Guyton and Hall Textbook of Medical Physiology 14th Edition Hall Test Bank

Chapter 1. Functional Organization of the Human Body and Control of the "Internal Environment"

Test Bank

1. The most abundant type of cell in the human body is which of the following?
   A. Neuron
   B. Epithelial cell
   C. Red blood cell
   D. White blood cell
   E. Vascular smooth muscle cell
   F. Skeletal muscle cell

ANS: C

2. The most abundant substance in the human body and the approximate percentage of that substance in the body is which of the following?
   A. Protein, 30%
   B. Protein, 60%
   C. Water, 30%
   D. Water, 60%
   E. Carbohydrate, 30%
   F. Carbohydrate, 60%

ANS: D

3. A large volume of blood is transfused to a person whose baroreceptor blood pressure control system is not functioning and arterial blood pressure rises from the normal level of 100 to 160 mm Hg. If the same volume of blood is infused into the same person when the baroreceptor system is functioning and this time the arterial pressure increases from the normal level from 100 mm Hg up to 120 mm Hg, calculate the gain of the baroreceptor system in this person.
   A. -3
   B. -2
   C. -1
   D. 0

E. +1
F. +2
G. +3

ANS: B

4. Which of the following substances has the highest extracellular fluid to intracellular fluid concentration ratio for most mammalian cells?
A. Sodium ions
B. Potassium ions
C. Carbon dioxide
D. Glucose
E. Protein

ANS: A

5. Exchange of substances between the cardiovascular system and the interstitial fluid occurs mainly in which of the following?
A. Arteries
B. Arterioles
C. Capillaries
D. Venules
E. Veins

ANS: C

6. Which of the following is the approximate distance from the capillaries to most cells of the body?
A. Less than 50 angstroms
B. Less than 50 microns
C. Less than 50 millimeters
D. Less than 100 angstroms
E. Less than 100 microns
F. Less than 100 millimeters

ANS: A

7. When a person is at rest, how much time is required for the blood in the circulation to traverse the entire circulatory circuit?
A. 1 second
B. 1 minute
C. 3 minutes
D. 4 minutes
E. 5 minutes

ANS: B

8. _____ feedback is often referred to as a "vicious cycle" because it leads to _____ instability and sometimes death.
   A. Postitive, progressive
   B. Positive, diminished
   C. Negative, progressive
   D. Negative, diminished
   E. Adaptive, progressive

ANS: A

9. Which of the following is an example of positive feedback in the body?
   A. Clotting of blood
   B. Return of blood pressure toward normal after a hemorrhage
   C. Increased respiration rate caused by accumulation of carbon dioxide in the blood
   D. Decreased sympathetic nervous system activity that occurs in response to increased blood pressure

ANS: A

Chapter 2. The Cell and Its Functions

Test Bank

Refer to the following list to answer questions 1-3:

   A. Nucleolus
   B. Nucleus
   C. Agranular endoplasmic reticulum
   D. Granular endoplasmic reticulum
   E. Golgi apparatus
   F. Endosomes
   G. Peroxisomes
   H. Lysosomes
   I. Cytosol

Identify the cellular location for each of the following steps involved in the synthesis and packaging of a secreted protein.

Initiation of translation. cytosol

ANS: I

Protein sorting and packaging. golgi apparatus

ANS: E

Gene transcription. nucleus

ANS: B

4. Which of the following is true for both pinocytosis and phagocytosis?
   A. Involves the recruitment of actin filaments
   B. Occurs spontaneously and non-selectively
   C. Permits the uptake of bacterium into the cytosol
   D. Is only observed in macrophages and neutrophils
   E. Does not require ATP

ANS: A

5. The cell membrane is **LEAST** permeable to which of the following?
   A. Sodium
   B. Oxygen
   C. Ethanol
   D. Carbon Dioxide
   E. Water

ANS: A

6. The term "glycocalyx" refers to:
   A. The negatively charged carbohydrate chains that protrude into the cytosol from glycolipids and integral glycoproteins
   B. The negatively charged carbohydrate layer on the outer cell surface
   C. The layer of anions aligned on the cytosolic surface of the plasma membrane
   D. The large glycogen stores found in "fast" muscles
   E. A mechanism of cell-cell attachment

ANS: B

7. Proteins are sorted for their delivery to lysosomes, secretory vesicles and the plasma membrane in the:
   A. Golgi apparatus
   B. smooth endoplasmic reticulum
   C. nucleus
   D. endocytotic vesicle

ANS: A

8. Ubiquinone, an electron acceptor in the electron transport chain (oxidative phosphorylation), is found in the:

A. Inner mitochondrial membrane
B. Mitochondrial matrix
C. Outer mitochondrial membrane
D. Nucleus

ANS: A

9. The citric acid cycle or Kreb's cycle, takes place in the:
A. Mitochondrial matrix
B. Inner mitochondrial membrane
C. Outer mitochondrial membrane
D. Inner mitochondrial space

ANS: A

10. Which of the following processes is NOT ATP-dependent?
A. Ciliary movement
B. Positive chemotaxis
C. Movement of carbon dioxide across a lipid bilayer
D. Endocytosis
E. Smooth muscle contraction

ANS: C

11. This cytoskeletal element plays a role in certain forms of cell movement and is an essential component of the mitotic spindle:
A. Phospholipids
B. Glycocalyx
C. F-actin
D. Microtubules
E. Clathrin

ANS: D

12. Lipid synthesis occurs in the:
A. Trans-Golgi network
B. Granular or "rough" endoplasmic reticulum
C. Agranular or "smooth" endoplasmic reticulum
D. Nucleus
E. Lysosome

ANS: C

13. This cytoskeletal element plays a role in certain forms of cell movement and is an essential component of the mitotic spindle:
A. Phospholipids
B. Glycocalyx

C. F-actin
D. Microtubules
E. Clathrin

ANS: D

14. The abnormal cleavage of mannose residues during the post-translational processing of glycoproteins has been shown to result in the development of a lupus-like autoimmune disease in mice. The abnormal cleavage is due to a mutation of the enzyme -mannosidase II.
Based on your understanding of the processing of membrane proteins, you would predict this enzyme to be localized to the:
A. Nucleus
B. Cytosol
C. Golgi apparatus
D. Lysosomes
E. Peroxisomes

ANS: C

15. The observation that abnormal cleavage of mannose residues from glycoproteins causes an autoimmune disease in mice is **most** consistent with the role of which of the following structures in the normal immune response?
A. Cytoskeleton
B. Glycocalyx
C. Peroxisomes
D. Lysosomes
E. Microtubules

ANS: B

16. A pure phospholipid bilayer is most permeable to:
A. Sodium
B. Calcium
C. Chloride
D. Water
E. Oxygen

ANS: E

Chapter 3. Genetic Control of Protein Synthesis, cell function, and cell reproduction

Test Bank

1. Facioscapulohumeral muscular dystrophy (FSHD) is characterized by the deletion of a DNA sequence on chromosome 4q35. This deletion correlates with both the inability of a specific protein complex to bind to the DNA and an overexpression of the genes upstream of the deletion. The sequence deleted in FSHD **most likely** functions normally as:
   A. An activator protein
   B. A repressor protein
   C. An activator element
   D. A repressor element
   E. A promoter sequence

ANS: D

2. In comparing two cell types from the same person (e.g. a neuron and an epithelial cell) the variation in their proteomes, or the proteins expressed by each cell type, reflects:
   A. Differences in the DNA contained in the nucleus of each cell
   B. Variation in the numbers of copies of specific genes in their respective genomes
   C. Cell-dependent expression and/or repression of specific genes
   D. Differences in the number of chromosomes in each cell
   E. The loss of genes from each genome over time

ANS: C

3. Which of the following correctly describes the sequence of events that occur during the synthesis and packaging of a secreted protein?
   A. The gene is transcribed in the cytosol; mRNA is translated by ribosomes bound to "rough" endoplasmic reticulum; the protein is packaged for secretion in the trans-Golgi network
   B. The gene is transcribed in the nucleus; RNA polymerase binds to the start codon; the protein is packaged for secretion in the trans-Golgi network
   C. Translation is initiated in the cytosol; the protein is carried in membrane-bound vesicles to the cis-Golgi apparatus; the protein is packaged for secretion in the trans-Golgi network
   D. Translation is initiated in the cytosol; new polypeptide is co-transported with Na^+ across the outer ER membrane; the protein is glycosylated in the Golgi apparatus
   E. Translation is initiated by small ribosomal subunits anchored to the ER membrane; protein is glycosylated in the Golgi apparatus; the protein is packaged into lysosomes

ANS: C

4. Which of the following does NOT play a direct role in the process of transcription?
   A. Helicase
   B. RNA polymerase

C. A chain terminating sequence
D. “Activated” RNA molecules
E. A promoter sequence

ANS: A

5. “Redundancy” or “degeneration” of the genetic code occurs during which of the following steps of protein synthesis?
A. DNA replication
B. Transcription
C. Post-transcriptional modification
D. Translation
E. Protein glycosylation

ANS: B

6. Which of the following bases is NOT present in RNA?
A. Cytosine
B. Thymine
C. Adenine
D. Guanine

ANS: B

7. The process of translation takes place:
A. In the cytosol and on the surface of the “rough” endoplasmic reticulum
B. In the nucleus and on the surface of the “rough” endoplasmic reticulum
C. In the cytosol and the trans-Golgi network (TGN)
D. In the nucleus and on the outer mitochondrial membrane

ANS: A

8. Which of the following statements about translation is NOT true?
A. Multiple ribosomes can simultaneously translate a single mRNA molecule
B. Each codon codes for one amino acid
C. One mRNA molecule can code for multiple proteins, depending on which start codon is recognized by the small ribosomal subunit
D. Translation is terminated when the release factor binds to the stop codon

ANS: C

9. The following statements accurately describe the process of DNA replication EXCEPT:
A. The entire genome is replicated only once per cell cycle
B. It occurs during the M phase of the cell cycle
C. Nucleotides are incorporated into the growing DNA strand at the 3’ end

D. DNA “proofreading” is performed by DNA polymerase

ANS: C

10. The mechanism by which allolactose regulates the transcription of the beta-galactosidase gene is **best** described as:
    A. De-repression
    B. Repression
    C. Activation
    D. Negative feedback
    E. Positive feedback

ANS: A

11. Which of the following does **NOT** occur during the process of mitosis?
    A. Replication of the genome
    B. Condensation of the chromosomes
    C. Fragmentation of the nuclear envelope
    D. Alignment of the chromatids along the equatorial plate
    E. Separation of the chromatids into two sets of 46 “daughter” chromosomes

ANS: A

12. “Redundancy” or “degeneration” of the genetic code occurs during which of the following steps of protein synthesis:
    A. DNA replication
    B. Transcription
    C. Post-transcriptional modification
    D. Translation
    E. Protein glycosylation

ANS: B

13. The appearance of which of the following distinguishes eukaryotic cells from lower units of life like bacteria and viruses?
    A. DNA
    B. RNA
    C. Membranes
    D. Protein
    E. Nucleus

ANS: E

Chapter 4. Transport of Substances Through Cell Membranes

Test Bank

1. An artificial membrane is created consisting of a lipid bilayer without protein molecules in the membrane. The lipid composition of the membrane is essentially the same as that of a normal, biological membrane. Which of the following substances permeates the membrane more readily than water molecules?
   A. Carbon Dioxide
   B. Glucose
   C. Glycerol
   D. Sodium
   E. Urea

ANS: A

2. A cell is equilibrated in an aqueous solution of 300 mOsm/L sodium chloride. Which of the following best describes what will happen to cell volume when the cell is placed in an aqueous solution of 300 mOsm/L calcium chloride?
   A. Decrease
   B. Decrease and then increase
   C. Increase
   D. Increase and then decrease
   E. No change

ANS: E

3. The intracellular calcium ion concentration of ventricular muscle cells averages 10^{-4} mmol/L during diastole. The calcium ion concentration in transverse tubules (T-tubules) averages 2.5 mmol/L at rest. A protein transporter on the membrane of the T-tubule exchanges sodium for calcium. The transporter uses the transmembrane sodium gradient to fuel the exchange. Which of the following transport mechanisms best describes this type of transporter?
   A. Facilitated diffusion
   B. Primary active transport
   C. Secondary active co-transport
   D. Secondary active counter-transport
   E. Simple diffusion

ANS: D

4. Human red blood cells (RBCs) and rabbit RBCs are equilibrated in separate solutions of isotonic saline (300 mOsm/L NaCl). The human RBCs are then placed in a solution of 300 mOsm/L glycerol, which causes them to swell and burst. However, rabbit RBCs placed in 300 mOsm/L glycerol neither swell nor shrink. Based on this information, which of the following can be concluded about a 300 mOsm/L solution of glycerol for the different cell types?

	Human RBCs	Rabbit RBCs
A.	Hypertonic and hyperosmotic	Hypotonic and hypoosmotic
B.	Hypotonic and hypoosmotic	Hypertonic and hyperosmotic
C.	Hypotonic and isoosmotic	Isotonic and isoosmotic
D.	Isotonic and hypoosmotic	Isotonic and hyperosmotic
E.	Isotonic and isoosmotic	Hypotonic and isoosmotic
F.	Isotonic and hyperosmotic	Isotonic and isoosmotic

ANS: C

5. The molarity of a 2% solution of NaCl is 340 mmol/L. The molecular weight of NaCl is 58.5. What is the osmolarity of a 2% solution of NaCl (in mOsm/L)?
   A. 170
   B. 340
   C. 510
   D. 680

ANS: D

6. Secondary active transport typically moves which of the following substances against a concentration gradient?

	Glucose	Amino acids	Sodium ions
A.	No	No	No
B.	No	No	Yes
C.	Yes	No	Yes
D.	Yes	Yes	No
E.	Yes	Yes	Yes

need ion channels

ANS: D

7. Which of the following transport mechanisms can move sodium ions across a cell membrane?

Primary active transport	Secondary active transport	Simple diffusion
No	No	No
No	Yes	Yes
Yes	No	Yes
Yes	Yes	No
Yes	Yes	Yes

ANS: E

8. The diagram illustrates possible changes in red blood cell volume resulting from a change in extracellular fluid composition for a cell equilibrated in a 150 mmol/L solution of sodium chloride (NaCl) at time zero. Which curve best illustrates the volume change caused by immersion of the cell in an aqueous solution of 300 mOsm/L calcium chloride ($CaCl_2$)?

ANS: C

9. The diagram illustrates possible changes in red blood cell volume resulting from a change in extracellular fluid composition for a cell equilibrated in a 150 mmol/L solution of sodium chloride (NaCl) at time zero. Which curve best illustrates the volume change caused by immersion of the cell in an aqueous solution of 200 mOsm/L NaCl and 200 mOsm/L glycerol?

ANS: B

10. Which of the following pairs of aqueous solutions will exert equal osmotic pressures across a normal cell membrane after steady-state conditions have been established?

	Solution A	Solution B
A.	10% albumin	10% IgG
B.	100 mmol/L NaCl	200 mmol/L $CaCl_2$
C.	300 mOsm/L glucose	300 mOsm/L urea
D.	300 mOsm/L glycerol	300 mOsm/L NaCl
E.	300 mOsm/L glycerol	300 mOsm/L urea

ANS: E

11. Two compartments (X and Y) are separated by a typical biological membrane (i.e., lipid bilayer). The concentrations of a permeant solute (i.e., urea) at time zero are shown. Which of the drawings below represents the volumes of X and Y when the system reaches equilibrium?

ANS: A

12. The diagram illustrates possible changes in red blood cell volume resulting from a change in extracellular fluid composition for a cell equilibrated in 150 mmol/L NaCl at

D. ↓ ↔
E. ↔ ↑

ANS: D

6. When a person lifts a 25-pound weight, what type or types of muscle contraction are involved?
   Isometric contraction only
   Isotonic contraction only
   Isometric contraction followed by isotonic contraction
   Isotonic contraction followed by isometric contraction

ANS: C

7. The length-tension diagram shown was obtained from a skeletal muscle with equal numbers of red and white fibers. Supramaximal tetanic stimuli were used to initiate an isometric contraction at each muscle length studied. The resting length was 20 cm. What is the maximum amount of active tension this muscle is capable of generating at a preload of 100 grams?
   A. 145 to 155 grams
   B. 25 to 35 grams
   C. 55 to 65 grams
   D. 95 to105 grams
   E. Cannot be determined

ANS: C

8. The diagram shows the relationship between muscle tension and sarcomere length for muscle. Which point on the curve represents tension development at a normal resting length for skeletal muscle?

ANS: C

9. The diagram shows the relationship between muscle tension and sarcomere length for muscle. Which point on the curve represents tension development at a normal resting length for cardiac muscle?

ANS: B