STUDY GUIDE

8th EDITION

anatomy & physiology



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Study and Review Guide to accompany

ANATOMY & PHYSIOLOGY

Eighth Edition

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Introduction

This *Study and Review Guide to accompany Anatomy and Physiology*, eighth edition, is designed to help you be successful in learning anatomy and physiology. Before attempting to complete any chapter in the *Study and Review Guide*, thoroughly read the corresponding chapter in the textbook, learn the key terms listed at the beginning and end of each textbook chapter, and study your lecture notes. You will then be prepared to complete the questions and exercises that are provided for each chapter.

Each chapter in the *Study and Review Guide* begins with a brief overview of the chapter concepts. A variety of questions is offered to help you cover the material effectively. These questions include multiple choice, true-false, matching, short answer, clinical challenges, labeling, and crossword puzzles. After completing the exercises in a chapter, you can check your answers in the back of the book. Each answer is referenced to the appropriate text page. Additionally, questions are grouped into specific topics that correspond to the text. Each major topic of the *Study and Review Guide* provides references to specific areas of the text, so if you are having difficulty with a particular grouping of questions you have a specific reference area to assist you with remedial work. This feature allows you to identify your area of weakness accurately.

Multiple Choice

For each multiple choice question, there is only one correct answer out of the choices given. Circle the correct choice.

True or False

Read each statement carefully and write true or false in the blank provided.

Matching

Match each numbered term or statement in the left-hand column with its corresponding lettered term or statement in the right-hand column. Write the correct letters in the blanks provided.

Fill in the Blanks

Fill-in-the-blank questions ask you to recall missing word(s) and insert it (them) into the answer blank(s). These questions may involve sentences or paragraphs.

Identify the Term that Does Not Belong

In questions that ask you to identify the incorrect term, three words are given that relate to each other in structure and function, and one more word is included that has no relationship to the other three terms. You are asked to circle the term that does not relate to the others. An example might be: iris, stapes, cornea, and retina. You would circle stapes because all other terms refer to the eye.

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Application Questions

Application questions ask you to make a judgment based on the information in the chapter. These questions may ask you how you would respond to a situation or to suggest a possible diagnosis for a set of symptoms.

Labeling Exercises

Labeling exercises present diagrams with parts that are not identified. According to the directions given, fill in the appropriate labels on the numbered lines or match the numbers with the list of terms provided.

Crossword Puzzles

Vocabulary words from the Key Terms section in each chapter of the text have been developed into crossword puzzles. This exercise encourages recall and proper spelling.

One Last Quick Check

This section selects questions from throughout the chapter to provide you with a final review. This mini-test gives you an overview of your knowledge of the chapter after completing all of the other sections. It emphasizes the main concepts of the unit, but should not be attempted until the specific topics of the chapter have been mastered.

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My thanks to Brian and Sam—Your encouragement kept me on task, the discussions kept my creative juices flowing, and your love makes my life special.

Finally, this book is dedicated in memory of my beloved husband Bill—my beautiful connection to the past, and to my grandchildren Billy, Maddie, and Heather—the sunshine of my life and my link to the future.

Linda Swisher, RN, EdD

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CHAPTER 1

Organization of the Body

The study of anatomy and physiology involves the structure and function of an organism and the relationship of its parts. It begins with a basic organization of the body into different structural levels. Beginning with the smallest level (the cell) and progressing to the largest, most complex level (the system), this chapter familiarizes you with the terminology and the levels of organization needed to facilitate the study of the body in parts or as a whole.

It is also important to be able to identify and describe specific body areas or regions as we progress in this field. The anatomical position is used as a reference when dissecting the body into planes, regions, or cavities. The terminology defined in this chapter allows you to describe the areas efficiently and accurately.

Finally, the process of homeostasis is reviewed. This state of relative constancy in the chemical composition of body fluids is necessary for good health. In fact, the very survival of the body depends on the successful maintenance of homeostasis.

I—ANATOMY AND PHYSIOLOGY AND CHARACTERISTICS OF LIFE

Multiple Choice—select the best answer.

1. *Anatomy* refers to:
   a. using devices to investigate parameters such as heart rate and blood pressure.
   b. investigating human structure via dissection and other methods.
   c. studying the unusual manner in which an organism responds to painful stimuli.
   d. examining the chemistry of life.

2. *Systemic anatomy* refers to anatomical investigation:
   a. at a microscopic level.
   b. that begins in the head and neck and concludes at the feet.
   c. that approaches the study of the body by systems: groups of organs having a common function.
   d. at the cellular level.

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3. *Physiology* refers to the:
   a. nature of human function.
   b. structure of the human form.
   c. evolution of human thought.
   d. accuracy of measuring the human physique.

4. The removal of waste products in the body is achieved by a process known as:
   a. secretion.
   b. excretion.
   c. circulation.
   d. conductivity.

5. *Metabolism* is the:
   a. exchange of gases in the blood.
   b. formation of new cells in the body to permit growth.
   c. sum total of all physical and chemical reactions occurring in the body.
   d. production and delivery of specialized substances for diverse body functions.

▶ *If you had difficulty with this section, review pages 1-6.*

II—LEVELS OF ORGANIZATION

Multiple Choice—select the best answer.

6. Beginning with the smallest level, the levels of organization of the body are:
   a. cellular, chemical, tissue, organelle, organ, system, organism.
   b. cellular, chemical, organelle, organ, tissue, organism, system.
   c. chemical, cellular, organelle, organ, system, organism.
   d. chemical, organelle, cellular, tissue, organ, system, organism.

7. Molecules are:
   a. combinations of atoms forming larger chemical aggregates.
   b. electrons orbiting a nucleus.
   c. a complex of electrons arranged in orderly shells.
   d. composed of cellular organelles.

8. Mitochondria, Golgi apparatus, and endoplasmic reticulum are examples of:
   a. macromolecules.
   b. cytoplasm.
   c. organelles.
   d. nuclei.

9. Blood production is a function of which system?
   a. circulatory
   b. respiratory
   c. skeletal
   d. urinary

10. Support and movement are functions of which systems?
    a. respiratory, digestive, and urinary systems
    b. reproductive and urinary systems
    c. skeletal and muscular systems
    d. cardiovascular and lymphatic/immune systems

Matching—match the term with the proper selection.

a. many similar cells that act together to perform a common function
b. the most complex units that make up the body
c. a group of several different kinds of tissues arranged to perform a special function
d. collections of molecules that perform a function
e. the smallest "living" units of structure and function

11. _____ organelle

12. _____ cells

13. _____ tissue

14. _____ organ

15. _____ systems

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Matching—match each system with its corresponding functions.

a. support and movement
b. communication, control, and integration
c. reproduction and development
d. transportation and defense
e. respiration, nutrition, and excretion

16. _____ integumentary system

17. _____ skeletal system

18. _____ muscular system

19. _____ nervous system

20. _____ endocrine system

21. _____ digestive system

22. _____ respiratory system

23. _____ cardiovascular system

24. _____ lymphatic system

25. _____ urinary system

26. _____ reproductive system

If you had difficulty with this section, review pages 7-10.

III—ANATOMICAL POSITION, BODY CAVITIES, BODY REGIONS, ANATOMICAL TERMS, BODY PLANES AND SECTIONS

Multiple Choice—select the best answer.

27. In the anatomical position, the subject is:
    a. seated with the head facing forward.
    b. standing with the arms at the sides and palms facing forward.
    c. seated with arms parallel to the ground.
    d. standing with the arms at the sides and palms facing backward.

28. The dorsal body cavity contains the:
    a. brain and spinal cord.
    b. abdominal organs.
    c. pelvic organs.
    d. thoracic organs.

29. The ventral body cavity contains the:
    a. thoracic and abdominopelvic cavities.
    b. thoracic cavity only.
    c. abdominopelvic cavity only.
    d. brain and spinal cord.

30. The axial portion of the body consists of:
    a. arms, neck, and torso.
    b. neck, torso, and legs.
    c. torso, arms, and legs.
    d. head, neck, and torso.

31. The abdominopelvic cavity contains all of the following *except* the:
    a. kidneys.
    b. pancreas.
    c. lungs.
    d. urinary bladder.

32. The mediastinum contains all of the following *except* the:
    a. esophagus.
    b. aorta.
    c. lungs.
    d. trachea.

33. Visceral peritoneum would cover which of the following organs?
    a. heart
    b. liver
    c. lungs
    d. brain

34. A sagittal section would divide the body into:
    a. upper and lower parts.
    b. right and left sides.
    c. front and back portions.
    d. none of the above.

35. A coronal section would divide the body into:
    a. upper and lower parts.
    b. right and left sides.
    c. front and back portions.
    d. none of the above.

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36. *Inguinal* is a term referring to which body region?
    a. anterior portion of elbow
    b. armpit
    c. posterior knee
    d. groin

Circle the correct answer.

37. The stomach is (superior or inferior) to the diaphragm.

38. The nose is located on the (anterior or posterior) surface of the body.

39. The lungs lie (medial or lateral) to the heart.

40. The elbow lies (proximal or distal) to the forearm.

41. The skin is (superficial or deep) to the muscles below it.

42. A midsagittal plane divides the body into (equal or unequal) parts.

43. A frontal plane divides the body into (anterior and posterior or superior and inferior) sections.

44. A transverse plane divides the body into (right and left or upper and lower) sections.

45. A coronal plane may also be referred to as a (sagittal or frontal) plane.

Matching—select the correct term from the choices given and insert the letter in the answer blank.

a. ventral cavity b. dorsal cavity

46. _____ thoracic

47. _____ cranial

48. _____ abdominal

49. _____ pelvic

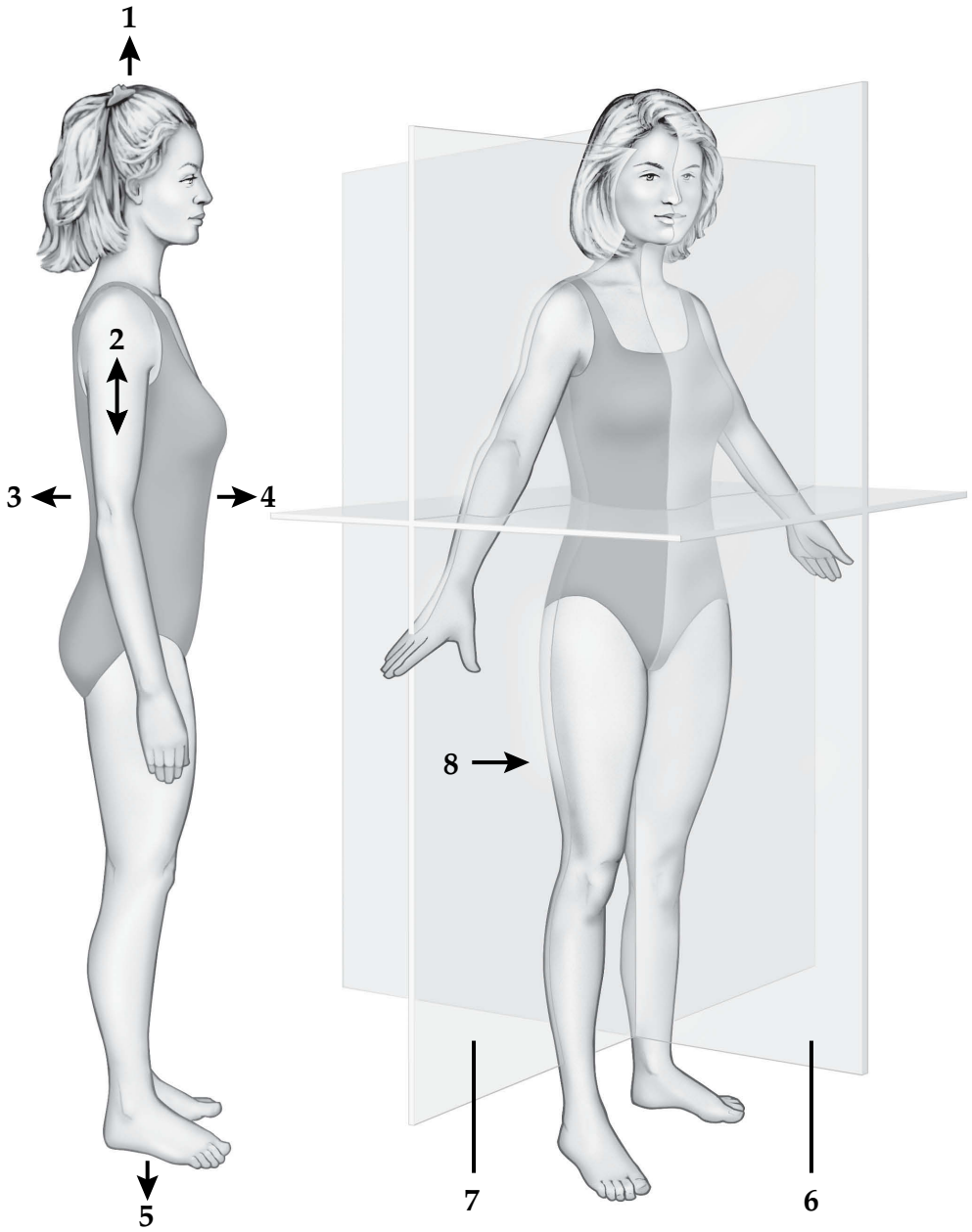
50. _____ mediastinum

51. _____ pleural

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Labeling—using the terms provided, label the anatomical directions on the illustration below.

anterior (ventral)
lateral
posterior (dorsal)
proximal
sagittal plane
frontal plane
superior
inferior



1 _____ 5 _____

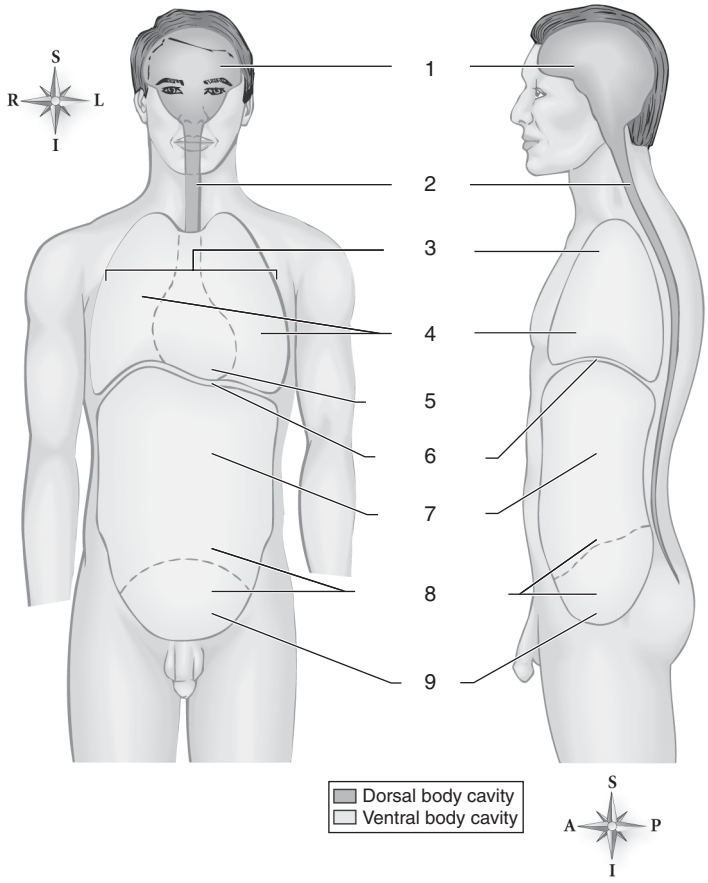
2 _____ 6 _____

3 _____ 7 _____

4 _____ 8 _____

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Labeling—label the various body cavities on the diagram below.



1 _____ 6 _____

2 _____ 7 _____

3 _____ 8 _____

4 _____ 9 _____

5 _____

▶ *If you had difficulty with this section, review pages 10-18.*

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IV—HOMEOSTASIS AND HOMEOSTATIC CONTROL MECHANISMS

Multiple Choice—select the best answer.

52. *Homeostasis* can be defined as the:
    a. relatively constant state maintained by the body.
    b. overall contribution of an organ system.
    c. external stimuli that evoke a disruption to an organism.
    d. lack of cytoplasm within a plasma membrane.

53. Which of the following is *not* a component of a feedback control loop?
    a. sensory mechanism
    b. integrating, or control center
    c. effector mechanism
    d. stressor stimulator

54. Negative feedback control systems:
    a. oppose a change.
    b. accelerate a change.
    c. ignore a change.
    d. none of the above.

55. Positive feedback control systems:
    a. oppose a change.
    b. accelerate a change.
    c. ignore a change.
    d. none of the above.

True or false

56. _____ Any given physiological parameter will never deviate beyond the set point.

57. _____ In the thermostatically regulated furnace example of negative feedback, the furnace functions as the sensor.

58. _____ Negative feedback systems are inhibitory.

59. _____ The process of childbirth, in which the baby's head causes increased stretching of the reproductive tract, which in turn feeds back to the brain, thus triggering the release of oxytocin, is an example of positive feedback.

▶ *If you had difficulty with this section, review pages 18-24.*

V—MECHANISMS OF DISEASE

Matching—match the term with the proper selection.

a. subjective abnormalities
b. study of disease
c. collection of different signs and symptoms that present a clear picture of a pathological condition
d. study of factors involved in causing a disease
e. objective abnormalities
f. undetermined causes
g. disease native to a local region
h. symptoms appear suddenly and for a short period
i. affects large geographic regions
j. actual pattern of a disease's development

60. _____ pathology

61. _____ signs

62. _____ symptoms

63. _____ etiology

64. _____ syndrome

65. _____ idiopathic

66. _____ acute

67. _____ pandemic

68. _____ endemic

69. _____ pathogenesis

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Fill in the blanks.

70. _____ is the organized study of the underlying physiological processes associated with disease.

71. Many diseases are best understood as disturbances of _____.

72. Altered or _____ genes can cause abnormal proteins to be made.

73. An organism that lives in or on another organism to obtain its nutrients is called a _____.

74. Abnormal tissue growths may also be referred to as _____.

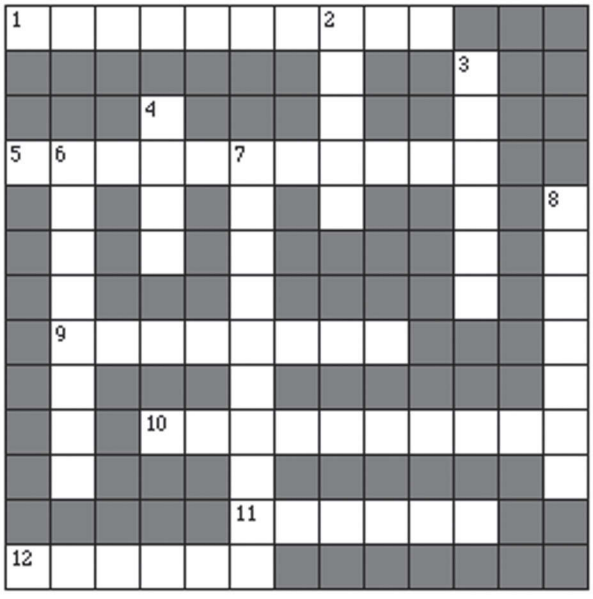
75. Autoimmunity literally means _____ _____.

If you had difficulty with this section, review pages 24-30.

Crossword Puzzle

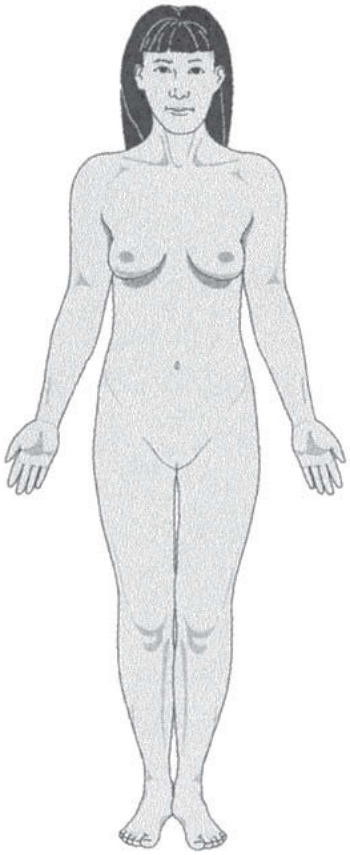
Across
1. Study of body function
5. "Staying the same"
9. _____ feedback is inhibitory
10. Total of chemical and physical reactions
11. Divides the body into sections
12. Group of similar cells

Down
2. Heart is an example
3. Organs arranged to perform a function
4. Basic unit of the body
6. Sum of its parts
7. Physique
8. Study of body systems



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APPLYING WHAT YOU KNOW



76. Laurie has had an appendectomy. The nurse is preparing to change the dressing. She knows that the appendix is located in the right iliac inguinal region, the distal portion extending at an angle into the hypogastric region. Place an X on the diagram where the nurse will place the dressing.

77. Penny noticed a lump in her breast. Dr. Reeder noted on her chart that a small mass was located in the left breast medial to the nipple. Place an X where Penny's lump would be located.

78. Madison was injured in a bicycle accident. X-ray films revealed that she had a fracture of the right patella. A cast was applied beginning at the distal femoral region and extending to the pedal region. Place an X where Madison's cast begins and ends.

DID YOU KNOW

- Many animals produce tears but only humans weep as a result of emotional stress.
- Men notice subtle signs of sadness in a face only 40% of the time; women pick up on them 90% of the time.

ONE LAST QUICK CHECK

Multiple Choice—select the best answer.

79. The body's ability to continuously respond to changes in the environment and maintain consistency in the internal environment is called:
    a. homeostasis.
    b. superficial.
    c. structural levels.
    d. none of the above.

80. The regions frequently used by health professionals to locate pain or tumors divide the abdomen into four basic areas called:
    a. planes.
    b. cavities.
    c. pleural.
    d. quadrants.

81. A lengthwise plane running from front to back that divides the body into right and left sides is called:
    a. transverse.
    b. coronal.
    c. frontal.
    d. sagittal.

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82. A study of the functions of living organisms and their parts is called:
    a. physiology.
    b. chemistry.
    c. biology.
    d. none of the above.

83. Which of the following structures does *not* lie within the abdominopelvic cavity?
    a. right iliac region
    b. left antecubital region
    c. left lumbar region
    d. hypogastric region

84. The dorsal body cavity contains components of the:
    a. reproductive system.
    b. digestive system.
    c. respiratory system.
    d. nervous system.

85. If your reference point is "nearest the trunk of the body" versus "farthest from the trunk of the body," where does the elbow lie in relation to the wrist?
    a. anterior
    b. posterior
    c. distal
    d. proximal

86. The buttocks are often used as injection sites. This region can also be called:
    a. sacral.
    b. buccal.
    c. cutaneous.
    d. gluteal.

87. Which of the following is *not* a component of the axial subdivision of the body?
    a. upper extremity
    b. neck
    c. trunk
    d. head

88. A synonym for medial is:
    a. toward the side.
    b. in front of.
    c. midline.
    d. anterior.

Fill in the blanks.

89. A principle of standardizing terminology is the avoidance of _____, or terms based upon a person's name.

90. The term _____ _____ means that the right and left sides of humans are mirror images of each other and only one plane can divide the body into left and right sides.

91. _____ refers to an inner region of an organ.

92. The narrow tip of an organ is the _____ portion.

93. Hereditary material called _____ carries the chemical blueprint of the body.

94. The endocrine system regulates internal environment by secreting _____ via the blood to target areas.

95. Processes for maintaining or restoring homeostasis are known as _____ _____ _____.

96. _____ _____ is the concept that information may flow ahead to another process to trigger a change in anticipation of an event that will follow.

97. _____ _____ mechanisms operate at the tissue and organ levels.

98. The study of aging is known as _____.

99. Tiny, primitive cells that lack nuclei and may cause infection are _____.

100. An inherited trait that puts one at greater than normal risk for development of a specific disease is a(n) _____ _____.

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CHAPTER 2

The Chemical Basis of Life

Although anatomy can be studied without knowledge of chemistry, it is hard to imagine an understanding of physiology without a basic comprehension of chemical reactions in the body. Trillions of cells make up the various levels of organization in the body. Our health and survival depend upon proper chemical maintenance in the cytoplasm of our cells.

Chemists use the terms *elements* or *compounds* to describe all of the substances (matter) in and around us. Distinguishing these two terms is the fact that an element cannot be broken down. A compound, on the other hand, is made up of two or more elements and has the ability to be broken down into the elements that form it.

Organic and inorganic compounds are equally important to us. Without organic compounds such as carbohydrates, proteins, and fats, and inorganic compounds such as water, we could not sustain life.

Because we cannot see many of the chemical reactions that take place daily in our bodies, it is sometimes difficult to comprehend the principles involved in initiating them. Chemicals are responsible for directing virtually all of our bodily functions. It is therefore important to master the fundamental concepts of chemistry.

I—BASIC CHEMISTRY

Multiple Choice—select the best answer.

1. Which of the following is *not* one of the major elements present in the human body?
   a. oxygen
   b. carbon
   c. iron
   d. hydrogen

2. Which of the following is *not* a subatomic particle?
   a. proton
   b. electron
   c. isotope
   d. neutron

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3. The total number of electrons in an atom equals the number of:
   a. neutrons in its nucleus.
   b. electrons in its nucleus.
   c. protons in its nucleus.
   d. ions in its nucleus.

4. An atom can be described as *chemically stable* if its outermost electron shell contains:
   a. three electrons.
   b. five electrons.
   c. six electrons.
   d. eight electrons.

5. Isotopes are atoms of elements that differ in their number of:
   a. protons.
   b. electrons.
   c. neutrons.
   d. nuclei.

6. Ionic bonds are chemical bonds formed by the:
   a. sharing of electrons between atoms.
   b. donation of protons from one atom to another.
   c. transfer of electrons from one atom to another.
   d. acceptance of protons from one atom by another.

7. Chemical bonds formed by the sharing of electrons are called:
   a. ionic.
   b. covalent.
   c. hydrogen.
   d. electronic.

8. A chemical reaction in which substances combine to form more complex substances is called:
   a. synthesis.
   b. decomposition.
   c. exchange.
   d. reversible.

True or false

9. _____ *Matter* is a term used by chemists to describe all the materials or substances around us.

10. _____ *Mass number* refers to the number of protons plus the number of neutrons in the atom's nucleus.

11. _____ Sodium chloride is an example of a covalent bond.

12. _____ Hydrogen bonds form from an equal charge distribution within a molecule.

13. _____ The digestion of food is an example of a decomposition reaction.

Identify the following elements:

14. O _____

15. Ca _____

16. K _____

17. Na _____

18. Mg _____

19. Fe _____

20. Se _____

▶ *If you had difficulty with this section, review pages 33-41.*

II—METABOLISM

Matching—select the best answer.

a. breaks down larger food molecules into smaller units
b. the form of energy that cells generally use
c. all the chemical reactions that occur in body cells
d. joins simple molecules together to form more complex ones
e. key chemical reaction during anabolism

21. _____ catabolism

22. _____ anabolism

23. _____ ATP

24. _____ metabolism

25. _____ dehydration synthesis

▶ *If you had difficulty with this section, review pages 41-42.*

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III—INORGANIC MOLECULES

Multiple Choice—select the best answer.

26. Water plays a key role in such processes as:
    a. cell permeability.
    b. active transport of materials.
    c. secretion.
    d. all of the above.

27. Which of the following is *not* a property of water?
    a. strong polarity
    b. high specific heat
    c. high heat of vaporization
    d. strong acidity

28. Acids:
    a. are proton donors.
    b. dye litmus blue.
    c. release hydrogen ions when in solution.
    d. accept electrons when in an aqueous solution.

29. Substances that accept hydrogen ions are referred to as:
    a. acids.
    b. bases.
    c. buffers.
    d. salts.

30. The constancy of the pH homeostatic mechanism is caused by the presence of substances called:
    a. salts.
    b. bases.
    c. buffers.
    d. acids.

True or false

31. _____ The pH scale indicates the degree of acidity or alkalinity of a solution.

32. _____ Milk is acid on the pH scale.

33. _____ Litmus will turn red in the presence of an acid.

34. _____ The basic substance of each cell is water.

35. _____ Oxygen and carbon dioxide are examples of organic compounds.

▶ *If you had difficulty with this section, review pages 42-45.*

IV—ORGANIC MOLECULES

Multiple Choice—select the best answer.

36. Which of the following is *not* a type of carbohydrate?
    a. monosaccharides
    b. disaccharides
    c. megasaccharides
    d. polysaccharides

37. Which of the following is *incorrect* in reference to carbohydrates?
    a. They include substances referred to as *sugars*.
    b. They serve critical structural roles in RNA and DNA.
    c. They represent a primary source of chemical energy for body cells.
    d. They are replete with nitrogen atoms.

38. Proteins are composed of ____ commonly occurring amino acids.
    a. 8
    b. 12
    c. 21
    d. 24

39. Amino acids frequently become joined by:
    a. peptide bonds.
    b. phospholipid reactions.
    c. degradation synthesis.
    d. none of the above.

40. Which of the following is *not* an example of proteins?
    a. hormones
    b. antibodies
    c. urine
    d. enzymes

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41. A structural lipid found in a cell membrane is a:
    a. triglyceride.
    b. phospholipid.
    c. steroid.
    d. prostaglandin.

42. Which of the following is the correct example of DNA base pairing?
    a. adenine-cytosine
    b. guanine-adenine
    c. adenine-thymine
    d. guanine-thymine

43. A DNA molecule contains each of the following *except:*
    a. sugar.
    b. nitrogenous base.
    c. phosphate.
    d. lipid.

44. DNA differs from RNA in that:
    a. RNA contains ribose instead of deoxyribose.
    b. RNA contains thymine instead of uracil.
    c. RNA contains a double polynucleotide strand.
    d. There is no structural difference between DNA and RNA.

True or false

45. _____ Steroids are poorly distributed throughout the body.

46. _____ High-density lipoprotein (HDL) is also called the "good" cholesterol.

47. _____ Protein compounds have no role in defending the body against harmful agents.

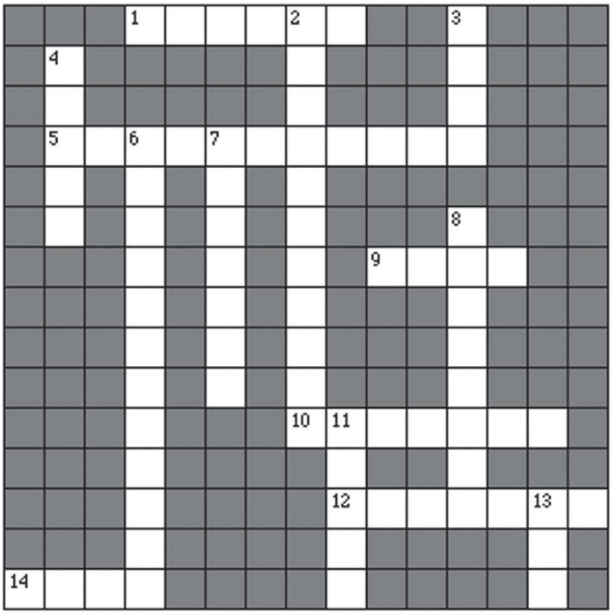
48. _____ The nonessential amino acids can be produced from the other amino acids or from simple organic molecules.

49. _____ Enzymes are proteins that function by the "lock and key" model.

50. _____ Prostaglandins are "tissue hormones."

If you had difficulty with this section, review pages 45-61.

Crossword Puzzle



Across
1. Acts as a reservoir for H^+ ions
5. DNA or RNA (two words)
9. Small particle of an element
10. Simple form of matter
12. Amino acid
14. Tastes bitter

Down
2. Dissociates in solution to form ions
3. Releases hydrogen when in solution
4. _____ bond/electrocovalent bond
6. Sugar or starch
7. Chemical catalysts
8. _____ bond/shares electron pairs between atoms
11. Fat
13. Electrically charged atom

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APPLYING WHAT YOU KNOW

51. Amanda and Steve own a home that was recently discovered to contain very high levels of radon. Where in the house would these levels be greatest? What could be done to eliminate the radon? What is the family at greatest risk for?

52. Shelley just finished preparing a meal of pan-fried hamburgers for her family. While the frying pan was still hot, she poured the liquid grease into a metal container to cool. Later she noticed that the liquid oil had solidified as it cooled. Explain the chemistry of why the now room-temperature fat was solid.



DID YOU KNOW

- After a vigorous workout, your triglycerides fall 10–20% and your HDL increases by the same percentage for 2–3 hours.
- The only letter not appearing on the Periodic Table is the letter "J."
- Hydrogen is the most abundant element in the universe (75%).



ONE LAST QUICK CHECK

Matching—identify each term with its corresponding description or definition.

a. atomic number
b. base pairs
c. electrolyte
d. high-energy bonds
e. isotopes
f. nucleotide
g. octet rule
h. polarity
i. polymers

53. _____ Atoms of the same element but with different mass number (because their nuclei contain different numbers of neutrons).

54. _____ Adenine-thymine and guanine-cytosine are examples of _____ present in DNA.

55. _____ Atoms with fewer than eight electrons in their valence shell will attempt to lose, gain, or share electrons with other atoms to achieve stability.

56. _____ The number of protons in an atom's nucleus.

57. _____ Any large molecule made up of many identical small molecules.

58. _____ Components of DNA and RNA that are composed of sugar, a nitrogenous base, and a phosphate group.

59. _____ Chemical property that allows water to act as an effective solvent.

60. _____ Large group of inorganic compounds including acids, bases, and salts.

Matching—select the best answer.

a. protein
b. carbohydrate
c. lipid

61. _____ ribose

62. _____ steroids

63. _____ amino acid

64. _____ glycerol

65. _____ monosaccharides

66. _____ phospholipids

67. _____ enzymes

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Matching—select the best answer.

a. acid b. base

68. _____ litmus turns blue

69. _____ "proton donor"

70. _____ bitter taste

71. _____ "proton acceptor"

72. _____ releases a hydrogen ion

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CHAPTER 3

Anatomy of Cells

Cells are the smallest structural units of living things. Therefore, because we are living, we are made up of a mass of cells. Human cells, which vary in shape and size, can only be seen under a microscope. The three main parts of a cell are the cytoplasmic membrane, the cytoplasm, and the nucleus. As you review this chapter, you will be amazed at the resemblance of a cell to the body as a whole. You will identify a miniature circulatory system, reproductive system, digestive system, lymphatic system, skeletal system, and many other structures that will aid in your understanding of these and other body systems in future chapters.

I—FUNCTIONAL ANATOMY OF CELLS

Multiple Choice—select the best answer.

1. Which of the following is *not* a main cellular structure?
   a. plasma membrane
   b. interstitial fluid
   c. cytoplasm (including organelles)
   d. nucleus

2. All of the following are examples of the plasma membrane function *except:*
   a. boundary of cell.
   b. self-identification.
   c. receptor sites.
   d. "power plants" of cell.

3. Which of the following is a functional characteristic of ribosomes?
   a. provision of ATP
   b. protein synthesis
   c. DNA replication
   d. binding site for steroid hormones

4. Production of ATP occurs within which organelle?
   a. smooth endoplasmic reticulum
   b. Golgi apparatus
   c. lysosomes
   d. mitochondria

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5. Preparation of protein molecules for cellular exportation is the function of which of the following organelles?
   a. Golgi apparatus
   b. microvilli
   c. peroxisomes
   d. mitochondria

6. In nondividing cells, DNA appears as threads that are referred to as:
   a. chromatin.
   b. nucleoplasm.
   c. nucleolus.
   d. none of the above.

7. The nucleolus is composed chiefly of:
   a. DNA.
   b. rRNA.
   c. tRNA.
   d. none of the above.

True or false

8. _____ The plasma membrane can be described as a triple layer of phospholipid molecules.

9. _____ The process by which cells translate the signal received by a membrane receptor into a specific chemical change in the cell is called *signal transportation*.

10. _____ Each and every cell always has one nucleus.

11. _____ Generally, the more active a cell is, the more mitochondria it will contain.

12. _____ Membranous bags that temporarily contain molecules for transport or later use are known as *peroxisomes*.

Matching—identify each cell structure with its corresponding function.

a. nucleolus
b. lysosome
c. cytoplasm
d. plasma membrane
e. endoplasmic reticulum
f. ribosome
g. mitochondria
h. nucleus

13. _____ forms ribosomes

14. _____ separates the cell from its environment

15. _____ acts as the cell's "digestive system"

16. _____ acts as a "protein factory"

17. _____ contains organelles

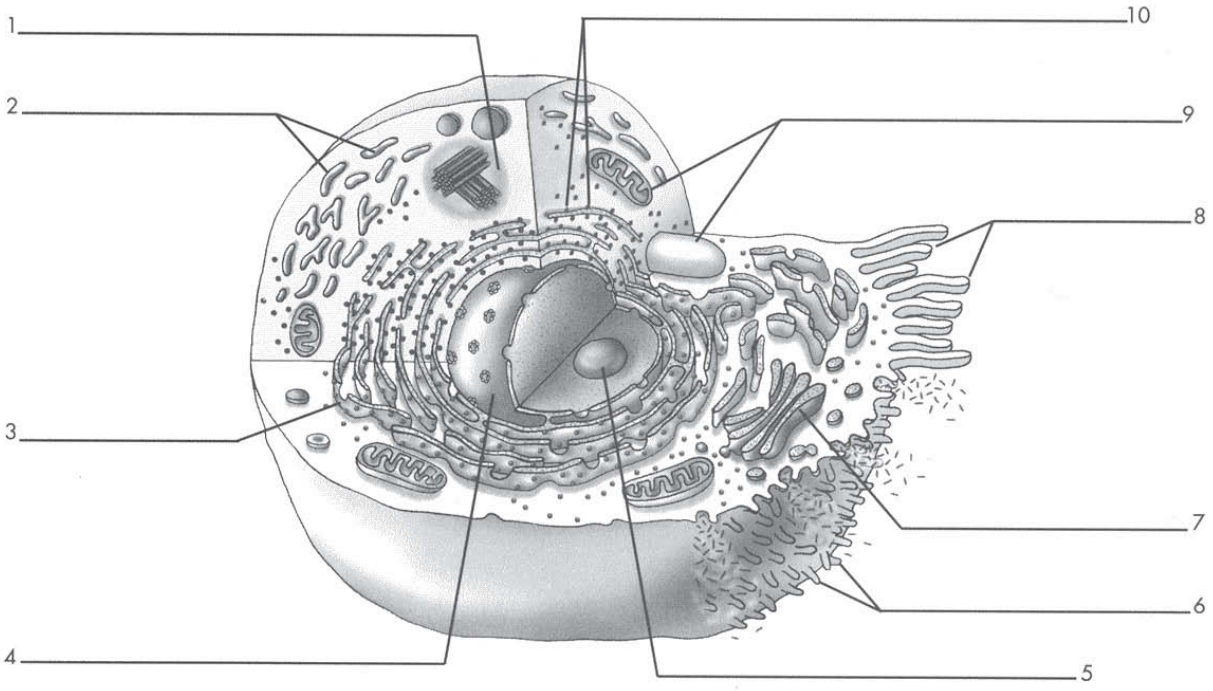
18. _____ contains DNA

19. _____ act as "power plants" of the cell

20. _____ classified as both smooth and rough

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Labeling—from memory, label the parts of the typical cell on the diagram below.



Animal cell.

▶ *If you had difficulty with this section, review pages 66-79.*

II—CYTOSKELETON

Fill in the blanks.

21. _____ is the cell's internal supporting framework.

22. _____ are the smallest cell fibers.

23. The thickest of the cell fibers are tiny, hollow tubes called _____.

24. The _____ is an area of the cytoplasm near the nucleus that coordinates the building and breaking of microtubules in the cell.

25. _____, _____, and _____ are cell extensions that appear on certain types of cells.

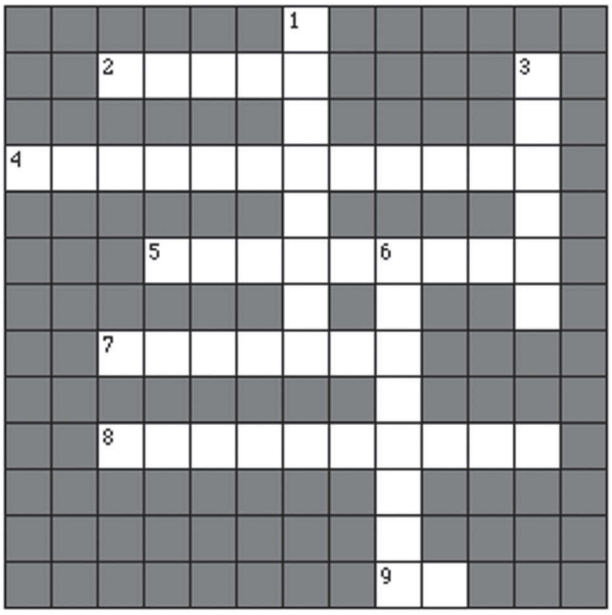
26. When membrane channels of adjacent plasma membranes connect to others, the formation is known as _____ _____.

27. _____ hold skin together.

▶ *If you had difficulty with this section, review pages 79-85.*

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Crossword Puzzle



Across

2. _____ apparatus, synthesizes carbohydrates
4. Power plants
5. Gel-like substance within the cell
7. Contains DNA
8. Area of cytoplasm near the nucleus
9. Rough and smooth (abbrev.)

Down

1. Protein factory
3. _____ membrane, surrounds the cell
6. Cell's digestive system

APPLYING WHAT YOU KNOW

28. Brian is a sedentary, overweight cigarette smoker who has chest pain whenever he exerts himself. Upon examination, his cardiologist determines that Brian is suffering from heart disease. Which receptors in the cells that line the blood vessels of his heart are responsible? What type of cholesterol is responsible?

    What other diseases may he be at risk for?

29. After several weeks of exercising in the weight room, Valerie notices that she has not only become stronger, but quite muscular as well. Which organelle has increased its density in the cytoplasm of the cells of her muscles in response to a greater demand for ATP production?

DID YOU KNOW

- The largest single cell in the human body is the female sex cell, the ovum. The smallest single cell in the human body is the male sex cell, the sperm.

ONE LAST QUICK CHECK

Multiple Choice—select the best answer.

30. Which of the following cellular extensions are required when absorption is important?
    a. cilia
    b. microvilli
    c. flagella
    d. none of the above

31. Movement of the ovum within the female reproductive tract is largely as a result of:
    a. the flagella extending from the ovum.
    b. the cilia extending from the ovum.
    c. the cilia lining the uterine tubes.
    d. none of the above.

32. Skin cells are held tightly together by:
    a. gap junctions.
    b. desmosomes.
    c. tight junctions.
    d. adhesions.

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33. Ribosomes are attached to:
    a. lysosomes.
    b. rough endoplasmic reticulum.
    c. peroxisomes.
    d. cilia.

34. The phospholipid area of the plasma membrane of a cell is:
    a. single-layered.
    b. bilayered.
    c. trilayered.
    d. multilayered.

Matching—identify each term with its corresponding definition.

a. release hormones
b. transport oxygen
c. destroy bacteria
d. contract for movement
e. detect changes in the environment

35. _____ nerve cells

36. _____ muscle cells

37. _____ red blood cells

38. _____ gland cells

39. _____ immune cells

Fill in the blanks.

40. A typical or _____ cell exhibits the most important characteristics of cell types.

41. _____ is the term meaning "water-loving."

42. _____ is the process that allows a message to be carried across a membrane.

43. _____ detoxify harmful substances that enter cells.

44. The _____ is one of the largest cell structures and occupies the central portion of the cell.

45. Embedded within the phospholipid bilayer of the cell membrane is a variety of _____ _____ _____ (IMPs).

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CHAPTER 4

Physiology of Cells

Cells, just like humans, require water, food, gases, elimination of wastes, and numerous other substances and processes in order to survive. Cells must transport the substances within the cytoplasm and across cell membranes. The movement of these substances in and out of the cell is accomplished by two primary methods: passive transport and active transport. In passive transport, no cellular energy is required to effect movement through the cell membrane. However, in active transport, cellular energy is necessary to provide movement through the cell membrane.

Once nutrients enter the cells, a series of chemical reactions is necessary to prepare the materials to be utilized by the body. The chemical reaction that breaks down larger, more complex substances into simpler substances and releases energy from the food molecules is known as *catabolism*. Energy is essential because it provides the body with the power (ATP) to perform its tasks and to maintain body temperature.

Cellular respiration is the process by which cells break down glucose, or a nutrient that has been converted to glucose or one of its simpler products, into carbon dioxide and water. As the molecule breaks down, energy is released. Three main pathways are available to the cell to accomplish cellular respiration. These pathways are glycolysis, the citric acid cycle, and the electron transport system. The anatomy and physiology of the cells allow us to adapt successfully to our environment and maintain health. By working together harmoniously, the various structures and functions of cells assure survival.

I—MOVEMENT OF SUBSTANCES THROUGH CELL MEMBRANES

Multiple Choice—select the best answer.

1. Which of the following is *not* a passive transport process?
   a. dialysis
   b. osmosis
   c. filtration
   d. pinocytosis

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2. Diffusion of water through a selectively permeable membrane in the presence of at least one impermeant solute is referred to as:
   a. diffusion.
   b. osmosis.
   c. phagocytosis.
   d. dialysis.

3. The trapping of bacteria by specialized white blood cells is an example of:
   a. pinocytosis.
   b. exocytosis.
   c. phagocytosis.
   d. none of the above.

4. A hypertonic solution is one that contains:
   a. a greater concentration of solute than the cell.
   b. the same concentration of solute as the cell.
   c. a lesser concentration of solute as the cell.
   d. none of the above.

5. The force of a fluid pushing against a surface could be described as:
   a. facilitated diffusion.
   b. hydrostatic pressure.
   c. hypostatic pressure.
   d. none of the above.

True or false

6. _____ Facilitated diffusion is a metabolically expensive process.

7. _____ The sodium-potassium pump is an example of an active transport process.

8. _____ Cellular secretion can be achieved by exocytosis.

9. _____ Solutes are particles dissolved in a solvent.

10. _____ Osmosis is a form of filtration that results in the separation of small and large solute particles.

Matching—identify each item with its corresponding description.

a. isotonic
b. hypertonic
c. hypotonic
d. diffusion
e. endocytosis

11. _____ solution that draws water from a cell

12. _____ two fluids that have the same potential osmotic pressure

13. _____ solution that causes cells to swell

14. _____ passive transport

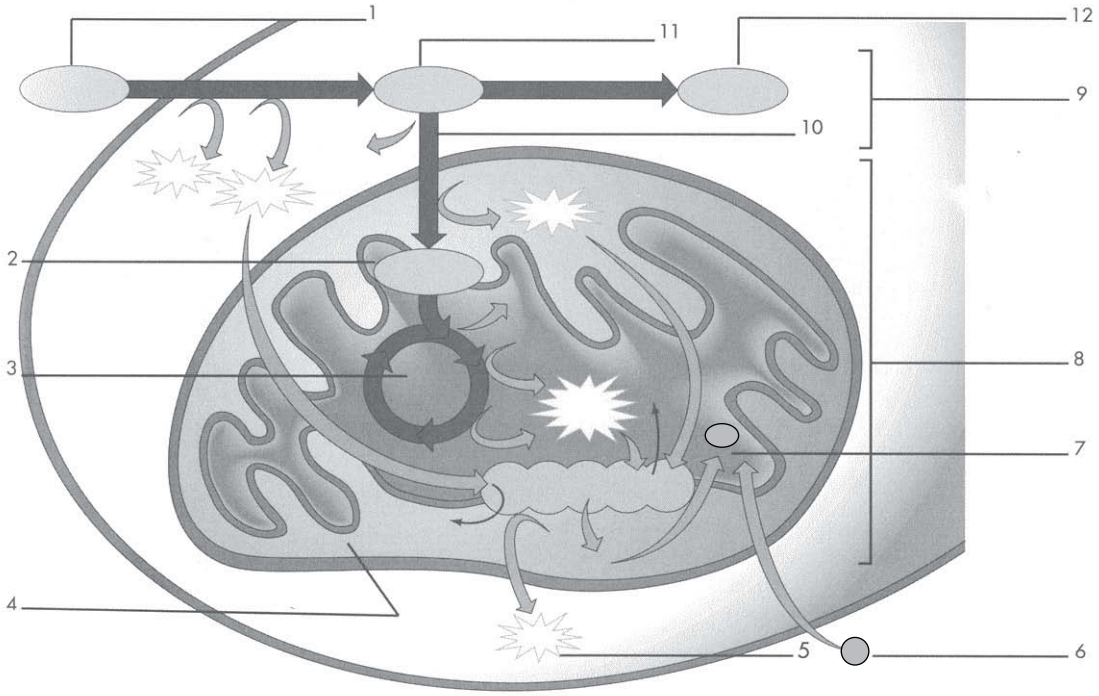
15. _____ active transport

▶ *If you had difficulty with this section, review pages 90-102.*

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Labeling—match each term with its corresponding number in the following diagram of cellular respiration.

_____ aerobic
_____ glucose
_____ mitochondrion
_____ anaerobic
_____ pyruvic acid
_____ citric acid cycle
_____ lactic acid
_____ O_2
_____ ATP
_____ transition
_____ H_2O
_____ acetyl CoA



II—CELL METABOLISM

Multiple Choice—select the best answer.

16. Enzymes that cause essential chemical reactions to occur are called:
    a. metabolic agents.
    b. catalysts.
    c. substrates.
    d. initiators.

17. Molecules that are acted upon by enzymes are known as:
    a. diploid.
    b. hypertonic.
    c. introns.
    d. substrates.

18. In naming enzymes, the root name of the substance whose chemical reaction is catalyzed is followed by the suffix:
    a. -ase.
    b. -cin.
    c. -ose.
    d. -ous.

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19. Most enzymes:
    a. are specific in their action.
    b. can alter their function by changing the shape of the molecule.
    c. are synthesized as inactive proenzymes.
    d. all of the above.

20. Which of the following activates enzymes by means of an allosteric effect?
    a. end-product inhibition
    b. kinases
    c. substrate
    d. pepsin

21. Enzymes are:
    a. fats.
    b. proteins.
    c. carbohydrates.
    d. minerals.

True or false

22. _____ The three processes that comprise cellular respiration are glycolysis, the citric acid cycle, and the electron transport system.

23. _____ The portion of an enzyme molecule that chemically "fits" the substrate molecule(s) is referred to as the *active site*.

24. _____ The "lock and key" model is used to describe how DNA base pairs align.

25. _____ Protein anabolism is a major cellular activity.

26. _____ The citric acid cycle is also known as the *Krebs cycle*.

27. _____ Glycolysis is aerobic.

Multiple Choice—select the best answer.

28. Which of the following statements is *not* true of glycolysis?
    a. It occurs in the cytoplasm of the cell.
    b. It is also known as the *Krebs cycle*.
    c. It is anaerobic.
    d. Glycolysis splits one molecule of glucose into two molecules of pyruvic acid.

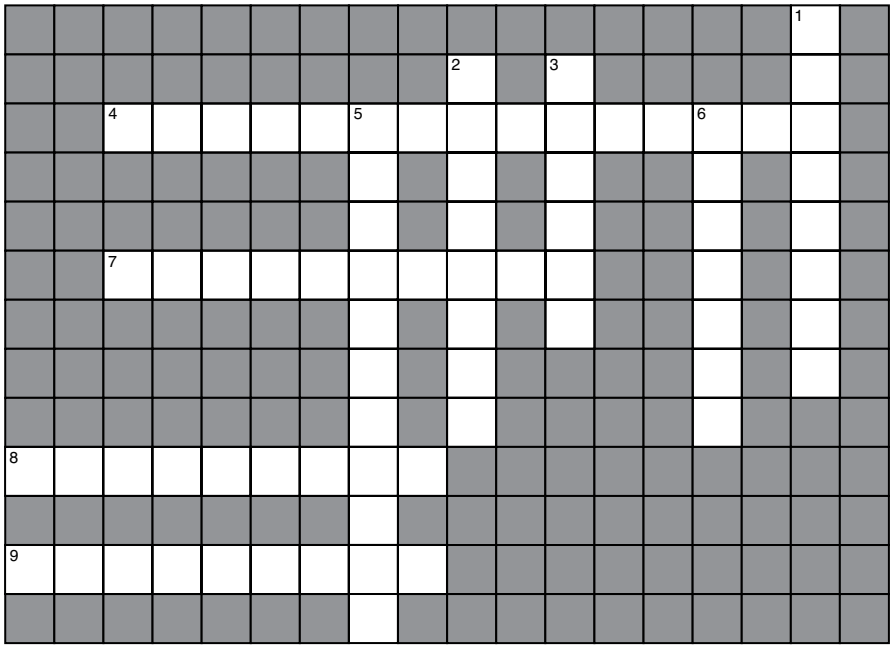
29. The Krebs cycle takes place in the:
    a. ribosome.
    b. cytoplasm.
    c. mitochondria.
    d. Golgi apparatus.

30. The third step in cellular respiration is:
    a. the electron transport system.
    b. transcription.
    c. the Krebs cycle.
    d. glycolysis.

▶ *If you had difficulty with this section, review pages 102-109.*

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Crossword Puzzle



Across

4. Movement that requires cell energy (two words)
7. Sum of chemical reactions in a cell
8. Passive process
9. Requires no oxygen

Down

1. Metabolism that breaks down molecules
2. Concentration _____ measures differences in concentration from one area to another
3. Chemical catalyst
5. "Traps" extracellular material and brings it into cell
6. Diffusion of water



APPLYING WHAT YOU KNOW

31. Nurse Bricker was instructed to dissolve a pill in a small amount of liquid medication. As she dropped the capsule into the liquid, she was interrupted by the telephone. On her return to the medication cart, she found the medication completely dissolved and apparently scattered evenly throughout the liquid.

    This phenomenon did not surprise her because she was aware from her knowledge of cell transport that _____ had created this distribution.

32. Bobbi ran in the Boston marathon. During the race, she lost a lot of fluids through perspiration and became dehydrated. Would you expect her cells to shrink, swell, or remain the same?



DID YOU KNOW

- A human can detect one drop of perfume diffused throughout a three-room apartment
- The longest-living cells in the body are brain cells, which can live an entire lifetime.

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ONE LAST QUICK CHECK

Multiple Choice—select the best answer.

33. The energy required for active transport processes is obtained from:
    a. ATP.
    b. DNA.
    c. diffusion.
    d. osmosis.

34. Movement of substances from a region of high concentration to a region of low concentration is:
    a. active transport.
    b. passive transport.
    c. cellular energy.
    d. concentration gradient.

35. Osmosis is the _____ of water across a selectively permeable membrane.
    a. filtration
    b. equilibrium
    c. active transport
    d. diffusion

36. A molecule or other agent that alters enzyme function by changing its shape is called:
    a. an allosteric effector.
    b. a kinase.
    c. an anabolic agent.
    d. a proenzyme.

37. Glycolysis is a catabolic pathway that begins with glucose and ends with:
    a. oxygen.
    b. filtration.
    c. pyruvic acid.
    d. sodium.

38. Which movement always occurs down a hydrostatic pressure gradient?
    a. osmosis
    b. filtration
    c. dialysis
    d. facilitated diffusion

39. The "uphill" movement of a substance through a living cell membrane is:
    a. osmosis.
    b. diffusion.
    c. active transport.
    d. passive transport.

40. Membrane pumps are an example of which type of movement?
    a. gravity
    b. hydrostatic pressure
    c. active transport
    d. passive transport

41. An example of a cell that performs phagocytosis is the:
    a. white blood cell.
    b. red blood cell.
    c. muscle cell
    d. bone cell.

42. A saline solution that contains a higher concentration of salt than living red blood cells would be:
    a. hypotonic.
    b. hypertonic.
    c. isotonic.
    d. homeostatic.

43. A red blood cell becomes engorged with water and will eventually lyse, releasing hemoglobin into the solution. This solution is _____ to the red blood cell.
    a. hypotonic
    b. hypertonic
    c. isotonic
    d. homeostatic

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MATCHING

Matching—match the statement with the proper selection. (Only one answer is correct.)

a. molecule able to diffuse across a particular membrane
b. protein "tunnels"
c. enzyme
d. facilitated diffusion
e. "cell drinking"
f. phagocytosis
g. type of membrane channel
h. enzymes that add or remove carbon dioxide
i. glycolysis

44. _____ membrane channels
45. _____ endocytosis
46. _____ pepsin
47. _____ carboxylases
48. _____ pinocytosis
49. _____ aquaporins
50. _____ carrier-mediated passive transport
51. _____ first stage of cellular respiration
52. _____ permeant

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