


3

Cytology

I. Introduction to Cytology

 *Concept:* The cell is the fundamental structural and functional unit of the body. Although cells vary widely in size and shape, they have basic structural similarities, and all cells metabolize to stay alive.


A. Multiple Choice Questions

- ___ 1. Cells were first observed as boxlike cavities in cork by
(a) Schleiden. (c) Hooke.
(b) Schwann. (d) both a and b.
- ___ 2. The cell theory states that living organisms are composed of
(a) proteins. (c) lipids.
(b) fats. (d) none of the above.
- ___ 3. Which human cell can be seen with the unaided eye?
(a) ovum (c) squamous cell
(b) red blood cell (d) both a and c
- ___ 4. A(n) _____ is a type of cell that is specialized to respond to a stimulus and transmit an impulse.
(a) neuron (c) effector
(b) ganglion (d) fiber

B. True-False Questions

- ___ 1. Metabolism is essential for cells to function properly.
- ___ 2. Cytology is the study of cells, while histology is the study of tissues.
- ___ 3. Etiology is the study of the life span of cells.
- ___ 4. With respect to the estimated 60 trillion to 100 trillion cells of the adult human, there are millions of specific types.

II. Cellular Chemistry

 *Concept:* All tissues and organs are composed of cellular structures that have basically the same chemical components. The most important inorganic substances in the body include water, acids, bases, and salts. The most important organic substances in the body include proteins, carbohydrates, and lipids.

A. Multiple Choice Questions

- ___ 1. Oxygen occurs as what percentage of body weight in the human organism?
(a) 95% (c) 18%
(b) 65% (d) 10%

- _____ 2. Which is *not* an organic compound within a cell?
 (a) protein (c) lipid
 (b) carbohydrate (d) water
- _____ 3. Water functions as a reactant in the breakdown, or _____, of food.
 (a) metabolism (c) hydrophobia
 (b) hydrolysis (d) emulsification
- _____ 4. The ratio of hydrogen to oxygen in carbohydrate compounds is
 (a) 1:1. (c) 2:2.
 (b) 2:1. (d) 2:3.

B. True–False Questions

- _____ 1. Water is the most common solvent within the body.
- _____ 2. Hormones are a specialized group of messenger carbohydrate molecules.
- _____ 3. If a person is deprived of food for an extended period of time, glycogen and fat reserves are used first, and the body will eventually break down protein to create needed energy.
- _____ 4. Lipids function only as a stored food supply for metabolic energy.

III. Cellular Structure

☞ *Concept:* The cell membrane separates the interior of a cell from the extracellular environment. The passage of substances into and out of the cell is regulated by the cell membrane. Most of the metabolic activities of a cell occur within the cytoplasmic organelles. The nucleus functions in protein synthesis and cell reproduction.

A. Multiple Choice Questions


- _____ 1. Which of the following is *not* a component of a cell?
 (a) nucleus (c) chromoplasm
 (b) cell membrane (d) protoplasm
- _____ 2. The process of passive movement of molecules from regions of higher concentration toward regions of lower concentration is called
 (a) osmosis. (c) diffusion.
 (b) active transport. (d) filtration.
- _____ 3. The principal source of energy for the filtration that occurs within the kidneys is
 (a) cellular energy. (c) molecular motion.
 (b) blood pressure. (d) carrier energy.
- _____ 4. The permeability of the cell membrane depends on each of the following factors *except*
 (a) the size of molecules. (c) the speed of molecular movement.
 (b) the ionic charge. (d) the presence of carrier molecules.
- _____ 5. Cell membranes in contact with the lumen of the GI (gastrointestinal) tract are highly specialized to permit
 (a) absorption. (d) filtration.
 (b) nucleoplasmic retention. (e) both a and d.
 (c) ectoplasmic retention.

- ___ 6. A hearing sensation within the spiral organ (organ of Corti) of the inner ear is initiated through the tactile stimulation of the specialized cilia-like receptors called
 (a) hair cells. (c) stereocilia.
 (b) microvilli. (d) auditory filaments.
- ___ 7. Protoplasm includes
 (a) the cytoplasm. (c) the ectoplasm.
 (b) the nucleoplasm. (d) both a and b.
- ___ 8. Ribosomes are tiny granules that
 (a) provide cellular energy in the form of ATP.
 (b) synthesize proteins.
 (c) function as carrier molecules.
 (d) synthesize carbohydrates.
- ___ 9. Mitochondria are double-membraned saclike organelles that
 (a) synthesize carbohydrates and form glycoproteins.
 (b) regulate the transport of RNA molecules.
 (c) synthesize proteins.
 (d) control the production of cellular energy in the form of ATP.
- ___ 10. Phagocytic activity is made possible by the enzymatic function of
 (a) vacuoles. (c) the Golgi complex.
 (b) lysosomes. (d) smooth ER.

B. True–False Questions

- ___ 1. The cell membrane encloses the components of the cell and regulates the passage of substances into and out of the cell.
- ___ 2. Both diffusion and osmosis involve passive movement of molecules across a cell membrane.
- ___ 3. Microvilli are specialized extensions of a cell membrane extending into the lumen of a duct.
- ___ 4. The Golgi complex is involved in the synthesis of carbohydrates and cellular secretion—a process called exocytosis.
- ___ 5. In pinocytosis, the cell membrane engulfs solid particles from the surrounding extracellular environment.
- ___ 6. Goblet cells secrete digestive enzymes.
- ___ 7. The only type of cell in humans that has a flagellum is a sperm cell.
- ___ 8. The perinuclear cisternae are the minute pores located along the nuclear membrane.
- ___ 9. Ribosomes are produced by nucleoli within the nucleus of a cell.
- ___ 10. The term *chromatin* is a synonym for the term *chromosome*.

IV. Cell Cycle

 **Concept:** A cell cycle consists of growth, synthesis, and mitosis. Growth is the increase in cellular mass resulting from metabolism. Synthesis is the production of DNA and RNA to regulate cellular activity. Mitosis is the division of the nucleus and cytoplasm of a cell that results in the formation of two daughter cells.

A. Multiple Choice Questions

- ___ 1. The term *double helix* best describes
- (a) the appearance of a spiraled chromosome.
 - (b) the structure of the nucleotides in deoxyribonucleic acid.
 - (c) the series of spindle fibers attached to the centrioles during prophase.
 - (d) the equatorial plate during prophase.
- ___ 2. Which of the following is *not* a type of nitrogenous base in a DNA molecule?
- (a) guanine
 - (b) thymine
 - (c) atropine
 - (d) cytosine
- ___ 3. In which phase of the cell cycle does the replication of the DNA occur?
- (a) S phase
 - (b) M phase
 - (c) G₁ phase
 - (d) G₂ phase
- ___ 4. Cytokinesis is
- (a) the division of the cytoplasm during cell division.
 - (b) the splitting of the chromosomes at the equatorial plate.
 - (c) the division of the chromosomes during cell division.
 - (d) the replication of the DNA molecule.
- ___ 5. Which of the following series of events of mitosis is in correct sequence?
- (a) telophase, anaphase, metaphase, prophase
 - (b) prophase, telophase, metaphase, anaphase
 - (c) anaphase, prophase, metaphase, telophase
 - (d) prophase, metaphase, anaphase, telophase

B. True–False Questions

- ___ 1. Approximately 2% of body mass is replaced each day.
- ___ 2. Before a cell can divide, it must first duplicate its chromosomes.
- ___ 3. The rungs of a DNA molecule are composed of pairs of nucleic acids.
- ___ 4. In a DNA molecule, adenine always pairs with guanine and thymine always pairs with cytosine.

C. Matching Questions

Match the stage of mitosis with the event that characterizes it.

- | | |
|-------------------|---|
| ___ 1. telophase | (a) daughter chromosomes reach their respective poles |
| ___ 2. prophase | (b) cell is preparatory for dividing |
| ___ 3. metaphase | (c) chromatic pairs line up on equatorial plane |
| ___ 4. anaphase | (d) chromosomes pull apart |
| ___ 5. interphase | (e) distinct chromosomes form from nuclear chromatin |

V. Clinical Considerations

A. Multiple Choice Questions

- ___ 1. Compensatory hypertrophy in muscles is characterized by
(a) an increase in number of cells.
(b) an increase in cellular mass in response to increased work.
(c) an increase in cellular mass because of increased protein absorption.
(d) a greater amount of blood flow to the muscle cells.
- ___ 2. Specialized cellular change in which one type of cell transforms into another is known as
(a) hyperplasia. (c) atrophy.
(b) metaplasia. (d) hypertrophy.
- ___ 3. An abnormally high cellular concentration of lipids and glycogen suggests a dysfunction of
(a) the lysosomes. (c) the mitochondria.
(b) the centrioles. (d) the endoplasmic reticulum.
- ___ 4. Which of the following is true?
(a) Cancerous cells divide more rapidly than regular cells.
(b) Cancerous cells divide at about the same rate as regular cells.
(c) Cancerous cells are more resistant to death than regular cells.
(d) Both a and c are true.

B. True–False Questions

- ___ 1. Bacteria are pathogens whose metabolic wastes poison surrounding cells.
- ___ 2. About 12% of all congenital malformations are caused by mutations.
- ___ 3. Monosomy is a genetic condition characterized by the absence of an entire chromosome.
- ___ 4. Carcinogens are cancers that metastasize and establish sites of secondary growth.

VI. Chapter Review

A. Completion Questions

1. The _____ states that all organisms are composed of cells.
2. The microfilaments and microtubules contained within a cell form the _____.
3. _____ are nitrogen-containing organic compounds composed of amino acid molecules.
4. During _____, the cell membrane invaginates, producing a deep furrow into which minute droplets of fluid become entrapped.
5. Lysosomes within a cell are responsible for _____, a process that destroys worn-out organelles so that they can be continuously replaced.
6. The cell nucleus is surrounded by a _____ composed of an inner and an outer membrane.

7. _____ are organic compounds that protect and insulate various body structures and serve as a reserve energy source.
8. _____ are found only in cells that are capable of mitosis.
9. Growth resulting from an increase in cell number is termed _____, whereas growth resulting from an increase in cell size is termed _____.
10. Each chromosome consists of a coiled _____ molecule.

B. Matching Questions

Match the cellular component with both its structure and its function.

- | | | |
|------------------------------|---------------------------------------|---|
| ___ 1. cytoplasm | A. phospholipid and protein | (a) carbohydrate synthesis; secretion of lipids and glycoproteins |
| ___ 2. mitochondria | B. membranous sacs; folded internally | (b) control of cellular activity |
| ___ 3. lysosomes | C. granular particles | (c) transport of substances; storage; synthesis; secretion |
| ___ 4. endoplasmic reticulum | D. rodlike centrioles | (d) movement at cell's surface |
| ___ 5. Golgi complex | E. jellylike matrix | (e) suspension of organelles |
| ___ 6. chromatin | F. protein and DNA molecules | (f) selective permeability |
| ___ 7. cilia | G. flattened membranous sacs | (g) energy transformation into ATP |
| ___ 8. cell membrane | H. membranous sacs | (h) separation of chromosomes during mitosis |
| ___ 9. centrosome | I. cytoplasmic extensions | (i) protein synthesis |
| ___ 10. ribosomes | J. interconnected tubules | (j) digestion of molecules and worn cells |