

Cell Reproduction

SECTION 1 Cell Division and Mitosis

Before You Read

List five living things on the lines below. Then write one thing that these items have in common with each other and with you.

What You'll Learn

- why mitosis is important
- the steps of mitosis
- the similarities and differences between mitosis in plant and animal cells
- examples of asexual reproduction

Read to Learn

Why is cell division important?

All living things are made up of cells. Many organisms start as one cell. The cell divides and becomes two cells, two cells become four, four become eight, and so on. Through the process of cell division, the organism grows.

Cell division is still important after an organism stops growing. For example, every day billions of your red blood cells wear out and are replaced through cell division. During the time it takes you to read this sentence, your bone marrow produced about six million red blood cells.

Cell division is the way a one-celled organism makes another organism of its kind. When a one-celled organism reaches a certain size, it reproduces by dividing into two cells.

The Cell Cycle

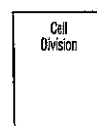
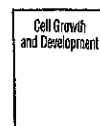
Every living organism has a life cycle. A life cycle has three parts. First, the organism forms. Next, it grows and develops. Finally, the life cycle ends when the organism dies. Right now, you are in a part of your life cycle called adolescence (a doh LEH sence), which is a time of active growth and development.

Mark the Text

Identify Details Highlight each question head. Then use another color to highlight the answer to that question.

FOLDABLES™

A Describe Use quarter sheets of notebook paper, as shown below, to describe cell growth and development and cell division.

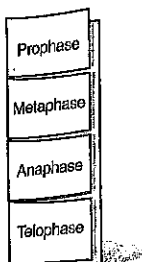


Picture This

- 1. Identify** Draw an outline around the interphase part of the cell cycle to the right. Approximately how much of the cell cycle is interphase?

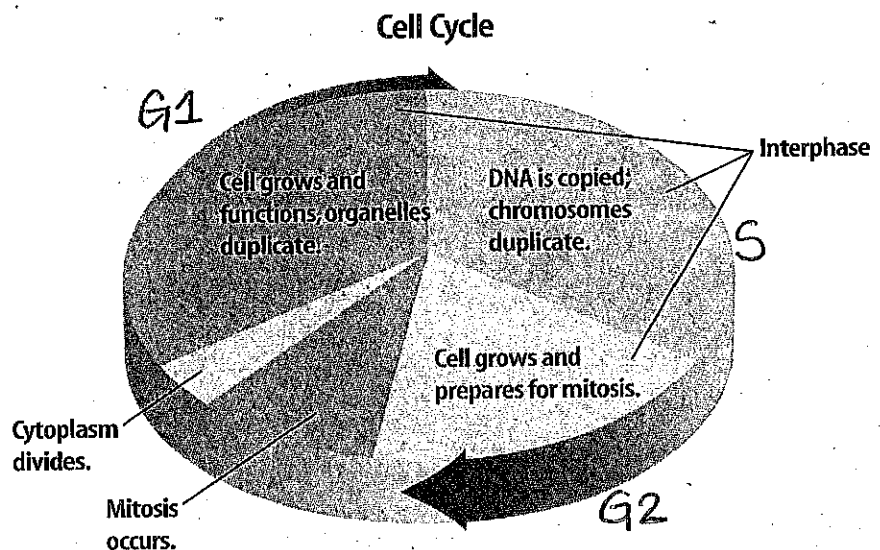
FOLDABLES

- Sequence** Make a four-tab book, as shown below. Use the Foldable to identify facts about the four steps of mitosis.



How long is the life cycle of a cell?

Every cell has a life cycle. A cell's life cycle is called a cell cycle, as shown in the figure below. A cell cycle is not completed in the same amount of time in all cells. For example, the cell cycle of some human cells takes about 16 hours. The cell cycle of some plant cells takes about 19 hours. A cell cycle has three parts—interphase, mitosis, and cytoplasm division.



What is the longest part of the cell cycle?

For cells that have a nucleus, the longest part of the cell cycle is a period of growth and development called **interphase**. Cells in your body that no longer divide, such as nerve and muscle cells, are always in interphase.

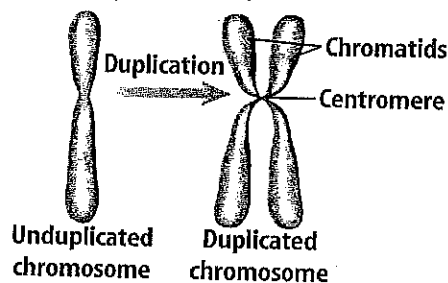
During interphase, an actively dividing cell, such as a skin cell, copies its DNA and prepares for cell division. DNA is the chemical code that controls an organism's growth and operation. A copy of a cell's DNA must be made before dividing so that each of the two new cells will get a complete copy. Each cell needs a complete set of hereditary material to carry out life functions.

Mitosis

After interphase, cell division begins. Mitosis is the first step in cell division. **Mitosis** (mi TOH sus) is the process in which the cell's nucleus divides to form two nuclei. Each new nucleus is identical to the original nucleus. The steps of mitosis are called prophase, metaphase, anaphase, and telophase.

What happens to chromosomes during cell division?

A chromosome (KROH muh soh-m) is a structure in the nucleus that contains DNA. During interphase, each chromosome is copied. When the nucleus is ready to divide, the two copies of each chromosome coil tightly into two thickened, identical DNA strands called chromatids (KROH muh tidz). In the figure to the right, the chromatids are held together at a place called the centromere.



Prophase During prophase, the chromatid pairs can be seen. The nuclear membrane breaks apart. Two small structures called centrioles (SEN tree olz) move to opposite ends of the cell. Between the centrioles, threadlike spindle fibers stretch across the cell. Animal cells have centrioles, but plant cells do not. ☒

Metaphase In metaphase, the chromatid pairs line up across the center of the cell. The centromere of each pair usually becomes attached to two spindle fibers—one from each side of the cell.

Anaphase In anaphase, each centromere divides. The spindle fibers become shorter, and each chromatid separates from its partner. The separated chromatids begin to move to opposite ends of the cell. They are now called chromosomes.

Telophase The final step of mitosis is telophase. During telophase, the spindle fibers start to disappear. The chromosomes start to uncoil, and a new nucleus forms.

How does the cytoplasm divide?

For most cells, after the nucleus divides, the cytoplasm separates and two new cells are formed. Each new cell contains one of the new nuclei. In animal cells, the cell membrane pinches in the middle, like a balloon with a string tightened around it. The cell divides at the pinched area to form two new cells. Each new cell contains half the cytoplasm from the old cell.

After the division of the cytoplasm, most new cells begin interphase again. Use the figure on the next page to review the cell division of an animal cell.

Picture This

2. **Identify** Circle the place where the chromatids are held together.

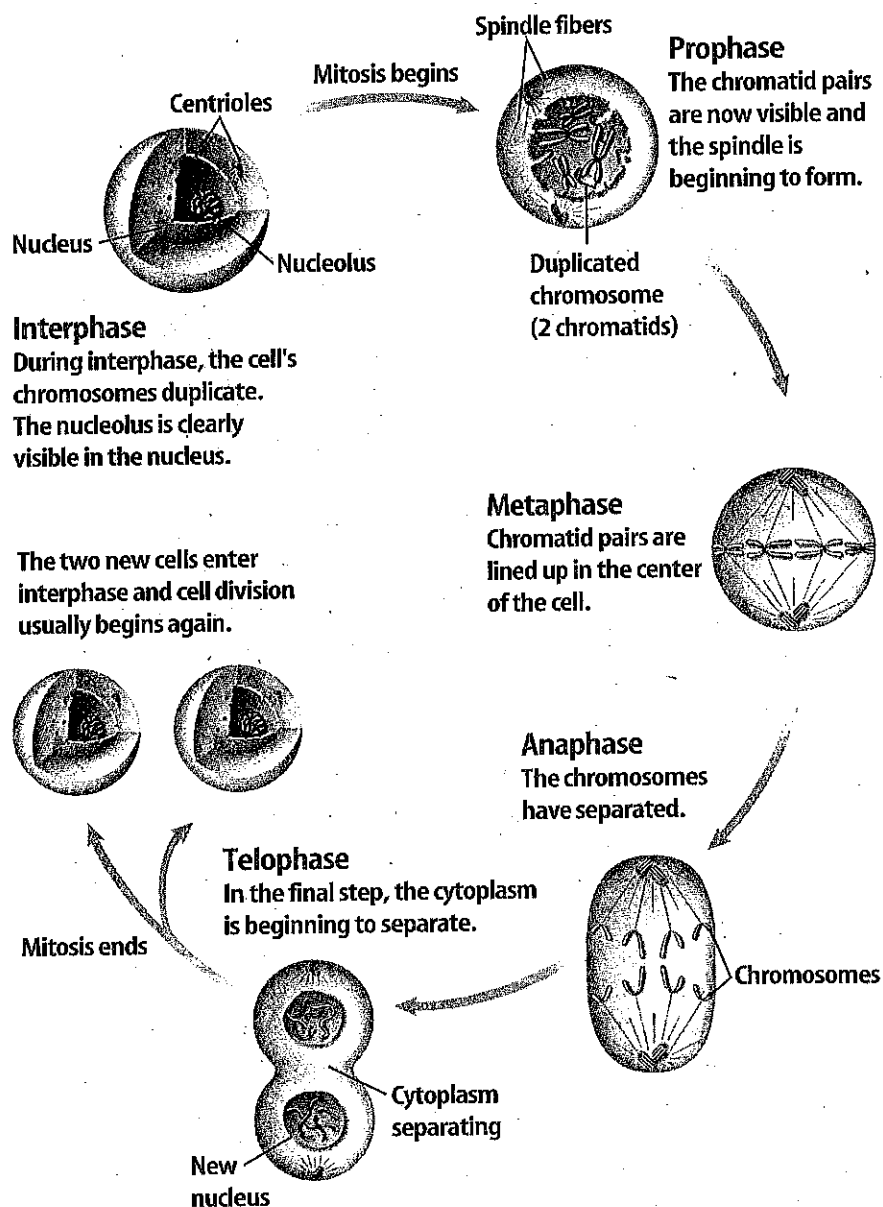
✓ Reading Check

3. **Explain** what happens to the centrioles during prophase.

Picture This

- 4. Describe** Highlight the chromosomes in each phase of mitosis. As you highlight the step, explain to a partner what is happening to the chromosome.

Cell Division for an Animal Cell



✓ Reading Check

- 5. Explain** In plant cells, what divides the cytoplasm into two parts?

How do plant cells divide after mitosis?

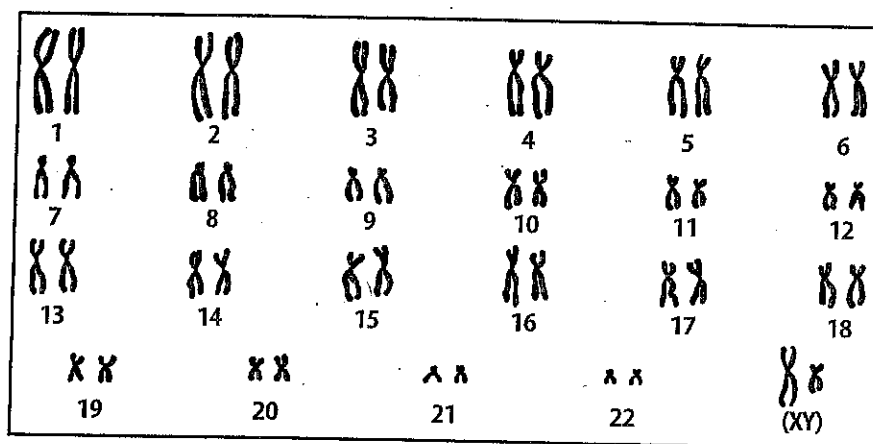
In plant cells, a cell plate forms in the middle of the cell. The cell plate divides the cytoplasm into two parts. New cell walls form along the cell plate, and new cell membranes develop inside the cell walls. ✓

What are the results of mitosis?

You should remember two important things about mitosis. First, mitosis is the division of a cell's nucleus. Second, it produces two new nuclei that are identical to each other and to the original nucleus. Every cell in your body, except sex cells, has a nucleus with 46 chromosomes—23 pairs. This is because you began as one cell with 46 chromosomes in its nucleus. Skin cells, produced to replace or repair your skin, have the same 46 chromosomes as the original single cell you developed from.

The 46 chromosomes of a human cell are shown below. Notice that the last pair is labeled XY. This is the chromosome pair that determines sex. The XY label indicates a male. Females have XX chromosome pairs.

Chromosomes of a human cell



_____ (No. of chromosome pairs) \times 2 = _____ (No. of chromosomes)

Each of the trillions of cells in your body, except sex cells, has a copy of the same DNA. All of your cells, however, use different parts of the DNA to become different types of cells. Skin cells and blood cells contain a copy of the same DNA. They use different parts of the DNA to perform their different functions.

Cell division allows growth and replaces worn out or damaged cells. You are much larger than you were when you were a baby. This is possible because of cell division. If you cut yourself, the wound heals because cell division replaces damaged cells. ☒

Picture This

6. **Solve** Complete the equation at the bottom of the figure using the information in the figure.

Reading Check

7. **Explain** What is the purpose of cell division?

Picture This

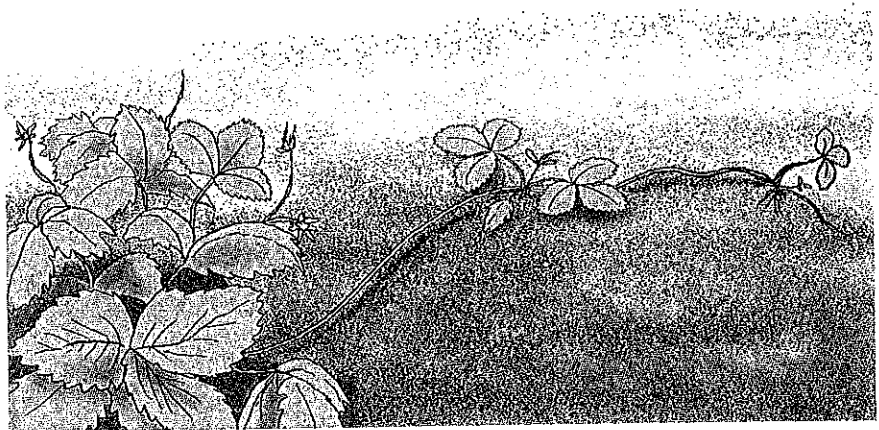
8. **Identify** How many organisms were needed to produce the strawberry runner?

✓ Reading Check

9. **Explain** budding, which is a form of asexual reproduction.

Asexual Reproduction

The way an organism produces others of its kind is called reproduction. Among living organisms, there are two types of reproduction—sexual and asexual. Sexual reproduction usually involves two parent organisms. In **asexual reproduction**, a new organism (sometimes more than one) is produced from only one parent organism. The new organism has the same DNA as the parent. New strawberry plants can be reproduced asexually from horizontal stems called runners. The figure below shows the asexual reproduction of a strawberry plant.



How do cells divide using fission?

Remember, mitosis involves the division of a nucleus. Bacteria do not have a nucleus, so they can not use mitosis. Instead, bacteria reproduce asexually by a process called fission. During fission, a bacteria cell's DNA is copied. The cell then divides into two identical organisms. Each new organism has a complete copy of the parent organism's DNA.

How do organisms reproduce using budding?

Budding is a type of asexual reproduction in which a new organism grows from the body of the parent. When the bud on the adult becomes large enough, it breaks away to live on its own. ✓

How do some organisms regrow body parts?

Some organisms, such as sponges and sea stars, can regrow damaged or lost body parts. The process that uses cell division to regrow body parts is called regeneration. If a sea star breaks into pieces, a whole new organism can grow from each piece.