Study Guide

Anatomy and Physiology 1

By
Kevin Hwang, M.D.

Reviewed by
Dawna Martich, MSN, RN
About the Author

Kevin Hwang, M.D., is a graduate of the University of Texas Medical Branch at Galveston. Dr. Hwang is currently a resident in internal medicine at Morristown Memorial Hospital—University of Medicine and Dentistry of New Jersey. He has done freelance medical writing for publishers such as F.A. Davis, Gale, Integrated Communications, and the Cancer Information Network.

About the Contributing Reviewer

Dawna Martich, MSN, RN, earned baccalaureate and master’s degrees in nursing from the University of Pittsburgh School of Nursing. In addition to over 15 years of teaching in staff development, her experience includes teaching in diploma and associate degree nursing programs. Dawna has been a freelance medical writer for over 20 years for a variety of nursing publishers, including Pearson Education, Cengage Delmar Learning, Elsevier, F.A. Davis, and Jones & Bartlett.
INSTRUCTIONS TO STUDENTS 1

LESSON ASSIGNMENTS 7


RESEARCH PROJECT 81

LAB ASSIGNMENT 87

SELF-CHECK ANSWERS 89
Remember to regularly check “My Courses” on your student homepage. Your instructor may post additional resources that you can access to enhance your learning experience.
YOUR COURSE

Welcome to Anatomy and Physiology 1. This is a challenging subject to master due to the large volume of material. Understanding this material will help you interpret the many medical reports you’ll be exposed to in your healthcare career. You’ll also become more familiar with terms commonly used in the field of anatomy and physiology. The suggested study plan can guide you through the learning process.

OBJECTIVES

When you complete this course, you’ll be able to

■ Define terms referring to location, position, direction, body planes, and sections

■ Locate the major body cavities

■ Explain the structures, functions, and diseases of the major body systems in humans

■ Identify and describe the basic anatomical structures of the human body

■ Describe the physiological functions of the human body systems

■ List and discuss the organizational levels of the human body in order of increasing complexity and explain how these levels are related to each other

■ Identify similarities between body systems

■ Discuss the process and mechanics of homeostasis

■ Explain how human anatomy and physiology are related

YOUR TEXTBOOK

Your textbook, Anatomy & Physiology for Health Professions, Second Edition, by Bruce J. Colbert, Jeff Ankney, and Karen T. Lee, is designed for health care practitioners like you. The text focuses on the application of information as it’s used in
the medical field. Your textbook is filled with exercises and illustrations that explain and reinforce the material. For example, the outer margins of the text provide medical terms covered in the chapter. The word is provided phonetically and might include additional information. The word also appears in the Glossary, in the back of the book on pages G-1 through G-31.

Your textbook contains 19 chapters, which focus on the structures, functions, and disorders of the major body systems. Each chapter’s Learning Objectives provide key information. The Pronunciation Key sections alert you to new terms that you’ll see as you read the text. Don’t be overwhelmed by the quantity of medical words. In the process of meeting all the learning objectives for the assignments, you’ll learn to define the key words correctly. Within the chapters, you’ll find useful information in tables and figures as well as boxes containing Clinical Application and Applied Science (on various body systems). Pay close attention to all this material.

Throughout each chapter, you’ll also find useful items such as Amazing Body Facts, Learning Hints, and Media Extras. At the end of each chapter, you’ll find Case Studies, Review Questions, and an additional Multimedia Preview section.

Other special features of the textbook include

- A DVD, organized by chapters with quizzes, puzzles, challenges, and other learning activities that can help you master key concepts (For installation, insert the DVD in the back of the book and select Run/Start here.)

- A table of contents, starting on page iv

- An index, starting on page I-1

**YOUR LAB ASSIGNMENTS**

The Anatomy and Physiology course has a required virtual lab. In your materials for this course is an online access card for your virtual lab software, Anatomy & Physiology Revealed 3.0. This software will help you master anatomy and physiology. To access and use your lab, follow the instructions printed on the card. This software will show you

- Dissection or layers of the body structures

- Animations of body organs
- Histology, or what the body parts look like under a microscope
- Imaging, or what the body part looks like on an x-ray

Each of the parts of this software has short quizzes to help evaluate how well you know the material.

**Lab Instructions**

This lab will reinforce concepts you’ll be learning, and you’ll complete multiple choice quizzes. You’ll save the quizzes in a Word document on your computer and submit them when you’ve finished all the other assignments in the study guide.

You won’t receive a numerical grade for the lab quizzes. Rather, the lab requirement is fulfilled by your participation, and you’ll earn a “P” for pass once all of the quizzes are completed and submitted for review. You’ll submit the quizzes all together after you’ve finished the assignments in the study guide.

Please take the time to view the instructional video located on your My Courses page. This video will help you understand how to access the lab assignments and address frequently asked questions.

**Obtaining Screen Captures**

As you complete each quiz, you’ll take a screen capture of your quiz results. You’ll copy the image and paste it into a Word document. For most desktop computers, pressing the `alt` key and the `print screen` key (usually located in the upper right corner) copies an image of the screen. If you’re using a laptop, you may need to press the `function` key (usually located in the lower left hand corner of the keyboard) and `print screen` key. The function key may just have the letters `fn` on it.

You’ll submit all the quizzes together in one document. To paste a copied image, open the document and right click the mouse at the point where you want to insert the image. Then, select the **paste** option. The image should then be pasted onto your document. Be sure you save your document each time you add a screen capture to it.
Give the document a name that you will be easily able to locate and identify, for example, *A&P1 Lab Quizzes*.

**Completing the Lab Quizzes**

1. Read the instructions carefully for each lab assignment. Some of the directions may be specific for that assignment.
2. Enter the lab website, and select the topic to be covered. Complete all the study portions of the lab.
3. When you’re ready select the quiz icon. Follow any specific directions for that quiz in that particular assignment in your study guide. Complete the multiple choice quiz.
4. After you answer all the questions, click on the **Results** button at the bottom of the screen.
5. A page then opens, lists your results, and shows what was answered correctly and incorrectly. Take a screen capture of this page by following the instructions for obtaining screen captures.

Complete these steps listed for every lab quiz. After you complete all your other assignments in the study guide, submit the lab quiz Word document for grading. Go to your **My Courses** page, and click the **Take Exam** button for this lab. Browse through your files, find your Word document, and follow the instructions on your My Courses for uploading the exam for grading. Additional instructions also appear near the end of this study guide.

**A STUDY PLAN**

The study material for your course consists of

1. This study guide, which is designed for use with your textbook, includes an introduction to your course and presents a summary of the material you’ll cover in each lesson. Your study guide contains material that will help reinforce the material you’ve studied. Your study guide also includes
   - A lesson assignment page, which outlines a schedule of the study assignments in your textbook
   - Self-checks for each lesson
Instructions to Students

■ Self-check answers
■ Lab assignments

2. The Anatomy & Physiology for Health Professions textbook

Read this study guide carefully. It represents a blueprint of your course. It tells you what your assignments are for each lesson, and it provides a good approach to building your knowledge base in this course.

There are two lessons; each lesson contains several assignments. For each assignment, you’ll read selected pages in your textbook. After completing the textbook and study guide readings, complete self-checks. Before moving on to Lesson 2, complete all the assignments and the examination for Lesson 1. Complete each lesson in the following manner:

1. Read the instructions to each assignment in this study guide. The study guide indicates the pages in your textbook that you’ll be reading, and it provides additional information about the topics. Read the pages in this study guide carefully. This material is meant to clarify the textbook material, summarize and highlight the topics covered, provide examples, and point out practical applications. Pay close attention to the objectives, and use them as a framework for organizing your study. Your study guide will help you gain an understanding of the information in your textbook and DVD.

2. Quickly read the assigned pages in your textbook. This is called skimming, and it’s a learning technique you should use to get a general idea of the topics covered in that part of the textbook.

3. Next, slowly read the assigned textbook pages. Review the learning objectives, which will help you focus on the key points you should gather from the text. View the designated sections on the DVD. Many concepts of anatomy and physiology are best expressed through figures, so pay special attention to all the figures in the textbook and DVD. Spend time on the textbook’s tables, because they’re designed to present the most critical facts in an organized fashion. Many examination questions are derived from these figures and tables.
4. When you’ve completed an assignment, complete the self-check for the assignment in this study guide. The self-checks are designed to show you how well you understand the material, so test yourself honestly. Make every effort to complete the questions before turning to the answers at the back of this study guide. The self-checks are for your use only; they aren’t graded. Do not submit your answers for grading.

5. Once you’ve completed each self-check, turn to the answers provided at the back of the study guide to see how well you understood the material. If you find any weak areas in your knowledge, go back and review the relevant material until you completely understand it.

6. Move on to the next assignment.

7. Complete the Lab Assignments as you come to them. The content for the labs is found in the Anatomy & Physiology Revealed 3.0 software.

8. When you’ve completed the assignments, self-checks, and lab assignments, take the lesson examination. The lesson examinations are based on both your textbook and this study guide. You may use your textbook to help you answer the examination questions. Take your time—the examinations aren’t timed tests. They’re designed to help you master the key concepts of your course.

9. After completing a lesson exam, proceed to the next lesson in the study guide. Continue until all lessons and exams are completed.

10. If you have any questions during your study, e-mail your instructor for assistance. Your instructor will answer questions, provide additional information, and further explain any part of your study materials. You should find your instructor’s guidance and suggestions helpful as you progress through the course material.

Review the description of lesson assignments in the outline that follows, and then begin your study of medical terminology with the first assignment of Lesson 1.
### Lesson 1: Basic Concepts, the Human Body, Biochemistry, Cells, Tissues, and the Skeletal System

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Read in the study guide:</th>
<th>Read in the textbook:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 1</td>
<td>Pages 9–12</td>
<td>Pages 1–16</td>
</tr>
<tr>
<td>Assignment 2</td>
<td>Pages 13–15</td>
<td>Pages 20–36</td>
</tr>
<tr>
<td>Body Orientation Lab and Quiz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignment 3</td>
<td>Pages 17–20</td>
<td>Pages 40–54</td>
</tr>
<tr>
<td>Cells and Chemistry Lab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignment 4</td>
<td>Pages 21–26</td>
<td>Pages 58–80</td>
</tr>
<tr>
<td>Cells and Chemistry Lab (continued), Quiz on Diffusion, and Quiz on the Cell Cycle and Mitosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignment 5</td>
<td>Pages 27–32</td>
<td>Pages 84–109</td>
</tr>
<tr>
<td>Tissues Lab, Quiz on the Epithelial Tissue, and Quiz on Nervous Tissue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignment 6</td>
<td>Pages 33–40</td>
<td>Pages 114–139</td>
</tr>
<tr>
<td>Skeletal Lab, Quiz on the Skull, and Quiz on the Synovial Joint</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** To access and complete any of the examinations for this study guide, click on the appropriate Take Exam icon on your “My Courses” page. You should not have to enter the examination numbers. These numbers are for reference only if you have reason to contact Student Services.

### Lesson 2: Muscles, the Skin, the Nervous System, the Senses, and the Endocrine System

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Read in the study guide:</th>
<th>Read in the textbook:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment 7</td>
<td>Pages 41–47</td>
<td>Pages 144–164</td>
</tr>
<tr>
<td>Muscular Lab and Quiz on Skeletal Muscle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignment 8</td>
<td>Pages 49–54</td>
<td>Pages 170–188</td>
</tr>
<tr>
<td>Integumentary Lab and Quiz on Thin Skin, Subcutaneous Tissue, and the Fingernail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assignment</td>
<td>Read in the study guide</td>
<td>Read in the textbook</td>
</tr>
<tr>
<td>------------</td>
<td>------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Assignment 9</td>
<td>Pages 55–61</td>
<td>Pages 192–214</td>
</tr>
<tr>
<td>Assignment 10</td>
<td>Pages 63–68</td>
<td>Pages 218–241</td>
</tr>
<tr>
<td>Assignment 11</td>
<td>Pages 69–74</td>
<td>Pages 246–263</td>
</tr>
<tr>
<td>Assignment 12</td>
<td>Pages 75–79</td>
<td>Pages 268–289</td>
</tr>
</tbody>
</table>

Nervous System Lab
Nervous System Lab (continued)
Nervous System Lab (continued), Quiz on Vision, and Quiz on Hearing
Endocrine System Lab, Quiz on the Thyroid Gland, and Quiz on the Pancreas

Examination 409433  Material in Lesson 2
Research Project 40943400
Lab Assignment 40943500
Examination 409436  Final Examination
ASSIGNMENT 1: INTRODUCTION TO ANATOMY AND PHYSIOLOGY: LEARNING THE LANGUAGE

Read Assignment 1 in this study guide. Then, read Chapter 1, pages 1–16, in your textbook. Complete the exercises for Chapter 1 on the DVD.

The interactive segments on the DVD supplement the textbook information. View the DVD in conjunction with the textbook, and then view it again later as a review and self-assessment.

What is Anatomy and Physiology?

It’s important to define the sciences of anatomy and physiology to appreciate the scope of this course. Anatomy and physiology are technically separate sciences. You may choose to study both areas as separate courses. For practical purposes, though, the two fields are closely associated.

Anatomy is the study of the internal and external structures of the human body. Physiology deals with how each body part functions and how all body parts form a complete body. This course presents the anatomy and physiology of each body system together as an integrated unit.

Various branches of anatomy correspond to different approaches in studying the structure of the human body. The assignments in this course include elements of gross anatomy, microscopic anatomy, and macroscopic anatomy.
The Language

Before delving into the internal anatomy of the human body, you need to understand the basic terms applicable to the whole body. Study Figure 1-2 in your textbook. This figure explains the root word and prefixes or suffixes that can be added to it to make the medical term. Table 1-1 shows some common root words that can be combined to create a medical term. In Table 1-2, common prefixes appear; in Table 1-3, common suffixes. Knowing these prefixes and suffixes helps you understand what the medical term means.

Abbreviations are used often in medical professions. Abbreviations help shorten long terms and names for body parts and diagnostic tests. Study Table 1-4 to learn some common abbreviations.

Another aspect of the language of anatomy and physiology is the metric system. The metric system is used to measure weight, volume, and length. This system is used to measure, for example, blood pressure in millimeters of mercury (mm Hg), the size of organs in centimeters (cm), amounts of fluids in milliliters (mL), and weight in kilograms (kg).

Language of Disease

Although this course focuses on normal body structure and function, at times it helps to understand the changes that occur with disease. Disease occurs when the body fails to function as it’s normally expected. Disease causes signs and symptoms. Signs are obvious indications of a disease and can be measured using numbers. Vital signs are an example of the measures used to assess the health of a patient. The Clinical Application box on page 12 reviews the pulse as a vital sign. Symptoms are subjective and harder to measure. An example of a symptom is pain.

At times, a disease can exhibit a set of signs and symptoms that are called a syndrome. Studying signs, symptoms, and syndromes helps to diagnose or identify a disease. Looking at the patient’s medical history can help one to understand the etiology, or cause of a disease. Conversely, the prognosis is a prediction of the outcome.
Anatomy and Physiology Concepts

The body needs to be in balance for all organs to function well. *Homeostasis* is a process that maintains a stable environment in the body. An example of a homeostatic mechanism is body temperature.

If the body’s temperature rises above a certain level, the body performs functions to try to bring the temperature down towards a normal level. This is called a *negative feedback loop*. A positive feedback loop means that whatever change is going on in the body will continue. Such an action does not work to maintain homeostasis. Figure 1-4 on page 14 focuses on the homeostatic control of body temperature.

Now, review the material you’ve just studied. Once you feel you understand the material, complete *Self-Check 1*. When you’re sure you completely understand the materials from Assignment 1, move on to Assignment 2.
Self-Check 1

At the end of each section of *Anatomy and Physiology 1*, you'll be asked to pause and check your understanding of what you've just read by completing a “Self-Check” exercise. Answering these questions will help you review what you've studied so far. Please complete *Self-Check 1* now.

Answer Review Questions 1, 3, 4, 5, and 7 on pages 16–17 of your textbook.

Check your answers with those on page 89.
ASSIGNMENT 2: THE HUMAN BODY: READING THE MAP

Read Assignment 2 in this study guide. Then, read Chapter 2, pages 20–36, in your textbook. Complete the exercises for Chapter 2 on the DVD.

The Map of the Human Body

Before delving into the internal anatomy of the human body, you need to know the basic terms applicable to the body as a whole. Study Figure 2-1. The man is standing in the anatomical position. This position is defined very specifically so that anyone in the world can use this framework when describing anatomical relationships.

The body can be in other positions too. The ones that you’ll refer to in anatomy are prone, supine, Trendelenburg, and Fowler’s. These positions are described in Figure 2-2 on page 23 of your book. Go to the DVD associated with your textbook and access chapter 2 Media Extras. Watch the videos associated with body positions for more information.

Pay special attention to the designation of right and left. Right refers to the subject’s right side, not what’s on the right side of the viewer. It might be easier to learn these anatomical terms by using your own body as a model. Notice that your hand is distal to your elbow, and your nose is medial to your eyes. The Clinical Application box on page 24 explains the body directional terms. Table 2-1 on page 26 provides an easy list of the major directional terms that you’ll use when studying the human body.

Another directional concept that you’ll use is planes. A plane is an imaginary line drawn through the body or an organ to separate it into sections. Figures 2-5, 2-6, and 2-7 on pages 27–28 illustrate the body planes that you’ll be using. These planes are particularly useful in the field of radiology because cross-sectional images of the body are frequently obtained.

Figure 2-8 on page 29 and the Clinical Application box on page 30 describe the various body cavities. Knowledge of these cavities is important in understanding the targets of
radiological imaging tests. Also, many disease processes or symptoms are specified in terms of body cavities. Pain in the *thoracic cavity*, or chest, is a common symptom that brings people to the emergency room for help. *Abdominal pain* signifies pain that feels like it originates from the abdominal cavity. Figure 2-10 depicts the nine regions of the abdomen that are useful for describing the exact location of abdominal pain or symptoms. Another way to look at the abdominal regions is to study Figure 2-12. Here the abdomen is divided into four regions, which are different than what is described in Figure 2-11.

It’s a good idea for you to review Figure 2-13 on page 34 to learn the anterior and posterior areas of the body. And Table 2-2 on page 35 gives a list of body regions, the location, and an example that’s used in medicine.

---

**Body Orientation Lab and Quiz**

In Anatomy & Physiology Revealed, access Module 1: Body orientation. Complete the nine content topics using the Dissection icon, and complete one 10-question, multiple choice quiz of All structures.

Obtain your screen capture of the quiz results, and paste it into your Word document.
Self-Check 2

Reinforce what you have just learned by answering Review Questions 1, 2, 3, 4, and 5 on page 37 of your textbook.

Check your answers with those on page 89.
ASSIGNMENT 3: BIOCHEMISTRY: THE BASIC INGREDIENTS OF LIFE

Read Assignment 3 in this study guide. Then, read Chapter 3, pages 40–54, in your textbook. Complete the exercises for Chapter 3 on the DVD.

This assignment introduces the simplest particles that make up the human body. These particles form the fabric with which the body is constructed. The information in this assignment can be applied to the whole body and thus is important to know early in the course.

Biochemistry: Atoms, Elements, and Ions

All matter is made up of elements. An element can’t be broken down chemically into something else. Elements are usually abbreviated using the first two letters of their names. Table 3-1 on page 43 lists a few common elements in the body.

The smallest unit of an element is an atom. Atoms are made of protons, neutrons, and electrons. Atoms that gain or lose electrons are called ions and have either a negative or positive charge. Figure 3-2 on page 43 shows a diagram of atoms with positive and negative charges. We need to know about ions because electrolytes or charged ions in the body are needed to make the nervous and muscle systems in the body work. Electrolytes also help regulate body fluid balance.

Acids and bases are electrolytes because they conduct electricity and break down in water. An acid is a chemical substance that can release hydrogen ions. Bases accept hydrogen ions. The strength of an acid or base present is expressed as pH. The pH scale ranges from 0 to 14. A pH of 7 is considered neutral. A pH of 0 to 6.9 is considered an acid, and a pH of 7.1 to 14 is basic or alkaline. In the body, the respiratory and renal systems control acid-base balance.

Bonding occurs to make elements stick together to form molecules. An example of a molecule is table salt. Figures 3-3 and 3-4 on pages 44–45 and the content on pages 45–46 explain bonding.
One molecule that’s important in the human body is water. A molecule of water is made up of two hydrogen atoms and one oxygen atom. Water is needed to store heat and dissolve other elements into solution.

### Biological Molecules

Most of human anatomy is made up of biological molecules. These are molecules found in living systems, and they contain

- Carbon (C)
- Hydrogen (H)
- Oxygen (O)
- Nitrogen (N)
- Sulfur (S)
- Phosphorous (P)

These molecules make up the categories of carbohydrates, lipids, proteins, and nucleic acids.

Carbohydrates are starches and sugars. They’re used by the body for energy. Figure 3-7 on page 48 shows the chemical makeup of several common carbohydrates.

Lipids are made of carbon and hydrogen. Lipids include fats and oils and are used for energy, communication, and body protection. Another type of lipid is formed into a ring-like structure. These lipids are considered steroids and include cholesterol, estrogen, and testosterone. Figure 3-8 on page 49 shows the structure of major body lipids.

Proteins are made of chains of amino acids. Proteins have a nitrogen molecule, so you can often identify the chemical abbreviation for a protein by the presence of an N. Proteins are used by the body to provide structure, energy, and protection against infection.

The last type of biological molecule is nucleic acids. There are only two types of nucleic acids: RNA and DNA. These structures are found in every body cell and store genetic code. Figure 3-10 on page 51 shows the structure of nucleic acids.
It’s amazing to think of all the chemical and electrical processes that occur in the human body. These processes make up the metabolism, or all the life-sustaining reactions that occur in the body. The body also can build up materials for growth, repair, and reproduction. This process is called anabolism. However, the body also breaks down substances, such as food, in catabolism. An extreme form of catabolism occurs during starvation.

All these chemical and electronic processes wouldn’t occur without the help of enzymes. Enzymes are protein molecules that speed up the rate of chemical reactions so that body cells can use the materials. Enzymes are specific to certain molecules, and when they’re not needed, they remain dormant. Figure 3-12 on page 52 shows a body process that uses an enzyme.

The body can’t function unless food taken in through eating is broken down and used for energy. To make energy from food, a chemical process occurs that turns food into glucose or into a molecule called adenosine triphosphate (ATP). Once the body uses a molecule of glucose from ATP, it changes into the structure called adenosine diphosphate (ADP). When this happens, another molecule of glucose can be added and supplied to a body part for use.

**Cells and Chemistry Lab**

In Anatomy & Physiology Revealed, access Module 2: Cells & chemistry. Click on the Animations icon, and observe DNA structure and Electron transport and ATP synthesis under Cells. Review all four animations under Chemistry.
Self-Check 3

Reinforce what you’ve just learned by answering Review Questions 1, 2, 3, 4, and 5 on page 55 of your textbook.

Check your answers with those on page 89.
ASSIGNMENT 4: CELLS

Read Assignment 4 in this study guide. Then, read Chapter 4, pages 58–80, in your textbook. Complete the exercises for Chapter 4 on the DVD.

You’re now going to learn about the cell. It’s the simplest of all living things, yet it’s remarkably sophisticated. The most advanced computer in the world can’t match the complexity of a single cell. Indeed, you could devote an entire career to studying cells.

In this assignment, you’ll learn about the basic characteristics and functions of cells, and some of the illnesses caused by cell disorders. Many concepts regarding the cell are best communicated visually, so pay close attention to the textbook figures.

Cells are tiny, microscopic living units. Your body has a countless number of cells—muscle cells, brain cells, skin cells, and so on. Each cell has a life cycle. It’s born, performs functions, and dies. However, cells aren’t independent. Each cell contributes to the healthy functioning of your body, and each cell depends on other cells.

The Cell and Its Parts

Read about the cell membrane on pages 61–62 of your textbook. Notice that proteins and lipids make up the cell membrane. Figure 4-3 on page 63 is a graphic of the cell membrane. Study Figures 4-1 and 4-2 on pages 61–62 to learn the types of cells and the structure of cells in the body.

The next section discusses the transport methods within cells. Nutrients must get into cells, and waste products have to get out of cells. This movement in and out cells occurs through passive and active transport. Passive transport means that things move into and out of cells without using any energy. There are four types of passive transport:

- Diffusion
- Osmosis
- Filtration
- Facilitated diffusion
Diffusion is the most common type of passive transport. During diffusion, a solute moves from an area of higher concentration to an area of lower concentration. Imagine dumping a packet of powder drink into a pitcher of water. In osmosis, water moves through a permeable membrane when a concentration gradient is present. In filtration, pressure is applied to water and other materials across a membrane. Picture a large group of people all trying to get through a single door. Lastly, in facilitated diffusion, a substance helps another substance get through a membrane. Imagine wearing a backpack until you get to a revolving door. To get through the door you need to drop the backpack off. The backpack helped you get to the revolving door, but you don’t need it to go through the door. Figures 4-4, 4-5, and 4-6 on pages 64–66 help explain these concepts.

There are three types of active transport:

■ Active transport pumps
■ Endocytosis
■ Exocytosis

What occurs by active transport pumps is similar to facilitated diffusion, except that the pump needs energy to work. In endocytosis, a substance is too large to go through a cell membrane. The cell membrane surrounds the substance and forms a sac. This happens, for example, when the body is trying to prevent bacteria from entering the body. In exocytosis, a large particle needs to get out of a cell. The substance is surrounded by a membrane forming a sac and becomes a part of the cell membrane. The substance is then expelled out of the cell. Figure 4-8 on page 68 shows you the types of active transport.

Each cell contains other parts, including

■ Cytoplasm
■ Nucleus
■ Nucleolus
■ Ribosomes
■ Centrosomes
Cytoplasm is the internal environment of every cell. The nucleus is considered the brain of the cell. Within each nucleus is chromatin, which contains the deoxyribonucleic acid (DNA), the genetic material to make new cells. Chromatin forms chromosomes, which contain genes. The nucleolus makes ribonucleic acid (RNA), which forms ribosomes.

Ribosomes are found on a structure called the endoplasmic reticulum, and they help the body make enzymes and other proteins for cell repair and reproduction. Centrosomes contain centrioles, which are needed for cell division. Centrioles are tube-shaped and exist in pairs.

The mitochondria are tiny bean-shaped organelles that provide the power for the cell. If a cell performs many functions, then that cell will have more mitochondria than a cell that has one function. Figures 4-9 and 4-10 on pages 70–71 are diagrams of the structures within a cell.

The endoplasmic reticulum is like a highway within the cell. One type of reticulum is rough and is used to make protein. The other type is smooth and synthesizes fats. The Golgi apparatus is like a small truck that moves items within the cell to make sure it functions. And lysosomes are the parts of the cell that get rid of waste. Figure 4-11 on page 72 is a graphic of a cell including all the major structures.

The cytoskeleton is a series of tubes and filaments that give cells shape. Cells also contain flagella, whip-shaped tails that help some cells move like a tadpole. The last structure we’ll discuss is cilia, which are short hair-like structures that work like escalators to move particles in one direction.
Mitosis and the Cell Cycle

Cells can reproduce to make new cells. The process of making new cells is done through cell division. The cells within the human body are called eukaryotic cells. This means they have a nucleus, organelles, and chromosomes in the nucleus. To make a new cell with all the correct chromosomes, the cell goes through the process of mitosis.

A eukaryotic cell goes through two phases called the cell cycle. The first phase is called the interphase. Not much different is happening inside the cell during this phase; however, the cell is getting ready to divide by stockpiling materials. Then, during the mitotic phase, the cell divides and genetic material is deposited inside the new cell. The mitotic phase has four parts:

1. Prophase
2. Metaphase
3. Anaphase
4. Telophase

In the prophase, the nucleus disappears, the chromosomes are visible, and guide wires form. In the metaphase, the chromosomes get into a line in the center of the cell. During the anaphase, the chromosomes split and the guide wires pull them apart. Then during the telophase, the chromosomes go to the far end of the cell, the guide wires disappear, and the nucleus reappears.

Mitosis is very important. It’s needed to repair damaged bone, skin tissue, and blood cells. Without mitosis, the body wouldn’t be able to grow or replace old or damaged cells. Figure 4-13 on page 75 shows the phases of mitosis.

Microorganisms

Microorganisms are small structures that can carry or cause disease. The main microorganisms are

- Bacteria
- Viruses
Fungi

Protozoa

Many think that the only purpose of bacteria is to cause disease or be a pathogen. Actually, there are many bacteria that normally live in the body, and these make up what is called the normal flora. Figure 4-14 on page 78 shows the types of bacteria.

Viruses are infectious particles that can’t reproduce on their own. They have to get inside a cell and use the cell’s energy and power to reproduce. Viruses can stay dormant inside the body for many years and become active years later. An example of a virus that does this is chicken pox. The chicken pox virus stays in the body, and if it becomes active later in life it causes a problem called shingles. Figure 4-15 on page 78 gives a closer look at a virus.

Fungi are one- or multiple-celled organisms. Fungi travel through the air and on food and spread through spores. Examples of fungi include athlete’s foot and candidiasis. Figure 4-16 on page 79 shows the types of fungi.

The last type of microorganism is protozoa. Protozoa are one-celled organisms found in water and dirt. People get sick from protozoa by drinking contaminated water or being bitten by bugs that carry the organism in their bodies. Figure 4-17 on page 80 shows types of protozoa.

**Cells and Chemistry Lab (continued), Quiz on Diffusion, and Quiz on the Cell Cycle and Mitosis**

In Anatomy & Physiology Revealed, return to Module 2: Cells & chemistry. Click on the Dissection icon, and select the topic Generalized cell. Click through the 23 terms listed under Overview. Then, switch from Generalized cell to Plasma membrane. Click through the 14 terms. Next, access the Animations icon and watch the animations on Cell cycle and mitosis; DNA replication; Diffusion; Endocytosis and exocytosis, Osmosis; and Facilitated diffusion.

Then, complete a My animations quiz on Diffusion, and another on Cell cycle and mitosis.

Obtain screen captures of the quiz results of both quizzes, and paste them into your Word document.
Self-Check 4

Reinforce what you’ve just learned by answering Review Questions 1–5 on page 81 of your textbook.

Check your answers with those on page 89.
ASSIGNMENT 5: TISSUES AND SYSTEMS: THE INSIDE STORY

Read Assignment 5 in this study guide. Then, read Chapter 5, pages 84–109 in your textbook. Complete the exercises for Chapter 5 on the DVD.

So far, you’ve learned about atoms, molecules, cells—components too small to be seen with the naked eye. In this assignment, you’ll read about tissues, organs, and systems. These components represent the next level of organization in the human body.

Tissues

A tissue is group of similar cells that work together for one purpose or function. There are four main types of tissues:

- Epithelial
- Connective
- Muscle
- Nervous

*Epithelial tissue* is like plastic wrap that it used to cover food. This tissue covers most of the body’s parts and organs. The cells within the epithelial can be flat or squamous, cube-shaped or cuboidal, placed in a column or columnar, or stretchy or transitional. Figure 5-1 on page 87 provides a diagram showing the types of epithelial tissue and where they’re located in the body.

*Membranes* are a type of epithelial tissue that line a cavity or cover an organ or structure. There are three main types of epithelial membranes: cutaneous, serous, and mucous. Read Table 5-1 on page 88 for more information about epithelial membranes. Figure 5-2 on page 89 shows the location of serous and mucous membranes in the body.
The one tissue that’s the most commonly found in the body is called *connective tissue*. This tissue is found in organs, bones, muscles, membranes, and skin and functions to provide structure, hold things together, store fluids and nutrients, and protect against infections. There are four types of connective tissue:

- Connective tissue proper
- Cartilage
- Bone
- Blood

Connective tissue proper can be fine and loose or tough and dense. Examples of this type of tissue include fat or adipose tissue, tendons, and ligaments. *Cartilage* is a stronger type of tissue and is able to withstand pressure. *Bone* is the hardest tissue in the body. Together, cartilage and bone provide the tissues within the body’s skeleton. The type of membrane that works with connective tissue is called *synovial*. This membrane is found between the joints and provides a slippery surface to make joints move without friction. Figure 5-3 on page 90 shows the types and locations of connective tissue in the body, and Figure 5-4 on page 91 gives a close-up picture of a synovial joint and membrane.

Muscle tissue is needed for body movement. There are three types of muscle tissue:

- Skeletal
- Cardiac
- Smooth

*Skeletal muscle* attaches to bone and causes movement by contracting or relaxing. This tissue has a striped appearance that’s called striated. *Cardiac muscle* is found inside the walls of the heart. This type of tissue is called involuntary because the heart beats without input from the brain. Smooth muscle is found in the walls of hollow organs. This type of muscle is also involuntary in that it will contract and relax as needed. Figure 5-5 on page 92 shows you the types of muscle tissue.
The last type of tissue is *nervous tissue*. This tissue is needed so that the body parts communicate with the brain and spinal cord. There are two types of nervous tissue: neurons and neuroglia. *Neurons* conduct information, and *neuroglia* (or *glia*) support the nervous tissue cells. Figure 5-6 on page 93 shows a snapshot of nervous tissue.

The body tissues have the ability self-repair if they become damaged or worn out. If an injury occurs that damages blood vessels, the wound fills with blood and then the blood clots and forms a scab. At the same time, the body responds by inflammation that causes the wound to swell and become warm and painful. The body then begins to repair the wound by sending *fibroblasts*, cells that make connective tissue. The tissue then begins to regenerate or make new tissue and creates a scar.

Organs are groups of tissues that work together to perform a task or function. The body has both *vital* and *non-vital organs*. Vital organs are those that the body can’t live without, and include the heart, brain, and lungs. Organs that are non-vital, which the body can live without, include the appendix, spleen, and gallbladder. Table 5-2 on pages 95–97 provides a chart of the systems and organs of the human body.

**Systems**

A *body system* is formed by organs and other structures that work together to perform a specific function. There are eleven main systems in the body:

- Skeletal
- Muscular
- Integumentary
- Nervous
- Endocrine
- Cardiovascular
- Respiratory
- Lymphatic and immune
■ Gastrointestinal, or digestive
■ Urinary
■ Reproductive

The skeletal system provides a framework or support for the body organs. It also protects the brain, provides movement, stores nutrients, and produces blood cells. The skeletal system works in conjunction with the muscular system. Muscles attach to bones to provide voluntary and involuntary movement. Study Figures 5-7 and 5-8 on pages 98–99 for more information about the skeletal and muscular systems of the body.

The skin is often referred to as the largest organ in the body. The integumentary system includes the skin, hair, sweat glands, sebaceous glands, and nails. Figure 5-9 on page 100 shows a diagram of this system, including the organs and primary functions.

The nervous system is the communication relay center of the body and is made up of two other systems: the central nervous system and peripheral nervous system. Figure 5-10 on page 101 shows the parts of the nervous system and identifies the organs and primary functions.

Another body system that participates in body communication is the endocrine system. This system controls and secretes chemicals called hormones, which help regulate other body organs. Review Figure 5-11 on page 102, and pay particular attention to the organs that are considered a part of the endocrine system in the body.

The cardiovascular system has three main parts: the heart, the blood vessels, and blood. This system affects all the other body systems and is necessary to sustain life. Figure 5-12 on page 103 shows the cardiovascular system and the major associated structures.

The respiratory system is vital. Everyone knows that the lungs are a part of this system, but other body structures are too, such as the nose and the throat. Be sure to review Figure 5-13 on page 104 to learn about the organs and functions of the respiratory system.
Another system that’s often overlooked is the lymphatic and immune system. This system works to maintain body fluid balance and protects the body from invading microorganisms. Four body structures that are a part of this system include lymphatic vessels, lymph nodes, the spleen, and the thymus gland. Figure 5-14 on page 105 shows the lymphatic and immune system and lists the primary functions of the organs within this system.

The gastrointestinal, or digestive, system is needed to break down food so that it can be absorbed by the body for energy. This system also prepares waste products for removal from the body. Figure 5-15 on page 106 outlines this system and provides a review of the organs and the functions of this vital body system.

The primary function of the urinary system is to remove body waste. However, this system does other things such as keeping the blood clean and regulating blood pressure. Figure 5-16 on page 107 shows the urinary system for both male and female. The major body organs within this system are reviewed along with the purpose of each organ.

The last major body system is the reproductive system. This system is needed to ensure a steady supply of new people on earth! Figure 5-17 on page 108 shows the reproductive systems for both male and female. Each system has specific organs and functions. Be sure to review this information carefully.

---

**Tissues Lab, Quiz on the Epithelial Tissue, and Quiz on Nervous Tissue**

In Anatomy & Physiology Revealed, access **Module 3: Tissues**. Click on the **Animations** icon, and observe the four overviews listed: Epithelial tissue, Connective tissue, Muscle tissue, and Nervous tissue. Then, click on the **Histology** icon and review each of the types of tissues listed.

Complete a My animations quiz on **Epithelial tissue overview** and one on **Nervous tissue overview**.

Obtain screen captures of each of your quiz results, and paste them into your Word document.
Self-Check 5

Reinforce what you’ve just learned by answering Review Questions 1 through 5 on page 110 of your textbook.

Check your answers with those on page 90.

Anatomy and Physiology Online
Watch a video on epithelial tissue:
http://www.youtube.com/watch?v=0w-FAZc1DCo
ASSIGNMENT 6:  
THE SKELETAL SYSTEM

Read Assignment 6 in this study guide. Then read Chapter 6, pages 114–139, in your textbook. Complete the exercises for Chapter 6 on the DVD.

The skeletal system is composed of 206 individual bones, as well as the joint structures and ligaments that join one bone to another. The bones range from the large thigh bones to the tiny bones in your inner ear apparatus. Although popular culture associates a skeleton with death, bones are alive. Not only do they allow movement of the body, they also contribute to metabolic processes.

Overview of the Skeletal System

The bones are the primary structures within the skeleton. Although in Greek the word skeleton means “dried up body,” the bones are alive, constantly rebuilding and repairing themselves. There are four major shapes of bones:

- **Long**
- **Short**
- **Flat**
- **Irregular**

*Long bones* are found in the arms and legs. *Short bones* are equal in length and height and are found in the wrists and ankles. *Flat bones* are thin and are found in the skull, ribs, and breastbone or sternum. *Irregular bones* are odd-shaped and are used to connect to other bones. Examples of irregular bones include the hip bone and the vertebrae, or the bones in the spine. Figure 6-1 on page 117 provides a picture of the shapes of bones.

Bones have parts that make up the anatomy. Bones are covered with *periosteum*, a tough and fibrous connective tissue. Each end of the bone is called the *epiphysis*, and the part running through the middle of the bone to each end is called the *diaphysis.*
The diaphysis is hollow and is called the *medullary cavity.* This area of the bone is where bone marrow is stored. *Yellow marrow* has a high fat content, and *red marrow* is the location where red blood cells are made.

There are two major types of bone tissue: *compact* and *spongy.* Compact bone tissue is hard and found in the shafts of long bones and the outer layer of most bones. Compact bone is formed from small cylinder-shaped units called *osteons,* which contain osteocytes and a central *Haversian canal* that contains blood vessels.

Spongy bone is arranged in bars and plates called *trabeculae.* There are irregular holes between the trabeculae which makes the bone look like a sponge. This type of bone is lined with *endosteum.* Spongy bone makes bones weigh less and provides more room for red bone marrow. Figures 6-2 and 6-3 on pages 118–119 provide the basic anatomy of the bone and a comparison between compact and spongy bone.

Many people think that bones are smooth, when in reality they’re bumpy and have areas of depressions and projections. The areas of projections are where the muscles attach to the bones and the areas of depressions are where the nerves and blood vessels can be found. Table 6-1 of page 120 outlines specific features of bones.

Remember that bones are not static; they grow and need repair if injured. There are four specific cells that form and grow bone:

- Osteoprogenitor cells
- Osteoblasts
- Osteocytes
- Osteoclasts

*Osteoprogenitor cells* are non-specialized bone cells that are found in the *periosteum, endosteum,* and *central canal.* These bone cells can turn into another type of bone cell when needed. Osteoblasts are the cells that form bone. Osteocytes are osteoblasts that have matured. And osteoclasts are bone cells that break down bone to repair and reshape the bone as needed.
Bones are made through the process of intramembranous and endochondral ossification while being formed in the uterus. As the bone matures upon birth, one bone area, the epiphyses, continues to grow and is called the epiphyseal plate. This area is important because it makes sure the bones continue to grow as a newborn baby matures into an adult. Figure 6-4 on page 122 reviews the process of endochondral ossification.

If a bone is fractured, bone repair occurs using the same process as endochondral ossification. However, for a broken bone to heal, the two edges must be touching. Then, the bone must be immobilized so that healing can occur.

Bone repair occurs in stages: hematoma formation and inflammation, soft fibrocartilage callus formation, hard bony callus formation, and remodeling. In hematoma formation and inflammation, the bone bleeds. The blood accumulates around the fracture and makes a hematoma. The bone tissue releases chemicals that cause local inflammation.

In the stage of soft fibrocartilage callus formation, cartilage fills the space between the edges of the broken bone and blood vessels begin to grow. By the stage of hard bony callus formation, bone tissue replaces the cartilage. The final stage of remodeling is where the bone is shaped so that the fracture is hardly detectable.

Cartilage is a type of connective tissue that’s needed for body parts to bend and withstand pressure. It’s needed between bones as a cushion to prevent the ends of bones from grinding together. Around each area of cartilage is a small sac called the bursa. Bursa contains synovial fluid. When the bursa becomes worn out, the areas between bones become inflamed and cause arthritis or osteoarthritis. Figure 6-5 on page 124 provides a diagram of cartilage and the synovial joint.

The body needs joints to move. Two or more bones joined together are called a joint, or an articulation. Joints are held together with the connective tissue called a ligament. Ligaments are not the same as tendons because tendons attach muscle to bone.

Joints differ according to function and structure. As far as function, some joints are immobile, move a little, or move a great deal. For structure, joints can be classified according to
the type of tissue holding the bones together. *Fibrous joints* are held together by short connective tissue strands. *Cartilaginous joints* are held together by cartilage.

*Synovial joints* are joined by a cavity filled with synovial fluid, and are free-moving. There are several types of synovial joints:

- **Gliding joints** slide back and forth to help move the wrists and ankles.
- **Hinge joints** bend and are found in the knees and elbows.
- **Saddle joints** rock up and down and side to side and are found in the thumbs.
- **Ellipsoidal joints** form two movements such as what is needed to move the wrists.
- **Pivot joints** can only partially rotate and are found in the neck and forearm.
- **Ball-and-socket joints** perform all types of movement and are found in the hips and shoulders.

Figure 6-6 on page 126 identifies the types of joints.

Remember that a purpose of the joints is to ensure body movement. Because of this, there are types of movements that the joints perform.

- **Flexion** is bending.
- **Extension** is straightening a joint.
- **Plantar flexion** is standing on the toes.
- **Dorsiflexion** is bending the foot at the ankle joint towards the knee.
- **Abduction** is moving the body part away from the midline of the body.
- **Adduction** is moving the body part towards the midline of the body.
- **Inversion** is turning a body part inward.
- **Eversion** is turning a body part outward.
- **Supination** is turning the hand so that the palm is facing up.
- **Pronation** is turning the hand so that the palm is facing down.
- **Protraction** is bringing a body part forward.
- **Retraction** is bringing a body part backward.
- **Rotation** is a bone spinning on the axis.
- **Circumduction** is moving a limb in a circle.

All these movements can be complicated to learn. To help you, start with reviewing Figure 6-7 on page 127 of your textbook. Then go to chapter 6 on the DVD and select Media Extras. Here you can watch animations of how the joints move.

**The Skeleton**

The skeleton can be divided into two areas: **axial** and **appendicular**. The axial skeleton includes the bones of the chest, spinal cord, and head. This part of the skeleton contains 80 bones. The appendicular skeleton includes the bones of the arms, legs, hips, and shoulders. This part of the skeleton contains 126 bones. Figure 6-8 on page 129 provides diagrams of the human skeleton in both anterior and posterior views.

Skeletal bones can be further subdivided into regions, specifically:
- The skull
- The thorax
- The spinal column
- The upper and lower extremities

The skull protects and supports the human brain. There are openings in the skull for the structures such as the nose, eyes, ears, and mouth. Figure 6-9 on page 130 identifies the bones found in the skull.
There are bones in the thorax that form a cage to protect and support the heart, lungs, and major blood vessels. Major bones of the thorax include the sternum and ribs. The sternum has three bones: the manubrium, the body, and the xiphoid.

There are twelve pairs of ribs. The first seven are called the true ribs, and ribs 8 through 10 are referred to as the false ribs. Ribs 11 and 12 are called floating ribs. The first seven pairs of ribs are considered true because they connect to the sternum anteriorly and the spinal column posteriorly. The false ribs connect to the cartilage of the superior rib anteriorly and the spinal column posteriorly. The floating ribs have no anterior attachment to the sternum or other ribs. Figure 6-10 on page 131 diagrams the contents of the thorax.

The spinal column protects the spinal cord and contains vertebrae that are numbered according to the body location. There are 7 vertebrae in the cervical or neck area, 12 vertebrae in the upper back or thoracic region, and 5 vertebrae in the lower back or lumbar area. The tailbone or coccyx is made up of 3 to 5 small bones. The spinal column has primary and secondary curvatures that help keep the body balanced and in alignment. Figure 6-11 on page 132 identifies the vertebrae within the sections of the spinal column. And Figure 6-12 on page 133 shows how the curvatures of the spinal column can be malformed.

The bones of the upper and lower extremities are those that perform most of the body movements. The bones of the leg have one large bone and two smaller bones. The bones of the arm are similar with one large and two smaller bones. There are multiple bones in the wrists, ankles, fingers and toes. Additionally there are bones that support the shoulder and pelvic regions. Figure 6-13 on page 135 identifies the bones of the upper and lower extremities including the shoulder and pelvic regions.

**Disorders of the Skeletal System**

As the body ages, the cartilage and bone structure deteriorates. Aging causes changes to cartilage from being supple and flexible to being brittle and hard. This hardening of the cartilage contributes to the development of arthritis.
The amount of bone mass also changes with aging. After age 50, more bone is broken down than is formed. Bone becomes lighter and weaker, which means it can break more easily. A condition in which bone density decreases is called osteoporosis.

Although these changes can’t be avoided, they can be slowed considerably by engaging in healthy lifestyle choices such as eating enough foods containing calcium and vitamin D, and staying active with weight-bearing exercises. Smoking and caffeine intake reduce the amount of healthy bone density and should be avoided. Other disorders affect the skeletal system. These are reviewed in Tables 6-2 and 6-3 on page 136 of your textbook.

After you’ve completed Self-Check 6, prepare to take the examination. When you’re sure you completely understand the material, complete the Lesson 1 examination.

**Skeletal Lab, Quiz on the Skull, and Quiz on the Synovial Joint**

In Anatomy & Physiology Revealed, access Module 5: Skeletal. Click on the Dissection icon, and select each topic area and study all of the views available (anterior, posterior, and lateral). Then, select the Animations icon and view the three animations for the Back, neck, and head, as well as the animations for the Upper limb and Lower limb. Next, click on the Histology icon, and study the views for Compact bone and Spongy bone. Lastly, select the Imaging icon, and view the images for all the topics provided.

Complete a My animations quiz on the Skull and one quiz on the Synovial joint.

Obtain screen captures of each of the quiz results, and paste them into your Word document.
Self-Check 6

Reinforce what you’ve just learned by playing the Match Games in Chapter 6 under Review Activities on the DVD. Then answer Review Questions 1–5 on page 140 of your textbook.

Check your answers with those on page 90.

Anatomy and Physiology Online

Watch a short video on the skeletal system:

http://www.youtube.com/watch?v=8d-RBe8JBVs
Muscles, the Skin, the Nervous System, the Senses, and the Endocrine System

ASSIGNMENT 7:
THE MUSCULAR SYSTEM

Read Assignment 7 in this study guide. Then read Chapter 7, pages 144–164, in your textbook. Complete the Learning Games for Chapter 7 on the DVD.

Muscles are the prime movers in our body. They move us from point A to point B by working with the skeletal system. Every move we make, from blinking an eye to jumping over a log, must start with a muscular contraction. Many internal body functions also depend on the motion of muscles, such as the circulation of blood and digestion of food. Muscles also help us maintain a fixed position when we’re not moving. The muscles of the vertebral column work to allow us to stand erect. Muscles also aid in the production of body heat. This assignment will first discuss some general properties of muscles and then focus on a certain type of muscle called skeletal muscle.

Overview of the Muscular System

Not all muscles are the same. The three main types are skeletal, smooth, and cardiac muscles. Read about these muscle types on pages 146–147. Pay close attention to Figures 7-1 and 7-2.

You’re probably most familiar with skeletal muscles, which are muscles we build up by lifting weights. The muscles are labeled skeletal because they’re intimately associated with the skeletal system. Each muscle is attached to the skeleton at two or more sites. A skeletal muscle generates movement by pulling against bone. For example, your biceps muscle pulls against the bones of your forearm, allowing you to flex your elbow. A skeletal muscle without its bony attachments
is like a bicycle without a chain. When examined under a microscope, a skeletal muscle appears to have bands running across the cells. For this reason, skeletal muscle is referred to as striated muscle. See Figure 7-1 on page 147. Skeletal muscle is also voluntary muscle because you can voluntarily control the movements.

Smooth muscle (Figure 7-1 on page 147) contracts involuntarily and in a rhythmic, slow manner. Smooth muscles in the walls of your stomach and intestines are responsible for the continual movement of food along the digestive tract. This is involuntary muscle action because you don’t consciously control these smooth muscles. Smooth muscle also lines the walls of your blood vessels to help maintain blood pressure.

The third type of muscle is the highly specialized cardiac muscle found in the heart. Like skeletal muscle, cardiac muscle is striated and produces forceful contractions. However, like smooth muscle, cardiac muscle is under involuntary control (Figure 7-1 on page 147). The cells of cardiac muscle form an interdependent contracting system such that the entire heart contracts in a coordinated manner to pump blood throughout the body. The heart is a remarkable muscle that contracts rhythmically throughout your life.

Skeletal Muscle Movement

The main action of muscles, unique among body tissues, is contraction. Think of how each function of muscle is caused by a contraction. When you lift your arm above your head, you’re contracting the shoulder muscles. Your hand and forearm muscles allow you to write a letter. Muscles can be categorized as being either agonists or primary movers.

The chief muscle in a movement is called the primary mover. However, if one muscle moves in one direction, another muscle or muscles must also move. If the primary mover contracts, then the agonist or opposite muscle has to relax. This means that the opposite muscles are synergistic—they assist the primary mover muscle. Muscles help bones move through their attachments to the bone or through the point of origin. Figure 7-3 on page 149 shows how antagonist muscles move to perform movement.
In Assignment 5, we reviewed terms that help with skeletal movement. These same terms help with muscular movement, particularly:

- Rotation
- Abduction
- Adduction
- Extension

Figure 7-5 on page 152 shows how the forearm and leg extend and flex. Review this figure closely.

**Muscle Movement at the Cellular Level**

Muscle is made up of elongated cells called *muscle fibers*. Some of these fibers can be up to a foot long! Each muscle fiber is made up of *myofibrils*, each of which is the functional unit. Several myofibrils bundle together to form a *muscle cell*.

For a muscle to contract, each muscle fiber contains a *sarcomere* that contracts. Each sarcomere has two parts: *myosin*, which is a thick protein, and *actin*, which is a thin protein. These two parts arrange in repeating units separated only by bands called *Z lines*. It’s this pattern of repeating units and Z lines that gives muscle the appearance of being striped or striated.

To make a muscle move, the myosin and actin slide towards each other to shorten the muscle. To make the muscle relax, myosin and actin return to their resting positions. Figure 7-6 on page 154 shows the movement of a muscle, beginning with a muscle segment, the sarcomere, and then the contraction with myosin and actin.

Muscles need specific energy to move. This energy is in the form of *adenosine triphosphate (ATP)* and calcium. ATP provides the energy needed to bring the myosin and actin together.

Calcium is stored in the *sarcoplasmic reticulum*, a small sac around each muscle cell. When the muscle is stimulated, calcium is released from the sarcoplasmic reticulum, and it interacts with ATP to make the muscle move. When calcium
leaves the area, the muscle relaxes. The steps to muscle contraction are a bit more complicated and include interaction with the nervous system. To deepen your understanding, read the Learning Hint on page 155.

The muscles need a specific type of fuel for energy. Glycogen, a carbohydrate, is stored in muscle tissue and is always ready to be converted to glucose for muscle energy. Muscles with high demands, such as your leg muscles, also store fat and use it as energy when necessary. The use of glucose and fat for energy produces heat, which explains the need to sweat when exercising. The Applied Science box on page 157 explains how heat is produced with muscle movement.

**Skeletal Muscles of Specific Body Regions**

There is no right or wrong way to learn the muscles of the body. Actually, the Learning Hint on page 156 provides a few tips to help you remember muscle names. Another learning tool is Table 7-1 on pages 157–158. This table lists the name, location, origin, insertion, and action of many muscles.

Your text breaks down the body into regions to show you all the muscles. Figures 7-7 and 7-8 on page 159 show you the muscles of the face and the anterior and posterior chest. Likewise, Figures 7-9 and 7-10 on pages 160–161 focus on the muscles of the shoulder, arm, hand, hip, and leg. The DVD that accompanies your text provides animations that can help you with the muscles. These animations are found in the Media Extras under Chapter 7. You can test to see how much you remember by answering the questions in the Test Your Knowledge 7-4 Box found on page 158 of your textbook. Check your answers with those found in Appendix A page A-3.

**Muscle Types**

Two other types of muscles are in the body: visceral or smooth, and cardiac. Visceral muscle is found in all the body organs except the heart. This type of muscle also lines the blood vessels needed to control blood pressure. When smooth
muscle in blood vessels constricts, the vessel vasoconstricts, or becomes smaller. When smooth muscle in blood vessels widens the vessel vasodilates and becomes larger.

Another structure in the body is made up of visceral muscle. These structures are termed sphincters. Sphincters are found throughout the digestive tract and act like doors to let substances in and out of the system. Sphincters are involuntary muscles and do not contract as rapidly as skeletal muscles. Visceral muscles do not have a large blood supply, so when there is any injury to a muscle the muscle does not repair but develops a scar.

The last type of muscle in the body is cardiac muscle. This muscle is found in the walls of the heart and has a rich supply of blood and nutrients. The cardiac muscle fibers connect with intercalated discs. This connection ensures that when one cardiac muscle fiber contracts, other muscle fibers that are adjacent also contract. This is important to make sure there is a steady heart beat and flow of blood into and out of the circulatory system. Cardiac muscle can’t regenerate after an injury. If the blood supply is interrupted, the cardiac tissue starts to die. The areas of dead tissue form scars, which do not help the rest of the heart contract.

**Common Disorders of the Muscular System**

There are many disorders that can occur to the muscular system. Read pages 163–164 carefully to understand what the following terms mean:

- Myalgia
- Fibromyalgia
- Ataxia
- Paralysis
- Spasm/cramp
- Sprain
- Strain
Muscular disorders can be diagnosed through the use of electromyography (EMG), a test that measures the amount of muscle contraction by stimulating the muscle with an electrode. Spend some time looking at two videos, Muscle Atrophy and Muscular Dystrophy, in the Media Extras section of the DVD.

**Muscular Lab and Quiz on Skeletal Muscle**

In Anatomy & Physiology Revealed, access Module 6: Muscular. Click on the Dissection icon, and select each body section under the topic Muscle (Layered Dissection). Review the available Anterior, Lateral, Midsagittal, and Posterior views for each. Next, click on the Animations icon, and review the five animations under Anatomy & Physiology. Finally, click on the Histology icon and review the content under Skeletal muscle, Smooth muscle, and Cardiac muscle. Use both medium and high magnification.

Complete a My animations quiz on Skeletal muscle.

Obtain a screen capture of the quiz results, and paste it into your Word document.
Self-Check 7

Reinforce what you’ve just learned by completing the Matching exercise under the Review Activities on the DVD. Then, answer Review Questions 1, 3, 5, 6, and 7 on page 166 of your textbook.

Check your answers with those on page 90.
ASSIGNMENT 8:
THE INTEGUMENTARY SYSTEM

Read Assignment 8 in this study guide. Then, read Chapter 8, pages 170–188. Complete the Learning Games exercises for Chapter 8 on the DVD. Be sure to view the videos and animations under the Media Extras section of the DVD.

You’re now ready to learn the organ systems. Going forward, each assignment focuses on a particular organ system. The first system is the integumentary system, comprised of the skin, hair, nails, and glands. Although the skin may appear to be an inactive sheet of tissue, it’s a dynamic organ with blood vessels and nerves just like any other organ. The skin serves several functions and interacts with several organ systems.

System Overview

The integumentary system performs several vital functions that include protection from invading microorganisms, maintaining body fluids, storing fat for energy, producing vitamin D, sensory input, and regulating body temperature.

The skin is considered the largest organ in the body and weighs nearly 20 pounds. There are three layers of tissue in the skin:

- Epidermis
- Dermis
- Subcutaneous fascia

While you read this next section, refer to Figure 8-1 on page 173. The epidermis is the outer layer of the skin that’s visible to the naked eye. It really contains five other layers of epithelium. This layer has no blood vessels, and the cells are constantly shedding and being replaced with new cells from the stratum basale. The actual outer layer of the skin is really dead tissue called the stratum corneum. The average person loses 500 million cells each day, which amounts to about one and a half pounds of dead skin each year.
There are specialized cells within the epidermis. *Melanocytes* are responsible for skin color and produce melanin. *Melanin* is made when the skin is exposed to the sun and is what happens when getting a tan.

*Carotene* normally gives a yellowish cast to the skin, but if the body can’t excrete a substance called *bilirubin*, the skin will turn dark yellow. This condition is called *jaundice* and is easily seen in the whites of the eyes. Changes in skin color can also help determine diseases, such as bronze skin in a person with a disease of the adrenal glands, or *ecchymosis* which are black and blue marks caused by circulatory problems or injuries to the skin.

The *dermis* is the layer right below the epidermis. This is considered the true skin and contains capillaries, collagen and elastin fibers, involuntary muscles, nerve endings, lymph vessels, hair follicles, and sweat and oil glands. The finger and toe prints arise from this layer of the skin. Read pages 174–176 to learn more about the dermis. While reading this material, glance at Figure 8-2, which shows the location of the sweat and sebaceous glands. Then, go to the DVD for Chapter 7 and access Media Extras. Click on the Review Activity – Labeling, and complete the labeling activities for Features of the Integument and Layers of the Skin.

The deepest layer of the skin is the *subcutaneous fascia*, or *hypodermis*. This layer contains elastic and connective tissue and fat. *Lypocytes* or fat cells produce padding to protect deeper body tissues and insulation for temperature regulation. This layer of the skin also attaches to the body muscles.

### How Skin Heals

The skin has the amazing ability to heal itself. Practically everyone has had a cut, laceration, or minor burn. If the skin is punctured or cut, the first thing that happens is the area fills in with blood. The blood has substances in it that cause it to clot. As the clot becomes exposed to air, a scab forms. The skin tissue then begins to heal inside out.

Burns are often a challenge to heal. Burns are measured according to depth and size of the area burned. *Burn depth* is often classified according to the layers of the skin affected.
A first-degree burn has damaged the outer layer of the skin. This is also considered a partial thickness burn. This kind of burn is red and painful and does not cause a blister. This burn will heal without a scar.

A second-degree burn involves the entire epidermis and part of the dermis. This kind of burn is still considered a partial thickness burn and is painful, red, and will blister. This burn can take up to two weeks to heal and will leave a scar.

A third-degree burn affects all three layers of the skin and is considered full thickness. The skin of this burn will be leathery and black, brown, tan, red, or white. This burn does not cause continuing pain because the nerve endings are destroyed. A fourth-degree burn is also a full thickness burn because the injury extends to the bone. Third- and fourth-degree burns can’t heal without extensive treatment and wound care. These two burns will leave behind extensive tissue damage and scarring. In Figure 8-3 on page 178, the middle and bottom areas show the types of burns.

The size of the burned area is estimated according to body part. One way to make this estimate is to use the rule of nines, in which the body parts are divided into nine percent. The top of Figure 8-3 on page 178 shows how the rule of nines is divided for an adult, child, and infant.

The one thing to remember about burns is that third- and fourth-degree burns will not heal without surgery to remove dead damaged skin and apply skin grafts. Because the nerve endings and capillaries are burned, the skin is unable to regenerate on its own. Skin grafts are used to help the skin regenerate over the burned areas.

**Nails**

The nails are formed from epithelial cells that are in the nail root. These cells grow and cover the nail bed and become keratinized. The cuticle is a fold of tissue that covers the nail root. The portion of the nails that we see and have to trim is called the nail body. Nails grow at the rate of 1 millimeter every week. The pink part of the nail is from the vascular tissue under the nail. The white half-moon of the nail, or the lunula, is the thicker layer of the cells at the nail base. Figure 8-4 on
page 180 shows a diagram of the nail structures. The Clinical Application box on the same page explains how the nails are used to assess blood flow and determine the risk of developing peripheral vascular disease.

**Hair**

*Hair* is a necessary part of the human body. It regulates temperature, functions as a sensor to detect objects on the skin, and protects the eyes and the nose from foreign objects and matter. Hair is made up of *keratin*. The part of the hair that many painstakingly fix every morning is the *shaft*. Each shaft has a *root* that extends into the dermis to the *follicle*. The follicle has a rich blood supply, which causes cells to divide and grow. As new cells form, old ones are pushed out and away from the skin surface. As the old cells are pushed out, they die and become keratinized. The hair on our heads is really dead cells. Figure 8-6 on page 181 diagrams the hair follicle. Note that each hair follicle has an associated *sebaceous gland* that secretes *sebum*, an oily substance that coats the follicle. Sebum helps prevent skin infections and waterproofs the skin and hair. Because the amount of sebum produced decreases with age, older people have drier skin and hair.

Hair color is dependent on the amount of melanin produced. The more melanin a person has, the darker their hair will be. Hair follicles also produce a substance like hydrogen peroxide that’s thought to cause hair to gray.

Hair has a relatively long lifespan. Eyelashes will last about three to four months. The hair on our heads lasts from three to four years. Now go to the Media Extras section on the DVD and click on **Labeling** to complete the exercise **Hair Follicle**.

**Temperature Regulation**

Your skin is needed to regulate body temperature. One way this happens is by changes in the size of the blood vessels in the skin. If your temperature goes up, the blood vessels get larger so that heat can escape. The sweat glands secrete water to the skin surface. As this water evaporates, the skin cools. If this happens for long periods of time, the body can become dehydrated.
If the temperature goes down, the blood vessels in the skin become smaller. This forces the blood away from the skin and back toward the core of the body. When you’re cold, the hairs on your skin stand on end. This is because the tiny muscles, called *arrector pili*, are activated when they’re cold. This causes goose flesh or goose pimples. The hair standing on end causes pockets of warm air to sit right above the skin’s surface. This warm air protects the skin and the body from chilling. Figure 8-7 on page 184 diagrams the regulation of body temperature.

**Common Disorders of the Integumentary System**

There are many types of skin infections, conditions, and diseases. Your book identifies some of the most common disorders on pages 184–187. Figure 8-8 on page 185 shows the types of skin lesions. Table 8-1 on page 188 lists and described common pathological conditions of the skin. Figure 8-9 on page 187 provides pictures of skin conditions such as hives, acne, and poison ivy. Study these pages, figures and table in your textbook very well. Afterwards access the DVD for this chapter and click on Media Extras. Watch the videos for *Eczema, Skin Cancer*, and *Decubitus Ulcers*.

---

**Integumentary Lab and Quiz on Thin Skin, Subcutaneous Tissue, and the Fingernail**

In Anatomy & Physiology Revealed, access Module 4: *Integumentary*. Click on the Dissection icon. Go through both listed topics, and view all the views listed for each. Then, select Histology and go through each topic and its available views.

Then, complete the 10-question, multiple-choice, My structures quiz on Thin skin, subcutaneous tissue, and fingernail.

Obtain a screen capture of the quiz results, and paste it into your Word document.
Self-Check 8

Reinforce what you’ve just learned by completing the Matching exercise under the Review Activities on the DVD. Then answer the Review Questions 1 through 5 on pages 188–189.

Check your answers with those on page 90.

Anatomy and Physiology Online

Watch a short video on the integumentary system:
http://www.youtube.com/watch?v=kyxKDYUF-RM
ASSIGNMENT 9:  
THE NERVOUS SYSTEM PART I

Read Assignment 9 in this study guide. Then read Chapter 9, pages 192–214 of your textbook. Complete the Learning Games exercises for Chapter 9 on the DVD. Be sure to view the videos and animations under the Media Extras section of the DVD.

The nervous system is the major communication and relay system of the body. Because this system is so large and complex, it’s divided into two assignments. This first assignment will focus on the cells and peripheral nervous system. Assignment 10 will focus on the brain and associated structures.

Organization

The brain and spinal cord are considered the central nervous system (CNS), and the parts of the system responsible for transmitting and responding to information make up the peripheral nervous system (PNS). To get an idea of how big this system really is, study Figure 9-1 on page 195.

The part of the nervous system responsible for inputting information is called the sensory system. Sensory information goes into the nervous system where it’s processed by the brain and spinal cord. The brain and spinal cord decide what to do about the information and then tell the motor system what to do. The motor system has two parts: the somatic nervous system and the autonomic nervous system. The somatic nervous system controls skeletal muscles and voluntary movements. The autonomic nervous system is involuntary and is further divided into two branches: the parasympathetic and sympathetic systems. The parasympathetic nervous system is responsible for resting and digesting activities, whereas the sympathetic nervous system is the body’s radar and responds with either fight or flight.
Nervous Tissue

Nervous tissue does not contain epithelium, connective tissue, or muscle. Nervous tissue is made up of two kinds of cells: neuroglia and neurons. Neuroglia, or glial cells, are specialized cells that perform specific functions. There are four types of glial cells:

- **Astrocytes** are structure and support cells.
- **Microglia** remove debris.
- **Ependymal cells** cover surfaces and line cavities.
- **Oligodendrocytes** make myelin which is a fatty substance.

In the PNS, there are only two types of glial cells: *Schwann cells* that make myelin, and *satellite cells* for support. Figure 9-2 on page 197 diagrams the types of glial cells.

Another group of cells within the nervous system is responsible for assessing the environment and making and acting on decisions. These cells are neurons and have an odd shape. Figure 9-3 on page 198 provides a picture of a neuron. Notice that the neuron has a main body which is responsible for the cell’s metabolism. **Dendrites** are the long tentacle structures whose responsibility is to receive information from the environment and other cells. Information signals travel down axons until they reach the *axon terminal*, where the information synapses or is transmitted to the receiving cell in the body. Neurons that receive information are considered *sensory neurons*. Those that take information away are *motor neurons*. And neurons that carry information between other neurons are *interneurons*.

How Neurons Work

A neuron is an excitable cell. This means that it carries an electric charge when stimulated. When the neuron is excited, it’s *polarized*. When the cell is not excited, it’s *resting*.

When the neuron is polarized, parts of the cell open and sodium ions are released and travel along the cell membrane. Once the sodium ion goes into a cell, it makes the cell more positive, or *depolarizes* the cell. At this point, the cell has an
action potential. Once depolarization occurs, no further sodium ions are released. At this time, the potassium channels open causing positive potassium ions to leave the cell. This then causes the cell to become negative or repolarized. The period of time before the cell repolarizes is called the refractory period. Figure 9-4 on page 200 shows the steps in the depolarizing and repolarizing process.

Once an action potential is formed, it travels down the axon to the terminal. The speed in which the impulse travels is determined by the presence of myelin and the size of the axon. Myelin is a fatty substance and has a white appearance. This makes up the “white matter” in the nervous system. Areas of the nervous tissue that are the cell bodies are gray or the “gray matter” in the nervous system.

The myelinated areas wrap around the axon in short intervals or areas called nodes of Ranvier. The action potential skips down the axon from node to node. Figure 9-5 on page 202 diagrams impulse conduction along a myelinated axon.

The diameter of the axon impacts the speed of impulse transmission too. Impulses travel faster down an axon with a large diameter. And if the axon is myelinated, the speed can be as fast as 100 meters a second.

Neurons also need a method to communicate between each other. This communication occurs at synapses in which there are two types: chemical and electrical. With a chemical synapse when an impulse arrives at the axon terminal, tiny sacs called vesicles open and release the contents. These contents are neurotransmitters.

Neurotransmitters are used to send signals from the neuron across the cell to the next cell in line. Some neurotransmitters excite a cell. Others calm a cell down.

Once the neurotransmitter has been released, it needs to be removed from the area otherwise the cell will continue to either be excited or calmed. The cell needs to return to a resting state. Figure 9-6 on page 204 diagrams the chemical synapse process. Table 9-1 on this same page lists the common neurotransmitters, their action, and where they’re located.
There is one specialized chemical synapse important to the function of the motor system. The neuromuscular junction is a specialized synapse between voluntary motor neurons and skeletal muscles. When this synapse is activated, acetylcholine is released from the terminal of the motor neuron and binds to the surface of the skeletal muscle. This causes the muscle to depolarize and the muscle contracts.

Synapses within the cardiac muscle fibers do not need chemicals to transmit information from one cell to another. In the heart these synapses use electrical impulses which communicate through gap junctions.

**Spinal Cord and Spinal Nerves**

The spinal cord is located in a tube that runs through the vertebral column from the foramen magnum to the second lumbar vertebrae. It’s divided into 31 segments that each has a pair of spinal nerves. The spinal cord ends at L2 in a pointed structure called the *conus medullaris*. Hanging from this structure is the cauda equina or horse’s tail. This tail consists of spinal nerves L2 through the coccygeal nerve.

The brain and spinal cord are surrounded by protective membranes called *meninges*. Meninges provide a cushion and act as a shock absorber for the brain and spinal cord and have three layers. The *dura mater* is the thick fibrous outer layer. The *arachnoid mater* is the middle layer. This layer is thin and delicate and contains cerebrospinal fluid to absorb shock. The innermost layer is the *pia mater*. This layer contains blood vessels for the brain and spinal cord.

There are spaces between each of these three layers. Between the dura and the vertebral column is the *epidural space*. Between the dura mater and arachnoid mater is the subdural space and the space between the arachnoid mater and pia mater is the *subarachnoid space*. These membranes and spaces serve to protect the delicate spinal cord and brain tissue from injury. Figure 9-7 on page 207 diagrams the spinal cord. The meninges of the brain and spinal cord are further explained in Figure 9-8 on page 208.
The spinal cord has several layers divided by a fissure and a sulcus. The interior of the cord is further divided into white matter columns and gray matter horns. The horns are where the cell bodies of the neurons are located. Figure 9-9 on page 209 provides a diagram showing the internal anatomy of the spinal cord. Read pages 208–210 of your text very carefully to understand the tracts that exist within the spinal cord and each of the tracts’ functions.

Nerves connect the CNS with the rest of the world and are considered a part of the PNS. Nerves run between the CNS and the organs and tissues. There are 31 pairs of spinal nerves each carrying both sensory and motor information. Nerves that support the cervical, lumbar, and sacral regions are more complex and branch. These three areas form plexuses. Figure 9-10 on page 211 shows a diagram of the spinal nerves and explains the three spinal nerve plexuses.

The most primitive form of motor function in the body is the reflex. Reflexes are protective and involuntary. One example of a reflex is when the doctor hits the kneecap with the reflex hammer. When the hammer hits the knee, the lower leg swings or kicks out. This is called the knee-jerk reflex. Other types of reflexes include the withdrawal reflex, the vestibular reflex, and the startle reflex. These reflexes are explained further on pages 210–212 of your textbook.

**Common Disorders of the Nervous System**

There are many disorders that can impact the functioning of the nervous system. These disorders include

- Peripheral neuropathy
- Spinal cord injury
- Guillain-Barré syndrome
- Myasthenia gravis
- Botulism
- Meningitis
- Carpal tunnel syndrome
Each of these disorders is examined further on pages 212–214 of your textbook. Study the content of these pages carefully before advancing to the next part of this assignment.

**Nervous System Lab**

In Anatomy & Physiology Revealed, access Module 7: Nervous. Click on the Dissection icon. Go through all five of the views for the spinal cord, peripheral nerves, sympathetic (ANS) and parasympathetic (ANS) topics. Then click on Animations. Select Action potential generation, Action potential propagation, Chemical synapse, Typical spinal nerve, and Reflex arc. Lastly, select Histology. Examine all the views listed for Unmyelinated axon, Synapse, Neuromuscular junction, and Schwann cell.
Self-Check 9

Reinforce what you’ve just learned by completing the Matching exercise under the Review Activities on the DVD. Then answer the Review Questions 3 through 7 on page 215.

Check your answers with those on page 91.

Anatomy and Physiology Online

This link, http://www.youtube.com/watch?v=Ma8KkwN4_X8, brings up a video on the peripheral nervous system.

This is a comprehensive video. Even though the lecturer talks about part of the brain and cranial nerves, the bulk of this video focuses on the peripheral nervous system.
ASSIGNMENT 10:  
THE NERVOUS SYSTEM PART II

Read Assignment 10 in this study guide. Then read pages 218–241 of your textbook. Complete the Learning Games exercises for Chapter 10 on the DVD. Be sure to view the videos and animations under the Media Extras section of the DVD.

The nervous system wouldn’t function without the brain and cranial nerves. These parts represent the major control mechanism of the nervous system.

**Overall Organization**

As you begin studying this part of the assignment, keep Figure 10-1 on page 221 available to refer to as these parts of the nervous system are reviewed. The brain consists of three parts: cerebrum, cerebellum, and brain stem. The cerebrum is the largest part of the brain and is divided into two hemispheres by the longitudinal fissure. The cerebrum is divided from the cerebellum by the transverse fissure. The surface of the cerebrum has ridges or gyri and grooves called sulci. The two large right and left parts of the brain are further divided into lobes, specifically the frontal, parietal, occipital, and temporal. Table 10-1 on page 222 identifies the lobes of the cerebrum with their specific functions.

The cerebellum is behind or posterior to the brain stem and is responsible for sensory and motor coordination and balance. This part of the brain is often referred to as the “little brain.”

The final major structure within the brain is the brain stem. It’s divided into the medulla oblongata, pons, and midbrain. The medulla oblongata is continuous with the spinal cord and controls the heartbeat, breathing, and muscle tone in blood vessels. The pons connects the medulla oblongata and the cerebellum with upper brain sections. This structure also plays a role with breathing. The last section, the midbrain, is the top portion of the brain stem and conducts impulses to the cerebrum. The entire brain is covered with a membrane called the meninges. Table 10-2 on page 223 provides the functions of the brain stem and Figure 10-2 on page 224 diagrams the brain stem and the meninges.
The brain contains both white and gray matter just like the spinal cord. There are also hollow cavities within the brain that store cerebrospinal fluid. These cavities are called ventricles and are continuous with the central canal of the spinal cord and the subarachnoid space. The right and left sides of the brain are connected by a structure called the corpus callosum. This structure makes sure that the right side of the body knows what the left side is doing.

Right beneath the cerebrum is a part of the brain called the diencephalon. This section contains the thalamus, hypothalamus, pineal body, and pituitary gland. These structures work with the endocrine system to control hormone levels, hunger, thirst, body temperature, and sleep-wake cycles. Even though more about the diencephalon will be provided in Assignment 12, Table 10-3 on page 226 reviews the function of each of these structures. Figure 10-3 on page 225 diagrams the superior, sagittal, and frontal views of the cerebrum. Once you’ve studied these diagrams, go to the DVD for this chapter and access Drag and Drop Labeling under Learning Games and complete Parts 1 and 2 for the Brain.

**Cranial Nerves**

As the spinal cord is connected to the rest of the body through peripheral nerves, the brain is connected by cranial nerves. There are 12 pairs of cranial nerves that carry sensory and motor information. Figure 10-4 on page 228 provides a diagram of the cranial nerves. Refer to this diagram as you read Table 10-4 on page 229 which identifies the function of each of the cranial nerves.

**Brain, Spinal Cord, and PNS**

The brain, spinal cord, and peripheral nervous system all work together as the major communication system of the body. As you read through this next section, refer to the diagram in Figure 10-5 on page 230. This will help you understand the structures.

The somatic nervous system provides sensory input into the nervous system. Somatic sensation is a term to describe the sense of touch. Structures within the nervous system
communicate touch and include those listed in Table 10-5 on page 231. Figure 10-6, also on page 231, diagrams the primary somatic areas and shows the part of the brain that interprets the bodily sensation. The spinal and cranial nerves can also be “mapped” to the body surface. This mapping is called a dermatome. Figure 10-7 on page 232 shows the complete dermatome map for the anterior and posterior body surfaces.

**The Motor System**

The motor system works parallel with the somatic system but information is now going in the opposite direction. Figure 10-8 on page 234 diagrams the relationship of the motor system to the rest of the nervous system. The part of the brain that controls movement will depend upon the size and location of the body part as shown in Figure 10-9 on page 234.

One additional structure that exists deep within the cerebrum is the basal nuclei. Even though it’s part of the limbic system (more about this later), the basal nuclei are responsible for ensuring that movements are fluid and not jerky and uncoordinated. The complete coordination of motor movements through the entire nervous system is dependent upon the corticospinal and corticobulbar tracts that were discussed in Chapter 9 of your textbook. Table 10-6 on page 236 reviews the spinal tracts and the role that each of them plays in motor function.

**Autonomic Nervous System**

Recall from the discussion on the PNS that the autonomous nervous system is divided into two parts: the somatic system which controls skeletal muscles and the autonomic system which controls involuntary muscles. The autonomic nervous system is divided into two balancing systems called the sympathetic and parasympathetic nervous systems. See Figure 10-10 on page 238 for a good diagram depicting these two systems. This sympathetic nervous division of the autonomic nervous system is involved in “flight or fight” reactions. The sympathetic nervous system kicks into high gear during stressful situations, preparing your body for physical and/or emotional conflict. These situations are sometimes called “fight or flight” situations,
which refer to the survival instinct that forces you to either stand and face the danger or escape quickly. Effects of this system include increased heart rate, increased blood pressure, sweating, dry mouth, and dilated pupils.

This parasympathetic nervous division of the autonomic nervous system counterbalances the action of the sympathetic nervous system and is often referred to as the “resting and digesting” portion of the nervous system. Effects of this part of the nervous system include decreased heart rate, respirations, and blood pressure and increased digestive activity.

**Other Systems**

Two other systems that participate in nervous system functioning are the limbic system and the reticular system. The limbic system is a group of nuclei within the cerebrum, diencephalon, and superior brain stem that help control mood, emotion, and memory. The reticular system is a network of nuclei within the brain stem. It’s this system that makes sure you wake up in the morning and it’s this system that’s affected when receiving anesthesia before having surgery.

**Common Disorders of the Nervous System**

There are a variety of disorders that can affect the nervous system, including

- Paralysis
- Cerebral palsy
- Stroke or cerebral vascular accident
- Subdural hematoma
- Huntington’s disease

Carefully read the content on pages 240–241 to learn more information about these disorders. Then access the Media Extras section on the DVD and watch the videos and animations that further explain these disorders.
Nervous System Lab (continued)

In Anatomy & Physiology Revealed, return to Module 7: Nervous. Click on the Dissection icon. Go through all identified views for the Brain and Cranial nerves topics. Then click on Animations. Select Divisions of brain, Brain ventricles fly-through, Meninges, CSF flow, and Dural sinus blood flow. Finally, select Imaging and review the images available for the Brain.
Self-Check 10

Reinforce what you’ve just learned by completing the Matching exercise under the Review Activities on the DVD. Then answer the Review Questions 2, 3, 4, 6, and 7 on page 242.

Check your answers with those on page 91.

Anatomy and Physiology Online

For more information about some of the parts of the nervous system, click on these video links:

- [http://www.youtube.com/watch?v=8eJcHefMSiI](http://www.youtube.com/watch?v=8eJcHefMSiI)
- [http://www.youtube.com/watch?v=R8VBTk0yrdg](http://www.youtube.com/watch?v=R8VBTk0yrdg)
ASSIGNMENT 11: THE SENSES

Read Assignment 11 in this study guide. Then read pages 246–263 of your textbook. Complete the Learning Games exercises for Chapter 11 on the DVD. Be sure to view the videos and animations under the Media Extras section of the DVD.

Many of us learned at a very young age that there are five senses: sight, hearing, taste, smell, and touch. Even though touch or sensation was already discussed in the previous assignment, this assignment will provide additional information on this important sense.

Sight

The eye is an amazing organ that interprets an enormous amount of sensory data to give us the sense of vision. The orbit is a cone-shaped cavity formed by the skull that houses the eyeball. The cavity has openings for nerves and blood vessels and is lined with fatty tissue for protection. The eyeball connects to the orbital cavity with six short muscles that enable the eye to move in all directions. The eye structure also includes the eyelids and eyelashes.

The conjunctiva is a protective membrane that lines the exposed surface of the eyeball. Each eye also has a lacrimal apparatus that produces tears. The lacrimal gland is within the lacrimal apparatus which transports tears to the tear ducts. The eyes tear constantly but they do not overflow because they drain into the nose. Tears provide an antiseptic function in that they keep germs away from the eyeball. Figure 11-1 on page 250 shows the lacrimal structures of the eye.

The actual eyeball is divided into two chambers: aqueous humor and vitreous humor. The aqueous humor bathes the iris, pupil, and lens and is located in the anterior and posterior eye chambers. The vitreous humor is a clear jellylike substance that fills the entire eye cavity behind the lens.
The eyeball has three layers: sclera, choroid, and retina. The sclera is the outer layer and provides a tough protective shield for the eye. This is the area that’s referred to as the “whites of the eyes.” The sclera contains the cornea, which is the part of the eye that receives light rays which pass into the eye.

The choroid is the middle layer that provides the blood supply to the eye. This layer contains the iris and the pupil. The iris is the colored part of the eye and controls the size of the eye opening or pupil. The iris relaxes and contracts to accommodate the amount of light going through the eye. This relaxation or contraction is what changes the size of the pupil. Behind the pupil is the lens. The lens is held in place by ciliary muscles which alter the shape of the lens to accommodate for vision.

The inner layer of the eye is the retina. There is where the nerve endings are found to receive and interpret light rays as images. The retina joins the optic nerve and contains two types of light sensing cells: rods and cones. Rods are active in dim light and do not perceive color. The cones are active in bright light and perceive color. Figure 11-2 on page 251 provides a diagram of the internal structures of the eye. And Table 11-1 on page 252 lists the eye structures and their corresponding functions. Review this diagram and table carefully and then access the Drag and Drop Labeling exercise Parts of the Eye under Learning Games on the DVD.

**Hearing**

The ear is the structure for hearing and contains three parts: external ear, middle ear or tympanic cavity, and inner ear. Figure 11-3 on page 254 provides a diagram of these three sections. Review this diagram as you follow along in this part of the assignment.

The external ear has a variety of parts that include the pinna or the auricle. This is the part that we typically associate with an “ear.” The pinna is where sound enters the auditory canal or external auditory meatus. The canal contains cerumen or earwax which is made by the ceruminous glands. The external ear ends at the eardrum or tympanic membrane.
The middle ear or tympanic cavity contains three of the smallest bones or ossicles in your entire body. These bones are joined and serve to amplify sound from the external ear. These bones have interesting names that exemplify their shapes: hammer or malleus, anvil or incus, and the stirrup or stapes. The malleus is attached to the tympanic membrane. The incus is attached to the malleus and the stapes is connected to a membrane called the oval window. The middle ear also contains the eustachian tubes. These tubes allow for the equalization of pressure on either side of the eardrum. They connect to the nasal cavity and the pharynx.

The inner ear begins at the oval window and contains three areas that look like a labyrinth. The three areas are the vestibule chamber, cochlea, and semicircular canals. The vestibule chamber is the housing for the entire inner ear. The cochlea is a bony snail-shaped space that connects to the oval window. This area contains perilymph fluid that’s needed to transmit sound. Once sound reaches the back of the inner ear, another fluid, endolymph, carries the sound to hair-like receptors that conduct the signal to the brain via the acoustic or vestibulocochlear nerve (CN VIII). Figure 11-4 on page 255 of your text diagrams the structures of the inner ear. Table 11-2 on page 256 identifies each ear structure and associated function. Review these two areas carefully before accessing the Media Extras section on the DVD. Here you’ll view the animations for the ear, child ear, adolescent ear, and middle ear. Then access the Drag and Drop Labeling exercise Parts of the Ear under Learning Games on the DVD.

Taste

Taste is often referred to as the gustatory sense. The tongue is covered with papillae which contain taste receptors or taste buds. The taste buds detect five tastes: sweet, sour, salty, bitter, and umami. Umami is a distinct taste associated with glutamates. The sense of taste is dependent upon the sense of smell and the number of functioning taste buds. Figure 11-5 on page 258 of your text provides a diagram for the sense of taste.
Smell

The sense of smell originates in the receptors located in the upper area of the nasal cavity. Sniffing brings the aroma or odor higher up into the nose where it can be interpreted. Since taste and smell are tied together, a person will lose the taste for foods when experiencing a head cold. The sense of smell is linked and can trigger memories. Figure 11-6 on page 259 provides a diagram of the sense of smell.

Touch

The body has touch receptors called tactile corpuscles that sit inside the skin. These structures are concentrated in the fingertips and the tip of the tongue. Temperature sensors are also located in the skin and help the body adapt to extremes in environmental temperature.

The sense of touch is needed to communicate the presence of pain and is the most widely distributed sense in the body. There are types of pain including referred and phantom. Referred pain originates in a body organ but is felt in another body part. Phantom pain is the feeling of pain after a body limb has been amputated. Figure 11-7 on page 260 provides a diagram of the sites for referred pain. And Figure 11-8 on page 261 uses a diagram to exemplify the types of touch.

Common Eye and Ear Disorders

There are a number of disorders common to the eye, including

- Conjunctivitis
- Cataract
- Glaucoma
- Hyperopia
- Presbyopia
- Myopia
- Amblyopia
The eyes are also used to help diagnose disorders such as liver disease, brain injury, and sleep disorders. Figure 11-9 on page 262 provides photographs of eyes with common eye disorders.

Disorders common to the ear include

- Otitis media
- Labyrinthitis
- Vertigo
- Ménière’s disease
- Tinnitus
- Deafness

Read pages 260–262 carefully to understand the eye and ear disorders.

**Nervous System Lab (continued), Quiz on Vision, and Quiz on Hearing**

In Anatomy & Physiology Revealed, return again to **Module 7: Nervous**. Click the **Dissection** icon. Go through all identified views for the **Taste, Smell, Hearing/balance**, and **Vision** topics. Then click on **Animations**. Watch **Vision** and **Hearing**. Then, select **Histology**. Examine all the views available for **Hearing/balance - cochlea**, **Hearing/balance - spinal organ**, **Smell - olfactory mucosa**, **Taste - taste bud**, **Vision - eye**, **Vision - retina**, and **Vision - retinal rods and cones**. Finally, select **Imaging** and view the images for **Tympanic membrane**, **Tympanic membrane with otis media**, and **Retina**.

Complete a **My animations** quiz on **Vision** and one on **Hearing**. Obtain screen captures of the each of the quiz results, and paste them into your Word document.
Self-Check 11

Reinforce what you’ve just learned by completing the Matching exercise under the Review Activities on the DVD. Then answer the Review Questions 1, 2, 3, 5, and 7 on page 264.

Check your answers with those on page 91.

Anatomy and Physiology Online

For more information about the senses, watch these videos:

- http://www.youtube.com/watch?v=ZxSEkuiMhhM
- http://www.youtube.com/watch?v=5p2i0hMXzuk
- http://www.youtube.com/watch?v=NmGRRDugvIA
- http://www.youtube.com/watch?v=LiiB9dKwjVI
- http://www.youtube.com/watch?v=v6XynC_rPKg
ASSIGNMENT 12:
The Endocrine System

Read Assignment 12 in this study guide. Then read pages 268–289 of your textbook. Complete the Learning Games exercises for Chapter 12 on the DVD. Be sure to view the videos and animations under the Media Extras section of the DVD.

The endocrine system is often thought of as being a system that provides steady control to organs and other systems. Let’s start this final assignment by first looking at the organization of this fascinating system.

Organization of the Endocrine System

The endocrine system is divided into organs and hormones. Organs that are a part of this system include the hypothalamus, pineal gland, pituitary gland, thyroid, parathyroid glands, pancreas, adrenal glands, ovaries, and testes. Study Figure 12-1 on page 271 to see a diagram of all the organs and glands in this system.

Hormones are chemical messengers that tell an organ or gland “what to do.” Table 12-1 on page 272 lists all the endocrine organs and associated hormones released. This table also includes the effect the hormones have on the body. Some hormones are neurotransmitters and are listed in Table 12-2 on page 272. Hormones bind to receptors on target cells of the organs which tell the cell to change what it has been doing in the body.

Control of Endocrine Activity

The endocrine system is always working to maintain homeostasis in the body. Figure 12-1 on page 274 provides a diagram of the process of homeostasis. If any of the body processes becomes disrupted, the endocrine control mechanisms use a negative feedback process to bring the body back into balance. At times, the body needs more of a hormone. If this occurs, the endocrine system will use a positive feedback process to increase the magnitude of a change within a cell or body organ. Figure 12-3 on page 275 diagrams the negative feedback process.
Hormones can be controlled by one of three ways: nervous system, by other hormones, or by body fluids. When being controlled by the nervous system, communication to the endocrine organ is made through signals from the sympathetic nervous system. Figure 12-4 on page 276 provides a diagram showing sympathetic control of the adrenal gland.

Hormones can control other hormones through a “chain of command” within the endocrine system. Figure 12-5 on page 277 provides a diagram that explains hormonal control of the adrenal glands.

The last way that hormones can be controlled is through body fluids or humoral control. The endocrine glands sense the amount of a hormone in the blood or other body fluid and communicate to the endocrine organ to change the amount of hormone being produced. Figure 12-6 on page 277 diagrams humoral control of blood glucose levels.

**Major Endocrine Glands**

There are several major glands within the endocrine system: hypothalamus, pituitary, thyroid, thymus, pineal, pancreas, adrenal, and gonads. Remember that the hypothalamus is located in the diencephalon and controls hunger, thirst, fluid balance, and body temperature. This gland is considered as being the “commander in chief” of the endocrine system.

The pituitary gland is also a part of the diencephalon and is commonly called the “master gland” because it controls other glands. The pituitary gland though will work only under direction by the hypothalamus. The pituitary gland has two parts: posterior or neurohypophysis and anterior or adenohypophysis. Each of these parts is responsible for secreting specific hormones. Figure 12-7 on page 279 provides a diagram of the hypothalamus and pituitary glands. And Table 12-3 on page 278 lists the specific hormones secreted by both the hypothalamus and the two parts of the pituitary glands.

The thyroid gland is located in the anterior portion of the neck and secretes thyroid hormones under the direction of the pituitary gland. Thyroid hormones control cell metabolism and growth. Another hormone, calcitonin, is also released by the thyroid and is responsible for maintaining blood calcium levels.
level and stimulating the building of bone. The thyroid gland has two smaller glands embedded in the posterior surface area. These glands are the parathyroid glands which produce parathyroid hormone. This hormone regulates the amount of calcium in the blood. Figure 12-8 on page 282 diagrams the thyroid and parathyroid glands.

The thymus gland is a small gland located in the upper thorax near the sternum and helps with immune function. The pineal gland is found in the diencephalon but no one really knows the full function of this structure. It’s believed to control the hormone melatonin which changes levels with waking and sleeping. Melatonin is thought to peak at night which triggers sleep.

The pancreas has various organ functions but within the endocrine system it’s largely responsible for maintaining blood glucose levels in the body. The pancreas makes the hormones insulin and glucagon. Insulin removes glucose from the blood and lowers blood glucose level. Glucagon puts glucose into the cell. Figure 12-9 on page 284 diagrams the role of the pancreas with controlling high and low blood glucose levels. You can also access the Media Extras on the associated DVD and watch the animations for Diabetes Parts 1 and 2 and the animations for Hypo- and Hyperglycemia to learn more about the role of the pancreas within the endocrine system.

The adrenal glands are small glands that sit on top of the kidneys (like little hats). These glands have two areas: medulla and cortex. The adrenal medulla releases the hormones epinephrine or adrenaline and norepinephrine. These hormones potentiate the effect of the sympathetic nervous system causing an increase in heart rate, blood pressure, and respirations and cause sweaty palms and a dry mouth. The adrenal cortex makes steroid hormones called adrenocorticosteroids which are released under the direction of the pituitary gland. These hormones regulate many things such as electrolyte and fluid balance, blood sugar, reproduction, secondary sexual characteristics, cell metabolism, growth, and immune system function.

The last glands within the endocrine system are the gonads. The gonads are either the testes in males or ovaries in females. They produce and store gametes, eggs, and sperm in addition
to producing sex hormones that control reproduction. These hormones include testosterone in males and estrogen and progesterone in females.

**Common Disorders of the Endocrine System**

As you can see from the number of organs and glands that are a part of the endocrine system, there could be many disorders that affect this system. A few of these disorders include the following:

- Hashimoto’s disease
- Graves’ disease
- Pheochromocytoma
- Addison’s disease
- Cushing’s syndrome

Read carefully pages 286–287 to learn more about these common endocrine disorders.

After you’ve completed Self-Check 12, prepare to take the examination. When you’re sure you completely understand the material, complete the Lesson 2 examination.

---

**Endocrine System Lab, Quiz on the Thyroid Gland, and Quiz on the Pancreas**

In Anatomy & Physiology Revealed, access Module 8: Endocrine. Click on the Dissection icon. Select the first six topics, and review each of the views that present. Then, click on Animations. Watch the animations for the first six topics listed. Then, select Histology and review all the views for each of the glands listed. Finally, select Imaging and study the views for the two topics listed.

Complete a My animations quiz on the Thyroid gland and a quiz on the Pancreas.

Obtain screen captures of each of the quiz results, and paste them into your Word document.
Self-Check 12

Reinforce what you’ve just learned by completing the Matching exercise under the Review Activities on the DVD. Then answer the Review Questions 1 through 5 on page 291.

Check your answers with those on page 91.

Anatomy and Physiology Online

For more information about the endocrine system, view on these videos:

- http://www.youtube.com/watch?v=gYyH-u0fGlQ
- http://www.youtube.com/watch?v=OjjbPqRTRjs
BACKGROUND

During your study, you may have found one of the medical disorders you read about to be especially interesting. This assignment gives you an opportunity to apply what you’ve learned by doing some research in outside sources and increasing your understanding of one disorder.

PROCEDURE

Go to http://lessons.pennfoster.com/pdf/sp0754.pdf and read the instructions for research papers. Select a single medical disorder that affects the skeletal, muscular, integumentary, nervous, sensory, or endocrine systems. Consult the software program Anatomy & Physiology Revealed 3.0, and determine the Histology and possible Imaging studies used to diagnose the disorder. Utilize other resources including textbooks, journal articles, and primary websites to validate your findings. Then prepare a detailed report on the medical disorder, including the following elements:

1. Definition
2. Method(s) of diagnosis
3. Symptoms and complications of the disorder
4. Diagnostic findings from Imaging and Histology
5. Treatment of the disorder
6. Methods of prevention, if any
7. Directions for future research

The information from this course should be incorporated but not limited to what you’ve learned while studying this course.
GOAL

This assignment is designed to help you apply what you’ve learned from your lessons by researching and writing about a medical disorder you’ve studied and to give you an opportunity to demonstrate your written communication and research skills.

WRITING GUIDELINES

1. Type your submission, double-spaced, in a standard print font, Times New Roman or Arial Font size 12. Use a standard document format with 1-inch margins. (Do not use any fancy or cursive fonts.)

2. Include the following information at the top of your paper:
   a. Name and complete mailing address
   b. Student number
   c. Course title and number (Anatomy and Physiology 1, SCI 135)
   d. Research project number (40943400)

3. Read the assignment carefully and address the topic suggested. Use proper citation in either APA or MLA style.

4. Be specific. Limit your submission to the main topic identified.

5. Include a reference page in either APA or MLA style. On this page, list websites, journals, and all other references used in preparing the submission.

6. Proofread your work carefully. Check for correct spelling, grammar, punctuation, and capitalization.
GRADING CRITERIA

Your grade will be based on the following criteria:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>40 percent</td>
</tr>
<tr>
<td>Written communication</td>
<td>40 percent</td>
</tr>
<tr>
<td>Format</td>
<td>20 percent</td>
</tr>
</tbody>
</table>

Here’s a brief explanation of each of these points.

**Content**

The student

- Provides a clear discussion of the assigned topic or issue
- Addresses the subject in complete sentences, not just simple yes or no statements
- Supports his or her opinion by citing specific information from the assigned websites and any other references using correct APA or MLA guidelines for citations and references
- Stays focused on the assigned issues
- Writes in his or her own words and uses quotation marks to indicate direct quotations

**Written Communication**

The student

- Includes an introductory paragraph, a body, and a concluding paragraph
- Uses correct grammar, spelling, punctuation, and sentence structure
- Provides clear organization (for example, uses words like first, however, on the other hand, and so on, consequently, since, next, and when)
- Makes sure the paper contains no typographical errors
Format

The paper is double-spaced and typed using either Times New Roman or Arial in font size 12. It includes the student’s

- Name and complete mailing address
- Student number
- Course title and number (Anatomy and Physiology 1, SCI 135)
- Research project number (40943400)

Submitting Your Project

Follow this procedure to submit your project online:

1. On your computer, save a revised and corrected version of your assignment. Be sure it includes all the information listed in “Writing Guidelines.”

2. Go to http://www.takeexamsonline.com and log on to the site.

3. At your homepage, click on Take an Exam.

4. In the box provided, enter the examination number. The number for this research project is 40943400.

5. Click on Submit.

6. On the next screen, enter your e-mail address. (This information is required for online submission.)

7. If you wish to tell your instructor anything specific regarding this assignment, enter it in the Comments box.

8. Attach your file as follows:
   
   a. Click on the first Browse box.

   b. Locate the file you wish to attach.

   c. Double-click on the file.

9. Click on Submit.
Important

After you submit the project for evaluation, you will see the letters *RCD* next to the exam number on your My Courses page.
BACKGROUND

Near the beginning of this study guide, you received instructions on obtaining and recording screen captures for the lab assignments.

When you’re sure that you’ve followed the instructions there and in the lab assignment boxes throughout this study guide, you’re ready to submit your Word document.

WRITING GUIDELINES

Include the following information at the top of your paper:

1. Name and complete mailing address
2. Student number
3. Course title and number (Anatomy and Physiology 1, SCI 135)
4. Lab assignment number (40943500)

GRADING CRITERIA

Your grade for this aspect of your course is a simple pass/fail grade, and it’s based on whether you correctly completed the lab assignment quizzes and pasted your screen captures into a Word document.

SUBMITTING YOUR PROJECT

Follow this procedure to submit your project online:

1. On your computer, save a revised and corrected version of your assignment. Be sure it includes all the information listed in “Writing Guidelines.”

2. Go to http://www.takeexamsonline.com and log on to the site.

3. At your homepage, click on Take an Exam.
4. In the box provided, enter the examination number. The number for this lab assignment is 40943500.

5. Click on **Submit**.

6. On the next screen, enter your e-mail address. (This information is required for online submission.)

7. If you wish to tell your instructor anything specific regarding this assignment, enter it in the **Comments** box.

8. Attach your file or files as follows:
   a. Click on the first **Browse** box.
   b. Locate the file you wish to attach.
   c. Double-click on the file.

9. Click on **Submit**.

After you submit the project for evaluation, you will see the letters **RCD** next to the exam number on your My Courses page.
Self-Check 1

1. c
3. a
4. b
5. d
7. c

Self-Check 2

1. a
2. d
3. d
4. d
5. a

Self-Check 3

1. d
2. b
3. c
4. c
5. b

Self-Check 4

1. d
2. b
3. b
4. d
5. d
Self-Check 5
1. a
2. b
3. c
4. b
5. d

Self-Check 6
1. a
2. b
3. b
4. d
5. b

Self-Check 7
1. b
3. d
5. c
6. b
7. b

Self-Check 8
1. a
2. a
3. c
4. d
5. b
Self-Check 9

3. a  
4. b  
5. c  
6. b  
7. b  

Self-Check 10

2. d  
3. a  
4. d  
6. b  
7. b  

Self-Check 11

1. c  
2. a  
3. b  
5. d  
7. a  

Self-Check 12

1. a  
2. b  
3. c  
4. b  
5. b