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- Learning to speak the language
- Orienting yourself to the body
- Exploring the body's regions

Chapter 1

Learning a New Language: How to Speak Fluent A&P

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

A Word about Jargon

Why does science have so many funny words? Why can't scientists just say what they mean, in plain English? Good question! The answer is a great place to start this chapter.

Scientists need to be able to communicate with others in their field, just like in any other career. They develop vocabularies of technical terminology and other forms of jargon so they can better communicate with colleagues. It's important that both the scientist sending the information and the one receiving it use the same words to refer to the same phenomenon. They say what they mean (most of them, most of the time, to the best of their ability), but what they mean can't be said in the English language that people use to talk about routine daily matters. As a result, we get jargon. And while it seems like an unnecessary obstacle on your course of learning something new, jargon is a good and needed thing.

Consider this. We're sitting on a porch, enjoying a cool evening, and I say to you, "Hey! You got any tea?" You would likely offer whatever variety of hot tea you have (or kindly say that you don't have any). Nothing too confusing there, right? If I were to ask my son (or any teenager, really) the same question, I wouldn't be getting a refreshing beverage; I'd be getting the latest gossip. You know what I meant because the word *tea* means the same thing to us. But to my son, it's like jargon.

To understand anatomy and physiology, you must know and use the same terminology as those in the field. The jargon can be overwhelming at first, but understanding the reason for it and taking the time to learn it before diving into the complicated content will make your learning experience less painful.

A great way to start is to take a moment to look at just how these complicated terms are created. The words sound foreign to us because they're derived from Greek and Latin. Unlike other languages, those haven't changed in centuries. *Mono* has always meant *one*, but I don't even know what *cool* means anymore (except that my son says I'm not it!). In science, anatomy included, things are named by putting the relevant word roots together. Let's look at the word *dermatitis.* The root *derm-* means *skin*, and *-itis* means *inflammation*. Put them together, and you get skin inflammation, commonly referred to as a rash. Table 1-1 gets you going with a list of commonly used word roots in anatomy and physiology, matched up with the body system in which you'll likely encounter them.

TIP

Every time you come across an anatomical or physiological term that's new to you, see whether you recognize any parts of it. Using this knowledge, go as far as you can in guessing the meaning of the whole term. After studying Table 1-1 and the other vocabulary lists in this chapter, you should be able to make some pretty good guesses!

Table 1-1 Technical Anatomical Word Fragments

Body System	Root or Word Fragment	Meaning
Skeletal	os-, oste-, arth-	bone, joint
Muscular	myo-, sarco-	muscle, striated muscle
Integument	derm-	skin
Nervous	neur-	nerve
Endocrine	aden-, estr-	gland, steroid
Cardiovascular	card-, angi-, hema-, vaso-	heart (muscle), vessel, blood vessels
Respiratory	pulmon-, bronch-	lung, windpipe
Digestive	gastr-, enter-, dent-, hepat-	stomach, intestine, teeth, liver
Urinary	ren-, neph-, ur-	kidney, urinary
Lymphatic	lymph-, leuk-, -itis	lymph, white, inflammation
Reproductive	andr-, uter-	male, uterine

Looking at the Body from the Proper Perspective

Remember that story about your sister's friend's boyfriend's uncle who went in to have a foot amputated, only to awaken from surgery to find that the surgeon removed the wrong one? This story highlights the need for a consistent perspective to go with the jargon. Terms that indicate direction make no sense if you're looking at the body the wrong way. You likely know your right from your left, but ignoring perspective can get you all mixed up. This section shows you the anatomical position, planes, regions, and cavities, as well as the main membranes that line the body and divide it into major sections.

Getting in position

Stop reading for a minute and do the following: Stand up straight. Look forward. Let your arms hang down at your sides and turn your palms so they're facing forward. You are now in *anatomical position* (see Figure 1-1). Any time the position of one structure is compared with another, the relationship comes from the body in this position.

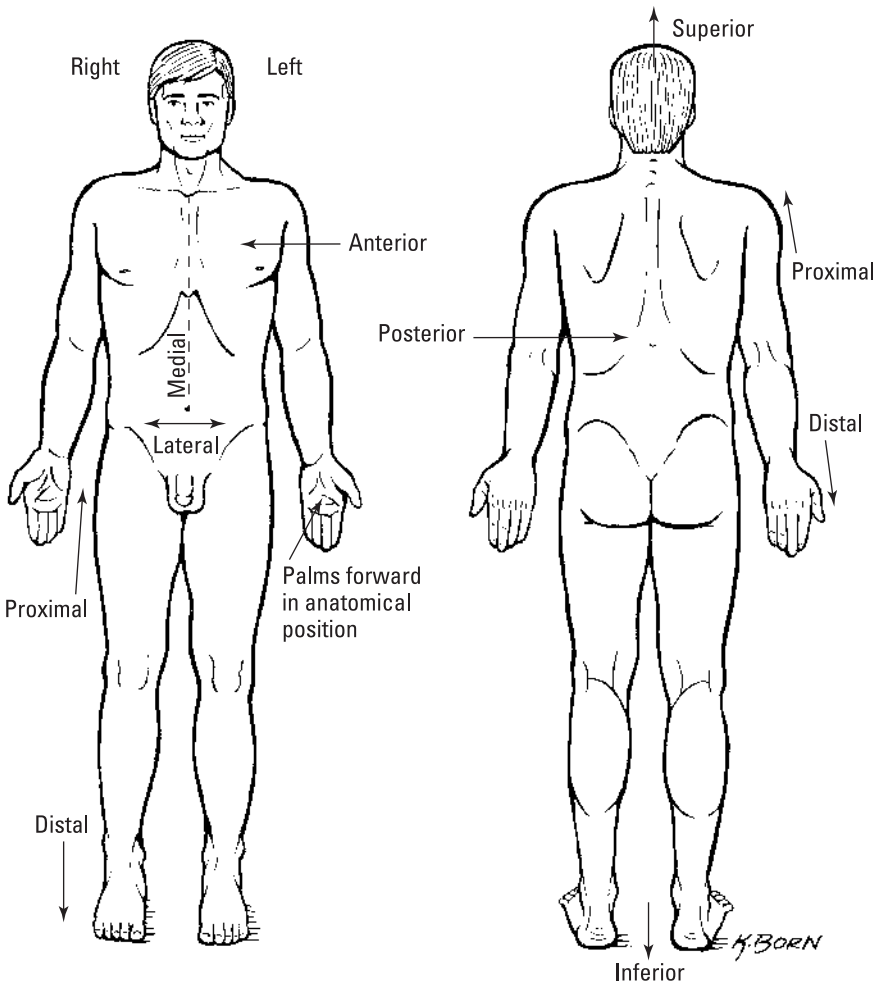

FIGURE 1-1: The standard anatomical position.

Illustration by Kathryn Born, MA

REMEMBER

Unless you're told otherwise, any reference to location (diagram or description) assumes this position. Using anatomical position as the standard removes confusion.

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
- **Ventral/dorsal:** toward the stomach/back (in humans, these mean the same as anterior/posterior)
- **Superior/inferior:** above/below
- **Medial/lateral:** closer to/farther from the midline (also used with rotation)
- **Superficial/deep:** closer to/farther from the body surface
- **Proximal/distal:** closer to/farther from the 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.

Dividing the anatomy

Because we can see only the external surface of the body, *sections* (cuts, in other words) must be made 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. As illustrated in Figure 1-2, There are three planes (directions) in which these can be made:

- **Frontal:** Divides the body or organ into anterior and posterior portions. Think front and back. This plane is also referred to as *coronal.*
- **Sagittal:** Divides the body or organ lengthwise into right and left sections. If the vertical plane runs exactly down the middle of the body, it's referred to as the *midsagittal plane.*
- **Transverse:** Divides the body or organ horizontally, into superior and inferior portions, or top and bottom. Diagrams from this perspective can be quite disorienting. Think of this plane in terms of a body opened at the waist like taking a lid off a box; viewing a transverse diagram is like peering down at the box's contents (and trying to not be disappointed that there's no puppy inside).

The three planes provide an important reference; but don't expect the structures of the body, and especially the joints, to line up or move along the standard planes. It's also important to note that anatomical planes don't always create two equal portions, and to further complicate matters, they can also "pass through" the body at an angle, which is called an *oblique section*. Additionally, any cylindrical structure, such as blood vessels or intestines, can be cut straight across (a *cross section*) or lengthwise (a *longitudinal section*).

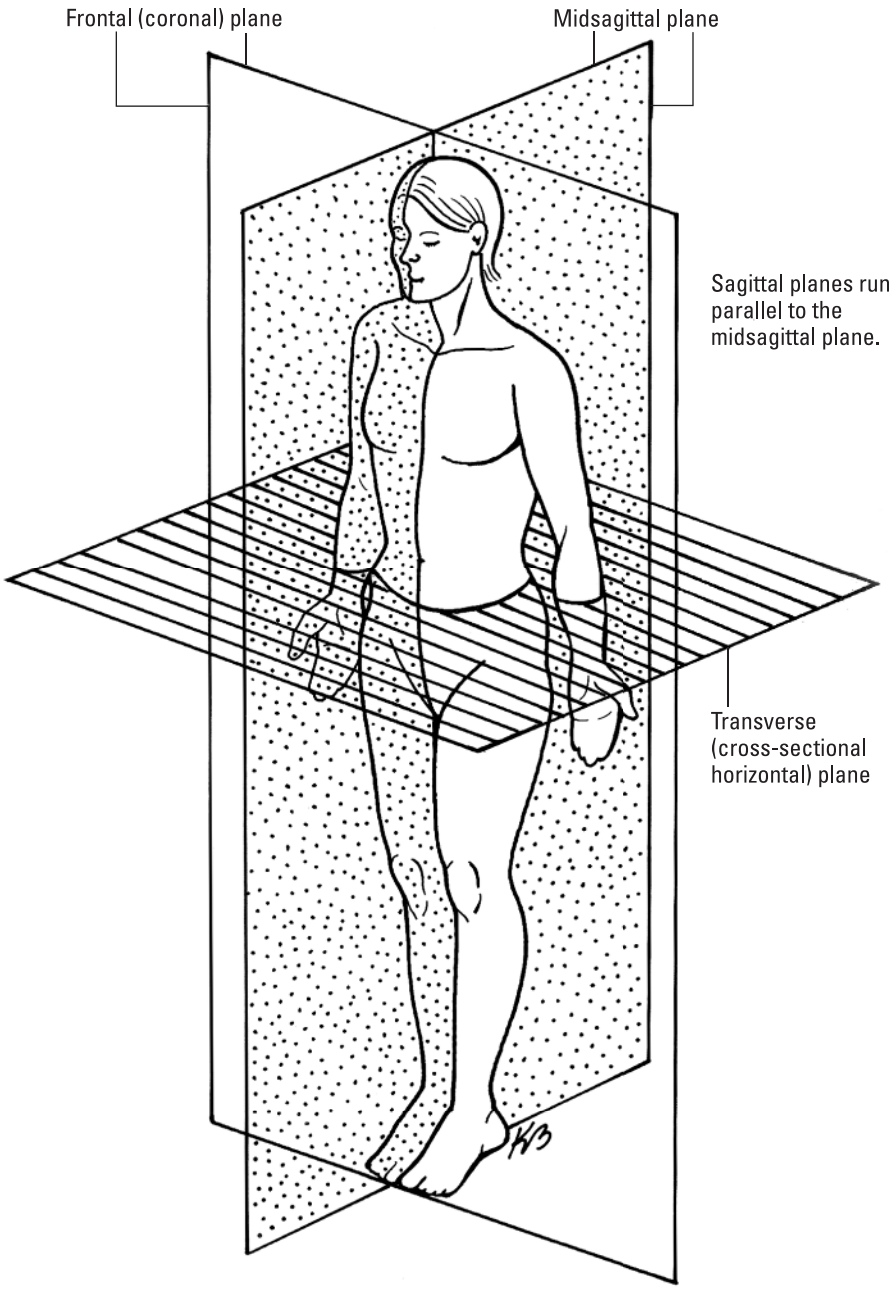

FIGURE 1-2: Planes of the body: frontal, sagittal, and transverse.

Illustration by Kathryn Born, MA

Mapping the regions

The anatomical planes orient you to the human body, but the *regions* compartmentalize it. Just like on a map, a region refers to a certain area. The body is divided into two major portions: axial and appendicular. The *axial body* runs right down the center (axis) and consists of everything except the limbs, meaning the head, neck, thorax (chest and back), abdomen, and pelvis. The *appendicular body* consists of appendages, otherwise known as *upper and lower*

extremities (which you call arms and legs). The proper terms for all the body's regions are shown in Figures 1-3 and 1-4.

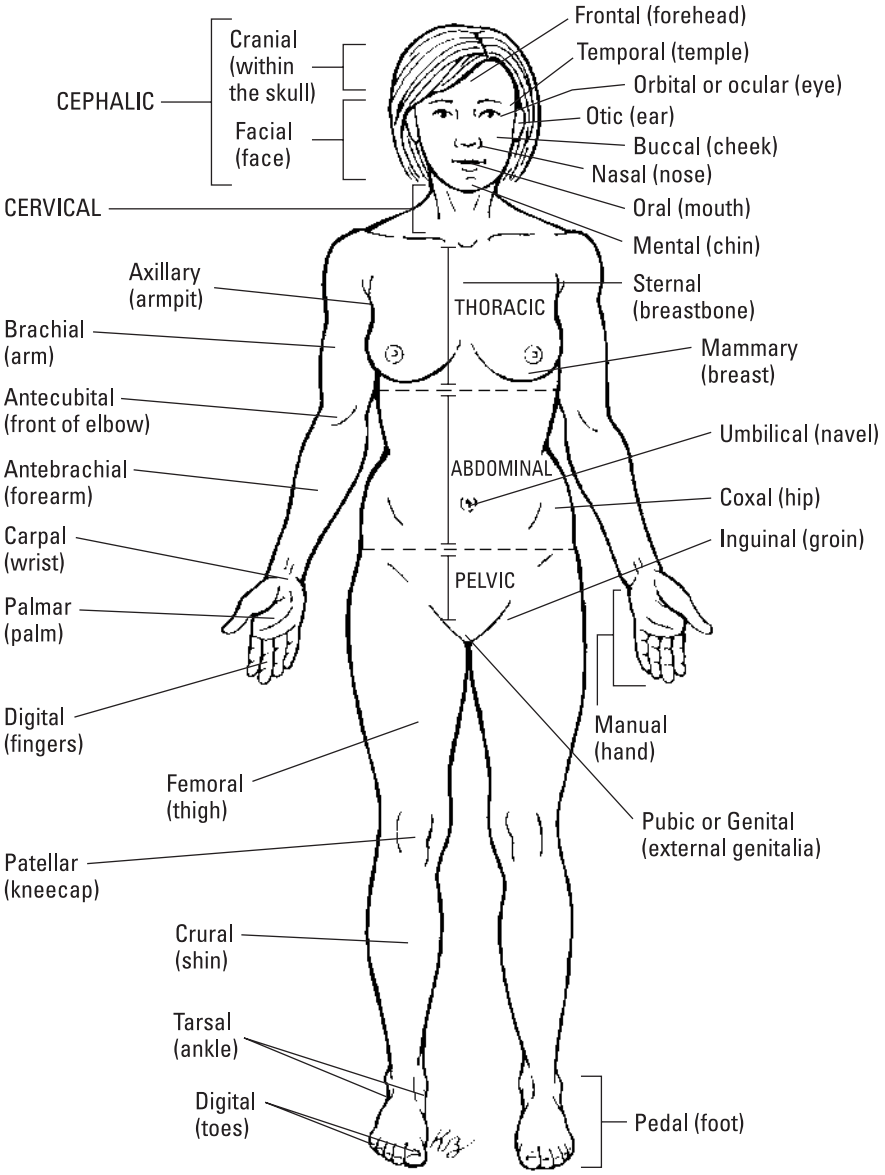

FIGURE 1-3: The body's regions: Anterior view.

Illustration by Kathryn Born, MA

WARNING

It's helpful to practice these terms both visually (on a diagram) and descriptively, especially since you'll see them popping up throughout this book.

Additionally, the abdomen is divided into quadrants and regions. The midsagittal plane and a transverse plane intersect at an imaginary axis passing through the body at the *umbilicus* (navel or belly button). This axis divides the abdomen into *quadrants* (four sections). Putting an imaginary cross on the abdomen creates the right upper quadrant, left upper quadrant, right lower

quadrant, and left lower quadrant. Physicians take note of these areas when a patient describes symptoms of abdominal pain.

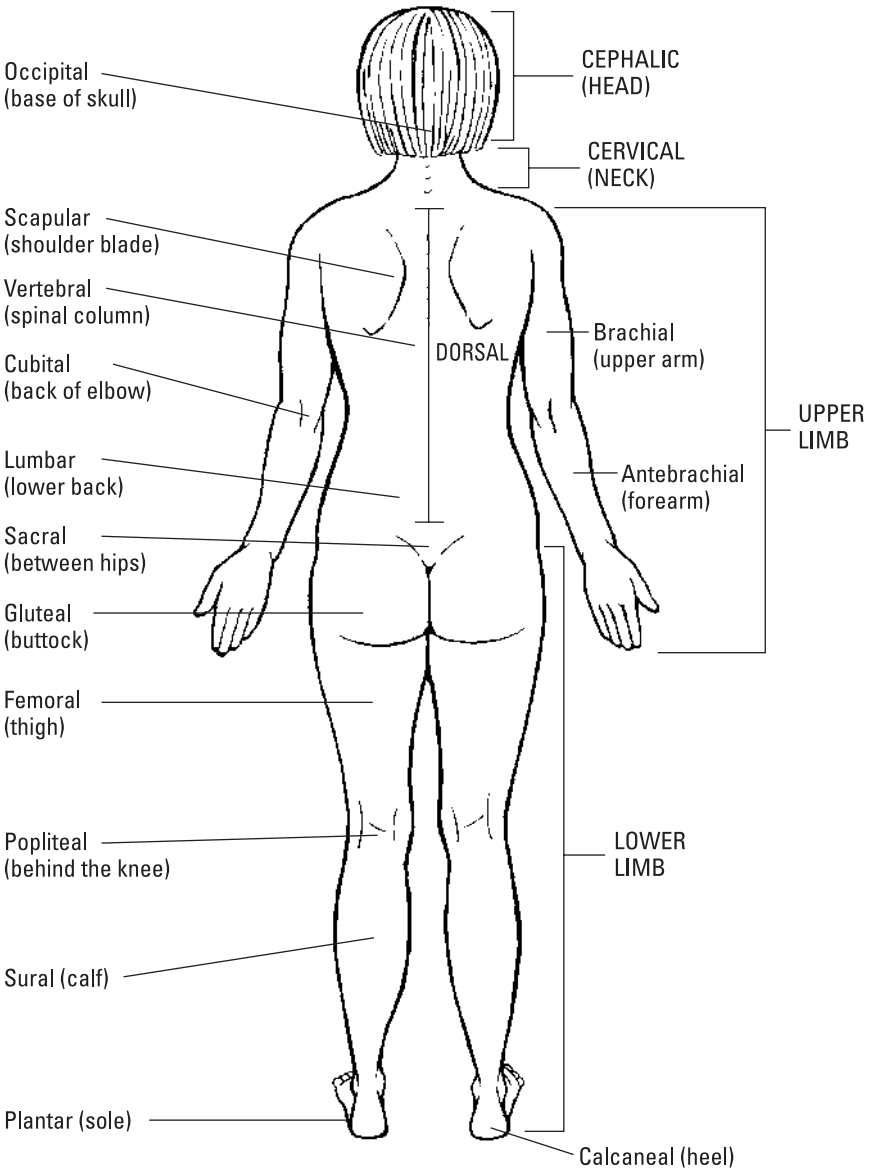

Illustration by Kathryn Born, MA

FIGURE 1-4: The body's regions: Posterior view.

The regions of the abdominopelvic cavity include the following:

- **Epigastric:** The central part of the abdomen, just above the navel.
- **Hypochondriac:** Doesn't moan about every little ache and illness, but lies to the right and left of the epigastric region and just below the cartilage of the rib cage. (*Chondral* means *cartilage,* and *hypo* means *below.*)

- **Umbilical:** The area around the umbilicus.
- **Lumbar:** Forms the region of the lower back to the right and left of the umbilical region.
- **Hypogastric:** Below the stomach and in the central part of the abdomen, just below the navel.
- **Iliac:** Lies to the right and left of the hypogastric regions near the hip bones.

Casing your cavities

Now let's dig a little deeper. When looking at the body regions of our trunk, there's more organization to be considered. We can't just shove all our internal organs between some muscles and fat; neither could we pick them all up and just pile them in a big, empty space. To house all these organs, our body must create structured spaces to hold them. We have two cavities that achieve this purpose: the *dorsal cavity,* which holds the brain and spinal cord, and the *ventral cavity,* which holds everything else. The dorsal cavity splits into the *vertebral* (spinal) *cavity,* which holds the spinal cord, and the *cranial cavity,* which 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 trachea, esophagus, and thymus gland. (The organs listed are within the mediastinum but not the pericardial cavity, it's misleading with the edits that were made.) 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.

Serous membranes are created to define the cavities, lining the walls and covering the organs contained within. The thin layers release a slippery *(serous)* fluid that reduces friction. The *visceral membrane* lies atop of the organs, making direct contact with them. The outermost layer of the heart, for example, is called the *visceral pericardium,* and on the lungs, that layer is 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.)

WARNING

When identifying the layers of the body cavities, visually or descriptively, it helps to think of the terms instead of the structures. That is, you have two columns of information:

Layer	Place
parietal (wall)	pericardial (heart)
visceral (organ)	pleural (lungs)
cavity (space)	peritoneal (everything else)

Everything is identified by choosing one word from each column. That's much easier than remembering nine structures.

Getting Organized

When you think about learning anatomy and physiology, you likely think about humans as *organisms* — living beings that function as a whole. Then you might recall learning in grade school about the *levels of organization* of our bodies:

organism ← organ systems ← organs ← tissues ← cells ← molecule

"Wait," you might say. "I thought there were only five levels of organization, so why are there six here? And why are the arrows backward?"

Traditionally, scientists have ended the levels with cells — the smallest things that can be considered to be alive. It doesn't take a long swim in the pool of physiology, though, to see that our bodies' actions are carried out by macromolecules, such as proteins, or even just ions (Chapter 2 discusses what those things are) — hence, the six levels. Sometimes, you'll see atoms added as the seventh level.

About those backward arrows: You often see the levels of organization listed in the opposite order. A group of cells working together to achieve the same goal is a tissue, a group of tissues working together creates an organ, and so on. In this section, though, I start with you — your whole self. Then I'll break you down and build you back up as the book progresses.

Level 1: The organism level

This level is the real you; the good, the bad, and the ugly (I mean, beautiful). The entire context of anatomy and physiology is looking at how all the structures support you on the organism level, keeping you the best version of yourself that you can be!

Level 2: The organ system level

Human anatomists and physiologists have divided the human body into *organ systems* — groups of organs that work together to meet a major physiological need. The digestive system, for example, is the organ system responsible for obtaining energy from the environment. Realize, though, that this isn't a classification system for your organs. That is, each organ isn't placed in a single system; the systems are defined by the function they carry out. Organs can "belong" to more than one system. The pancreas, for example, produces enzymes that are vital to the breakdown of our food (digestive system), as well as hormones to maintain the balance of the body's many chemicals (endocrine system).

The chapter structure of this book is based on the definition of organ systems.

Level 3: The organ level

An *organ* is a group of tissues (at least two types) assembled to perform a specialized physiological function. The stomach, for example, is an organ that has the function of breaking down food, and the function of the biceps muscle is to move your forearm. This level is where the labeling fun begins. If only it were also where it ends!

Level 4: The tissue level

A *tissue* is a structure made of many cells — sometimes many different kinds of cells — that performs a specific function. Tissues are divided into four categories:

- **Connective tissue** serves to support body parts and bind them together. Tissues as different as bone and fat are classified as connective tissue.
- **Epithelial tissue (epithelium)** lines and covers organs, and also carries out absorption and secretion. The outer layer of the skin is made up of epithelial tissue.
- **Muscle tissue** — surprise! — is found in the muscles (which allow your body parts to move), in the walls of hollow organs (such as intestines) to help move their contents along, and in the heart to move blood throughout the body. (Find out more about muscles in Chapter 7.)
- **Nervous tissue** carries out communication within out body. Nerves and the brain are made of nervous tissue. (I talk about the nervous system in Chapter 8.)

Level 5: The cellular level

If you examine a sample of any human tissue under a microscope, you see cells, possibly millions of them. All living things are made of cells. The work of the body actually occurs within the cells. Your whole heart beats to push blood around your body because the muscle cells that create its walls shorten, causing the heart to contract.

Level 6: The molecular level

Though you can't see *molecules* without an incredibly powerful microscope, the creation and interaction of them "do our physiology." Those heart muscle cells that shorten to cause contraction do so because the molecules (proteins) inside the cell pull on each other, causing them to overlap. Even the familiar organelles of a cell are just organized collections of molecules.

Following that logic, that's all any of us are – just a bunch of molecules hanging out. That concept kind of blows your mind — or, well, your molecules — doesn't it?

That was a lot of new terms for just the first chapter! Take a moment now to see how they're sticking.

Whaddya Know? Chapter 1 Quiz

Quiz time! Complete each problem to test your knowledge on the various topics covered in this chapter. You can find the solutions and explanations in the next section.

1 Fill in Table 1-2 with the common and proper terms of your body's regions.

Table 1-2 The Body's Regions

Proper Term	Common Term	Proper Term	Common Term
	ankle		shin
Coxal			shoulder
Popliteal		Frontal	
	upper arm		forearm
	eye	Mental	
Plantar		Carpal	
	calf	Axillary	
	head		foot
	hand	Otic	
Femoral		Sternal	
Lumbar		Antecubital	
	elbow	Bucchal	
	neck		fingers/toes

For questions 2–11, label the body cavities illustrated in Figure 1-5.

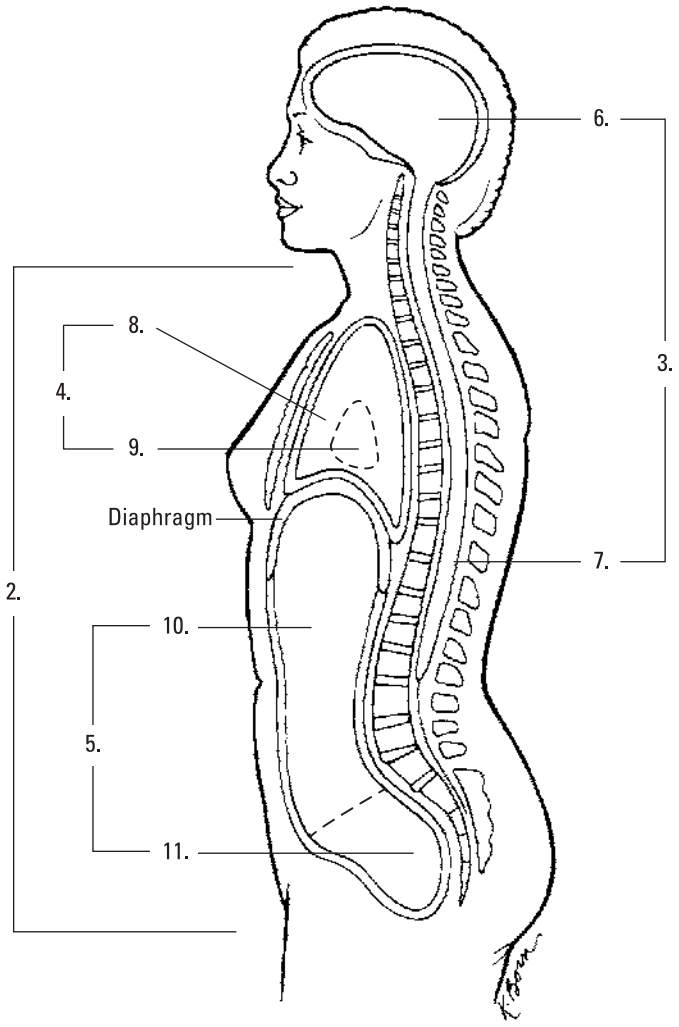

FIGURE 1-5:
Body cavities.

Illustration by Kathryn Born, MA

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

9 _____

10 _____

11 _____

For questions 12–15, identify the statement as true or false. When the statement is false, identify the error.

12 The cephalic region is considered to be part of the appendicular body.

13 The heart is located within the mediastinum, which is an area within the thoracic cavity.

14 An organ, by definition, has to be made up of at least two different tissues.

15 The terms *right* and *left* are dictated by the observer's perspective when the body is in anatomical position.

16 Which of the following correctly matches the section term with the description? Choose all that apply:

(a) Frontal: separates anterior from posterior

(b) Sagittal: separates left from right

(c) Longitudinal: separates lengthwise

(d) Transverse: separates superior from inferior

(e) Oblique: separates at an angle

17 Why don't we stop at cells when breaking down our bodies' levels of organization?

For questions 18–21, identify the abdominal regions by writing the corresponding letter from Figure 1-6.

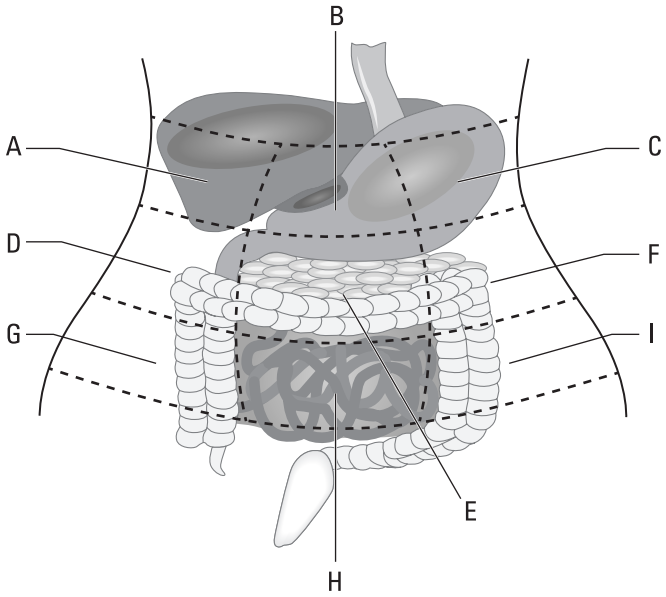

FIGURE 1-6: Abdominal regions.

18 _____ Left lumbar

19 _____ Hypogastric

20 _____ Iliac

21 _____Hypochondriac

To complete questions 22–26, fill in the correct directional terms.

22 The nose is _____ to the eyes.

23 The rib cage is _____ to the lungs.

24 The fingers are _____ wrist.

25 The back is _____ to the chest.

26 The shoulders are _____ to the knees.

For questions 27–32, match the descriptions 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

27 _____ The outermost layer encasing the heart

28 _____ The membrane that lies on the surface of the liver

29 _____ The surface of the heart

30 _____ The lining of the thoracic cavity

31 _____ The membrane that makes direct contact with the lungs

32 _____ The layer that lines the abdominopelvic cavity

Answers to Chapter 1 Quiz

1. Here is the completed table:

Proper Term	Common Term	Proper Term	Common Term
Tarsal	ankle	**Crural**	shin
Coxal	**hip**	**Scapular**	shoulder
Popliteal	**back of knee**	Frontal	**forehead**
Brachial	upper arm	**Antebrachial**	forearm
Orbital	eye	Mental	**chin**
Plantar	**sole/bottom of foot**	Carpal	**wrist**
Sural	calf	Axillary	**armpit**
Cephalic	head	**Pedal**	foot
Manual	hand	Otic	**ear**
Femoral	**thigh**	Sternal	**breastbone/sternum**
Lumbar	**lower back**	Antecubital	**inner elbow**
Cubital	elbow	Bucchal	**cheek**
Cervical	neck	**Digital**	fingers/toes

2. **Ventral.**
3. **Dorsal.**
4. **Thoracic.**
5. **Abdominopelvic or peritoneal.**
6. **Cranial.**
7. **Spinal or vertebral.**
8. **Pleural.**
9. **Pericardial.** It's within the thoracic cavity but not within the pleural cavity.
10. **Abdominal.**
11. **Pelvic.** There is not a structure that clearly marks the border between the abdominal and pelvic cavities.
12. **False.** It's part of the axial skeleton. Appendicular is appendages, or arms and legs.
13. **True.** The mediastinum contains everything within the thoracic cavity that isn't inside the pleural cavity.
14. **True.**
15. **False.** Although anatomical position is important here, it's the patient's right and left, not yours.
16. **All the statements are accurate.** You didn't question yourself for that reason, did you?

TIP

Don't question your knowledge or your gut when you notice a pattern like this one, or like answering (a) five times in a row. Odds are that the test writer either didn't pay attention to patterns or created one on purpose to mess with you, as I just did.

17 **It's true that cells are the smallest structures considered to be alive. Some organisms are themselves single-cell organisms (like bacteria). Obviously, we aren't single-celled, but that's why you've previously learned that cells are the smallest level of organization. In the context of physiology, however, the cells aren't what's changing to carry out functions; it's the molecules contained inside of them. That's the reason for the sixth level, which is molecules; they carry out the work.**

18 **F.**

19 **H.**

20 **G or I.** G is the right iliac, and I is the left.

21 **A or C.** A is the right hypochondriac, and C is the left.

22 **Medial.**

23 **Superficial.** Not anterior! The ribs aren't in front of the lungs; they surround them.

24 **Distal.**

25 **Posterior or dorsal.**

26 **Superior.** Though the shoulders and the knees are both on appendages, they're not on the SAME one, so you wouldn't use proximal/distal.

27 **(a) Parietal pericardium.**

28 **(e) Visceral peritoneum.**

29 **(d) Visceral pericardium.**

30 **(c) Parietal pleura.**

31 **(f) Visceral pleura.**

32 **(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 always makes direct contact with an organ. The pattern holds true everywhere except the brain and spinal cord; they're special.