

## 1.3 Meiosis is the basis for sexual reproduction.

### 1.3.1 Meiosis

You know that mitosis is the process that produces two identical daughter cells from one parent cell. You have also seen that mitosis is the basis for asexual reproduction. Cells that reproduce through mitosis—and organisms that reproduce asexually—have exactly the same genetic information as their parents. The process of **meiosis** is another form of cell division and is the basis for **sexual reproduction**. Sexual reproduction requires two parents. Unlike mitosis, meiosis ensures variation within a species.

Meiosis refers to the production of **gametes**, or sex cells, which contain half the number of chromosomes found in a body cell such as a skin cell. Gametes or sex cells are responsible for carrying genetic information from one generation to another.

In humans, a body cell contains 46 chromosomes. Half of these chromosomes come from the mother and half from the father. These cells are said to be **diploid** ( $2n$ ), which means there are two sets of 23 chromosomes. The diploid number in a body cell can be expressed as  $2n = 46$ .

#### Homologous Chromosomes

Of the 23 chromosomes from each set of human chromosomes, 22 have a matching chromosome from the other set. A pair of matching chromosomes (one from each set) is called a pair of **homologous chromosomes** (Figure 1.20).

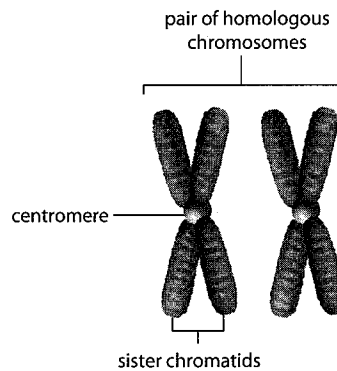


FIGURE 1.20 This pair of replicated homologous chromosomes each has a pair of sister chromatids connected by a centromere.

The 23rd pair of chromosomes are called the sex chromosomes. For the female, the sex chromosomes appear to be identical and have an X shape. This pair is referred to as XX. For the male, the chromosomes do not appear identical. One chromosome has an X shape, and the other smaller chromosome is referred to as Y. Male sex chromosomes are called XY.

#### Quick Check

Circle true or false for each of the following statements.

- |   |      |       |
|---|------|-------|
| 1. There are two sets of chromosomes in humans.               | True | False |
| 2. One set of human chromosomes has 46 chromosomes.           | True | False |
| 3. Two sets of human chromosomes have 46 chromosomes.         | True | False |
| 4. Humans have 46 pairs of homologous chromosomes.            | True | False |
| 5. For females, the homologous pair of sex chromosomes is XY. | True | False |

## The Process of Meiosis

Male and female gametes or sex cells contain half the number of chromosomes that other body cells have. As a result, these cells are said to be **haploid** ( $n$ ). The haploid number in a sex cell is  $n = 23$ . In males, the sex cell is the sperm cell; in females, the sex cell is the egg cell. These two specialized cells are produced through the process of meiosis. Figure 1.21 shows an overview of this process.

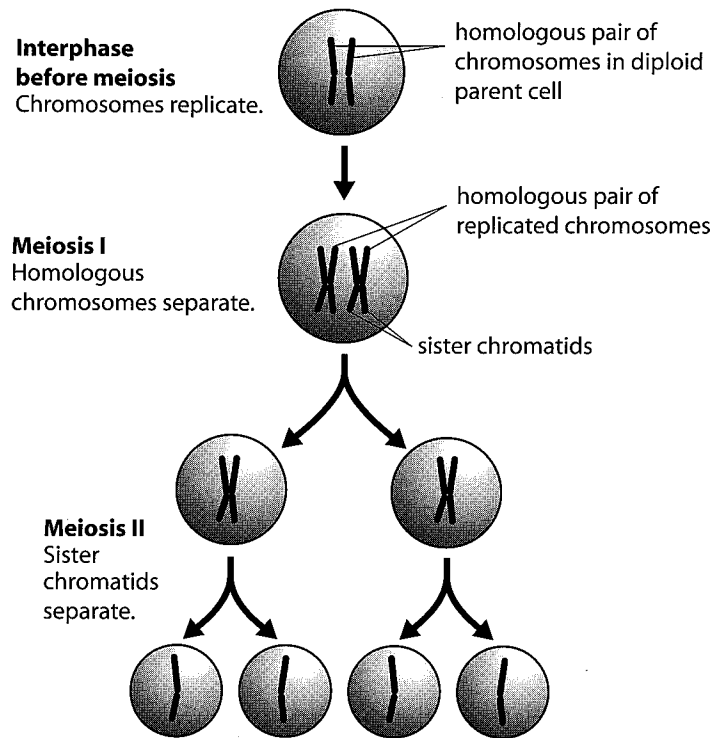


FIGURE 1.21 The process of meiosis. After the homologous chromosomes replicate in interphase, they separate in meiosis I. Then the sister chromatids separate to form the sex cells in meiosis II.

Meiosis has three main phases: interphase, meiosis I, and meiosis II. During interphase, each homologous pair of chromosomes is replicated. During meiosis I, the homologous chromosomes separate into two cells. Unlike mitosis, where the process ends after one division, meiosis continues with a second division. This second division happens without the chromosomes replicating. This results in the sister chromatids separating during meiosis II. The outcome of meiosis is four cells with one haploid set of chromosomes in each cell.

In males, all four sex cells become sperm. In females, one sex cell becomes an egg. The other three cells receive minimal cytoplasm and do not form into gametes. They are sometimes referred to as polar bodies.