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CORRECT ANSWERS ARE LOCATED IN THE 2ND HALF OF THIS DOC.

TRUE/FALSE - Write 'T' if the statement is true and 'F' if the statement is false.

1) The basic function of neurons is to conduct a nerve impulse.
   - ◎ true
   - ◎ false

CHECK ALL THE APPLY. Choose all options that best completes the statement or answers the question.

2) All cells have fundamentally similar organization, but may not all contain the same types of structures. Which of the following structures is/are common to *all* (prokaryotic and eukaryotic) cells. Select all that apply.
   - A) Mitochondria
   - B) Cell membrane
   - C) Ribosomes
   - D) Membrane-bound nuclei

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3) Animals respire aerobically most of the time. Which of the following statements help us understand why the size and activity of animals required the evolution of aerobic cellular metabolism?
   - A) Aerobic cellular metabolism involves fewer metabolic conversions, and it is, therefore, a more direct metabolic process.
   - B) Aerobic metabolic pathways provide multiple branch points and can serve functions other than the breakdown of glucose to yield ATP.
   - C) Energy produced by aerobic metabolism is usually a little less than two-fold that of anaerobic metabolism. Aerobic metabolism has a higher useful energy yield.
   - D) Aerobic metabolism oxidizes glucose more completely. An animal can derive more energy from glucose aerobically than it can anaerobically.

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4) Which of the following statements are true regarding glycolysis? Check all that apply.
   A) Under anaerobic conditions in an animal, there is a net gain of two ATP and lactic acid is a by-product.
   B) Glycolysis occurs only under anaerobic conditions in a cell.
   C) Under aerobic, conditions glycolysis yields a net gain of two ATP and two NADH. Two pyruvates are produced. The two pyruvates per glucose and the two NADH move to the mitochondrion for further processing to produce more ATP.
   D) $CO_2$is released during glycolysis in animal cells.</p>

5) Select the statements that accurately reflect events occurring in a mitochondrion.
   A) Pyruvate is an endproduct of events occurring in the mitochondrial matrix.
   B) Protons accumulate between the inner and outer mitochondrial membranes.
   C) $CO_2$is released from the mitochondrion as a result of the breakdown of pyruvates from glycolysis.</p>
   D) Electron transport along the inner mitochondrial membrane eventually results in the formation of water.

MULTIPLE CHOICE - Choose the one alternative that best completes the statement or answers the question.

6) The simplest organization of matter that exhibits the properties of life is the _____.
   A) cell
   B) tissue
   C) protein
   D) nucleic acid
   E) organism

7) The surface to volume ratio of a cell limits _____.
   A) the type of organelles present
   B) the organelle/microtubule volume
   C) the number of organelles present
   D) the plasma membrane/DNA volume
   E) the size a cell may reach

8) As the radius of a cell increases, the surface area _____ and the ratio of surface area to volume _____.
   A) decreases; increases
   B) increases; decreases
   C) decreases; remains the same
   D) increases; remains the same
   E) remains the same; increases

9) An organelle that is used for storage and internal transport, serves as a site for attachment of ribosomes, and makes steroids is the _____.
   A) cytoskeleton
   B) mitochondrion
   C) lysosome
   D) endoplasmic reticulum
   E) centriole

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10) The organelle that packages and routes the synthesized products of a eukaryotic cell is the _____.
A) flagellum
B) ribosome
C) peroxisome
D) nucleolus
E) Golgi apparatus

11) A structure of a cell that detoxifies alcohol and breaks down hydrogen peroxide is the_____.
A) ribosome
B) vault
C) peroxisome
D) Golgi apparatus
E) rough endoplasmic reticulum

12) These structures have recently been shown to act as signal-receiving "antennae" for cells that help them monitor the extracellular environment.
A) Vacuoles
B) Mitochondria
C) Smooth endoplasmic reticulum
D) Cilia
E) Rough endoplasmic reticulum

13) This organelle functions in cell division and organization of the cytoskeleton.
A) Mitochondrion
B) Centriole
C) Endoplasmic reticulum
D) Chloroplast
E) Lysosome

14) The semifluid phase of the cytoplasm that contains organelles, vesicles, and inclusions, and serves as a medium for metabolic reactions is the _____.
A) nucleoplasm
B) cytoskeleton
C) cytosol
D) peroxisome
E) plasma membrane

15) The _____ of the mitochondria function in increasing the inner membranous surface area and function in electron transport and chemiosmosis.
A) centrioles
B) matrix
C) strobili
D) cristae
E) thylakoids

16) Membrane proteins attached to the inner or outer surfaces of plasma membranes are called _____ proteins.
A) transmembrane
B) hydrophobic
C) monolayer-associated
D) hydrophilic
E) mosaic

17) Membrane proteins that are embedded within the membrane and may function in moving materials across the membrane are called _____ proteins.
A) hydrophobic
B) monolayer associated
C) mosaic
D) transmembrane
E) hydrophilic

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18) The "cell coat," made of surface carbohydrates and portions of proteins, is called the _____.
A) tunic
B) cell wall
C) plasma membrane
D) desmosome
E) glycocalyx

19) The ability of a membrane to regulate passage of materials into and out of a cell is called _____.
A) selective permeability
B) innate regulation
C) active transport
D) membrane uniformity
E) homeostasis

20) Water molecules move through selectively permeable membranes from areas of high concentration of water to areas of lower concentration by _____.
A) simple diffusion
B) endocytosis
C) osmosis
D) facilitated diffusion
E) hydrostatic infusion

21) When large polar molecules bind temporarily with a carrier protein in a cell's membrane and move across the membrane from areas of higher concentration to areas of lower concentration, _____ has occurred. No ATP energy has been used.
A) Simple diffusion.
B) Endocytosis.
C) Receptor-mediated osmosis.
D) Active transport.
E) Facilitated diffusion.

22) The form of transport involved when blood pressure forces water and small dissolved molecules into kidney tubules is _____.
A) osmosis
B) simple diffusion
C) complex diffusion
D) filtration
E) facilitated diffusion

23) Cells placed in this type of solution will shrivel.
A) Isotonic
B) Water
C) Hypertonic
D) Hypotonic
E) Metatonic

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24) Active transport _____.
A) can only move molecules from higher to lower concentrations
B) uses cellular energy to move molecules from lower to higher concentrations
C) moves molecules through protein channels by binding them to large lipid molecules
D) can only move protein molecules
E) can only move carbohydrate molecules

25) _____ may enter or leave a cell through an aquaporin.
A) Water
B) Cholesterol
C) Glucose
D) Beta carotene
E) Vitamin D

26) When a plasma membrane encloses small fluid droplets and takes them into the cell, a form of transport known as _____ occurs.
A) active diffusion
B) receptor-mediated exocytosis
C) pinocytosis
D) facilitated diffusion
E) phagocytosis

27) When cells such as white blood cells of a vertebrate engulf bacteria, the membrane transport mechanism used is _____.
A) receptor-mediated endocytosis
B) active transport
C) passive transport
D) phagocytosis
E) exocytosis

28) Two important and well-known active transport mechanisms in nerve and muscle cells are the _____ pumps.
A) sodium–phosphorus and calcium
B) calcium and sulfur
C) oxygen and carbon dioxide
D) protein and nucleic acid
E) calcium and sodium–potassium

29) The protein that makes up the microtubules inside cilia and flagella is
A) tubulin.
B) actin.
C) myosin.
D) mucin.
E) collagen.

30) Structures associated with the endoplasmic reticulum, necessary for protein synthesis, are the
A) desmosomes.
B) ribosomes.
C) peroxisomes.
D) chromosomes.
E) nucleosomes.

31) The organelle that is especially prominent and well-developed in secretory cells (such as glandular epithelial cells) is the _____.
A) centriole
B) phagolysosome
C) Golgi apparatus
D) mitochondrion
E) peroxisome

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32) The structures that are elongated appendages used for propelling the cell or for moving material over the cell surface are the _____.
A) cilia and flagella
B) axonemes and myonemes
C) basal bodies and centrioles
D) microtubules and microfilaments
E) axopodia and myopodia

33) A major function of the cell nucleus is _____.
A) storing proteins
B) storing genetic information
C) packaging materials for secretion
D) packaging ATP for cellular use
E) serving as a site for protein synthesis

34) The nuclear envelope is continuous with the _____ at a number of points.
A) plasma membrane
B) Golgi apparatus
C) endoplasmic reticulum
D) mitochondria
E) cytoskeleton

35) The _____ is a nonmembranous structure inside the nucleus that serves as the preassembly point for ribosomes.
A) nucleosome
B) nucleotide
C) nucleoplasm
D) nucleolus
E) nucleoside

36) _____ aid in transport of messenger RNA into the cytoplasm of eukaryotic cells.
A) Vaults
B) Ribosomes
C) Peroxisomes
D) Nucleoli
E) Centrioles

37) Which of the following is not an example of an organ system?
A) Digestive
B) Lymphatic
C) Respiratory
D) Nervous
E) Blood

38) The type of tissue that covers or lines structures is _____.
A) epithelial tissue
B) fibrous tissue
C) adipose tissue
D) contractile tissue
E) skeletal tissue

39) Blood is considered to be a/an _____ tissue.
A) epithelial
B) liquid
C) hyaline
D) connective
E) adipose

40) Heart, lungs, and liver are examples of functional units called _____.
A) tissues
B) organelles
C) systems
D) histological entities
E) organs

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41) Two organelles called _____ lie at right angles to each other near the nucleus and are involved with movement of the chromosomes during cell division.
A) centrioles
B) centrosomes
C) centromeres
D) concentricyclones
E) cycloses

42) There are three types of muscle tissue, yet they all share one common feature. Of the following, which describes this feature?
A) The cells in muscle tissue can shorten and accomplish movement.
B) Muscle tissue is attached to the skeleton of the body.
C) Muscle tissue is striated.
D) The cells in muscle tissue all have a centrally located nucleus.

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43) Adenosine triphosphate (ATP) is the energy currency of a cell. All of the following statements regarding ATP are true except one. Select the exception.
A) ATP is formed when ADP is phosphorylated using energy derived from molecules an animal consumes in its diet.
B) <p>The splitting of the third phosphate from ATP to produce ADP and P_i releases energy used to support an animal's metabolism.
C) ATP is a nucleotide similar in structure to the nucleotides that comprise DNA.
D) ATP is used to lower the activation energy in enzymatic reactions.

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44) Which of the following is true regarding an enzyme's function?
A) An enzyme raises the energy of activation in a reaction.
B) Enzymes are only employed in metabolic reactions when a net energy input is required for the reaction to occur.
C) During a reaction, an enzyme combines with its substrate, stresses the substrate (or brings two substrates together), and the reaction occurs under conditions that would otherwise not be favorable for the reaction. This combination of enzyme and substrate is called the enzyme–substrate complex.
D) Enzymes catalyze a reaction one time and are then degraded by lysosomes.

45) Which of the following statements is true regarding chemiosmosis?
A) Chemiosmosis results in the formation of water.
B) Chemiosmosis requires the establishment of a proton gradient between the inner and outer mitochondrial membranes and the mitochondrial matrix.
C) Chemiosmosis, like all osmotic phenomena, involves the movement of water from an area of higher concentration to an area of lower concentration.
D) Chemiosmosis involves the transfer of electrons from reduced coenzymes through carriers in the inner mitochondrial membrane.

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Answer Key

Test name: Chapter 02

1) TRUE
2) [B, C]
3) [B, D]
4) [A, C]
5) [B, C, D]
6) A
7) E
8) B
9) D
10) E
11) C
12) D
13) B
14) C
15) D
16) C
17) D
18) E
19) A
20) C
21) E
22) D
23) C
24) B
25) A
26) C
27) D
28) E
29) A
30) B
31) C
32) A
33) B
34) C
35) D
36) A
37) E
38) A
39) D
40) E
41) A
42) A
43) D
44) C
45) B

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2

Learning Outcomes

2.1 CELLS: THE COMMON UNIT OF ALL LIFE

1. Analyze the concept depicted by cell theory that states (in part) "cells are the basic unit of structure and function of life."
2. Describe elements of cell organization common to all cells.

2.2 CELLULAR MEMBRANES AND MEMBRANE TRANSPORT

1. Discuss how our understanding of the structure of the plasma membrane informs our understanding of the following membrane functions: restricting passage of some polar molecules but promoting transport of other polar molecules, promoting the passage of most nonpolar molecules, and recognition of specific types of cells by other cells (e.g., an egg by a sperm cell).
2. Differentiate non-transporter-mediated membrane exchanges from carrier-mediated exchanges, explaining why each type of exchange is important for a cell.

2.3 ENERGY, ENZYMES, AND REACTIONS

1. Cellular functions are usually carried out in multistep metabolic pathways. Explain why multistep pathways are advantageous, and explain the roles of enzymes and energy in these pathways.

2.4 CELLULAR RESPIRATION

1. Hypothesize on possible reasons that animals are aerobic organisms rather than anaerobic like some bacteria and many archaea. Explain how the reactions of cellular respiration provide support for your hypothesis.
2. Explain the role of mitochondria in animal cells.

2.5 THE NUCLEUS, RIBOSOMES, AND VAULTS

1. Assess the related functions of chromatin, the nuclear envelope, ribosomes, and vaults.

2.6 THE ENDOMEMBRANE SYSTEM

1. Explain why the endoplasmic reticulum, Golgi apparatus, endosomes, and lysosomes are functionally related and comprise the endomembrane system.

2.7 PEROXISOMES

1. Explain how peroxisomes protect animals from degradative processes.

2.8 THE CYTOSKELETON AND CELLULAR MOVEMENT

1. Contrast the structure and function of microtubules, intermediate filaments, and microfilaments.

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2. Compare and contrast the structure and function of cilia and flagella.

2.9 LEVELS OF ORGANIZATION IN AN ANIMAL

1. Describe the relationships of tissues to organs and organs to organ systems.
2. Contrast the functions of the four types of tissues found in animals.

Chapter Summary

The plasma membrane is a selective membrane that forms the boundary of the cell. The cytoplasm is a semi-fluid substance (cytosol) in which the organelles are suspended. The nucleus contains the chromatin (uncoiled DNA and the proteins associated with it) surrounded by the nucleoplasm. Cell size is constrained by the surface area to volume ratio. Smaller cells have a higher surface area to volume ratio than do larger cells. When the surface area to volume ratio is too low, diffusion cannot support the movement of materials in and out of the cell at a rate that is necessary to support the metabolism of the cell, so large cells are precluded.

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Answers to End of Chapter: Review and Apply

2.1 Cells: The Common Unit of All Life

a) Cell theory states in part that cells are the basic unit of structure and function of life. We have seen in this section that cells have a fundamentally similar organization and structure. This common organization and structure reflects the fact that all cells had a common origin. The diversity that we see in cells reflects the effects of evolution acting on cells through their 3.9 billion years of existence. The fact that the diversity we see in cells today can be traced back to a common origin means that all life is unified at the cellular level.

2.2 Cellular Membranes and Membrane Transport

a) As lipids cool, they become less fluid. Membrane fluidity facilitates the movement of proteins within the phospholipid of a membrane and many functions related to membrane transport and cellular identification. Membrane sterols modulate the fluidity of cellular membranes, keeping membranes fluid at low temperatures and preserving their normal fluidity at higher temperatures. Were it not for sterols in the membrane fluidity would vary with environmental temperature and interfere with vital membrane functions.

b) Since molecules tend to move along concentration gradients, from higher to lower concentrations, movement against concentration gradients require an input of energy. This energy is in the form of ATP, and it powers the function of various active transport proteins. Many functions could not occur if animal cells lacked this ability. These functions include nerve impulse conduction, muscle

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contraction, absorption of many nutrients across the digestive tract, and the regulation of ion and water balances.

2.3 Energy, Enzymes, and Reactions

a) Metabolic reactions occur in multistep reaction sequences. These multistep sequences provide intermediate compounds that can serve as branch points for alternative pathways and provide multiple points for control of the pathway. A specific enzyme catalyzes each step to allow reactions to occur at temperature conditions compatible with life. Generating ATP requires that glucose be oxidized to provide energy for phosphorylating ADP. If all energy from glucose were to be released in a single step, most of the energy would be lost as heat. Heat thus generated would not be compatible with life. Small-step reactions allow cells to capture most of the energy contained within glucose in a controlled manner.

2.4 Cellular Respiration

a) Glycolysis can occur aerobically or anaerobically, thus it must be the oldest of the three phases of cellular respiration. Animal life flourished after the advent of photosynthesis because photosynthesis resulted in the accumulation of molecular oxygen in the primitive oceans and atmosphere. Oxygen is required for the aerobic functions occurring in mitochondria, which provide much greater efficiency in generating ATP from glucose (2 ATP vs. about 30 ATP).
b) The citric acid cycle is aptly named because citric acid (citrate) is the first compound to be generated in the cycle when acetyl from acetyl CoA combines with oxaloacetic acid.
c) Energy from glucose is carried into the electron transport chain in the form of high energy electrons carried in the form of NADH and $FADH_2$. Energy in these electrons is used to power proton pumps, which create a proton gradient between intermembrane compartment and the mitochondrial matrix. Movement of protons down this gradient through ATP synthase provides the energy for phosphorylating ADP.
d) Oxygen serves as the final electron acceptor in the electron transport chain. If oxygen is absent, all reactions within the mitochondria cease and the ATP derived from glucose is limited to that provided through glycolysis and lactate fermentation.
e) The pathways of cellular respiration are versatile because sugars other than glucose can be metabolized. Fats can be metabolized for energy, or they can be produced when animals consume more food than needed. Glycolysis and lactate fermentation can be used by muscles to provide short bursts of energy under anaerobic condition. Proteins can be metabolized for energy, and their amino acids can be interconverted.

2.4 The Nucleus, Ribosomes, and Vaults

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a) Archaeal and bacterial cells have both RNA and ribosomes. Both are required for the production of proteins vital for the function of all life forms. Vaults, on the other hand, are unique to eukaryotic cells. They aid in the transport of materials, including RNA, between the nucleus and cytoplasm. Since archaeal and bacterial cells have no nuclear envelope, exchanges between the DNA regions and ribosomes do not involve crossing a membrane.

2.5 The Endomembrane System

a) Organelles that comprise the endomembrane system arise from, receive contents from, or are otherwise functionally related to the Golgi apparatus

2.6 Peroxisomes

a) This disease would result in the accumulation of oxidizing materials that could induce DNA damage and be associated with inflammation, aging, or cancer.

2.7 The Cytoskeleton and Cellular Movement

a) A cell without its cytoskeleton would have no internal support and would be incapable of most kinds of cellular movements and internal transport functions that depend on microfilaments (e.g., actin and myosin). Since cilia and flagella are comprised of microtubules, movements promoted by these organelles would not be possible.

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2.8 Levels of Organization in an Animal

a) Tissues are groups of cells that have similar structure and embryonic origin that perform a specialized function. Multicellularity in animals is advantageous because it allows groups of cells to be specialized for functions, which means that all cells do not have to be capable of performing all functions required for survival and reproduction.

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