



Figure 9.21 An animal-pollinated dicotyledonous flower typically shows these structures.

Flowers occur in a myriad of colours, shapes, and types. Some different types are:

- complete flowers, which contain all four basic flower parts, the sepals, petals, stamens, and carpels
- incomplete flowers, which lack at least one of the four basic parts
- staminate flowers, which only have stamens, and no carpels
- carpellate flowers, which only have carpels, and no stamens.

Meiosis occurs in the stamen and carpel to produce the sex cells.

## Pollination and fertilization

All plants show two different generations in their life cycle. The generations are:

- the gametophyte generation, which is haploid
- the sporophyte generation, which is diploid.

In plants, these two generations alternate with one another. Not surprisingly, this is called alternation of generations. The generations are named according to the reproductive cells they produce. The gametophyte generation produces the plant gametes by mitosis, whereas the sporophyte generation produces spores by meiosis. When we look at a flowering plant such as a cherry tree, we are looking at the sporophyte generation. It grew from a zygote and produces new cells by mitosis. When the cherry tree produces flowers, haploid spores are formed and develop into the haploid bodies referred to as gametophytes. Sperm form within the male gametophytes, and eggs form within the female gametophytes.

Pollination and fertilization are two very different processes in plants. Let's consider

## Pollination

Pollination is the process by which pollen (containing male sex cells) is placed on the female stigma. It is the first step in the progression towards fertilization and the production of seeds. Pollen can be carried from anther to stigma by a variety of means. The earliest seed plants relied upon wind as their pollen vector. Later, insects became a major factor in the process. It appears that the first angiosperms were pollinated by insects. There is very convincing fossil evidence showing that the angiosperms and insects coevolved; they appear to be instrumental in each other's development.

There are many vectors of pollination besides insects and wind. These include birds, water, and animals other than insects. Most flowering plants use mutualistic relationships with pollinators in sexual reproduction. Flowers of plants that involve insect or other animal pollinators employ various means to attract their vector. For example:

- red flowers are conspicuous to birds
- yellow and orange flowers are noticed by bees
- heavily scented flowers can be located at night.

Plants that rely on wind as their pollen vector have inconspicuous, odourless flower parts.

There are two general types of pollination:

- self-pollination
- cross-pollination.

In self-pollination, pollen from the anther of the same plant falls upon its own stigma. Self-pollination is a form of inbreeding and results in less genetic variation within a species.

When cross-fertilization occurs, pollen is carried from the anther of one plant to the stigma of a different plant of the same species. Cross-pollination increases variation and may result in offspring with better fitness. The problem with cross-pollination is that the female stigma may not receive the male pollen because of the longer distance to travel.

Botanists can select plant genetic characteristics by controlling the process of pollination. Gregor Mendel controlled the process of pollination in garden pea plants in the development of his genetic principles.

Once pollination occurs, the next step is fertilization.

## Fertilization

Fertilization happens when the male and female sex cells unite to form a diploid zygote. The female sex cells that are fertilized by the pollen are present within the ovules of the flower. The ovules are present within the ovary of the carpel. When the pollen grain adheres to the stigma, which is covered by a sticky, sugary substance, pollen tube growth and fertilization occur in the

Grasses, a type of monocotyledonous plant, have tiny, almost inconspicuous flowers. As these common plants do not have showy petals to attract insects, they rely on the wind for pollination. A fruit is a structure that originates from the ovary of a flower. Grass fruits, differing from most fruits by not containing seeds, are specifically called grain and they supply food for almost every human in the world. Specific examples of important grain crops include wheat, rice, and maize.

## NATURE OF SCIENCE

A paradigm shift has occurred in our approach to saving the world's pollinators. Recognizing that human activity has placed a large pressure on pollinators by removing their natural habitats, and that pollinators prefer a diverse population of plants, scientists are now working to bring about the preservation of pristine natural vegetation and whole ecosystems. Prior to this, scientists had worked to protect individual plant species to save specific pollinators.

**Fertilization in flowering plants is actually a double fertilization. After pollination, one of the two sperms produced by the pollen grain combines with the egg. The other combines with two**