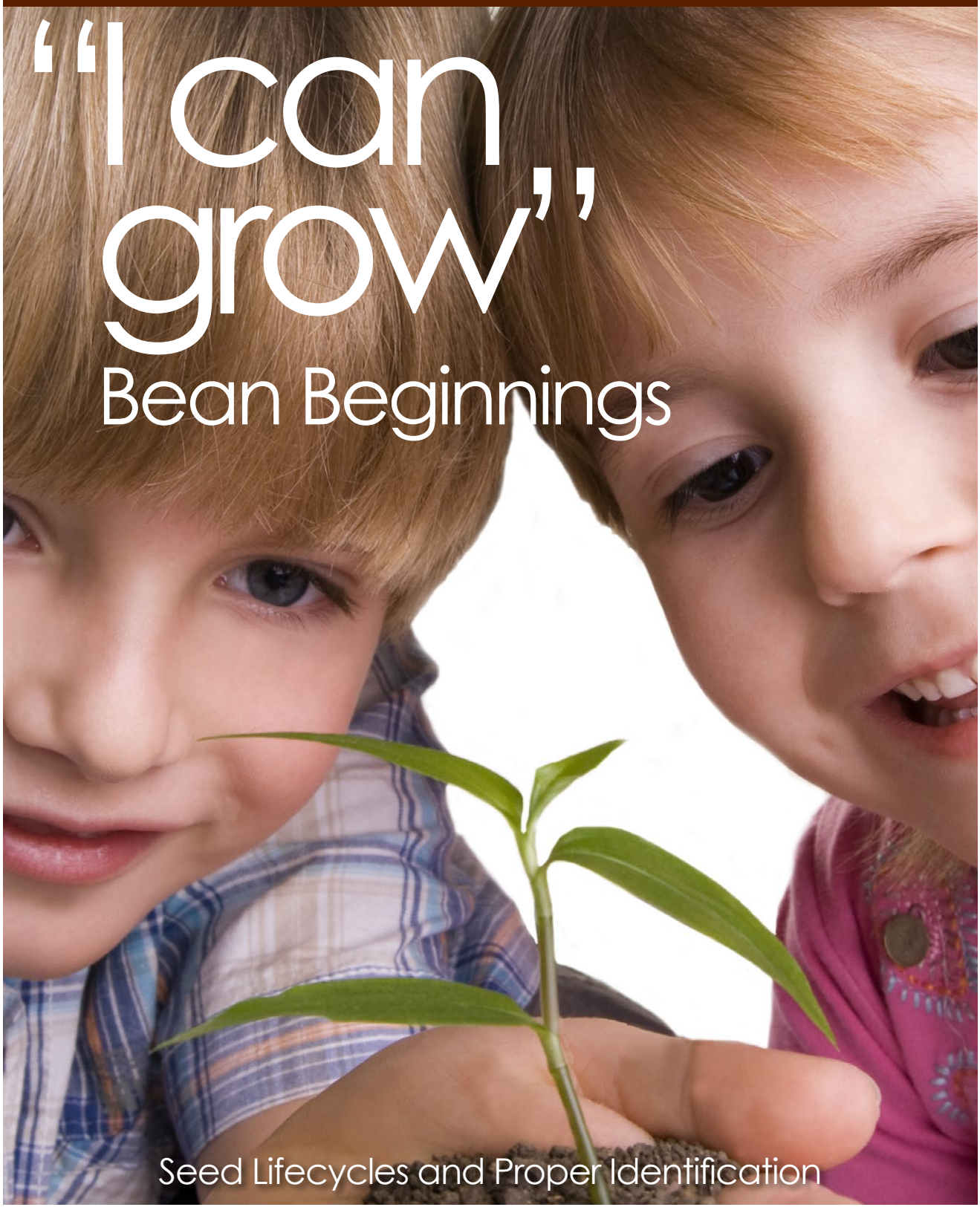
BURPEE
HOME GARDENS®

"I can grow"

Bean Beginnings



Seed Lifecycles and Proper Identification

Burpee Home Gardens acknowledges the National Gardening Association for their participation in developing the “I Can Grow” guide and educational materials.

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There is nothing like seeing the joy of discovery and self-satisfaction in the eyes of a child! At Burpee Home Gardens, we believe the vegetable garden offers the perfect opportunity to sow the seeds of a healthy mind, body and soul. It can teach children the wonders of nature along with hands-on skills that will stay with them – for a lifetime of good eating habits and environmental stewardship.

As the interest in school garden programs rises, so does the need for useful and fun curriculum guides and activities. In partnership with the National Gardening Association, Burpee has developed the "I Can Grow" guide for educators, and now expands that resource with individual lesson activities. These educational guides cover a range of subjects with activities rooted in the ground and in the world around us.

"I Can Grow" remains Burpee Home Gardens' initiative to support the new, popular interest in vegetable gardening among younger and novice gardeners. The program reflects a growing interest in fresher, more nutritious food; supporting community needs and environmental responsibility; saving money; and finding personal satisfaction through home gardening.

From seed science and plant classification, to basic genetic and heredity lessons, and on to sustainability and nutrition practices, we hope these "I Can Grow" educational resources complement lessons in the classroom to discover a newfound awareness of the benefits of homegrown vegetables.

Bean Beginnings

Objectives: Students will recognize that seeds are living organisms and that living things have a lifecycle. Students will dissect seeds and be able to label parts of dicotyledon seeds by function as well as proper name.

Grade Level: 1-8

Time: 1 hour

Materials:

Note: *Lima, kidney and northern beans work well for these activities. The bean seeds need to soak for 24 hours to prepare them for dissection. Seeds soaked for 4 to 24 hours will begin to deteriorate.*

For Younger Students

- A bean seed for each student, soaked in advance
- A pine nut for each student
- A paper clip for each student
- Paper and pencil, for recording observations

For Older Students

- A dried bean seed for each student
- A "soaked" bean seed for each student
- Envelope of vocabulary words and definitions for each pair of students (see the Plant Vocabulary worksheet)
- Paper and pencils for recording observations
- Glue
- One clear plastic cup
- Iodine solution
- Eye dropper

For Everyone

- Seeds for planting
- Clear gelatin, such as Knox Gelatin®
- Clear plastic cups
- Liquid plant food

Background:

Plants are nearly everywhere. You can walk through a forest, drive down a road, view fields planted with crops for food, even explore a city park that is lined with trees or weeds poking through cracks in the sidewalk. Plants come in all different sizes and shapes and they grow in a variety of environments from the cold North to the heat of the Tropics. Scientists estimate that at least 260,000 different species of plants live on Earth today.

Plants are living organisms. Living organisms have lifecycles. A seed may not appear to be alive, but it is a small embryonic plant covered by a seed coat. Seeds are produced by gymnosperm and angiosperm plants after fertilization occurs in the ovule of the plant. Plants that have seeds are found in a variety of climates and conditions. A typical seed has three basic parts: an embryo, the seed coat and a temporary food supply. The food supply is either an endosperm that is packed around the young plant or stored in special leaves called cotyledons.

The embryo is a "baby" plant. It will develop, under the right conditions, into a new plant. The embryo has several parts, including an immature root, shoot and leaves. The cotyledon is the seed leaf. A seed with one cotyledon will be called a monocotyledon, or monocot. A seed with two or more cotyledons will be called a dicotyledon, or dicot.

Easier: Labeled with seed coat, embryo, leaf, stem, cotyledon/ food, endosperm and root system.

More Difficult: The radicle is the root of the embryo. The plumule is the embryonic shoot that will become the stem and leaves. The epicotyl is the portion of the embryo that will develop into the shoot and the hypocotyl connects the epicotyl and the radicle.

Monocots do not have a hypocotyl or epicotyl. They have a coleoptile that forms the first leaf and connects to the coleorhiza (protective covering) that connects to the root.

Seeds come in a variety of different shapes, sizes and colors. Seeds need to be as diverse as the environments in which they live and grow. Seeds are dispersed by the wind, animals, people, even machinery. The plant cannot ensure its survival unless it is able to relocate to a suitable location for development and avoid competing with the parent plant for resources. All seeds require oxygen, water and the proper temperature range in order to germinate.

Plant Vocabulary

Seed Embryo
A multicellular plant in its earliest stage of development.

Seed Coat
The protective covering for the embryo.

Hypocotyl
The embryonic stem that supports the cotyledon. It eventually develops into the stem of the plant.

Plumule
The embryonic shoot that bears the first true leaves of a plant. It moves against gravity or away from the soil.

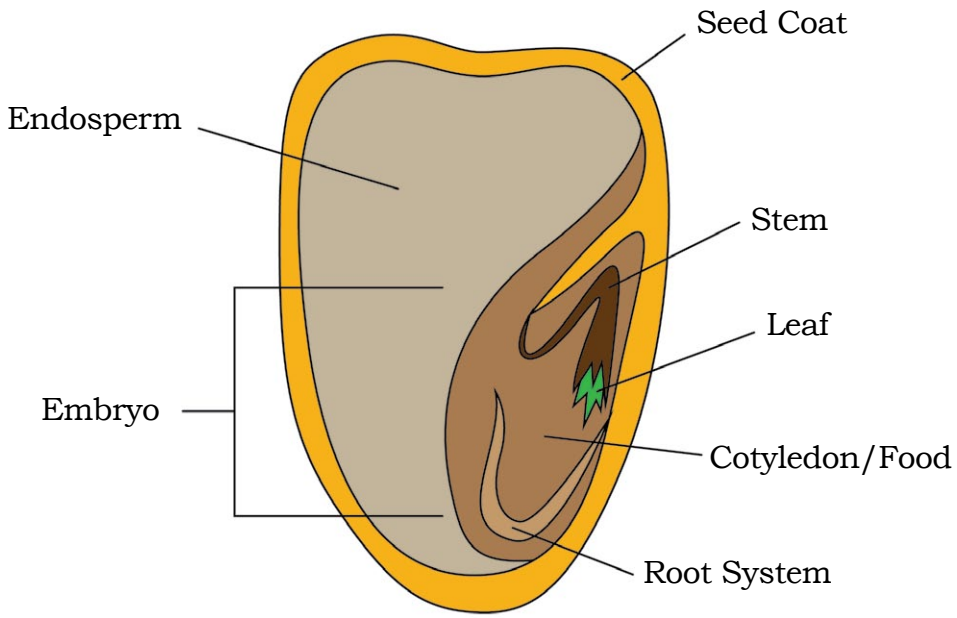
Cotyledon
A significant part of the embryo within the seed of a plant. These special leaves provide a temporary food supply for the seed.

Hilum
The seed coat scar. Sometimes referred to as the "belly button" of the seed, it is the location where the seed was attached to the ovule of the parent plant

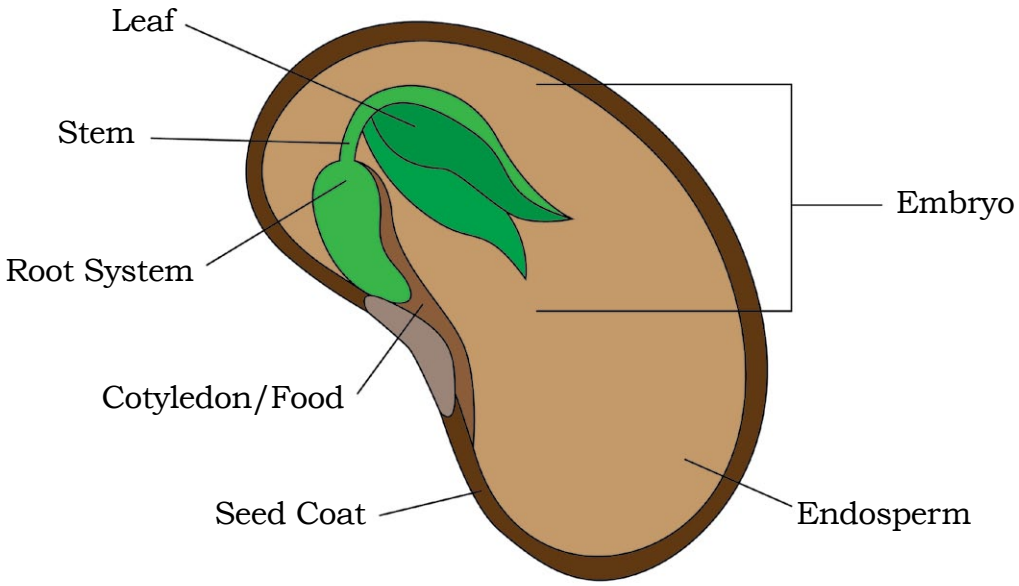
Radicle
The embryonic root of the plant that grows downward in the soil. It is the first part of a seedling to emerge from the seed during the process of germination.

Easier

Picture of a monocot embryo

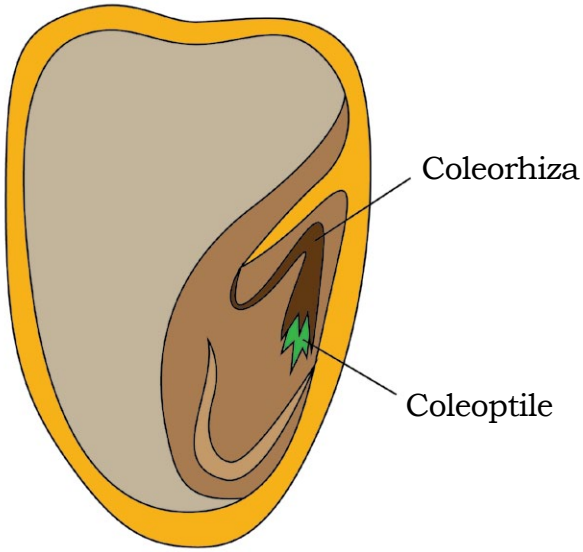


Picture of a dicot embryo

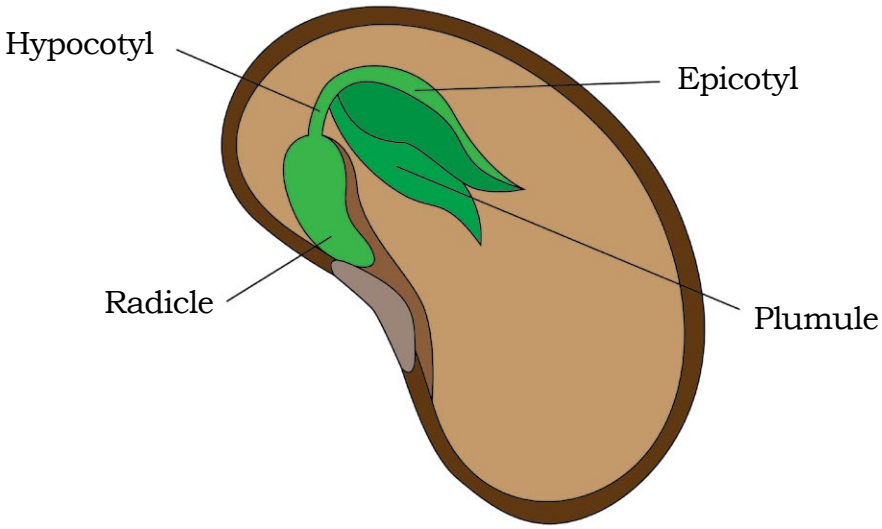


More Difficult

Picture of a monocot embryo



Picture of a dicot embryo



Lesson Takeaways:

- Seeds are small, embryonic plants covered by a seed coat.
- Seeds have three basic parts: embryo, seed coat, temporary food supply.
- A cotyledon is an immature seed leaf. A seed with one cotyledon is called a monocot. A seed with two or more is called a dicot.
- All seeds require oxygen, water and the proper temperature to germinate.

Activity for Everyone: Seed Starting

1. Dilute liquid plant food to one-eighth its strength.

2. Make a clear gelatin solution, using the diluted plant food in place of the water.

3. Pour the plant food gelatin into a clear plastic cup that is clearly labeled. Allow the gelatin to set slightly.

4. Press a seed about one-half inch below the gelatin's surface. Clear gelatin makes an ideal growing medium for seed germination. The students can observe the entire process. Have the students document the seeds' changes each day. You may wish to plant a variety of seeds to compare and contrast monocots and dicots or simply examine the difference in germination times.

Activity for Older Students: Seed Exploration

1. Give each student a dried bean and a "soaked" or rehydrated bean. Have the students carefully examine the dried bean. Are there external landmarks on the dried bean that show where the bean was attached to the ovule?

2. Have the students glue the dried bean to a sheet of paper. Ask the students to use descriptive words to depict characteristics about the size, shape, texture and potential mode of dispersal for the seed. These words should be listed underneath the dried bean.

3. Hand out an envelope of vocabulary words and definitions to each pair of students. Tell the students to place the words in two columns on their desk. One column is for: Words Known; the other column is for: Words Unknown. Have the students place their vocabulary words in the columns according to their understanding. You may wish to help students with the pronunciations of these new words.

4. Have the students carefully dissect the rehydrated bean. Tell the students to carefully glue their dissected seed to a sheet of paper. Now, using their new vocabulary words and definitions, have the students try to identify the parts of the seed. Have the students place the word slips by the part of the seed that it identifies (do not have them glue them to the paper). If students are struggling they may benefit from breaking down the words or looking at the root-meanings.

5. Once students have made their basic determinations for the seed parts, allow them to correct each other's work or work together as a class to make any necessary corrections.

6. Students should then glue the word and definition slips to correctly label the seed parts.

7. As a class, take one soaked bean and separate the cotyledons and place them in the clear plastic cup.

8. Place a few drops of the iodine solution onto the seed in each cup. The iodine solution will turn dark blue in the presence of starch. It does not change color in the presence of sugar. Have the students observe and describe what happened to the color of the iodine solution after a few minutes.

9. Tell the students that starches and sugars are sources of energy for the plant. What do the students' observations suggest to them about how plants store energy? Why would the plant need stored energy for germination?

Activity for Younger Students: Seed Exploration

Teacher's Note: Make sure to check with parents about nut allergies before suggesting students taste the pine nuts. Sunflower seeds may be another option if they have not been processed in a facility where nuts are processed.

1. Give each student a bean seed, a pine nut and a paper clip.

2. Working with the beans first, have the students carefully remove the seed coat and split the bean seed in half. Ask the students if the bean is alive. Have students discuss the possible ways to determine if the bean is alive.

3. Ask the students to identify the embryo. Explain to the students that this is the immature plant that will develop into a larger plant. Have them draw or record their observations on a sheet of paper.

4. Ask the students to carefully remove the seed coat of the pine nut. Have them bend a side of the paper clip upward so that it can be used to slice into the seed. Tell the students to carefully open the pine nut, using the paper clip as a tool.

5. Students should easily recognize the embryo within the pine nut. Have them give some detailed descriptions of what the embryo looks like and write it on their observation sheet. You may choose to have them label their picture using the proper vocabulary.

6. Have the students taste a portion of their pine nut (see Teacher's Note). Ask them to name some seeds commonly eaten by people or animals. Tell the students that some seeds are very nutritious. They are rich in protein, minerals, fats and vitamins. Explain to the students that the parts that are nutritious for people and animals are just as nutritious for the growing plant. Help them to understand that the part of the seed surrounding the embryo is utilized as food until the plant can produce its own food from the sun.

Plant Vocabulary

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