

SECTION 2-5

SECTION SUMMARY

Cell Division

Guide for Reading

- ◆ What events take place during the three stages of the cell cycle?
- ◆ What is the role of DNA replication?

The regular sequence of growth and division that cells undergo is known as the **cell cycle**. The cell cycle is divided into three main stages.

The first stage of the cell cycle is called **interphase**. **During interphase, the cell grows to its mature size, makes a copy of its DNA, and prepares to divide into two cells.** During the first part of interphase, the cell doubles in size and produces all the structures needed to carry out its functions. After a cell has grown to its mature size, the cell makes a copy of the DNA in its nucleus in a process called **replication**. At the end of DNA replication, the cell contains two identical sets of DNA.

Once interphase is complete, the second stage of the cell cycle begins. **Mitosis** is the stage during which the cell's nucleus divides into two new nuclei. **During mitosis, one copy of the DNA is distributed into each of the two daughter cells.** Scientists divide mitosis into four parts, or phases: prophase, metaphase, anaphase, and telophase. During prophase, the threadlike chromatin in the cell's nucleus begins to condense into tiny rods. Scientists call each doubled rod of condensed chromatin a **chromosome**. Each identical rod, or strand, of the chromosome is called a **chromatid**. The two strands are held together by a structure called a centromere. As the cell progresses through metaphase, anaphase, and telophase, the chromatids separate from each other and move to opposite ends of the cell. Then two nuclei form around the chromatids at the two ends of the cell.

After mitosis, the final stage of the cell cycle, called **cytokinesis**, completes the process of cell division. **During cytokinesis, the cytoplasm divides, distributing the organelles into each of the two new cells.** Each daughter cell has the same number of chromosomes as the original parent cell. At the end of cytokinesis, each cell enters interphase, and the cycle begins again.

How long it takes a cell to go through one cell cycle depends on the type of cell. The length of each stage in the cell cycle also varies.

A cell makes a copy of its DNA before mitosis occurs. **DNA replication ensures that each daughter cell will have all of the genetic information it needs to carry out its activities.** The two sides of the DNA ladder are made up of alternating sugar and phosphate molecules. Each rung of the DNA ladder is made up of a pair of molecules called nitrogen bases. There are four kinds of nitrogen bases: adenine, thymine, guanine, and cytosine. Adenine only pairs with thymine, and guanine only pairs with cytosine. DNA replication begins when the two sides of the DNA molecule unwind and separate. Next, nitrogen bases in the nucleus pair up with the bases on each half of the DNA molecule. Once the new bases are attached, two new DNA molecules are formed. The order of the bases in each new DNA molecule will exactly match the order in the original DNA molecule.