

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?
- What happens when cells divide too quickly?



California Science Standards

7.1.b, 7.1.e, 7.2.e

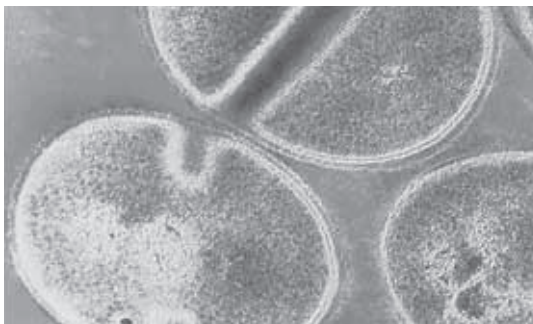
How Are New Cells Made?

As you grow, you pass through different stages in your life. Cells also pass through different stages in their life cycle. 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 the molecule that contains all the instructions for making new cells. The DNA is stored in structures called chromosomes. The chromosomes are copied to make sure that each new cell has all the DNA of the parent cell. Although all cells pass through a cell cycle, the process differs in prokaryotic and eukaryotic cells. ✓

How Do Prokaryotic Cells Divide?

Prokaryotes are made of 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 simple process called binary fission. Binary fission splits the cell into two parts. Each part has one copy of the cell's DNA.



Bacteria reproduce by binary fission.



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



READING CHECK

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

The cell must make a copy of all of its DNA before it divides to make sure that each new cell has a copy.

TAKE A LOOK

2. Complete Prokaryotic cells divide by _____.

binary fission

SECTION 2 The Cell Cycle *continued*

How Do Eukaryotic Cells Divide?

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.

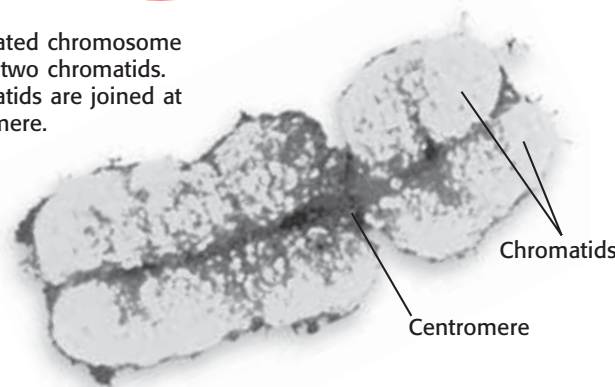
Critical Thinking

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

A chromatid is a single unit shaped like the letter V.

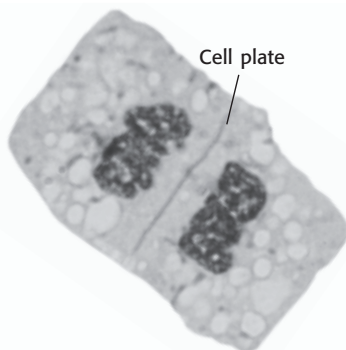
A chromosome has two sister chromatids and is shaped like an X with the centromere at the middle.

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: 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.



When a plant cell divides, a cell plate forms. The cell then divides into two cells. After the cell divides, a new cell wall forms where the cell plate was.

CALIFORNIA STANDARDS CHECK

7.1.e Students know cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes.

Word Help: process

a set of steps, events, or changes

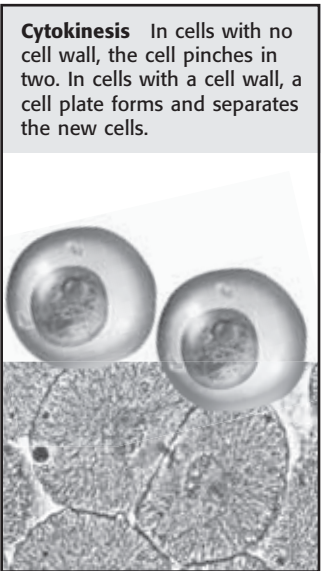
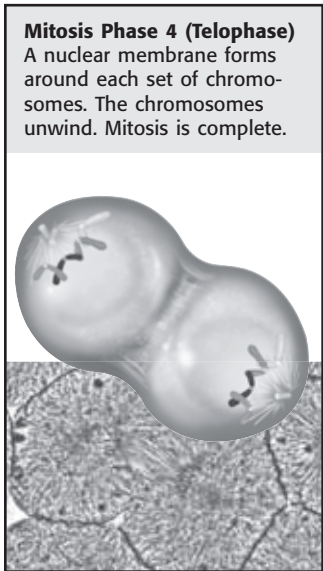
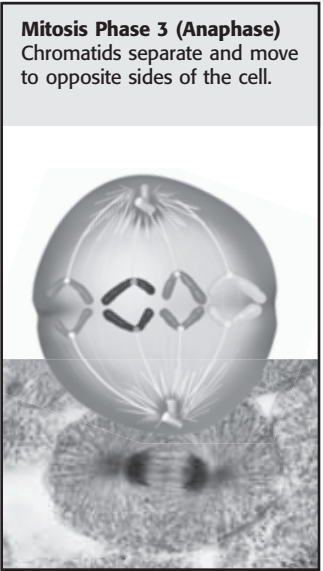
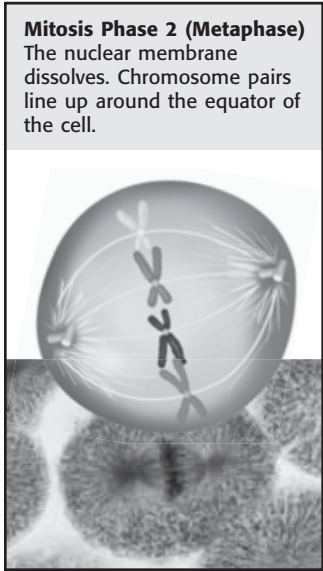
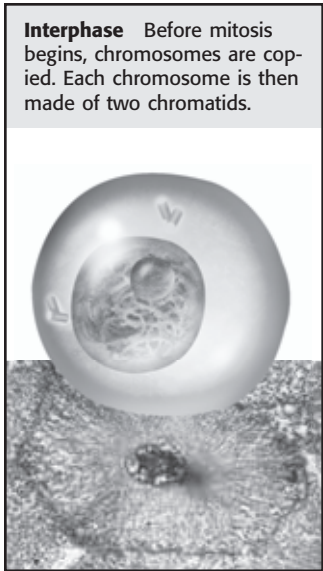
4. Identify After one cell goes through mitosis and cytokinesis, how many cells are there?

2

How Does the Cell Cycle Work?

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 2 The Cell Cycle *continued*



TAKE A LOOK

5. List What are the four phases of mitosis?

- 1. Prophase
- 2. Metaphase
- 3. Anaphase
- 4. Telophase (PMAT)

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

cell plate

SECTION 2 The Cell Cycle *continued*

What Tells a Cell When to Divide?

After cytokinesis is complete, each new cell is an exact copy of the parent cell. How did the parent cell know when to start copying its chromosomes?

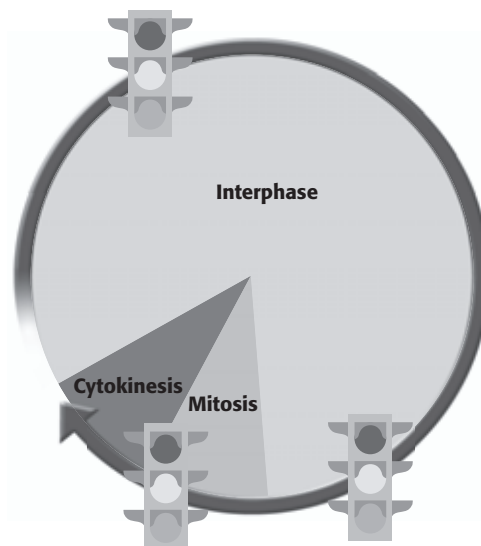
As a baby, you cried when you were hungry. Crying was your way of reporting your condition to others. Cells also report conditions. This is called feedback. Cells use feedback to control the stages of the cell cycle, as shown below.

In a cell, feedback is used to turn on switches that work like red and green traffic lights. A cell spends most of its life in interphase, when it is not dividing. During this time, the cell grows. When feedback messages report that the cell is large and healthy, proteins in the cell get the “green light.” The cell starts to copy its organelles and chromosomes. ✓

READING CHECK

7. Identify In which stage of the cell cycle does a cell spend most of its life?

interphase



The cell cycle in eukaryotes is controlled at three points. Feedback at each point determines whether the cell will get a “red light” or a “green light” to continue cell division.

What Happens When Cell Division Is Not Controlled?

The molecules that control the “red light-green light” signals are proteins. The information for making these proteins is found in a cell’s DNA. If the DNA mutates, or changes, the proteins the cell makes could be changed. The changed protein may not control the cell correctly. This can cause cancer to occur. Cancer is the uncontrolled growth of cells.

There are different ways cancer can begin in a cell. Some mutations in DNA cause too many molecules that make a cell grow. This speeds up the cell cycle. Other mutations turn off the proteins that stop a cell from dividing. This would allow cells to divide constantly.

Math Focus

8. Calculate Cell A normally divides once every two days. If its control mechanisms aren’t working correctly, cell A divides six times faster than normal. How many hours does it take cell A to divide when its control mechanisms aren’t working correctly?

Every eight hrs

Section 2 Review

7.1.b, 7.1.e, 7.2.e 

SECTION VOCABULARY

cancer a tumor in which the cells begin dividing at an uncontrolled rate and can become invasive

cell cycle the life cycle of a cell

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

cytokinesis the division of cytoplasm of a cell

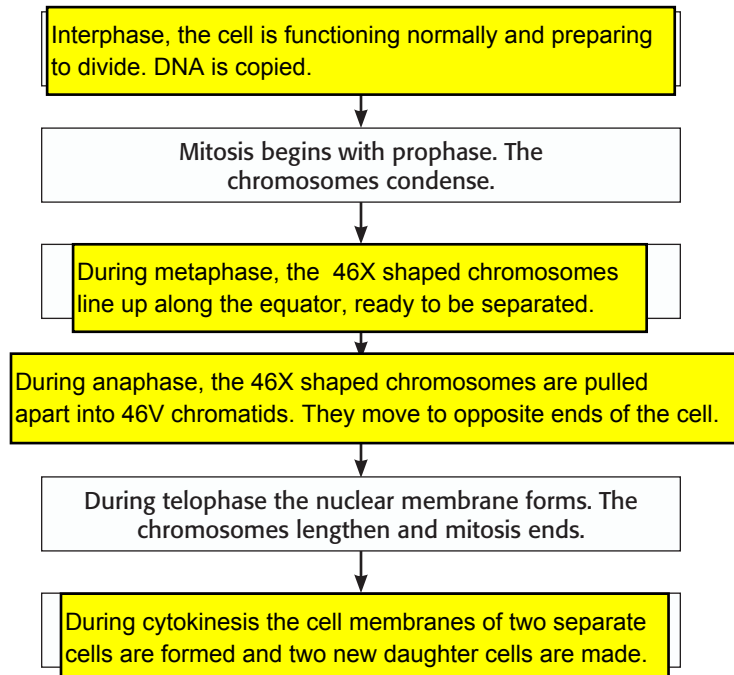
mitosis in eukaryotic cells, a process of cell division that forms two new nuclei, each of which has the same number of chromosomes

1. Compare How does the the DNA of prokaryotic and eukaryotic cells differ?

DNA in a prokaryote is shaped like a loop or ring. "O" shaped chromosome

DNA in Eukaryotes are shaped like V's for chromatids and X's for chromosomes.
There is more DNA in the eukaryotes than prokaryotes.

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?

The cell must make an exact copy of all of its DNA to be passed into the new daughter cell. This new daughter cell will eventually make a complete copy of that DNA to pass on to a new "granddaughter" cell. This cycle can only go on if each time there is a whole copy of DNA inherited from cell to cell. Especially because the DNA tells the cell how to live divide.

4. Explain Why does cancer occur?

Cancer occurs when cells do mitosis quickly and out of control. The cells ignore the feedback stoplights. A tumor or lump of cells may form. Theses cells can stop their normal function and interfere with neighboring cells.