CHAPTER

3 Cell Division

the BIG idea

Organisms grow, reproduce, and maintain themselves through cell division.

Getting Ready to Learn

Review Concepts

- The cell is the basic unit of life.
- All cells come from other cells.
- DNA provides the instructions a cell needs to function and reproduce.

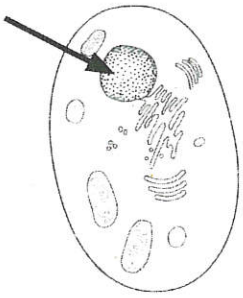
Activity

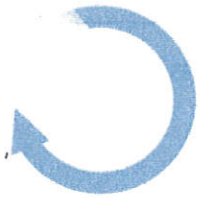
Division and Volume
See student text, page 71.

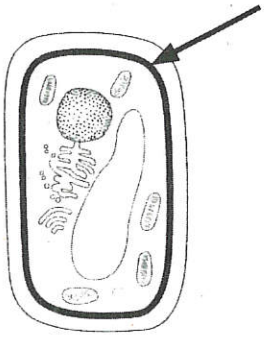
Review Vocabulary

Draw a line to connect each word to the picture that it matches.

cell membrane **nucleus** **cycle**







Preview Key Vocabulary

As you read the chapter, use the frames below to write important details about each of the terms.

chromosome	mitosis

SECTION 3.1

Key Concept

Cell division occurs in all organisms.

Student text pages 73–78

What are the functions of cell division?

Cell division is a process that divides one cell into two cells. The process of cell division occurs in all organisms. There are several different functions of cell division.

Unicellular organisms A **unicellular organism** is made up of just one cell. When a unicellular organism divides into two cells, it reproduces. In other words, it produces offspring.

Multicellular organisms Most organisms that are big enough to be seen are **multicellular organisms**—they are made of more than one cell. Cell division helps multicellular organisms grow, develop, repair themselves, and reproduce.

INSTANT REPLAY

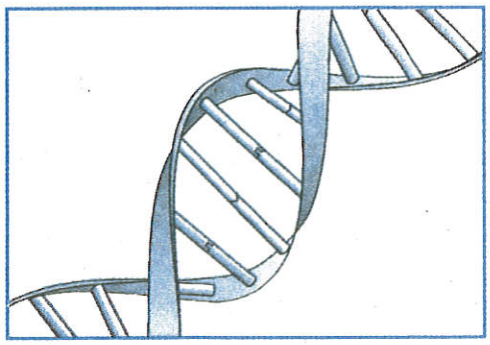
What is the role of cell division in

unicellular organisms? _____

multicellular organisms? _____

What is DNA?

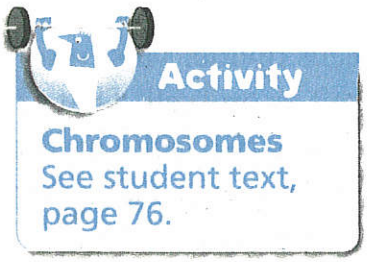
When a cell divides, each new cell needs a full copy of genetic material. The genetic material in cells is made up of DNA molecules.



A DNA molecule is made of two strands that are connected like a twisted ladder.

DNA is the genetic material in cells. The letters DNA stand for deoxyribonucleic acid (dee-AHK-see-RY-boh-noo-KLEE-ihk). DNA has information for an organism's growth and other functions. A DNA molecule is shaped like a twisted ladder. You can see this shape in the picture.

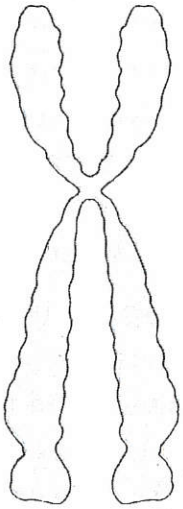
What are chromosomes?



In a eukaryotic cell, most of the DNA is in the nucleus. When in the nucleus, DNA looks like long loose strands—like a plate of spaghetti. But before the cell divides, the DNA gets replicated, or copied. Then, it gets folded into compact* structures called **chromosomes** (KROH-muh-SOHMZ).

Remember that before a cell divides, the chromosomes get copied. The chromosome in the picture has two copies. This chromosome's right and left halves are held together in the center. The right and left parts are identical; they are copies of each other.

Remember that chromosomes are made up of DNA. But in the picture, the DNA strands are so small and tightly folded you cannot actually see them.



A chromosome is made of tightly packed DNA.

How are chromosomes and DNA related?

_____

Each type of organism has a particular number of chromosomes. Humans have 46 chromosomes. Fern plants may have more than 100 chromosomes. Fruit flies only have 8.

How many chromosomes do humans have?

_____

What is the role of cell division in growth, development, and repair?

You started out as one cell. How did you get so big? Your cells divided over and over. In multicellular organisms—including you—cell division is used for growth, development, and repair.

Compact means small and tightly packed together. When you cram your clothes into a suitcase, the clothes are **compact.**

Growth Multicellular organisms grow as their cells divide. Most multicellular organisms start out as one cell. That cell divides into two cells. Those two cells can then divide into four cells, and so on. An organism's cells continue to divide as it grows.

Development As an organism grows, the cells do not look the same. During development, cells become specialized* to do different jobs. Some cells become skin cells and others become nerve cells. The different cells all have the same set of DNA, but they each do only one job.

Repair If you get a cut, your body uses cell division to repair itself. The surrounding cells divide and replace the damaged ones. Cell division also replaces cells that are old or worn out. Even after you are fully grown, your body will still use cell division to replace damaged cells.

This infant will grow as its cells divide.

Visual Connection
See Repair in the student text, page 78.

INSTANT REPLAY

Circle three roles of cell division.

SECTION 3.1	
SUMMARIZE	**VOCABULARY**
1. What are three main jobs of cell division in multicellular organisms? _____ _____ _____ _____ _____	Fill in each blank with the correct word from the list. **chromosomes** **DNA** **nucleus** In eukaryotic cells, the genetic material is contained in the **2.**_____ Before cell division, the genetic material, or **3.**_____, becomes tightly packaged into structures called **4.**_____.

*Academic Vocabulary: **Specialized** means only doing one job. The actors, set designers, and lighting experts each have **specialized** roles in the school play.

SECTION 3.2

Key Concept

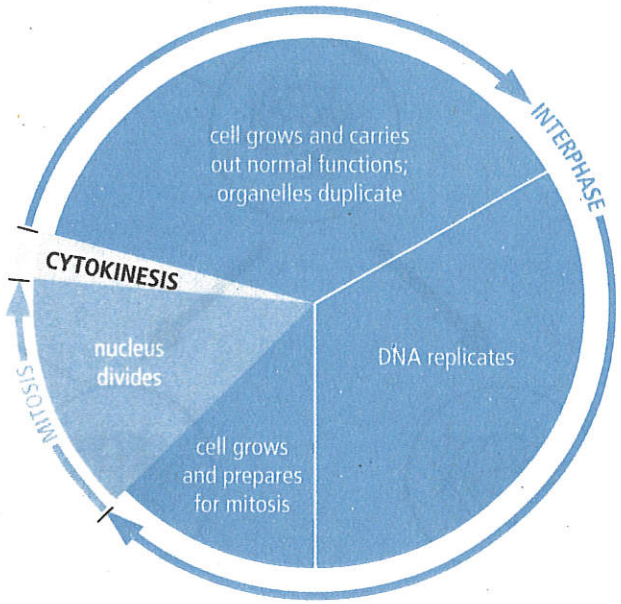
Cell division is part of the cell cycle.

Student text pages 80–85

What is the cell cycle?

A cycle is a process that repeats. In the life cycle, living things grow, reproduce, and die. Cells have a life cycle too. A cell's life cycle is called the cell cycle. The **cell cycle** is the normal pattern of development and division of a cell. There are two main parts of the cell cycle: interphase and cell division.

Cell Cycle



Interphase As you can see in the picture, most of the cell's life cycle is spent in interphase. **Interphase** is the part of the cell cycle when the cell grows and carries out normal functions. The cell does not divide during interphase. But the cell gets ready to divide by copying, or replicating, its DNA.

Cell Division There are two parts of cell division: mitosis and cytokinesis.

- **Mitosis** is the process that divides the nucleus in eukaryotic cells. Remember that the nucleus holds a cell's DNA. The nucleus divides during mitosis. The cell's genetic material divides too.
- **Cytokinesis** (SY-toh-kuh-NEE-sihs) is the division of the cytoplasm.

Mark It Up

Circle the names of the two processes in the cell division phase.

When mitosis and cytokinesis are done, there are two new cells. Each new cell has a complete set of DNA and other cell structures.

INSTANT REPLAY

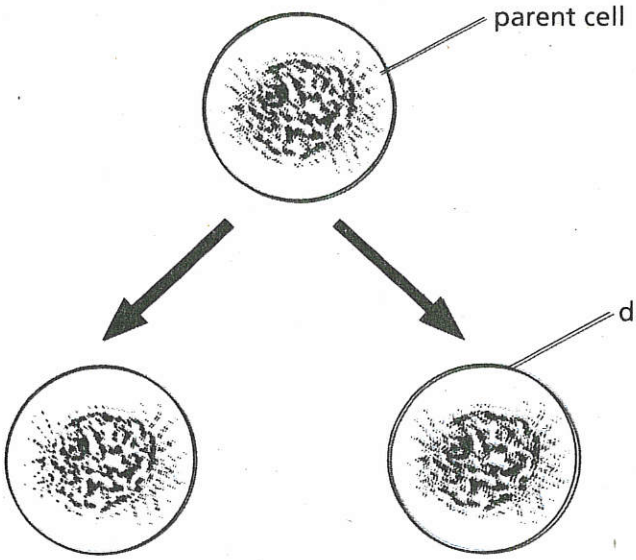
What happens during mitosis?

_____

What are the products of cell division?

When a cell divides, it produces two new genetically identical* cells. The cell that divides is called a parent cell. The two cells that result are called daughter cells. The term *daughter cell* does not mean that it's a female. It is just a term scientists use to talk about these new cells.

Visual Connection
See Cell Division in the student text, page 83.



When a cell divides, the daughter cells have the exact same DNA as the parent cell.

INSTANT REPLAY

What does it mean for two cells to be "genetically identical"?_____

Mitosis

Before cell division can take place, a parent cell's DNA is copied. The cell then has two complete sets of DNA. The two copies of the genetic material are divided during mitosis. This means that when mitosis is done, each new cell has only one complete set of DNA.

INSTANT REPLAY

What part of a parent cell is separated by mitosis?

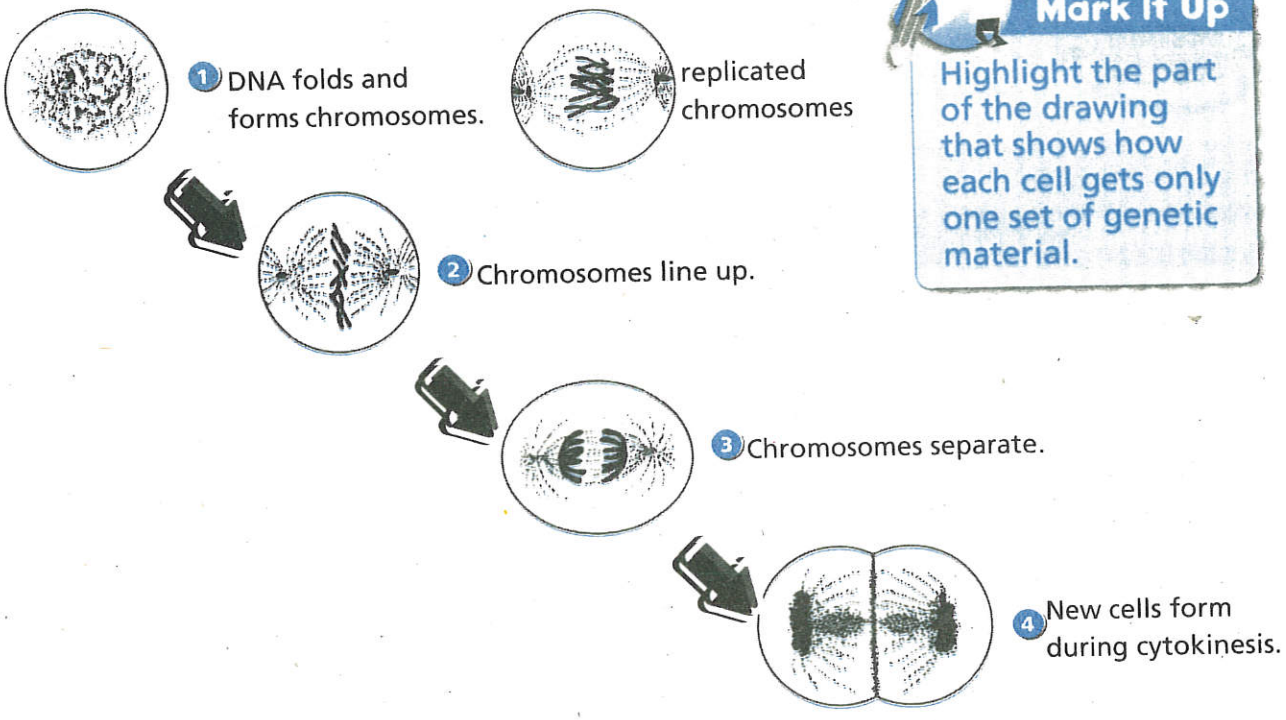
_____

*Academic Vocabulary: **Identical** means exactly the same. The pieces of blank paper in your notebook are **identical** to one another.

Mitosis is a continuous process. It does not really happen in separate steps. However, it can be helpful to break the process into parts in order to learn about it. In general, mitosis happens in this way:

1. DNA folds and forms chromosomes.
2. Chromosomes line up.
3. Chromosomes separate.
4. New cells form during cytokinesis.

CLASSZONE.COM
Visualization Watch the process of mitosis in action.



Mark It Up
Highlight the part of the drawing that shows how each cell gets only one set of genetic material.

INSTANT REPLAY

Fill in the blank: After mitosis, each daughter cell has identical _____.

Cytokinesis

Cell Division
See student text, page 84.

During cytokinesis the parent cell's cytoplasm divides. Cytokinesis happens after mitosis. The cell pinches together at the middle. This separates the parent cell's cytoplasm into two. At the end of cytokinesis, the two new cells are completely separated. Each cell is surrounded by a cell membrane. Each cell has a full set of DNA.

The new cells continue the cell cycle. They are now back in interphase, growing and carrying out regular functions.

After cytokinesis, how many cells are there?

_____

SECTION 3.2

SUMMARIZE	VOCABULARY
1. Imagine that a cell goes through mitosis and cytokinesis. Draw the cells that result.	Draw a line to connect each word to its definition. 2. cell cycle — a. when a cell grows and carries out normal functions 3. interphase — b. division of the cytoplasm 4. mitosis — c. division of the nucleus 5. cytokinesis — d. life cycle of a cell

SECTION 3.3

Key Concept

Both sexual and asexual reproduction involve cell division.

Student text pages 88–92

What is asexual reproduction?

Some living things produce offspring that are genetically the same as the parent. In **asexual reproduction** one parent produces offspring that have the same exact DNA. Asexual means *not* sexual. Some types of asexual reproduction are described below.

Activity

Asexual Reproduction
See student text, page 91.

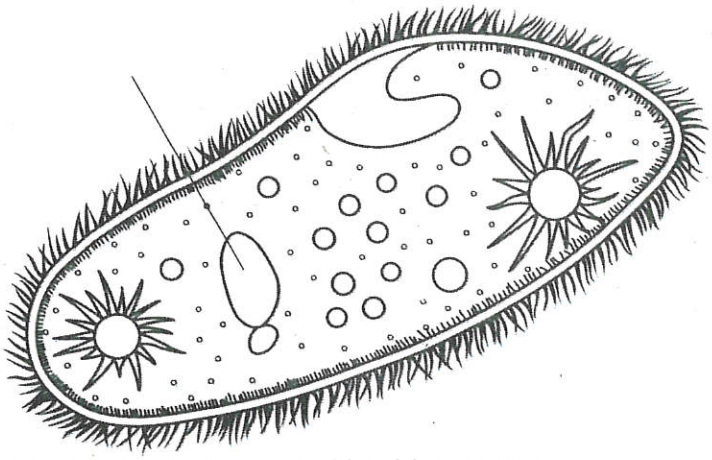
INSTANT REPLAY

How many parent organisms are involved in asexual reproduction?

_____

Mitosis

A single-celled organism reproduces each time it divides. This is a type of asexual reproduction because the offspring have the same DNA as the parent. Both single-celled eukaryotes and prokaryotes may reproduce through cell division. A eukaryotic cell—a cell with a nucleus—divides by mitosis and cytokinesis.



Single-celled eukaryotes, like this one, may reproduce through mitosis and cytokinesis.

INSTANT REPLAY

Fill in the blanks: Single-celled eukaryotes may reproduce through _____ and _____.

Regeneration

Some multicellular organisms can reproduce by regeneration. **Regeneration** is a process in which a body part gets broken off and grows into a whole new organism.

If one arm of this sea star breaks off, it may grow into a whole new organism.

INSTANT REPLAY

What is one way that some multicellular organisms can reproduce?

_____

The sea star is one animal that can reproduce through regeneration. If one of the sea star's arms gets broken off, it may grow into a new individual. Many plants can also reproduce this way. If a stem of a plant is cut off, the cut may heal, and the plant will keep growing. But the part that was cut off may also grow into a whole new plant.

Like all asexual reproduction, organisms produced by regeneration have the same DNA as the parent organism.

Mark It Up

Circle the two daughter cells that were produced through binary fission

INSTANT REPLAY

What are two examples of organisms that may reproduce through regeneration?

_____

_____

Binary Fission

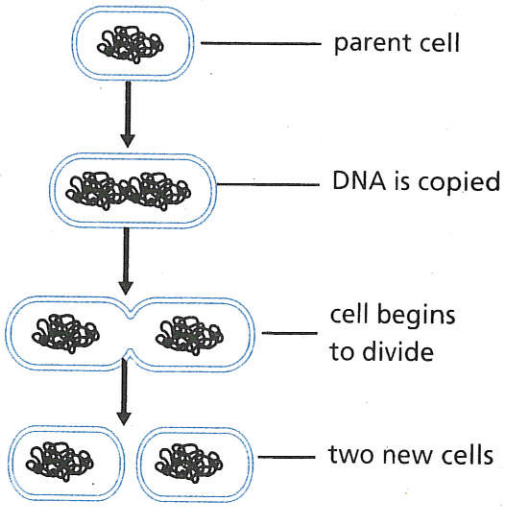
A prokaryotic cell does not have a nucleus, so it cannot divide by mitosis. Instead, it divides through a process called binary fission.

In **binary fission** the parent cell's DNA is replicated, or copied, and then the cell splits in two. This is different than mitosis because the cell does not have a nucleus that is divided.

INSTANT REPLAY

Fill in the blank: Single-celled prokaryotes may reproduce through _____.

Binary Fission



Prokaryotes do not have a nucleus, so they reproduce through binary fission.

What is sexual reproduction?

Sexual reproduction is different from asexual reproduction. In sexual reproduction, the offspring get their DNA from two parents. The offspring are not exactly the same as either parent. The chart below compares asexual reproduction with sexual reproduction.

	Asexual Reproduction	Sexual Reproduction
Number of Parents	one	two
Offspring's Genes	identical to parent's	not identical to parents'

How many parent organisms are involved in sexual reproduction?

_____

SECTION 3.3

SUMMARIZE	VOCABULARY
1. What are two ways in which asexual reproduction is different from sexual reproduction? _____ _____ _____ _____ _____ _____	Circle the word that makes each sentence correct. 2. Binary fission is one example of **asexual / sexual** reproduction. 3. Cells that do not have a nucleus divide through **regeneration / binary fission.**

Review

CHAPTER

3 Cell Division

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Go to ClassZone.com for activities, links, and more test practice.

Vocabulary

Choose a word from the box, and write it next to its definition.

asexual reproduction
chromosome
cytokinesis
DNA
mitosis

1 A chromosome is made of packaged _____.

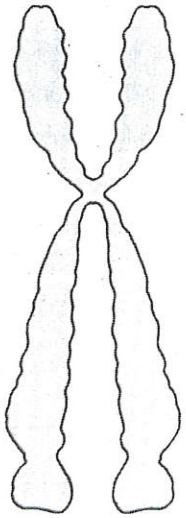
2 Two main parts of cell division are _____ and _____.

3 In unicellular organisms, cell division is a form of _____.

Reviewing Key Concepts

4 What is the name of the structure in the picture?

_____



5 Look at the picture. This structure contains two identical copies of DNA. Draw a circle around each of the identical parts of this structure.

the BIG idea

6 List the functions of cell division for unicellular and multicellular organisms.

Unicellular organisms: _____

Multicellular organisms: _____

Test Practice

7 Which process of cell division results in two identical cells?

A mitosis

B osmosis

C diffusion

D interphase

8 Where is a chromosome found?

A in the lysosome

B in the membrane

C in the nucleus

D in the Gogli apparatus