

10.2 The Process of Cell Division

Lesson Summary

Chromosomes Packages of DNA called **chromosomes** hold a cell's genetic information.

- ▶ Prokaryotic chromosomes consist of a single, circular strand of DNA.
- ▶ Eukaryotic chromosomes are highly organized structures.
 - The DNA winds around histone proteins, forming **chromatin**.
 - Chromosomes make the precise separation of DNA possible during cell division.

The Cell Cycle The **cell cycle** is the series of events in the growth and division of a cell.

- ▶ In the prokaryotic cell cycle, the cell grows, duplicates its DNA, and divides by pinching in the cell membrane.
- ▶ The eukaryotic cell cycle has four stages (the first three of which are referred to as **interphase**):
 - In the G₁ phase, the cell grows.
 - In the S phase, the cell replicates its DNA.
 - In the G₂ phase, the cell produces organelles and materials for division.
 - In the M phase, the cell divides in two stages—**mitosis**, the division of the nucleus, and **cytokinesis**, the division of the cytoplasm.

Mitosis The division of the nucleus, mitosis, occurs in four stages:

- ▶ **Prophase** : a cell's genetic material condenses, a spindle starts to form, and the nuclear envelope breaks down.
- ▶ **Metaphase** : the duplicated chromosomes line up and spindle fibers connect to the **centromeres**.
- ▶ **Anaphase** : sister **chromatids** separate and move toward the **centrioles**.
- ▶ **Telophase** : the chromosomes begin to unwind and a nuclear envelope reforms.

Cytokinesis Division of the cytoplasm differs in plant cells and animal cells.

- ▶ In animal cells, the cell membrane draws in and pinches off.
- ▶ In plant cells, a cell plate forms, followed by a new cell membrane, and finally a new cell wall forms.

Chromosomes

For Questions 1–5, complete each statement by writing the correct word or words.

1. Cells carry genetic information in packages of DNA called _____.
2. Most _____ have only one circular strand of DNA.
3. In eukaryotic cells, the genetic structure consists of DNA and a tightly wound protein, which together form a substance called _____.
4. The beadlike structures formed by DNA wrapped around _____ molecules are called nucleosomes.
5. _____ make possible the precise separation of DNA during cell division.

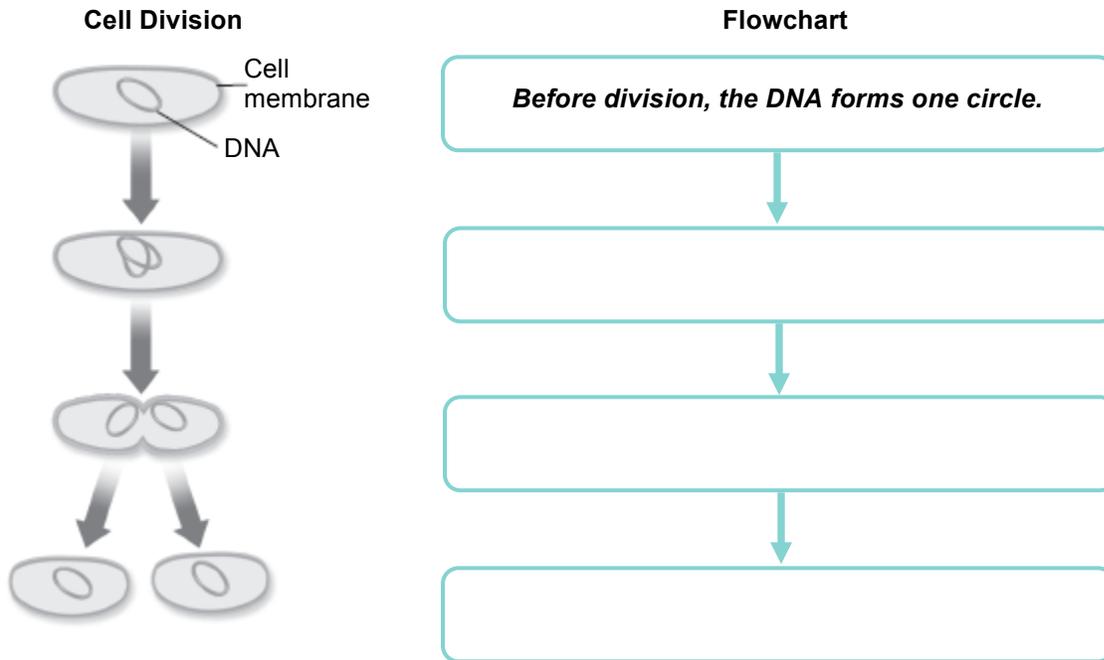
The Cell Cycle

The Prokaryotic Cell Cycle The diagram on the left shows how a prokaryotic cell divides. The stages of cell division are shown in order they happen.

Use the flowchart on the right to describe the steps in prokaryotic cell division. In a flowchart, arrows connect one step to the next.

Follow the directions.

6. Write the stages in prokaryotic cell division in order in the flowchart.



Answer the questions.

7. The process of cell division in prokaryotic cells is called _____.
8. Will the new cells have the same genetic material as the parent cell, or will each cell have different genetic material? _____
9. Is this asexual or sexual reproduction? _____
10. An example of an organism that reproduces with this kind of reproduction is a
 - A. salamander.
 - B. histone.
 - C. red blood cell.
 - D. bacterium.
11. What is the name of the type of cell division that occurs in the prokaryotic cell cycle?

12. What happens during interphase?

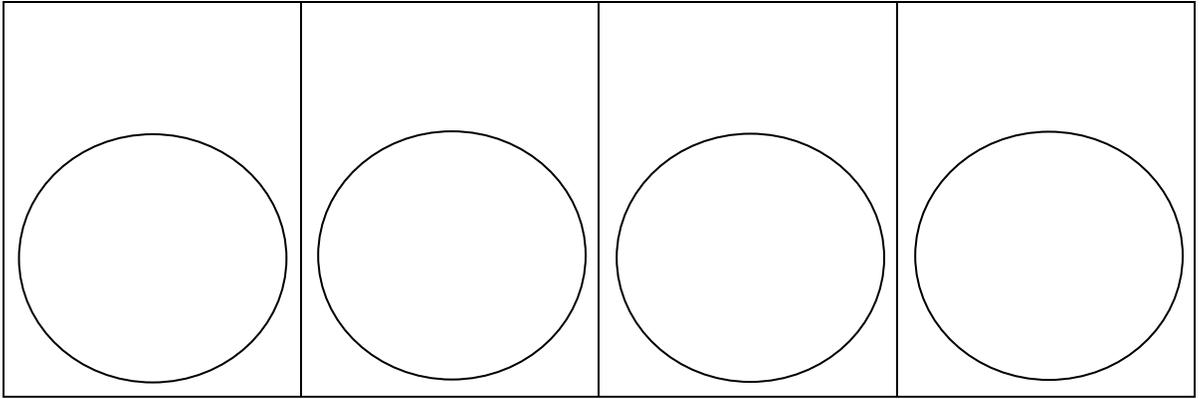
13. Complete the cell cycle diagram by writing the correct name of a phase on each line.

Mitosis

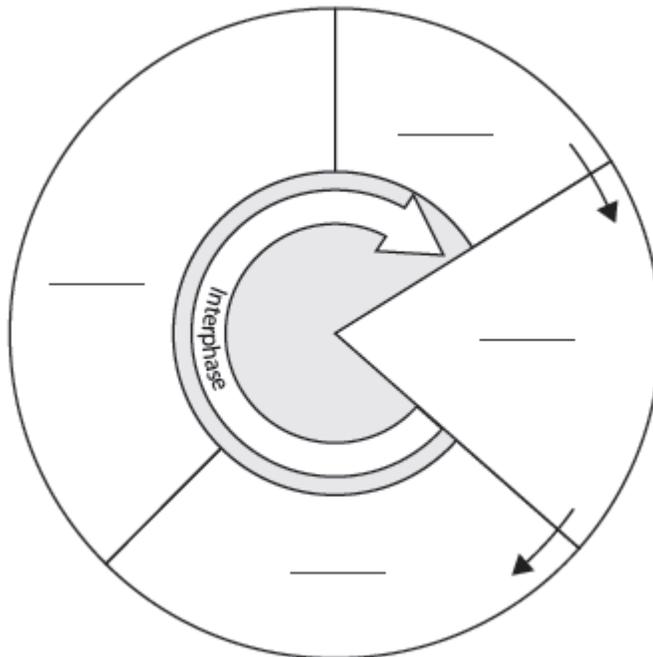
16. During prophase, when cell chromosomes become visible, what are the duplicated strands of DNA called? What is the name for the area in which these duplicated strands are joined?

17. What structures are spindle fibers attached to that help pull the paired chromosomes apart?

18. The four circles below represent the nucleus of a cell going through mitosis. Draw four chromosomes as they go through each phase. Label each phase and describe what is happening to the DNA.



14. In eukaryotic cells, what happens in the G₁ phase that differs from the G₂ phase?



For Questions 19–22, match the description of the event with the phase of mitosis in which it occurs. Each phase may be used more than once.

Event	Phase of Mitosis
_____ 19. The chromosomes separate and begin to move to opposite sides of the cell.	A. Telophase
_____ 20. The chromosomes become visible. The centrioles take up positions on opposite sides of the nucleus.	B. Prophase
_____ 21. A nuclear envelope re-forms around each cluster of chromosomes. The nucleolus becomes visible in each daughter nucleus.	C. Metaphase
_____ 22. The chromosomes line up across the center of the cell.	D. Anaphase

Cytokinesis

23. What is cytokinesis?

24. Compare and contrast cytokinesis in animal cells with cytokinesis in plant cells.

25. Find and define 6 new words related with the topic

1

2

3

4

5

6
