

TEST BANK

PATHOPHYSIOLOGY

THE BIOLOGIC BASIS FOR DISEASE IN ADULTS AND CHILDREN

8th Edition

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Chapter 01: Cellular Biology

MULTIPLE CHOICE

1. Which statement best describes the cellular function of metabolic absorption?
 - a. Cells can produce proteins.
 - b. Cells can secrete digestive enzymes.
 - c. Cells can take in and use nutrients.
 - d. Cells can synthesize fats.

ANS: C

In metabolic absorption, all cells take in and use nutrients and other substances from their surroundings. The remaining options are not inclusive in their descriptions of cellular metabolic absorption.

PTS: 1 DIF: Cognitive Level: Remembering

2. Where is most of a cell's genetic information, including RNA and DNA, contained?
 - a. Mitochondria
 - b. Ribosome
 - c. Nucleolus
 - d. Lysosome

ANS: C

The nucleus contains the *nucleolus*, a small dense structure composed largely of RNA, most of the cellular DNA, and the DNA-binding proteins, such as the histones, which regulate its activity. The mitochondria are responsible for cellular respiration and energy production. Ribosomes' chief function is to provide sites for cellular protein synthesis. Lysosomes function as the intracellular digestive system.

PTS: 1 DIF: Cognitive Level: Remembering

3. Which component of the cell produces hydrogen peroxide (H₂O₂) by using oxygen to remove hydrogen atoms from specific substrates in an oxidative reaction?
 - a. Lysosomes
 - b. Peroxisomes
 - c. Ribosomes
 - d. Endosome

ANS: B

Peroxisomes are so named because they usually contain enzymes that use oxygen to remove hydrogen atoms from specific substrates in an oxidative reaction that produces H_2O_2 , which is a powerful oxidant and potentially destructive if it accumulates or escapes from peroxisomes. Ribosomes are RNA-protein complexes (nucleoproteins) that are synthesized in the nucleolus and secreted into the cytoplasm through pores in the nuclear envelope called *nuclear pore complexes*. Lysosomes are saclike structures that originate from the Golgi complex and contain more than 40 digestive enzymes called *hydrolases*, which catalyze bonds in proteins, lipids, nucleic acids, and carbohydrates. An endosome is a vesical that has been pinched off from the cellular membrane.

PTS: 1 DIF: Cognitive Level: Remembering

4. Which cell component is capable of cellular autodigestion when it is released during cell injury?
- Ribosome
 - Golgi complex
 - Smooth endoplasmic reticulum
 - Lysosomes

ANS: D

The lysosomal membrane acts as a protective shield between the powerful digestive enzymes within the lysosome and the cytoplasm, preventing their leakage into the cytoplasmic matrix. Disruption of the membrane by various treatments or cellular injury leads to a release of the lysosomal enzymes, which can then react with their specific substrates, causing *cellular self-digestion*. The chief function of a ribosome is to provide sites for cellular protein synthesis. The Golgi complex is a network of flattened, smooth vesicles and membranes often located near the cell nucleus. The smooth endoplasmic reticulum is involved in steroid hormone production and removing toxic substances from the cell.

PTS: 1 DIF: Cognitive Level: Remembering

5. Which cAMP-mediated response is related to antidiuretic hormone?
- Increased heart rate and force of contraction
 - Secretion of cortisol
 - Increased retention of water
 - Breakdown of fat

ANS: C

Antidiuretic hormone leads to increased retention of water in the body. Epinephrine causes increases in heart rate and force of contraction. Increased cortisol secretion is due to ACTH. Breakdown of fat is due to glucagon.

PTS: 1 DIF: Cognitive Level: Remembering

6. During which phase of the cell cycle is DNA synthesized?
- G_1
 - S
 - G_2
 - M

ANS: B

The four designated phases of the cell cycle are: (1) the G₁ phase (G = gap), which is the period between the M phase (M = mitosis) and the start of DNA synthesis; (2) the S phase (S = synthesis), during which DNA is synthesized in the cell nucleus; (3) the G₂ phase, during which RNA and protein synthesis occurs, the period between the completion of DNA synthesis and the next phase (M); and (4) the M phase, which includes nuclear and cytoplasmic division.

PTS: 1 DIF: Cognitive Level: Remembering

7. What organic compound facilitates transportation across cell membranes by acting as receptors, transport channels for electrolytes, and enzymes to drive active pumps?
- Lipids
 - Proteases
 - Proteins
 - Carbohydrates

ANS: C

Proteins have several functions, including acting as receptors, transport channels for electrolytes, and enzymes to drive active pumps. Lipids help act as the “glue” holding cell membranes together. Proteases cause the breakdown of protein. Carbohydrates are involved in cellular protection and lubrication and help produce energy via oxidative phosphorylation.

PTS: 1 DIF: Cognitive Level: Remembering

8. Understanding the various steps of proteolytic cascades may be useful in designing drug therapy for which human diseases?
- Cardiac and vascular disorders
 - Autoimmune and malignant disorders
 - Gastrointestinal and renal disorders
 - Endocrine and gastrointestinal disorders

ANS: B

Understanding the various steps involved in this process is crucial for designing drug interventions. Dysregulation of proteases features prominently in many human diseases, including cancer, autoimmunity, and neurodegenerative disorders. Cardiac, vascular, gastrointestinal, renal, and endocrine disorders do not involve this process.

PTS: 1 DIF: Cognitive Level: Remembering

9. Which structure prevents water-soluble molecules from entering cells across the plasma membrane?
- Carbohydrate chains
 - Glycoprotein channels
 - Membrane channel proteins
 - Lipid bilayer

ANS: D

The bilayer's structure accounts for one of the essential functions of the plasma membrane. It is impermeable to most water-soluble molecules (molecules that dissolve in water) because the water-soluble molecules are insoluble in the oily core region. The bilayer serves as a barrier to the diffusion of water and hydrophilic substances while allowing lipid-soluble molecules, such as oxygen (O₂) and carbon dioxide (CO₂), to diffuse through it readily. Carbohydrate chains, glycoprotein channels, and membrane channel proteins do not prevent water-soluble molecules from entering cells across the cell membrane.

PTS: 1 DIF: Cognitive Level: Remembering

10. A student asks for an explanation of the absolute refractory period of the action potential. What response by the professor is best?
- A stronger than normal impulse will evoke another response.
 - No stimulus is able to evoke another response at this time.
 - Multiple stimuli can produce more rapid action potentials.
 - The hyperpolarized state means a weaker stimulus produces a response.

ANS: B

During the absolute refractory state of the action potential, no stimulus is able to evoke another response from the cell. A stronger than normal impulse may generate a response in the relative refractory period. This period of time is not related to the number of stimuli. A hyperpolarized state means a stronger than normal stimulus would be needed to generate a response.

PTS: 1 DIF: Cognitive Level: Remembering

11. Which form of cell communication is used to communicate within the cell itself and with other cells in direct physical contact?
- Protein channel (gap junction)
 - Plasma membrane-bound signaling molecules
 - Hormone secretion such as neurotransmitters
 - Extracellular chemical messengers such as ligands

ANS: B

Cells communicate in three main ways; they display plasma membrane-bound signaling molecules that affect the cell itself and other cells in direct physical contact with it, they affect receptor proteins inside the target cell, and they form protein channels (gap junctions) that directly coordinate the activities of adjacent cells. Neurotransmitters are released by neurons and cross the synaptic cleft to communicate with the cells they innervate. Ligands are involved in binding processes.

PTS: 1 DIF: Cognitive Level: Remembering

12. Which mode of chemical signaling uses blood to transport communication to cells some distance away?
- Paracrine
 - Autocrine
 - Neurotransmitter
 - Hormonal

ANS: D

Chemical signaling can be classified into three categories: (1) local-chemical mediator, (2) hormone, and (3) neurotransmitter. Hormones are released by one set of cells and travel through tissues or the bloodstream to another set of cells where they produce a response by those cells. In paracrine signaling, cells secrete local chemical mediators that are quickly absorbed, destroyed, or immobilized. Paracrine signaling requires close membrane-to-membrane contact. Paracrine signaling usually involves different cell types; however, cells also may produce signals that they, themselves, respond to, which is called autocrine signaling. Neurotransmitters are released by neurons and cross the synaptic cleft to communicate with the cells they innervate.

PTS: 1 DIF: Cognitive Level: Remembering

13. Which mode of chemical signaling uses local chemical mediators that are quickly taken up, destroyed, or immobilized?
- Paracrine
 - Autocrine
 - Neurotransmitter
 - Hormone

ANS: A

In paracrine signaling, cells secrete local chemical mediators that are quickly taken up, destroyed, or immobilized. Autocrine signaling occurs when the target cells produce signals that they themselves respond to. Neurotransmitters are released by neurons and cross the synaptic cleft to communicate with the cells they innervate. Hormones are released by one set of cells and travel through tissues or the bloodstream to another set of cells where they produce a response by those cells.

PTS: 1 DIF: Cognitive Level: Remembering

14. Neurotransmitters affect the postsynaptic membrane by binding to which structure?
- Lipids
 - Ribosomes
 - Amphipathic lipids
 - Receptors

ANS: D

In each type of chemical signaling, the target cell receives the signal by first attaching to its receptors. The other options do not correctly describe this process.

PTS: 1 DIF: Cognitive Level: Remembering

15. How do cells receive communication from the extracellular fluid surrounding them?
- Protein channel (gap junction)
 - Plasma membrane-bound signaling molecules (involving receptors)
 - Hormone secretion such as neurotransmitters
 - Chemical messengers such as ligands

ANS: D

Signal transduction involves incoming signals or instructions from extracellular chemical messengers (ligands) that are conveyed to the cell's interior for execution. The other options do not correctly describe how cells receive communication from the surrounding extracellular fluid.

PTS: 1 DIF: Cognitive Level: Remembering

16. Which molecule provides the second messenger necessary for extracellular communication to be activated?
- Guanosine triphosphate (GTP)
 - Adenosine monophosphate (AMP)
 - Adenosine triphosphate (ATP)
 - Guanosine diphosphate (GDP)

ANS: B

The two major second-messenger pathways are cyclic AMP (cAMP) and calcium (Ca^{++}). GTP, ATP, and GDP are not major second-messenger pathways. GTP and GDP are "middlemen" or intermediaries. Nutrients are transformed into energy in the form of ATP.

PTS: 1 DIF: Cognitive Level: Remembering

17. Under anaerobic conditions, what process provides energy for the cell?
- Oxidative phosphorylation
 - Glycolysis
 - Lactolysis
 - Passive transport

ANS: B

Glycolysis provides energy to the cells when oxygen delivery is insufficient or delayed. Oxidative phosphorylation is the process by which energy produced from nutrients is transferred to ATP. Lactolysis is the breakdown of lactose. Passive transport is the movement of water and small, nonelectrically charge molecules across plasma membranes.

PTS: 1 DIF: Cognitive Level: Remembering

18. What is the mechanism by which the energy produced from carbohydrates, proteins, and lipids is transferred to adenosine triphosphate (ATP)?
- Anaerobic glycolysis
 - Oxidative cellular metabolism
 - Oxidative phosphorylation
 - Tricarboxylic acid phosphorylation

ANS: C

Oxidative phosphorylation occurs in the mitochondria and is the mechanism by which the energy produced from carbohydrates, fats, and proteins is transferred to ATP. Glycolysis provides energy to the cells when oxygen delivery is insufficient or delayed. Oxidative cellular metabolism and tricarboxylic acid phosphorylation are not involved in transferring energy to ATP.

PTS: 1 DIF: Cognitive Level: Remembering

19. Passive transport is best described with which statement?
- Being driven by osmosis, hydrostatic pressure, and diffusion
 - Involving receptors that can bind with substances being transported
 - Being capable of transporting macromolecules
 - Requiring energy generated by the cell

ANS: A

Water and small electrically uncharged molecules move easily through pores in the plasma membrane's lipid bilayer. This process, called *passive transport*, naturally occurs through any semipermeable barrier. It is driven by osmosis, hydrostatic pressure, and diffusion, all of which depend on the laws of physics and do not require life. The other options do not correctly describe passive transport.

PTS: 1 DIF: Cognitive Level: Remembering

20. Which is the best example of active transport?
- Movement across a membrane due to differences in solute concentration
 - Movement requiring the expenditure of metabolic energy
 - Movement of two molecules simultaneously in one direction
 - Movement of two molecules simultaneously in opposite directions

ANS: B

Active transport requires a life, biologic activity, and the expenditure of metabolic energy. Movement due simply to differences in concentration gradients is called passive transport. Movement of two molecules in the same direction is called symport, while moving two molecules in opposite directions is called antiport.

PTS: 1 DIF: Cognitive Level: Remembering

21. Which method of transport uses transmembrane proteins with receptors with a high degree of specificity for the substance being transported?
- Active
 - Mediated
 - Transmembranous
 - Passive

ANS: B

Mediated transport (passive and active) involves integral or transmembrane proteins with receptors having a high degree of specificity for the substance being transported. Active and passive transport are opposites with active transport requiring the use of energy and passive transport relying on osmosis, hydrostatic pressure, and diffusion and not energy. Transmembranous means "across membranes."

PTS: 1 DIF: Cognitive Level: Remembering

22. The movement of fluid across the arterial end of capillary membranes into the interstitial fluid surrounding the capillary is an example of which fluid movement process?
- Hydrostatic pressure

- b. Osmosis
- c. Diffusion
- d. Active transport

ANS: A

Hydrostatic pressure is the mechanical force of water pushing against cellular membranes.

Osmosis is the movement of water “down” a concentration gradient, that is, across a semipermeable membrane from a region of higher water concentration to a region of lower water concentration. Diffusion is the movement of a solute molecule from an area of greater solute concentration to an area of lesser solute concentration. Active transport requires a life, biologic activity, and the expenditure of metabolic energy.

PTS: 1 DIF: Cognitive Level: Remembering

23. A student asks why osmolality is preferred over osmolarity as the measurement of osmotic activity in the clinical assessment of individuals. What response by the professor is most accurate?
- a. Plasma contains sodium and chloride, which influence the volume of solution.
 - b. Volume affects perfusion more than the weight of solutes.
 - c. More of the weight of plasma is influenced by solutes rather than by water.
 - d. Osmotic activity depends on the concentration of solutes present in plasma.

ANS: C

Osmolality is a measure of the number of milliosmoles per kilogram (mOsm/kg) of water, or the concentration of molecules per *weight* of water. Osmolarity is a measure of the number of milliosmoles per liter (mOsm/L) of solution, or the concentration of molecules per *volume* of solution. Osmolality is a measure of the number of milliosmoles per kilogram (mOsm/kg) of water, or the concentration of molecules per *weight* of water. Osmolarity is a measure of the number of milliosmoles per liter (mOsm/L) of solution, or the concentration of molecules per *volume* of solution. In plasma, less of the plasma weight is water; therefore the overall concentration of particles is greater. The osmolality will be greater than the osmolarity because of the smaller proportion of water. Osmolality is thus the preferred measure of osmotic activity in clinical assessment of individuals.

PTS: 1 DIF: Cognitive Level: Remembering

24. A patient who has diarrhea receives a 3% saline solution intravenously to replace the sodium and chloride lost in the stool. What effect will this fluid replacement have on cells?
- a. Become hydrated
 - b. Swell or burst
 - c. Shrink
 - d. Divide

ANS: C

A hypertonic solution has a concentration of greater than 285 to 294 mOsm/kg. An example of a hypertonic solution is 3% saline solution. Water can be pulled out of the cells by a hypertonic solution; therefore the cells shrink. An isotonic solution will cause the cells to become more hydrated without disrupting the osmolality of either intracellular or extracellular fluid. Hypotonic solutions can cause cells to swell or burst. No solutions lead to cell division.

PTS: 1 DIF: Cognitive Level: Remembering

25. The transport of glucose from the blood to the cell is accomplished by which process?
- Hydrostatic pressure
 - Active diffusion
 - Passive osmosis
 - Mediated transport

ANS: D

Mediated transport is the means by which glucose is transported from the blood to the cells. This process uses transport proteins. Hydrostatic pressure is the force of water pushing against a cell membrane. Diffusion is a passive process, not active. Osmosis is the movement of water “down” a concentration gradient, that is, across a semipermeable membrane from a region of higher water concentration to a region of lower water concentration and is a passive process.

PTS: 1 DIF: Cognitive Level: Remembering

26. What transports potassium and sodium across plasma membranes?
- Passive electrolyte channels
 - Coupled channels
 - Adenosine triphosphatase (ATPase) enzyme
 - Diffusion

ANS: C

The exact mechanism for the transport of Na^+ and K^+ across the membrane is uncertain. One proposal is that ATPase enzyme induces the transporter protein to undergo several conformational changes, causing Na^+ and K^+ to move short distances (see Figure 1-29). The remaining options do not correctly describe the means by which K^+ and Na^+ are transported.

PTS: 1 DIF: Cognitive Level: Remembering

27. What occurs during exocytosis?
- Macromolecules can be secreted across eukaryotic cell membranes.
 - All substances are secreted into the cellular matrix.
 - No repairs in the plasma membrane can take place.
 - Solute molecules flow freely into and out of the cell.

ANS: A

In eukaryotic cells, secretion of macromolecules almost always occurs by exocytosis. The remaining options do not correctly describe exocytosis.

PTS: 1 DIF: Cognitive Level: Remembering

28. The cellular uptake of the nutrient cholesterol depends on which process?
- Receptor-mediated exocytosis
 - Antiport system
 - Receptor-mediated endocytosis
 - Passive transport

ANS: C

The cellular uptake of nutrients, such as cholesterol, for example, depends on receptor-mediated endocytosis. Nutrients are not transported via the other options.

PTS: 1 DIF: Cognitive Level: Remembering

29. What causes the rapid change in the resting membrane potential to initiate an action potential?
- Potassium gates open, and potassium rushes into the cell, changing the membrane potential from negative to positive.
 - Sodium gates open, and sodium rushes into the cell, changing the membrane potential from negative to positive.
 - Sodium gates close, allowing potassium into the cell to change the membrane potential from positive to negative.
 - Potassium gates close, allowing sodium into the cell to change the membrane potential from positive to negative.

ANS: B

When a resting cell is stimulated through voltage-regulated channels, the cell membranes become more permeable to Na^+ . As Na^+ moves into the cell the membrane potential decreases, or *moves forward*, from a negative value (in millivolts) to zero. The Na^+ gates open, and Na^+ rushes into the cell, causing the membrane potential to reduce to zero and then become positive (depolarization). The remaining options do not correctly describe the change that initiates an action potential.

PTS: 1 DIF: Cognitive Level: Remembering

30. The action of platelet-derived growth factor is to stimulate the production of which cells?
- Platelets
 - Epidermal cells
 - Connective tissue cells
 - Fibroblast cells

ANS: C

Different types of cells require different factors to stimulate proliferation; for example, platelet-derived growth factor stimulates the production of connective tissue cells. Platelet-derived growth factor does not stimulate production of platelets, epidermal cells, or fibroblasts.

PTS: 1 DIF: Cognitive Level: Remembering

31. What role do cytokines play in cell reproduction?
- Provide growth factor for tissue growth and development
 - Block progress of cell reproduction through the cell cycle
 - Restrain cell growth and development

d. Provide nutrients for cell growth and development

ANS: A

Growth factors, also called *cytokines*, stimulate an increase in cell mass or cell growth by promoting the synthesis of proteins and other macromolecules and inhibiting their degradation.

PTS: 1 DIF: Cognitive Level: Remembering

32. What is the process of cellular reproduction?

- a. The process often takes months or years to complete.
- b. Cellular reproduction typically has a short interphase.
- c. Two diploid cells, called *daughter cells*, have been formed.
- d. The process involves the interaction of male and female cells.

ANS: C

During telophase, the final stage of cellular reproduction, two identical diploid cells, called *daughter cells*, has been formed from the original cell. The process occurs hundreds of times a second. Interphase is the longest phase of the cell cycle. Male and female cells do not interact in cellular reproduction; each cell is responsible for reproducing itself.

PTS: 1 DIF: Cognitive Level: Remembering

33. Which statement is *true* about eukaryotic cells?

- a. They lack distinct nucleus.
- b. They contain compartments called *organelles*.
- c. They lack an encasing nuclear membrane.
- d. They are smaller than the typical prokaryote cell.

ANS: B

Eukaryotic cells have a characteristic set of membrane-bound intracellular compartments called *organelles* that include a well-defined nucleus encased in a nuclear membrane. Eukaryotic cells are also larger than prokaryotes.

PTS: 1 DIF: Cognitive Level: Remembering

34. Which statement is *true* about phagocytosis?

- a. Phagocytosis is an example of exocytosis.
- b. Phagocytosis is dependent on small vesicles.
- c. Phagocytosis involves the ingestion of bacteria.
- d. Phagocytosis focuses on solute molecules.

ANS: C

Phagocytosis is the engulfment of large particles in phagocytic cells. Phagocytosis is an example of endocytosis, not exocytosis and does not focus on solutes.

PTS: 1 DIF: Cognitive Level: Remembering

35. A muscle cell possesses which specialized function?

- a. Movement

- b. Conductivity
- c. Secretion
- d. Respiration

ANS: A

A cell has the potential to differentiation and to gain the ability to perform one of eight specialized functions. Muscle cells can generate forces that produce motion. Nerve cells are capable of conductivity. Cells of the adrenal gland, testis, and ovary can secrete. Respiration is a function that all cells possess.

PTS: 1 DIF: Cognitive Level: Remembering

36. When a mucous gland cell creates a new substance from previously absorbed material, this process is known as which specialized cellular function?
- a. Excretion
 - b. Metabolic absorption
 - c. Reproduction
 - d. Secretion

ANS: D

Certain cells, such as mucous gland cells, can synthesize new substances from substances they absorb and then secrete the new substances to serve elsewhere as needed. Excretion occurs when cells rid themselves of waste products. Reproduction is the process of forming new cells.

PTS: 1 DIF: Cognitive Level: Remembering

37. All cells are capable of what process?
- a. Excretion
 - b. Movement
 - c. Conductivity
 - d. Continuous division

ANS: A

All cells have the capacity to excrete, thus allowing them to rid themselves of waste products resulting from the metabolic breakdown of nutrients. Muscle cells have the property of movement. Conductivity is a property of nerve cells. Many, but not all, cells are capable of reproduction.

PTS: 1 DIF: Cognitive Level: Remembering

38. What is the best description of cell cycle arrest?
- a. The cell cycle is stopped due to damaged DNA.
 - b. Programmed cell death is suppressed.
 - c. Macromolecule degradation is inhibited.
 - d. Production of growth factors is halted.

ANS: A

The DNA damage response occurs when DNA is damaged and several protein kinases are recruited to the site of damage and start a signaling pathway that stops the progression of the cell cycle, or cell cycle arrest. Cell cycle arrest does not involve suppressing programmed cell death, macromolecule degradation, or growth factor production.

PTS: 1 DIF: Cognitive Level: Remembering

MULTIPLE RESPONSE

1. What are the major chemical components of the cell membranes? (*Select all that apply.*)
 - a. Lipids
 - b. Sodium ions
 - c. Carbohydrates
 - d. DNA
 - e. Proteins

ANS: A, E

The major chemical components of all cell membranes are lipids and proteins. Sodium ions, carbohydrates, and DNA are not major chemical components of cell membranes.

PTS: 1 DIF: Cognitive Level: Remembering

2. Which statements are *true* concerning the process of mediated transport? (*Select all that apply.*)
 - a. Can be active or passive
 - b. Only moves one molecule at a time
 - c. Involves transport proteins
 - d. Expend tremendous energy
 - e. Occurs only with hormones

ANS: A, C

Mediated transport uses membrane transport proteins and can be either active or passive. Mediated transport systems can move molecules singly or two at a time and may or may not use energy. Many substances can be moved through mediated transport.

PTS: 1 DIF: Cognitive Level: Remembering

3. What is passive transport dependent on? (*Select all that apply.*)
 - a. Semipermeable barrier membrane
 - b. The process of osmosis
 - c. Diffusion as a driving force
 - d. A living host
 - e. Hydrostatic pressure

ANS: A, B, C, E

Passive transport naturally occurs through any semipermeable barrier. It is driven by osmosis, hydrostatic pressure, and diffusion, all of which depend on the laws of physics and do not require life.

PTS: 1 DIF: Cognitive Level: Remembering

4. What is the primary function of proteins? (*Select all that apply.*)
- a. Proteins are binding units.
 - b. Proteins are transport channels.
 - c. Proteins are ribonucleoproteins.
 - d. Proteins provide cell surface markers.
 - e. Proteins are chemical reaction catalysts.

ANS: A, B, D, E

Protein functions include (a) recognition and binding units (receptors) for substances moving in and out of the cell; (b) pores or transport channels; (c) enzymes that drive active pumps; (d) cell surface markers, such as glycoproteins; (e) cell adhesion molecules; and (f) catalysts of chemical reactions.

PTS: 1 DIF: Cognitive Level: Remembering

Chapter 02: Altered Cellular and Tissue Biology: Environmental Agents

MULTIPLE CHOICE

1. Which type of cell adaptation occurs when normal columnar ciliated epithelial cells of the bronchial lining have been replaced by stratified squamous epithelial cells?
 - a. Hyperplasia
 - b. Metaplasia
 - c. Dysplasia
 - d. Anaplasia

ANS: B

Metaplasia is the reversible replacement of one mature cell by another, sometimes a less-differentiated cell type. The best example of metaplasia is the replacement of normal columnar-ciliated epithelial cells of the bronchial (airway) lining by stratified squamous epithelial cells. The other options do not accurately describe the event in the question.

PTS: 1 DIF: Cognitive Level: Remembering

2. What does the loss of the adenosine triphosphate (ATP) during ischemia cause cells to do?
 - a. Shrink because of the influx of calcium (Ca)
 - b. Shrink because of the influx of potassium chloride (KCl)
 - c. Swell because of the influx of sodium chloride (NaCl)
 - d. Swell because of the influx of nitric oxide (NO)

ANS: C

A reduction in ATP levels causes the plasma membrane's sodium–potassium ($\text{Na}^+\text{-K}^+$) pump and sodium–calcium exchange to fail, which leads to an intracellular accumulation of sodium and calcium and diffusion of potassium out of the cell. (The $\text{Na}^+\text{-K}^+$ pump is discussed in Chapter 1.) Sodium and water can then freely enter the cell, and cellular swelling results. The other options do not accurately describe the result of ATP at the cellular level.

PTS: 1 DIF: Cognitive Level: Remembering

3. The mammary glands enlarge during pregnancy primarily as a consequence of what hormonal process?
 - a. Atrophy
 - b. Hyperplasia
 - c. Anaplasia
 - d. Dysplasia

ANS: B

Hormonal hyperplasia occurs chiefly in estrogen-dependent organs, such as the uterus and breast. Atrophy is a decrease or shrinkage in cellular size. Anaplasia is a condition of poor cellular differentiation, a characteristic of cancer cells. Dysplasia is a change in the size, shape, and organization of mature cells.

PTS: 1 DIF: Cognitive Level: Remembering

4. Free radicals play a major role in the initiation and progression of which diseases?
- Cardiovascular diseases such as hypertension and ischemic heart disease
 - Renal diseases such as acute tubular necrosis and glomerulonephritis
 - Gastrointestinal diseases such as peptic ulcer disease and Crohn disease
 - Muscular disease such as muscular dystrophy and fibromyalgia

ANS: A

Emerging data indicate that reactive oxygen species play major roles in the initiation and progression of cardiovascular alterations associated with hyperlipidemia, diabetes mellitus, hypertension, ischemic heart disease, and chronic heart failure. Free radical damage is not a contributing mechanism for the renal, gastrointestinal, or muscular diseases listed.

PTS: 1 DIF: Cognitive Level: Remembering

5. How do free radicals cause cell damage?
- Stealing the cell's oxygen to stabilize the electron, thus causing hypoxia
 - Stimulating the release of lysosomal enzymes that digest the cell membranes
 - Transferring one of its charged, stabilized atoms to the cell membrane, which causes lysis
 - Giving up an electron, which causes injury to the chemical bonds of the cell membrane

ANS: D

A free radical is an electrically uncharged atom or group of atoms having an unpaired electron. Having one unpaired electron makes the molecule unstable; thus to stabilize, the molecule gives up an electron to another molecule or steals one. Therefore it is capable of forming injurious chemical bonds with proteins, lipids, or carbohydrates—key molecules in membranes and nucleic acids. Free radical damage is not caused by hypoxia, lysosomal enzymes, or transferring atoms.

PTS: 1 DIF: Cognitive Level: Remembering

6. What is a consequence of plasma membrane damage to the mitochondria?
- Enzymatic digestion halts DNA synthesis.
 - Influx of calcium ions halts ATP production.
 - Edema from an influx in sodium causes a reduction in ATP production.
 - Potassium shifts out of the mitochondria, which destroys the infrastructure.

ANS: B

Calcium alterations are an important mechanism of cell injury and death. Cell membrane injury leads to calcium influx into the cell. An influx of calcium ions from the extracellular compartment activates multiple enzyme systems, resulting in cytoskeleton disruption, membrane damage, activation of inflammation, and eventually DNA degradation. Calcium ion accumulation in the mitochondria causes the mitochondria to swell, which is an occurrence that is associated with irreversible cellular injury. The injured mitochondria can no longer generate ATP, but they do continue to accumulate calcium ions. Mitochondrial consequences of cell membrane damage do not include enzymatic digestion, reduced ATP production due to edema, or infrastructure damage from potassium shifts.

PTS: 1 DIF: Cognitive Level: Remembering

7. What is a consequence of leakage of lysosomal enzymes during chemical injury?
- Enzymatic digestion of the nucleus and nucleolus occurs, halting DNA synthesis.
 - Influx of potassium ions into the mitochondria occurs, halting the ATP production.
 - Edema of the Golgi body prevents the transport of proteins out of the cell.
 - Shift of calcium out of the plasma membrane occurs, destroying the cytoskeleton.

ANS: A

Acid hydrolases from leaking lysosomes are activated in the reduced pH of the injured cell and they digest cytoplasmic and nuclear components. Influx of potassium ions into the mitochondria, edema of Golgi bodies, and calcium destruction of the cytoskeleton are not a consequence of leakage of lysosomal enzymes during chemical injury.

PTS: 1 DIF: Cognitive Level: Remembering

8. Lead causes damage within the cell by interfering with the action of what?
- Sodium and chloride
 - Potassium
 - Calcium
 - ATP

ANS: C

Lead affects many different biologic activities at the cellular and molecular levels, many of which may be related to its ability to interfere with the functions and homeostasis of calcium. Lead does not appear to cause damage by interfering with the action of sodium, chloride, potassium, or ATP.

PTS: 1 DIF: Cognitive Level: Remembering

9. A health professions student asks the professor to explain apoptosis. What response is most accurate?
- Programmed cell death
 - Due to chemical injury
 - Unpredictable patterns of cell death
 - Results in benign malignancies

ANS: A

Apoptosis is an active process of cellular self-destruction, also known as *programmed cell death*, which is implicated in normal and pathologic tissue changes. Apoptosis causes cell death in many pathologic states, not just from chemical injury. A predictable, tightly regulated cellular program leads to apoptosis. Apoptosis does not cause benign malignancies.

PTS: 1 DIF: Cognitive Level: Understanding

10. A healthcare professional is assessing a child whose parents report poor grades in school, trouble paying attention, and “naughty” behaviors that have become so frequent the child is always in trouble. For which health condition should the professional facilitate testing?
- Hypoxic injury
 - Lead poisoning
 - Mercury exposure
 - Cadmium injection

ANS: B

Decreased academic achievement, IQ, and specific cognitive measures; increased incidence of attention-related behaviors and problem behaviors are related to lead exposure. Hypoxic injury is usually caused by ischemia, which is not apparent in this child. Exposure to mercury poisoning in utero can lead to deafness, blindness, intellectual disability, cerebral palsy, and central nervous system (CNS) defects. The main effects of cadmium poisoning are renal tubular disease and obstructive lung disease.

PTS: 1 DIF: Cognitive Level: Applying

11. A student asks why carbon monoxide causes tissue damage. What response by the professor is best?
- Competes with carbon dioxide so that it cannot be excreted
 - Binds to hemoglobin so that it cannot carry oxygen
 - Destroys the chemical bonds of hemoglobin so it cannot carry oxygen
 - Removes iron from hemoglobin so it cannot carry oxygen

ANS: B

Because carbon monoxide’s affinity for hemoglobin is 200 times greater than that of oxygen, it quickly binds with the hemoglobin, preventing oxygen molecules from doing so. Carbon monoxide does not cause tissue damage by competing with carbon dioxide, destroying chemical bonds, or removing iron from hemoglobin.

PTS: 1 DIF: Cognitive Level: Understanding

12. A healthcare professional is working with a person who drinks several 6-packs of beer a week. What testing does the professional encourage the person to get?
- Hepatic function
 - Gastrointestinal function
 - Renal function
 - Central nervous system function

ANS: A

Chronic alcohol use/abuse affects the hepatic system primarily. The gastrointestinal and renal systems are not as significantly impacted. Central nervous system problems are often seen in acute alcohol intoxication, and may be seen in advanced alcoholic liver disease.

PTS: 1 DIF: Cognitive Level: Comprehension

13. During cell injury caused by hypoxia, why does an increase in the osmotic pressure within the cell occur?
- Plasma proteins enter the cell.
 - The adenosine triphosphatase (ATPase)-driven pump is stronger during hypoxia.
 - Sodium chloride enters the cell.
 - An influx of glucose occurs through the injured cell membranes.

ANS: C

In hypoxic injury, movement of fluid and ions into the cell is associated with acute failure of metabolism and a loss of ATP production. Normally, the pump that transports sodium ions out of the cell is maintained by the presence of ATP and ATPase, the active transport enzyme. In metabolic failure caused by hypoxia, reduced ATP and ATPase levels permit sodium to accumulate in the cell, whereas potassium diffuses outward. The increase of intracellular sodium increases osmotic pressure, which draws more water into the cell. (Transport mechanisms are described in Chapter 1.) The remaining options do not accurately describe the cell injury that results in increased osmotic pressure caused by hypoxia.

PTS: 1 DIF: Cognitive Level: Remembering

14. Which statement is *true* regarding the difference between subdural hematoma and epidural hematoma?
- No difference exists, and these terms may be correctly used interchangeably.
 - A subdural hematoma occurs above the dura, an epidural hematoma occurs under the dura.
 - A subdural hematoma is often the result of shaken baby syndrome, whereas an epidural hematoma rapidly forms as a result of a skull fracture.
 - A subdural hematoma usually forms from bleeding within the skull, an epidural hematoma occurs from trauma outside the skull.

ANS: C

A subdural hematoma is a collection of blood between the inner surface of the dura mater and the surface of the brain, resulting from the shearing of small veins that bridge the subdural space. Subdural hematomas can be the result of blows, falls, or sudden acceleration-deceleration of the head, which occurs in the *shaken baby syndrome*. An epidural hematoma is a collection of blood between the inner surface of the skull and the dura and is almost always associated with a skull fracture. The other options do not accurately describe the differences between the two hematomas.

PTS: 1 DIF: Cognitive Level: Remembering

15. A healthcare professional is working at the health tent during a marathon. A runner is brought to the tent complaining of nausea and weakness. What is the first thing the professional should do?

- a. Call 911.
- b. Have the person lie down.
- c. Give the person salt tablets.
- d. Ask about street drug use.

ANS: B

Heat exhaustion is probably the most common heat-related injury. Symptoms include nausea and weakness due to hypovolemia. The person can suddenly collapse due to the loss of fluids, so the first measure the professional should take is to have the runner lie down. This is not a medical emergency so 911 does not yet need to be called. Salt replacement is the treatment for heat cramps. Street drug use could cause nausea or weakness, but since the person is running outside and sweating, a heat-related injury is far more likely.

PTS: 1 DIF: Cognitive Level: Applying

16. In hypoxic injury, why does sodium enter the cell and cause swelling?
 - a. The cell membrane permeability increases for sodium during periods of hypoxia.
 - b. ATP is insufficient to maintain the pump that keeps sodium out of the cell.
 - c. The lactic acid produced by the hypoxia binds with sodium in the cell.
 - d. Sodium cannot be transported to the cell membrane during hypoxia.

ANS: B

In hypoxic injury, movement of fluid and ions into the cell is associated with acute failure of metabolism and a loss of ATP production. Normally, the presence of ATP and ATPase, the active transport enzyme, maintains the pump that transports sodium ions out of the cell. In metabolic failure caused by hypoxia, reduced ATP and ATPase levels permit sodium to accumulate in the cell, whereas potassium diffuses outward. The other options do not accurately describe the cause of the swelling caused by hypoxia.

PTS: 1 DIF: Cognitive Level: Remembering

17. What is the most common site of lipid accumulation?
 - a. Coronary arteries
 - b. Kidneys
 - c. Liver
 - d. Subcutaneous tissue

ANS: C

Although lipids sometimes accumulate in heart and kidney cells, the most common site of intracellular lipid accumulation, or fatty change, is liver cells. Subcutaneous tissue is not a common site of lipid accumulation.

PTS: 1 DIF: Cognitive Level: Remembering

18. What mechanisms occur in the liver cells as a result of lipid accumulation?
 - a. Accumulation of lipids that obstruct the common bile duct, preventing flow of bile from the liver to the gallbladder
 - b. Increased synthesis of triglycerides from fatty acids and decreased synthesis of apoproteins

- c. Increased binding of lipids with apoproteins to form lipoproteins
- d. Increased conversion of fatty acids to phospholipids

ANS: B

Lipid accumulation in liver cells occurs after cellular injury sets the following mechanisms in motion: increased synthesis of triglycerides from fatty acids (increases in the enzyme, β -glycerophosphatase, which can accelerate triglyceride synthesis) and decreased synthesis of apoproteins (lipid-acceptor proteins). Accumulation of lipids does not cause obstruction of bile flow, increased binding of lipids with apoproteins, or conversion of fatty acids to phospholipids.

PTS: 1 DIF: Cognitive Level: Remembering

19. Hemoprotein accumulations are a result of the excessive storage of what?
- a. Iron, which is transferred from the cells to the bloodstream
 - b. Hemoglobin, which is transferred from the bloodstream to the cells
 - c. Albumin, which is transferred from the cells to the bloodstream
 - d. Amino acids, which are transferred from the cells to the bloodstream

ANS: A

Excessive storage of iron, which is transferred to the cells from the bloodstream, causes hemoprotein accumulations in cells. Hemoglobin, albumin, or amino acids will not cause hemoprotein accumulations.

PTS: 1 DIF: Cognitive Level: Remembering

20. A patient suffered multiple traumatic injuries and received many blood transfusions within a few days of the injuries. For which medical condition should the healthcare professional monitor the patient for?
- a. High blood pressure
 - b. HIV infection
 - c. Hemosiderosis
 - d. Kidney damage

ANS: C

Hemosiderosis is a condition that occurs only when excess iron is stored as hemosiderin in the cells of many organs and tissues. This condition is common in individuals who have received repeated blood transfusions or prolonged parenteral administration of iron. While blood transfusions can expose a person to infectious diseases, this is not as likely to be a problem since blood products are tested. Kidney damage may occur in patients with traumatic injuries, but is not directly related to the multiple blood transfusions.

PTS: 1 DIF: Cognitive Level: Applying

21. What is the cause of free calcium in the cytosol that damages cell membranes by uncontrolled enzyme activation?
- a. Activation of endonuclease interferes with the binding of calcium to protein.
 - b. Activation of phospholipases, to which calcium normally binds, degrades the proteins.
 - c. An influx of phosphate ions competes with calcium for binding to proteins.

d. Depletion of ATP normally pumps calcium from the cell.

ANS: D

If abnormal direct damage occurs to membranes or ATP is depleted, then calcium increases in the cytosol. The other options do not accurately describe the cause of free calcium in cytosol to damage cell membranes.

PTS: 1 DIF: Cognitive Level: Remembering

22. What two types of hearing loss are associated with noise?

- a. Acoustic trauma and noise-induced
- b. High frequency and low frequency
- c. High frequency and acoustic trauma
- d. Noise-induced and low frequency

ANS: A

Two types of hearing loss are associated with noise: (1) acoustic trauma or instantaneous damage caused by a single sharply rising wave of sound (e.g., gunfire), and (2) noise-induced hearing loss, the more common type, which is the result of prolonged exposure to intense sound (e.g., noise associated with the workplace and leisure-time activities). The remaining options are not related to noise but rather to the amplitude of the sound.

PTS: 1 DIF: Cognitive Level: Remembering

23. What type of necrosis results from ischemia of neurons and glial cells?

- a. Coagulative
- b. Liquefactive
- c. Caseous
- d. Gangrene

ANS: B

Liquefactive necrosis commonly results from ischemic injury to neurons and glial cells in the brain. Coagulative necrosis commonly occurs in the kidney, heart, and adrenal glands. Caseous necrosis is a combination of coagulative and liquefactive processes and is seen in tuberculosis. Gangrene refers to death of tissue and results from severe hypoxic injury, commonly occurring because of arteriosclerosis, or blockage, of major arteries, especially in the lower leg.

PTS: 1 DIF: Cognitive Level: Remembering

24. What type of necrosis is often associated with pulmonary tuberculosis?

- a. Bacteriologic
- b. Caseous
- c. Liquefactive
- d. Gangrenous

ANS: B

Caseous necrosis, which commonly results from tuberculous pulmonary infection, particularly *Mycobacterium tuberculosis*, is a combination of coagulative and liquefactive necrosis. The other types of necrosis are not observed in pulmonary tuberculosis.

PTS: 1 DIF: Cognitive Level: Remembering

25. What type of necrosis is associated with wet gangrene?
- Coagulative
 - Liquefactive
 - Caseous
 - Gangrene

ANS: B

Wet gangrene develops only when neutrophils invade the site, causing liquefactive necrosis.

PTS: 1 DIF: Cognitive Level: Remembering

26. After ovulation, the uterine endometrial cells divide under the influence of estrogen. This process is an example of what hormonal process?
- Hyperplasia
 - Dysplasia
 - Hypertrophy
 - Anaplasia

ANS: A

Hormonal hyperplasia chiefly occurs in estrogen-dependent organs, such as the uterus and breast. After ovulation, for example, estrogen stimulates the endometrium to grow and thicken for reception of the fertilized ovum. Dysplasia refers to abnormal changes in the size, shape, and organization of mature cells. Hypertrophy is an increase in the size of cells that consequently increases the size of the affected organ. Anaplasia is a condition of poor cellular differentiation, a characteristic of cancer cells. Dysplasia is a change in the size, shape, and organization of mature cells.

PTS: 1 DIF: Cognitive Level: Remembering

27. What is the abnormal proliferation of cells in response to excessive hormonal stimulation?
- Dysplasia
 - Pathologic dysplasia
 - Hyperplasia
 - Pathologic hyperplasia

ANS: D

Pathologic hyperplasia is the abnormal proliferation of normal cells and can occur as a response to excessive hormonal stimulation or the effects of growth factors on target cells. Dysplasia refers to abnormal changes in the size, shape, and organization of mature cells. Hyperplasia is an increase in the number of cells in an organ or tissue resulting from an increased rate of cellular division and is a response to prolonged injury.

PTS: 1 DIF: Cognitive Level: Remembering

28. Removal of part of the liver leads to the remaining liver cells undergoing which compensatory process?