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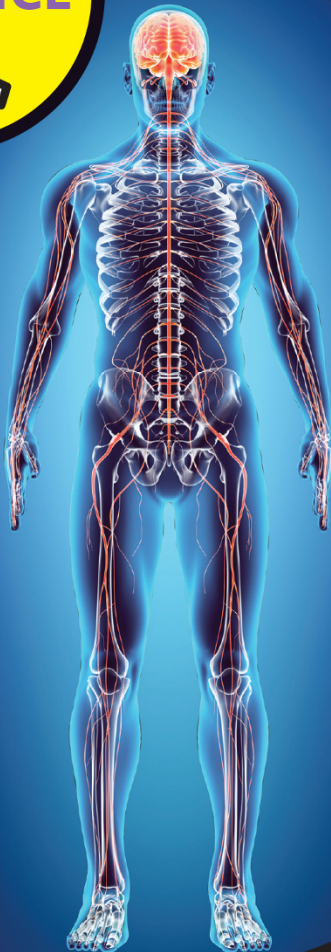
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# Anatomy & Physiology Workbook

3rd Edition with Online Practice

**by Erin Ody and Pat DuPree**

for  
**dummies**<sup>®</sup>  
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# Anatomy & Physiology Workbook For Dummies®, 3rd Edition with Online Practice

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# Contents at a Glance

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<b>Introduction</b> .....	1
<b>Part 1: The Building Blocks of the Body</b> .....	5
CHAPTER 1: The Language of Anatomy & Physiology .....	7
CHAPTER 2: The Chemistry of Life .....	15
CHAPTER 3: The Cell: Life's Basic Building Block .....	35
CHAPTER 4: Divide and Conquer: Cellular Mitosis .....	53
CHAPTER 5: The Study of Tissues: Histology .....	63
<b>Part 2: Weaving It Together: Bones, Muscles, and Skin</b> .....	77
CHAPTER 6: It's Skin Deep: The Integumentary System .....	79
CHAPTER 7: A Scaffold to Build On: The Skeleton .....	95
CHAPTER 8: Getting in Gear: The Muscles .....	127
<b>Part 3: Mission Control: All Systems Go</b> .....	155
CHAPTER 9: Feeling Jumpy: The Nervous System .....	157
CHAPTER 10: Raging Hormones: The Endocrine System .....	191
<b>Part 4: Feed and Fuel: Supply and Transport</b> .....	207
CHAPTER 11: Spreading the Love: The Cardiovascular System .....	209
CHAPTER 12: Keeping Up Your Defenses: The Lymphatic System .....	231
CHAPTER 13: Oxygenating the Machine: The Respiratory System .....	249
CHAPTER 14: Fueling the Functions: The Digestive System .....	265
CHAPTER 15: Filtering Out the Junk: The Urinary System .....	287
<b>Part 5: Survival of the Species</b> .....	301
CHAPTER 16: Why Ask Y? The Male Reproductive System .....	303
CHAPTER 17: Carrying Life: The Female Reproductive System .....	317
<b>Part 6: The Part of Tens</b> .....	337
CHAPTER 18: Ten Study Tips for Anatomy and Physiology Students .....	339
CHAPTER 19: Ten Fun Physiology Facts .....	345
<b>Index</b> .....	351





# Table of Contents

<b>INTRODUCTION</b>	1
About This Book	1
Foolish Assumptions	2
Icons Used in This Book	2
Beyond the Book	3
Where to Go from Here	3
 <b>PART 1: THE BUILDING BLOCKS OF THE BODY</b>	 5
<b>CHAPTER 1: The Language of Anatomy &amp; Physiology</b>	7
Organization of the Body	7
Getting into Position	11
Answers to Questions on Terminology	14
 <b>CHAPTER 2: The Chemistry of Life</b>	 15
Building from Scratch: Atoms and Elements	15
Chemical Reactions	19
Chemical bonds	19
Organic compounds	21
Cycling through Life: Metabolism	26
Energy from food	27
Getting energy from energy	29
Answers to Questions on Life's Chemistry	33
 <b>CHAPTER 3: The Cell: Life's Basic Building Block</b>	 35
Life and Death of a Cell	35
Gaining Admission: The Cell Membrane	37
Diffusion	37
Osmosis	38
Active transport	39
Aiming for the Nucleus	41
Looking Inside: Organelles and Their Functions	43
Putting Together New Proteins	47
Answers to Questions on the Cell	50
 <b>CHAPTER 4: Divide and Conquer: Cellular Mitosis</b>	 53
Walking through the Cell Cycle	54
Waiting for action: Interphase	54
Sorting out the parts: Prophase	55
Dividing at the equator: Metaphase	55
Packing up to move out: Anaphase	55
Pinching off: Telophase	55
Splitting up: Cytokinesis	55
Understanding What Can Go Wrong during Cell Division	59
Answers to Questions on Mitosis	61

<b>CHAPTER 5: The Study of Tissues: Histology</b>	63
Getting into Your Skin: Epithelial Tissue	64
Making a Connection: Connective Tissue	68
Flexing It: Muscle Tissue	71
Getting the Signal Across: Nervous Tissue	73
Answers to Questions on Histology	74
 <b>PART 2: WEAVING IT TOGETHER: BONES, MUSCLES, AND SKIN</b>	 77
<b>CHAPTER 6: It's Skin Deep: The Integumentary System</b>	79
Digging Deep into Dermatology	79
The epidermis: Don't judge this book by its cover	80
The dermis: Going more than skin deep	82
Touching a Nerve in the Integumentary System	86
Accessorizing with Hair, Nails, and Glands	87
Wigging out about hair	87
The oil slick	88
Nailing the fingers and toes	88
Sweating the details	88
Getting an earful	89
Answers to Questions on the Skin	93
 <b>CHAPTER 7: A Scaffold to Build On: The Skeleton</b>	 95
Understanding the Functions of Dem Bones	95
Boning Up on Classifications and Structures	98
Turning Bone into Bone: Ossification	103
Endochondral ossification	103
Intramembranous ossification	103
The Axial Skeleton: Keeping It All in Line	105
Making a hard head harder	105
Putting your backbones into it	107
The Appendicular Skeleton: Reaching beyond Our Girdles	113
Arthrology: Articulating the Joints	117
Answers to Questions on the Skeleton	122
 <b>CHAPTER 8: Getting in Gear: The Muscles</b>	 127
Flexing Your Muscle Knowledge	128
Muscle Classifications: Smooth, Cardiac, and Skeletal	131
Contracting for a Contraction	133
Breaking down a muscle's anatomy and movement	133
Understanding what stimulates muscle contraction	135
Pulling Together: Muscles as Organs	138
Assuming the Right Tone	140
Leveraging Muscular Power	142
What's in a Name? Identifying Muscles	144
Answers to Questions on Muscles	150

<b>PART 3: MISSION CONTROL: ALL SYSTEMS GO</b>	155
<b>CHAPTER 9: Feeling Jumpy: The Nervous System</b>	157
Our Motherboard	157
Building from Basics: Neurons, Nerves, and Glial cells	158
Neurons	158
Nerves	160
Glial cells	161
Feeling Impulsive?	164
Along the neuron	165
Across the synapse	166
Minding the Central Nervous System	168
The spinal cord	168
The brain	169
Taking Side Streets: The Peripheral Nervous System	176
Keep Breathing: The Autonomic Nervous System	178
Coming to Your Senses	181
On watch: The eyes	181
Listen up: The ears	182
Answers to Questions on the Nervous System	187
<b>CHAPTER 10: Raging Hormones: The Endocrine System</b>	191
No Bland Glands	192
Enter the Ringmasters	194
The hypothalamus	194
The pituitary	195
The Supporting Cast of Glandular Characters	197
Topping off the kidneys: The adrenal glands	197
Thriving with the thyroid	198
Pairing up with the parathyroid	198
Pinging the pineal gland	199
Thumping the thymus	199
Pressing the pancreas	199
Dealing with Stress: Homeostasis	202
Answers to Questions on the Endocrine System	204
<b>PART 4: FEED AND FUEL: SUPPLY AND TRANSPORT</b>	207
<b>CHAPTER 11: Spreading the Love: The Cardiovascular System</b>	209
Moving to the Beat of a Pump	209
Finding the Key to the Heart's Chambers	213
The atria	213
The ventricles	214
Conducting the Heart's Music	218
The orchestra	218
The music	219
The performance	220
Riding the Network of Blood Vessels	223
Withstanding the pressure	224
Capillary exchange	225
Answers to Questions on the Cardiovascular System	227

<b>CHAPTER 12: Keeping Up Your Defenses: The Lymphatic System</b>	231
Duct, Duct, Lymph	231
Poking at the Nodes	235
Having a Spleen-did Time with the Lymphatic Organs	238
Reuse and recycle: The spleen	238
T cell central: The thymus gland	239
Open wide and move along: The tonsils and Peyer's patches	239
Investigating Immunity	242
Innate defenses	242
Adaptive defenses	243
Answers to Questions on the Lymphatic System	245
<b>CHAPTER 13: Oxygenating the Machine: The Respiratory System</b>	249
Breathing In the Basics	250
Preparing the Air	254
Knowing about the nose (and sinuses)	254
Dealing with throaty matters	257
Swapping the bad for the good	260
Answers to Questions on the Respiratory System	263
<b>CHAPTER 14: Fueling the Functions: The Digestive System</b>	265
Digesting the Basics: It's Alimentary!	265
Nothing to Spit At: Into the Mouth and Past the Teeth	268
Entering the vestibule	269
Moving along the oral cavity	270
Stomaching the Body's Fuel	274
Breaking Down the Work of Digestive Enzymes	277
The small intestine	277
The liver	279
The pancreas	280
One Last Look Before Leaving	282
The appendix	282
The large intestine	282
Answers to Questions on the Digestive Tract	284
<b>CHAPTER 15: Filtering Out the Junk: The Urinary System</b>	287
Examining the Kidneys, the Body's Filters	288
Kidney structure	288
Going microscopic	288
Focusing on Filtering	292
Retaining water	292
Controlling blood volume	294
Getting Rid of the Waste	296
Surfing the ureters	296
Ballooning the bladder	296
Distinguishing the male and female urethras	296
Spelling relief: Urination	297
Answers to Questions on the Urinary System	299

<b>PART 5: SURVIVAL OF THE SPECIES</b> .....	301
<b>CHAPTER 16: Why Ask Y? The Male Reproductive System</b> .....	303
Identifying the Parts of the Male Reproductive System .....	303
Packaging the Chromosomes for Delivery .....	309
Answers to Questions on the Male Reproductive System .....	315
<b>CHAPTER 17: Carrying Life: The Female Reproductive System</b> .....	317
Identifying the Female Reproductive Parts and Their Functions .....	318
External genitalia .....	318
Internal genitalia .....	318
Gamete production .....	319
Making Eggs: A Mite More Meiosis .....	324
Making Babies: An Introduction to Embryology .....	325
Growing from Fetus to Baby .....	327
Parturition .....	329
Growing, Changing, and Aging .....	330
Answers to Questions on the Female Reproductive System .....	333
<b>PART 6: THE PART OF TENS</b> .....	337
<b>CHAPTER 18: Ten Study Tips for Anatomy and Physiology Students</b> .....	339
Writing Down Important Stuff in Your Own Words .....	339
Gaining Better Knowledge through Mnemonics .....	340
Discovering Your Learning Style .....	340
Getting a Grip on Greek and Latin .....	341
Connecting with Concepts .....	341
Forming a Study Group .....	342
Outlining What's to Come .....	342
Putting In Time to Practice .....	342
Sleuthing Out Clues .....	343
Reviewing Your Mistakes .....	343
<b>CHAPTER 19: Ten Fun Physiology Facts</b> .....	345
Boning Up on the Skeleton .....	345
Flexing Your Muscles .....	346
Fighting Biological Invaders .....	346
Cells Hair, There, and Everywhere .....	347
Swallowing Some Facts about Saliva and the Stomach .....	347
Appreciating the Extent of the Cardiovascular System .....	347
"You're Glowing" Isn't Just an Expression .....	348
Looking at a Few of Your Extra Parts .....	348
Understanding Your Brain on Sleep .....	349
Getting Sensational News .....	349
<b>INDEX</b> .....	351



# Introduction

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Whether your aim is to become a physical therapist or a pharmacist, a doctor or an acupuncturist, a nutritionist or a personal trainer, a registered nurse or a paramedic, a parent or simply a healthy human being — your efforts have to be based on a good understanding of anatomy and physiology. But knowing that the knee bone connects to the thigh bone (or does it?) is just the tip of the iceberg. In *Anatomy & Physiology Workbook For Dummies*, 3rd Edition, you discover intricacies that will leave you agog with wonder. The human body is a miraculous biological machine capable of growing, interacting with the world, and even reproducing despite any number of environmental odds stacked against it. Understanding how the body's interlaced systems accomplish these feats requires a close look at everything from chemistry to structural mechanics.

Early anatomists relied on dissections to study the human body, which is why the Greek word *anatomia* means “to cut up or dissect.” Anatomical references have been found in Egypt dating back to 1600 BC, but it was the Greeks — Hippocrates, in particular — who first dissected bodies for medical study around 420 BC. That's why more than two millennia later we still use words based on Greek and Latin roots to identify anatomical structures.

That's also part of the reason so much of the study of anatomy and physiology feels like learning a foreign language. Truth be told, you are working with a foreign language, but it's the language of you and the one body you're ever going to have.

## About This Book

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This workbook isn't meant to replace a textbook, and it's certainly not meant to replace going to an actual anatomy and physiology class. It is designed as a supplement to your ongoing education and as a study aid in prepping for exams. That's why we give you insight into what your instructor most likely will emphasize as you move from one body system or structure to the next.

Your coursework might cover things in a different order than we've chosen for this book. We encourage you to take full advantage of the table of contents and the index to find the material addressed in your class. Whatever you do, certainly don't feel obligated to go through this workbook in any particular order. However, please do answer the practice questions and check the answers at the end of each chapter because, in addition to answers, we clarify why the right answer is the right answer and why the other answers are incorrect; we also provide you with memory tools and other tips whenever possible.

Within this book, you may note that some web addresses break across two lines of text. If you're reading this book in print and want to visit one of these web pages, simply key in the web address exactly as it's noted in the text, pretending as though the line break doesn't exist. If you're reading this as an e-book, you've got it easy — just click the web address to be taken directly to the web page.

## Foolish Assumptions

In writing *Anatomy & Physiology Workbook For Dummies*, 3rd Edition, we had to make some assumptions about you, the reader. If any of the following apply, this book's for you:

- » You're an advanced high school student or college student trying to puzzle out anatomy and physiology for the first time.
- » You're a student at any level who's returning to the topic after some time away, and you need some refreshing.
- » You're facing an anatomy and physiology exam and want a good study tool to ensure that you have a firm grasp of the topic.

Because this is a workbook, we had to limit our exposition of each and every topic so that we could include lots of practice questions to keep you guessing. (Believe us, we could go on forever about this anatomy and physiology stuff!) In leaving out some of the explanation of the topics covered in this book, we assume that you're not just looking to dabble in anatomy and physiology and therefore have access to at least one textbook on the subject.

## Icons Used in This Book

Throughout this book, you'll find symbols in the margins that highlight critical ideas and information. Here's what they mean:



TIP

The Tip icon gives you juicy tidbits about how best to remember tricky terms or concepts in anatomy and physiology. It also highlights helpful strategies for fast translation and understanding.



REMEMBER

The Remember icon highlights key material that you should pay extra attention to in order to keep everything straight.



WARNING

This icon — otherwise known as the Warning icon — points out areas and topics where common pitfalls can lead you astray.



EXAMPLE

The Example icon marks questions for you to try your hand at. We give you the answer straightaway to get your juices flowing and your brain warmed up for more practice questions.



# Beyond the Book

In addition to the material in the print or e-book you're reading right now, this product also comes with some access-anywhere goodies on the web. While it's important to study each anatomical system in detail, it's also helpful to know how to decipher unfamiliar anatomical terms the first time you see them. Check out the free Cheat Sheet by going to [www.dummies.com](http://www.dummies.com) and typing for "Anatomy & Physiology Workbook For Dummies cheat sheet" in the Search box.

You also get access to our online database of questions with even more practice for you. It contains an interactive quiz for each chapter, allowing you to hone your new knowledge even more!

To gain access to the online practice, all you have to do is register. Just follow these simple steps:

1. **Register your book or ebook at Dummies.com to get your PIN. Go to [www.dummies.com/go/getaccess](http://www.dummies.com/go/getaccess).**
2. **Select your product from the dropdown list on that page.**
3. **Follow the prompts to validate your product, and then check your email for a confirmation message that includes your PIN and instructions for logging in.**

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Now you're ready to go! You can come back to the practice material as often as you want — simply log on with the username and password you created during your initial login. No need to enter the access code a second time.

Your registration is good for one year from the day you activate your PIN.

# Where to Go from Here

If you purchased this book and you're already partway through an anatomy and physiology class, check the table of contents and zoom ahead to whichever segment your instructor is covering currently. When you have a few spare minutes, review the chapters that address topics your class already has covered. It's an excellent way to prep for a midterm or final exam.

If you haven't yet started an anatomy and physiology class, you have the freedom to start wherever you like (although we suggest that you begin with Chapter 1) and proceed onward and upward through the glorious machine that is the human body!



1

# **The Building Blocks of the Body**

### IN THIS PART . . .

Learn the language of anatomy and physiology.

Explore the basic building blocks and functions that make the parts of the body what they are. Dig into atoms, elements, chemical reactions, and metabolism.

Crack open the cell to see what's happening at life's most fundamental level. Find out about the cell membrane, the nucleus, organelles, proteins, and the cell life cycle.

Plunge into cell division, which has several phases: interphase, prophase, metaphase, anaphase, telophase, and cytokinesis.

Use histology to build all of the body's tissues — epithelial, connective, muscular, and nervous — from the inside out.

- » Learning to speak the language
- » Casing the cavities
- » Orienting yourself to the body

## Chapter 1

# The Language of Anatomy & Physiology

**H**uman *anatomy* is the study of our bodies' structures while *physiology* is how they work. It makes sense, then, to learn the two in tandem. But before we can dive in to the body systems and their intricate structures, you must first learn to speak the language of the science.

## Organization of the Body

As you know, the body is organized into systems, grouping together the organs that work together to achieve a common goal. To house all these organs, our body must create spaces to hold them. The body has two cavities that achieve this: the *dorsal cavity*, which holds the brain and spinal cord and the *ventral cavity* that holds everything else. The dorsal cavity splits into the *spinal cavity*, which holds the spinal cord, and the *cranial cavity* that houses the brain. The ventral cavity is split into the *thoracic cavity* and the *abdominopelvic cavity* by a large band of muscle called the *diaphragm*. Within the thoracic cavity are the right and left *pleural cavities*, which hold each lung, and the *mediastinum*. Within the mediastinum is the *pericardial cavity* which contains the heart. The abdominopelvic cavity divides into the *abdominal cavity* (with the stomach, liver, and intestines) and the *pelvic cavity* (with the bladder and reproductive organs), though there's no distinct barrier between the two.

In order to create these cavities within our bodies, we have membranes to border the space. The *visceral membrane* lies atop of the organs, making direct contact with them. For example, the

outermost layer of the heart is called the *visceral pericardium* and on the lungs it's the *visceral pleura*. The *parietal membrane* lies on the other side of the spaces or lining the cavity itself. So the lining of the abdominopelvic cavity is known as the *parietal peritoneum* (note that it's not the parietal abdominopelvic that just sounds weird).

The other parts of the body are divided into *axial* and *appendicular* areas. The axial portions are the parts of your body that form your axis — the head, chest, and abdomen. The appendicular portions form your appendages — your arms and legs. For consistency when referencing them, there are proper terms for all of the body's areas. The terminology used in identifying many of the regions is found in Table 1-1. You'll notice these terms popping up all over this book.

Table 1-1      The Body's Regions

Proper Term	Region	Proper Term	Region
Antebrachial	forearm	Genicular	knee
Antecubital	inner elbow	Inguinal	groin/inner thigh
Axillary	armpit	Lumbar	lower back
Brachial	upper arm	Mental	chin
Buccal	cheek	Orbital	eye
Carpal	wrist	Otic	ear
Cephalic	head	Pectoral	chest
Cervical	neck	Pedal	foot
Coxal	hip	Plantar	sole/bottom of foot
Crural	shin	Popliteal	back of knee
Cubital	elbow	Sural	calf
Dorsum	back	Tarsal	ankle
Femoral	thigh	Vertebral	backbone
Frontal	forehead		

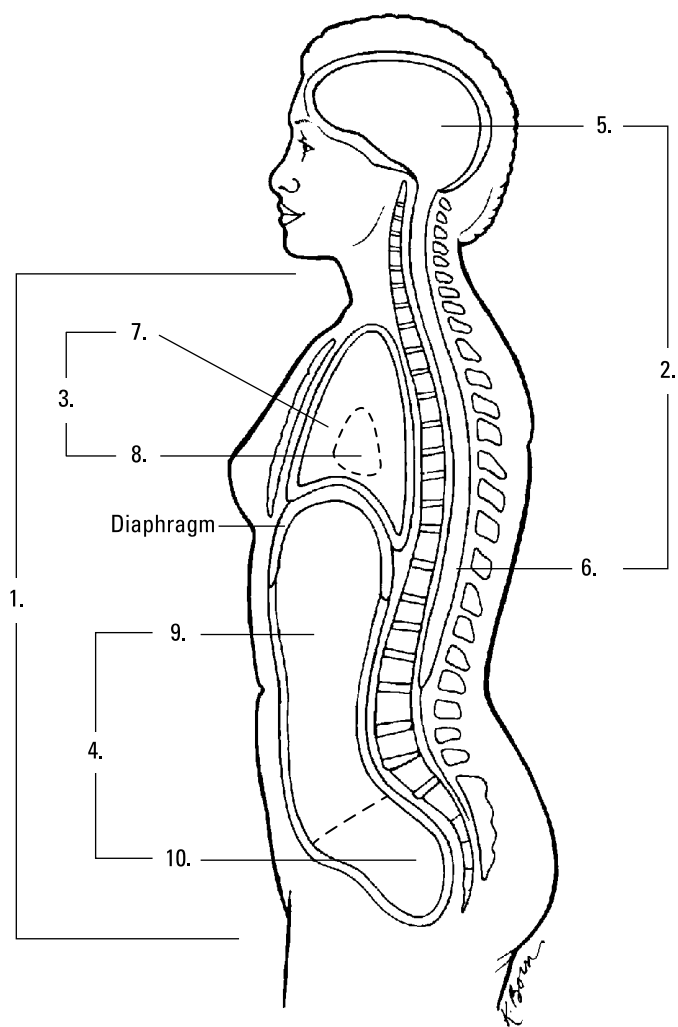
That's a lot of new terms for the first chapter! Let's see how well they're sticking.



- Q.** Which of the following organs would you find in the mediastinum?
- I. lungs
  - II. heart
  - III. liver
- a. I only
  - b. II only
  - c. III only
  - d. I & II
  - e. I, II, & III

**A.** The correct answer is only the heart. The mediastinum is defined as the area between the lungs and the liver is in the abdomino-pelvic cavity.

1-10 Label the body cavities illustrated in Figure 1-1.



**FIGURE 1-1:**  
Body  
cavities.

*Illustration by Kathryn Born, MA*

- a. Abdominal
- b. Abdominopelvic
- c. Cranial
- d. Dorsal
- e. Pelvic
- f. Pericardial
- g. Pleural
- h. Spinal
- i. Thoracic
- j. Ventral

11–16

Match the description to identify the membranes that create the body's cavities.

- a. parietal pericardium
- b. parietal peritoneum
- c. parietal pleura
- d. visceral pericardium
- e. visceral peritoneum
- f. visceral pleura

- 11 \_\_\_\_\_ The outermost layer encasing the heart
- 12 \_\_\_\_\_ The membrane that lies on the surface of the liver
- 13 \_\_\_\_\_ The surface of the heart
- 14 \_\_\_\_\_ The lining of the thoracic cavity
- 15 \_\_\_\_\_ The membrane making direct contact with the lungs
- 16 \_\_\_\_\_ The layer that lines the abdominopelvic cavity

17

True or False: The cephalic region is considered part of the appendicular body.

18

Which body part would be affected if you injured your tarsal region?

- a. knee
- b. wrist
- c. ankle
- d. shoulder
- e. hip

19

If you suffered a laceration (cut) to your chin, the injury would be located in the \_\_\_\_\_ region.

- a. cubital
- b. cervical
- c. buccal
- d. mental
- e. frontal



20 Identify the correct pairing of terms:

- a. popliteal – inner elbow
- b. lumbar – back of the neck
- c. antecubital – upper arm
- d. coxal – shoulder
- e. sural – back of lower leg

## Getting into Position

In anatomy and physiology, we often identify the body's features in reference to other body parts. Because of this, we need a standardized point of reference, which is known as *anatomical position*.



REMEMBER

Anatomical position is the body facing forward, feet pointed straight ahead, arms resting on the sides, with the palms turned outward. Unless you are told otherwise, this is the body's position whenever specific body parts are described in reference to other locations.

Because we can only see the external surface of the body, sections must be made in order for us to see what's inside. It's important to take note of what type of section was made to provide the view you see in a picture or diagram. There are three planes (directions) in which sections can be made:

- » **frontal:** separating the front from the back
- » **sagittal:** dividing right and left sides
- » **transverse:** creating top and bottom pieces

We also use directional terms to describe the location of structures. It helps to learn them as their opposing pairs to minimize confusion. The most commonly used terms are:

- » **anterior/posterior:** in front of/behind
- » **superior/inferior:** above/below
- » **medial/lateral:** closer to/further from the midline (also used with rotation)
- » **superficial/deep:** closer to/further from the body surface
- » **proximal/distal:** closer to/further from attachment point (used for appendages)



WARNING

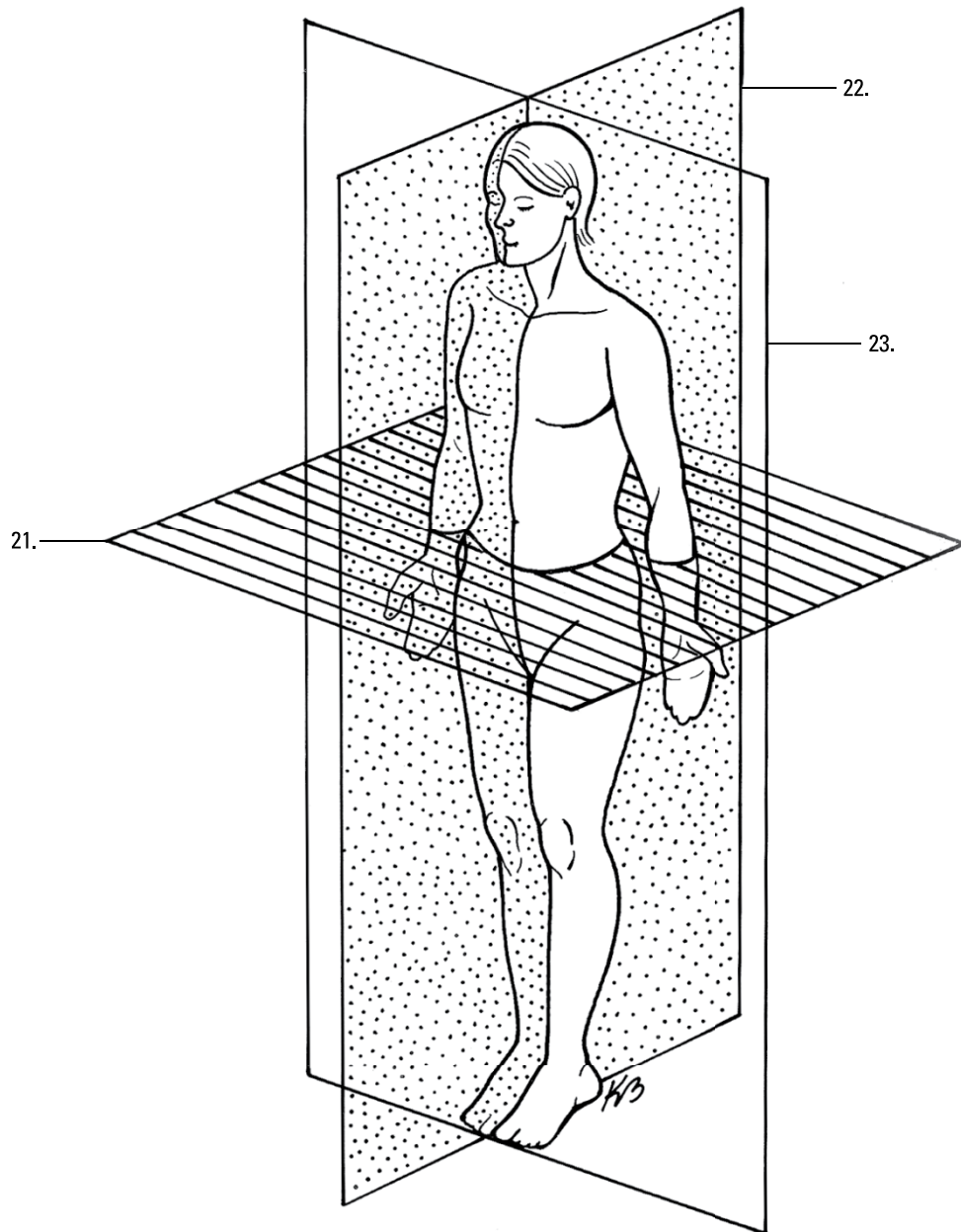
Right and left are also used quite often but be careful! They refer to the patient's right and left, not yours.

You got it? Let's find out.

21-23

Identify the planes of body sections in Figure 1-2.

- a. Sagittal
- b. Transverse
- c. Frontal



**FIGURE 1-2:**  
The body's  
planes.

*Illustration by Kathryn Born, MA*

Fill in the blanks.

- 24 The neck is \_\_\_\_\_ to the hips.
- 25 The lungs are \_\_\_\_\_ to the rib cage.
- 26 The nose is \_\_\_\_\_ to the ears.
- 27 The wrist is \_\_\_\_\_ to the shoulder.
- 28 The buttocks are \_\_\_\_\_ to the navel (belly button).

# Answers to Questions on Terminology

The following are answers to the practice questions presented in this chapter.

- 1-10 Figure 1-1 should be labeled as follows:  
1. **j.** ventral, 2. **d.** dorsal, 3. **i.** thoracic, 4. **b.** abdominopelvic, 5. **c.** cranial, 6. **h.** spinal, 7. **g.** pleural, 8. **f.** pericardial, 9. **a.** abdominal, 10. **e.** pelvic
- 11 The outermost layer encasing the heart: **a. parietal pericardium**
- 12 The membrane that lies on the surface of the liver: **e. visceral peritoneum**
- 13 The surface of the heart: **d. visceral pericardium**
- 14 The lining of the thoracic cavity: **c. parietal pleura**
- 15 The membrane making direct contact with the lungs: **f. visceral pleura**
- 16 The layer that lines the abdominopelvic cavity: **b. parietal peritoneum**



TIP

Don't memorize all nine terms (cavities included), memorize the naming system. The space is always the cavity and the visceral layer is always making direct contact with an organ. The pattern holds true everywhere (except for surrounding the brain and spinal cord; they're special).

- 17 The cephalic region is considered part of the appendicular body. **False.** The cephalic region is the head and though it does stick off the trunk, it's axial. Only the arms and legs are appendicular.
- 18 Which body part would be affected if you injured your tarsal region? **c. ankle**
- 19 If you suffered a laceration (cut) to your chin, the injury would be located in the **d. mental** region.
- 20 Identify the correct pairing of terms: **e. sural – back of lower leg**
- 21-23 Figure 1-2 should be labeled as follows: 21. **b.** transverse, 22. **a.** sagittal, 23. **c.** frontal
- 24 The neck is superior to the hips.
- 25 The lungs are deep to the ribcage.
- 26 The nose is medial to the ears.
- 27 The wrist is distal to the shoulder.
- 28 The buttocks are posterior to the navel (belly button).

- » Getting to the heart of all matter: Atoms
- » Checking into chemical reactions and compounds
- » Making sense of metabolism

## Chapter 2

# The Chemistry of Life

**W**e can hear your cries of alarm. You thought you were getting ready to learn about the knee bone connecting to the thigh bone. How in the heck does that involve (horrors!) *chemistry*? As much as you may not want to admit it, chemistry — particularly *organic chemistry*, the branch of the field that focuses on carbon-based molecules — is a crucial starting point for understanding how the human body works. When all is said and done, the universe boils down to two fundamental components: *matter*, which occupies space and has mass; and *energy*, the ability to do work or create change. In this chapter, we review the interactions between matter and energy to give you some insight into what you need to know to ace those early-term tests.

## Building from Scratch: Atoms and Elements

All matter — be it solid, liquid, or gas — is composed of atoms. An *atom* is the smallest unit of matter capable of retaining the identity of an element during a chemical reaction. An *element* is a substance that can't be broken down into simpler substances by normal chemical reactions (the ones on the periodic table that you may have had to memorize at some point). There are 98 naturally occurring elements in nature (though 10 of these have only ever been observed in trace amounts) and 20 (at last count) artificially created elements for a total of 118 known elements. The periodic table of elements organizes all the elements by name, symbol, atomic

weight, and atomic number. The *bulk elements* of interest to students of anatomy and physiology are

- » **Oxygen:** Symbol O
- » **Carbon:** Symbol C
- » **Hydrogen:** Symbol H
- » **Nitrogen:** Symbol N
- » **Phosphorus:** Symbol P
- » **Sulfur:** Symbol S



TIP

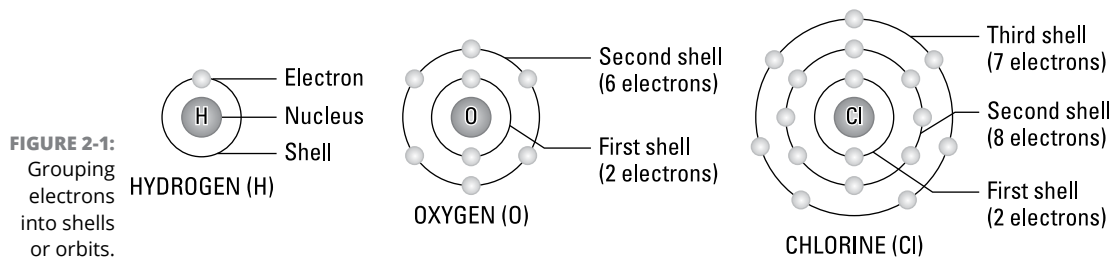
These six elements make up 95 percent of all living material. Just remember CHNOPS (read: chin-ops).



REMEMBER

Atoms are made up of the subatomic particles *protons* and *neutrons*, which are in the atom's *nucleus*, and clouds of *electrons* orbiting the nucleus. The *atomic weight*, or *mass*, of an atom is the total number of protons and neutrons in its nucleus. The *atomic number* of an atom is its number of protons; conveniently, atoms that are electrically neutral have the same number of positive charges as negative charges. Opposite charges attract, so negatively charged electrons are attracted to positively charged protons. The attraction holds electrons in orbits outside the nucleus. The more protons there are in the nucleus, the stronger the atom's positive charge is and the more electrons it can attract.

- » The first shell holds only two electrons.
- » The second and third shells hold eight electrons each.
- » The fourth shell (which can be found in elements such as potassium, calcium, and iron) holds up to 18 electrons. Higher shells also exist that hold even more electrons.



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Other key chemistry terms that you need to know are

- » **Isotopes:** Atoms of an element that have a different number of neutrons and a different atomic weight than usual. In other words, isotopes are alternate forms of the same chemical element, so they always have the same number of protons as that element but a different number of neutrons. The two most common in the body are potassium 40 and carbon 14.