





## 11.4 Meiosis

### Lesson Objectives

-  Contrast the number of chromosomes in body cells and in gametes.
-  Summarize the events of meiosis.
-  Contrast meiosis and mitosis.
-  Describe how alleles from different genes can be inherited together.

### BUILD Vocabulary

- A.** The chart below shows key terms from the lesson with their definitions. Complete the chart by writing a strategy to help you remember the meaning of each term. One has been done for you.

Term	Definition	How I'm Going to Remember the Meaning
Crossing-over	Exchange of DNA by the chromatids in a tetrad	<i><b>In crossing-over, tetrads cross their arms to swap DNA.</b></i>
Diploid	Two sets of chromosomes, one from each parent	
Haploid	One set of chromosomes	
Homologous	Chromosomes in which one set comes from the female parent and one from the male parent	
Meiosis	Cell division in which gametes are produced	
Tetrad	A set of four chromatids formed by two pairs of replicated chromosomes	
Zygote	Cell produced by the union of egg and sperm	

- B.** As you work through this lesson, you may find these terms in the activities. When you need to write a key term or a definition, **highlight** the term or the definition.

## BUILD Understanding

**Compare/Contrast Table** Use a compare/contrast table when you want to see the similarities and differences between two or more objects or processes. As you read Lesson 1, make a compare/contrast table to show the differences between mitosis and meiosis.

*Use the terms or phrases to complete the compare/contrast chart. Write the terms or phrases in the correct column.*

**Produces body cells**  
**Produces gametes**  
**Tetrads are formed.**  
**Yields four haploid cells**

**Crossing-over occurs.**  
**Yields two diploid cells**  
**Involves two cell divisions**

Mitosis	Meiosis

## Phases of Meiosis

During meiosis, haploid gametes are produced from diploid cells. At the end of meiosis, the number of chromosomes in gametes is half the number of chromosomes in body cells.

*Look at the diagrams below. Then use the words in the box to label the phases shown in the diagrams.*

**Metaphase I**

**Anaphase II**

**Prophase I**







*Answer the question.*

- Suppose an organism's heart cells have 10 chromosomes. How many chromosomes will its egg cells have? \_\_\_\_\_ How many chromosomes does its sperm cells have? \_\_\_\_\_

## 11.4 Meiosis

### Lesson Objectives

-  Contrast the number of chromosomes in body cells and in gametes.
-  Summarize the events of meiosis.
-  Contrast meiosis and mitosis.
-  Describe how alleles from different genes can be inherited together.

### Lesson Summary

**Chromosome Number** **Homologous** chromosomes are pairs of chromosomes that correspond in body cells. One chromosome from each pair comes from each parent.

- ▶ A cell that contains both sets of homologous chromosomes has a **diploid** number of chromosomes (meaning “two sets”).
- ▶ **Haploid** cells contain only one set of chromosomes. Gametes are haploid.

**Phases of Meiosis** **Meiosis** is the process that separates homologous pairs of chromosomes in a diploid cell, forming a haploid gamete. The phases are as follows:

- ▶ Meiosis I, which is preceded by a replication of chromosomes. Its stages are
  - Prophase I: Each replicated chromosome pairs with its corresponding homologous chromosome forming a **tetrad**. During tetrad formation, alleles can be exchanged between chromatids, a process called **crossing-over**.
  - Metaphase I: Paired homologous chromosomes line up across the center of the cell.
  - Anaphase I: Spindle fibers pull each homologous pair toward opposite ends of the cell.
  - Telophase I: A nuclear membrane forms around each cluster of chromosomes. Cytokinesis then occurs, resulting in two new cells. The resulting daughter cells contain chromosome sets that are different from each other and the parent cell.
- ▶ Meiosis II: Chromosomes do not replicate.
  - Prophase II: Chromosomes, each consisting of two chromatids, become visible.
  - Metaphase II, Anaphase II, Telophase II, and Cytokinesis: These phases are similar to meiosis I. Four haploid cells form. They are the gametes. During fertilization, two gametes unite forming a **zygote**.

### Comparing Meiosis and Mitosis

- ▶ Mitosis is one cell division that results in two genetically identical diploid cells.
- ▶ Meiosis is two cell divisions that result in four genetically different haploid cells.

### Gene Linkage and Gene Maps

- ▶ Alleles tend to be inherited together if they are located on the same chromosome.
- ▶ Chromosomes, not genes, segregate independently.
- ▶ The farther apart genes are on a chromosome, the more likely is cross over.
- ▶ Information on linkage and the frequency of crossing-over lets geneticists construct maps of the locations of genes on chromosomes.

## Chromosome Number

*For Questions 1–8, write True if the statement is true. If the statement is false, change the underlined word to make the statement true.*

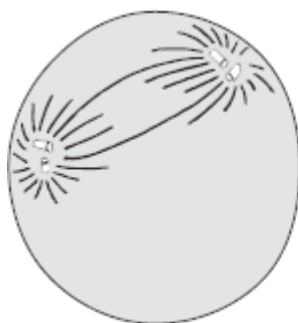
- \_\_\_\_\_ 1. The offspring of two parents obtains a single copy of every gene from each parent.
- \_\_\_\_\_ 2. A gamete must contain one complete set of genes.
- \_\_\_\_\_ 3. Genes are located at specific positions on spindles.
- \_\_\_\_\_ 4. A pair of corresponding chromosomes is homozygous.
- \_\_\_\_\_ 5. One member of each homologous chromosome pair comes from each gene.
- \_\_\_\_\_ 6. A cell that contains both sets of homologous chromosomes is haploid.
- \_\_\_\_\_ 7. The gametes of sexually reproducing organisms are haploid.
- \_\_\_\_\_ 8. If an organism's haploid number is 6, its diploid number is 3.

## Phases of Meiosis

*On the lines provided, identify the stage of meiosis I or meiosis II in which the event described occurs.*

- \_\_\_\_\_ 9. Each replicated chromosome pairs with its corresponding homologous chromosome.
- \_\_\_\_\_ 10. Crossing-over occurs between tetrads.
- \_\_\_\_\_ 11. Paired homologous chromosomes line up across the center of the cell.
- \_\_\_\_\_ 12. Spindle fibers pull each homologous chromosome pair toward an opposite end of the cell.
- \_\_\_\_\_ 13. A nuclear membrane forms around each cluster of chromosomes and cytokinesis follows, forming two new cells.
- \_\_\_\_\_ 14. Chromosomes consist of two chromatids, but they do not pair to form tetrads.
- \_\_\_\_\_ 15. A nuclear membrane forms around each cluster of chromosomes and cytokinesis follows, forming four new cells.

16. **THINK** Draw two homologous pairs of chromosomes (in different colors if you have them) in these diagrams to illustrate what happens during these three phases of meiosis.



Prophase I

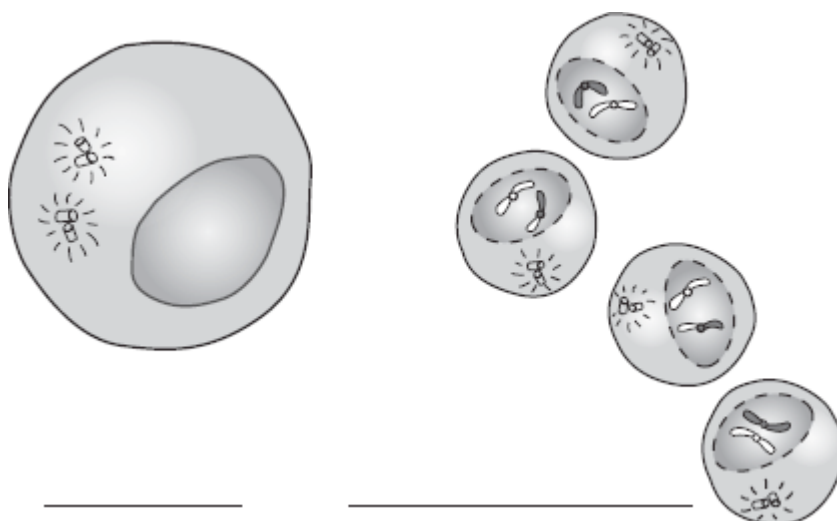


Metaphase I



Anaphase II

17. Identify which phase of meiosis is shown in the diagrams below.



Use this diagram to answer Questions 18–20.

18. What does the diagram show?

---



---

19. During what phase of meiosis does this process occur?

---



---

20. What is the result of this process?

---



---

