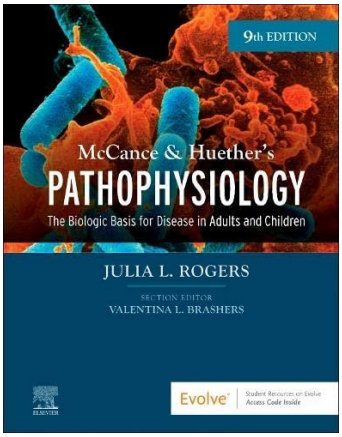
Test Bank - Pathophysiology: The Biological Basis forDisease in Adults and Children 9th Edition



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Chapter 1: 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 REF: Page 2

2. Most of a cell's genetic information, including RNA and DNA, is contained in the:
   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 other options do not contain most of a cell's genetic information.

   PTS: 1 REF: Page 2

3. Which component of the cell produces hydrogen peroxide (H_2O_2) by using oxygen to remove hydrogen atoms from specific substrates in an oxidative reaction?
   a. Lysosomes
   b. Peroxisomes
   c. Ribosomes
   d. Oxyhydrosomes

   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. Oxyhydrosomes are involved in enzyme production.

   PTS: 1 REF: Page 8

4. Which cell component is capable of cellular autodigestion when it is released during cell injury?
   a. Ribosome
   b. Golgi complex
   c. Smooth endoplasmic reticulum
   d. 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 other options do not correctly describe this process.

PTS: 1 REF: Pages 7-8

5. What is the sequence of steps in the development of a digestive enzyme by the pancreas cells from the initial transcription to the release from the cell?
   a. The enzyme is transcribed from DNA by RNA in the nucleus, proceeds to the ribosome for synthesis, and is transported in a secretory vesicle to the cell membrane.
   b. The enzyme is transcribed from RNA by DNA in the nucleus, proceeds to the lysosome for synthesis, and is transported in an encapsulated membrane to the cell membrane.
   c. The enzyme is transcribed by the mitochondria in the nucleus, proceeds to the ribosome for synthesis, and is transported in a cytoskeleton to the cell membrane.
   d. The enzyme is transcribed from DNA by RNA in the nucleus, proceeds to the Golgi complex for synthesis, and is transported in a cytosol to the cell membrane.

   ANS: A
   The enzyme is transcribed from DNA by RNA in the nucleus, proceeds to the ribosome for synthesis, and is transported in a secretory vesicle to the cell membrane. The other options do not correctly describe this process.

   PTS: 1 REF: Page 7 | Figure 1-5

6. During which phase of the cell cycle is DNA synthesized?
   a. G_1
   b. S
   c. G_2
   d. M

   ANS: B
   The four designated phases of the cell cycle are: (1) the G_1 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 G_2 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 REF: Page 37

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

   ANS: C

Proteins act as (1) recognition and binding units (receptors) for substances moving in and out of the cell; (2) pores or transport channels for various electrically charged particles called *ions* or *electrolytes* and specific carriers for amino acids and monosaccharides; and (3) specific enzymes that drive active pumps that promote the concentration of certain ions, particularly potassium (K^+), within the cell while keeping concentrations of other ions, for example, sodium (Na^+), below the concentrations found in the extracellular environment. The other options do not correctly describe this process.

PTS: 1 REF: Page 13 | Page 15

8. Understanding the various steps of proteolytic cascades, such as caspase-mediated apoptosis and complement cascades, may be useful in designing drug therapy for which human diseases?
   a. Cardiac and vascular disorders
   b. Autoimmune and malignant disorders
   c. Gastrointestinal and renal disorders
   d. 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. The other options do not correctly describe this process.

   PTS: 1 REF: Page 15

9. Which structure prevents water-soluble molecules from entering cells across the plasma membrane?
   a. Carbohydrate chains
   b. Glycoprotein channels
   c. Membrane channel proteins
   d. 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 (O_2) and carbon dioxide (CO_2), to diffuse through it readily. The other options do not correctly describe this process.

   PTS: 1 REF: Pages 12-13

10. The fluid mosaic model explains:
    a. How a cell membrane functions
    b. Why our bodies appear to be solid
    c. How tissue is differentiated
    d. How fluid moves between the intracellular and extracellular compartments

    ANS: A
    The fluid mosaic model accounts for the flexibility of cellular membranes, their self-sealing properties, and their impermeability to many substances. The remaining options do not explain the mosaic model.

PTS: 1 REF: Page 12 | What's New box

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

    ANS: A
    Cells communicate by using hundreds of kinds of signal molecules, for example, insulin. Cells communicate in three main ways; they display plasma membrane–bound signaling molecules (receptors) that affect the cell itself and other cells in direct physical contact. The other options do not correctly describe this process.

    PTS: 1 REF: Page 20

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

    ANS: D
    Chemical signaling can be classified into three categories: (1) local-chemical mediator, (2) hormone, and (3) neurotransmitter. In the local-chemical mediator model, the secreted chemical acts on the cells in the immediate environment. Hormones are used for communication with distant target cells. For example, cells can secrete a chemical and rely on the blood system to deliver the signal to a distant cell. Finally, neurotransmitters are secreted by neurons to stimulate an adjoining cell. For example, a neuron might secrete acetylcholine to stimulate the movement of a muscle cell.

    PTS: 1 REF: Page 20

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

    ANS: A
    In paracrine signaling**,** cells secrete local chemical mediators that are quickly taken up, destroyed, or immobilized. The other options do not correctly describe this process.

    PTS: 1 REF: Page 20

14. Neurotransmitters affect the postsynaptic membrane by binding to:
    a. Lipids
    b. Ribosomes
    c. Amphipathic lipids
    d. 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 REF: Page 17

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

    ANS: D
    Cellular communication can occur by the binding of a chemical massager (a ligand) to a specific membrane receptor that is closely associated with the channel (e.g., G proteins). The other options do not correctly describe how cells communicate.

    PTS: 1 REF: Pages 21-22

16. When a second message is necessary for extracellular communication to be activated, it is provided by which one?
    a. Guanosine triphosphate (GTP)
    b. Adenosine monophosphate (AMP)
    c. Adenosine triphosphate (ATP)
    d. Guanosine diphosphate (GDP)

    ANS: B
    The two major second messenger pathways are cyclic AMP (cAMP) and calcium (Ca^{++}).

    PTS: 1 REF: Pages 22-23

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

    ANS: B
    Glycolysis produces a net of two molecules of ATP per glucose molecule through the process of oxidation or the removal and transfer of a pair of electrons. The other options do not correctly identify an anaerobic process that provides energy to the cell.

    PTS: 1 REF: Page 28

18. What is the mechanism by which the energy produced from carbohydrates, proteins, and lipids is transferred to adenosine triphosphate (ATP)?
    a. Anaerobic glycolysis
    b. Oxidative cellular metabolism
    c. Oxidative phosphorylation
    d. 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. The other options do not correctly identify the mechanism described in the question.

    PTS: 1 REF: Pages 27-28

19. Passive transport is best described with which statement?
    a. Being driven by osmosis, hydrostatic pressure, and diffusion
    b. Involving receptors that can bind with substances being transported

c. Being capable of transporting macromolecules
d. 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 REF: Page 28

20. Active transport occurs across which type of membranes?
a. Membranes that have a higher concentration of the solute on the outside of the cell
b. Membranes that are semipermeable to water and small electrically uncharged molecules
c. Membranes that have receptors that are capable of binding with the substances to be transported
d. Membranes that have a cell membrane that is hydrophobic rather than hydrophilic

ANS: C
Some molecules are moved into the cell by mechanisms of active transport**,** which require receptors that are capable of recognizing and binding with the substance to be transported. Diffusion is the movement of a solute molecule from an area of greater solute concentration to an area of lesser solute concentration. 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 lower water concentration

PTS: 1 REF: Page 28

21. Which method of transport uses transmembrane proteins with receptors with a high degree of specificity for the substance being transported?
a. Active
b. Mediated
c. Transmembranous
d. 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. Inorganic anions and cations (e.g., Na^+, K^+, Ca^{++}, chloride [Cl^-], bicarbonate [HCO_3^-]) and charged and uncharged organic compounds (e.g., amino acids, sugars) require specific transport systems to facilitate movement through different cellular membranes. The remaining options do not correctly identify the process described.

PTS: 1 REF: Page 31

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?
a. Hydrostatic pressure
b. Osmosis
c. Diffusion
d. Active transport

ANS: A

Hydrostatic pressure is the mechanical force of water pushing against cellular membranes. In the vascular system, hydrostatic pressure is the *blood pressure* generated in vessels by the contraction of the heart. Blood reaching the capillary bed has a hydrostatic pressure of 25 to 30 mm Hg, which is sufficient force to push water across the thin capillary membranes into the interstitial space. The remaining options do not correctly identify the process described.

PTS: 1 REF: Pages 29-30

23. Why is osmolality preferred over osmolarity as the measurement of osmotic activity in the clinical assessment of individuals?
    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, such as protein and glucose, rather than by water.
    d. Osmotic activity depends on the concentration of solutes present in plasma, such as proteins and glucose.

    ANS: C
    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 REF: Page 30

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. The remaining options do not correctly describe the effect identified in the stem.

    PTS: 1 REF: Page 31

25. The transport of glucose from the blood to the cell is accomplished by which process?
    a. Active-mediated transport (active transport)
    b. Active diffusion
    c. Passive osmosis
    d. Passive-mediated transport (facilitated diffusion)

    ANS: D
    Facilitated diffusion is the means by which glucose is transported from the blood to the cells. The remaining options do not correctly identify this process.

    PTS: 1 REF: Pages 31-32

26. Potassium and sodium are transported across plasma membranes by:

a. Passive electrolyte channels
b. Coupled channels
c. Adenosine triphosphatase (ATPase) enzyme
d. 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 REF: Pages 32-33

27. What occurs during exocytosis?
a. Macromolecules can be secreted across eukaryotic cell membranes.
b. All substances are secreted into the cellular matrix.
c. No repairs in the plasma membrane can take place.
d. 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 REF: Pages 35-36

28. Why is it possible for potassium to diffuse easily into and out of cells?

a. Potassium has a greater concentration in the intracellular fluid (ICF).
b. Sodium has a greater concentration in the extracellular fluid (ECF).
c. The resting plasma membrane is more permeable to potassium.
d. An excess of anions are inside the cell.

ANS: C
Because the resting plasma membrane is more permeable to K^+ than to Na^+, K^+ can easily diffuse from its area of higher concentration in the ICF to its area of lower concentration in the ECF. Because Na^+ and K^+ are both cations, the net result is an excess of anions inside the cell, resulting in the resting membrane potential. The remaining options do not correctly identify the process that most easily diffuses K^+.

PTS: 1 REF: Page 36

29. The cellular uptake of the nutrient cholesterol depends on which process?
a. Receptor-mediated exocytosis
b. Antiport system
c. Receptor-mediated endocytosis
d. 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 REF: Page 33

30. What causes the rapid change in the resting membrane potential to initiate an action potential?
    a. Potassium gates open, and potassium rushes into the cell, changing the membrane potential from negative to positive.
    b. Sodium gates open, and sodium rushes into the cell, changing the membrane potential from negative to positive.
    c. Sodium gates close, allowing potassium into the cell to change the membrane potential from positive to negative.
    d. 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^+. A net Na^+ moves into the cell, and 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 REF: Page 36

31. The action of platelet-derived growth factor is to stimulate the production of which cells?
    a. Platelets
    b. Epidermal cells
    c. Connective tissue cells
    d. Fibroblast cells

    ANS: C
    Different types of cells require different factors; for example, platelet-derived growth factor stimulates the production of connective tissue cells. The remaining options do not correctly describe the action of platelet-derived growth factor.

    PTS: 1 REF: Page 39

32. The role of cytokines in cell reproduction is that they:
    a. Provide growth factor for tissue growth and development.
    b. Block progress of cell reproduction through the cell cycle.
    c. Restrain cell growth and development.
    d. Provide nutrients for cell growth and development.

    ANS: A
    Growth factors, also called *cytokines*, are peptides that transmit signals within and among cells. They have a major role in the regulation of tissue growth and development (see Table 1-6). The remaining options do not correctly describe the role of cytokines in cell reproduction.

    PTS: 1 REF: Pages 38-39

33. 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, a new nuclear membrane is formed around each group of 46 chromosomes, the spindle fibers disappear, and the chromosomes begin to uncoil. Cytokinesis causes the cytoplasm to divide into roughly equal parts during this phase. At the end of telophase, two identical diploid cells, called *daughter cells,* have been formed from the original cell.

PTS: 1 REF: Page 37

34. 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 and are larger than prokaryotes. The remaining statements are not true regarding eukaryotic cells.

    PTS: 1 REF: Page 2

35. 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
    In phagocytosis, the large molecular substances are engulfed by the plasma membrane and enter the cell so that they can be isolated and destroyed by lysosomal enzymes. Two types of endocytosis are designated, based on the size of the vesicle formed. Pinocytosis (cell drinking) involves the ingestion of fluids and solute molecules through the formation of small vesicles, and phagocytosis (cell eating) involves the ingestion of large particles, such as bacteria, through formation of large vesicles (also called *vacuoles*). Phagocytosis in an example of endocytosis, not exocytosis.

    PTS: 1 REF: Pages 33-34

36. 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. Nerves 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 REF: Page 2