

# CLASS SET

## Chromosomes and Meiosis

**KEY CONCEPT** Gametes have half the number of chromosomes that body cells have.

### You have body cells and gametes.

All of the different cells in your body can be divided into two groups: somatic cells and germ cells.

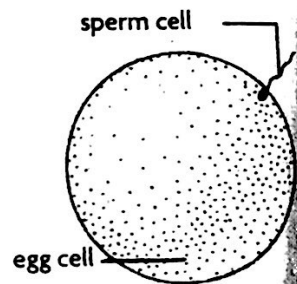
- **Germ cells** are the cells in your reproductive organs—the ovaries or testes—that develop into eggs or sperm.
- **Somatic cells** (soh-MAT-ihk), or body cells, are all the other cells in your body.

Somatic cells make up most of your tissues and organs. The DNA in your somatic cells will not be passed on to your children. Only the DNA in the egg or sperm cells gets passed on to offspring. Egg cells and sperm cells are called **gametes**.

Each species has a characteristic number of chromosomes per cell. For example:

- **Humans** have 23 pairs of chromosomes. In other words, there are  $23 \times 2 = 46$  chromosomes in all body cells.
- **Fruit flies** have 4 pairs of chromosomes, or 8 chromosomes per cell.
- **Yeast** have 16 pairs of chromosomes, or 32 chromosomes per cell.

The organism currently known to have the most chromosomes is a fern. It has more than 1200 chromosomes. Chromosome number is not related to the size or complexity of an organism.



Egg cells and sperm cells are called gametes.



Do gametes come from germ cells or somatic cells?

### Your cells have autosomes and sex chromosomes.

Suppose you had 23 pairs of gloves. You would have a total of  $23 \times 2 = 46$  gloves. You could divide them into two sets: 23 right-hand and 23 left-hand gloves. Similarly, your body cells have 23 pairs of chromosomes, for a total of 46. These can be divided into two sets: 23 from your mother and 23 from your father. Just as you use both gloves if it is cold outside, your cells use both sets of chromosomes to function properly.

Each pair of chromosomes is called a homologous pair. Here, *homologous* means “having the same structure.” **Homologous chromosomes** are two chromosomes—one from the mother and one from the father—that are the same size and have copies of the same genes.

Although each chromosome in a homologous pair has copies of the same genes, the two copies may differ. For example, each chromosome in a pair might have a gene that influences eye color. But the gene on one chromosome of the pair may lead to brown eyes and the gene on the other chromosome may lead to green eyes.

One of your 23 pairs of chromosomes is your pair of sex chromosomes. These chromosomes control the sex of an organism. Humans, and all mammals, have two different sex chromosomes called X and Y.

- Females have two X chromosomes.
- Males have one X chromosome and one Y chromosome.

The rest of your chromosomes—the other 22 pairs—are called autosomes. These chromosomes contain genes for all of the rest of an organism's life functions.



If a person's pair of sex chromosomes is XY, is the person male or female? \_\_\_\_\_

## Body cells are diploid; gametes are haploid.

Sexual reproduction involves two gametes—an egg and a sperm—joining together. Fertilization happens when the egg and sperm actually combine. The nucleus of the egg combines with the nucleus of the sperm to form one nucleus. This new nucleus must have the correct number of chromosomes—46 for humans. Therefore, the egg and sperm each must have half that number of chromosomes—23 for humans.

### Diploid and Haploid Cells

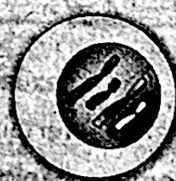
Gametes—eggs and sperm—are haploid (HAP-LOYD) cells. Haploid cells have one copy of each chromosome—again, 23 for humans. A sperm and egg join together to form a diploid (DIHP-LOYD) cell—for a total of 46 chromosomes for humans. Body cells are all diploid. Only gametes are haploid.

### Meiosis


The germ cells in your reproductive organs form gametes through a process called meiosis. Meiosis (my-OH-sihs) is a process that divides a diploid cell into a haploid cell. In Chapter 5 you learned about mitosis, another process that divides a cell. The figure on the next page shows some of the differences between mitosis and meiosis.

**VISUAL VOCAB**

Diploid cells have two copies of each chromosome: one copy from the mother and one from the father.



Body cells are diploid (2n).

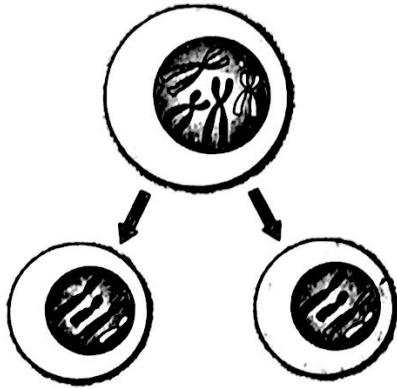


Gametes (sex cells) are haploid (n).

Haploid cells have only one copy of each chromosome.

## COMPARING MITOSIS AND MEIOSIS

### MITOSIS



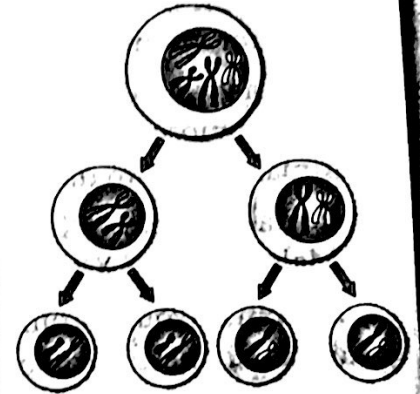
Produces genetically identical cells

Results in diploid cells

Takes place throughout an organism's lifetime

Involved in asexual reproduction

### MEIOSIS



Produces genetically unique cells

Results in haploid cells

Takes place only at certain times in an organism's life cycle

Involved in sexual reproduction

Remember that mitosis results in two identical diploid cells. Mitosis is used for development, growth, and repair. In contrast, meiosis results in four haploid cells that are unique. Meiosis happens only in germ cells to make gametes. Meiosis will be presented in detail in the next section.



What is the difference between the cells that result from mitosis and the cells that result from meiosis?

\_\_\_\_\_

## 6.1 Vocabulary Check

somatic cell

gamete

homologous chromosome

sex chromosome

autosome

sexual reproduction

fertilization

haploid

diploid

meiosis

## Mark It Up

Go back and highlight each sentence that has a vocabulary word in bold.



1. when the nucleus of an egg joins the nucleus of a sperm \_\_\_\_\_
2. a body cell \_\_\_\_\_
3. an egg or sperm cell \_\_\_\_\_
4. any chromosome except a sex chromosome \_\_\_\_\_

## 6.1 The Big Picture

5. If a diploid cell with 8 chromosomes goes through meiosis, how many chromosomes will the resulting haploid cells have? \_\_\_\_\_
6. Circle the sex of a person with the sex chromosomes XX: male / female