

Reinforcement 5.1: The Cell Cycle

KEY CONCEPT Cells have distinct phases of growth, reproduction, and normal functions.

Cells have a regular pattern of growth, DNA duplication, and division that is called the **cell cycle**. In eukaryotic cells, the cell cycle consists of four stages: gap 1 (G_1), synthesis (S), gap 2 (G_2), and mitosis (M). G_1 , S, and G_2 are collectively called interphase.

- During gap 1 (G_1), a cell carries out its normal functions. Cells may also increase in size and duplicate their organelles during this stage. Cells must pass a checkpoint before they can progress to the S stage.
- During synthesis (S), cells duplicate their DNA. At the end of the S stage, a cell contains two complete sets of DNA.
- During gap 2 (G_2), a cell continues to grow and carry out its normal functions. Cells must pass a checkpoint before they can progress to the M stage.
- The mitosis (M) stage consists of two processes. **Mitosis** divides the cell nucleus, creating two nuclei that each have a full set of DNA. **Cytokinesis** divides the cytoplasm and organelles, resulting in two separate cells.

Cells divide at different rates to accommodate the needs of an organism. For example, cells that receive a lot of wear and tear, such as the skin, have a life span of only a few days. Cells making up many of the internal organs have a life span of many years.

Cells tend to stay within a certain size range. To maintain a suitable size range, cell growth must be coordinated with cell division. Cell volume increases much faster than cell surface area for most cells. All materials that a cell takes in or secretes enter and exit through the membrane. The cell's surface area must be large enough relative to its overall volume in order for the cell to get its necessary materials. Therefore, most cells tend to be very small.

1. What are the four stages of the cell cycle?

2. What two processes make up the M phase of the cell cycle?

3. Why don't cells all divide at the same rate?

Section Quiz 5.1: The Cell Cycle

Choose the letter of the best answer.

- _____ 1. In which stage of the cell cycle do the nucleus and its contents divide?
 - a. synthesis
 - b. gap 1
 - c. mitosis
 - d. gap 2

- _____ 2. During the gap 1 stage of the cell cycle, a cell
 - a. splits into two new cells.
 - b. carries out its normal functions.
 - c. duplicates its DNA.
 - d. divides its cytoplasm

- _____ 3. Which of the following phrases best describes cytokinesis?
 - a. division of the cytoplasm
 - b. division of the nucleus
 - c. division of DNA
 - d. division of surface area

- _____ 4. Which statement is true about the rates of cell division in eukaryotes?
 - a. They remain the same for the life of the organism.
 - b. They are faster than that of prokaryotes.
 - c. They increase with the age of the organism.
 - d. They vary greatly within an organism

- _____ 5. Which of the following limits the maximum size of a cell?
 - a. the stage of the cell cycle
 - b. the ratio of cell surface area to volume
 - c. the number of mitochondria in the cell
 - d. the size of the organism