

## CHAPTER TWO

### Content Review

1. The cell has three main regions: (1) The plasma membrane is a bilayer of lipids and proteins that encloses the cell; (2) the cytoplasm includes all of the contents of the cell (cytosol, organelles, and inclusions) between the plasma membrane and the nucleus; and (3) the nucleus is the cell's control center, and it contains all of the genetic material of the cell.
2. The plasma membrane forms the cell border. It is composed of both lipids and proteins. It regulates the passage of gases, nutrients, and wastes between the internal and external environments.
3. Passive transport moves substances across a plasma membrane without any expenditure of energy by the cell. Passive transport processes include simple diffusion, osmosis, facilitated diffusion, and bulk filtration.
4. Active transport differs from passive transport in that substances are moved against a concentration gradient and energy in the form of ATP must be expended. The types of endocytosis are phagocytosis, pinocytosis, and receptor-mediated endocytosis.
5. Organelles are complex, organized cellular structures that are either (1) membrane-bound or (2) non-membrane-bound. The most obvious difference is that membrane-bound organelles are enclosed within a membrane similar to a plasma membrane to separate organelle components from the rest of the cell, and non-membrane-bound organelles are always in direct contact with the cytosol of the cell.
6. Lysosomes are membrane sacs formed by the Golgi apparatus. They contain enzymes used by the cell to digest waste products and ingested macromolecules. Peroxisomes are membrane-enclosed sacs that are usually smaller in diameter than lysosomes. Peroxisomes detoxify specific harmful substances within the cell.
7. The cytoskeleton is composed of microfilaments, intermediate filaments, and microtubules. Microfilaments are composed of thin protein filaments (actin proteins) organized into two intertwined strands. They maintain cell shape, support cell shape changes, help muscles contract, separate the two cells formed during cell division, and facilitate cytoplasmic streaming. Intermediate filaments are slightly larger and more rigid than microfilaments. They support cells structurally and stabilize junctions between cells. Microtubules are hollow tubes composed of long chains of proteins called tubulin. They help hold organelles in place, maintain cell shape and rigidity, direct organelle movement between different regions of the cell, provide a means of cell motility, and move chromosomes during the process of cell division.
8. The nucleus contains three basic structures: a nuclear envelope, a nucleolus, and chromatin. The nuclear envelope is a double membrane structure that encloses the nucleus. The nucleolus is a dark-staining body responsible for making both small and large subunits of ribosomes. Some cells have multiple nucleoli. Chromatin is the name of the tightly coiled strands of DNA and protein in the nucleus.
9. Interphase is a time in the cell cycle when the cell appears to be resting because no overt activity is observed. However, if the cell is preparing for division, it is also a time of growth and making new cellular parts. Interphase is composed of three distinct phases:  $G_1$ , S, and  $G_2$ .

10. The four consecutive phases (or stages) during mitosis are prophase, metaphase, anaphase, and telophase. During prophase, the replicated DNA in chromatin supercoils into chromosomes (a duplicated chromosome is composed of two sister chromatids); the nucleolus breaks down and disappears; microtubules form from centrioles that move to opposite sides of the cell; and the nuclear envelope disappears. During metaphase, the chromosomes line up along the equatorial plate; the mitotic spindle is completely formed. During anaphase, sister chromatids are pulled apart and begin to move toward opposite sides of the cell. During telophase, single-stranded chromosomes arrive at each pole of the cell; the mitotic spindle breaks up; and new nucleoli appear.