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EDITION



# Anatomy and Physiology Coloring Workbook

*A Complete Study Guide*

TWELFTH EDITION

Elaine N. Marieb • Simone Brito



# **ANATOMY & PHYSIOLOGY COLORING WORKBOOK**

*A Complete Study Guide*

**TWELFTH EDITION**

**GLOBAL EDITION**

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*Authorized adaptation from the United States edition, entitled Anatomy and Physiology Coloring Workbook, 12th edition, ISBN 978-0-134-45936-3, by Elaine N. Marieb and Simone Brito, published by Pearson Education © 2018.*

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ISBN 10: 1-292-21414-7  
ISBN 13: 978-1-292-21414-6

British Library Cataloguing-in-Publication Data  
A catalogue record for this book is available from the British Library

10 9 8 7 6 5 4 3 2 1

Typeset by iEnergizer Aptara<sup>®</sup>, Ltd.  
Printed and bound by Jiwaburu



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## PREFACE

Although never a simple task, the study of the human body is always fascinating. Over the years, thousands of students have benefited in their studies and enjoyed the process of working through this book. Whether you are taking a one- or two-semester course, you will find this book invaluable to the study of anatomy and physiology.

### What's New to This Edition?

The twelfth edition of the *Anatomy & Physiology Coloring Workbook* continues to serve as a review and reinforcement tool to help health professional and life-science students master the basic concepts of human anatomy and physiology. We have helped students by making the following revisions:

- **New crossword puzzle exercises** have been added to every chapter.
- **New streamlined presentation** of exercises has been created.
- **Updated terminology** has been added throughout the book.
- **Seventeen figures** have been revised.
- **New figure** illustrating the skeletal muscle has been added.
- **New exercise and figure** illustrating the blood flow through the heart have been added.
- **New groupings of terms** have been added to the elimination-type exercises.
- **Direct instructions** for coloring exercises were introduced, replacing “as you wish” coloring sections.

### Scope

Although this book reviews the human body from microscopic to macroscopic levels (that is, topics range from simple chemistry and cells to body organ systems), it is not intended to be encyclopedic. In fact, to facilitate learning, this workbook covers only the most important and useful aspects of human anatomy and physiology. Pathophysiology is briefly introduced with each system so that students can apply their learning. Where relevant, clinical aspects (for example, muscles used for injection sites, the role of ciliated cells in protection of the respiratory tract, and reasons for skin ulcer formation) are covered. To encourage a view of the human body as a dynamic and continually changing organism, developmental aspects of youth, adulthood, and old age are included.

### Learning Aids

As in previous editions, multiple pedagogical devices are used throughout the book to test comprehension of key concepts. The integration of a traditional study guide approach with visualization and coloring exercises is unique. The variety of exercises demands learning on several levels, avoids rote memorization, and helps maintain a high level of interest.

The exercises include completion from a selection of key choices, matching terms or descriptions, and labeling diagrams. Elimination questions require the student to discover the similarities or dissimilarities among a number of structures or

objects and to select the one that is not appropriate. Correctable true/false questions add a new dimension to the more traditional form of this exercise. Also, students are asked to provide important definitions. In the completion sections, the answer lines are long enough so that the student can write in either the key letter or the appropriate term. Both responses are provided in the answer section.

Coloring exercises are a proven motivating, effective approach to learning. Each illustration has been carefully prepared to show sufficient detail for learning without students becoming bored with coloring. There are more than 120 coloring exercises distributed throughout the text that should prove valuable to all students. Students who are visually oriented will find these exercises particularly beneficial. When completed, the color diagrams provide an ideal reference and review tool.

At least one crossword puzzle is found within each chapter of this book. These crossword puzzle exercises were created to increase student learning in a new and fun way.

Visualization exercises are a truly unique feature of this book. With the exception of the introductory chapter on terminology, each chapter contains an “Incredible Journey.” Students are asked to imagine themselves in miniature, traveling within the body through various organs and systems. These visualization exercises are optional, but they often summarize chapter content, allowing students to assimilate what they have learned in unusual and amusing ways.

Thought-provoking “At the Clinic” questions challenge students to apply their newly acquired knowledge to clinical situations. Additionally, the twelfth edition features a finale to each chapter with challenging multiple-choice questions.

## **Acknowledgments**

To those educators, colleagues, and students who have provided feedback and suggestions during the preparation of all twelve editions of this workbook, we are sincerely grateful. In particular, we want to thank the following reviewers for their valuable comments and suggestions: Laura Bianco (Delaware Technical Community College), Allen Crooker (Hartwick College), Jackie Hedgpeth (Everett Community College), Sara Kalifa (Northern Virginia Community College), Karen Martin (Fulton Montgomery Community College), Kathy Monroe (Blue Ridge Community and Technical College), Laura Ritt (Burlington County College), Trish Sevene (CSU Monterey Bay), and Laura Sweet (Eastern Michigan University). For this edition, special thanks to Joshua Parker, Fresno City College; and Patricia Mote and Janna Blum, Georgia State University—Perimeter College.

The staff at Pearson Education has continuously supported our efforts to turn out a study tool that will be well-received and beneficial to both educator and student audiences. For this edition, Kelly Ricci at Aptara and Susan Malloy, Brooke Suchomel, and Tiffany Mok at Pearson Education deserve special mention.

## **Acknowledgments for the Global Edition**

Pearson would like to thank and acknowledge the contributor, Christiane Van den Branden (Vrije Universiteit Brussel), and the reviewers, Hemant Kumar, Asha Sharma, and Anne D Souza (Manipal University), for their valuable work on this book.

## INSTRUCTIONS FOR THE STUDENT— HOW TO USE THIS BOOK

Dear Student,

The *Anatomy & Physiology Coloring Workbook* has been created particularly for you. It is the outcome of years of personal attempts to find and create exercises helpful to our own students when they study and review for a lecture test or laboratory quiz.

We never cease to be amazed by how remarkable the human body is, but we would never try to convince you that studying it is easy and, like learning a new language, it requires a lot of dedication. The study of human anatomy and physiology has its own special terminology. It also requires that you become familiar with the basic concepts of chemistry to understand physiology, and often (sadly) it requires rote memorization of facts. It is our hope that this workbook will help simplify your task. To make the most of the exercises, read these instructions carefully before starting work.

**Labeling and Coloring.** Some of these questions ask you only to label a diagram, but most also ask that you do some coloring of the figure. You can usually choose whichever colors you prefer. Soft-colored pencils are recommended so that the underlying diagram shows through. Most figures have several parts to color, so you will need a variety of colors—18 should be sufficient. In the coloring exercises, you are asked to choose a particular color for each structure to be colored. That color is then used to fill in both a color-coding circle found next to the name of the structure or organ, and the structure or organ on the figure. This allows you to identify the colored structure quickly and by name in cases where the diagram is not labeled. In a few cases, you are given specific coloring instructions to follow.

**Matching.** Here, you are asked to match a key term denoting a structure or physiological process with a descriptive phrase or sentence. Because you must write the chosen term in the appropriate answer blank, the learning is more enduring.

**Completion.** You select the correct term to answer a specific question, or you fill in blanks to complete a sentence. In many exercises, some terms are used more than once and others are not used at all.

**Definitions.** You are asked to provide a brief definition of a particular structure or process.

**True or False.** One word or phrase is underlined in a sentence. You decide if the sentence is true as it is written. If not, you correct the underlined word or phrase.

**Elimination.** Here, you are asked to find the term that does not “belong” in a particular grouping of related terms. You will also have to identify a key word, or in some cases a phrase, that the remaining terms have in common and that defines them as a group. In this type of exercise, you must analyze how the various terms are similar to or different from the others.

**Crossword Puzzle.** Here, you fill in the crossword puzzle with one or two words from the key choices that answer each clue. In some exercises, more choices than clues are provided. When the answer to a puzzle is composed of two words, the words are used in the puzzle without a space.

**Visualization.** The “Incredible Journey” is a special type of completion exercise, found in every chapter except the first one. For this exercise, you are asked to imagine that you have been miniaturized and injected into the body of a human being (your host). Anatomical landmarks and physiological events are described from your miniaturized viewpoint, and you are then asked to identify your observations. Although this exercise is optional, our students have found them fun to complete and we hope you will too.

**At the Clinic.** “At the Clinic” sections ask you to apply your newly acquired knowledge to clinical situations.

**The Finale: Multiple Choice.** The multiple-choice questions test you from several vantage points, and 1, 2, 3, or all of the answers may be correct—an approach that really tests your understanding of what you have studied.

Each exercise has complete instructions, which you should read carefully before beginning the exercise. When there are multiple instructions, complete them in the order given.

At times, it may appear that information is duplicated in the different types of exercises. Although there is some overlap, the understandings being tested are different in the different exercises. Remember, when you understand a concept from several different perspectives, you have mastered that concept.

We sincerely hope that the *Anatomy & Physiology Coloring Workbook* challenges you to increase your knowledge, comprehension, retention, and appreciation of the structure and function of the human body.

Good luck!



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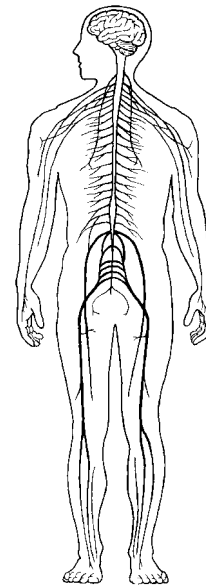
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# 1 THE HUMAN BODY: AN ORIENTATION



Most of us have a natural curiosity about our bodies, and a study of anatomy and physiology elaborates on this interest. Anatomists have developed a universally acceptable set of reference terms that allows body structures to be located and identified with a high degree of clarity. Initially, students might have difficulties with the language used to describe anatomy and physiology, but without such a special vocabulary, confusion is bound to occur.

The topics in this chapter enable students to test their mastery of terminology commonly used to describe the body and its various parts, and concepts concerning functions vital for life and homeostasis. Body organization from simple to complex levels and an introduction to the organ systems forming the body as a whole are also covered.

## AN OVERVIEW OF ANATOMY AND PHYSIOLOGY

1. Match the terms in Column B to the appropriate descriptions provided in Column A. Enter the correct letter or its corresponding term in the answer blanks.

### Column A

- \_\_\_\_\_ 1. The branch of biological science that studies and describes how body parts work or function
- \_\_\_\_\_ 2. The study of the shape and structure of body parts
- \_\_\_\_\_ 3. The tendency of the body's systems to maintain a relatively constant or balanced internal environment
- \_\_\_\_\_ 4. The term that indicates *all* chemical reactions occurring in the body

### Column B

- A. Anatomy
- B. Homeostasis
- C. Metabolism
- D. Physiology

## 12 Anatomy & Physiology Coloring Workbook

2. Use a highlighter to identify the terms or phrases that correctly relate to the study of *physiology*. Use a different color highlighter to identify those terms or phrases that relate to the study of *anatomy*. Color the coding circles.

Physiology

Anatomy

- A. Measuring an organ's size, shape, and weight      H. Dynamic  
B. Can be studied in dead specimens                      I. Dissection  
C. Often studied in living subjects                      J. Experimentation  
D. Chemistry principles                                      K. Observation  
E. Measuring the acid content of the stomach          L. Directional terms  
F. Principles of physics                                        M. Static  
G. Observing a heart in action

## LEVELS OF STRUCTURAL ORGANIZATION

3. The structures of the body are organized into successively larger and more complex structures. Fill in the answer blanks with the correct terms for these increasingly larger structures.

Chemicals    →    \_\_\_\_\_    →    \_\_\_\_\_    →  
\_\_\_\_\_    →    \_\_\_\_\_    →    Organism

4. Circle the term that does not belong in each of the following groupings. Then, fill in the answer blanks with the correct group name. Follow the example below.

E.g. Atom    Cell    Tissue    Alive    Organ    **Group:** Levels of structural organization

1. Brain    Stomach    Heart    Liver    Epithelium    **Group:** \_\_\_\_\_

2. Neuron    Erythrocyte    Fibroblast    Muscle    Oocyte    **Group:** \_\_\_\_\_

3. Human    Digestive system    Horse    Pine tree    Amoeba    **Group:** \_\_\_\_\_

5. Using the key choices, complete the crossword puzzle by naming the organ system that correctly answers each of the clues provided.

### Key Choices

Cardiovascular

Digestive

Endocrine

Integumentary

Lymphatic (Immune)

Muscular

Nervous

Reproductive

Respiratory

Skeletal

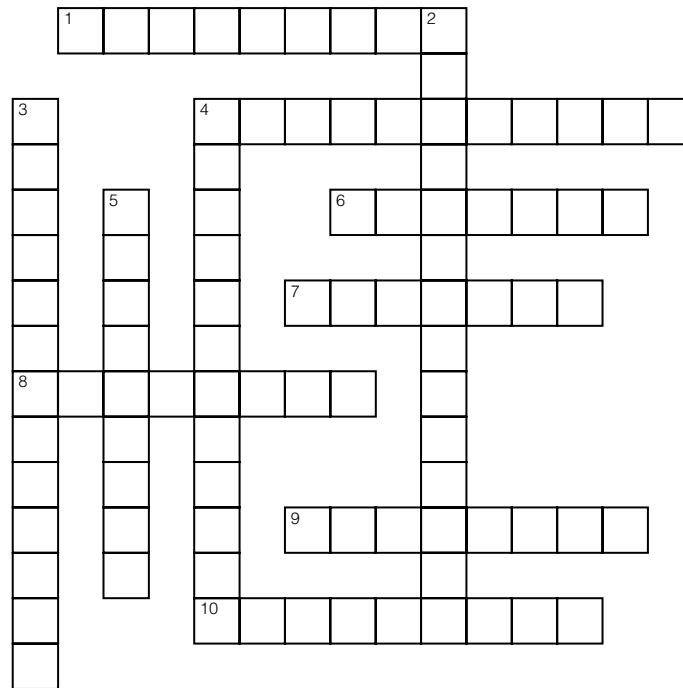
Urinary

**Across**

1. Protects the body; destroys bacteria and tumor cells.
4. Removes carbon dioxide from the blood.
6. Rids the body of nitrogen-containing wastes; conserves body water or eliminates excesses.
7. Includes the brain, nerves, and sensory receptors.
8. Moves the limbs; allows facial expression.
9. Provides support and levers on which the muscular system can act.
10. Is affected by the removal of the thyroid gland.

**Down**

2. Delivers oxygen and nutrients to the body tissues.
3. Protects underlying organs from drying out and from mechanical damage.
4. Includes the testis, vas deferens, and urethra.
5. Includes the esophagus, large intestine, and rectum.



6. Figures 1–1 to 1–6, on pages 14–16, represent the various body organ systems. Complete the following:
  - (A) Identify and name each organ system by labeling the organ system under each illustration.
  - (B) Select a different color for each organ and use it to color the coding circles and corresponding structures in the illustrations.

- Blood vessels
- Heart

- Nasal cavity
- Lungs
- Trachea

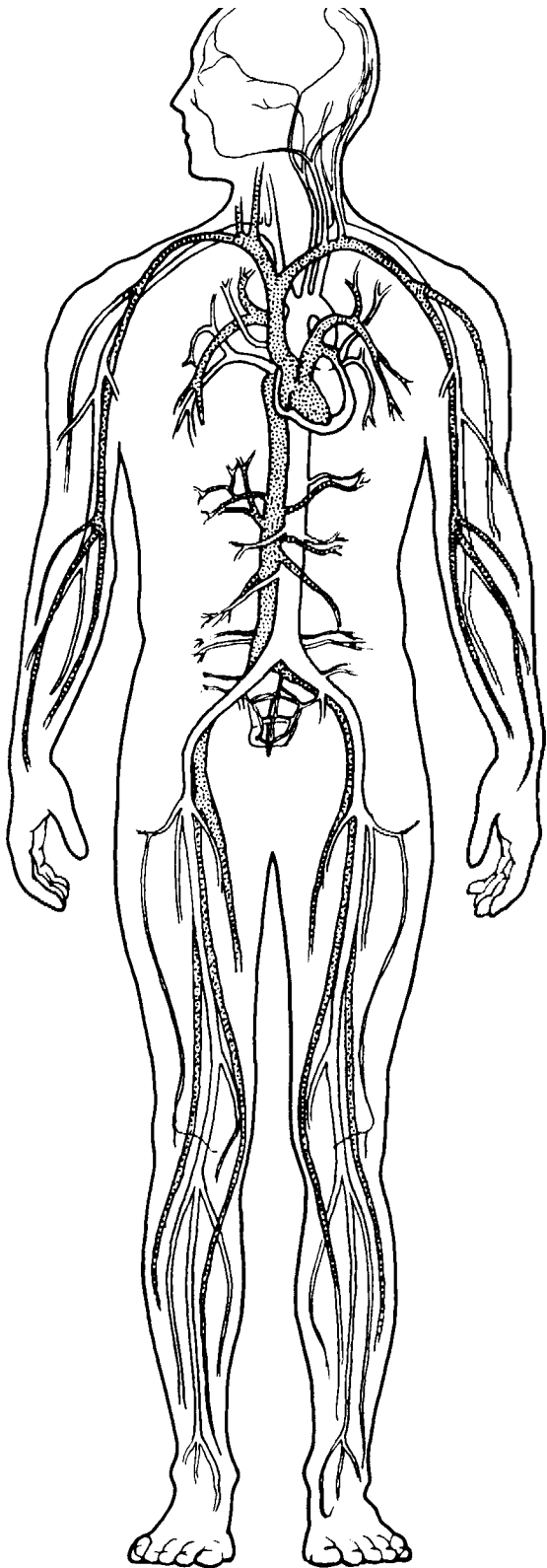


Figure 1-1

Organ System: \_\_\_\_\_

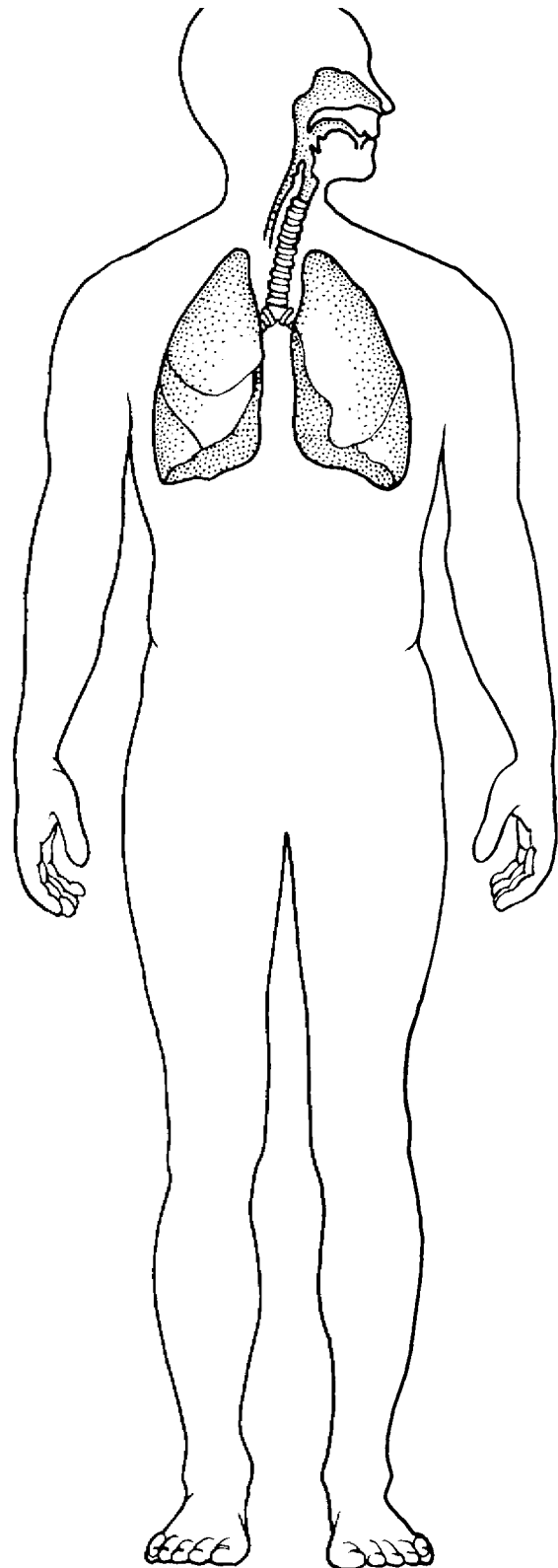


Figure 1-2

Organ System: \_\_\_\_\_

- Brain
- Spinal cord
- Nerves

- Kidneys
- Ureters
- Bladder

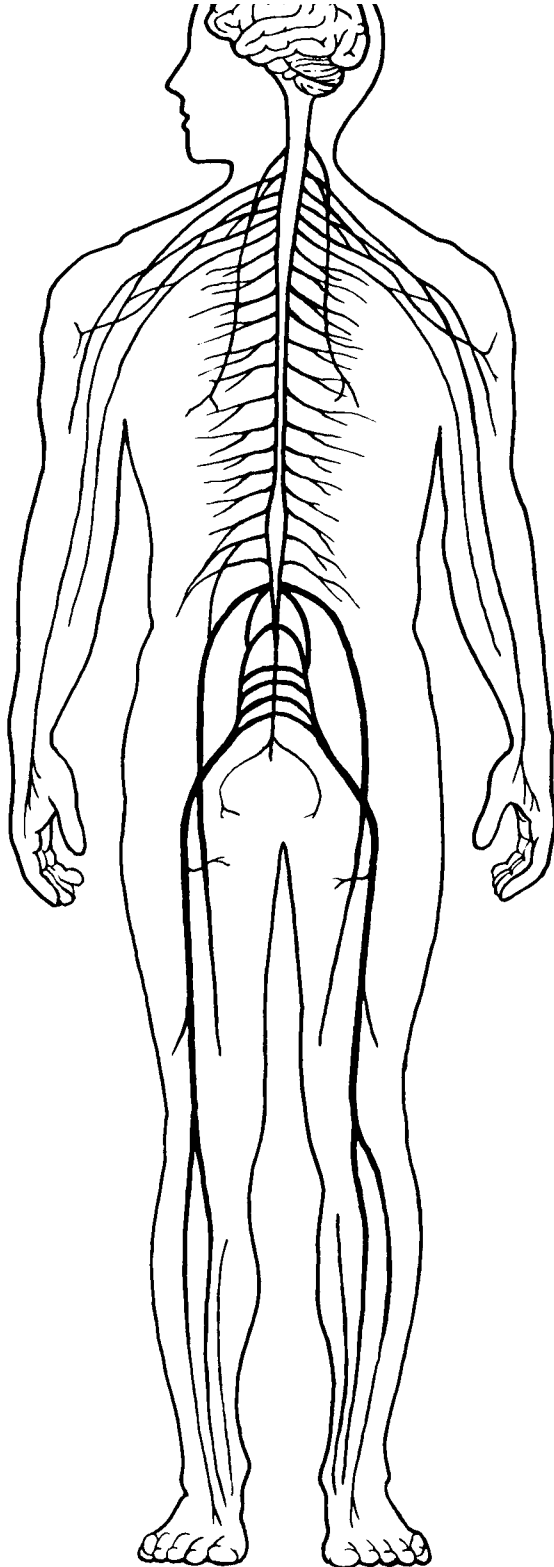


Figure 1-3

Organ System: \_\_\_\_\_

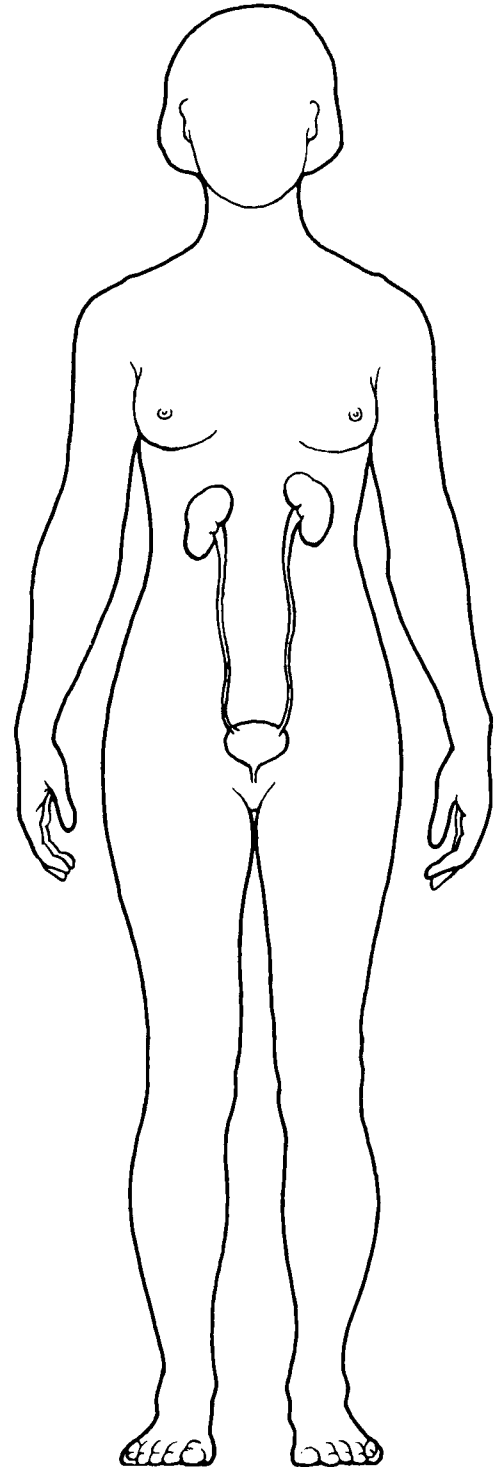


Figure 1-4

Organ System: \_\_\_\_\_



Stomach

Intestines

Esophagus

Oral cavity

Ovaries

Uterus

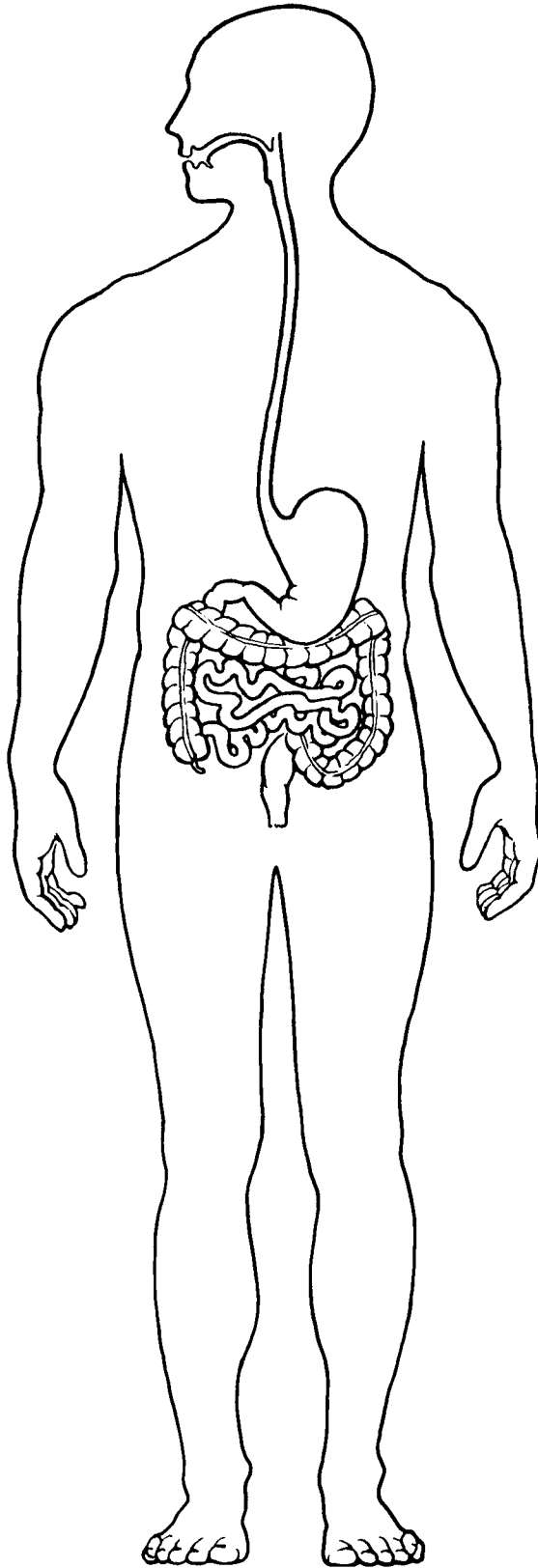


Figure 1-5

Organ System: \_\_\_\_\_

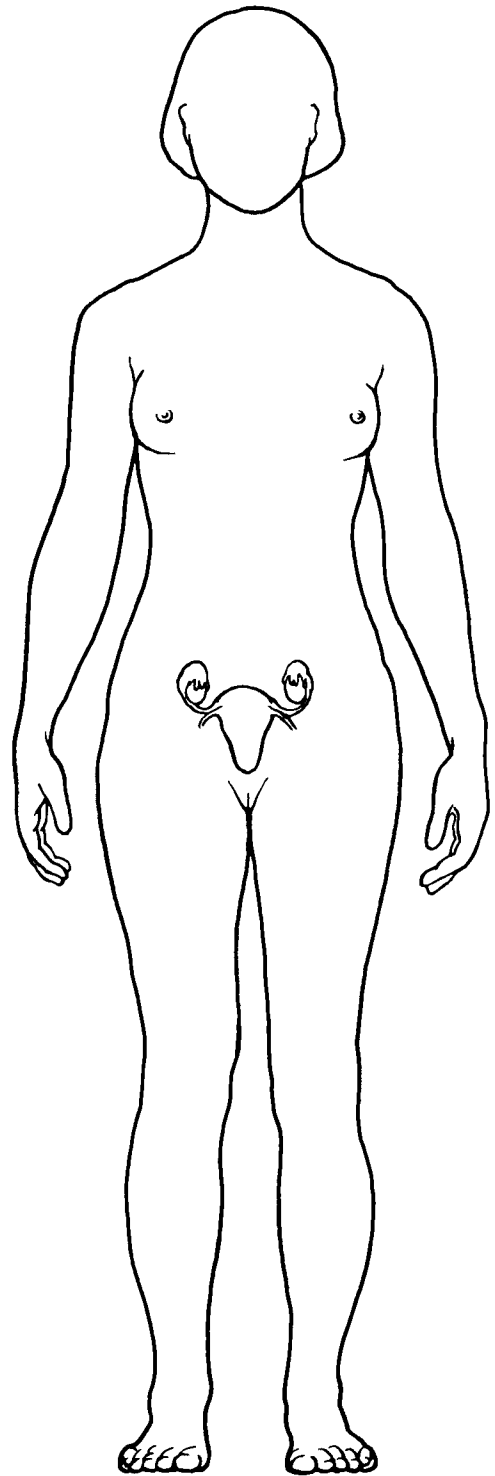


Figure 1-6

Organ System: \_\_\_\_\_

## MAINTAINING LIFE

7. Match the terms that relate to functional characteristics of organisms in Column B with the appropriate descriptions in Column A. Fill in the answer blanks with the appropriate letter or term.

Column A	Column B
_____ 1. Keeps the body's internal environment distinct from the external environment	A. Digestion
_____ 2. Provides new cells for growth and repair at a cellular level	B. Excretion
_____ 3. Occurs when constructive activities occur at a faster rate than destructive activities	C. Growth
_____ 4. The tuna sandwich you have just eaten is broken down to its chemical building blocks	D. Maintenance of boundaries
_____ 5. Elimination of carbon dioxide by the lungs and elimination of nitrogenous wastes by the kidneys	E. Metabolism
_____ 6. Ability to react to stimuli; a major role of the nervous system	F. Movement
_____ 7. Production of feces to get rid of indigestible food residues	G. Responsiveness
_____ 8. All chemical reactions occurring in the body	H. Reproduction
_____ 9. At the cellular level, membranes; for the whole organism, the skin	

8. Using the key choices, correctly identify the survival needs that correspond to the following descriptions. Insert the correct letter or term in the answer blanks. Letters or terms can be used more than once.

### Key Choices

- |                                 |              |          |
|---------------------------------|--------------|----------|
| A. Appropriate body temperature | C. Nutrients | E. Water |
| B. Atmospheric pressure         | D. Oxygen    |          |

- |  |
|--|
| _____ 1. Includes carbohydrates, proteins, fats, and minerals  |
| _____ 2. Essential for normal operation of the respiratory system and breathing  |
| _____ 3. Single substance accounting for more than 60% of body weight  |
| _____ 4. Required for the release of energy from foodstuffs  |
| _____ 5. Provides the basis for body fluids of all types   |
| _____ 6. Needs to be maintained within a small range to ensure that metabolic reactions occur at appropriate rates to sustain life |

## HOMEOSTASIS

9. The following statements refer to homeostatic control systems. Complete each statement by inserting your answers in the answer blanks.

\_\_\_\_\_ 1. There are three essential components of all homeostatic control mechanisms: control center, receptor, and effector. The \_\_\_\_\_ 2. \_\_\_\_\_ (1) senses changes in the environment and responds by sending information (input) to the \_\_\_\_\_ (2) along the \_\_\_\_\_ (3) pathway. The \_\_\_\_\_ (4) analyzes the input, determines the appropriate response, and activates the \_\_\_\_\_ (5) by sending information along the \_\_\_\_\_ (6) pathway. When the response causes the initial stimulus to decline, the homeostatic mechanism is referred to as a \_\_\_\_\_ (7) feedback mechanism. When the response enhances the initial stimulus, the mechanism is called a \_\_\_\_\_ (8) feedback mechanism. \_\_\_\_\_ (9) feedback mechanisms are much more common in the body.

\_\_\_\_\_ 3.

\_\_\_\_\_ 4.

\_\_\_\_\_ 5.

\_\_\_\_\_ 6.

\_\_\_\_\_ 7.

\_\_\_\_\_ 8.

\_\_\_\_\_ 9.

## THE LANGUAGE OF ANATOMY

10. Complete the following statements by filling in the answer blanks with the correct term.

\_\_\_\_\_ 1. The abdominopelvic and thoracic cavities are subdivisions of the \_\_\_\_\_ (1) body cavity; the cranial and spinal cavities are parts of the \_\_\_\_\_ (2) body cavity. The \_\_\_\_\_ (3) body cavity is totally surrounded by bone and provides very good protection to the structures it contains.

\_\_\_\_\_ 2.

\_\_\_\_\_ 3.

11. Circle the term or phrase that does not belong in each of the following groupings. Then, fill in the answer blanks with the correct group name.

1. Transverse                  Distal                  Frontal                  Sagittal                  **Group:** \_\_\_\_\_

2. Lateral                  Distal                  Frontal                  Proximal                  **Group:** \_\_\_\_\_

3. Sural                  Brachial                  Femoral                  Popliteal                  **Group:** \_\_\_\_\_

4. Epigastric                  Hypogastric                  Right iliac                  Left upper quadrant                  **Group:** \_\_\_\_\_

5. Orbital cavity                  Nasal cavity                  Ventral cavity                  Oral cavity                  **Group:** \_\_\_\_\_

12. Select different colors for the *dorsal* and *ventral* body cavities and color the coding circles below. Complete the following in Figure 1–7:

(A) Color the corresponding cavities in figure A.

(B) Label the body cavity subdivisions that have a leader line in figure A.

(C) Label each of the abdominal regions indicated by a leader line in figure B.

Dorsal body cavity

Ventral body cavity

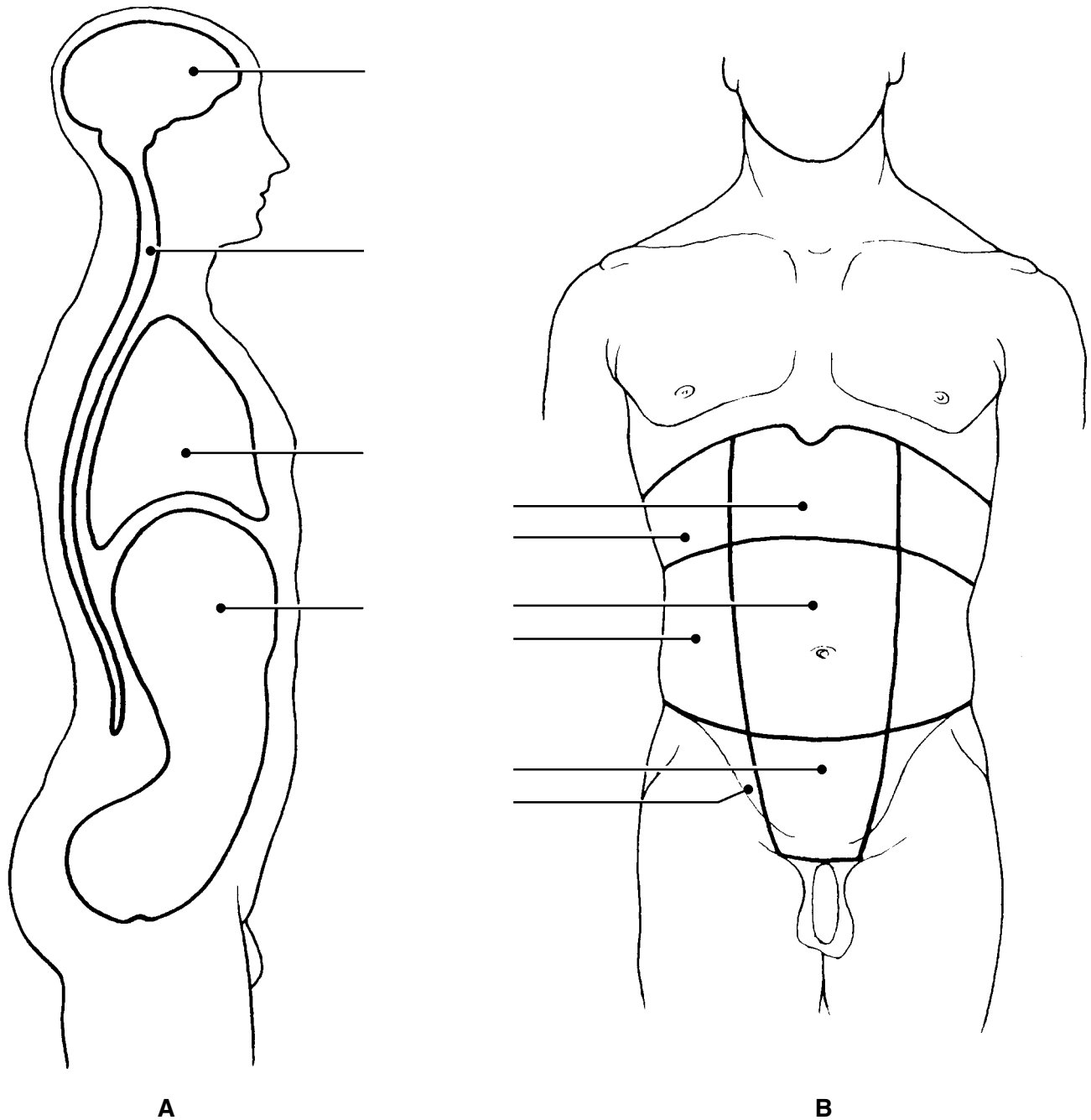


Figure 1–7

- 13.** Select the key choices that identify the following body parts or areas.  
Enter the appropriate letter or corresponding term in the answer blanks.

*Key Choices*

- |                |             |              |              |
|----------------|-------------|--------------|--------------|
| A. Abdominal   | E. Buccal   | I. Inguinal  | M. Pubic     |
| B. Antecubital | F. Cervical | J. Lumbar    | N. Scapular  |
| C. Axillary    | G. Femoral  | K. Occipital | O. Sural     |
| D. Brachial    | H. Gluteal  | L. Popliteal | P. Umbilical |

- \_\_\_\_\_ 1. Armpit
- \_\_\_\_\_ 2. Thigh region
- \_\_\_\_\_ 3. Buttock area
- \_\_\_\_\_ 4. Neck region
- \_\_\_\_\_ 5. Shoulder blade
- \_\_\_\_\_ 6. Genital area
- \_\_\_\_\_ 7. Anterior aspect of elbow
- \_\_\_\_\_ 8. Posterior aspect of head
- \_\_\_\_\_ 9. Area where trunk meets thigh
- \_\_\_\_\_ 10. Back area from ribs to hips
- \_\_\_\_\_ 11. Pertaining to the cheek

- 14.** Using the key terms from Exercise 13, correctly label all body areas indicated with leader lines on Figure 1–8.

In addition, identify the sections labeled A and B in the figure.

Section A: \_\_\_\_\_

Section B: \_\_\_\_\_

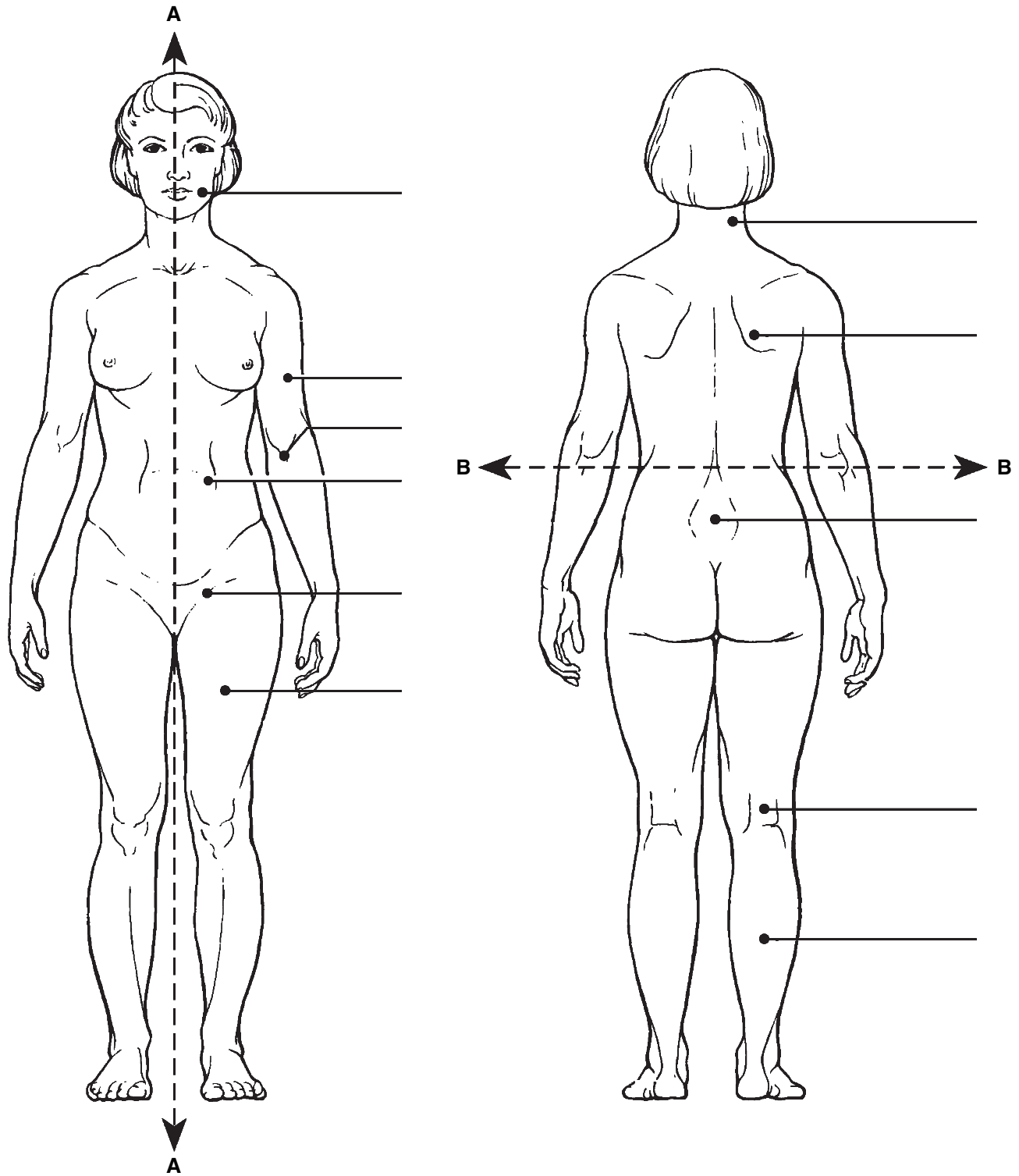


Figure 1-8

15. From the key choices, select the body cavities and the cavity subdivision where the following surgical procedures would occur. Insert the correct letter(s) or term(s) in the answer blanks. Be precise. Items may have more than one answer.

*Key Choices*

- |              |           |             |            |
|--------------|-----------|-------------|------------|
| A. Abdominal | C. Dorsal | E. Spinal   | G. Ventral |
| B. Cranial   | D. Pelvic | F. Thoracic |            |

- \_\_\_\_\_ 1. Insertion of a shunt for hydrocephalus (water on the brain)
- \_\_\_\_\_ 2. A gall bladder operation
- \_\_\_\_\_ 3. Removal of a lung tumor
- \_\_\_\_\_ 4. Investigation of an ovarian cyst
- \_\_\_\_\_ 5. Removal of a kidney stone

16. Complete the following statements by choosing an anatomical term from the key choices. Enter the appropriate letter or term in the answer blanks.

*Key Choices*

- |             |             |              |               |
|-------------|-------------|--------------|---------------|
| A. Anterior | D. Inferior | G. Posterior | J. Superior   |
| B. Distal   | E. Lateral  | H. Proximal  | K. Transverse |
| C. Frontal  | F. Medial   | I. Sagittal  |               |

- \_\_\_\_\_ 1. In the anatomical position, the face and palms are on the \_\_\_\_\_ (1) body surface, the buttocks and shoulder blades are on the \_\_\_\_\_ (2) body surface, and the top of the head is the most \_\_\_\_\_ (3) part of the body. The ears are \_\_\_\_\_ (4) to the shoulders and \_\_\_\_\_ (5) to the nose. The heart is \_\_\_\_\_ (6) to the spine and \_\_\_\_\_ (7) to the lungs. The elbow is \_\_\_\_\_ (8) to the fingers but \_\_\_\_\_ (9) to the shoulder. In humans, the dorsal surface can also be called the \_\_\_\_\_ (10) surface; however, in four-legged animals, the dorsal surface is the \_\_\_\_\_ (11) surface.
- \_\_\_\_\_ 6.
- \_\_\_\_\_ 7.
- \_\_\_\_\_ 8.
- \_\_\_\_\_ 9.
- \_\_\_\_\_ 10.
- \_\_\_\_\_ 11.

- \_\_\_\_\_ 12. If an incision cuts the heart into right and left parts, the section is a (12) section, but if the heart is cut so that anterior and posterior parts result, the section is a (13) section.
- \_\_\_\_\_ 13. You are told to cut an animal along two planes so that the paired kidneys are observable in both sections. The two sections that meet this requirement are the (14) and (15) sections.
- \_\_\_\_\_ 14.
- \_\_\_\_\_ 15.

- 17.** Using the key choices, identify the body cavities where the following body organs are located. Enter the appropriate letter or term in the answer blanks. Letters or terms can be used more than once.

**Key Choices**

A. Abdominopelvic

B. Cranial

C. Spinal

D. Thoracic

- |                          |                           |
|--------------------------|---------------------------|
| _____ 1. Stomach         | _____ 7. Bladder          |
| _____ 2. Small intestine | _____ 8. Trachea          |
| _____ 3. Large intestine | _____ 9. Lungs            |
| _____ 4. Spleen          | _____ 10. Pituitary gland |
| _____ 5. Liver           | _____ 11. Rectum          |
| _____ 6. Spinal cord     | _____ 12. Ovaries         |

- 18.** Number the following structures, from darkest (black) to lightest (white), as they would appear on an X-ray. Number the darkest one 1, the next darkest 2, etc. (Hint: Denser structures appear lighter).

- \_\_\_\_\_ A. Soft tissue
- \_\_\_\_\_ B. Femur (bone of the thigh)
- \_\_\_\_\_ C. Air in lungs
- \_\_\_\_\_ D. Gold (metal) filling in a tooth



## AT THE CLINIC

- 19.** A man is carrying some heavy groceries upstairs to his second-floor apartment. Which organ systems need to respond?



- 20.** An 18-year-old student reports to the medical center complaining of a severe headache, and the appearance of a rash across his body. The staff suspects he has meningitis. Which systems are affected as a result of his symptoms?
- 21.** Some parts of the body cannot be as easily diagnosed as others. Suppose you are obliged to collect a sample of cerebrospinal fluid from the spinal cavity. What does the spinal cavity contain and why is obtaining the fluid not so easy?
- 22.** Sylvia has had her lymph nodes removed from her left armpit. She is also having a lump removed from her left breast, and will have targeted radiotherapy in this region. Identify the correct anatomical terms for the affected areas.
- 23.** While helping his dad with gardening, little Jake got a nasty cut on his forearm. He kept crying until he noticed that the bleeding stopped rather quickly. What mechanism was at work? Is this an example of a positive or a negative feedback mechanism?
- 24.** Jim is suffering from chronic kidney disease. His condition is serious and requires hemodialysis. Since Jim is severely anemic, he is administered erythropoietin (EPO). Jim asks his doctor to explain why he needs EPO, a product that Jim knows to be a forbidden drug used by sportspeople for improving athletic performance. Do you think EPO is required and through which mechanism does it operate?

25. The following advanced imaging techniques are discussed in the text: CT, DSA, PET, and MRI. Which of these techniques uses X-ray? Which uses radio waves and magnetic fields? Which uses radioisotopes? Which displays body regions in sections? (You may have more than one answer for each question.)
26. A patient reports a crushing sensation across the chest and down their left arm. Which organ is most likely to be affected?
27. Tyler has to have an injection for tetanus after falling from his skateboard. The nurse tells him that he will be injected in his gluteal region. Which clothing should Tyler remove to have his injection?
28. Mrs. Gallo's physician suspects that she is showing the initial signs of multiple sclerosis, a disease characterized by the formation of hardened plaques in the insulating sheaths surrounding nerve fibers. What medical imaging technique will the physician probably order to determine if such plaques are present?



## THE FINALE: MULTIPLE CHOICE

29. Select the best answer or answers from the choices given.
- Which of the following activities would *not* represent an anatomical study?
    - Making a section through the heart to observe its interior
    - Drawing blood from recently fed laboratory animals at timed intervals to determine their blood sugar levels
    - Examining the surface of a bone
    - Viewing muscle tissue through a microscope
  - The process that results in the production of small molecules from large ones is:
 

A. digestion	C. respiration
B. excretion	D. anabolism
  - Which of the following is (are) involved in maintaining homeostasis?
 

A. Effector	D. Feedback
B. Control center	E. Lack of change
C. Receptor	

4. When a capillary is damaged, a platelet plug is formed. The process involves platelets sticking to each other. The more platelets that stick together, the more the plug attracts additional platelets. This is an example of:
  - A. negative feedback.
  - B. positive feedback.
5. A sagittal section through the body would pass:
  - A. through the liver, both kidneys, and pancreas
  - B. down the body's midline
  - C. through the heart and the pancreas
  - D. across the thoracic cavity
6. Which of the following statements is correct?
  - A. The knee is superior to the ankle.
  - B. The heart is superficial to the kidneys.
  - C. The sternum is posterior to the coccyx.
  - D. The ankles are rostral to the shoulders.
  - E. The eyes are inferior to the teeth.
7. Which of the following body regions is/are associated with the limbs?
 

A. Popliteal	D. Olecranal
B. Acromial	E. Inguinal
C. Gluteal	
8. A neurosurgeon orders a spinal tap for a patient. Into what body cavity will the needle be inserted?
 

A. Ventral	D. Cranial
B. Thoracic	E. Pelvic
C. Dorsal	
9. An accident victim has a collapsed lung. Which cavity has been entered?
 

A. Mediastinal	D. Vertebral
B. Pericardial	E. Ventral
C. Pleural	
10. Which organ system is affected by the common cold?
 

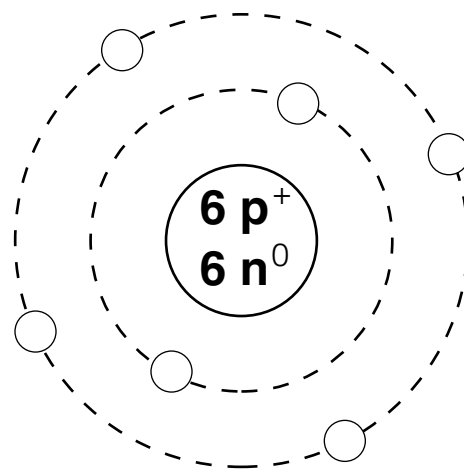
A. Endocrine	D. Digestive
B. Reproductive	E. Cardiovascular
C. Respiratory	
11. The position of the heart relative to the structures around it would be described accurately as:
  - A. deep to the sternum (breast bone).
  - B. lateral to the lungs.
  - C. superior to the diaphragm.
  - D. inferior to the ribs.
  - E. anterior to the vertebral column.
12. What term(s) could be used to describe the position of the nose?
  - A. Intermediate to the eyes
  - B. Inferior to the brain
  - C. Superior to the mouth
  - D. Medial to the ears
  - E. Anterior to the ears
13. The radiographic technique used to provide information about blood flow is:
 

A. DSR.	D. ultrasonography.
B. CT.	E. any X-ray technique.
C. PET.	
14. A patient complains of pain in the upper left quadrant. Which system is most likely to be involved?
 

A. Lymphatic	D. Cardiovascular
B. Reproductive	E. Nervous
C. Endocrine	
15. Harry was sweating profusely as he ran in the 10K race. The sweat glands producing the sweat would be considered which part of a feedback system?
 

A. Stimulus	C. Control center
B. Effectors	D. Receptors

## 2 BASIC CHEMISTRY



Everything in the universe is composed of one or more elements, the unique building blocks of all matter. Although more than 100 elemental substances exist, only four of these (carbon, hydrogen, oxygen, and nitrogen) make up more than 96% of all living material.

The student activities in this chapter consider basic concepts of both inorganic and organic chemistry. Chemistry is the science that studies the composition of matter. Inorganic chemistry studies the chemical composition of nonliving substances that (generally) do not contain carbon. Organic chemistry studies the carbon-based chemistry (or biochemistry) of living organisms, whether they are maple trees, fish, or humans.

Understanding of atomic structure, bonding behavior of elements, and the structure and activities of the most abundant biological molecules (proteins, fats, carbohydrates, and nucleic acids) is tested in various ways. Mastering these concepts is necessary to understand how the body functions.

### CONCEPTS OF MATTER AND ENERGY

1. Select *all* phrases that apply to each of the following statements and insert the letters in the answer blanks.

- \_\_\_\_\_ 1. The energy located in the bonds of food molecules:
- A. is called thermal energy.
  - B. is a form of potential energy.
  - C. causes molecular movement.
  - D. can be transformed to the bonds of ATP (adenosine triphosphate).
- \_\_\_\_\_ 2. Heat is:
- A. thermal energy.
  - B. infrared radiation.
  - C. kinetic energy.
  - D. molecular movement.
- \_\_\_\_\_ 3. Whenever energy is transformed:
- A. the amount of useful energy decreases.
  - B. some energy is lost as heat.
  - C. some energy is created.
  - D. some energy is destroyed.

2. Use choices from the key to identify the energy *form* in use in each of the following examples. Items may have more than one answer.

**Key Choices**

- A. Chemical                      B. Electrical                      C. Mechanical                      D. Radiant

- \_\_\_\_\_ 1. Clapping your hands  
 \_\_\_\_\_ 2. Vision (two types of energy, please—think!)  
 \_\_\_\_\_ 3. Knee movements when kicking a ball  
 \_\_\_\_\_ 4. Breaking the bonds of ATP molecules to energize your muscle cells to make that fist  
 \_\_\_\_\_ 5. Getting a tan on the beach

**COMPOSITION OF MATTER**

3. Complete the following table by inserting the missing words.

Particle	Location	Electrical charge	Mass
		0	
			0 amu

4. Insert the *chemical symbol* (the chemist's shorthand) in the answer blank for each of the following elements.

- \_\_\_\_\_ 1. Oxygen      \_\_\_\_\_ 4. Iodine      \_\_\_\_\_ 7. Calcium      \_\_\_\_\_ 10. Magnesium  
 \_\_\_\_\_ 2. Carbon      \_\_\_\_\_ 5. Hydrogen      \_\_\_\_\_ 8. Sodium      \_\_\_\_\_ 11. Chlorine  
 \_\_\_\_\_ 3. Potassium      \_\_\_\_\_ 6. Nitrogen      \_\_\_\_\_ 9. Phosphorus      \_\_\_\_\_ 12. Iron

5. Using the key choices, complete the crossword puzzle by answering each of the clues provided.

**Key Choices**

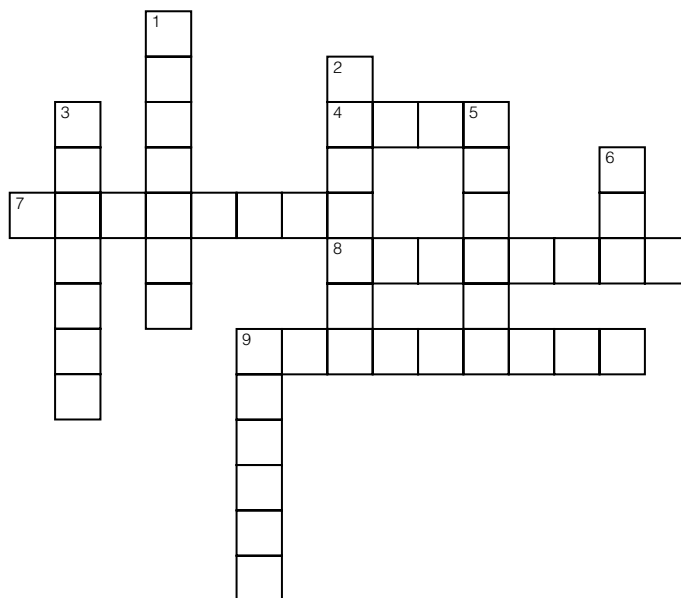
- Atom                      Element                      Ion                      Molecule                      Protons  
 Electrons                      Energy                      Matter                      Neutrons                      Valence

**Across**

4. The smallest particle of an element that retains the properties of the element.  
 7. Formed when atoms combine chemically.  
 8. Uncharged subatomic particles, forming part of an atom.  
 9. Subatomic particles that determine an atom's chemical behavior or bonding ability.

**Down**

1. A unique substance composed of atoms having the same atomic number.
2. Name given to the electron shell that contains the most reactive electrons.
3. Positively charged particles forming part of an atom.
5. Anything that takes up space and has mass (weight).
6. An electrically charged atom or group of atoms.
9. The ability to do work.



6. For each of the following statements that is true, insert *T* in the answer blank. If any of the statements are false, correct the underlined term by inserting your correction in the answer blank.

- \_\_\_\_\_ 1.  $\text{Na}^+$  and  $\text{K}^+$  are needed for nerve cells to conduct electrical impulses.
- \_\_\_\_\_ 2. The atomic number of oxygen is 8. Therefore, oxygen atoms always contain 8 neutrons.
- \_\_\_\_\_ 3. The greater the distance of an electron from the nucleus, the less energy it has.
- \_\_\_\_\_ 4. Electrons are located in more or less designated areas of space around the nucleus called orbitals.
- \_\_\_\_\_ 5. An unstable atom that decomposes and emits energy is called retroactive.
- \_\_\_\_\_ 6. Iron is necessary for oxygen transport in red blood cells.
- \_\_\_\_\_ 7. The most abundant negative ion in extracellular fluid is calcium.
- \_\_\_\_\_ 8. The element essential for the production of thyroid hormones is magnesium.
- \_\_\_\_\_ 9. Calcium is found as a salt in bones and teeth.

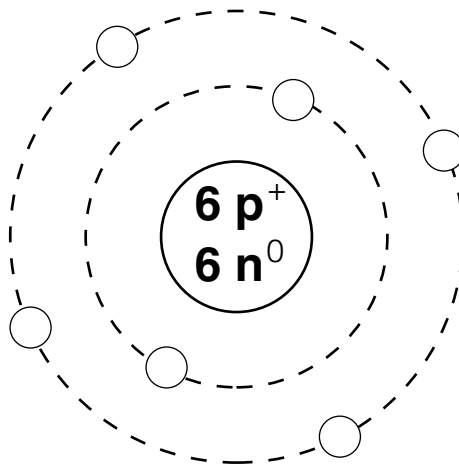
## MOLECULES, CHEMICAL BONDS, AND CHEMICAL REACTIONS

7. Match the terms in Column B to the chemical equations listed in Column A. Enter the correct letter or term in the answer blanks.

Column A	Column B
_____ 1. $A + B \rightarrow AB$	A. Decomposition
_____ 2. $AB + CD \rightarrow AD + CB$	B. Exchange
_____ 3. $XY \rightarrow X + Y$	C. Synthesis

8. Figure 2-1 is a diagram of an atom. Select two different colors and use them to color the coding circles and corresponding structures on the figure. Complete this exercise by responding to the questions that follow, referring to the atom in this figure. Insert your answers in the answer blanks provided.

- Nucleus
- Electrons



**Figure 2-1**

1. What is the atomic number of this atom? \_\_\_\_\_
2. What is its atomic mass? \_\_\_\_\_
3. Which atom is this? \_\_\_\_\_
4. If this atom had one additional neutron but the other subatomic particles remained the same as shown, this slightly different atom (of the same element) would be called a(n) \_\_\_\_\_
5. Is this atom chemically active or inert? \_\_\_\_\_
6. How many electrons would be needed to fill its outer (valence) shell? \_\_\_\_\_