

# Cell Reproduction

## section ● DNA

### What You'll Learn

- the parts of a DNA molecule and its structure
- how DNA copies itself
- the structure and role of each kind of RNA

### ● Before You Read

Write on the lines below how police departments use DNA to solve crimes.

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### Study Coach

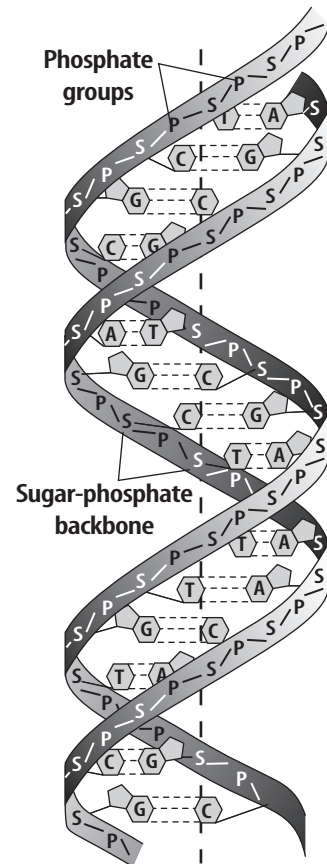
**Discuss** Read a paragraph to yourself, then take turns with your partner saying something about what you have learned. Continue your discussion until you and your partner understand the paragraph. Then repeat the process with the remaining paragraphs in the section.

### ● Read to Learn

#### What is DNA?

Before you could learn to read, you learned the alphabet. The letters of the alphabet are a code you needed to know before you could read. A cell also uses a code. That code contains information for an organism's growth and function. It is stored in a cell's hereditary material. The code is a chemical called deoxyribonucleic acid, or **DNA**. The figure to the right shows the spiral-shaped structure of DNA.

When a cell divides, the DNA code is copied and passed to the new cells. New cells get the same DNA code that was in the original cell. Every cell that has ever been formed in your body or in any organism has DNA.



### Picture This

1. **Infer** Examine the DNA strand in the figure. What is the DNA code used to represent?

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## What does DNA look like?

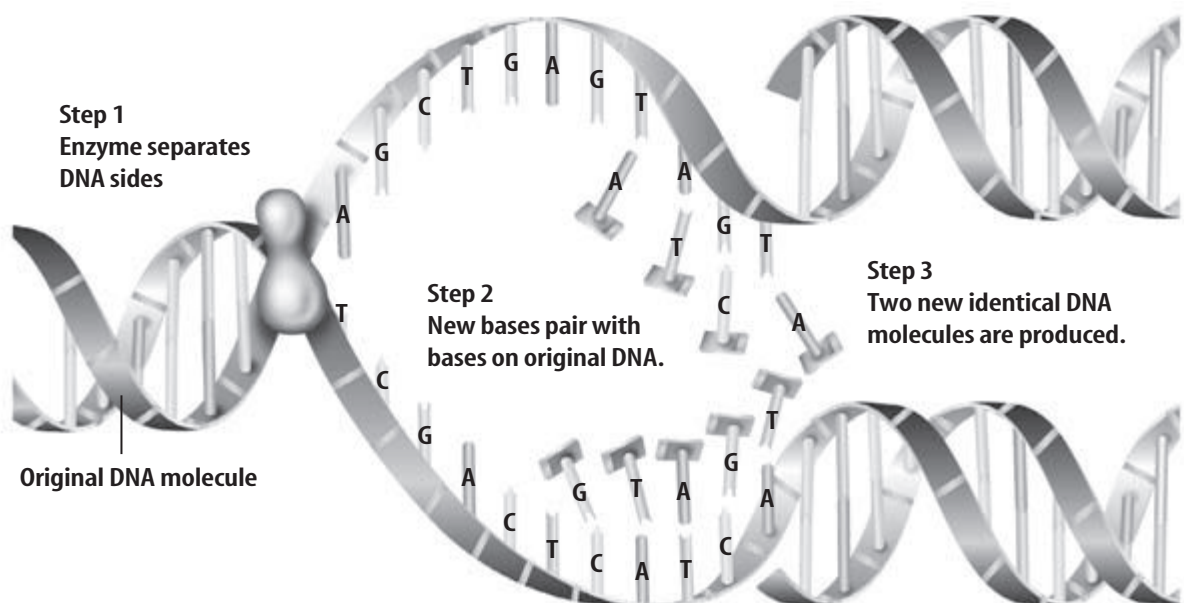
In 1952, scientist Rosalind Franklin discovered that DNA is two chains of molecules. As you can see in the figure on the previous page, DNA looks like a twisted ladder. Each side of the ladder is made up of sugar-phosphate molecules. The sugar in each molecule is called deoxyribose (dee AHK sih ri boh). In 1953, scientists James Watson and Francis Crick made a model of a DNA molecule. ✓

## What are the four nitrogen molecules that make up DNA?

The rungs, or steps, of the DNA ladder are made up of molecules called nitrogen bases. The four kinds of nitrogen bases found in DNA are adenine (A duh neen), guanine (GWAH neen), cytosine (SI tuh seen), and thymine (THI meen). In the DNA model on the previous page, the first letters of the name of each base, A, G, C, and T, are used to stand for the bases. Also notice that adenine (A) always pairs with thymine (T), and guanine (G) always pairs with cytosine (C).

## How is DNA copied?

When chromosomes are copied before mitosis or meiosis, the amount of DNA in the nucleus is doubled. The figure below shows how the DNA copies itself. The two sides of DNA unwind and separate. Each side then becomes a pattern on which a new side can form. The new DNA pattern is exactly the same as the original DNA pattern.



## Reading Check

2. **Identify** What did Rosalind Franklin discover?

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## Picture This

3. **Determine** Write one quiz question in the space below based on one of the steps in this figure.

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### ✓ Reading Check

4. **Explain** where the instructions for making certain proteins are found.

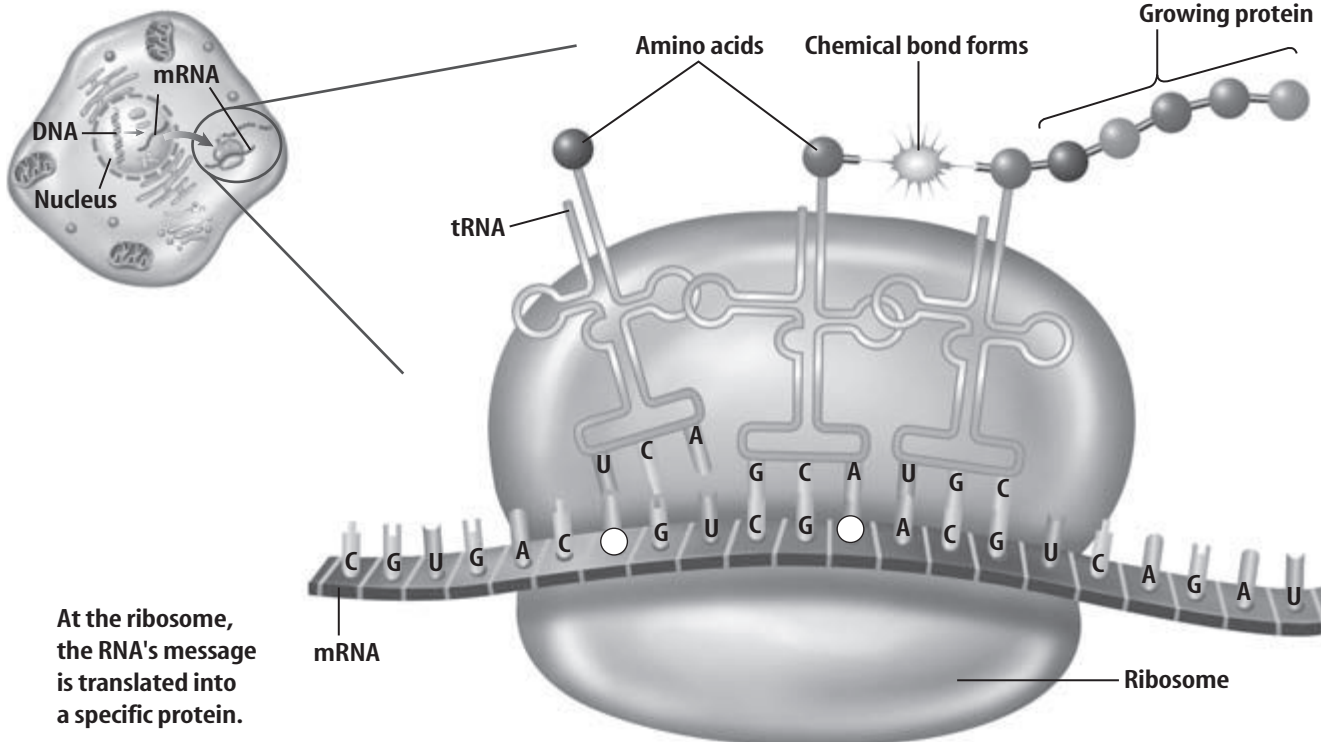
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### Picture This

5. **Apply** Fill in the two circles in the figure with the correct letter.



At the ribosome, the RNA's message is translated into a specific protein.

## Genes

What color are your eyes? How tall are you? The answers to questions like these depend on the kinds of proteins your cells make. Proteins build cells and tissues or work as enzymes. The instructions for making certain proteins are found in genes.

A **gene** is a section of DNA on a chromosome. Each chromosome has hundreds of genes. ✓

### What are proteins?

Proteins build cells and tissues. Proteins are made of chains of many amino acids. The gene decides the order of amino acids in a protein. Changing the order of the amino acids makes a different protein. Genes are found in the nucleus, but proteins are made on ribosomes in cytoplasm.

### What is RNA?

The codes for making proteins are carried from the nucleus to the ribosomes by ribonucleic acid, or **RNA**. RNA is made in the nucleus on a DNA pattern, but it is different from DNA. Look at the model of an RNA molecule below. Notice that RNA is like a ladder with its rungs sawed in half. Like DNA, RNA has the bases A, G, and C. But it has the base uracil (U) instead of thymine (T). The sugar-phosphate molecules in RNA contain the sugar ribose.

## What does RNA do?

There are three main kinds of RNA made from DNA in a cell's nucleus. They are messenger RNA (mRNA), ribosomal RNA (rRNA), and transfer RNA (tRNA). Protein is made when mRNA moves into the cytoplasm. In the cytoplasm, ribosomes, which are made of rRNA, attach to the mRNA. The ribosomes get amino acids from tRNA molecules that are already in the cytoplasm. Inside the ribosomes, three nitrogen bases on the mRNA temporarily match with three nitrogen bases on the tRNA. The same thing happens for the mRNA and another tRNA molecule. The amino acids that are attached to the two tRNA molecules connect. This is the beginning of a protein.

## How do cells control genes?

Even though most cells in an organism have exactly the same genes, they do not make the same proteins. Each cell uses only the genes that make the proteins that it needs. For example, muscle proteins are made in muscle cells but not in nerve cells.

Cells control genes by turning some genes off and turning other genes on. Sometimes the DNA is twisted so tightly that no RNA can be made. Other times, chemicals attach to DNA so that it cannot be used.

## Mutations

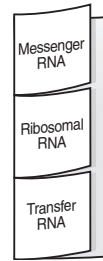
If DNA is not copied exactly, proteins may not be made correctly. These mistakes, called **mutations**, are permanent changes in the DNA sequence of a gene or chromosome. ✓

## What are the results of a mutation?

An organism with a mutation may not be able to grow, repair, or maintain itself. A mutation in a body cell may or may not cause problems for the organism. A mutation in a sex cell, however, makes changes to the species when the organism reproduces. Many mutations are harmful to organisms, often causing their death. Some mutations have no effect on an organism. Other mutations can be helpful to an organism.

### FOLDABLES™

● **Identify** Make a three-tab book, as shown below. Use the Foldable to write facts about the three types of RNA.



### ✓ Reading Check

**6. Explain** What is a mutation?

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## After You Read

### Mini Glossary

**DNA:** a chemical in a cell that contains information for an organism's growth and function

**gene:** a section of DNA on a chromosome that contains the instructions for making a specific protein

**mutations:** any permanent change in the DNA sequence of a gene or chromosome of a cell

**RNA:** a nucleic acid that carries the codes for making proteins from the nucleus to the ribosomes

1. Review the terms and their definitions in the Mini Glossary. Write a short paragraph that contrasts DNA and RNA.

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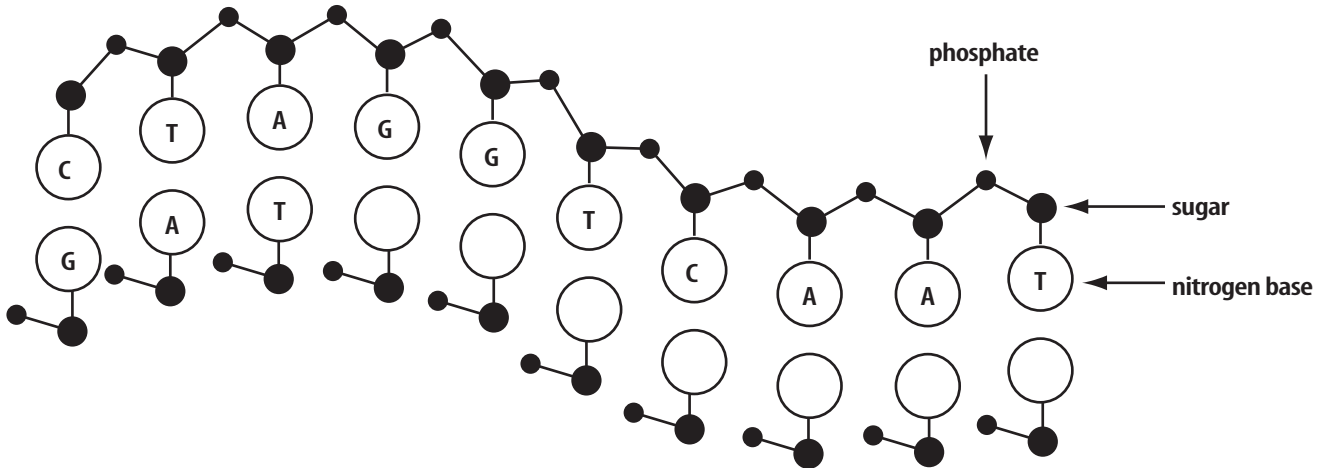
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2. Moving from left to right, write the letters (A, T, C, or G) in the empty circles of the bases that will pair with the bases on the top strand to this DNA molecule. The first three pairs have been created for you.



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