

“I can  
grow”

‘Shoe’ Me How to Classify

The Importance of Plant Classification

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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.



# 'Shoe' Me How to Classify

**Objectives:** Students will examine the life cycle of plants and understand the importance of classification.

**Grade Level:** 1-9

**Time:** 1 hour per activity

## **Materials:**

### **For Older Students:**

- *Life Cycle of a Gymnosperm*, transparency or screenshot
- *Life Cycle of an Angiosperm*, transparency or screenshot
- An assortment of seeds and leaves that should represent both gymnosperms and angiosperms; enough for each pair or small group of students to have 10 or more. Instructors should know the plant name for each seed or leaf so that students can confirm their classification.
- Paper and pencils for each group of students

### **For Younger Students:**

- One plain white paper plate for each student
- Stapler
- Crayons, markers or colored pencils
- Green construction paper
- White construction paper
- Green yarn, an arm-length strand for each student
- Hole punch
- Scissors, enough for more than one student to use at a time\*
- Children's books about plant growth and development (optional)
- Pea Pod Patterns, see worksheets

*\* Young children should be supervised carefully at all times when using scissors, knives, etc.*

## Background:

Botanists use classification systems to group plants with similar characteristics together. They examine the flowers, fruit, seeds and leaves of plants to determine details about the plant's anatomy. Anatomy, along with how the plant grows, will help to determine in which category the plant will be placed. Classification is critical for not only keeping things organized, but for helping people to be successful in growing those plants for food, clothing and shelter. For instance, knowing which types of plants germinate quickly or in harsh environments can be critical information.

Understanding the many layers of categories can be useful, but also very confusing. The most basic classification for plants is by plant families. Not to be confused with a nuclear family that consists of simply a parent plant and its offspring, these plant families are more like a widely extended family that shares related characteristics. The squash family, for example, includes cucumbers, melons, gourds, pumpkins, winter and summer squash. Their seeds and plant anatomy have similarities and they have male and female flowers on the same plants. Plants in the squash family depend on pollinators to set their fruit. Although they share common traits, they also have many differences. For example, their fruits are very different in appearance—just the same way that you may have some characteristics similar to a cousin or nephew, but you are also unique to your individual parents.

In a grouping broader than families, plants are also divided based on whether or not they reproduce by making seeds. Seed-producing plants can be classified into two groups: **Gymnosperms** and **Angiosperms**. Gymnosperm seeds are not enclosed in fruit. The word gymnosperm means “naked seed.” Angiosperms are plants that have flowers and produce seeds that are enclosed in fruit. And while not all plants propagate through seeds (for example, ferns reproduce through spores), this lesson will focus on the basic plant life cycle: seed, plant, flower and seed. The steps in this process are the same for all seed-producing plants, although the life cycle will vary in length and schedule. Examining this life cycle gives botanists even another level to categorize seed-producing plants: annuals, biennials and perennials.

**Annuals** are plants that flower and complete a full life cycle, from seed to seed, in one growing season.

**Biennials** complete a full life cycle in two growing seasons. During the first season, the plant puts energy primarily into roots and vegetative growth, and it flowers and sets seed during the second growing season. Some good examples of this are beets, carrots and onions.

**Perennials** continue to flower, produce seeds, and grow for at least three years. They often have adaptations such as dormancy and dropping leaves to help them survive year-round in a changing environment. Perennials may or may not have woody stems.

## **Lesson Takeaways:**

- Classification keeps things organized.
- Plant families are widely extended families that share related characteristics.
- Plants are further divided and classified based on other traits, such as reproduction and growing season.
- The basic plant life cycle is seed, plant, flower and seed.

## Activity for Everyone: The Shoe Organizer

1. As a class, ask the students to identify things that are organized by groups—e.g., sports teams, store departments, school districts. Have the students list possible reasons for organization. How difficult would it be to find something in a large store if items were not grouped into sections and aisles?
2. To illustrate methods of classification used by scientists, have all of the students remove one shoe and place them in a pile in the center of the room. Select one student to come to the front of the room and determine how to organize the shoes in the pile by one specific characteristic (such as “sandal” or “not sandal”). Have the student separate the shoes based upon the “secret categorization”—the student should not reveal by which category he/she has determined the divide. Encourage the class to try to identify by what factor the shoes have been categorized. You may choose to select another “classifier” to divide the shoes from the full pile again, or to further divide the already separated shoes. Play the game until students have a good understanding of how the shoes can be organized.

*\*Note: An instructor can simplify this activity for younger students by becoming the “classifier” to adjust the activity to meet the students’ level of understanding and by suggesting simpler characteristics like color.*

3. Tell the students that, just like department stores group their products, botanists also classify plants. Explain to the students that plant classification systems are necessary because they help us understand a plant’s relationship within the world. For instance, what if you knew a certain plant could help you fight a disease—you may wish to find plants that are similar to see if they could also help people. Also, understanding the challenges plants may have in certain environments may also help us to better understand which plants would be at risk if we were to build a road, school or other structure in a specific location.
4. Ask the students what characteristics might be used to develop a classification system for plants.

## Activity for Older Students: Plant Classifications

1. Show the students the *Life Cycle of a Pine Tree* [gymnosperm] and *Life Cycle of a Cherry Tree* [angiosperm]. Ask the students to identify similarities and differences. Review the main characteristics of gymnosperms and angiosperms. Tell the students that plants are organized by these characteristics to make them easier to identify and study (just like they did with the shoes). Explain that plants are further organized by how they develop during a growing season.
2. Working in pairs or small groups, give each set of students 10 or more assorted seeds and leaves. Have the students use their classification skills to organize these items. Students should record the basis for their classification on a piece of paper. The items for this section of the activity can be classified in any random way.
- 3) Tell the students that they are now going to organize the items more scientifically. Give the students the name of each plant for the seeds and leaves. Using the Internet and other plant classification materials, ask the students to identify whether the seeds or leaves are gymnosperms or angiosperms. Once the students have made that determination, they should explore whether the plant is an annual, biennial or perennial. Have the students create an organizational chart to showcase their findings.
4. Ask the students to answer the following questions on the bottom of their chart:
  - a. In nature, how does the pollen grain in the gymnosperm get to the seed cone? *Wind pollination.*
  - b. How does the shape of the gymnosperm seed relate to the way it is dispersed? *It is winged to help it fly in the wind.*
  - c. Why do angiosperm seeds have an advantage being enclosed in a fruit? *Protection. Aids in seed dispersal (the fruit and seeds are eaten by other organisms and it leaves the digestive tract ready to grow, or some fruits have barbs to attach to animals or people). Fruit decomposes and becomes nutrients for the plant.*
  - d. How would the seeds you have in your examination be dispersed?
  - e. Why is it an advantage to have flowers with varied shapes, sizes, colors and odors? *These are all used to attract animals/insects that aid in pollination and seed dispersal.*
  - f. What are some advantages of knowing whether a plant is annual, biennial, or perennial?

## Activity for Younger Students: The Pea Pod

1. Ask the students about how they have changed since they were babies. What are some of the things that they are able to do now that they couldn't do when they were "little"? What will be different when they are adults? What things will be the same?

2. Show the students a pea seed. Tell the students that a seed is an immature or "baby" plant. Ask them what they think will change about the seed as it grows or "gets bigger."

3. Discuss the life cycle of a pea plant. The seed germinates; roots grow, followed by shoots and leaves; the plant flowers and then develops new peas. Write the steps in order on the board.

4. Give each student a paper plate. Have them color it green and fold it in half. Staple the paper plate three-quarters of the way around the circle—making sure to leave an access point for the other plant parts. Students can now draw some large peas on their plate to represent a mature pea pod.

5. Have the students trace the paper patterns onto the construction paper, using the appropriate colors (all are green, except for the white flower). You may also copy the pattern directly onto the construction paper to save time. Cut out the plant parts and punch a hole in the top of each one.

6. Thread a piece of yarn through the holes punched in the paper (you may need to tie a simple knot carefully at the top of each one). Students should make sure to put the plant parts in the correct order.

7. Carefully slide the plant parts attached to the piece of yarn into the pea pod.

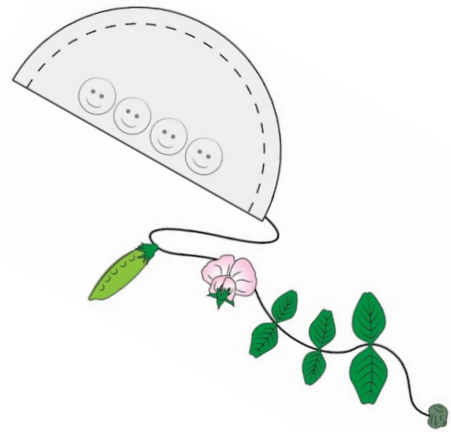
8. Now students can describe the whole life cycle of the pea by slowly pulling the seed, leaves, vine, flower and pea pod from the larger pea pod. You may choose to have the students write the steps of plant development to further enhance the sequencing aspect of this activity.

9. You may choose to read one of the following books to the students:

a. *From Seed to Plant* by Gail Gibbons,  
ISBN: 978-0823410255

b. *The Vegetables We Eat* by Gail Gibbons,  
ISBN: 978-0823421534

c. *Jack's Garden* by Henry Cole, ISBN: 978-0688152833



## The Pea Pod Pattern

Adapt this idea and these drawings as you deem appropriate for the activity. Make the pieces large enough to be manipulated by small hands, but small enough to be pulled through the space on the paper plate

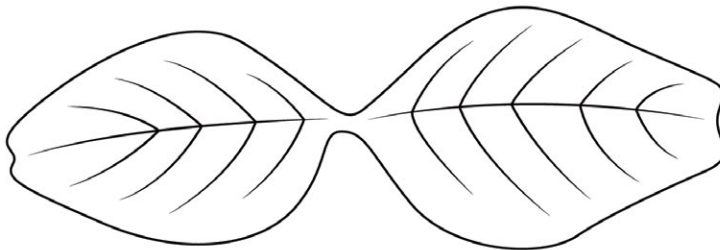
**Pea Seed**



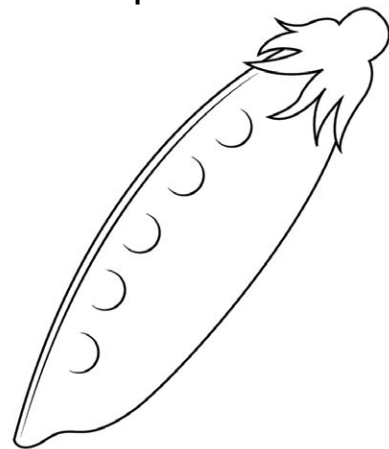
**Pea flower**



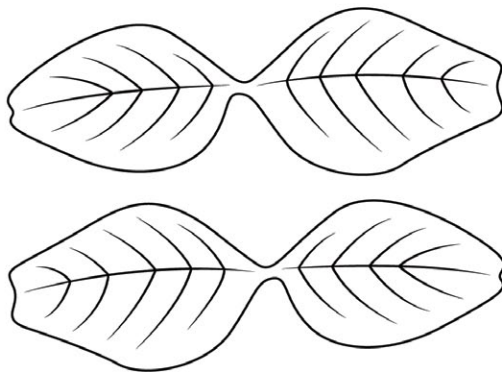
**First pea leaves**



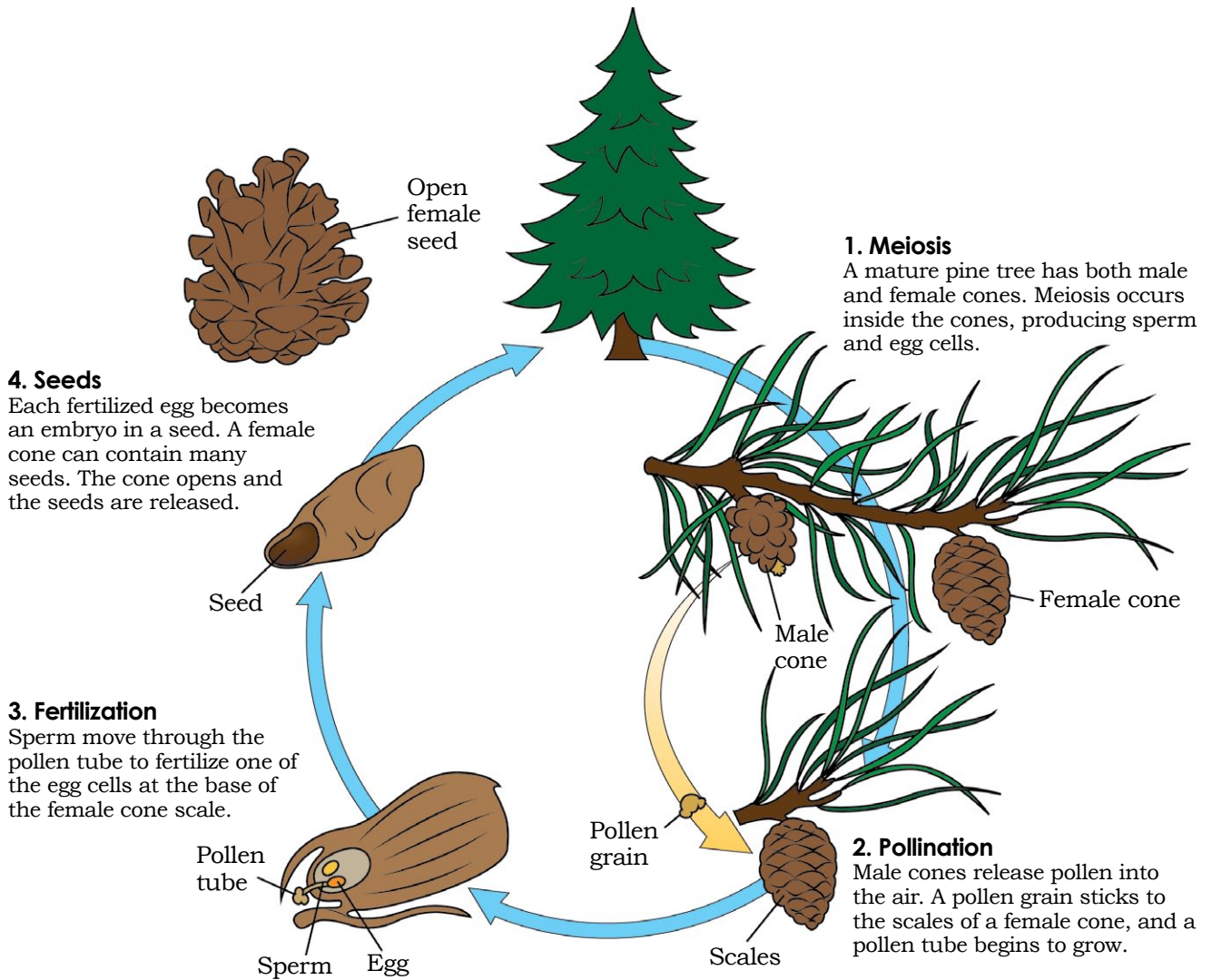
**Peapod**



**Pea leaves for vine**



# Life Cycle of Gymnosperm



# Life Cycle of Angiosperm

