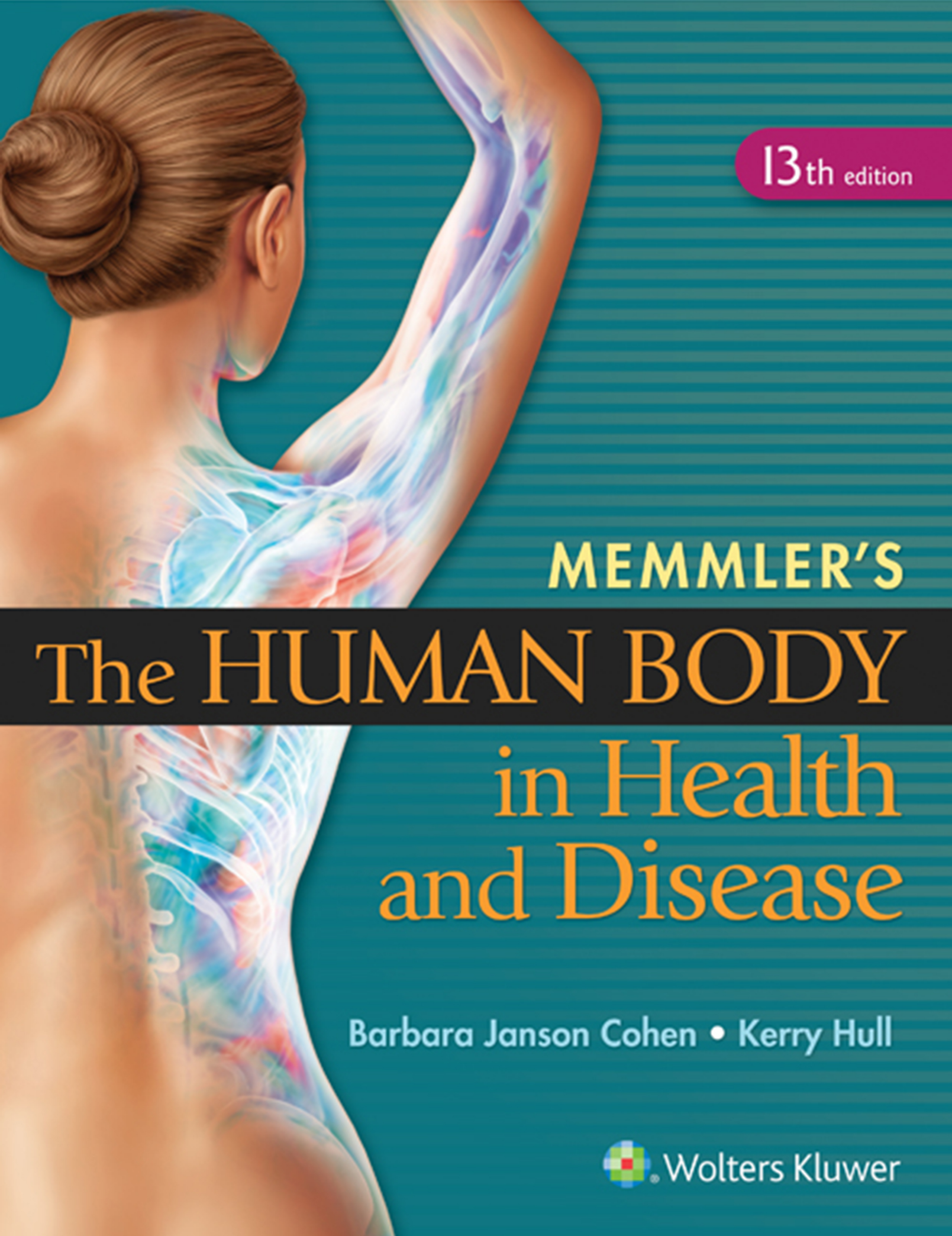
13th edition
MEMMLER'S
The HUMAN BODY
in Health
and Disease
Barbara Janson Cohen • Kerry Hull
Wolters Kluwer

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Barbara Janson Cohen • Kerry L. Hull

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Preface

Memmler's The Human Body in Health and Disease is a textbook for introductory-level health professions and nursing students who need a basic understanding of anatomy and physiology, the interrelationships between structure and function, and the effects of disease on body systems.

Like preceding editions, the 13th edition remains true to Ruth Memmler's original vision. The features and content specifically meet the needs of those who may be starting their health career preparation with little or no science background. This book's primary goals are

- To provide the essential knowledge of human anatomy, physiology, and the effects of disease at an ideal level of detail and in language that is clear and understandable
- To illustrate the concepts discussed with anatomic art of appropriate detail with accuracy, simplicity, and style that is integrated seamlessly with the narrative
- To incorporate the most recent scientific findings into the fundamental material on which Ruth Memmler's classic text is based
- To include pedagogy designed to enhance interest in and understanding of the concepts presented
- To teach the basic anatomic and medical terminology used in healthcare settings, preparing students to function efficiently in their chosen health careers
- To present an integrated teaching–learning package that includes all of the elements necessary for a successful learning experience

This revision is the direct result of in-depth market feedback solicited to tell us what instructors and students at this level most need. We listened carefully to the feedback, and the results we obtained are integrated into many features of this book and into the ancillary package accompanying it. The text itself has been revised and updated where needed to improve organization of the material and to reflect current scientific thought.

Because visual learning devices are so important to students, this new edition continues to include "The Body Visible," a series of illustrations with labeled transparent overlays of the major body systems described in the text. In addition to being a learning and testing tool, these illustrations provide enrichment and are a valuable general reference.

The 13th edition retains its extensive art program with updated versions of figures from previous editions and many new figures. These features appear in a modified design that makes the content more user-friendly and accessible than ever. Our innovative ancillary package on *thePoint* helps students match their learning styles to a wealth of resources, while the comprehensive package of instructor resources provides instructors with maximum flexibility and efficiency. The online Instructor's Manual describes all of the updates in this new edition and presents teaching and learning strategies for traditional classrooms, flipped classrooms, and online courses.

Organization and Structure

Like previous editions, this 13th edition uses a body systems approach to the study of the normal human body and the effects of disease. The book is divided into seven units, grouping related information and body systems together as follows:

- Unit I, The Body as a Whole (Chapters 1–4), focuses on the body's organization, basic chemistry needed to understand body functions, cells and their functions, and tissues, glands, and membranes.
- Unit II, Disease and the First Line of Defense (Chapters 5 and 6), presents information on disease, organisms that produce disease, and the integumentary system, which is the body's first line of defense against injury and disease.
- Unit III, Movement and Support (Chapters 7 and 8), includes the skeletal and muscular systems.
- Unit IV, Coordination and Control (Chapters 9–12), focuses on the nervous system, the sensory system, and the endocrine system.
- Unit V, Circulation and Body Defense (Chapters 13–17), includes the blood, the heart and heart disease, blood vessels and circulation, the lymphatic system, and the immune system.
- Unit VI, Energy: Supply and Use (Chapters 18–22), includes the respiratory system; the digestive system; metabolism, nutrition, and temperature control; body fluids; and the urinary system.
- Unit VII, Perpetuation of Life (Chapters 23–25), covers the male and female reproductive systems, development and birth, and heredity and hereditary diseases.

The main Glossary defines all the chapters' key terms and many additional terms emphasized in the text. An additional Glossary of Word Parts is a reference tool that not only teaches basic medical and anatomic terminology but also helps students learn to recognize unfamiliar terms. Appendices include a variety of supplementary information that students will find useful as they work with the text, including a photographic Dissection Atlas (Appendix 5) and answers to the Chapter Checkpoint questions and Zooming In illustration questions (Appendix 4) that are found in every chapter.

Pedagogic Features

Every chapter contains pedagogy that has been designed with the health professions and nursing student in mind.

- **Learning Objectives:** Chapter objectives at the start of every chapter help the student organize and prioritize learning.
- **Ancillaries At-A-Glance:** Learning Tools, Learning Resources, and Learning Activities are highlighted in a one-stop overview of the supplemental materials available for the chapter.
- **Disease in Context:** Familiar scenarios transport chapter content into a real-life setting, bringing the information to life for students and showing how disease may affect the body's state of internal balance.
- **A Look Back:** With the exception of Chapter 1, each chapter starts with a brief review of how its content relates to prior chapters.
- **Chapter Checkpoints:** Brief questions at the end of main sections test and reinforce the student's recall of key information in that section. Answers are in Appendix 4.
- **Key Points:** Critical information in figure legends spotlights essential aspects of the illustrations.
- **"Zooming In" questions:** Questions in the figure legends test and reinforce student understanding of concepts depicted in the illustration. Answers are in Appendix 4.
- **Phonetic pronunciations:** Easy-to-learn phonetic pronunciations are spelled out in the narrative, appearing in parentheses directly following many terms—no need for students to understand dictionary-style diacritical marks (see the "Guide to Pronunciation").
- **Special interest boxes:** Each chapter contains special interest boxes focusing on topics that augment chapter content. The book includes five kinds of boxes altogether:
  - **Disease in Context Revisited:** Traces the outcome of the medical story that opens each chapter and shows how the cases relate to material in the chapter and to others in the book.
  - **A Closer Look:** Provides additional in-depth scientific detail on topics in or related to the text.
  - **Clinical Perspectives**: Focuses on diseases and disorders relevant to the chapter, exploring what happens to the body when the normal structure–function relationship breaks down.
  - **Hot Topics:** Focuses on current trends and research, reinforcing the link between anatomy and physiology and related news coverage that students may have seen.
  - **Health Maintenance**: Offers supplementary information on health and wellness issues.
- **Figures:** The art program includes full-color anatomic line art, many new or revised, with a level of detail that matches that of the narrative. Photomicrographs, radiographs, and other scans give students a preview of what they might see in real-world healthcare settings. Supplementary figures are available on the companion website on *thePoint*.
- **Tables:** The numerous tables in this edition summarize key concepts and information in an easy-to-review form. Additional summary tables are available on the companion website on *thePoint*.
- **Color figure and table callouts:** Figure and table numbers appear in color in the narrative, helping students quickly find their place after stopping to look at an illustration or table.
- **Word Anatomy:** This chart defines and illustrates the various word parts that appear in terms within the chapter. The prefixes, roots, and suffixes presented are grouped according to chapter headings so that students can find the relevant text. This learning tool helps students build vocabulary and promotes understanding even of unfamiliar terms based on a knowledge of common word parts.
- **Chapter Wrap-Up:** A graphic outline at the end of each chapter provides a concise overview of chapter content, aiding in study and test preparation.
- **Key Terms:** Selected boldface terms throughout the text are listed at each chapter's end and defined in the book's glossary.
- **Questions for Study and Review:** Study questions are organized hierarchically into three levels. (Note that answers appear in the online Instructor's Manual as well as on the instructor resource website.) New in this edition, the section includes questions that direct students to "The Body Visible" and the various appendices to promote use of these resources. Question levels include the following:
  - **Building Understanding**: Includes fill-in-the-blank, matching, and multiple choice questions that test factual recall
  - **Understanding Concepts**: Includes short-answer questions (define, describe, compare/contrast) that test and reinforce understanding of concepts
  - **Conceptual Thinking**: Includes short-essay questions that promote critical thinking skills. Included are thought questions related to the Disease in Context case stories.

For Students

Look for callouts throughout the chapters for pertinent supplementary material on the companion website on *thePoint*.

The companion website on *thePoint* includes a practical system that lets students learn faster, remember more, and achieve success. Students consider their unique learning styles then choose from a wealth of resources for each learning style, including animations, a pre-quiz, and 10

different types of online learning activities; an audio glossary; and other supplemental materials such as health professions career information, additional charts and images, and study and test-taking tips and resources. Throughout the textbook, the graphic icon shown above alerts students to pertinent supplementary material.

See the inside front cover of this text for the passcode you will need to gain access to the companion website, and see pages xv–xvii for details about the website and a complete listing of student resources.

Instructor Ancillary Package

All instructor resources are available to approved adopting instructors and can be accessed online at http://thepoint.lww.com/MemmlerHBHD13e

- Instructor's Manual is available online as a PDF.
- Brownstone Test Generator allows you to create customized exams from a bank of questions.
- PowerPoint Presentations use visuals to emphasize the key concepts of each chapter.
- Image Bank includes labels-on and labels-off options.
- Supplemental Image Bank with additional images can be used to enhance class presentations.
- Lesson Plans are organized around the learning objectives and include lecture notes, in-class activities, and assignments, including student activities from the student companion website.
- Answers to "Questions for Study and Review" provide responses to the quiz material found at the end of each chapter in the textbook.
- Strategies for Effective Teaching provide sound, tried-and-true advice for successful instruction in traditional, flipped, and online learning environments.
- WebCT/Blackboard/Angel Cartridge allows easy integration of the ancillary materials into learning management systems.

Instructors also have access to all student ancillary assets, via *thePoint* website.

Guide to Pronunciation

The stressed syllable in each word is shown with capital letters. The vowel pronunciations are as follows:

Any vowel at the end of a syllable is given a long sound, as follows:

a as in say
e as in be
i as in nice
o as in go
u as in true

A vowel followed by a consonant and the letter e (as in rate) also is given a long pronunciation.

Any vowel followed by a consonant receives a short pronunciation, as follows:

a as in absent
e as in end
i as in bin
o as in not
u as in up

The letter *h* may be added to a syllable to make vowel pronunciation short, as in *vanilla* (vah-NIL-ah).

Summary

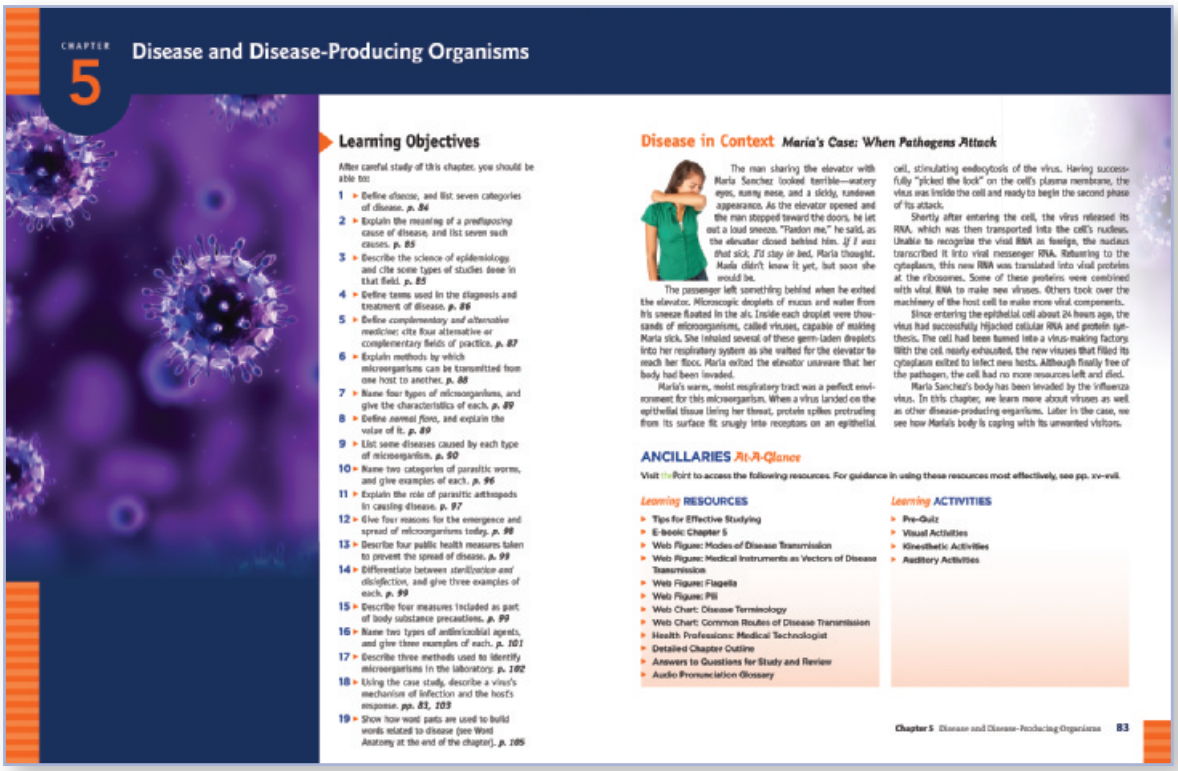
The 13th edition of *Memmler's The Human Body in Health and Disease* builds on the successes of the previous 12 editions by offering clear, concise narrative into which accurate, aesthetically pleasing anatomic art has been woven. We have made every effort to respond thoughtfully and thoroughly to reviewers' and instructors' comments, offering the ideal level of detail for students preparing for careers in the health professions and nursing and the pedagogic features that best support them. With the online resources, we have provided students with an integrated system for understanding and using their unique learning styles—and ultimately succeeding in the course. We hope you will agree that the 13th edition of *Memmler's* suits your educational needs.

User's Guide

For today's health careers, a thorough understanding of human anatomy and physiology is more important than ever. Memmler's *The Human Body in Health and Disease,* 13th edition not only provides the conceptual knowledge you'll need but also teaches you how to apply it. This User's Guide introduces you to the features and tools that will help you succeed as you work through the materials.

Your journey begins with your textbook, ***Memmler's The Human Body in Health and Disease***. Newly updated and fully illustrated, this easy-to-use textbook is filled with resources and activities that will enhance your personal learning style.

- **Disease in Context** provides an interesting case story that uses a familiar, real-life scenario to illustrate key concepts in anatomy and physiology. Later in the chapter, the case story is revisited in more detail—improving your understanding and helping you remember the information.
- **Ancillaries At-A-Glance** highlights the Learning Resources and Learning Activities available for the chapter.
- **Learning Objectives** help you identify learning goals and familiarize yourself with the materials covered in the chapter. These objectives are referenced to page numbers in the text.



CHAPTER 5 Disease and Disease-Producing Organisms

Learning Objectives

After careful study of this chapter, you should be able to:

1. Define *disease*, and list seven categories of disease. *p. 84*
2. Explain the meaning of a *predisposing cause* of disease, and list seven such causes. *p. 85*
3. Describe the science of epidemiology and cite some types of studies done in that field. *p. 85*
4. Define terms used in the diagnosis and treatment of disease. *p. 86*
5. Define *complementary and alternative medicine*; cite four alternative or complementary fields of practice. *p. 87*
6. Explain methods by which microorganisms can be transmitted from one host to another. *p. 88*
7. Name four types of microorganisms, and give the characteristics of each. *p. 89*
8. Define *normal flora*, and explain the value of it. *p. 89*
9. List some diseases caused by each type of microorganism. *p. 90*
10. Name two categories of parasitic worms, and give examples of each. *p. 96*
11. Explain the role of parasitic arthropods in causing disease. *p. 97*
12. Give four reasons for the emergence and spread of microorganisms today. *p. 98*
13. Describe four public health measures taken to prevent the spread of disease. *p. 99*
14. Differentiate between *sterilization* and *disinfection*, and give three examples of each. *p. 99*
15. Describe four measures included as part of body substance precautions. *p. 99*
16. Name two types of antimicrobial agents, and give three examples of each. *p. 101*
17. Describe three methods used to identify microorganisms in the laboratory. *p. 102*
18. Using the case study, describe a virus's mechanism of infection and the host's response. *pp. 83, 103*
19. Show how word parts are used to build words related to disease (see Word Anatomy at the end of the chapter). *p. 105*

Disease in Context *Maria's Case: When Pathogens Attack*

The man sharing the elevator with Maria Sanchez looked terrible—watery eyes, runny nose, and a sickly, sundown appearance. As the elevator opened and the man stepped toward the doors, he let out a loud sneeze. "Pardon me," he said, as the elevator closed behind him. *If I was that sick, I'd stay in bed,* Maria thought. Maria didn't know it yet, but soon she would be.

The passenger left something behind when he exited the elevator. Microscopic droplets of mucus and water from his sneeze floated in the air. Inside each droplet were thousands of microorganisms, called viruses, capable of making Maria sick. She inhaled several of these germ-laden droplets into her respiratory system as she waited for the elevator to reach her floor. Maria exited the elevator unaware that her body had been invaded.

Maria's warm, moist respiratory tract was a perfect environment for this microorganism. When a virus landed on the epithelial tissue lining her throat, protein spikes protruding from its surface fit snugly into receptors on an epithelial cell, stimulating endocytosis of the virus. Having successfully "picked the lock" on the cell's plasma membrane, the virus was inside the cell and ready to begin the second phase of its attack.

Shortly after entering the cell, the virus released its RNA, which was then transported into the cell's nucleus. Unable to recognize the viral RNA as foreign, the nucleus transcribed it into viral messenger RNA. Returning to the cytoplasm, this new RNA was translated into viral proteins at the ribosomes. Some of these proteins were combined with viral RNA to make new viruses. Others took over the machinery of the host cell to make more viral components.

Since entering the epithelial cell about 24 hours ago, the virus had successfully hijacked cellular RNA and protein synthesis. The cell had been turned into a virus-making factory. With the cell nearly exhausted, the new viruses that filled its cytoplasm exited to infect new hosts. Although finally free of the pathogen, the cell had no more resources left and died.

Maria Sanchez's body has been invaded by the influenza virus. In this chapter, we learn more about viruses as well as other disease-producing organisms. Later in the case, we see how Maria's body is coping with its unwanted visitors.

ANCILLARIES *At-A-Glance*

Visit the Point to access the following resources. For guidance in using these resources most effectively, see pp. xv–xvii.

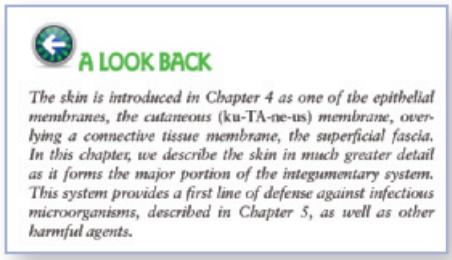
Learning RESOURCES

- Tips for Effective Studying
- E-book: Chapter 5
- Web Figure: Modes of Disease Transmission
- Web Figure: Medical Instruments as Vectors of Disease Transmission
- Web Figure: Flagella
- Web Figure: Pili
- Web Chart: Disease Terminology
- Web Chart: Common Routes of Disease Transmission
- Health Professions: Medical Technologist
- Detailed Chapter Outline
- Answers to Questions for Study and Review
- Audio Pronunciation Glossary

Learning ACTIVITIES

- Pre-Quiz
- Visual Activities
- Kinesthetic Activities
- Auditory Activities

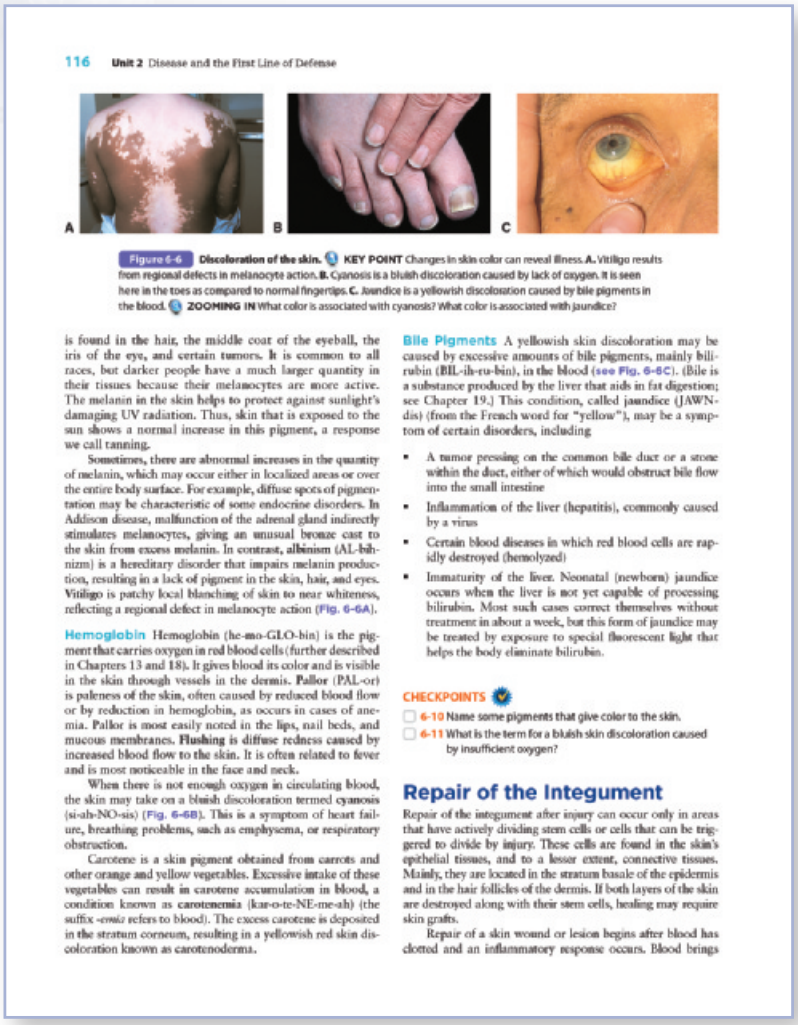
Chapter 5 Disease and Disease-Producing Organisms 83



A LOOK BACK

The skin is introduced in Chapter 4 as one of the epithelial membranes, the cutaneous (ku-TA-ne-us) membrane, overlying a connective tissue membrane, the superficial fascia. In this chapter, we describe the skin in much greater detail as it forms the major portion of the integumentary system. This system provides a first line of defense against infectious microorganisms, described in Chapter 5, as well as other harmful agents.

- **A Look Back** relates each chapter's content to concepts in the preceding chapters.



116 Unit 2 Disease and the First Line of Defense

A B C

Figure 6-6 **Discoloration of the skin.** KEY POINT Changes in skin color can reveal illness. **A.** Vitiligo results from regional defects in melanocyte action. **B.** Cyanosis is a bluish discoloration caused by lack of oxygen. It is seen here in the toes as compared to normal fingertips. **C.** Jaundice is a yellowish discoloration caused by bile pigments in the blood. ZOOMING IN What color is associated with cyanosis? What color is associated with jaundice?

is found in the hair, the middle coat of the eyeball, the iris of the eye, and certain tumors. It is common to all races, but darker people have a much larger quantity in their tissues because their melanocytes are more active. The melanin in the skin helps to protect against sunlight's damaging UV radiation. Thus, skin that is exposed to the sun shows a normal increase in this pigment, a response we call tanning.

Sometimes, there are abnormal increases in the quantity of melanin, which may occur either in localized areas or over the entire body surface. For example, diffuse spots of pigmentation may be characteristic of some endocrine disorders. In Addison disease, malfunction of the adrenal gland indirectly stimulates melanocytes, giving an unusual bronze cast to the skin from excess melanin. In contrast, **albinism** (AL-bih-nizm) is a hereditary disorder that impairs melanin production, resulting in a lack of pigment in the skin, hair, and eyes. Vitiligo is patchy local blanching of skin to near whiteness, reflecting a regional defect in melanocyte action (Fig. 6-6A).

Hemoglobin Hemoglobin (he-mo-GLO-bin) is the pigment that carries oxygen in red blood cells (further described in Chapters 13 and 18). It gives blood its color and is visible in the skin through vessels in the dermis. **Pallor** (PAL-or) is paleness of the skin, often caused by reduced blood flow or by reduction in hemoglobin, as occurs in cases of anemia. Pallor is most easily noted in the lips, nail beds, and mucous membranes. **Flushing** is diffuse redness caused by increased blood flow to the skin. It is often related to fever and is most noticeable in the face and neck.

When there is not enough oxygen in circulating blood, the skin may take on a bluish discoloration termed **cyanosis** (si-ah-NO-sis) (Fig. 6-6B). This is a symptom of heart failure, breathing problems, such as emphysema, or respiratory obstruction.

Carotene is a skin pigment obtained from carrots and other orange and yellow vegetables. Excessive intake of these vegetables can result in carotene accumulation in blood, a condition known as **carotenemia** (kar-o-te-NE-me-ah) (the suffix *-emia* refers to blood). The excess carotene is deposited in the stratum corneum, resulting in a yellowish red skin discoloration known as carotenoderma.

Bile Pigments A yellowish skin discoloration may be caused by excessive amounts of bile pigments, mainly bilirubin (BIL-ih-ru-bin), in the blood (see Fig. 6-6C). (Bile is a substance produced by the liver that aids in fat digestion; see Chapter 19.) This condition, called **jaundice** (JAWN-dis) (from the French word for "yellow"), may be a symptom of certain disorders, including

- A tumor pressing on the common bile duct or a stone within the duct, either of which would obstruct bile flow into the small intestine
- Inflammation of the liver (hepatitis), commonly caused by a virus
- Certain blood diseases in which red blood cells are rapidly destroyed (hemolyzed)
- Immaturity of the liver. Neonatal (newborn) jaundice occurs when the liver is not yet capable of processing bilirubin. Most such cases correct themselves without treatment in about a week, but this form of jaundice may be treated by exposure to special fluorescent light that helps the body eliminate bilirubin.

CHECKPOINTS

- 6-10 Name some pigments that give color to the skin.
- 6-11 What is the term for a bluish skin discoloration caused by insufficient oxygen?

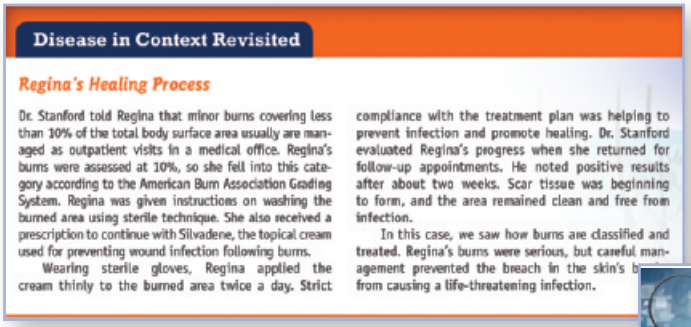
Repair of the Integument

Repair of the integument after injury can occur only in areas that have actively dividing stem cells or cells that can be triggered to divide by injury. These cells are found in the skin's epithelial tissues, and to a lesser extent, connective tissues. Mainly, they are located in the stratum basale of the epidermis and in the hair follicles of the dermis. If both layers of the skin are destroyed along with their stem cells, healing may require skin grafts.

Repair of a skin wound or lesion begins after blood has clotted and an inflammatory response occurs. Blood brings

- **Chapter Checkpoints** pose brief questions at the end of main sections that test and reinforce student recall.
- **Key Points** in the figure captions spotlight essential aspects of the illustrations.
- **"Zooming In" questions** in the figure captions test and reinforce student understanding of concepts depicted in the illustration.
- **Phonetic pronunciations** spelled out in the narrative directly following many terms make learning pronunciation easy—no need to understand dictionary-style diacritical marks.
- **Color figure and table callouts** help students quickly find their place after stopping to look at an illustration or table.

Special interest boxes focus on topics that augment chapter content.



Disease in Context Revisited

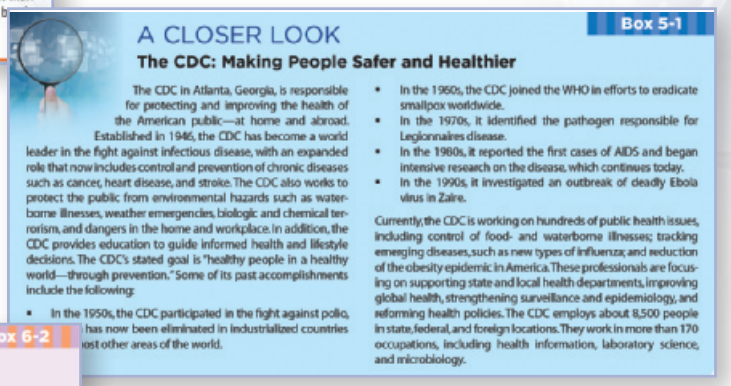
Regina's Healing Process

Dr. Stanford told Regina that minor burns covering less than 10% of the total body surface area usually are managed as outpatient visits in a medical office. Regina's burns were assessed at 10%, so she fell into this category according to the American Burn Association Grading System. Regina was given instructions on washing the burned area using sterile technique. She also received a prescription to continue with Silvadene, the topical cream used for preventing wound infection following burns.

Wearing sterile gloves, Regina applied the cream thinly to the burned area twice a day. Strict compliance with the treatment plan was helping to prevent infection and promote healing. Dr. Stanford evaluated Regina's progress when she returned for follow-up appointments. He noted positive results after about two weeks. Scar tissue was beginning to form, and the area remained clean and free from infection.

In this case, we saw how burns are classified and treated. Regina's burns were serious, but careful management prevented the breach in the skin's b... from causing a life-threatening infection.

- **Disease in Context Revisited** boxes provide the outcome of the clinical case story that opens each chapter.



Box 5-1

A CLOSER LOOK

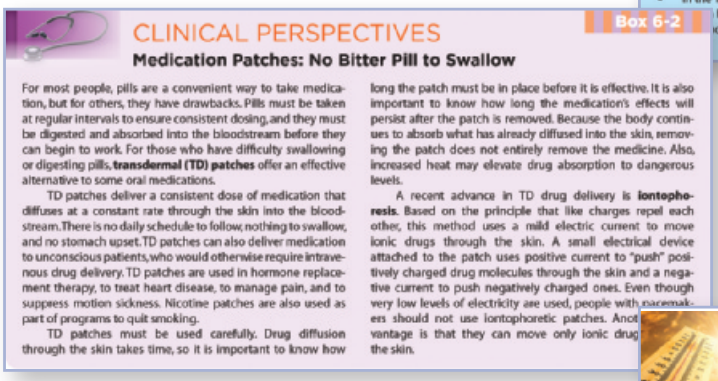
The CDC: Making People Safer and Healthier

The CDC in Atlanta, Georgia, is responsible for protecting and improving the health of the American public—at home and abroad. Established in 1946, the CDC has become a world leader in the fight against infectious disease, with an expanded role that now includes control and prevention of chronic diseases such as cancer, heart disease, and stroke. The CDC also works to protect the public from environmental hazards such as waterborne illnesses, weather emergencies, biologic and chemical terrorism, and dangers in the home and workplace. In addition, the CDC provides education to guide informed health and lifestyle decisions. The CDC's stated goal is "healthy people in a healthy world—through prevention." Some of its past accomplishments include the following:

- In the 1950s, the CDC participated in the fight against polio, ... has now been eliminated in industrialized countries ...ost other areas of the world.
- In the 1960s, the CDC joined the WHO in efforts to eradicate smallpox worldwide.
- In the 1970s, it identified the pathogen responsible for Legionnaires disease.
- In the 1980s, it reported the first cases of AIDS and began intensive research on the disease, which continues today.
- In the 1990s, it investigated an outbreak of deadly Ebola virus in Zaire.

Currently, the CDC is working on hundreds of public health issues, including control of food- and waterborne illnesses; tracking emerging diseases, such as new types of influenza; and reduction of the obesity epidemic in America. These professionals are focusing on supporting state and local health departments, improving global health, strengthening surveillance and epidemiology, and reforming health policies. The CDC employs about 8,500 people in state, federal, and foreign locations. They work in more than 170 occupations, including health information, laboratory science, and microbiology.

- **A Closer Look** boxes give in-depth scientific detail on topics in or related to the text.



Box 6-2

CLINICAL PERSPECTIVES

Medication Patches: No Bitter Pill to Swallow

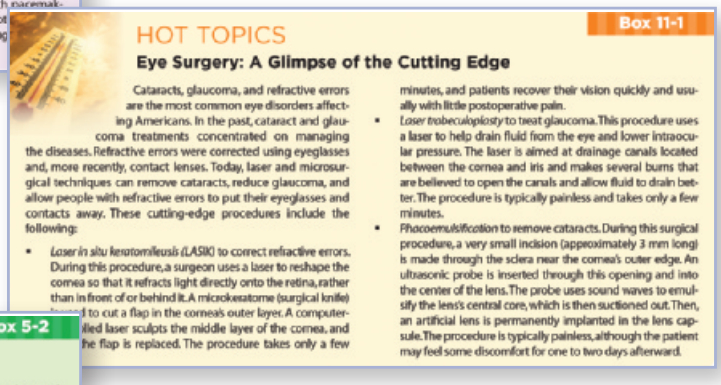
For most people, pills are a convenient way to take medication, but for others, they have drawbacks. Pills must be taken at regular intervals to ensure consistent dosing, and they must be digested and absorbed into the bloodstream before they can begin to work. For those who have difficulty swallowing or digesting pills, **transdermal (TD) patches** offer an effective alternative to some oral medications.

TD patches deliver a consistent dose of medication that diffuses at a constant rate through the skin into the bloodstream. There is no daily schedule to follow, nothing to swallow, and no stomach upset. TD patches can also deliver medication to unconscious patients, who would otherwise require intravenous drug delivery. TD patches are used in hormone replacement therapy, to treat heart disease, to manage pain, and to suppress motion sickness. Nicotine patches are also used as part of programs to quit smoking.

TD patches must be used carefully. Drug diffusion through the skin takes time, so it is important to know how long the patch must be in place before it is effective. It is also important to know how long the medication's effects will persist after the patch is removed. Because the body continues to absorb what has already diffused into the skin, removing the patch does not entirely remove the medicine. Also, increased heat may elevate drug absorption to dangerous levels.

A recent advance in TD drug delivery is **iontophoresis**. Based on the principle that like charges repel each other, this method uses a mild electric current to move ionic drugs through the skin. A small electrical device attached to the patch uses positive current to "push" positively charged drug molecules through the skin and a negative current to push negatively charged ones. Even though very low levels of electricity are used, people with pacemakers should not use iontophoretic patches. Anot... vantage is that they can move only ionic drug... the skin.

- **Clinical Perspectives** boxes focus on diseases and disorders relevant to the chapter, exploring what happens to the body when the normal structure–function relationship breaks down.



Box 11-1

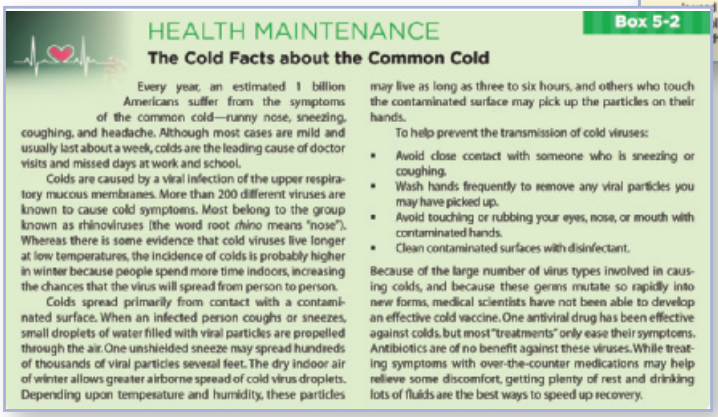
HOT TOPICS

Eye Surgery: A Glimpse of the Cutting Edge

Cataracts, glaucoma, and refractive errors are the most common eye disorders affecting Americans. In the past, cataract and glaucoma treatments concentrated on managing the diseases. Refractive errors were corrected using eyeglasses and, more recently, contact lenses. Today, laser and microsurgical techniques can remove cataracts, reduce glaucoma, and allow people with refractive errors to put their eyeglasses and contacts away. These cutting-edge procedures include the following:

- *Laser in situ keratomileusis (LASIK)* to correct refractive errors. During this procedure, a surgeon uses a laser to reshape the cornea so that it refracts light directly onto the retina, rather than in front of or behind it. A microkeratome (surgical knife) ...d to cut a flap in the corneas outer layer. A computer-...lled laser sculpts the middle layer of the cornea, and ...he flap is replaced. The procedure takes only a few minutes, and patients recover their vision quickly and usually with little postoperative pain.
- *Laser trabeculoplasty* to treat glaucoma. This procedure uses a laser to help drain fluid from the eye and lower intraocular pressure. The laser is aimed at drainage canals located between the cornea and iris and makes several burns that are believed to open the canals and allow fluid to drain better. The procedure is typically painless and takes only a few minutes.
- *Phacoemulsification* to remove cataracts. During this surgical procedure, a very small incision (approximately 3 mm long) is made through the sclera near the cornea's outer edge. An ultrasonic probe is inserted through this opening and into the center of the lens. The probe uses sound waves to emulsify the lens's central core, which is then suctioned out. Then, an artificial lens is permanently implanted in the lens capsule. The procedure is typically painless, although the patient may feel some discomfort for one to two days afterward.

- **Hot Topics** boxes examine current trends and research.



Box 5-2

HEALTH MAINTENANCE

The Cold Facts about the Common Cold

Every year, an estimated 1 billion Americans suffer from the symptoms of the common cold—runny nose, sneezing, coughing, and headache. Although most cases are mild and usually last about a week, colds are the leading cause of doctor visits and missed days at work and school.

Colds are caused by a viral infection of the upper respiratory mucous membranes. More than 200 different viruses are known to cause cold symptoms. Most belong to the group known as rhinoviruses (the word root *rhino* means "nose"). Whereas there is some evidence that cold viruses live longer at low temperatures, the incidence of colds is probably higher in winter because people spend more time indoors, increasing the chances that the virus will spread from person to person.

Colds spread primarily from contact with a contaminated surface. When an infected person coughs or sneezes, small droplets of water filled with viral particles are propelled through the air. One unshielded sneeze may spread hundreds of thousands of viral particles several feet. The dry indoor air of winter allows greater airborne spread of cold virus droplets. Depending upon temperature and humidity, these particles may live as long as three to six hours, and others who touch the contaminated surface may pick up the particles on their hands.

To help prevent the transmission of cold viruses:

- Avoid close contact with someone who is sneezing or coughing.
- Wash hands frequently to remove any viral particles you may have picked up.
- Avoid touching or rubbing your eyes, nose, or mouth with contaminated hands.
- Clean contaminated surfaces with disinfectant.

Because of the large number of virus types involved in causing colds, and because these germs mutate so rapidly into new forms, medical scientists have not been able to develop an effective cold vaccine. One antiviral drug has been effective against colds, but most "treatments" only ease their symptoms. Antibiotics are of no benefit against these viruses. While treating symptoms with over-the-counter medications may help relieve some discomfort, getting plenty of rest and drinking lots of fluids are the best ways to speed up recovery.

- **Health Maintenance** boxes offer supplementary information on health and wellness issues.

- **Figures:** The art program includes full-color anatomic line art, many new or revised, with a level of detail that matches that of the narrative. Photomicrographs, radiographs, and other scans give students a preview of what they might see in real-world healthcare settings. Supplementary figures are available on the companion website on *thePoint*.

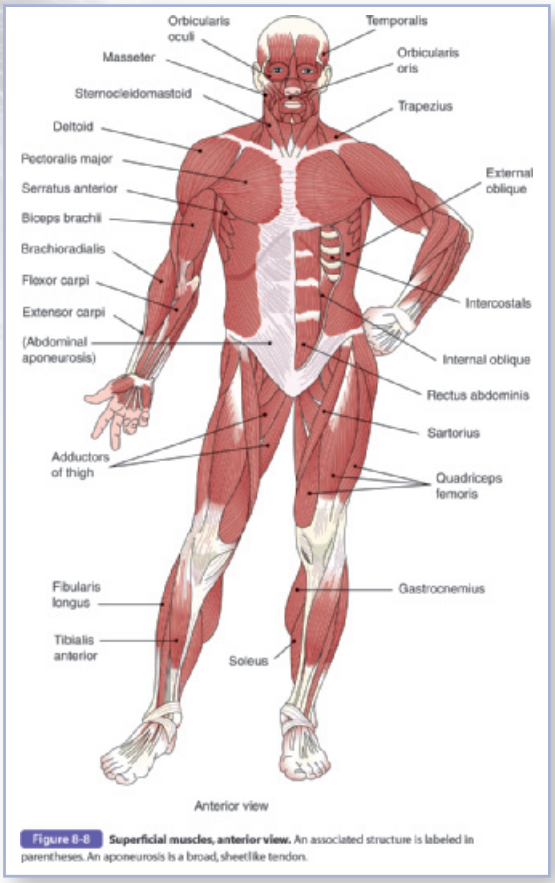


Figure 8-8 **Superficial muscles, anterior view.** An associated structure is labeled in parentheses. An aponeurosis is a broad, sheetlike tendon.

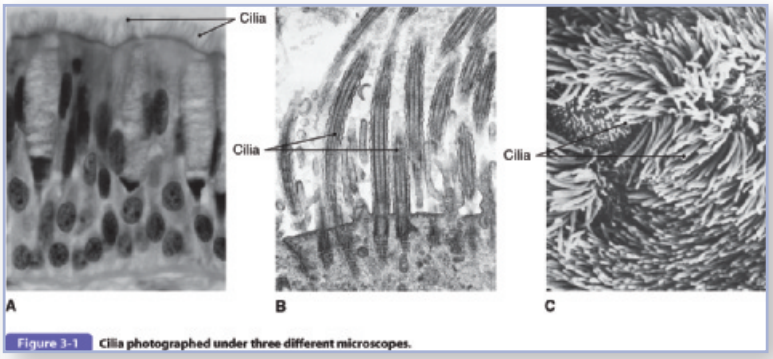
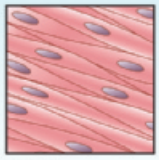
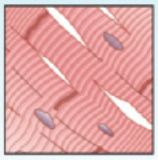
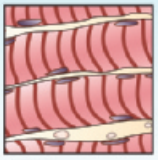


Figure 3-1 **Cilia photographed under three different microscopes.**

Table 8-1 Comparison of the Different Types of Muscle

	Smooth	Cardiac	Skeletal
Location	Wall of hollow organs, vessels, respiratory passageways	Wall of heart	Attached to bones
Cell characteristics	Tapered at each end, branching networks, nonstriated	Branching networks; special membranes (intercalated disks) between cells; single nucleus; lightly striated	Long and cylindrical; multinucleated; heavily striated
			
Control	Involuntary	Involuntary	V
Action	Produces peristalsis; contracts and relaxes slowly; may sustain contraction	Pumps blood out of the heart; self-excitatory but influenced by nervous system and hormones	P

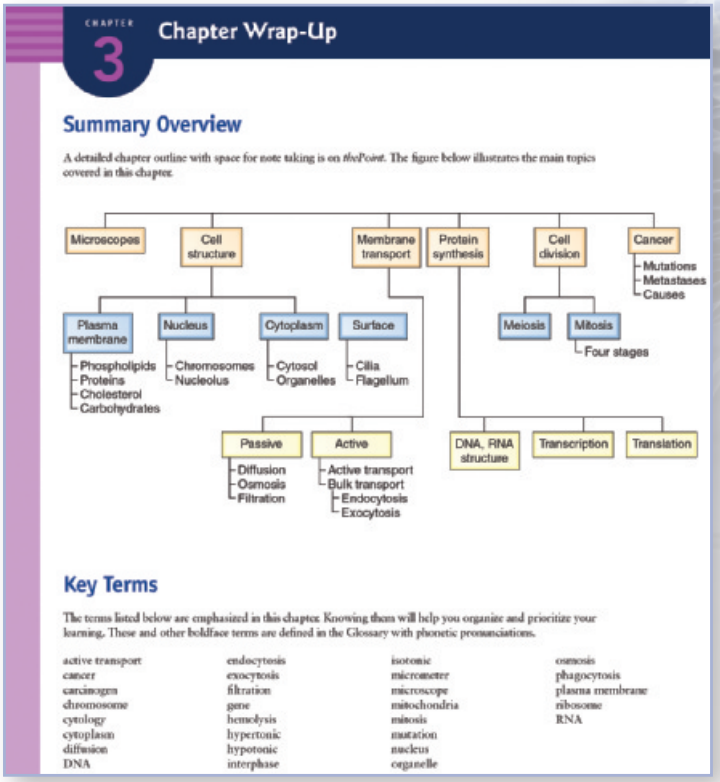
- **Tables:** The numerous tables in this edition summarize key concepts and information in an easy-to-review form. Additional summary tables are available on the companion website on *thePoint*.

Table 3-6 The Genetic Code

Amino Acid	Transcribed DNA Triplet	mRNA	tRNA
Glycine	CCC	GGG	CCC
Proline	GGG	CCC	GGG
Valine	CAC	GUG	CAC
Phenylalanine	AAA	UUU	AAA

The nucleotide triplet code in DNA and RNA is shown for four amino acids.

- **Chapter Wrap-Up** at the end of each chapter outlines the chapter content.
- **Key Terms** sections provide a concise list of selected boldface terms used in the chapter and defined in the book's glossary.



CHAPTER 3

Chapter Wrap-Up

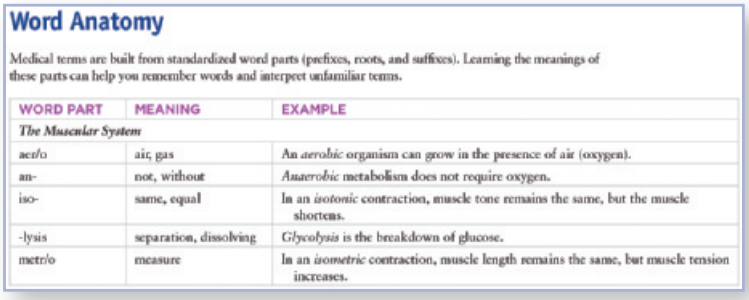
Summary Overview

A detailed chapter outline with space for note taking is on *thePoint*. The figure below illustrates the main topics covered in this chapter.

Key Terms

The terms listed below are emphasized in this chapter. Knowing them will help you organize and prioritize your learning. These and other boldface terms are defined in the Glossary with phonetic pronunciations.

active transport
cancer
carcinogen
chromosome
cytology
cytoplasm
diffusion
DNA
endocytosis
exocytosis
filtration
gene
hemolysis
hypertonic
hypotonic
interphase
isotonic
micrometer
microscope
mitochondria
mitosis
mutation
nucleus
organelle
osmosis
phagocytosis
plasma membrane
ribosome
RNA



Word Anatomy

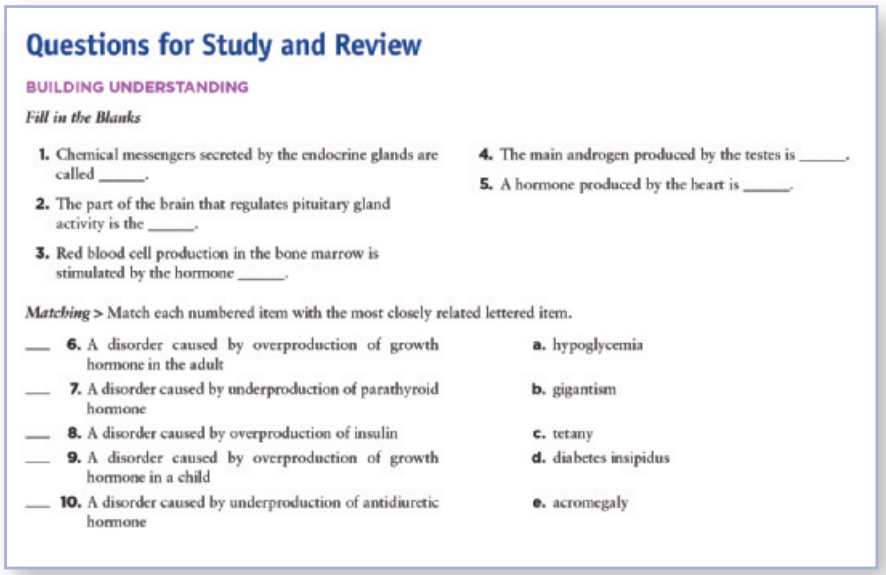
Medical terms are built from standardized word parts (prefixes, roots, and suffixes). Learning the meanings of these parts can help you remember words and interpret unfamiliar terms.

WORD PART	MEANING	EXAMPLE
The Muscular System		
aer/o	air, gas	An *aerobic* organism can grow in the presence of air (oxygen).
an-	not, without	*Anaerobic* metabolism does not require oxygen.
iso-	same, equal	In an *isotonic* contraction, muscle tone remains the same, but the muscle shortens.
-lysis	separation, dissolving	*Glycolysis* is the breakdown of glucose.
metr/o	measure	In an *isometric* contraction, muscle length remains the same, but muscle tension increases.

- **Word Anatomy** defines and illustrates the various word parts that constitute the chapter's specialized terminology, helping to build vocabulary and promote understanding of unfamiliar terms.

- **Questions for Study and Review** sections organize study questions hierarchically into three levels.

- **Building Understanding:** Includes fill-in-the-blank, matching, and multiple choice questions that test factual recall.



Questions for Study and Review

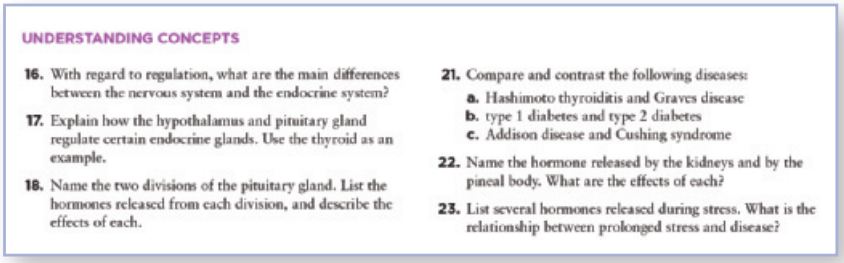
BUILDING UNDERSTANDING

Fill in the Blanks

1. Chemical messengers secreted by the endocrine glands are called _____.
2. The part of the brain that regulates pituitary gland activity is the _____.
3. Red blood cell production in the bone marrow is stimulated by the hormone _____.
4. The main androgen produced by the testes is _____.
5. A hormone produced by the heart is _____.

Matching > Match each numbered item with the most closely related lettered item.

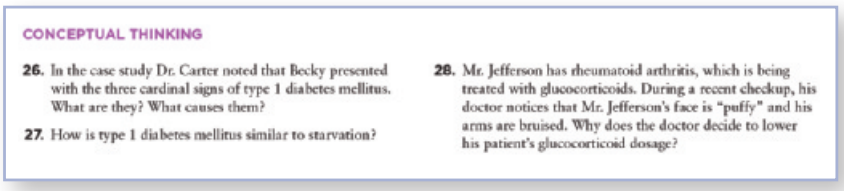
___ 6. A disorder caused by overproduction of growth hormone in the adult	a. hypoglycemia
___ 7. A disorder caused by underproduction of parathyroid hormone	b. gigantism
___ 8. A disorder caused by overproduction of insulin	c. tetany
___ 9. A disorder caused by overproduction of growth hormone in a child	d. diabetes insipidus
___ 10. A disorder caused by underproduction of antidiuretic hormone	e. acromegaly



UNDERSTANDING CONCEPTS

16. With regard to regulation, what are the main differences between the nervous system and the endocrine system?
17. Explain how the hypothalamus and pituitary gland regulate certain endocrine glands. Use the thyroid as an example.
18. Name the two divisions of the pituitary gland. List the hormones released from each division, and describe the effects of each.
21. Compare and contrast the following diseases:
    a. Hashimoto thyroiditis and Graves disease
    b. type 1 diabetes and type 2 diabetes
    c. Addison disease and Cushing syndrome
22. Name the hormone released by the kidneys and by the pineal body. What are the effects of each?
23. List several hormones released during stress. What is the relationship between prolonged stress and disease?

- **Understanding Concepts:** Includes short-answer questions (define, describe, compare/contrast) that test and reinforce understanding of ideas. This section now includes questions pertaining to "The Body Visible" and the diverse information in the appendices.



CONCEPTUAL THINKING

26. In the case study Dr. Carter noted that Becky presented with the three cardinal signs of type 1 diabetes mellitus. What are they? What causes them?
27. How is type 1 diabetes mellitus similar to starvation?
28. Mr. Jefferson has rheumatoid arthritis, which is being treated with glucocorticoids. During a recent checkup, his doctor notices that Mr. Jefferson's face is "puffy" and his arms are bruised. Why does the doctor decide to lower his patient's glucocorticoid dosage?

- **Conceptual Thinking:** Includes short-essay questions that promote critical thinking skills. This section includes thought questions related to the Disease in Context case stories.

GETTING STARTED WITH THE STUDENT RESOURCES

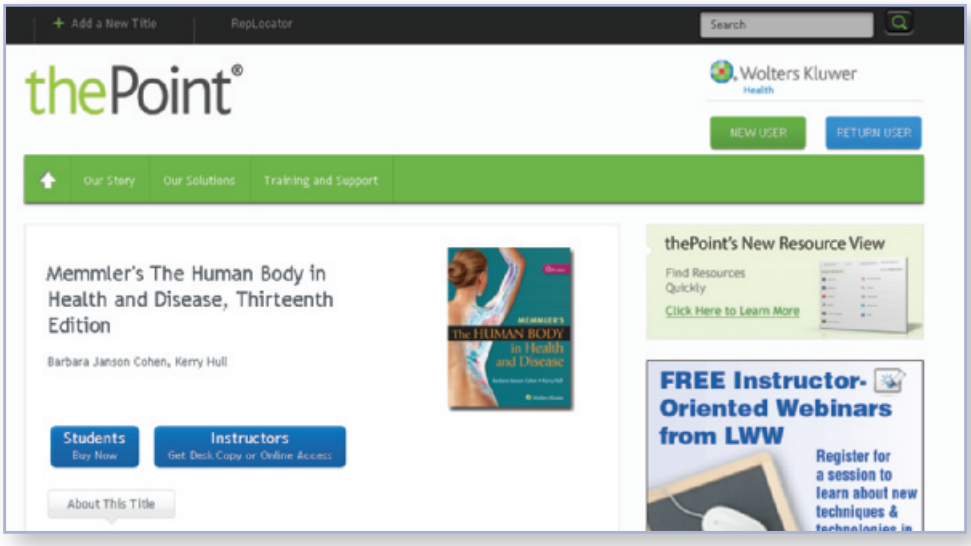
Your journey begins with your textbook, *Memmler's Human Body in Health and Disease*, 13th edition. The textbook has icons that guide you to resources and activities designed for your personal learning style.

Look for this icon throughout the book for pertinent supplementary material on the companion website.

thePoint

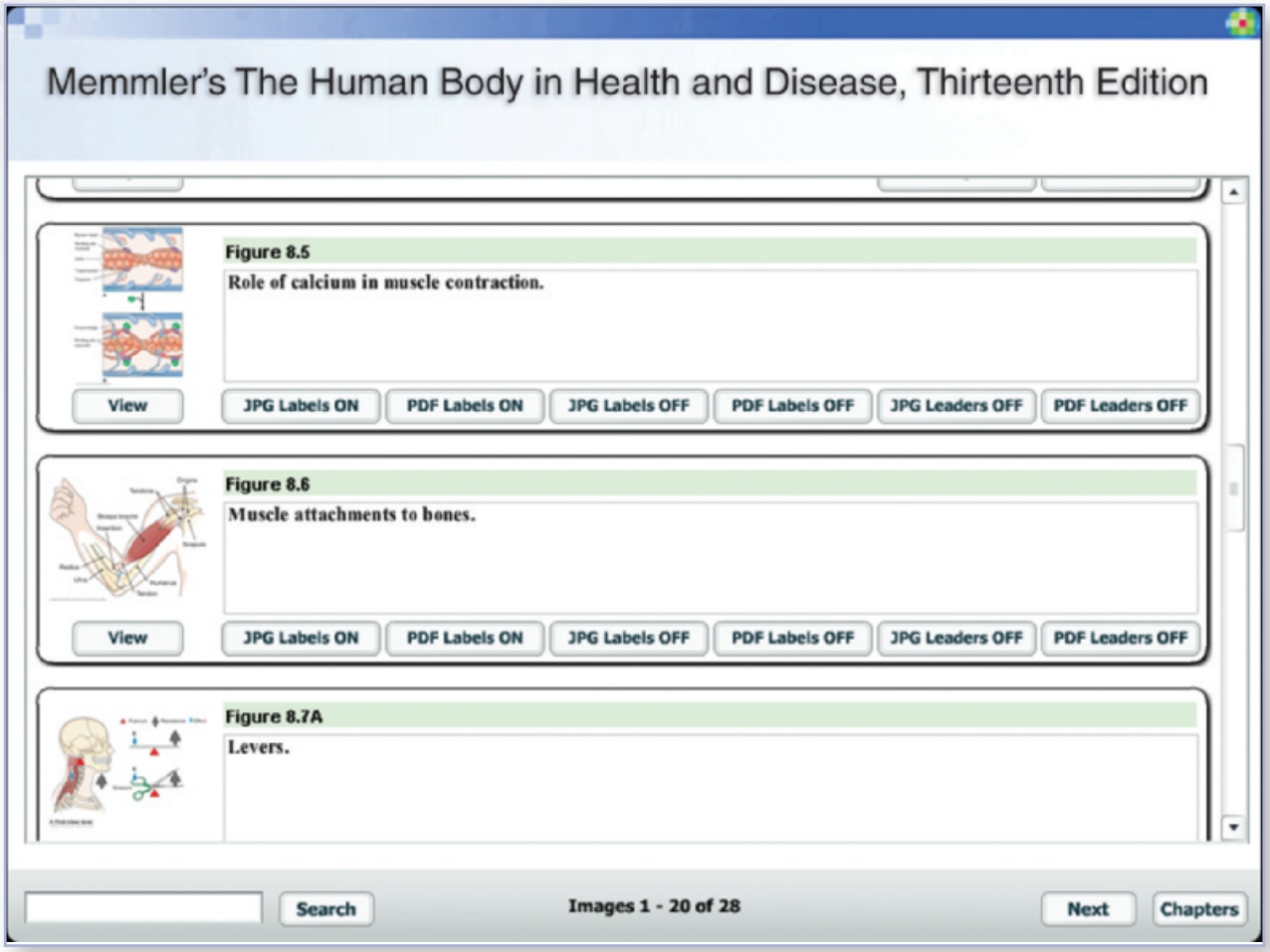
Here's how to begin:

1. Scratch off the personal access code inside the front cover of your textbook.
2. Log on to **http://thepoint.lww.com/MemmlerHBHD13e**, the companion website for *Memmler's The Human Body in Health and Disease*, 13th edition, on *thePoint*.
3. Click on "Student Resources," and explore the wide variety of auditory, visual, and kinesthetic activities to fit your learning style.



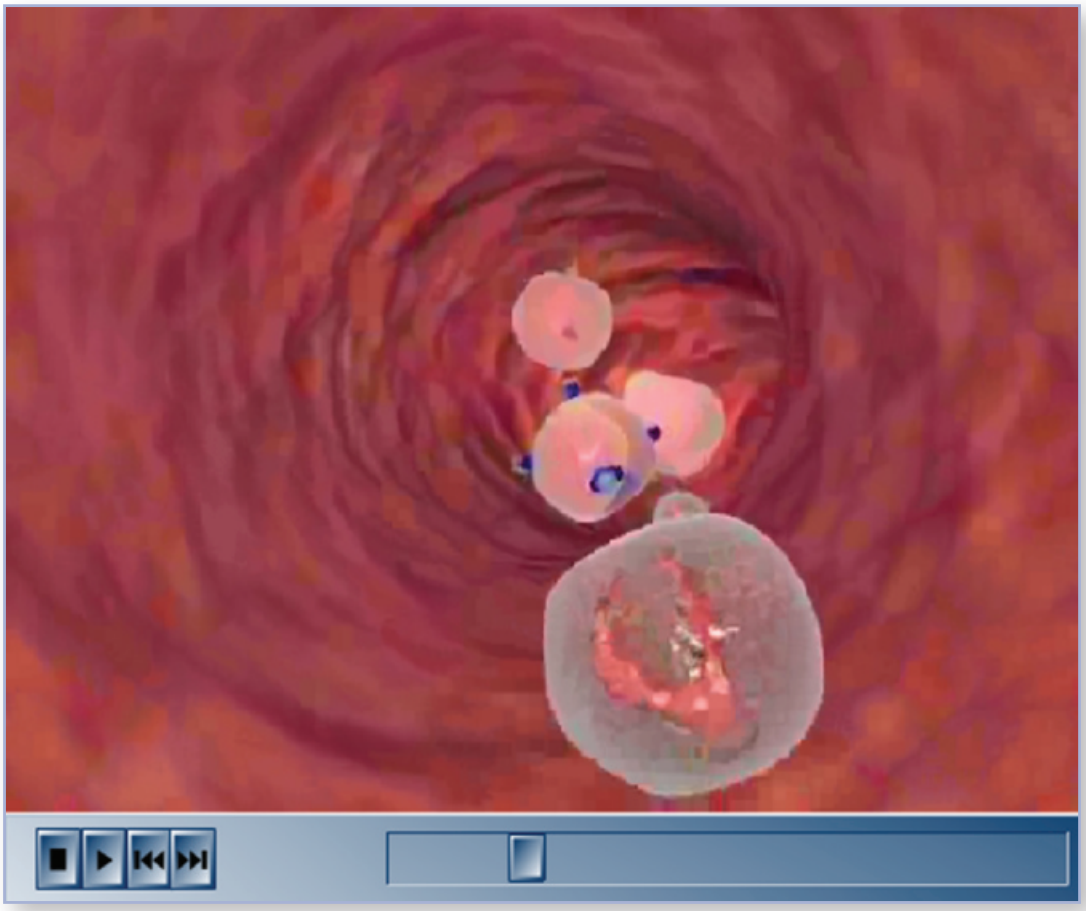
Resources and activities available to instructors include the following:

PowerPoints
Image Bank
Answer Key
Customizable Test Generator
WebCT, Angel, and Blackboard-Ready Cartridges



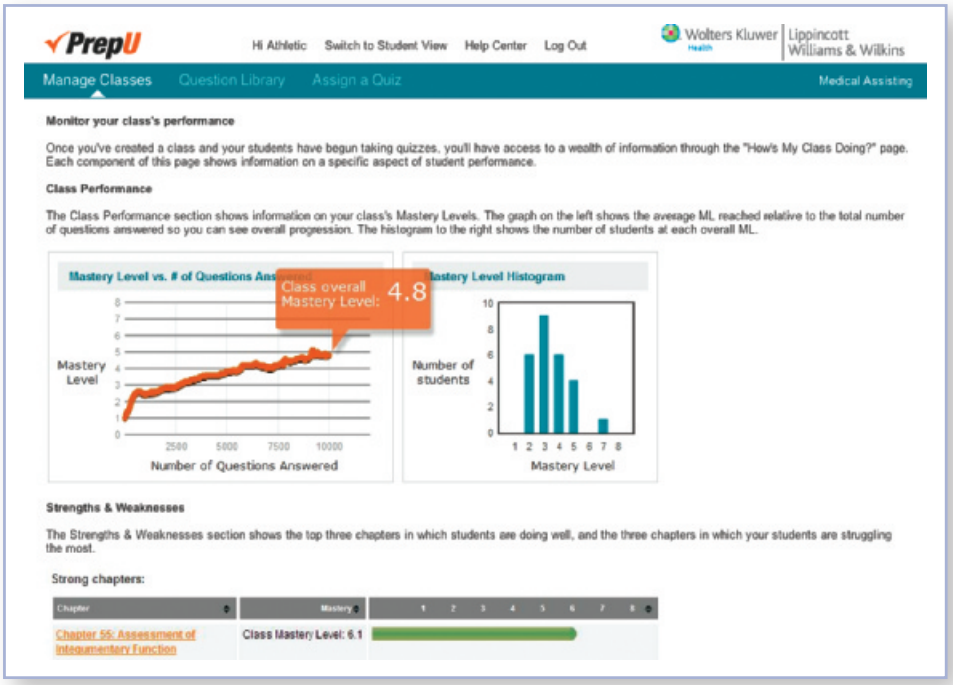
Resources and activities available to students include the following:

Pre-Quiz
True or False?
Key Terms Categories
Fill-in-the-Blank
Crossword Puzzle
Audio Flash Cards
Word Anatomy
Look & Label
Listen & Label
Zooming In
Body Building
Animations
Supplemental Images
Audio Pronunciation Glossary
Health Professions Career Information
Tips for Effective Studying
Chapter Outlines and Student Note-Taking Guides

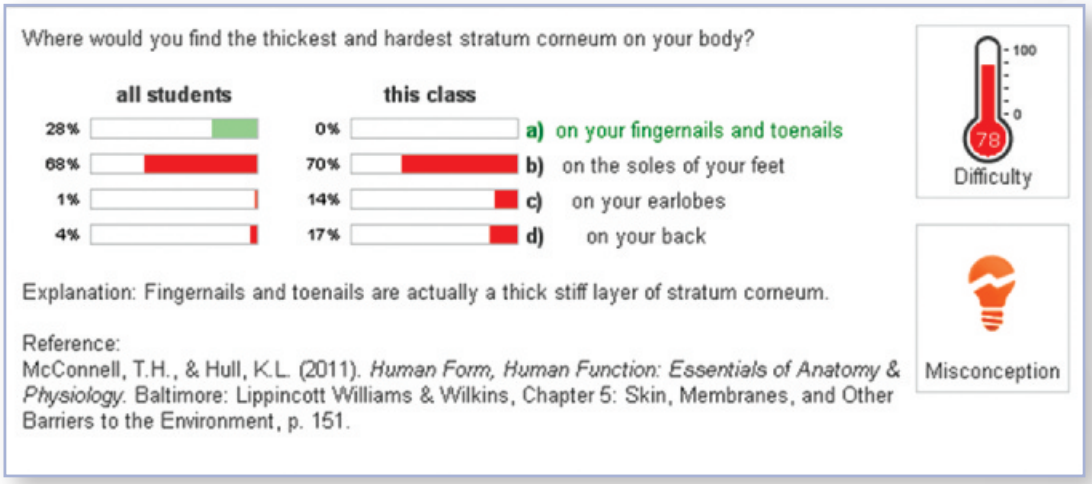


PrepU: AN INTEGRATED ADAPTIVE LEARNING SOLUTION

PrepU, Lippincott's adaptive learning system, is an integral component of *Memmler's The Human Body in Health and Disease*.



PrepU uses repetitive and adaptive quizzing to build mastery of A&P concepts, helping students to learn more while giving instructors the data they need to monitor each student's progress, strengths, and weaknesses. The hundreds of questions in PrepU offer students the chance to drill themselves on A&P and support their review and retention of the information they have learned. Each question provides not only an explanation for the correct answer but also references of the text page for the student to review the source material. PrepU for *The Human Body in Health and Disease* challenges students with questions and activities that coincide with the materials they have learned in the text and gives students a proven tool to learn A&P more effectively. For instructors, PrepU provides tools to identify areas and topics of student misconception; instructors can use this rich course data to assess students' learning and better target their in-class activities and discussions, while collecting data that are useful for accreditation.



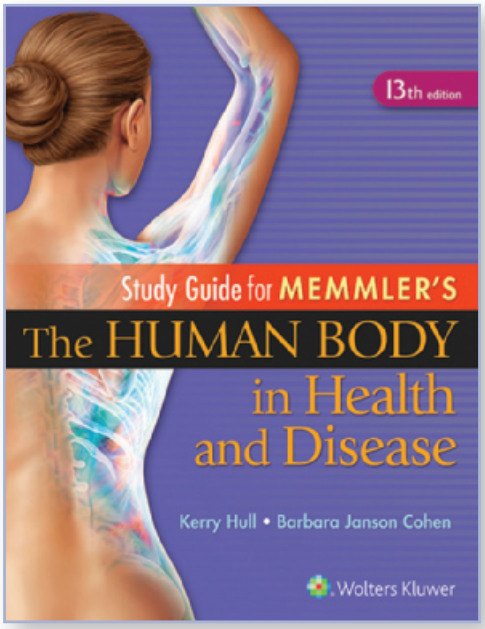
A learning experience individualized to each student. Being an adaptive learning engine, PrepU offers questions customized for each student's level of understanding, challenging students at an appropriate pace and difficulty level, while dispelling common misconceptions. As students review and master PrepU's questions, the system automatically increases the difficulty of questions, effectively driving student understanding of A&P to a mastery level. PrepU not only helps students to improve their knowledge but also helps foster their test-taking confidence.

PrepU works! PrepU works, and not just because we say so. PrepU efficacy is *backed by data*:

1. In an introductory nursing course at Central Carolina Technical College, student course outcomes were positively associated with PrepU usage. The students who answered the most PrepU questions in the class also had the best overall course grades.
2. In a randomized, controlled study at UCLA, students using PrepU (for biology) achieved 62% higher learning gains than those who did not.

To see a video explanation of PrepU, go to http://download.lww.com/wolterskluwer_vitalstream_com/mktg/prepuvid/prepupromo01.html

Study Guide for Memmler's The Human Body in Health and Disease, 13th edition
Kerry L. Hull, BSC, PhD
Barbara Janson Cohen, BA, MSEd



Along with the companion website on *thePoint*, this *Study Guide* is the ideal companion to the 13th edition of *Memmler's The Human Body in Health and Disease*. Following the text's organization chapter by chapter, the *Study Guide* provides a full range of self-study aids that actively engage you in learning and enable you to assess and build your knowledge as you advance through the text. Most importantly, the *Study Guide* allows you to get the most out of your study time, with a variety of exercises that meet the needs of all types of learners.

Inside the Study Guide you'll find the following:

- Chapter Overview summarizes the chapter's critical concepts.
- Addressing the Learning Objectives includes labeling, coloring, matching, and short-answer questions, all designed to foster active learning.
- Making the Connections integrates information from each chapter's learning objectives into concept mapping exercises.
- Testing Your Knowledge provides multiple choice, true/false, completion, short-answer, and essay questions to identify areas requiring further study. Practical Applications questions use clinical situations to test your understanding of a subject.
- Expanding Your Horizons helps you learn from the world around you and highlights emerging issues and discoveries in the health professions.

Visit **www.lww.com**, and reference
ISBN 978-1-4511-9348-0 to order your copy
of this important resource.

Acknowledgments

It is with great satisfaction that we welcome Kerry Hull as coauthor for this 13th edition of *Memmler's The Human Body in Health and Disease*. Kerry has extensive experience with these books, as she has worked with diligence and dedication as a contributing editor for several past editions of the text and author of the ancillary materials. In addition to her knowledge and skills, Kerry has brought talent, patience, and great attention to detail to the preparation of this learning package. I could not have a better coworker or someone more trusted to carry on the traditions of this fine text. I also thank Ann DePetris for reviewing all aspects of the books, for her clinical expertise, and for her contributions to the case studies and ancillary materials.

The skilled staff at Lippincott Williams & Wilkins, as always, has been instrumental in the development of these texts. Consistently striving for improvements and high quality, they have helped achieve the great success of these books over their long history. Specifically, I'd like to acknowledge Michael Nobel, Senior Acquisitions Editor; Staci Wolfson, Product Development Editor, who showed great insights and was always ready with support and suggestions; and Jennifer Clements, Art Director, who assisted ably with art and illustrations.

Ongoing words of appreciation to Dragonfly Media Group, the artists whose skills, knowledge, and imagination have contributed so much to these books.

Thanks to the reviewers, listed separately, who made valuable comments on the text. Their suggestions and insights formed the basis for this revision.

As always, thanks to my husband, Matthew, an instructor in anatomy and physiology, who not only gives consistent support but also contributes advice and suggestions for the text.

—Barbara Janson Cohen

My greatest thanks go to Barbara Cohen, who welcomed me into "Team Memmler" and has served as a mentor for the past 12 years. Thanks to Barbara, I have discovered an entirely new area of scholarship that has proven enormously rewarding. I echo Barbara in her thanks to Michael Nobel, Jennifer Clements, and Staci Wolfson, whose creativity, flexibility, and gentle whip-cracking enabled us to produce the best book and learning package possible. My thanks also go out to the reviewers for their expertise and careful proofreading.

And, finally, my heartfelt thanks to my husband Norm for his support (and cappuccino-making skills), and to my children, Evan and Lauren, for their patience and hugs.

—Kerry L. Hull

Brief Contents

Contents

The Body Visible

The Body Visible is a unique study tool designed to enhance your learning of the body's systems in this course and in your future work.

The Body Visible illustrates the systems discussed in the text in the same sequence in which they appear in the text. Each full-color detailed illustration also contains numbers and lines for identifying the structures in the illustration. A transparent overlay with labels for all of the numbered structures in the art accompanies each image.

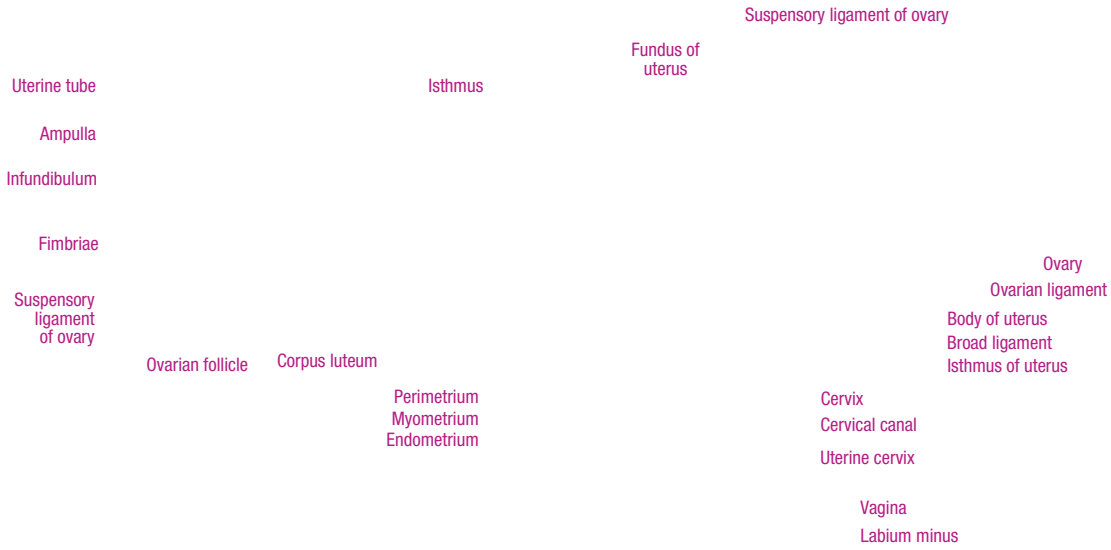
With the labels in place, *The Body Visible* allows you to study each illustration and helps you learn the body's structures. When you view each system without the overlay in place, *The Body Visible* becomes a self-testing resource. As you test your knowledge and identify each numbered part, you can easily check your answers with the overlay.

Many of the images in *The Body Visible* have somewhat more detail than is covered in the text. We encourage you to keep *The Body Visible* available as a general reference and as a useful study tool as you progress to more advanced levels in your chosen healthcare career.

*The Body Visible** begins on the next page.

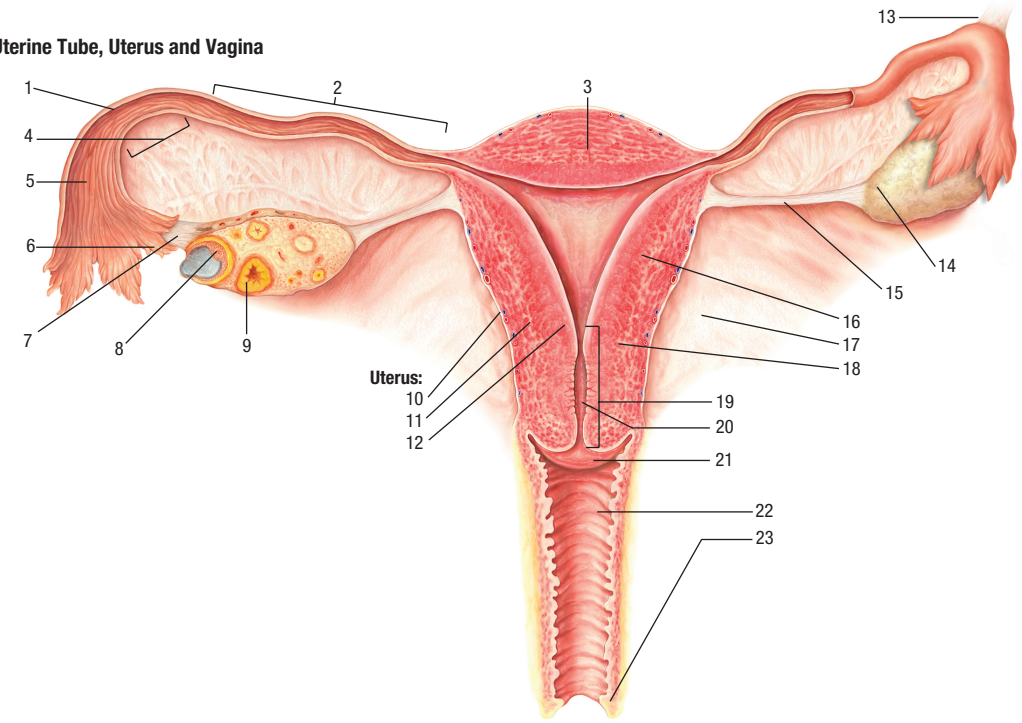
*The images in *The Body Visible* are adapted with permission from Anatomical Chart Company, *Rapid Review: A Guide for Self-Testing and Memorization*, 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins, 2010.

The Female Reproductive System

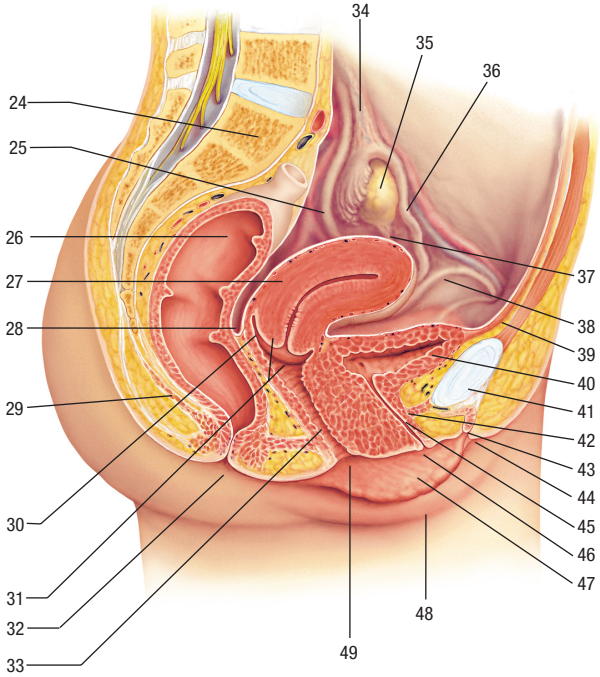


The Female Reproductive System

Ovary, Uterine Tube, Uterus and Vagina



Female Pelvic Organs (median section)



Urinary bladder
Interureteric fold
Urethral crest
Openings of prostatic duct
Opening of ejaculatory ducts
Bulbourethral gland & duct
External urethral sphincter

Trigone
Prostatic sinus
Prostatic utricle

Bulb of penis
Crus of penis
Opening of bulbourethral duct

Sacrum

Peritoneum

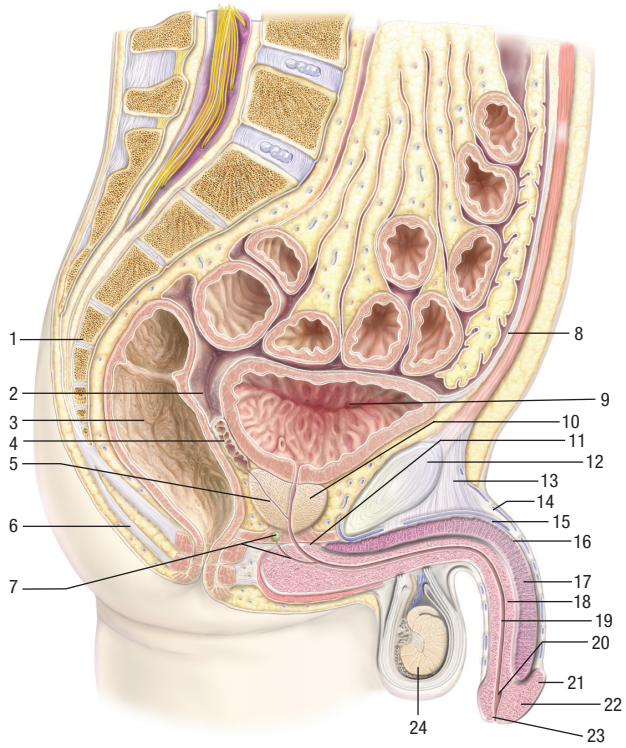
Cul-de-sac
Rectum
Seminal vesicle
Ejaculatory duct
Anococcygeal ligament
Bulbourethral gland and duct

Urinary bladder
Prostate gland & urethra
Perineal membrane
Pubic symphysis
Suspensory ligament of penis
Superficial dorsal vein of penis
Deep dorsal vein of penis
Deep fascia of penis
Corpus cavernosum
Corpus spongiosum
Penile urethra
Navicular fossa of urethra
Corona of glans penis
Glans penis
External urethral meatus

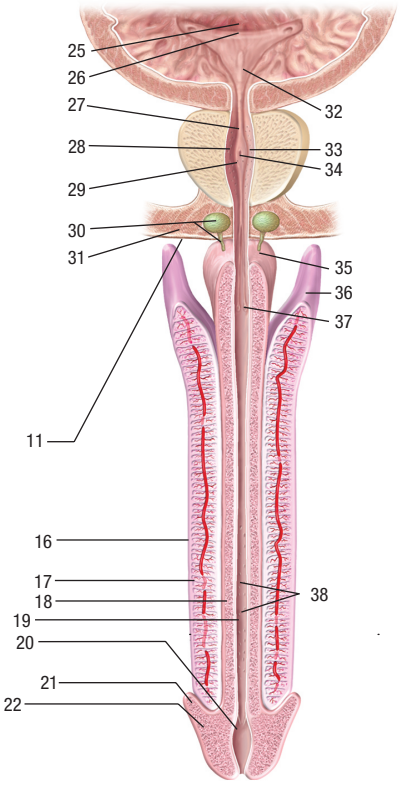
Urethral lacunae

Testis

Pelvic Organs (median section)

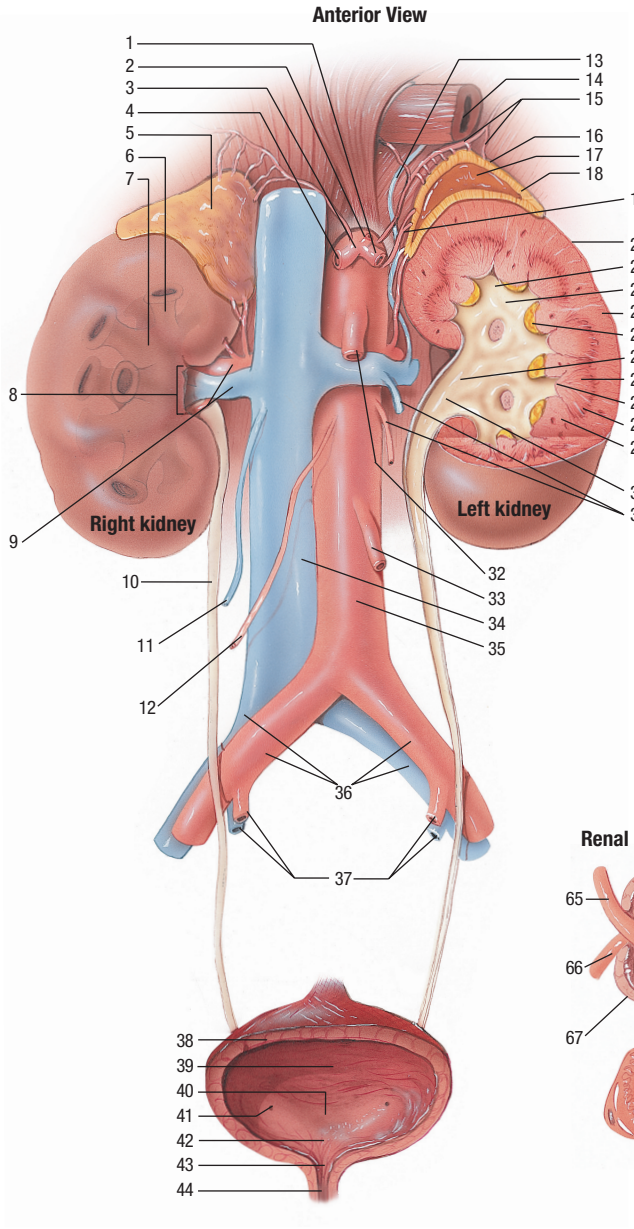


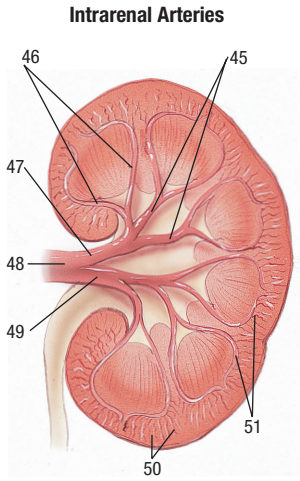
Anterior View (oblique section)

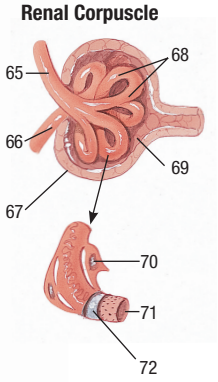


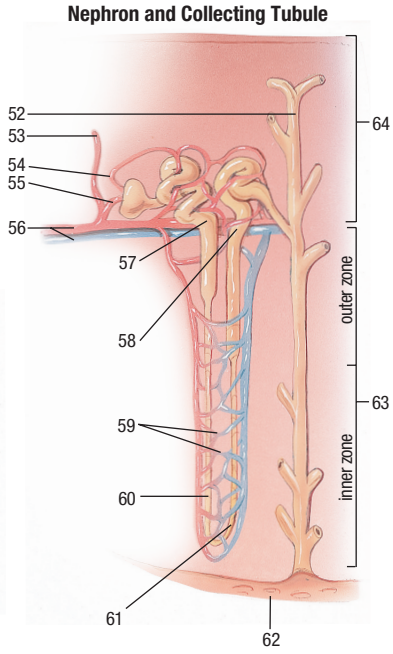
The Urinary System

The Urinary System



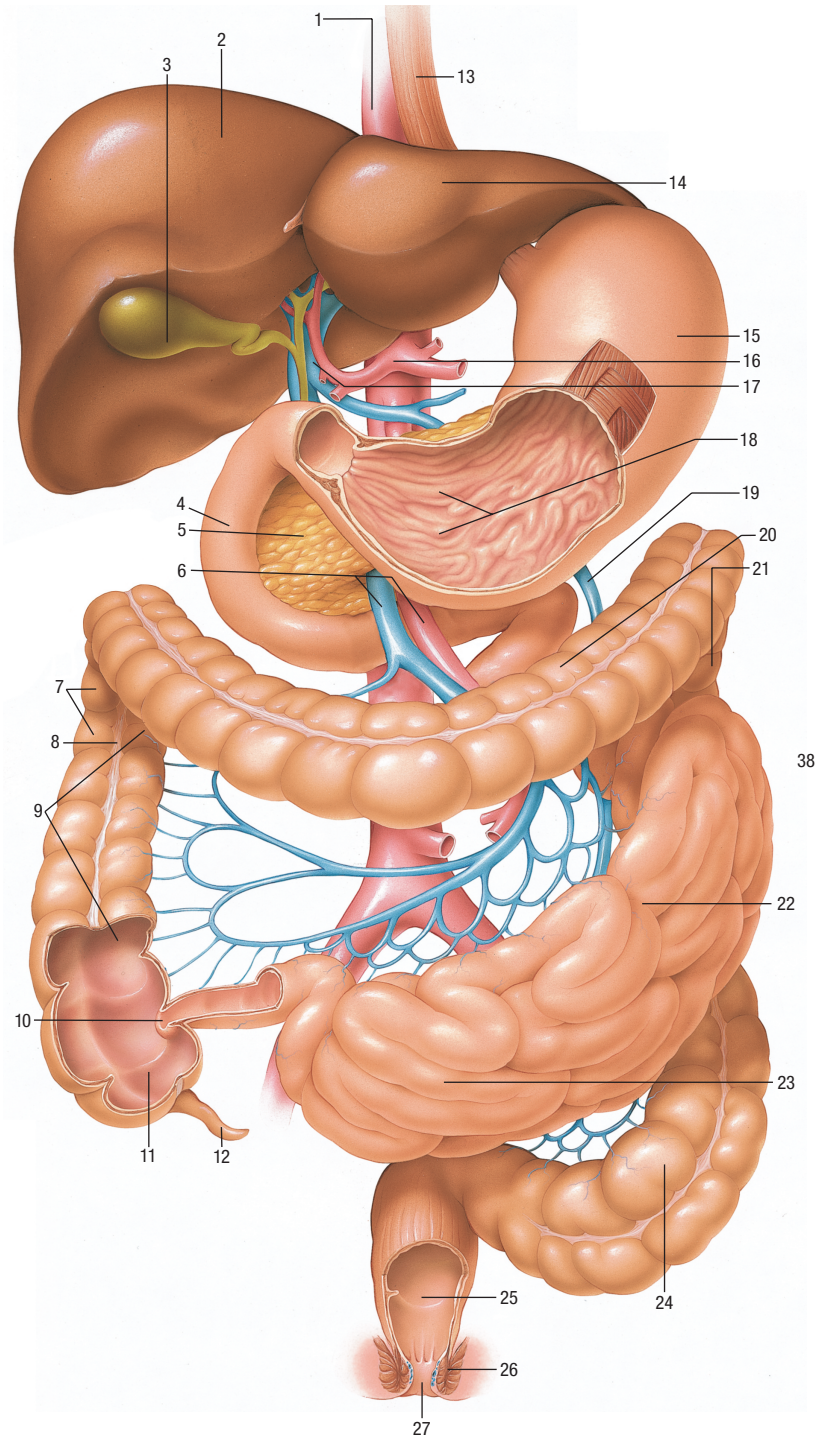




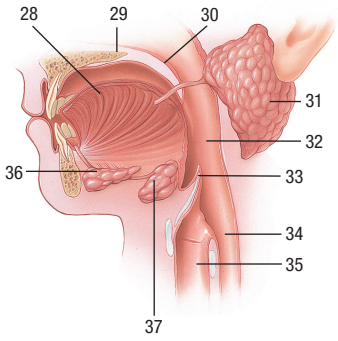



Aorta
Liver, right lobe
Gallbladder
Esophagus
Tongue
Hard palate
Soft palate
Liver, left lobe
Parotid gland
Pharynx
Epiglottis
Sublingual gland
Esophagus
Larynx
Stomach
Celiac trunk
Hepatic portal vein
Submandibular gland
Rugae
Duodenum
Pancreas
Superior mesenteric vein and artery
Inferior mesenteric vein
Transverse colon
Descending colon
Haustra
Taenia coli
Ascending colon
Cystic duct
Right & left hepatic ducts
Common hepatic duct
Common bile duct
Pyloric sphincter
Gallbladder
Pancreas
Jejunum
Pancreatic duct
Common bile duct
Duodenal papilla
Ileocecal valve
Duodenum
Circular folds
Ileum
Cecum
Appendix
Sigmoid colon
Rectum
Anal sphincter muscles
Anus

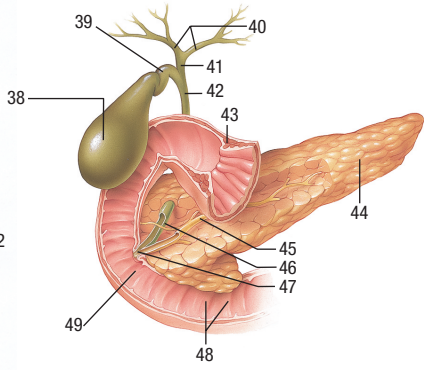
Anterior View



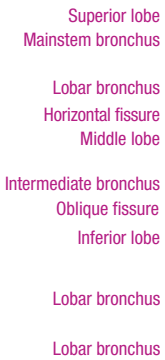
Oral Cavity

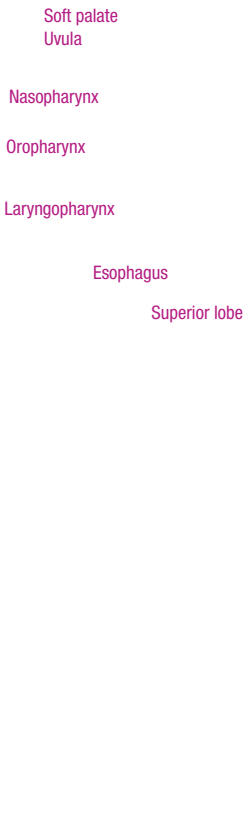


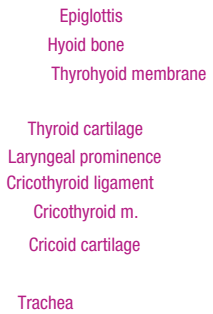
Duodenum, Pancreas, Gallbladder and Bile Ducts



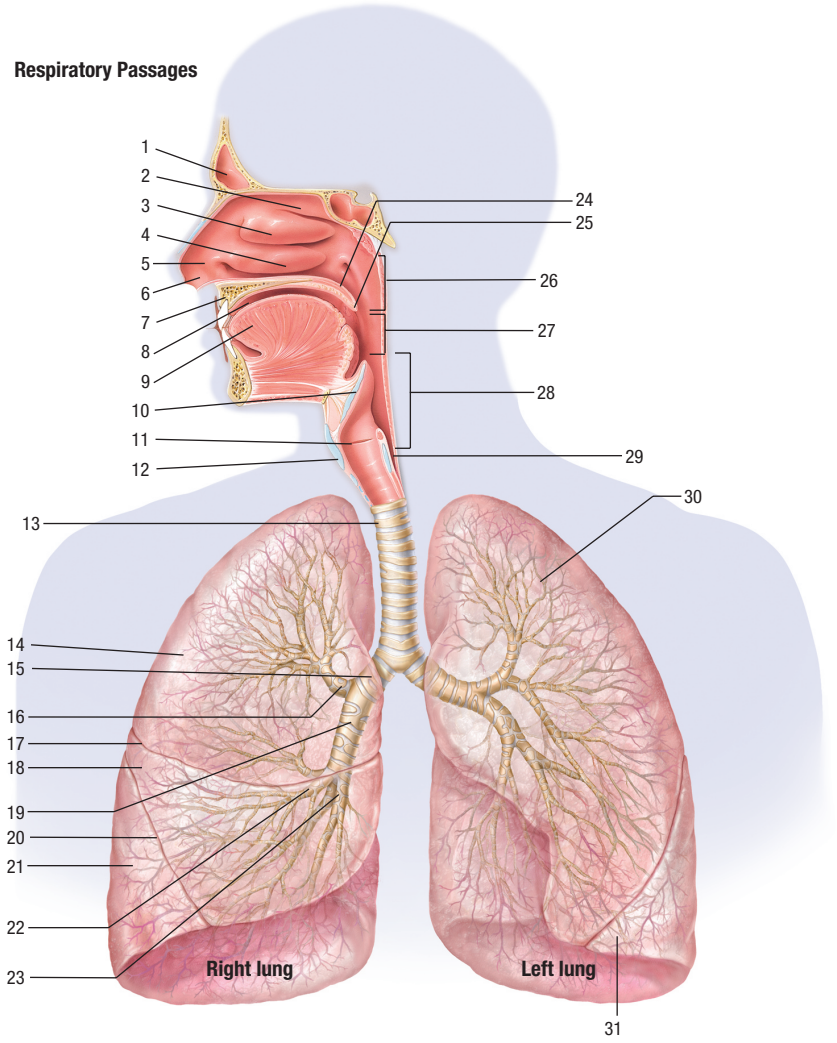
The Respiratory System

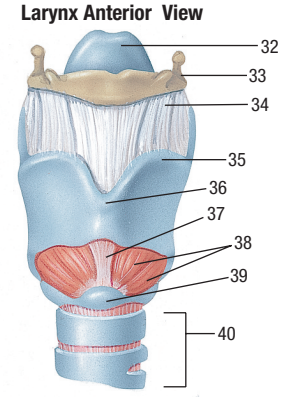


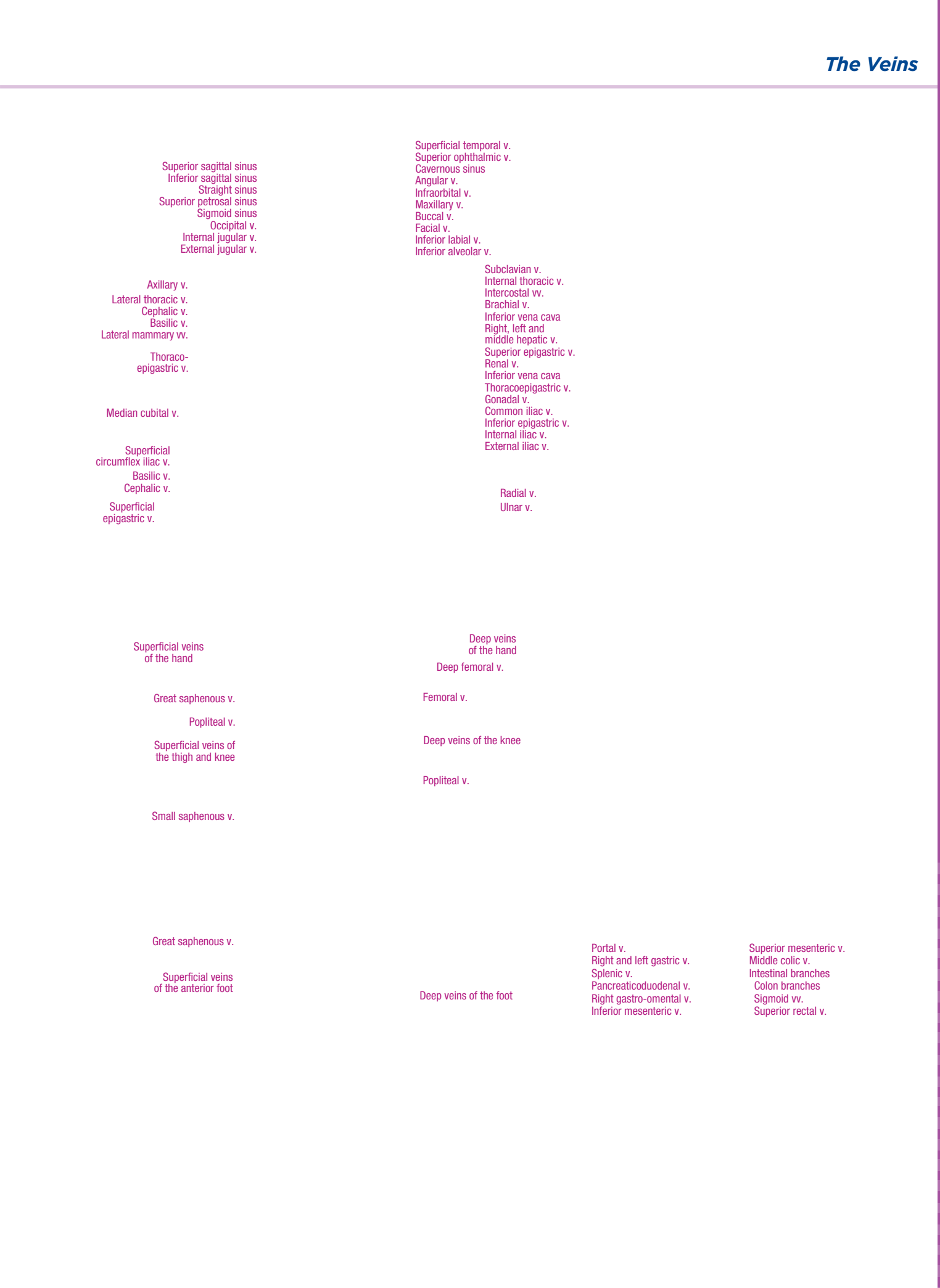




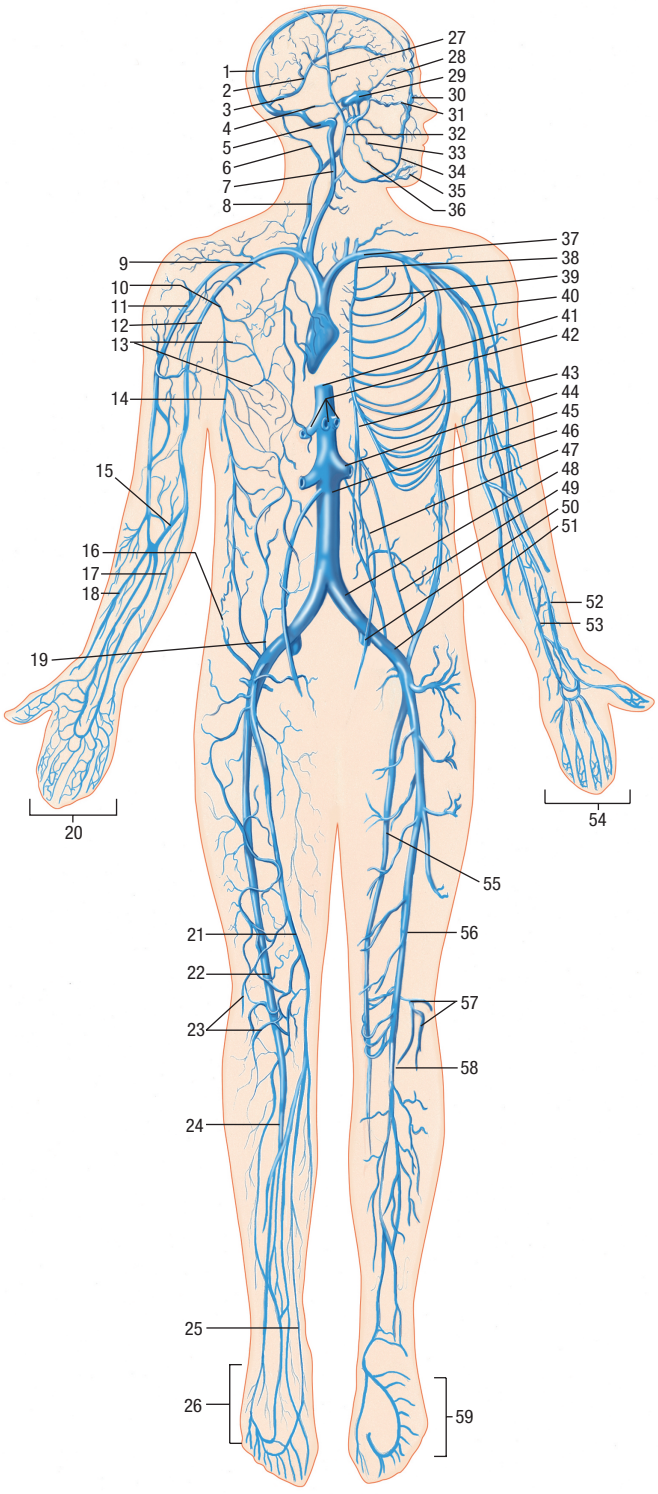
The Respiratory System



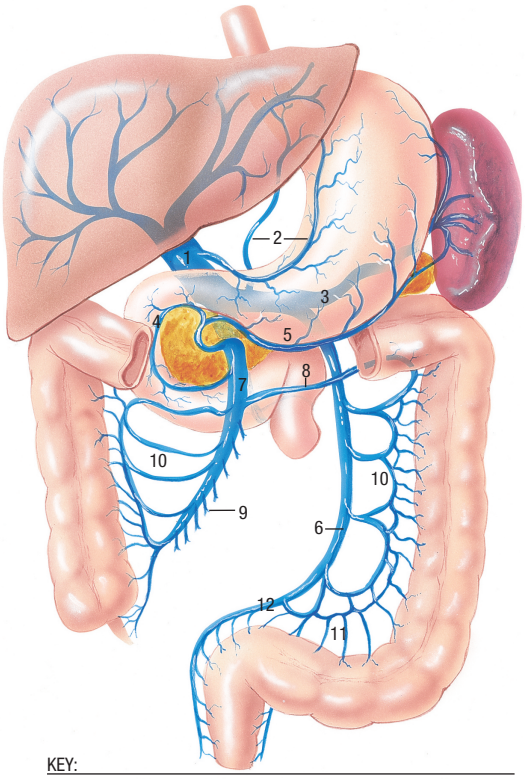



Superior sagittal sinus
Inferior sagittal sinus
Straight sinus
Superior petrosal sinus
Sigmoid sinus
Occipital v.
Internal jugular v.
External jugular v.
Axillary v.
Lateral thoracic v.
Cephalic v.
Basilic v.
Lateral mammary vv.
Thoraco-
epigastric v.
Median cubital v.
Superficial
circumflex iliac v.
Basilic v.
Cephalic v.
Superficial
epigastric v.
Superficial veins
of the hand
Great saphenous v.
Popliteal v.
Superficial veins of
the thigh and knee
Small saphenous v.
Great saphenous v.
Superficial veins
of the anterior foot
Superficial temporal v.
Superior ophthalmic v.
Cavernous sinus
Angular v.
Infraorbital v.
Maxillary v.
Buccal v.
Facial v.
Inferior labial v.
Inferior alveolar v.
Subclavian v.
Internal thoracic v.
Intercostal vv.
Brachial v.
Inferior vena cava
Right, left and
middle hepatic v.
Superior epigastric v.
Renal v.
Inferior vena cava
Thoracoepigastric v.
Gonadal v.
Common iliac v.
Inferior epigastric v.
Internal iliac v.
External iliac v.
Radial v.
Ulnar v.
Deep veins
of the hand
Deep femoral v.
Femoral v.
Deep veins of the knee
Popliteal v.
Deep veins of the foot
Portal v.
Right and left gastric v.
Splenic v.
Pancreaticoduodenal v.
Right gastro-omental v.
Inferior mesenteric v.
Superior mesenteric v.
Middle colic v.
Intestinal branches
Colon branches
Sigmoid vv.
Superior rectal v.

Veins



Hepatic Portal System



KEY:

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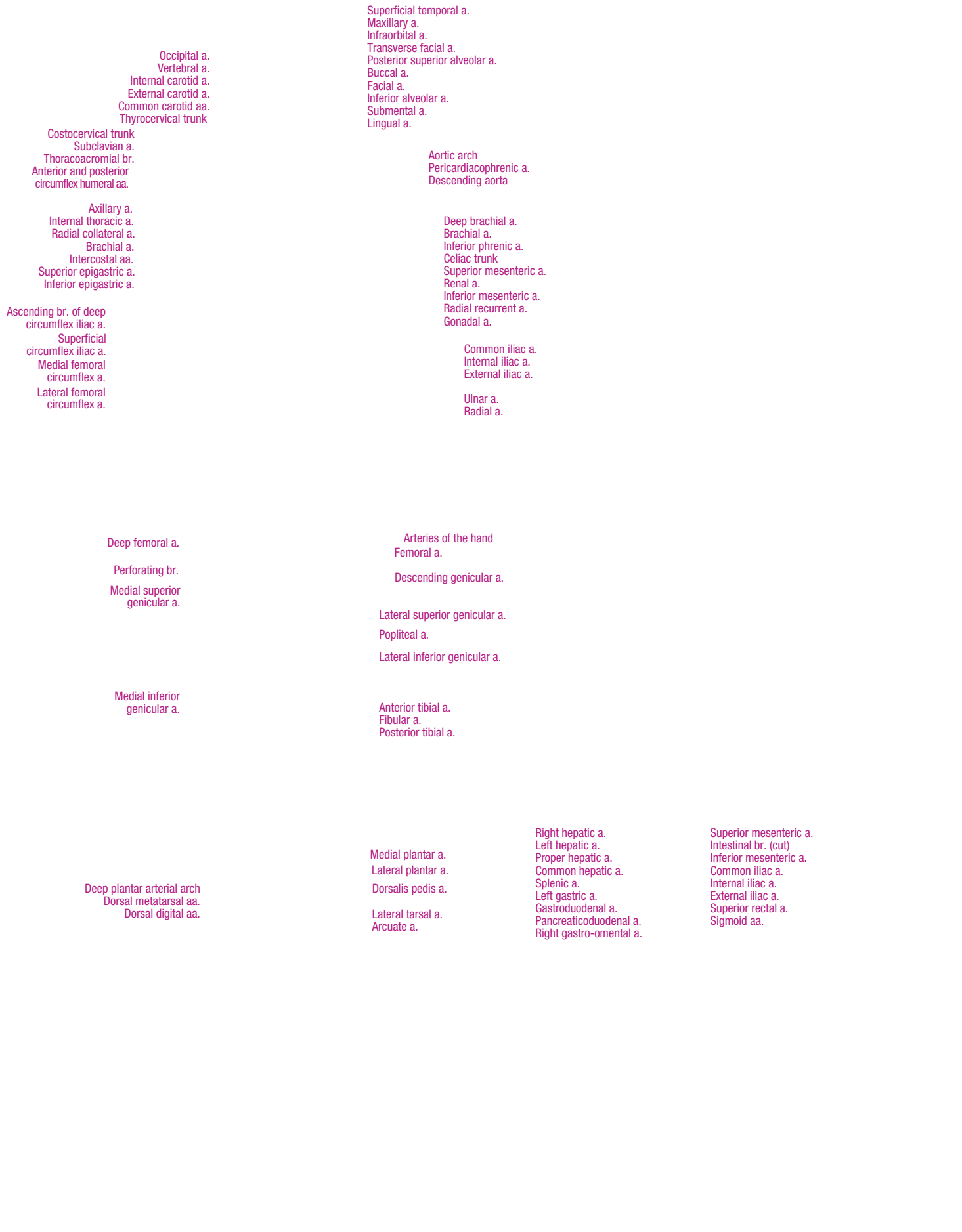
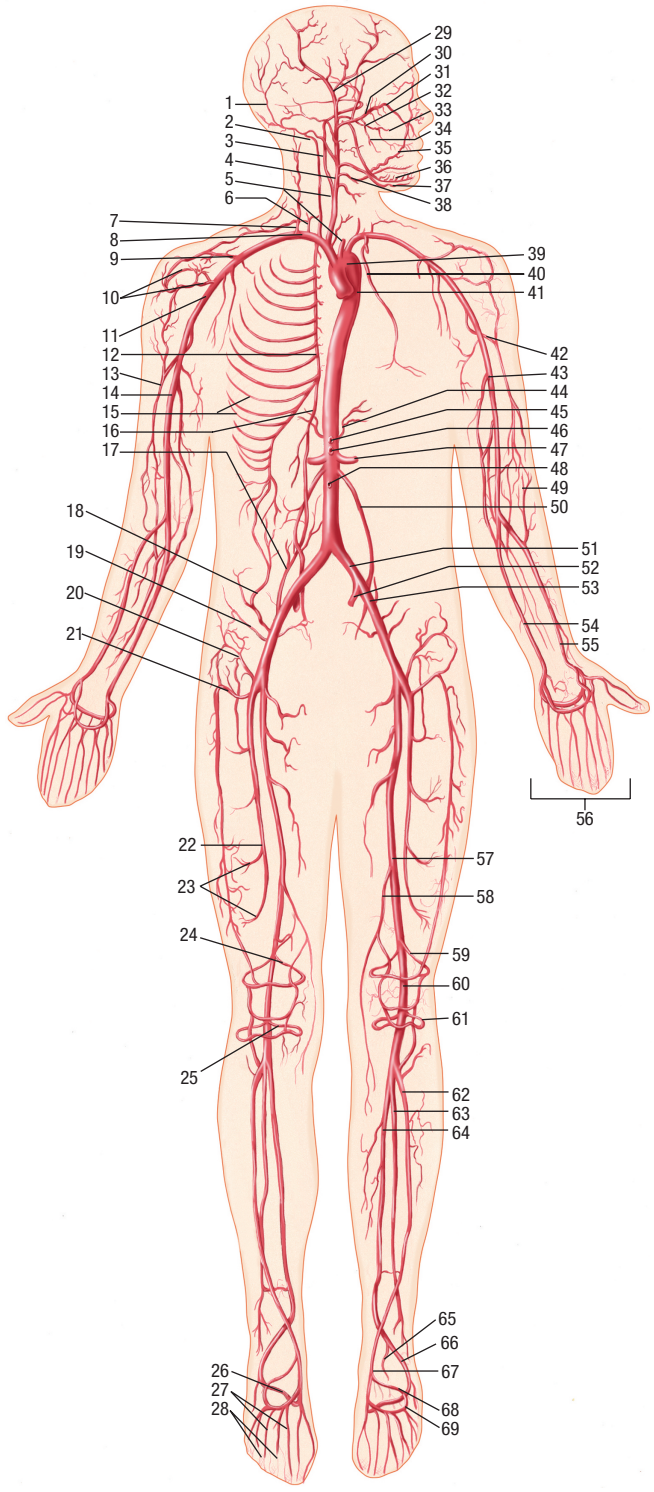
Vein	–	v.
Veins	–	vv.

The Arteries

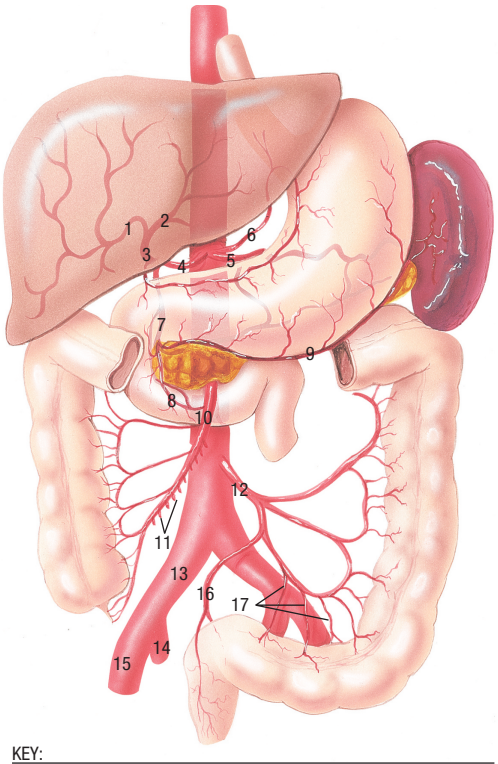


The Arteries

Arteries



Visceral Arteries (abdominal region)



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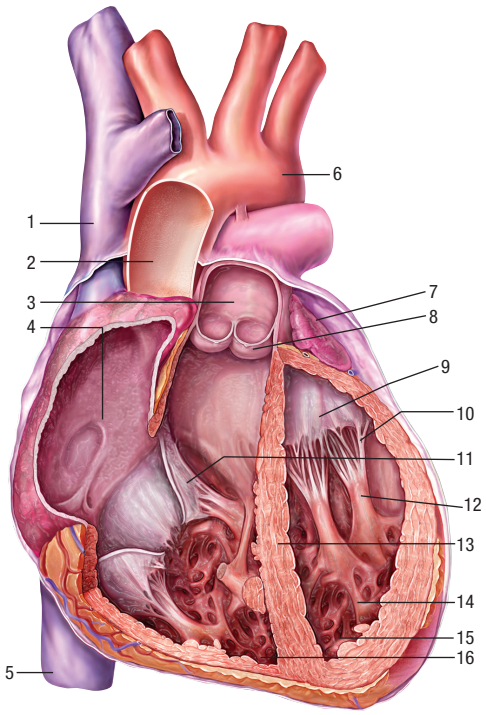
17)

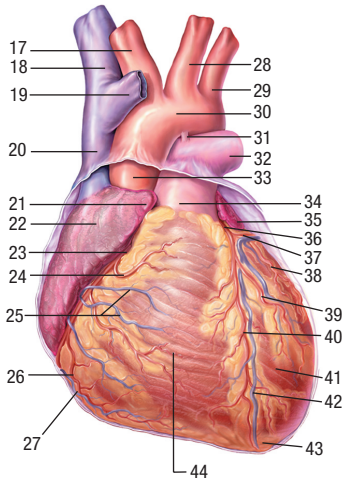
Artery	–	a.
Arteries	–	aa.
Branch	–	br.


Brachiocephalic trunk
Right brachiocephalic v.
Left brachiocephalic v.
Superior vena cava
Aortic arch
Left common carotid a.
Left subclavian a.
Arch of aorta
Ligamentum arteriosum
Left pulmonary a.
Ascending aorta
Pulmonary trunk
Left auricle
Left coronary a.
Circumflex a.
Left marginal a.
Superior vena cava
Ascending aorta
Pulmonary trunk
Right atrium
Right auricle
Right atrium
Right coronary a.
Left auricle
Conus br.
Anterior cardiac vv.
Pulmonary valve
Diagonal a.
Anterior interventricular a.
Left ventricle
Great cardiac v.
Left AV (mitral) valve
Right marginal a.
Chordae tendineae
Small cardiac v.
Right AV (tricuspid) valve
Apex
Right ventricle
Papillary muscle
Interventricular septum
Left common carotid artery
Brachiocephalic artery
Trabeculae
Left subclavian artery
Superior vena cava
Left ventricle
Right ventricle
Aortic arch
Inferior vena cava
Left pulmonary artery
Inferior vena cava
Pulmonary semilunar valve
Left atrium
Left pulmonary vein
Sinoatrial node (SA node)
Aortic semilunar valve
Left coronary artery
Right atrium
Interatrial septum
Coronary sinus
Atrioventricular node
Right coronary artery
Left ventricle
Atrioventricular bundle (bundle of His)
Right ventricle
Right & left bundle branches
Right atrioventricular valve
Interventricular septum
Left atrioventricular valve
Anterior
Posterior
Left
Right
Septal

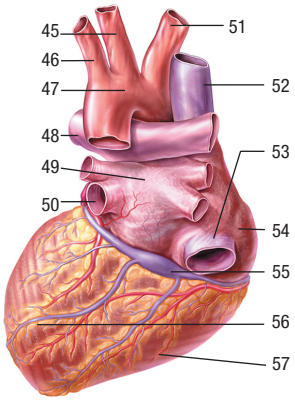
Coronal Section



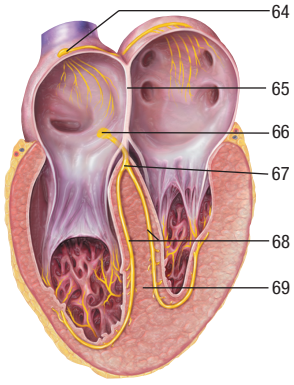
Anterior View



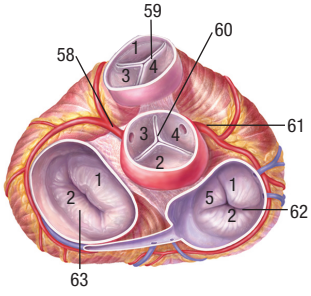
Posterior view



Conduction System



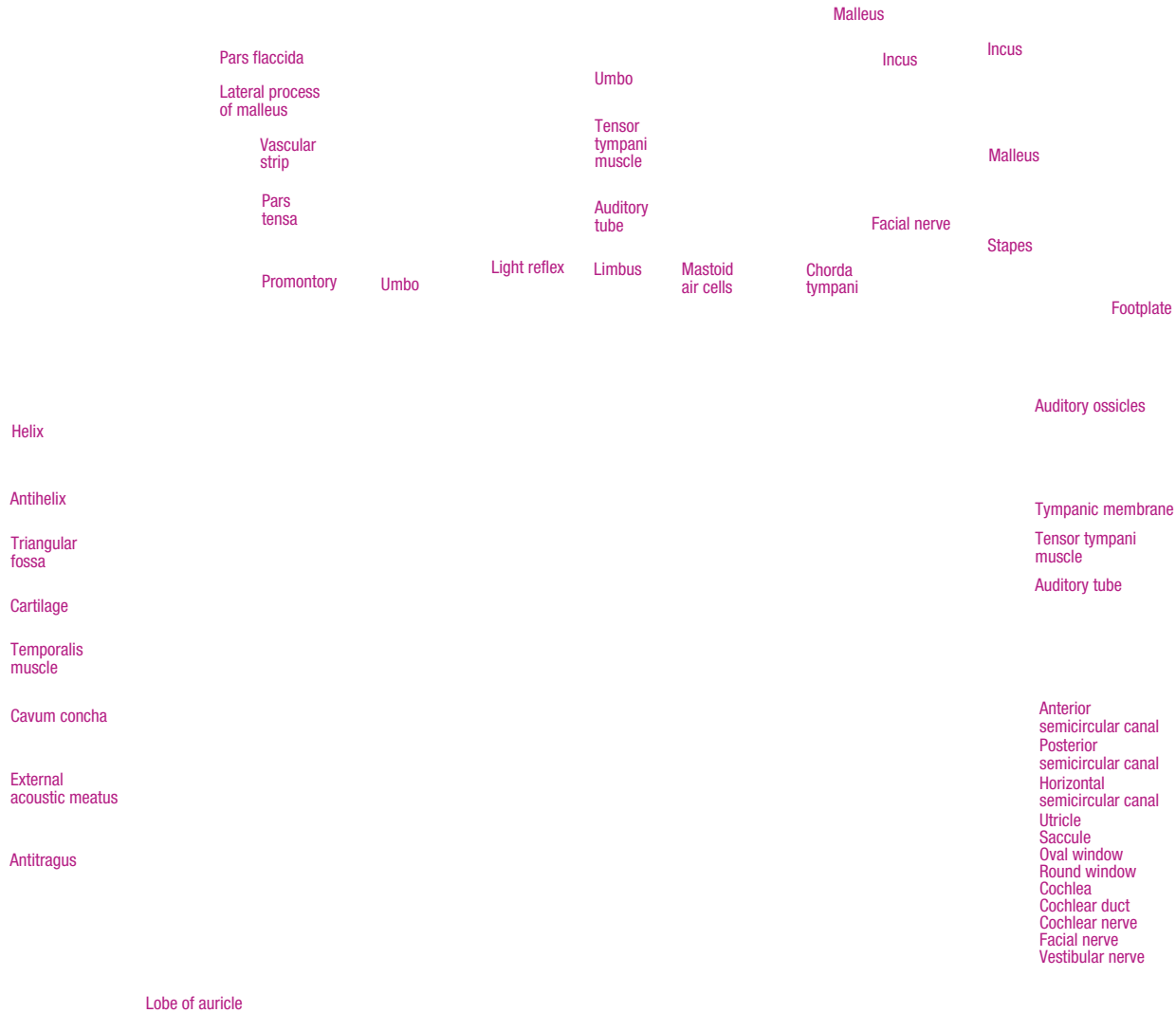
Valves



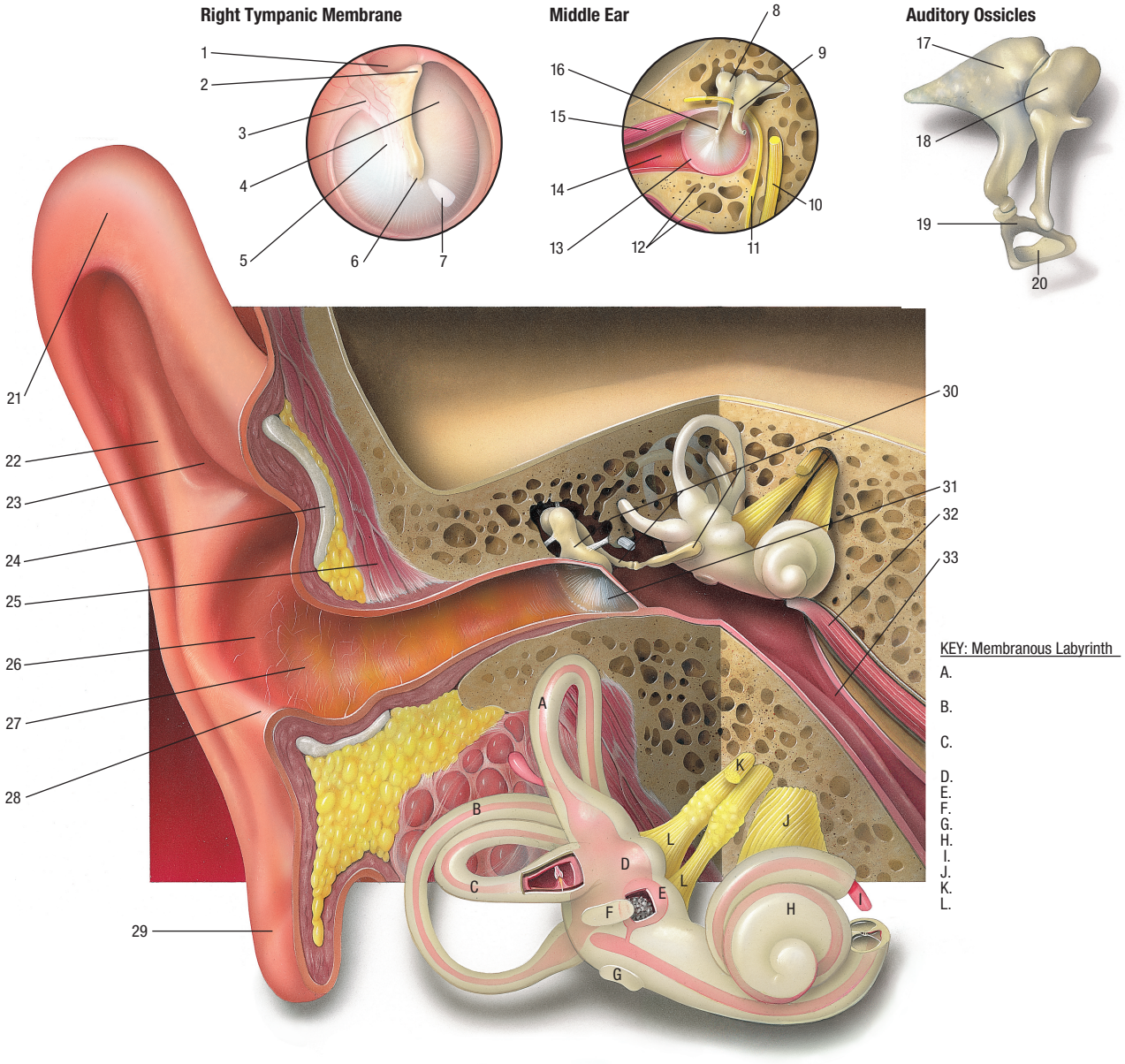
KEY:

1) 3) 5)
2) 4)

The Ear


Malleus
Incus
Incus
Pars flaccida
Umbo
Lateral process of malleus
Tensor tympani muscle
Vascular strip
Malleus
Pars tensa
Auditory tube
Facial nerve
Stapes
Promontory
Umbo
Light reflex
Limbus
Mastoid air cells
Chorda tympani
Footplate
Auditory ossicles
Helix
Antihelix
Tympanic membrane
Triangular fossa
Tensor tympani muscle
Cartilage
Auditory tube
Temporalis muscle
Cavum concha
Anterior semicircular canal
Posterior semicircular canal
External acoustic meatus
Horizontal semicircular canal
Utricle
Antitragus
Saccule
Oval window
Round window
Cochlea
Cochlear duct
Cochlear nerve
Facial nerve
Vestibular nerve
Lobe of auricle

The Ear


Right Tympanic Membrane
1
2
3
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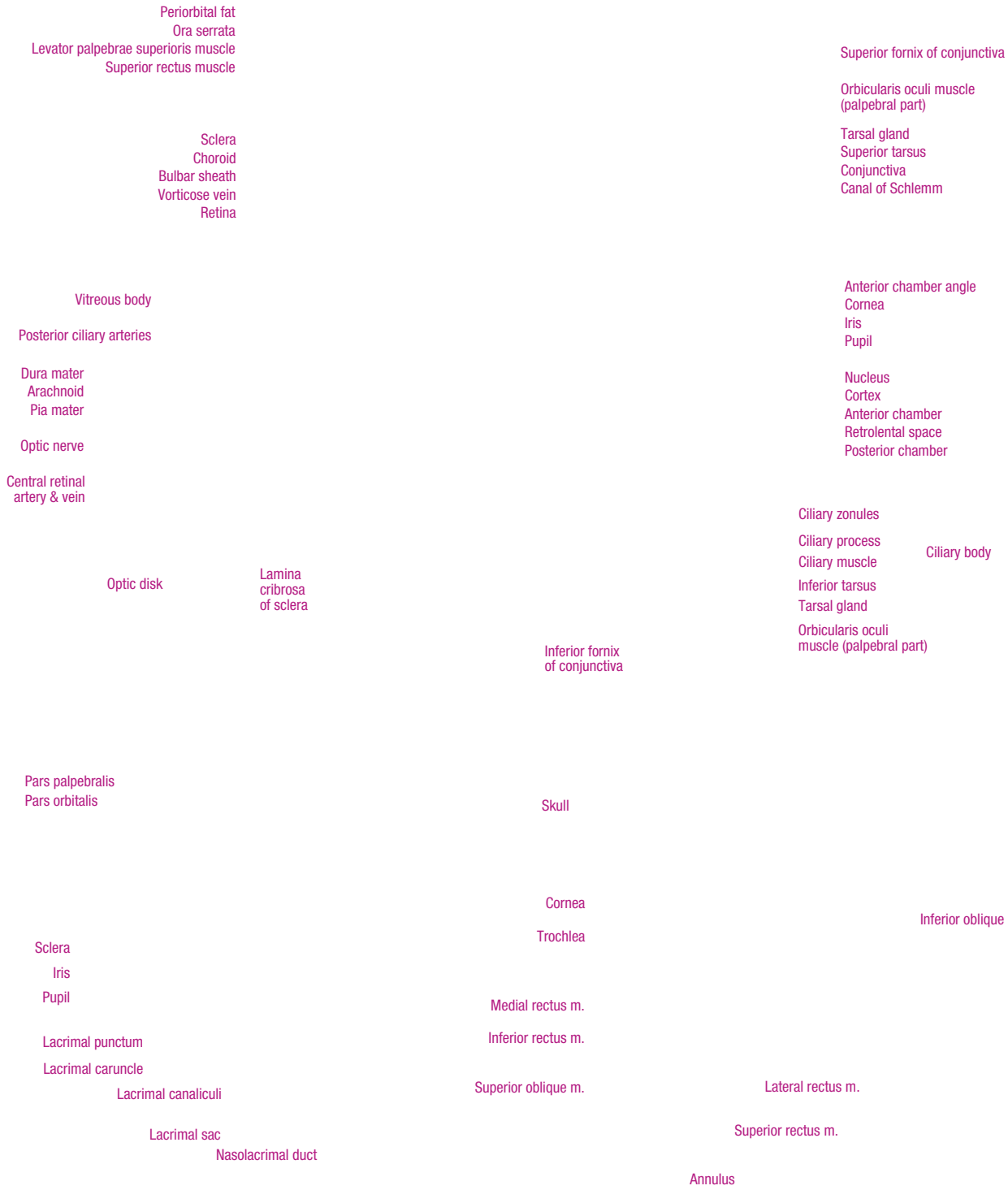
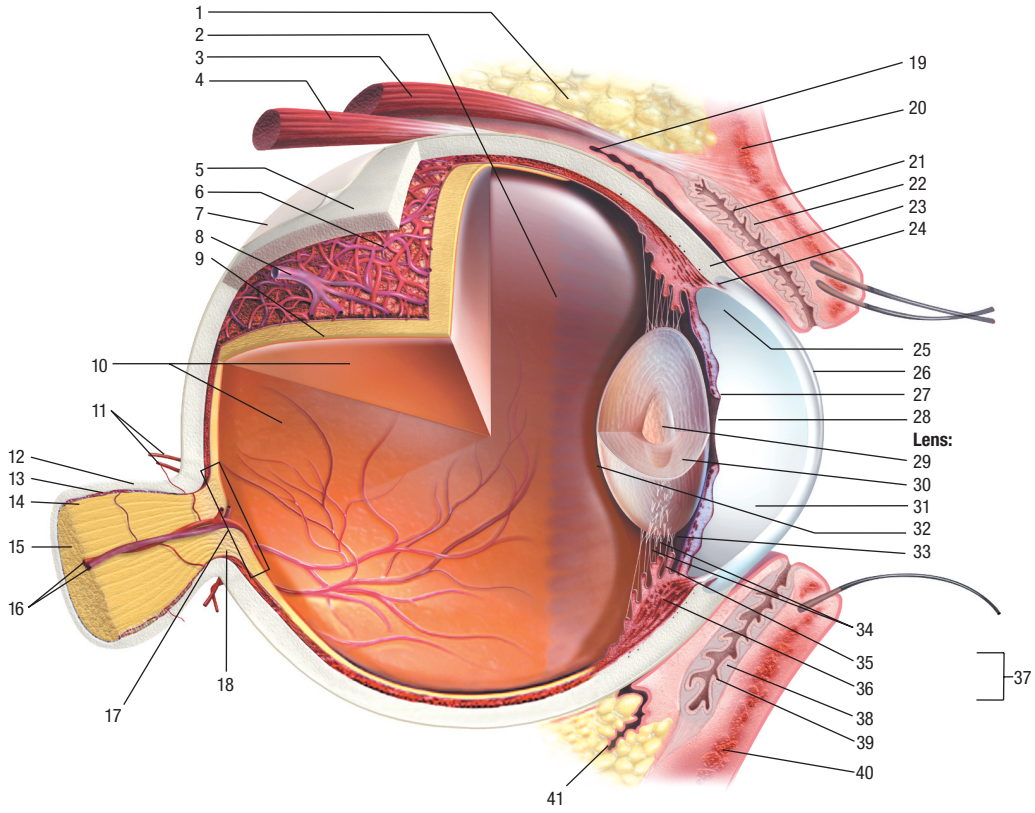
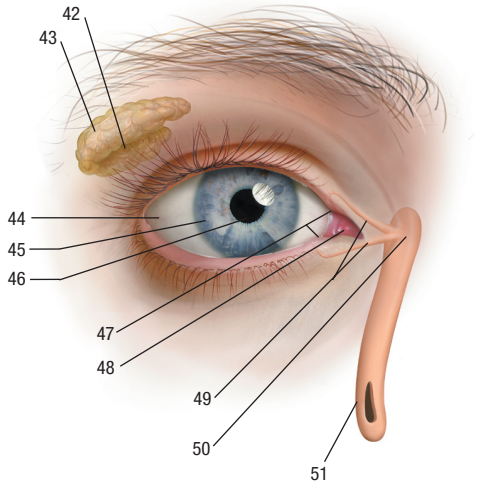
7
Middle Ear
8
9
16
15
14
13
12
11
10
Auditory Ossicles
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
A
B
C
D
E
F
G
H
I
J
K
L
KEY: Membranous Labyrinth
A.
B.
C.
D.
E.
F.
G.
H.
I.
J.
K.
L.

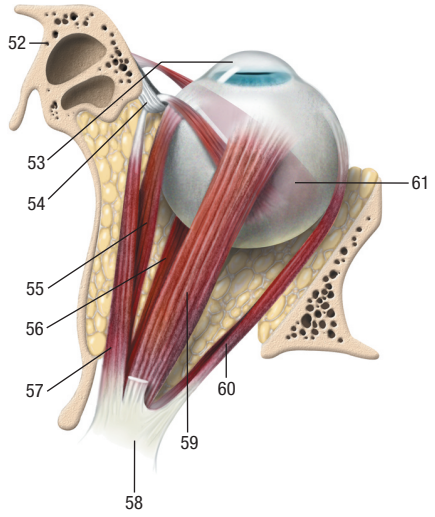

Periorbital fat
Ora serrata
Levator palpebrae superioris muscle
Superior rectus muscle
Sclera
Choroid
Bulbar sheath
Vorticose vein
Retina
Vitreous body
Posterior ciliary arteries
Dura mater
Arachnoid
Pia mater
Optic nerve
Central retinal artery & vein
Optic disk
Lamina cribrosa of sclera
Pars palpebralis
Pars orbitalis
Sclera
Iris
Pupil
Lacrimal punctum
Lacrimal caruncle
Lacrimal canaliculi
Lacrimal sac
Nasolacrimal duct
Superior fornix of conjunctiva
Orbicularis oculi muscle (palpebral part)
Tarsal gland
Superior tarsus
Conjunctiva
Canal of Schlemm
Anterior chamber angle
Cornea
Iris
Pupil
Nucleus
Cortex
Anterior chamber
Retrolental space
Posterior chamber
Ciliary zonules
Ciliary process
Ciliary muscle
Ciliary body
Inferior tarsus
Tarsal gland
Orbicularis oculi muscle (palpebral part)
Inferior fornix of conjunctiva
Skull
Cornea
Trochlea
Medial rectus m.
Inferior rectus m.
Superior oblique m.
Inferior oblique
Lateral rectus m.
Superior rectus m.
Annulus



Lacrimal Gland:

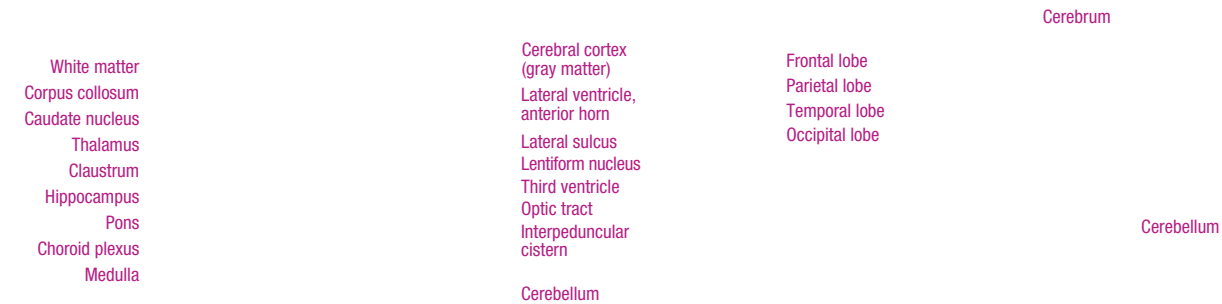


Eye Muscles Superior View



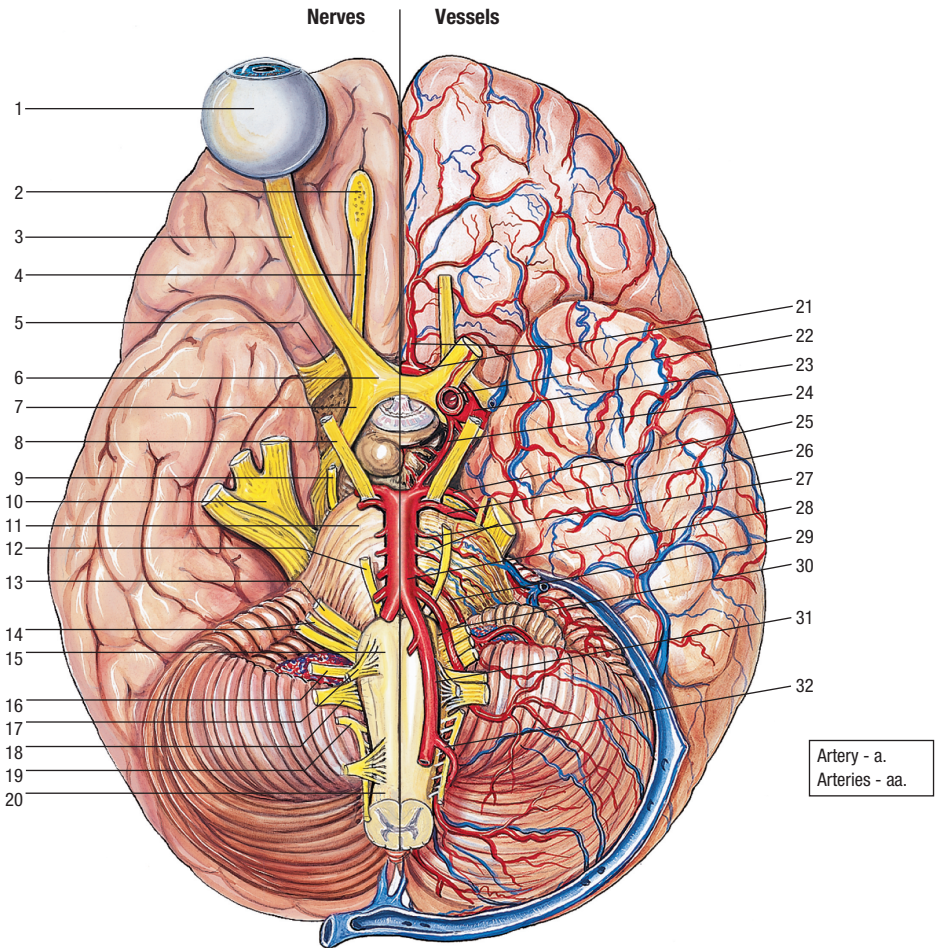
The Brain


Eyeball
Olfactory bulb
Optic n. (II)
Olfactory tract (I)
Lateral olfactory stria
Optic chiasma
Optic tract
Oculomotor n. (III)
Trochlear n. (IV)
Trigeminal n. (V)
Pons
Abducens n. (VI)
Facial n. (VII)
Vestibulocochlear n. (VIII)
Medulla oblongata
Glossopharyngeal n. (IX)
Hypoglossal n. (XII)
Vagus n. (X)
Accessory n. (XI)
Spinal cord
Anterior cerebral a.
Internal carotid a.
Middle cerebral a.
Posterior communicating a.
Posterior cerebral a.
Superior cerebellar a.
Pontine aa.
Basilar a.
Labyrinthine a.
Anterior inferior cerebellar a.
Vertebral a.
Posterior spinal a.

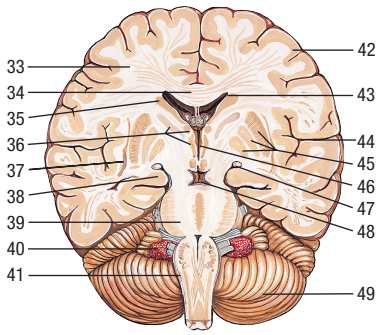

White matter
Corpus collosum
Caudate nucleus
Thalamus
Claustrum
Hippocampus
Pons
Choroid plexus
Medulla
Cerebral cortex (gray matter)
Lateral ventricle, anterior horn
Lateral sulcus
Lentiform nucleus
Third ventricle
Optic tract
Interpeduncular cistern
Cerebellum
Frontal lobe
Parietal lobe
Temporal lobe
Occipital lobe
Cerebrum
Cerebellum

The Brain

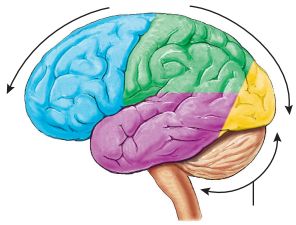
Base of Brain

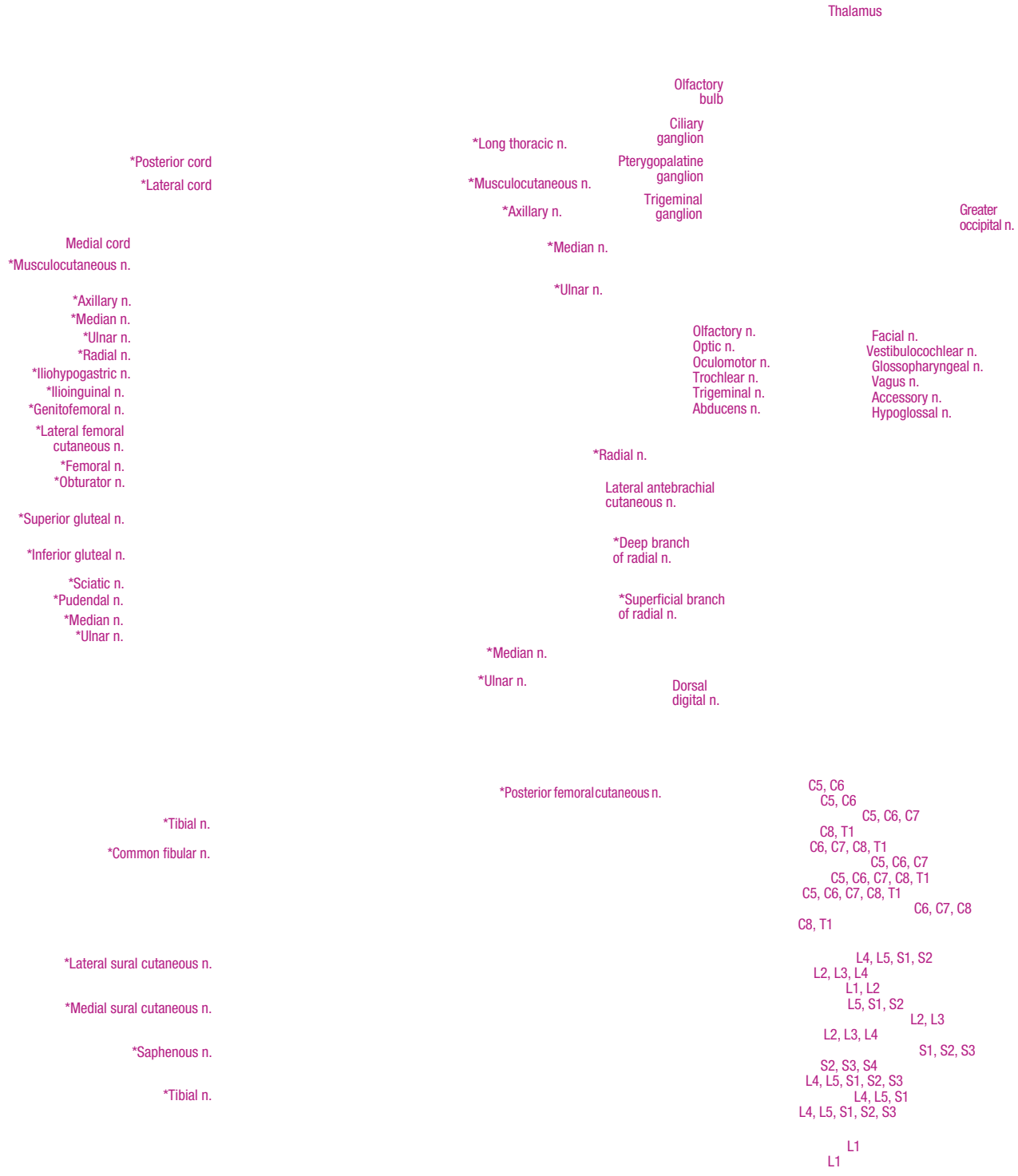


Coronal Section

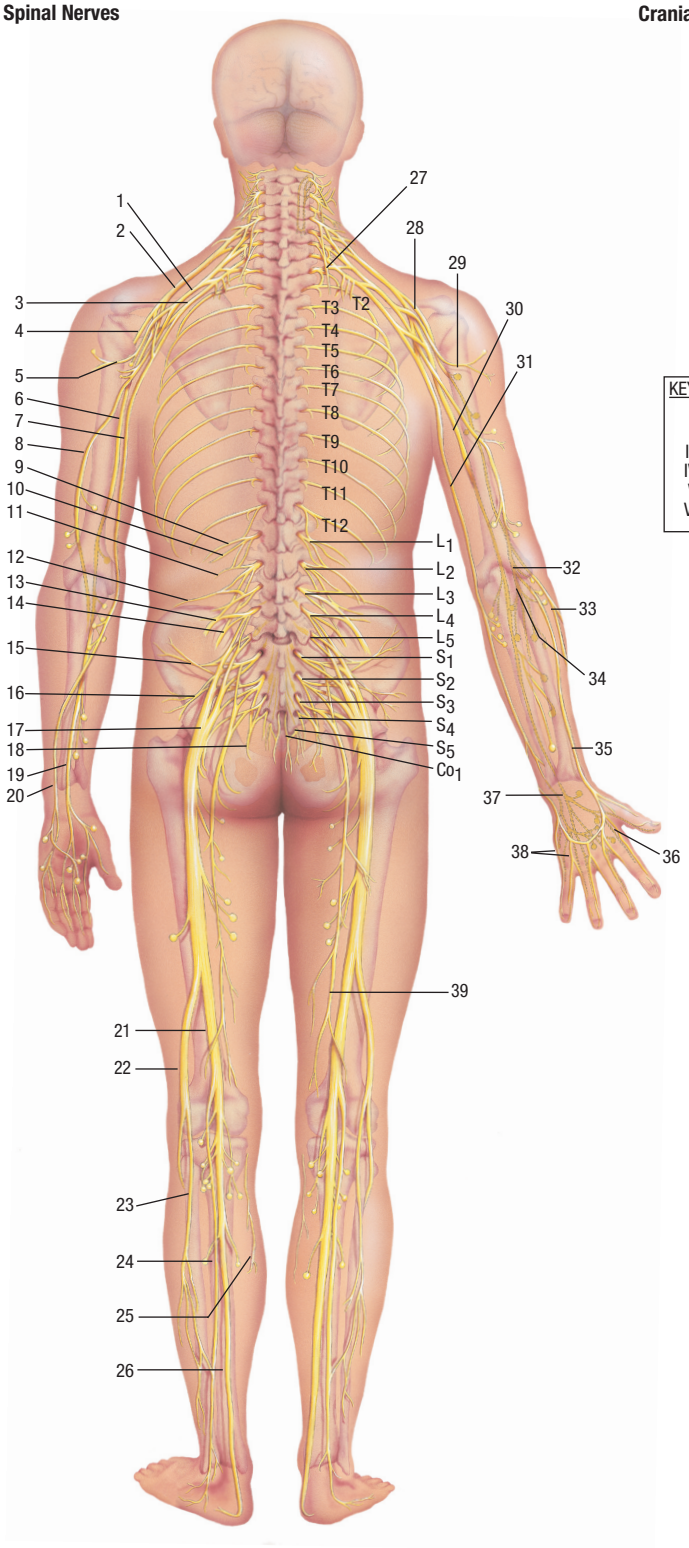


Lobes

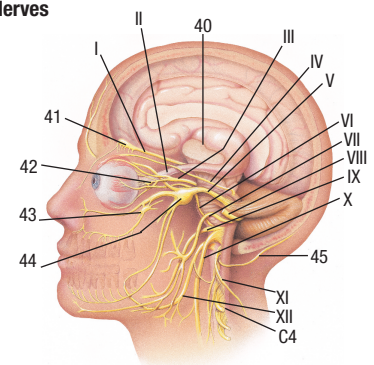



Thalamus
Olfactory bulb
Ciliary ganglion
*Long thoracic n.
Pterygopalatine ganglion
*Musculocutaneous n.
Trigeminal ganglion
*Axillary n.
Greater occipital n.
*Posterior cord
*Lateral cord
Medial cord
*Musculocutaneous n.
*Axillary n.
*Median n.
*Ulnar n.
*Radial n.
*Iliohypogastric n.
*Ilioinguinal n.
*Genitofemoral n.
*Lateral femoral cutaneous n.
*Femoral n.
*Obturator n.
*Superior gluteal n.
*Inferior gluteal n.
*Sciatic n.
*Pudendal n.
*Median n.
*Ulnar n.
Olfactory n.
Optic n.
Oculomotor n.
Trochlear n.
Trigeminal n.
Abducens n.
Facial n.
Vestibulocochlear n.
Glossopharyngeal n.
Vagus n.
Accessory n.
Hypoglossal n.
*Radial n.
Lateral antebrachial cutaneous n.
*Deep branch of radial n.
*Superficial branch of radial n.
*Median n.
*Ulnar n.
Dorsal digital n.
*Posterior femoral cutaneous n.
*Tibial n.
*Common fibular n.
*Lateral sural cutaneous n.
*Medial sural cutaneous n.
*Saphenous n.
*Tibial n.
C5, C6
C5, C6
C5, C6, C7
C8, T1
C6, C7, C8, T1
C5, C6, C7
C5, C6, C7, C8, T1
C5, C6, C7, C8, T1
C6, C7, C8
C8, T1
L4, L5, S1, S2
L2, L3, L4
L1, L2
L5, S1, S2
L2, L3
L2, L3, L4
S1, S2, S3
S2, S3, S4
L4, L5, S1, S2, S3
L4, L5, S1
L4, L5, S1, S2, S3
L1
L1

Spinal Nerves



Cranial Nerves



KEY: CRANIAL NERVES

I)	VII)
II)	VIII)
III)	IX)
IV)	X)
V)	XI)
VI)	XII)

KEY: SPINAL CORD SEGMENTS*

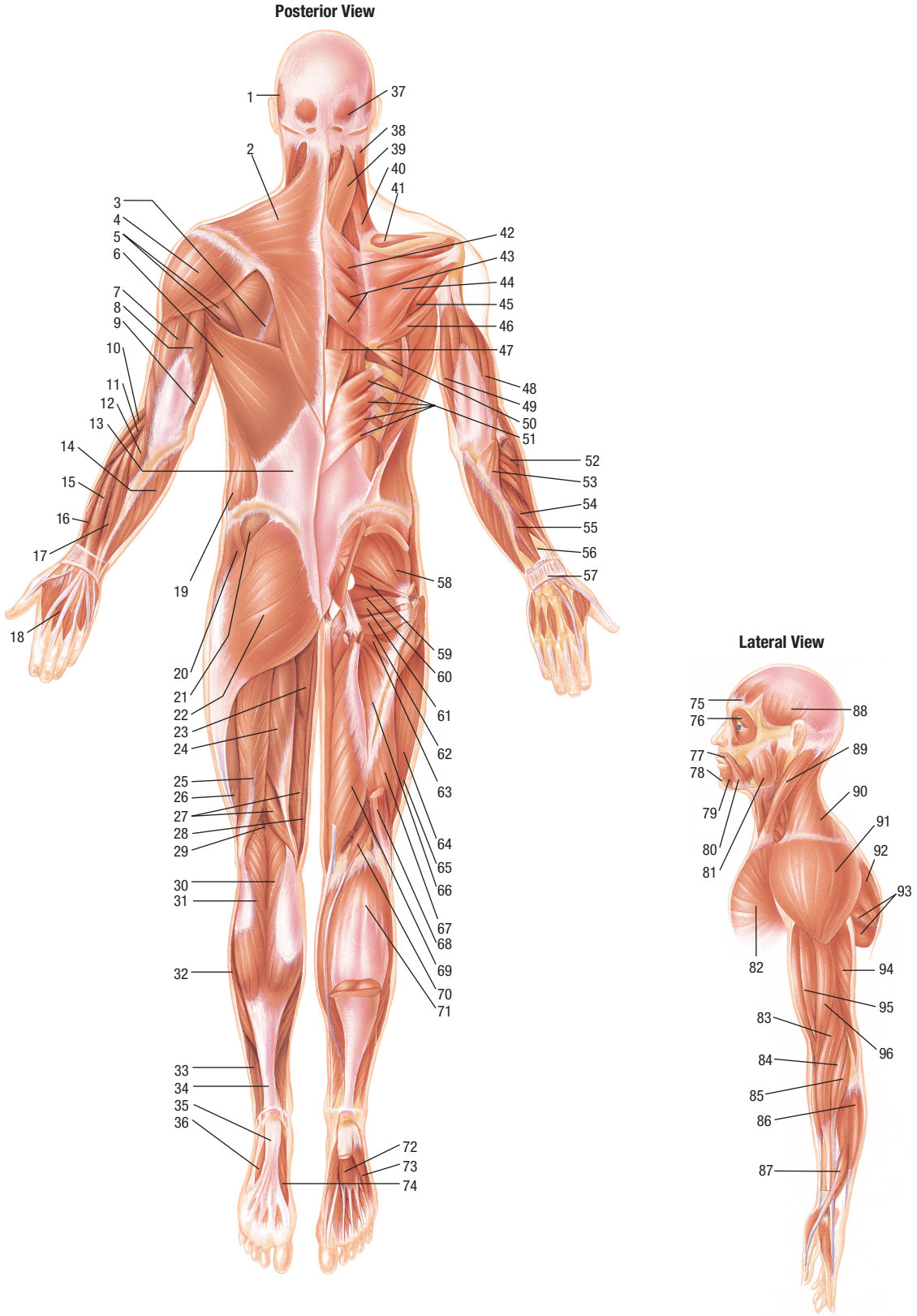
Upper Limb
Axillary n. –
Lateral cord –
Long thoracic nerve –
Medial cord –
Median n. –
Musculocutaneous n. –
Posterior cord –
Radial n. –
Superficial branch of radial n. –
Ulnar n. –

Lower Limb
Common fibular n. –
Femoral n. –
Genitofemoral n. –
Inferior gluteal n. –
Lateral femoral cutaneous n. –
Obturator n. –
Posterior femoral cutaneous n. –
Pudendal n. –
Sciatic n. –
Superior gluteal n. –
Tibial n. –

Trunk
Iliohypogastric n. –
Ilioinguinal n. –

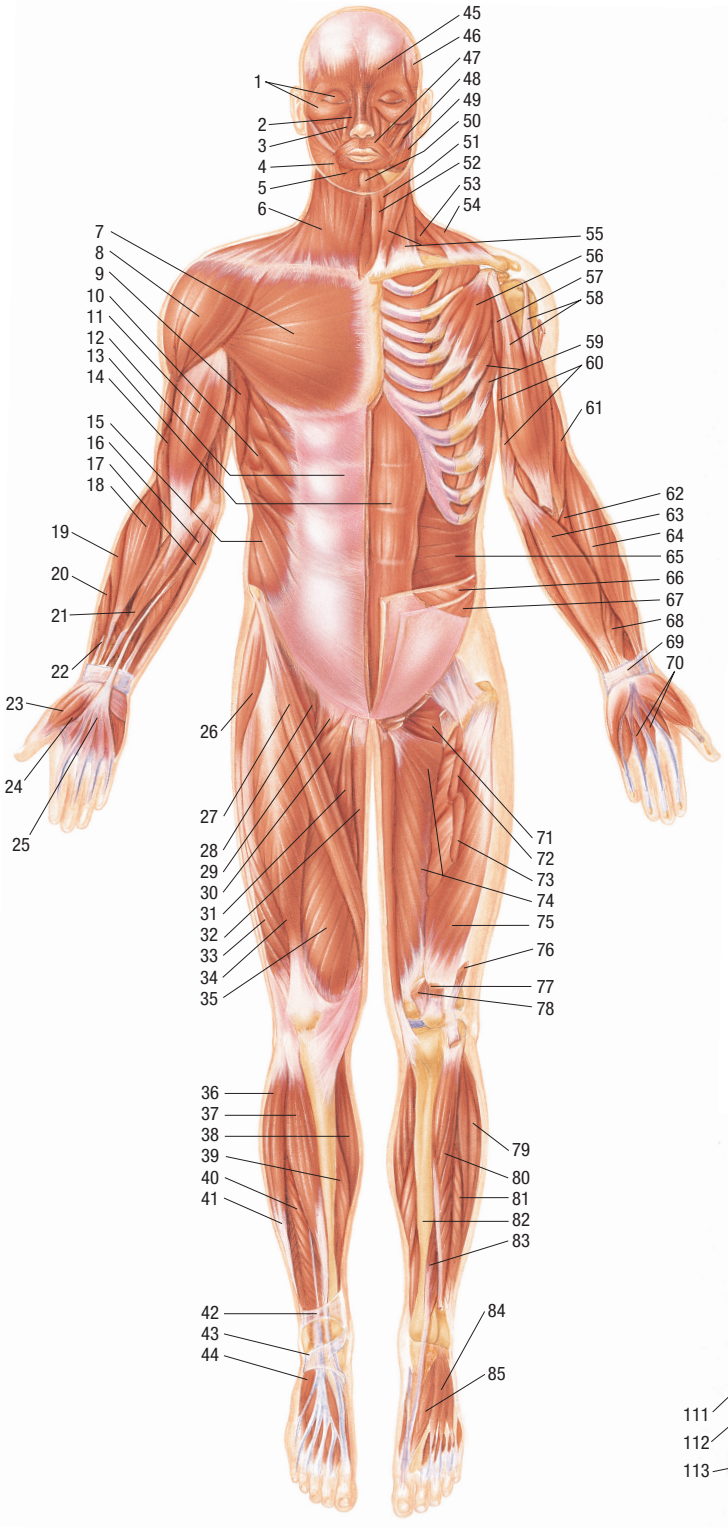
The Muscular System—Posterior View

The Muscular System—Posterior View

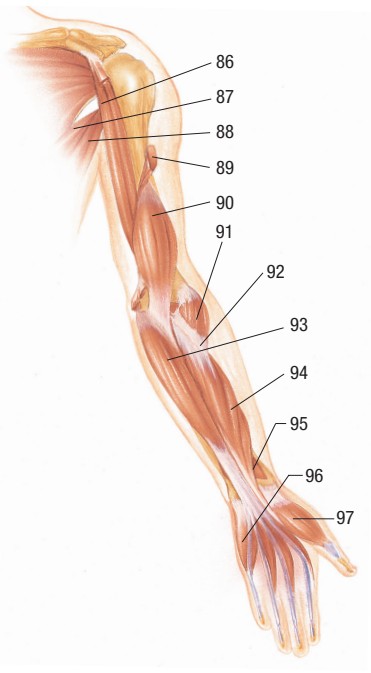


The Muscular System—Anterior View

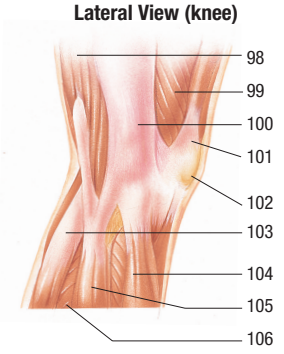
Anterior View



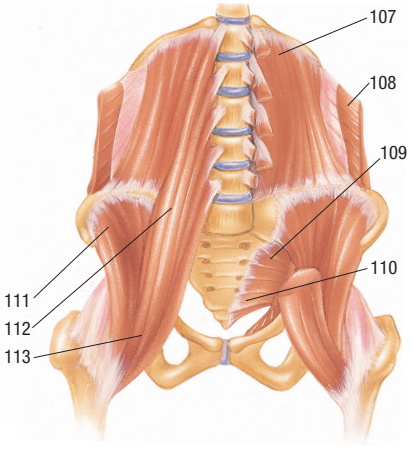
Deep Anterior View of Upper Limb



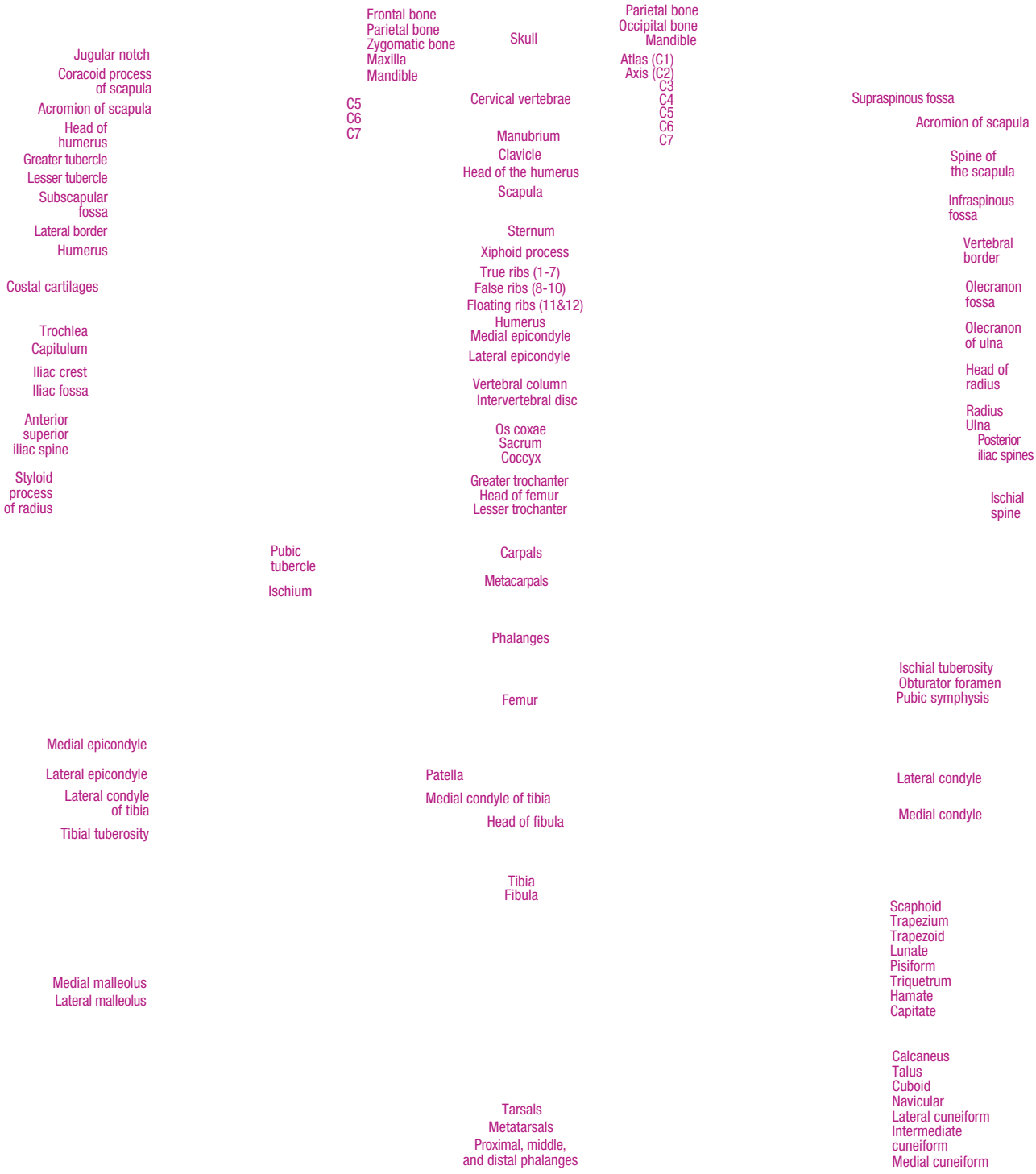
Lateral View (knee)



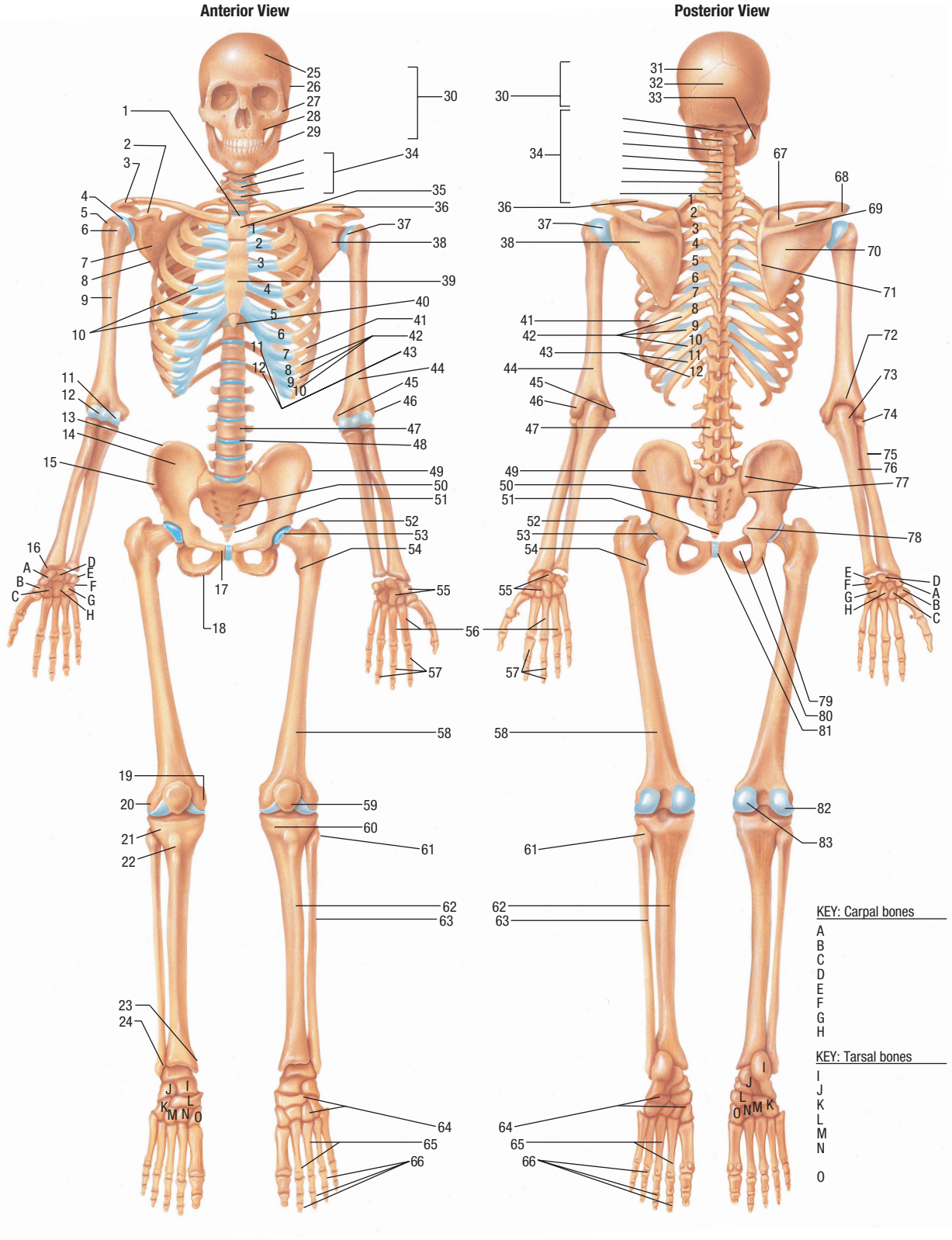
Posterior Abdominal Wall

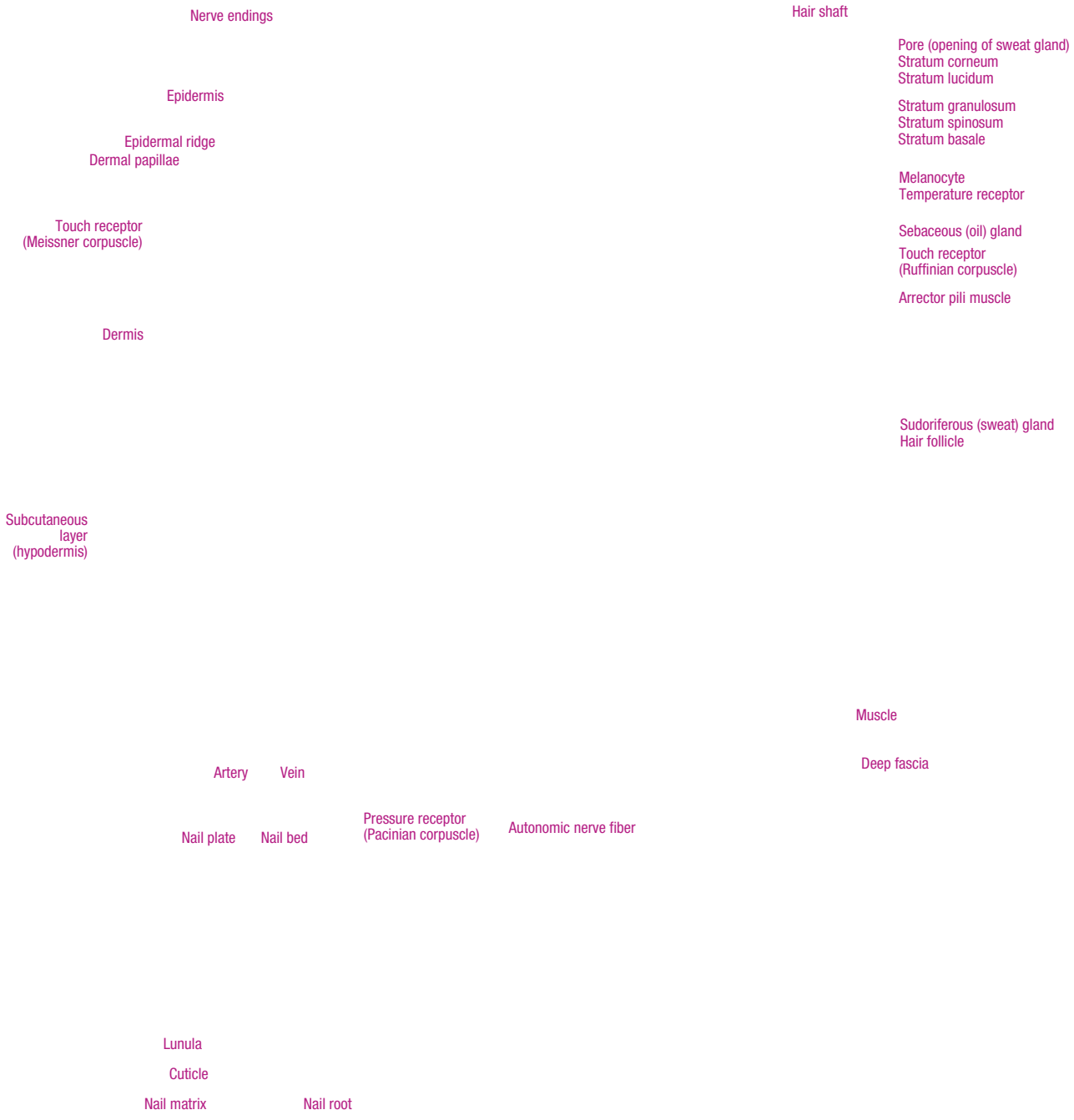


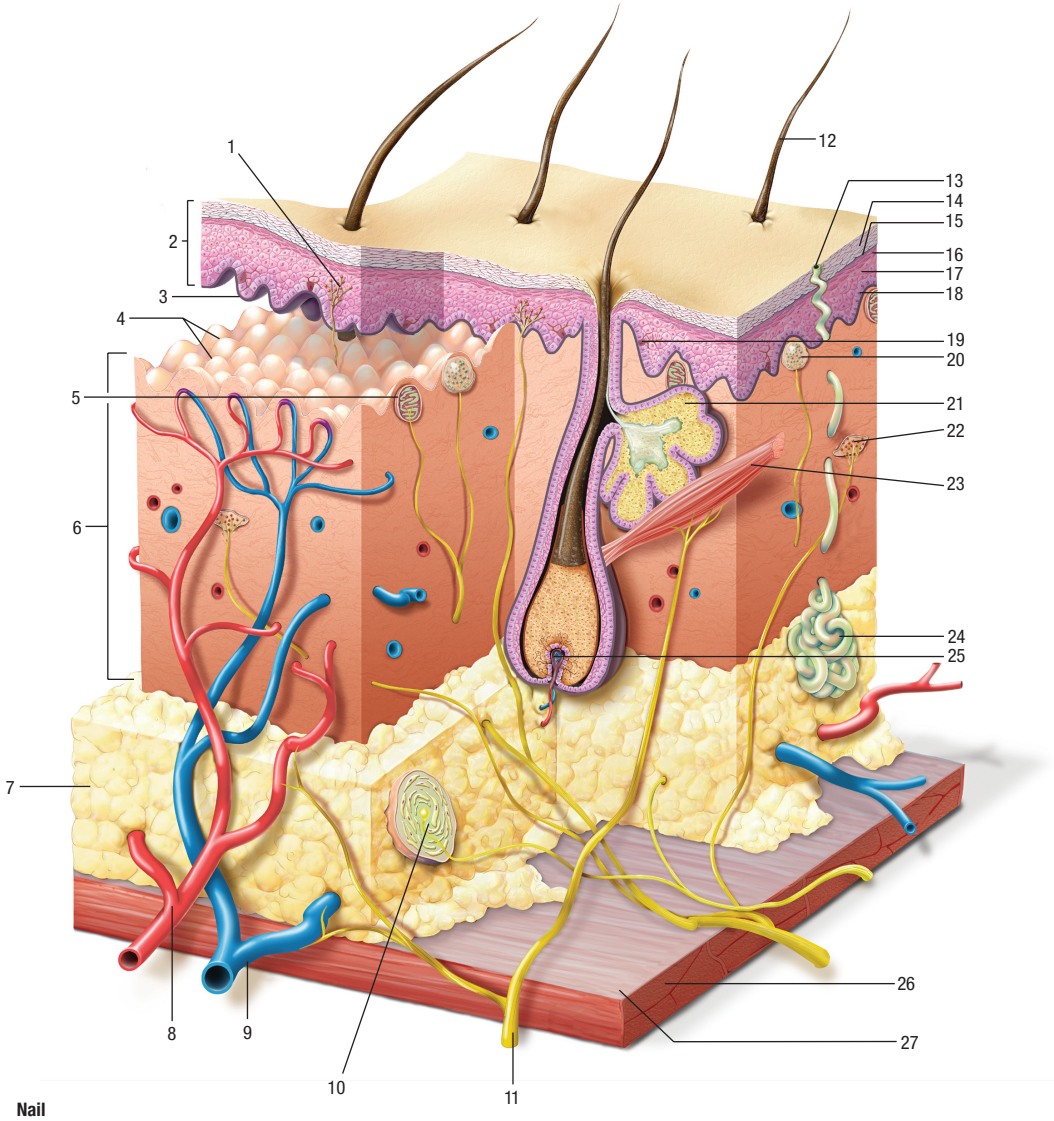
The Skeletal System



The Skeletal System




Nerve endings
Epidermis
Epidermal ridge
Dermal papillae
Touch receptor (Meissner corpuscle)
Dermis
Subcutaneous layer (hypodermis)
Hair shaft
Pore (opening of sweat gland)
Stratum corneum
Stratum lucidum
Stratum granulosum
Stratum spinosum
Stratum basale
Melanocyte
Temperature receptor
Sebaceous (oil) gland
Touch receptor (Ruffinian corpuscle)
Arrector pili muscle
Sudoriferous (sweat) gland
Hair follicle
Muscle
Deep fascia
Artery
Vein
Nail plate
Nail bed
Pressure receptor (Pacinian corpuscle)
Autonomic nerve fiber
Lunula
Cuticle
Nail matrix
Nail root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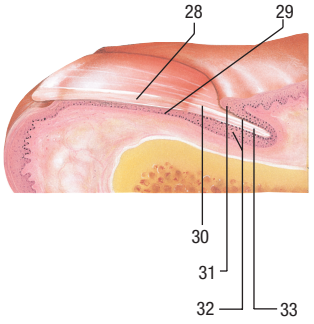
Nail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UNIT

I The Body as a Whole

The chapters in this unit provide the foundation for further studies of the human body. The unit begins with a broad overview of concepts in human anatomy and physiology and then zooms in to discuss the smallest units of matter—atoms and molecules. We then widen our view to discuss the smallest units of life, called cells, and continue to enlarge our scope even further to discuss groupings of similar cells, known as tissues. These chapters will prepare you for the more detailed study of individual body systems in the units that follow.