Porth's Essentials of Pathophysiology 5th edition Norris Test Bank

SKU: 9781975107192-TEST-BANK

1. Chapter 1

   Although the basic structure of the cell plasma membrane is formed by a lipid bilayer, most of the specific membrane functions are carried out by:
   A) Bound and transmembrane proteins
   B) Complex, long carbohydrate chains
   C) Surface antigens and hormone receptors
   D) A gating system of selective ion channels
   Ans: A
   Feedback:
   The functions of plasma membrane depend on the presence of proteins that are bound in the lipid bilayer and some that have the ability to pass freely into and out of the cell. Carbohydrate chains form a cell coat that surrounds the membrane and that contain surface antigens and surface hormone receptors. Some ion channels are gated and open only when the membrane potential changes significantly.

2. Which describes the function of the nucleus?
   A) It is basically the site of protein synthesis in the body.
   B) It contains the genetic code for the individual.
   C) It is the transformer of cellular energy.
   D) It initiates the process of aerobic metabolism.
   Ans: B
   Feedback:
   The nucleus contains DNA, which contains the genetic code that contains the information that controls cells. Ribosomes synthesize protein. Mitochondria transform organic compounds into cellular energy. Mitochondria require oxygen for aerobic metabolism, using hydrogen and carbon combined with oxygen molecules to form carbon dioxide and water as energy is released.

3. Which of the following aspects of the function of the nucleus is performed by ribosomal RNA (rRNA)?
   A) Copying and carrying DNA instructions for protein synthesis
   B) Carrying amino acids to the site of protein synthesis
   C) Providing the site where protein synthesis occurs
   D) Regulating and controlling protein synthesis
   Ans: C
   Feedback:
   There are three types of ribonucleic acid (messenger RNA, ribosomal RNA, and transfer RNA) that move to the cytoplasm and carry out the actual synthesis of proteins. Messenger RNA (mRNA) copies and carries the DNA instructions for protein synthesis to the cytoplasm; ribosomal RNA (rRNA) is the site of protein synthesis; and transfer RNA (tRNA) transports amino acids to the site of protein synthesis for incorporation into the protein being synthesized.

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4. Which accurately explains the functions of the organelles lysosomes? They:
   A) Are sacs filled with enzymes that breakdown and remove foreign substances and worn-out cell parts
   B) Function in association with the endoplasmic reticulum to modify protein end products and package them into secretory granules or vesicles
   C) Are small particles of nucleoproteins that are involved in the synthesis of proteins that remain in the cell as cytoplasmic structural or functional elements
   D) Are a dynamic system of interconnected membranous tubes that functions as a tubular communication system for transporting various substances from one part of the cell to another

   Ans: A

   Feedback:

   Lysosomes are sacs that are filled with hydrolytic enzymes that aid in the processing and removal of unwanted substances within the cytoplasm. The Golgi apparatus functions in association with the endoplasmic reticulum to modify and package substances in preparation for secretion, whereas ribosomes are small particles of nucleoproteins that are involved in the synthesis of proteins. The ER is a tubular communication system for transporting various substances from one part of the cell to another.

5. Impairment in the function of peroxisomes would result in:
   A) Inadequate sites for protein synthesis
   B) An inability to transport cellular products across the cell membrane
   C) Insufficient energy production within a cell
   D) Accumulation of free radicals in the cytoplasm

   Ans: D

   Feedback:

   Peroxisomes function in the control of free radicals; unless degraded, these highly unstable chemical compounds damage other cytoplasmic molecules. Peroxisomes do not directly contribute to energy production, protein synthesis, or transport of cellular secretions.

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6. Although energy is not made in mitochondria, they are known as the “power plants” of the cell because they:
   A) Contain RNA for protein synthesis
   B) Utilize glycolysis for oxidative energy
   C) Extract energy from organic compounds
   D) Store calcium bonds for muscle contractions
   Ans: C
   Feedback:
   Mitochondria contain the enzymes needed for transforming organic compounds into energy that is easily accessible to the cell. Mitochondria contain their own DNA. Glycolysis is anaerobic metabolism and unrelated to oxidative energy. Mitochondria store phosphate bonds (such as in ATP) to power cellular functions.

7. Semen analysis indicates that the client's sperm have decreased motility. Which of the following cellular components may be defective within the client's sperm?
   A) Ribosomes
   B) Microtubules
   C) Mitochondria
   D) Microfilaments
   Ans: B
   Feedback:
   Abnormalities in the structure and function of microtubules and consequent dysfunction of the flagella may contribute to impaired sperm motility. Ribosomes, microfilaments, and mitochondria do not directly contribute to movement in cells such as cilia and flagella.

8. When explaining the function of glycolysis as it relates to anaerobic metabolism, the faculty will mention which of the following key points? Select all that apply.
   A) Glycolysis requires the use of oxygen to begin the process.
   B) Glycolysis occurs in mitochondrion-lacking cells.
   C) Glycolysis provides the majority of the body's energy needs.
   D) Pyruvic acid is an end result from a series of reactions that converts glucose.
   Ans: B, D
   Feedback:
   Glycolysis is the anaerobic process by which energy is liberated from glucose, and it is an important source of energy for cells that lack mitochondria. The process also provides a temporary source of energy for cells that are deprived of an adequate supply of oxygen. Glycolysis involves a sequence of reactions that converts glucose to pyruvic acid, with the concomitant production of ATP from ADP. It accounts for a small minority of the body's energy needs and results in NADH, hydrogen ions, ATP, and pyruvic acid.

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9. Aerobic metabolism, also known as oxidative metabolism, provides energy to the body by:
   A) Removing the phosphate bonds from ATP
   B) Combining hydrogen and oxygen to form water
   C) Activating pyruvate stored in the cytoplasm
   D) Breaking down glucose to form lactic acid
   Ans: B
   Feedback:
   Aerobic metabolism involves the combination of carbon ions from dietary nutrients, hydrogen ions, and oxygen. The result is carbon dioxide and water as energy is released, which is stored in ATP. Phosphate bonds are added (not removed from) to ADP to form ATP. Pyruvate is formed from glucose in the anaerobic process of glycolysis and is converted to lactic acid during anaerobic metabolism.

10. To effectively relay signals, cell-to-cell communication utilizes a chemical messenger system to:
   A) Displace surface receptor proteins
   B) Accumulate within cell gap junctions
   C) Bind to contractile microfilaments
   D) Release secretions into extracellular fluid
   Ans: D
   Feedback:
   Signals are transmitted by releasing chemical secretions into extracellular fluid. Chemical signals move through cell-to-cell junctions to reach other cells and may attach to surface receptor proteins. The cytoplasmic contractile microfilaments are incapable of transmitting communication signals.

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11. Which identifies correctly how the G protein–linked receptors are similar?
    A) Their cytosolic domain has intrinsic enzyme activity.
    B) Insulin is an example of the second messenger cAMP, which binds to an enzyme-linked receptor.
    C) These linked receptors are involved in rapid synaptic signaling between cardiac electrical cells.
    D) They have a ligand-binding extracellular receptor component, which causes changes that activate the G protein on the cytoplasmic side of the cell membrane.

    Ans: D

    Feedback:

    Although there are differences among the G protein–linked receptors, all share a number of features. They all have a ligand-binding extracellular receptor component, which recognizes a specific ligand or first messenger. Upon ligand binding, they all undergo conformational changes that activate the G protein found on the cytoplasmic side of the cell membrane. Instead of having a cytosolic domain that associates with a G protein, enzyme-linked receptors have cytosolic domain either that has intrinsic enzyme activity or that associates directly with an enzyme. The binding of the hormone to a special transmembrane receptor results in activation of the enzyme adenylyl cyclase at the intracellular portion of the receptor. This enzyme then catalyzes the formation of the second messenger cAMP, which has multiple effects on cell function. Insulin, for example, acts by binding to an enzyme-linked receptor. Ion channel–linked receptors are involved in the rapid synaptic signaling between electrically excitable cells.

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12. When working with a client who has end-stage renal disease (ESRD) and is receiving peritoneal dialysis, the concept of diffusion can be explained by which of the following statements?
    A) "If your potassium level is high, then K^+ particles will move from your peritoneal cavity into the dialysis solution, where the concentration of K^+ is lower."
    B) "You will need to give yourself a potent diuretic so that you can pull the potassium into your blood stream and filter the potassium out in your kidneys."
    C) "Your potassium molecules are lipid soluble and will dissolve in the lipid matrix of your cell membranes."
    D) "If you can get very warm in a sauna, you will heat up your K^+ particles, and the kinetic movement of the particles will increase and pass through the cell membranes faster."

    Ans: A

    Feedback:

    Diffusion refers to the passive process by which molecules and other particles in a solution become widely dispersed and reach a uniform concentration because of energy created by their spontaneous kinetic movements. In the process of reaching a uniform concentration, these molecules and particles move "downhill" from an area of higher to an area of lower concentration. Lipid-soluble molecules, such as oxygen, carbon dioxide, alcohol, and fatty acids (not K^+), become dissolved in the lipid matrix of the cell membrane and diffuse through the membrane in the same manner that diffusion occurs in water. Diuretics are not very effective if a person has ESRD. The rate of diffusion depends on how many particles are available for diffusion, the kinetic movement of the particles, and the number and size of the openings in the membrane through which the molecules or ions can move. The environmental temperature does not play a role in this.

13. A male client with a diagnosis of type 1 diabetes mellitus is experiencing hyperglycemia because he lacks sufficient insulin to increase the availability of glucose transporters in his cell membranes. Consequently, his cells lack intracellular glucose, and it accumulates in his blood. Which of the following processes would best allow glucose to cross his cell membranes?
    A) Facilitated diffusion
    B) Simple diffusion
    C) Secondary active transport
    D) Endocytosis

    Ans: A

    Feedback:

    Transport molecules perform facilitated diffusion, in which one substance carries another substance across a cell membrane. Simple diffusion does not require a transport molecule. Glucose does not cross the cell membrane by secondary active transport or endocytosis.

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14. The client asks the health care provider to explain phagocytosis. The provider will respond, “Phagocytosis:
    A) Is a cotransport system that helps with the absorption of the medication.”
    B) Is the movement of particles from an area of higher concentration to one of lower concentration.”
    C) Uses proteins to form an open channel through which the drug can move into the cell.”
    D) Is a process where microorganisms are engulfed and subsequently degraded or killed.”
    Ans: D
    Feedback:
    Phagocytosis, which means “cell eating,” involves the engulfment and subsequent killing or degradation of microorganisms and other particulate matter. Certain cells, such as macrophages and neutrophils, are adept at engulfing and disposing of invading organisms, damaged cells, and unneeded extracellular constituents. An example of cotransport occurs in the intestine, where the absorption of glucose and amino acids is coupled with sodium transport. The process of diffusion describes particle movement from an area of higher concentration to an area of lower concentration, resulting in an equal distribution of permeable substances across the cell membrane. Ion channels are integral proteins that span the width of the membrane and are normally composed of several polypeptides or protein subunits that form a gating system. Specific stimuli cause the protein subunits to undergo conformational changes to form an open channel or gate through which the ions can move.

15. Exocytosis allows granular content to be released into extracellular fluid by:
    A) Engulfing and ingesting fluid and proteins for transport
    B) Killing, degrading, and dissolving harmful microorganisms
    C) Removing cellular debris and releasing synthesized substances like hormones
    D) Destruction of particles by lysosomal enzymes for secretion
    Ans: C
    Feedback:
    In exocytosis, a secretory granule fuses to the inner cell membrane to form an opening, allowing granule contents to be released. The granule contains cellular debris and synthesized substances such as hormones, which it releases into the extracellular fluid. Phagocytosis and pinocytosis—types of endocytosis—function to engulf, kill, and present particles to lysosomal enzymes for degradation.

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16. The process responsible for generating and conducting membrane potentials is:
    A) Diffusion of current-carrying ions
    B) Millivoltage of electrical potential
    C) Polarization of charged particles
    D) Ion channel neurotransmission
    Ans: A
    Feedback:
    Membrane potentials rely on the permeability of the cell membrane and the diffusion of electrically charged ions. Charged particles are polarized (positive charge on one side of the membrane and negative charge on the opposite side of the membrane), but membrane potential exists when the charges are unbalanced on the two sides. Ion channel neurotransmitters are involved with opening protein channels for purposes of cell-to-cell communication.

17. Epithelial tissues are classified according to the shape of the cells and the number of layers. Which of the following is a correctly matched description and type of epithelial tissue?
    A) Simple epithelium: cells in contact with the intercellular matrix; some do not extend to surface.
    B) Stratified epithelium: single layer of cells; all cells rest on the basement membrane.
    C) Glandular epithelium: arises from surface epithelia and underlying connective tissue.
    D) Pseudostratified epithelium: multiple layers of cells; the deepest layer rests on the basement membrane.
    Ans: C
    Feedback:
    Glandular epithelial tissue is formed by cells to produce fluid and arises from surface epithelium, involving connective tissue. Simple epithelium is a single layer of cells resting on the basement membrane; stratified epithelium has more than one layer, with the deepest layer resting on the basement membrane. Pseudostratified epithelium is in contact with the intercellular matrix and may not extend to the surface.

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18. Which body tissue exhibits the highest rate of turnover and renewal?
    A) The squamous epithelial cells of the skin
    B) The connective tissue supporting blood vessels
    C) The skeletal muscle that facilitates movement
    D) The nervous tissue that constitutes the central nervous system
    Ans: A
    Feedback:
    Cells making up the epithelial tissues generally exhibit a high rate of turnover, which is related to their location and function. Renewal of connective and muscle tissue takes place at a much slower pace, whereas nervous tissue is incapable of postnatal regeneration.

19. While explaining to a post–surgical knee client about the various forms and function of connective tissue, the nurse gives the example of the client's surgical repair of a torn anterior cruciate ligament (ACL), which is due to:
    A) A reticular fiber problem that interrupted the framework for capillaries
    B) A dense regular connective tissue tear that is usually rich in collagen fibers that allows ligaments to join bone to bone
    C) An irregular, dense connective tissue tear of loose connective tissue that is located in the perichondrium
    D) Irregular filling of spaces between tissues to facilitate keeping of joints and tendons in their proper place
    Ans: B
    Feedback:
    Dense regular connective tissues are rich in collagen fibers and form the tendons and aponeuroses that join muscles to bone or other muscles and the ligaments that join bone to bone. Dense irregular connective tissue consists of the same components found in loose connective tissue but exhibits a predominance of collagen fibers and fewer cells. This type of tissue can be found in the fibrous sheaths of cartilage (i.e., perichondrium) and bone (i.e., periosteum). Fibroblasts, the most abundant loose connective tissue cells, synthesize the gel-like substance and collagen, elastin, and reticular fibers. Reticular fibers provide a fibrous framework for capillaries. Adipose tissue helps to fill spaces between tissues and keep organs in place.

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20. A student asks the instructor what it means when the book states, skeletal muscles are syncytial or multinucleated? The instructor responds:
    A) "Each of the skeletal muscle cells has an apical, lateral, and basal surface."
    B) "They are closely apposed and are joined by cell-to-cell adhesion molecules."
    C) "This means that these muscles exhibit cross-striations formed by alternating segments of thick and thin protein filaments, with muscle cells having a branched appearance."
    D) "If a skeletal muscle is injured and a portion dies, the adjacent sections of that same skeletal muscle fiber do not die because they have their own nuclear material."
    Ans: D
    Feedback:
    Skeletal muscles are syncytial or multinucleated structures, meaning there are no true cell boundaries within a skeletal muscle fiber. The multinucleated arrangement is important in pathologic states where focal necrosis (death) of a portion of skeletal muscle fibers does not result in necrosis death of the adjacent sections of that same skeletal muscle fiber, because those adjacent sections have their own nuclear material. Cardiac muscle exhibits cross-striations formed by alternating segments of thick and thin protein filaments. In contrast to skeletal muscle, cardiac muscle cells may be branched instead of linear and longitudinal. The other noted qualities are associated with epithelial, not skeletal muscle, cells.

21. With skeletal muscle contraction, what prevent the development of cross-bridges between the actin and myosin? Select all that apply.
    A) Tropomyosin attaches globular heads to the myosin filament.
    B) Troponin covers the tropomyosin-binding sites and prevents the formation of cross-bridges.
    C) ATP actually plays a role in the positioning of the myosin filaments and actin.
    D) The concentration of calcium around the myofibrils will prevent the cross-bridges from being formed.
    Ans: A, B
    Feedback:
    Associated with each actin filament are the two regulatory proteins: tropomyosin and troponin. *Tropomyosin*, which lies in grooves of the actin strand, provides the site for attachment of the globular heads of the myosin filament. In the noncontracted state, *troponin* covers the tropomyosin-binding sites and prevents formation of cross-bridges between the actin and myosin. Energy from ATP is used to break the actin and myosin cross-bridges, stopping the muscle contraction. The binding of calcium to troponin uncovers the tropomyosin-binding sites such that the myosin heads can attach and form cross-bridges.

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22. Which of the following statements about how smooth muscle differs from skeletal or cardiac muscle are accurate? Smooth muscle: Select all that apply.
    A) Has dense bodies attached to actin filaments
    B) Contains sarcomeres between Z lines and M bands
    C) Contracts more rapidly than skeletal muscles
    D) Has one centrally located nucleus
    Ans: A, D
    Feedback:
    Smooth muscle cells are spindle shaped and smaller than skeletal muscle fibers. Each smooth muscle cell has one centrally positioned nucleus. Smooth muscle contains dense bodies that are attached to the membrane, dispersed in the cell, and attached to actin filaments. Smooth muscle has slow contractions and no cross-striations. Sarcomeres are the functional units of cardiac and skeletal muscle only. The sarcomeres extend between Z lines and M bands.

23. A client with a pathophysiologic condition that affects the desmosomes is most likely to exhibit:
    A) Impaired contraction of skeletal and smooth muscle
    B) Weakness of the collagen and elastin fibers in the extracellular space
    C) Impaired communication between neurons and effector organs
    D) Separation at the junctions between epithelial cells
    Ans: D
    Feedback:
    Desmosomes are a type of cell junction common in epithelium. Failure of epithelial desmosomes results in the inappropriate separation of adjacent cells. Desmosomes do not contribute to muscle contraction, communication between neurons and effector organs, or the structure of collagen and elastin.

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24. When exercising outside on an extremely warm day, the client can feel his heart pounding very rapidly. Thinking in terms of the ability of the aorta to stretch to accommodate more blood circulating during exercise and the warm environment, this is an example of the function of which fibrous protein?
    A) Collagen
    B) Reticular
    C) Elastin
    D) Ligaments
    Ans: C
    Feedback:
    Three types of fibers are found in the extracellular space: collagen, elastin, and reticular fibers. *Elastin* acts like a rubber band; it can be stretched and then returns to its original form. Elastin fibers are abundant in structures subjected to frequent stretching, such as the aorta and some ligaments. *Collagen* is the most common protein in the body. It is a tough, nonliving, white fiber that serves as the structural framework for skin, ligaments, tendons, and many other structures. *Reticular fibers* are extremely thin fibers that create a flexible network in organs subjected to changes in form or volume, such as the spleen, liver, uterus, or intestinal muscle layer.

25. While caring for a client who has just been diagnosed with leukocyte adhesion deficiency (LAD), the client asks why he is always sick with an infection. The nurse responds, “LAD is a rare autosomal recessive disorder that results in recurrent infections because of the lack of transmigration. This means:
    A) Your body doesn't make enough white blood cells.”
    B) Your white blood cells are not able to leave the blood vessels and move into the area of infection.”
    C) I don't really understand this, but it sounds like a good question to ask your physician.”
    D) Your bone marrow is damaged and can't put out enough white blood cells to fight off your infections.”
    Ans: B
    Feedback:
    Leukocyte adhesion deficiency (LAD) is a rare autosomal recessive disorder characterized by immunodeficiency, resulting in recurrent infections. A WBC differential will reveal extremely elevated levels of neutrophils (on the order of 6–10 times normal) because they are unable to leave the blood vessels. Certain integrins play an important role in allowing white blood cells to pass through the vessel wall, a process called *transmigration*.

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