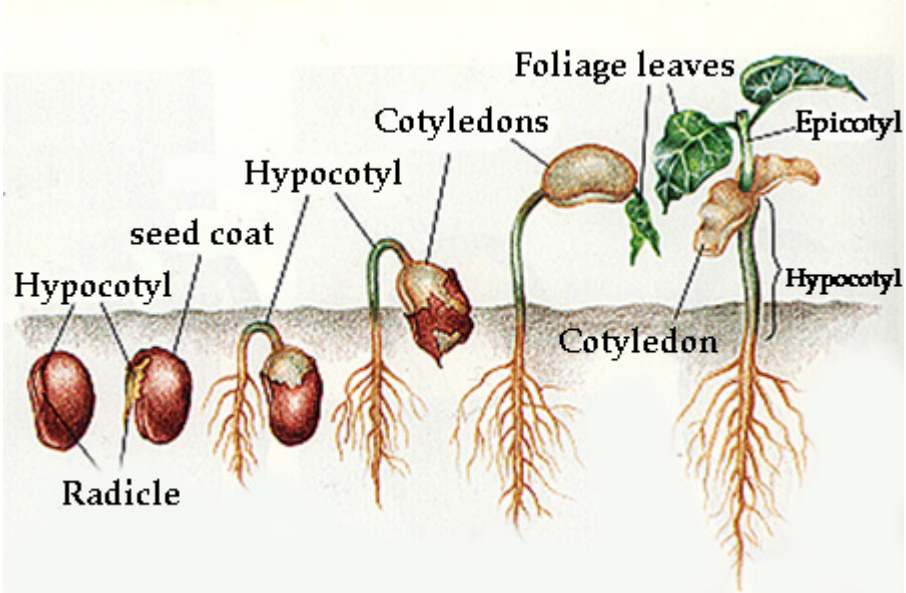
11. Check your baggy each class period for about three weeks or until you see significant changes. Make certain that the paper towels remain moist and free of fungus and that the top remains open. If the baggies are too wet, mold will grow; if they are too dry, nothing will grow. Add water as needed. Use forceps to remove any fungus-contaminated beans as soon as they appear.

12. Individually keep detailed notes and drawings of your observations. If you have access to a camera, photograph the baggy each class period. In three to four weeks, summarize your observations and write your conclusions about this experiment. Compare baggies

prepared by all groups. Is there variation in the growth? If so, how can you account for it? Answer the questions below.

For your reference, Figure 2 illustrates the growth of kidney beans in soil. When beans are grown in baggies, the cotyledons in the second and third drawings will be more upright, since there is no soil to hold them down as they grow:

Figure 2. Bean growth in soil. From Campbell, N. (1987) *Biology* . Menlo Park, CA: Benjamin/Cummings Publishing Co.



Name: _____ Date: _____

Data Analysis Questions:

1. Which emerges from the seed first: the roots, the leaves, or the stem? Is this true in all cases? If not, in what proportion of cases?

2. What happens to each seed as its plant grows? Does the seed's position change?

3. What happens to the shells or coats of the seeds? Are they still connected to the plant after three weeks of growth? If so, where?

4. Do the seeds change in appearance over time? What accounts for the changes you observe?

5. Use a magnifying glass to examine the leaves of your plants. Describe the top and bottom surfaces of the leaf.

6. Each leaf surface has been designed by the Creator to perform different functions. Can you identify the primary functions of each leaf surface and the adaptations that are present to support each function?

Photosynthesis is a process in which plants remove carbon dioxide molecules from the air and join the carbons from the CO2 molecules together to form a sugar molecule. This process requires light energy. The energy is captured by colored pigments, usually green, that are found in an organelle called the chloroplast. Chloroplasts are present in your bean plants wherever the plants are green in color.

7. What parts of the plants contain chloroplasts? What parts of the plant do not contain chloroplasts?

8. Examine the roots of the plants in the baggies using a magnifying glass. Draw and describe the structure of the roots. Do you see any root hairs?

9. At the end of three weeks, are some of your plants spindly and pale? Are some robust and green? In either case, can you explain why?

Name: _____ Date: _____

Data Analysis Questions:

1. Which emerges from the seed first: the roots, the leaves, or the stem? Is this true in all cases? If not, in what proportion of cases?
Without your prompting, this is precisely the kind of detailed observation students tend to overlook. The roots emerge first, uniformly.

2. What happens to each seed as its plant grows? Does the seed's position change?
Typically the roots grow down and the stems grow up. The seed may be reoriented if it is not held in a fixed position. If the roots are well anchored, the seed may be lifted out of the baggy by the hypocotyledon (the stem that grows between the roots and the seed).

3. What happens to the shells or coats of the seeds? Are they still connected to the plant after three weeks of growth? If so, where?
The seed coats are typically shed and the seed shrivels as its nutrients are used up by the young growing plant.

4. Do the seeds change in appearance over time? What accounts for the changes you observe?
The seed loses its seed coat and gradually shrivels as it loses its nutrients. The plant uses the nutrients stored in the seed for growth to help it get started, before its photosynthetic reactions are going full bore.

5. Use a magnifying glass to examine the leaves of your plants. Describe the top and bottom surfaces of the leaf.
The top surface of the leaf is smooth, covered with a waxy cuticle. The bottom surface is rough and has many openings called stomata through which gas exchange occurs. The plant can adjust the size of the openings, making them larger on cool days and smaller or closed altogether on hot days.

6. Each leaf surface has been designed by the Creator to perform different functions. Can you identify the primary functions of each leaf surface and the adaptations that are present to support each function?
The lower leaf surface has tiny openings called stomata. Stomata and their surrounding guard cells open to admit carbon dioxide for photosynthesis and oxygen for respiration. The stomata may also release oxygen produced by photosynthesis and carbon dioxide produced by respiration. Water vapor also escapes through the stomata, and on hot days a plant may close its stomata to preserve its water.
The upper surface is covered with a waxy cuticle to prevent water evaporation and to protect the leaf from the elements. However, this waxy covering is clear so that the light can reach the chloroplasts inside the cells of the plant leaf.

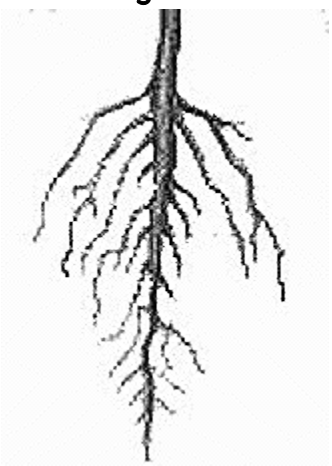
Photosynthesis is a process in which plants remove carbon dioxide molecules from the air and join the carbons from the CO2 molecules together to form a sugar molecule. This process requires light energy. The energy is captured by colored pigments, usually green, that are found in an organelle called the chloroplast. Chloroplasts are present in your bean plants wherever the plants are green in color.

7. What parts of the plants contain chloroplasts? What parts of the plant do not contain chloroplasts?

The stem and leaves are green and therefore contain chloroplasts. The roots do not contain chloroplasts, even when exposed to light. The flowers which develop after a few weeks also do not contain chloroplasts.

8. Examine the roots of the plants in the baggies using a magnifying glass. Draw and describe the structure of the roots. Do you see any root hairs?

Drawing 2: Roots



9. At the end of three weeks, are some of your plants spindly and pale? Are some robust and green? In either case, can you explain why?

The beans grow in a baggy by drawing nutrients from the endosperm in the seed. After about three weeks the nutrients in the seed will be depleted. At that point, the plants typically grow pale or begin to die. This occurs because the plants have no source of nitrogen needed for synthesizing proteins and nucleic acids. Sometimes, however, a plant will become more robust and green. In these cases, nitrogen-fixing bacteria have become associated with the plant roots, providing the missing ingredient. These bacteria are generally airborne contaminants.

Name: _____ Date: _____

Quiz: Organisms Reproduce

***Direction**: Answer the following questions*

1. Define *Reproduction*.

_____

2. What is the difference between asexual and sexual reproduction?

_____

_____

_____

Name: _____ Date: _____

Quiz Answer: Organisms Reproduce

***Direction**: Answer the following questions*

1. Define *Reproduction*.

The ability for organisms to multiply and create offspring.

2. What is the difference between asexual and sexual reproduction?

Asexual reproduction occurs when an organism uses its own DNA to create offspring while sexual reproduction requires a second parent of the same species in which the DNA of two parents combines to form new offspring.