

## Chapter 38: Angiosperm Reproduction and Biotechnology

### 1. Label all the floral parts and give the function of each.

Floral organs – sepals, petals, stamens, and carpels – are attached to a part of the stem called the receptacle. Stamens and carpels are reproductive organs, whereas sepals and petals are sterile. Sepals, which enclose and protect unopened floral buds, are usually more leafy in appearance than the other floral organs. Petals are typically more brightly colored than sepals and advertise the flower to insects and other pollinators. A stamen consists of a stalk called the filament and a terminal structure called the anther; within the anther are chambers called microsporangia that produce pollen. A carpel has an ovary at its base and a long, slender neck called the style. At the top of the style is a generally sticky structure called the stigma that captures pollen. Within the ovary are one or more ovules; the number of ovules depends on the species. The term pistil is sometimes used to refer to a single carpel or two or more fused carpels.

### 2. What is another name for the microsporangia?

The microsporangia are also known as swollen sacs.

### 3. Each microspore mother cell undergoes meiosis to form...

...four haploid microspores, each of which develops into a pollen grain.

### 4. Each microspore undergoes mitosis to produce...

...the male gametophyte in the pollen grain.

### 5. The male gametophyte is composed of only two cells.

Cell	Function
generative cell	produces two sperm
tube cell	produces the pollen tube

### 6. What makes up a pollen grain?

The generative cell, the tube cell, and the spore wall constitute a pollen grain.

### 8. Meiosis in the female part of the plant produces four megaspores. How many survive?

The megasporocyte divides by meiosis and gives rise to four haploid cells. In most species, only one survives as the megaspore.

### 9. What occurs in pollination?

In angiosperms, pollination is the transfer of pollen from an anther to a stigma. It is accomplished by wind, water, or animals. If pollination is successful, a pollen grain produces a pollen tube, which then grows down into the ovary via the style. The pollen tube discharges two sperm into the female gametophyte (embryo sac) within an ovule. One sperm fertilizes the egg, forming the zygote. The other sperm combines with the two polar nuclei of the embryo sac's large central cell, forming a triploid cell that develops into the nutritive tissue called the endosperm.

### 10. List six modes of pollination and describe a feature of the flower that aids each mode of pollination.

Mode	Typical Features
abiotic pollination by wind	small, green, inconspicuous; produce neither nectar nor scent; most flowers appear in early spring, when leaves not present to interfere with pollen movement; copious production of pollen grains; floral structures can create eddy currents that aid in pollen capture
pollination by bees	delicate, sweet fragrance; bright colors, primarily yellow, blue; ultraviolet markings called "nectar guides"

pollination by moths and butterflies	sweetly fragrant; bright colors for butterflies, white or yellow for nocturnal moths; self-abortion if too many eggs laid
pollination by flies	reddish, fleshy, odor like rotten meat; larvae die
pollination by bats	light-colored, aromatic
pollination by birds	usually large, bright red or yellow, little odor; sugary nectar; fused petals to form bent floral tube that fits curved beak of bird

*11. Describe double fertilization. ✎*

The union of two sperm cells with different nuclei of the female gametophyte is called double fertilization. This ensures that endosperm develops only in ovules where the egg has been fertilized, thereby preventing angiosperms from squandering nutrients on infertile ovules.

*12. Which cells and nuclei in #11a are fertilized in double fertilization?*

One sperm fertilizes the egg, forming the zygote. The other sperm combines with the two polar nuclei of the embryo sac's large central cell, forming a triploid cell that develops into the nutritive tissue called endosperm.

*13. When the polar nuclei are fertilized, what is formed?*

A sperm cell combines with the two polar nuclei of the embryo sac's large central cell, forming a triploid cell that develops into the nutritive tissue called endosperm.

*14. The chromosome number of endosperm is...*

...triploid.

*15. The chromosome number of the zygote is...*

...diploid.

*16. What is the role of the endosperm?*

The endosperm is the food-storing tissue of the seed. In most species of monocots, as well as many eudicots, the endosperm stores nutrients that can be used by the seedling after germination. In other eudicot seeds, the food reserves for the endosperm are completely exported to the cotyledons before the seed completes its development; consequently, the mature seed lacks endosperm.

*17. After double fertilization, what does each ovule become?*

Each ovule becomes a seed.

*18. After double fertilization, what does each ovary become?*

Each ovary becomes a fruit enclosing the seeds.

*19. Compare the seeds of eudicots and monocots. How many cotyledons does each type have?*

The embryos of monocots possess only a single cotyledon, while eudicot embryos have two.

*20. What is the function of a seed coat?*

The embryo and its food supply are enclosed by a hard, protective seed coat formed from the integuments of the ovule. In some species, dormancy is imposed by the presence of an intact seed coat rather than by the embryo itself.

*21. What part of the embryo plant emerges first?*

The first organ to emerge from the germinating seed is the radicle, the embryonic root.

22. *What are some mechanisms that maintain seed dormancy?*

Environmental conditions required to break seed dormancy vary among species. Seeds of some species germinate as soon as they are in a suitable environment. Others remain dormant, even if sown in a favorable place, until a specific environmental cue causes them to break dormancy. Seeds of many desert plants, for instance, germinate only after a substantial rainfall. Where natural fires are common, many seeds require intense heat or smoke to break dormancy; seedlings are therefore most abundant after fire has cleared away competing vegetation. Where winters are harsh, seeds may require extended exposure to cold.

24. *What is imbibition?*

Germination depends on imbibition, the uptake of water due to the low water potential of the dry seed. Imbibing water causes the seed to expand and rupture its coat and also triggers metabolic changes in the embryo that enable it to resume growth. Following hydration, enzymes begin digesting the storage materials of the endosperm or cotyledons, and the nutrients are transferred to the growing regions of the embryo.

25. *Fruit does not have to be sweet! A pea pod is a fruit. A green pepper is a fruit.*

To a botanist, a fruit is a ripe ovary.

26. *What are the three primary methods of dispersal?*

Plants use biotic dispersal agents, such as animals, as well as abiotic agents, such as water and wind.