chapter 12

# Molecular Genetics

## section 2 Replication of DNA

MAIN Idea

**DNA replicates by making a complementary strand to each original strand.**

### What You'll Learn

- the role of enzymes in the copying of DNA
- how leading and lagging DNA strands are made

## Before You Read

DNA is the instruction manual for a living thing. Each time one of your cells divides, your DNA is copied. That way, each new cell has its own copy of the instruction manual. On the lines below, list some items that come with instructions.

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Mark the Text

### Identify Main Ideas

As you read, underline or highlight the main ideas in each paragraph.

## Read to Learn

### Semiconservative Replication

Every time a cell divides, it must copy its DNA. That way, each cell has its own copy of the genetic material. When Watson and Crick presented their model of DNA, they also suggested a possible method of replication—semiconservative replication. In **semiconservative replication**, the two strands separate, serve as a pattern, and produce DNA molecules with one strand of the parental DNA and one strand of new DNA. Other scientists, armed with the knowledge of DNA's structure, began to explore ways that cells might copy DNA.

### What are the steps of DNA replication?

Recall that DNA replication occurs during interphase of mitosis and meiosis. The process of semiconservative replication happens in three phases: unwinding, base pairing, and joining.

### What happens during unwinding?

DNA replication is shown in the figure on the next page. In the first phase, an enzyme called DNA helicase unwinds the double helix. Single-stranded binding proteins hold the two strands apart. The RNA primase enzyme adds a short piece of RNA, called an RNA primer, to each strand of DNA.

Reading Check

1. **List** the three phases of semiconservative replication.

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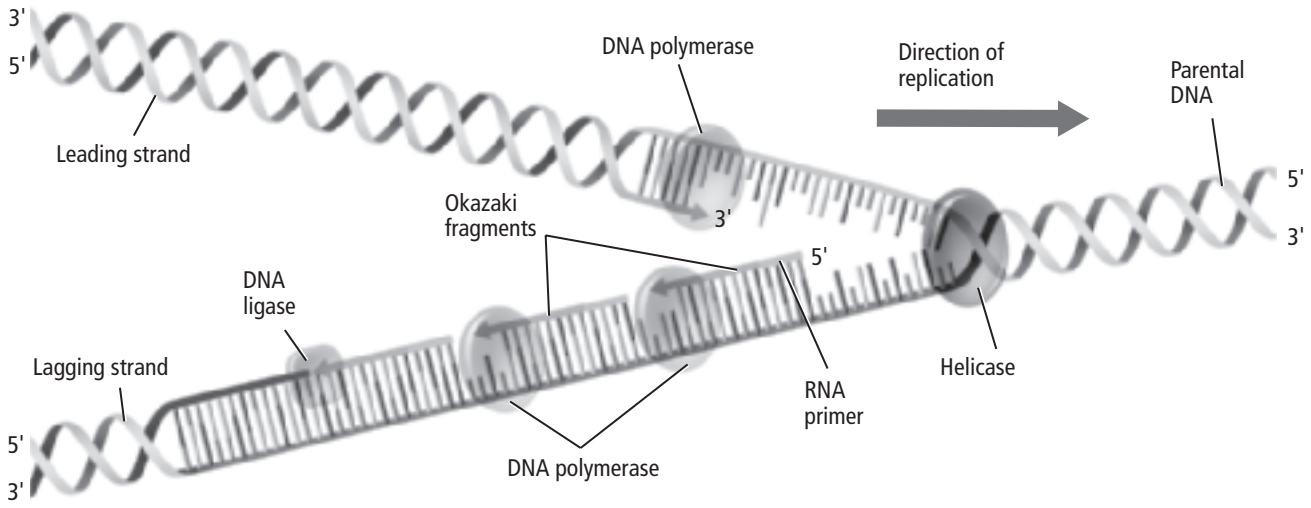
**Semiconservative Replication**




## How does base pairing occur?

In the next step, the enzyme **DNA polymerase** helps the addition of nucleotides, bonding a new nucleotide to the parent strand and creating base pairs as it forms new strands.

Recall that one DNA strand runs 3' to 5'. The other runs 5' to 3'. The two strands are copied differently. One strand, called the leading strand, is made longer as the original DNA unwinds and nucleotides are added to its 3' end. The other strand, called the lagging strand, becomes longer as small pieces called **Okazaki fragments** are added in the 3' to 5' direction.

## How are the fragments joined?

DNA polymerase removes RNA primers and replaces them with DNA nucleotides. When the last RNA primer has been removed and replaced with DNA nucleotides, the enzyme DNA ligase connects the DNA nucleotides.

# Comparing DNA Replication in Eukaryotes and Prokaryotes

Eukaryotic DNA replication occurs at many places at the same time. The sites of DNA replication look like bubbles in the DNA strand.

Prokaryotic DNA is circular. In prokaryotes, the DNA strand is opened at one place on the circle. Replication occurs in both directions, unzipping the circle, until the whole DNA strand is copied.

## Picture This

**2. Identify** Circle the names of the three enzymes involved in the process of semiconservative replication.

## Think it Over

**3. Compare** Name one difference between eukaryotic DNA replication and prokaryotic DNA replication.