

3 Cell Structure and Function

Chapter Summary

Chapter three describes various structures that are characteristic of most human cells and explains their functions. These structures include the plasma (cell) membrane, which regulates the entrance and exiting of materials into and out of the cell; the nucleus, which contains the genetic material; and the cytoplasm, which contains the organelles. The organelles perform specific functions within a cell much like organs perform specific functions within an organism. Several forms of plasma membrane transport are explained, including passive transport mechanisms which do not require cellular energy, as in diffusion, osmosis, and filtration, and active transport which does require cellular energy. The cell cycle and mitotic cell division are discussed, as are two events that occur during interphase at the cell cycle: DNA replication and protein synthesis. In order for the information on genes to be used to direct the synthesis of a protein, a messenger RNA copy of that gene must be constructed in the nucleus and shipped out to the ribosomes in the cytoplasm. At a ribosome, transfer RNA molecules carry over the appropriate amino acids and place them in a specific sequence that is coded for by the sequence of bases on the messenger RNA molecule. Mitotic cell division allows for growth and tissue repair and produces cells with the same number of chromosomes as the parent cell.

Chapter Outline

- I. Cellular Organization
 - A. The Plasma Membrane
 - B. The Nucleus
 - C. Ribosomes
 - D. Endomembrane System
 - 1. Endoplasmic Reticulum
 - 2. The Golgi Apparatus
 - 3. Lysosomes
 - E. Mitochondria
 - F. The Cytoskeleton
 - G. Centrioles
- II. Crossing the Plasma Membrane
 - A. Diffusion
 - B. Osmosis
 - C. Filtration
 - D. Transport by Carriers
 - E. Endocytosis and Exocytosis
- V. The Cell Cycle
 - A. Cell Cycle Stages
 - 1. Interphase
 - a. G₁ phase
 - b. S phase
 - c. G₂ phase
 - 2. Mitotic Stage
 - B. Events During Interphase
 - 1. Replication of DNA
 - C. Protein Synthesis
 - 1. Transcription and Translation

- D. Events During the Mitotic Stage
 1. Prophase
 - a. Structure of the Spindle
 2. Metaphase
 3. Anaphase
 - a. Function of the Spindle
 4. Telophase and Cytokinesis
 5. Importance of Mitosis

Suggested Student Activities

1. Label organelles on diagrams of cells and list the functions of the organelles.
2. Label structures that are involved in mitosis on a diagram of a dividing cell.
3. Place sheep red blood cells in hyper-, hypo-, and isotonic solutions and observe the results (a difference is evident even without a microscope).
4. Compare in detail the various forms of membrane transport.

Answers to Objective Questions

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|--------------------------|---------------------------|
| 1. c | 10. carrier, ATP |
| 2. e | 11. phagocytosis |
| 3. a | 12. 46 |
| 4. d | 13. cytoplasm, organelles |
| 5. b | 14. d |
| 6. protein, phospholipid | 15. b |
| 7. ribosomes | 16. a |
| 8. centrioles | 17. c |
| 9. hypotonic | |

Answers to Medical Terminology Reinforcement Exercise

1. hemo/lysis - destruction of blood (breakdown of red blood cells)
2. cyto/logy - study of cells
3. cyto/meter - instrument to measure cells
4. nucleo/plasm - substance in the nucleus
5. pan/cyto/penia - deficiency of all cell elements in the blood
6. cyto/genic - begins/originates with the cell
7. erythro/cyte - red blood cell
8. apopt/osis - programmed cell death
9. a/trophy - wasting of tissues
10. hyper/trophy - increase in size of a structure
11. onc/otic pressure (colloid osmotic pressure) - pressure difference between osmotic pressure at blood and tissue fluid
12. hyper/plasia - over formation of body part

Audiovisual Materials

Health Chart - Cell Structure and Tissues (Concept Media)
 Mitosis Model (#2067)(Concept Media)