

Unit B: Plant Anatomy

Lesson 5: Understanding Seed Anatomy

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Identify the major parts of a seed
2. List the function of each major part of a seed.
3. Describe seed dispersal
4. Recognize the economical importance of seeds

Recommended Teaching Time: 2 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed with use of this lesson plan
- <http://quorumsensing.ifas.ufl.edu/HCS200/Seed.html>
- http://en.wikipedia.org/wiki/Seed#Seed_structure

List of Equipment, Tools, Supplies, and Facilities

Writing surface

PowerPoint Projector

PowerPoint slides

Transparency Masters

Copies of Student Lab Sheet

Lima beans, and red kidney beans

Magnifying glass

Single edged razor OR scalpel

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide #2):

- Burs
- Cotyledon
- Embryo
- Epicotyl (plumule)
- Hypocotyl
- Radicle
- Seed
- Seed coat

Interest Approach: Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Have students get into equal sized groups and come up with different seeds and the uses of these seeds. Most of these seeds they list will be used as food, but try to get them to come up with other ways seeds are used. When they are finished discuss what they have come up with.

**** Use this activity to lead into a discussion of the parts of seeds.**

Summary of Content and Teaching Strategies

Objective 1: Identify the major parts of a seed

(PowerPoint Slide # 3)

- I. A seed is a living entity that serves as a bridge between generations of a plant. A **seed** contains the embryo plant and stored food.
 - A. It is formed in the pistil of the flower and develops from the ovule following fertilization.
As the fertilized egg (zygote) grows and develops, it becomes the embryo of the seed.
The zygote grows and develops to become the embryo of the seed.

(PowerPoint Slide # 4)

- B. The **embryo** has the parts (root, stem, leaf) of a complete plant. In addition, the seed contains stored food to support the development and growth of the embryo.
- C. This food is stored in the area of the seed known as either the endosperm or the **cotyledon**.
- D. The embryo root is the **radicle**, the stem is the **hypocotyl**, and the leaf is the **epicotyl (plumule)**.
- E. The embryo and endosperm (cotyledon in some plant species) is surrounded by the protective **seed coat**.

****Use PowerPoint Slide #5 and TM: B5-1 of the monocot and dicot seed to identify seed structures. LS: B5-1 will help students understand the location of the parts of a seed.**

Objective 2: List the function of each major part of a seed.

(PowerPoint Slide # 6)

- II. Each part of a seed has a specific function to help ensure that a healthy new plant will emerge from the seed.
 - A. The seed is a living entity which contains the embryo plant and everything necessary for its growth and development. Dicot plants (soybean, pea, oak) have two cotyledons

or seed leaves in its seed. Monocot plants (corn, coconut, lilies) have one cotyledon in its seed.

(PowerPoint Slide # 7)

- B. The radicle is the lower end of the hypocotyl that forms the first root of the plant. It is the radicle that emerges from the seed first as germination begins.
- C. The hypocotyl of the embryo plant develops into the true stem.
- D. The epicotyl above the hypocotyl develops into a pair of small leaves. The tip of the epicotyl may also be known as the plumule. The plumule is the terminal bud of the first shoot to emerge from the seed.

(PowerPoint Slide # 8)

- E. The endosperm found in monocot plants is an area of high concentration of food which is used as a food source for the embryo plant.
- F. The cotyledons store food absorbed from the endosperm when the seed was formed. The cotyledon provides the energy that permits the embryo to grow and emerge from the soil so that it can begin to manufacture its own food through photosynthesis.
- G. The seed coat surrounds the seed and protects it from injury and dehydration.

****Use TM: B5-2 of the developing embryo plant to discuss the function of each structural part. Repeat the function of each seed part and have the students tell you which seed part you are talking about.**

Objective 3: Describe seed dispersal

**** Before beginning this objective, ask the class how they think seeds get relocated. Have them brainstorm for ideas until you have a good list. Use this to lead into a discussion of how seeds are dispersed.**

(PowerPoint Slide # 9)

- III. Unlike animals, plants are limited in their ability to seek out favorable conditions for life and growth. As a result, plants have evolved many ways to disperse their offspring by dispersing their seeds. A seed must somehow "arrive" at a location and be there at a time favorable for germination and growth.

(PowerPoint Slide # 10)

- A. Seed dispersal is seen most obviously in fruits; however many seeds aid in their own dispersal. Some kinds of seeds are dispersed while still inside a fruit or cone, which later opens or disintegrates to release the seeds. Other seeds are expelled or released from the fruit prior to dispersal. For example, milkweeds produce a fruit type, known as a follicle, that splits open along one side to release the seeds. Iris capsules split into three "valves" to release their seeds.

(PowerPoint Slide # 11)

1. By wind
 - a. Many seeds like maple and pine have a wing that aids in wind dispersal.
 - b. The dustlike seeds of orchids are carried efficiently by the wind.
 - c. Some seeds like dandelion, milkweed, poplar have hairs that aid in wind dispersal.
 - d. Some winged seeds have two, and some have only one wing.

(PowerPoint Slide # 12)

2. By water
 - a. Some plants, such as Mucuna produce buoyant seeds termed sea-beans or drift seeds because they float in rivers to the oceans and wash up on beaches.

(PowerPoint Slide # 13)

3. By animals
 - a. Seeds with barbs or hooks are called **burs**. These seeds attach to animal fur or feathers, and then drop off later.
 - b. Seeds with a fleshy covering are eaten by animals such as birds, reptiles, fish, and mammals. They then disperse these seeds in their droppings. These types of seeds include apple, cherry, and grape seeds.
 - c. Nut seeds are an attractive long-term storable food resource for animals. The seeds are stored some distance from the parent plant, and some escape being eaten if the animal forgets them. These type of seeds include acorns, walnuts, pecans, and almonds.

****Ask students if they can think of specific examples of where seeds have been moved.
Ask them how they think they were moved.**

Objective 4: Recognize the economical importance of seeds

(PowerPoint Slide # 14)

IV. There are thousands of species whose seeds have economic uses.

- A. Most people and animal diets include seeds.
 1. Many seeds are edible and the majority of human calories come from seeds, especially from cereals, legumes and nuts.

(PowerPoint Slide # 15)

2. Seeds also provide most cooking oils, many beverages and spices and some important food additives. In different seeds the seed embryo or the endosperm dominates and provides most of the nutrients.
3. Seeds are used to propagate many crops such as cereals, legumes, forest trees, turf grasses and pasture grasses.

4. Seeds are also eaten by animals, and are fed to livestock. Many seeds are used as birdseed.

(PowerPoint Slide # 16)

B. Other uses of seeds

1. The world's most important clothing fiber grows attached to cotton seed. Other seed fibers are from kapok and milkweed.
2. Many important nonfood oils are extracted from seeds. Linseed oil is used in paints. Oil from jojoba and crambe are similar to whale oil.
3. Seeds are the source of some medicines including castor oil, tea tree oil and the discredited cancer drug, Laetrile.

(PowerPoint Slide # 17)

4. Many seeds have been used as beads in necklaces.
5. Seeds once used as weights for balances.
6. Seeds used as toys by children
7. Resin from *Clusia rosea* seeds used to caulk boats.

Review/Summary: Focus the review and summary of the lesson around the student learning objectives. Review the diagram of seed structure. Discuss and review the vocabulary of the seed and the function of each seed structure. There are some review questions on PowerPoint Slide # 18.

As an overall review of the plant anatomy unit you can choose to do the following activity. Instruct each student to bring a root, stem, leaf, flower, fruit, or seed that we eat to prepare a salad the following day. You may want to assign 1/4 of the class to each group to get a decent representation of each plant part. The final lesson will be initiated by a review of the plant parts by having the students present their contributions while the class identifies which plant part it represents. Then allow students to eat the plant parts they bring in.

Application: Application can involve the following student activity: Students may dissect pre-soaked seeds of corn and lima beans. A hand lens may be used to assist in locating the seed embryo and other seed structures.

Evaluation: Evaluation should be based on student comprehension of the learning objectives. This can be determined using the attached sample written test.

Answers to Sample Test:

Part One: Matching

1. a
2. e
3. b
4. c
5. d
6. f

Part Two: Completion

1. seed coat
2. embryo
3. cotyledon
4. endosperm

Part Three: Short Answer

1. Use your own knowledge of ways you use seeds in your area. Also look under Objective 4 for other reasons seeds are economically important.
2. Wind, water, animals

Sample Test

Name _____

Test

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Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | |
|--------------|------------|
| a. epicotyl | d. seed |
| b. hypocotyl | e. radicle |
| c. burs | f. embryo |

- _____ 1. The first leaves develop from this part of the embryo.
- _____ 2. The embryo root develops from this structure.
- _____ 3. The embryo plant part that develops into the true stem
- _____ 4. Seeds with barbs or hooks
- _____ 5. Contains the embryo plant and stored food.
- _____ 6. This holds the parts (root, stem, leaf) of a complete plant.

Part Two: Completion

Instructions. Provide the word to complete the following statements.

- 1 The _____ provides a protective shell surrounding the embryo and endosperm.
2. The little plant inside a seed that eventually grows and develops into a mature plant is the _____.
3. The _____ are the seed leaves of an embryo plant in which food is stored.
4. A seed stores food as a future source of energy in the _____.

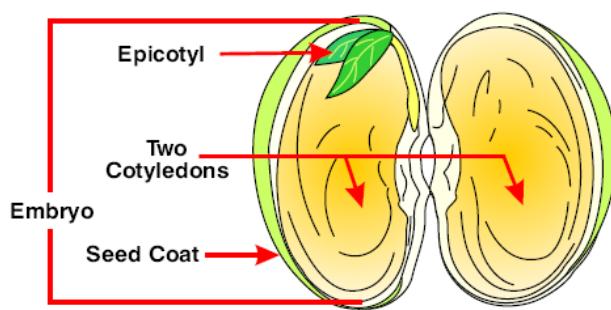
Part Three: Short Answer

Instructions. Provide information to answer the following question.

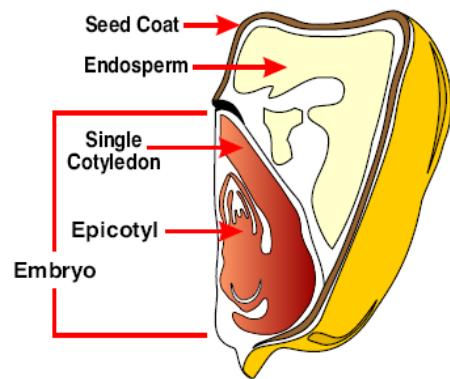
1. List three ways seeds are economical important in Afghanistan or around the world.

2. List three ways seeds are dispersed.

DICOT VS. MONOCOT SEEDS



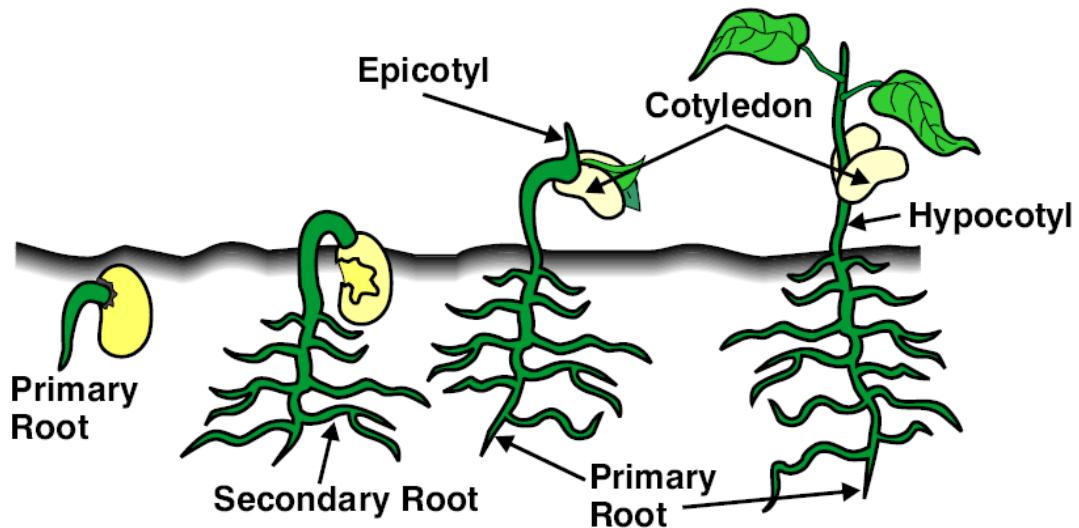
Bean Seed (dicot)



Corn Seed (monocot)

(Courtesy, Interstate Publishers, Inc.)

PARTS OF A DEVELOPING EMBRYO PLANT



Lab Sheet

Procedure:

Students will compare and contrast a dry bean versus a rehydrated bean, both lima and red kidney. (If these beans are not available, choose other types of beans. You can also use corn seeds to show the difference between monocots and dicots.) 24 hours is needed to soak the dried beans. Students can do this for themselves. CAUTION: DO NOT soak for more than 24 hours as the seed coats come off, and the likelihood of decomposition (rotting) is increased, with the growth of some molds.

Students are to examine both dried beans and wet beans, and locate the hypocotyl, epicotyl, cotyledons, and seed coat. Draw what you see. Below the drawing list the function of all of these parts. You may have to look back and forth at the dry bean and wet bean. Some parts show up better on the dry and vice versa.