

SECTION 3 The Cell Cycle

BEFORE YOU READ

After you read this section, you should be able to answer these questions:

- How are new cells made?
- What is mitosis?
- How is cell division different in animals and plants?

National Science Education Standards
LS 1c, 2d

How Are New Cells Made?

As you grow, you pass through different stages in your life. Cells also pass through different stages in their life cycles. These stages are called the **cell cycle**. The cell cycle starts when a cell is made, and ends when the cell divides to make new cells.

Before a cell divides, it makes a copy of its DNA (deoxyribonucleic acid). *DNA* is a molecule that contains all the instructions for making new cells. The DNA is stored in structures called **chromosomes**. Cells make copies of their chromosomes so that new cells have the same chromosomes as the parent cells. Although all cells pass through a cell cycle, the process differs in prokaryotic and eukaryotic cells. ✓

STUDY TIP

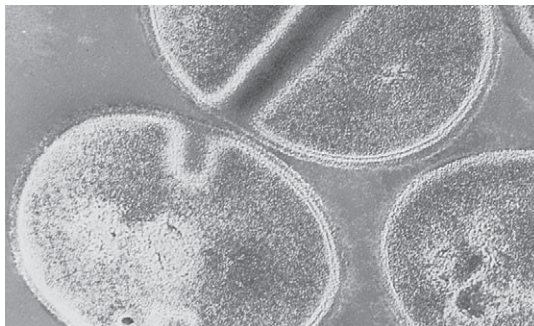
Summarize As you read this section, make a diagram showing the stages of the eukaryotic cell cycle.

How Do Prokaryotic Cells Divide?

Prokaryotes have only one cell. Prokaryotic cells have no nucleus. They also have no organelles that are surrounded by membranes. The DNA for prokaryotic cells, such as bacteria, is found on one circular chromosome. The cell divides by a process called *binary fission*. During binary fission, the cell splits into two parts. Each part has one copy of the cell's DNA.

READING CHECK

1. Explain What must happen before a cell can divide?



Bacteria reproduce by binary fission.

TAKE A LOOK

2. Complete Prokaryotic cells divide by _____.

_____.

SECTION 3 The Cell Cycle *continued*

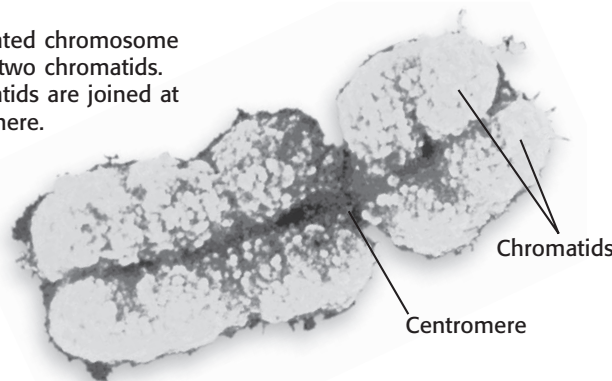
How Do Eukaryotic Cells Divide?

Different kinds of eukaryotes have different numbers of chromosomes. However, complex eukaryotes do not always have more chromosomes than simpler eukaryotes. For example, potatoes have 48 chromosomes, but humans have 46. Many eukaryotes, including humans, have pairs of similar chromosomes. These pairs are called **homologous chromosomes**. One chromosome in a pair comes from each parent.

Cell division in eukaryotic cells is more complex than in prokaryotic cells. The cell cycle of a eukaryotic cell has three stages: interphase, mitosis, and cytokinesis.

The first stage of the cell cycle is called *interphase*. During interphase, the cell grows and makes copies of its chromosomes and organelles. The two copies of a chromosome are called *chromatids*. The two chromatids are held together at the *centromere*.

This duplicated chromosome consists of two chromatids. The chromatids are joined at the centromere.



The second stage of the cell cycle is called **mitosis**. During this stage, the chromatids separate. This allows each new cell to get a copy of each chromosome. Mitosis happens in four phases, as shown in the figure on the next page: prophase, metaphase, anaphase, and telophase.

The third stage of the cell cycle is called **cytokinesis**. During this stage, the cytoplasm of the cell divides to form two cells. These two cells are called *daughter cells*. The new daughter cells are exactly the same as each other. They are also exactly the same as the original cell. ✓

Critical Thinking

3. Compare What is the difference between a chromosome and a chromatid?

READING CHECK

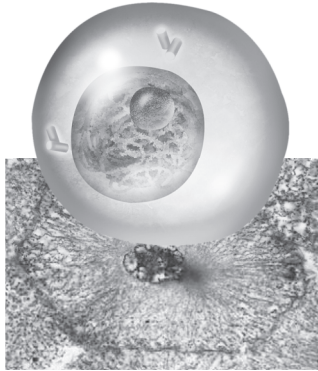
4. Identify What are the three stages of the eukaryotic cell cycle?

THE CELL CYCLE

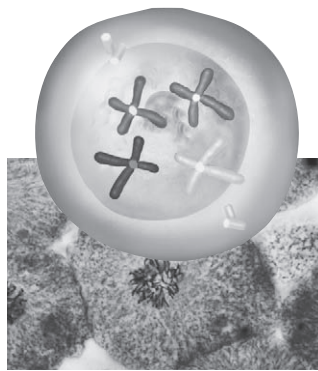
The figure on the following page shows the cell cycle. In this example, the stages of the cell cycle are shown in a eukaryotic cell that has only four chromosomes.

SECTION 3 The Cell Cycle *continued*

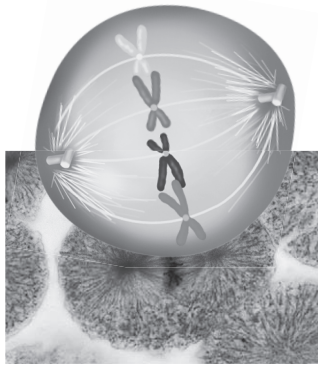
Interphase Before mitosis begins, chromosomes are copied. Each chromosome is then made of two chromatids.



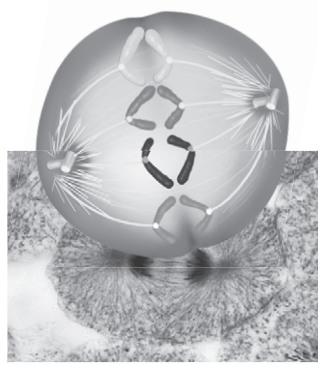
Mitosis Phase 1 (Prophase) Mitosis begins. Chromatids condense from long strands to thick rods.



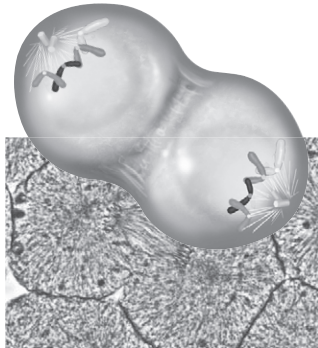
Mitosis Phase 2 (Metaphase) The nuclear membrane dissolves. Chromosome pairs line up around the equator of the cell.



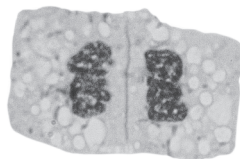
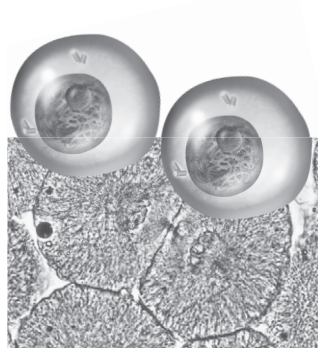
Mitosis Phase 3 (Anaphase) Chromatids separate and move to opposite sides of the cell.



Mitosis Phase 4 (Telophase) A nuclear membrane forms around each set of chromosomes. The chromosomes unwind. Mitosis is complete.



Cytokinesis In cells with no cell wall, the cell pinches in two.



In cells with a cell wall, a cell plate forms and separates the new cells.

Math Focus

5. Calculate Cell A takes 6 h to complete division. Cell B takes 8 h to complete division. After 24 h, how many more copies of cell A than cell B will there be?

TAKE A LOOK

6. List What are the four phases of mitosis?

7. Identify What structure do plant cells have during cytokinesis that animal cells do not have?

Section 3 Review

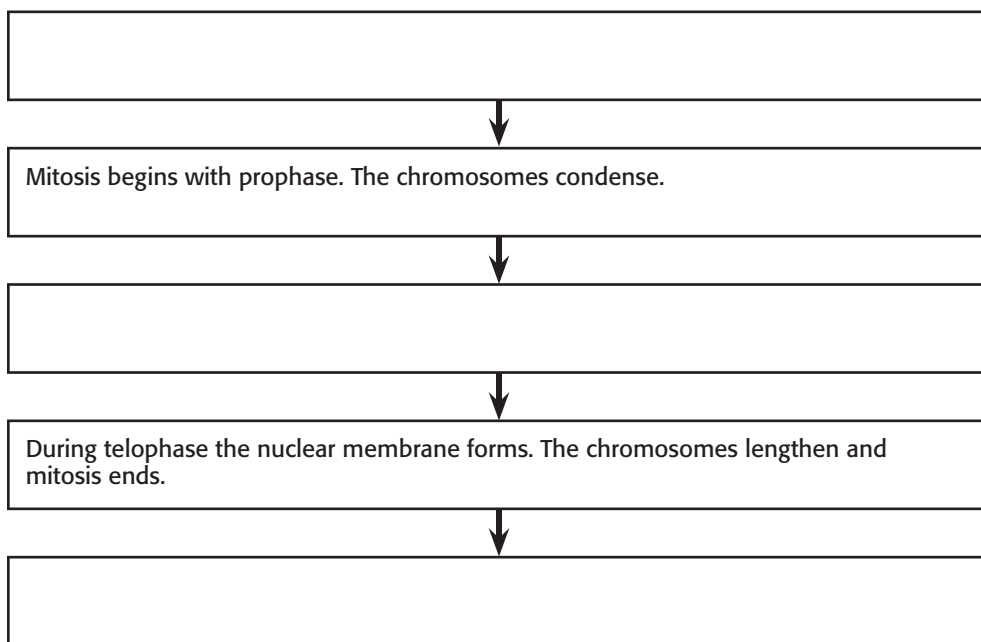
NSES LS 1c, 2d

SECTION VOCABULARY

<p>cell cycle the life cycle of a cell</p> <p>chromosome in a eukaryotic cell, one of the structures in the nucleus that are made up of DNA and protein; in a prokaryotic cell, the main ring of DNA</p> <p>cytokinesis the division of cytoplasm of a cell</p>	<p>homologous chromosomes chromosomes that have the same sequence of genes and the same structure</p> <p>mitosis in eukaryotic cells, a process of cell division that forms two new nuclei, each of which has the same number of chromosomes</p>
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1. Compare How does the DNA of prokaryotic and eukaryotic cells differ?

2. Summarize Complete the Process Chart to explain the three stages of the cell cycle. Include the four phases of mitosis.



3. Explain Why does a cell make a copy of its DNA before it divides?

4. Infer Why is cell division in eukaryotic cells more complex than in prokaryotic cells?
