

Chapter 38: Angiosperm Reproduction and Biotechnology

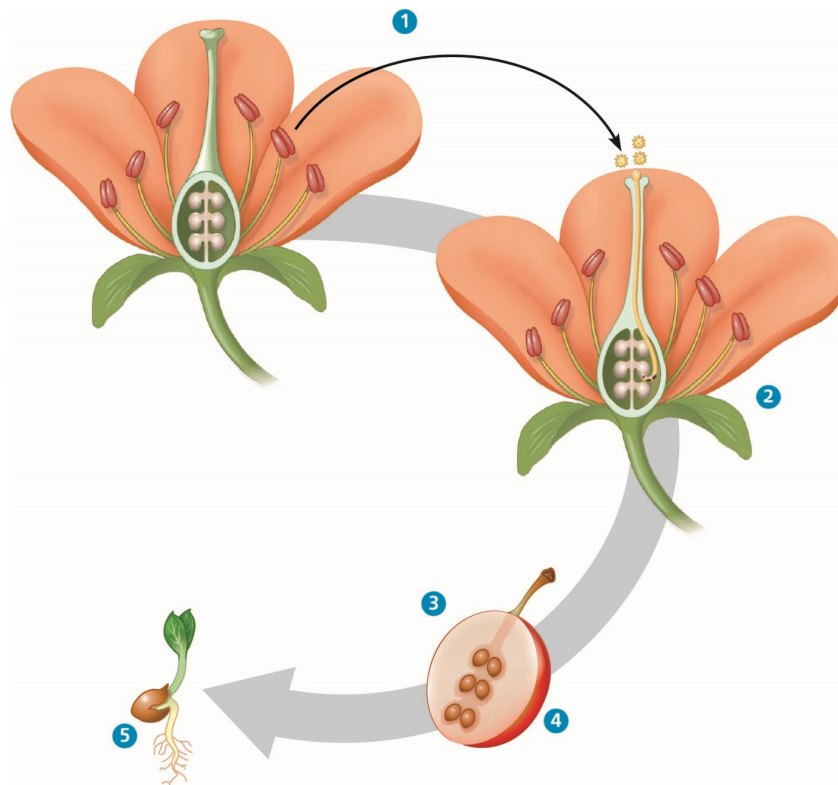
38.1 *Characterize features of the angiosperm life cycle.*

38.2 *Compare and contrast sexual and asexual reproductive processes in plants.*

38.3 *Explain how breeding and genetic engineering are used to modify plants.*

This chapter will look at specifics of angiosperm reproduction. Focus on evolutionary adaptations and how these increase fitness as you work through this material. The vast majority of the content in this chapter is in Concept 38.1. Once you have carefully worked through this part of the chapter the rest of the content will be easier to master.

Study Tip: Recall that angiosperms are plants that have flowers. Figure 38.1 in your text shows a simplified version of reproduction in flowering plants. This overview will prepare you for understanding the specifics of angiosperm reproduction. Label and explain the five stages as indicated in the figure below.

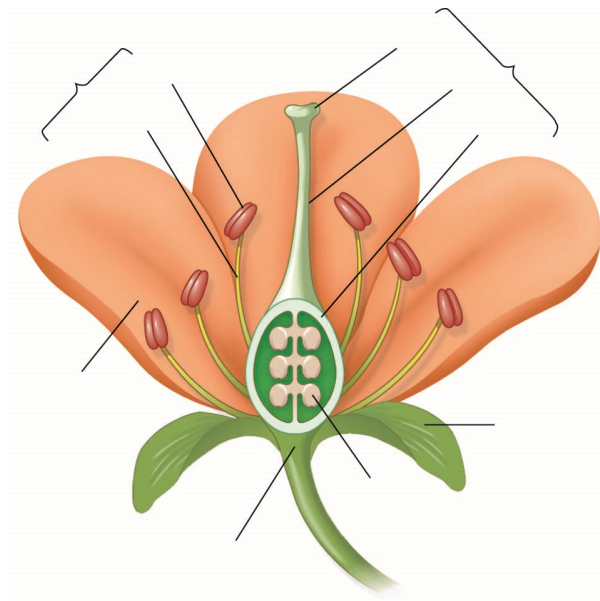


Concept 38.1 *Flowers, double fertilization, and fruits are key features of the angiosperm life cycle*

LO 38.1: *Characterize features of the angiosperm life cycle.*

This may be a good time for you to go back to Chapter 29 and review alternation of generations, a key feature of plant life cycles (Figure 29.5, p. 620, is a good starting point). The angiosperm life cycle has three unique features, all of which start with the letter *F*, which provides a good memory aid: *Flowers*, double *Fertilization*, and *Fruits*. You will want to remember these!

1. On this sketch of a flower, label all floral parts and give the function of each. Then, circle the flower parts that are essential for reproduction.



2. Reading Figure 38.4 in your text is pleasant and will give you an idea of the diversity of ways that pollen transfer can occur in flowering plants. List six ways pollination can occur.

- | | |
|----------|----------|
| 1. _____ | 4. _____ |
| 2. _____ | 5. _____ |
| 3. _____ | 6. _____ |

3. Explain and give an example of *coevolution*.

The Angiosperm Life Cycle: An Overview

4. The life cycle of an angiosperm in Figure 38.6 of your text is imposing, but you already have the core knowledge base to understand the main ideas.
 - a. As a carpel develops, an _____ forms deep within the ovary. Inside each ovule a female _____ forms. Inside the female gametophyte one cell will undergo meiosis to form four haploid _____. Usually only one of the megaspores survives and the other three degenerate.
 - b. By what process, inside the ovule of the carpel, will a haploid egg and two haploid polar bodies (among other cells and nuclei) form?
 - c. As the stamens develop, each anther develops four _____. Inside the microsporangia each microsporocyte undergoes _____ to form four haploid _____.
 - d. What structures are needed to form a pollen grain?
 - e. Explain how the pollen tube delivers two sperm nuclei to the female gametophyte.
 - f. What you have always heard about fertilization in humans is correct: it only takes one sperm for fertilization. In flowering plants, it takes two sperm in a process termed *double fertilization*. Using Figure 38.6 in your text, draw and label an ovule showing the pollen tube, one sperm nucleus about to fertilize the egg, and the other sperm about to combine with the two polar nuclei.
 - g. What is formed when a sperm nucleus combines with the egg nucleus?
 - h. What is the triploid ($3n$) tissue that is formed when the other sperm nucleus combines with both polar bodies? (Pause a moment to think about how bizarre a functioning $3n$ tissue is in biology!)

5. Explain why the process of double fertilization might have evolved.
6. After double fertilization, each ovule develops into a _____, while the ovary develops into the _____, which encloses the seeds and aids in their dispersal.
7. What is the difference between pollination and fertilization?

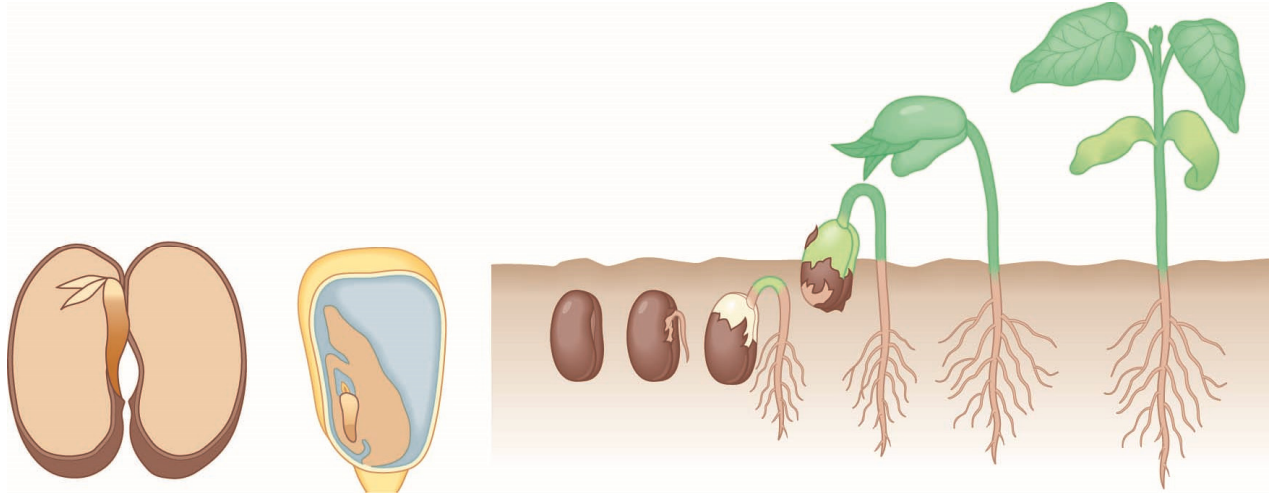
pollination

fertilization

Before leaving the topic of fertilization and seed development, take a few moments to read back through Figure 38.6. Fertilization is different in plants compared to animals, and it takes more than one look to understand the details.

8. A few review points on the transition from fertilization to seeds:
 - a. After double fertilization, what does each ovule become? _____
 - b. After double fertilization, what does each ovary become? _____
 - c. The chromosome number of the *endosperm* is (a) haploid, (b) diploid, or (c) triploid?
 - d. The chromosome number of the *zygote* is (a) haploid, (b) diploid, or (c) triploid?
 - e. What is the role of the *endosperm*?
9. What is the function of a *seed coat*?

10. On these figures of a corn seed and germinating bean, label the *seed coat*, *epicotyl*, *hypocotyl*, *cotyledons*, *radicle*, *seed coat*, *endosperm*, *embryonic leaves*, and *foliage leaves*. Also note the fate or function of each labeled structure.



11. Let's compare the seeds of *eudicots* and *monocots*. How many cotyledons does each type have?
12. Explain how *seed dormancy* is an evolutionary adaptation that increases fitness.
13. What are some mechanisms that maintain seed dormancy?
14. What is *imbibition*?
15. How do changes in the environment result in cues that cause molecular changes in the seed?

16. To a botanist, a *fruit* is a ripe _____. It does not have to be sweet! A pea pod is a fruit. A green pepper is a fruit. Figure 38.11 in your text shows different classes of fruits you have probably enjoyed.
17. An important function of the fruit is to aid in *dispersal*. Study Figure 38.12 in your text. What are three primary methods of dispersal and an example of each?

Method of Dispersal	Example

Concept 38.2 *Flowering plants reproduce sexually, asexually, or both*

LO 38.2: *Compare and contrast sexual and asexual reproductive processes in plants.*

18. *Asexual reproduction* in plants is also known as *vegetative reproduction*. Describe two different types of asexual reproduction in plants.
19. From an evolutionary perspective, what are the advantages and disadvantages of asexual and sexual reproduction in plants?

Type of Reproduction	Advantages	Disadvantages
Asexual Reproduction		
Sexual Reproduction		

20. Why is it important for plants to have mechanisms to prevent self-fertilization?
21. What are two mechanisms to prevent self-fertilization?

22. What is the relationship between plants having readily available totipotent cells and test-tube cloning?

Concept 38.3 *People modify crops by breeding and genetic engineering*

LO 38.3: *Explain how breeding and genetic engineering are used to modify plants.*

23. What is a transgenic organism?
- a. How does horizontal gene transfer play a role in forming a transgenic plant?
 - b. How does the *Bt* toxin affect plant yields and therefore world hunger?
24. *Genetically modified organisms (GMOs)* offer great promise but are also controversial. Discuss three of the possible risks of having GMOs in the environment.
- a.
 - b.
 - c.

Test Your Understanding, p. 841

1. _____ 2. _____ 3. _____ 4. _____ 5. _____
6. _____ 7. _____