

Q: If this control system were regulating room temperature, what apparatus would be the effector?

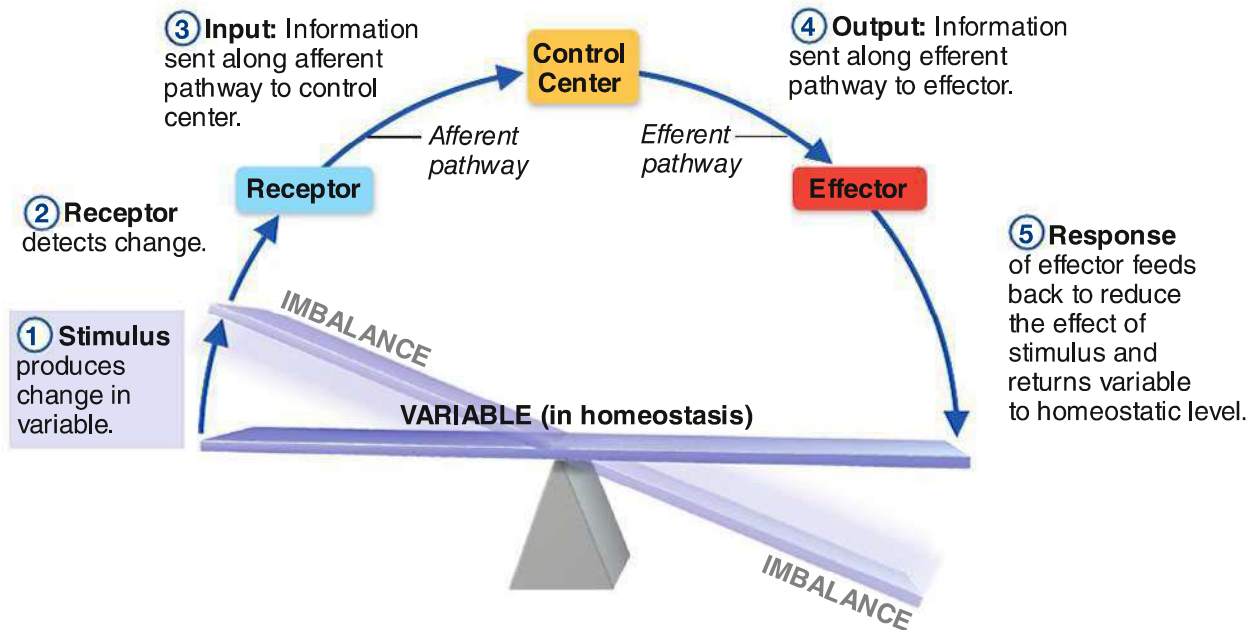


Figure 1.4 The elements of a homeostatic control system.

Interaction between the receptor, control center, and effector is essential for normal operation of the system.

Most homeostatic control mechanisms are **negative feedback mechanisms**. In such systems, the net effect of the response to the stimulus is to shut off the original stimulus or reduce its intensity. A good example of a nonbiological negative feedback system is a home heating system connected to a thermostat. In this situation, the thermostat contains both the receptor and the control center. If the thermostat is set at 20°C (68°F), the heating system (effector) will be triggered ON when the house temperature drops below that setting. As the furnace produces heat, the air is warmed. When the temperature reaches 20°C or slightly higher, the thermostat sends a signal to shut off the furnace. Your body “thermostat,” located in a part of your brain called the *hypothalamus*, operates in a similar way to regulate body temperature. Other negative feedback mechanisms regulate heart rate, blood pressure, breathing rate, and blood levels of glucose, oxygen, carbon dioxide, and minerals.

Positive feedback mechanisms are rare in the body because they tend to increase the original disturbance (stimulus) and to push the variable *farther* from its original value. Typically these mechanisms control infrequent events that occur explosively and do not require continuous adjustments. Blood clotting and the birth of a baby are the most familiar examples of positive feedback mechanisms.




HOMEOSTATIC IMBALANCE

Homeostasis is so important that most disease can be regarded as a result of its disturbance, a condition called **homeostatic imbalance**. As we age, our body organs become less efficient, and our internal conditions become less and less stable. These events place us at an increasing risk for illness and produce the changes we associate with aging.

We provide examples of homeostatic imbalance throughout this book to enhance your understanding of normal physiological mechanisms.

A: The heat-generating furnace or oil burner.

These homeostatic imbalance sections are preceded by the symbol  to alert you that an abnormal condition is being described. ▶

DID YOU GET IT?

7. When we say that the body demonstrates homeostasis, do we mean that conditions in the body are unchanging? Explain your answer.
8. When we begin to become dehydrated, we usually get thirsty, which causes us to drink liquids. Is the thirst sensation part of a negative or a positive feedback control system? Defend your choice.

For answers, see Appendix D.

The Language of Anatomy

- ✓ Verbally describe or demonstrate the anatomical position.
- ✓ Use proper anatomical terminology to describe body directions, surfaces, and body planes.
- ✓ Locate the major body cavities, and list the chief organs in each cavity.

Learning about the body is exciting, but our interest sometimes dwindles when we are faced with the terminology of anatomy and physiology. Let's face it. You can't just pick up an anatomy and physiology book and read it as though it were a novel. Unfortunately, confusion is inevitable without specialized terminology. For example, if you are looking at a ball, "above" always means the area over the top of the ball. Other directional terms can also be used consistently because the ball is a sphere. All sides and surfaces are equal. The human body, of course, has many protrusions and bends. Thus, the question becomes: Above what? To prevent misunderstanding, anatomists use a set of terms that allow body structures to be located and identified clearly with just a few words. We present and explain this language of anatomy next.

Anatomical Position

To accurately describe body parts and position, we must have an initial reference point and use directional terms. To avoid confusion, we always assume that the body is in a standard position called the **anatomical position**. It is important

to understand this position because most body terminology used in this book refers to this body positioning *regardless* of the position the body happens to be in. The face-front diagrams in Figure 1.5 and **Table 1.1** illustrate the anatomical position. As you can see, the body is erect with the feet parallel and the arms hanging at the sides with the palms facing forward.

- Stand up and assume the anatomical position. Notice that it is similar to "standing at attention" but is less comfortable because the palms are held unnaturally forward (with thumbs pointing away from the body) rather than hanging cupped toward the thighs.

Directional Terms

Directional terms allow medical personnel and anatomists to explain exactly where one body structure is in relation to another. For example, we can describe the relationship between the ears and the nose informally by saying, "The ears are located on each side of the head to the right and left of the nose." Using anatomical terminology, this condenses to, "The ears are lateral to the nose." Using anatomical terminology saves a good deal of description and, once learned, is much clearer. Commonly used directional terms are defined and illustrated in Table 1.1. Although most of these terms are also used in everyday conversation, keep in mind that their anatomical meanings are very precise.

Before continuing, take a minute to check your understanding of what you have read in Table 1.1. Give the relationship between the following body parts using the correct anatomical terms.

The wrist is _____ to the hand.

The breastbone is _____ to the spine.

The brain is _____ to the spinal cord.

The thumb is _____ to the fingers. (Be careful here. Remember the anatomical position.)

Regional Terms

There are many visible landmarks on the surface of the body. Once you know their proper anatomical names, you can be specific in referring to different regions of the body.

Table 1.1

Orientation and Directional Terms

Term	Definition	Illustration	Example
Superior (cranial or cephalad)	Toward the head end or upper part of a structure or the body; above		The forehead is superior to the nose.
Inferior (caudal)*	Away from the head end or toward the lower part of a structure or the body; below		The navel is inferior to the breastbone.
Ventral (anterior)†	Toward or at the front of the body; in front of		The breastbone is anterior to the spine.
Dorsal (posterior)†	Toward or at the backside of the body; behind		The heart is posterior to the breastbone.
Medial	Toward or at the midline of the body; on the inner side of		The heart is medial to the arm.
Lateral	Away from the midline of the body; on the outer side of		The arms are lateral to the chest.
Intermediate	Between a more medial and a more lateral structure		The collarbone is intermediate between the breastbone and the shoulder.
Proximal	Close to the origin of the body part or the point of attachment of a limb to the body trunk		The elbow is proximal to the wrist (meaning that the elbow is closer to the shoulder or attachment point of the arm than the wrist is).
Distal	Farther from the origin of a body part or the point of attachment of a limb to the body trunk		The knee is distal to the thigh.
Superficial (external)	Toward or at the body surface		The skin is superficial to the skeleton.
Deep (internal)	Away from the body surface; more internal		The lungs are deep to the rib cage.

*The term *caudal*, literally “toward the tail,” is synonymous with *inferior* only to the inferior end of the spine.

†*Ventral* and *anterior* are synonymous in humans; this is not the case in four-legged animals. *Ventral* refers to the “belly” of an animal and thus is the inferior surface of four-legged animals. Likewise, although the dorsal and posterior surfaces are the same in humans, the term *dorsal* refers to an animal’s back. Thus, the dorsal surface of four-legged animals is their superior surface.

Q: Study this figure for a moment to answer these two questions. Where would you hurt if you (1) pulled a groin muscle or (2) cracked a bone in your olecranal area?

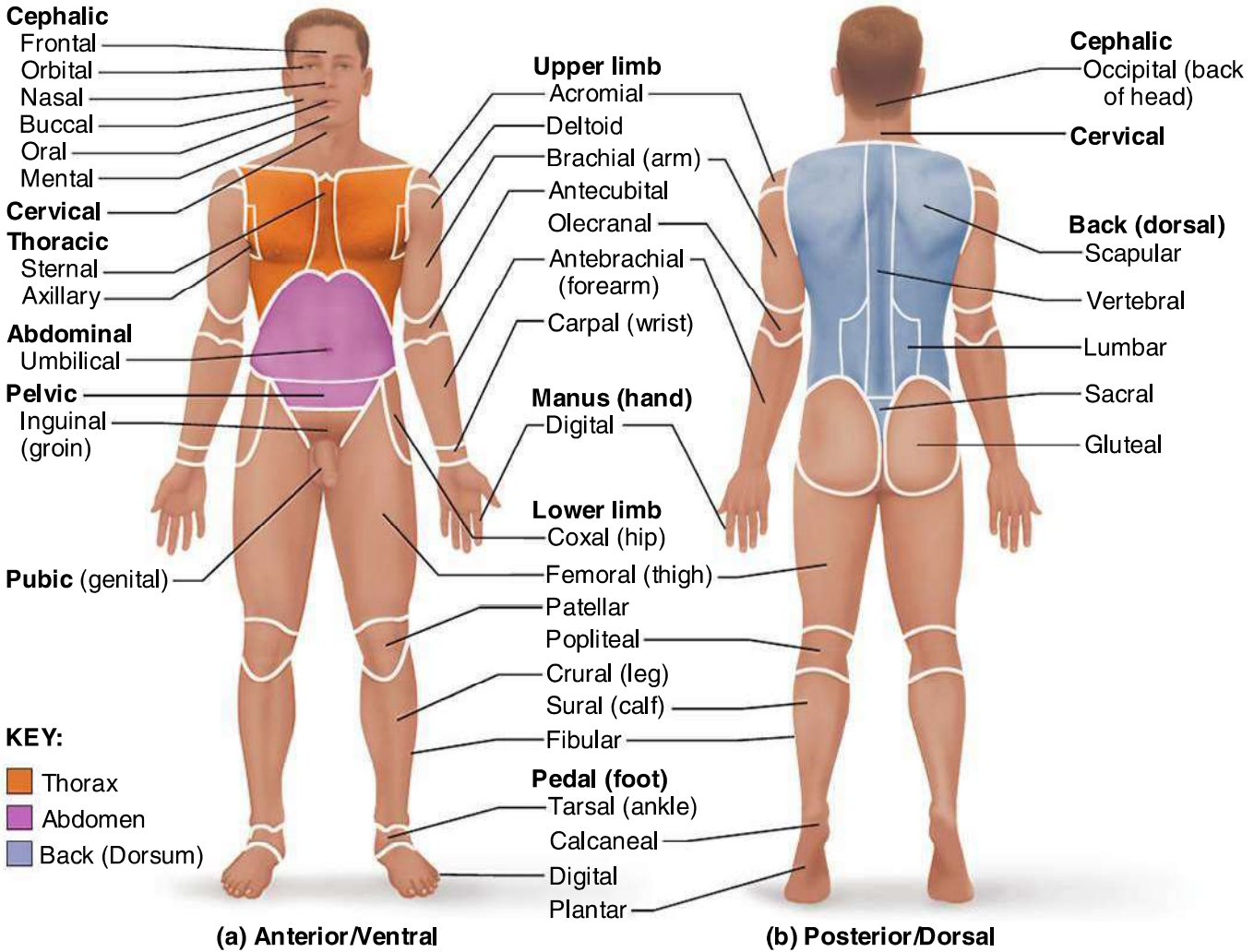


Figure 1.5 Regional terms used to designate specific body areas. (a) The anatomical position. (b) The heels are raised slightly to show the inferior plantar surface (sole) of the foot, which is actually on the inferior surface of the body.

Anterior Body Landmarks

Look at **Figure 1.5a** to find the following body regions. Once you have identified all the anterior body landmarks, cover the labels that describe what the structures are. Then go through the list again, pointing out these areas on your own body.

- **abdominal** (ab-dom' ĭ-nal): anterior body trunk inferior to ribs
- **acromial** (ah-kro' me-ul): point of shoulder
- **antebrachial** (an"te-bra' ke-ul): forearm
- **antecubital** (an"te-ku' bĭ-tal): anterior surface of elbow
- **axillary** (ak' sĭ-lar"e): armpit
- **brachial** (bra' ke-al): arm
- **buccal** (buk' al): cheek area
- **carpal** (kar' pal): wrist
- **cervical** (ser' vĭ-kal): neck region
- **coxal** (kox' al): hip
- **crural** (kroo' ral): leg

A: (1) Your inguinal area. (2) Your posterior elbow region.

- **deltoid** (del'toyd): curve of shoulder formed by large deltoid muscle
- **digital** (dij' ĭ-tal): fingers, toes
- **femoral** (fem'or-al): thigh
- **fibular** (fib' u-lar): lateral part of leg
- **frontal** (frun' -tal): forehead
- **inguinal** (in' gwĭ-nal): area where thigh meets body trunk; groin
- **mental** (men' tul): chin
- **nasal** (na' zul): nose area
- **oral** (o' ral): mouth
- **orbital** (or' bĭ-tal): eye area
- **patellar** (pah-tel' er): anterior knee
- **pelvic** (pel' vik): area overlying the pelvis anteriorly
- **pubic** (pu' bik): genital region
- **sternal** (ster' nul): breastbone area
- **tarsal** (tar' sal): ankle region
- **thoracic** (tho-ras' ik): chest
- **umbilical** (um-bil' ĭ-kal): navel

Posterior Body Landmarks

Identify the following body regions in Figure 1.5b, and then locate them on yourself without referring to this book.

- **calcaneal** (kal-ka' ne-ul): heel of foot
- **cephalic** (seh-fă' lik): head
- **femoral** (fem'or-al): thigh
- **gluteal** (gloo' te-al): buttock
- **lumbar** (lum' bar): area of back between ribs and hips, the loin
- **occipital** (ok-sip' ĭ-tal): posterior surface of head or base of skull
- **olecranal** (ol-eh-cra' nel): posterior surface of elbow
- **popliteal** (pop-lit' e-al): posterior knee area
- **sacral** (sa' krul): area between hips
- **scapular** (skap' u-lar): shoulder blade region
- **sural** (soo' ral): the posterior surface of leg; the calf
- **vertebral** (ver' tĕ-bral): area of spinal column

The **plantar** region, or the sole of the foot, actually on the inferior body surface, is illustrated

along with the posterior body landmarks in Figure 1.5b.

DID YOU GET IT ?

9. What is the anatomical position and why is understanding this position important to an anatomy student?
10. The axillary and the acromial areas are both in the general area of the shoulder. To what specific body area does each of these terms apply?

For answers, see Appendix D.

Body Planes and Sections

When preparing to look at the internal structures of the body, medical students make a **section**, or cut. When the section is made through the body wall or through an organ, it is made along an imaginary line called a **plane**. Because the body is three-dimensional, we can refer to three types of planes or sections that lie at right angles to one another (**Figure 1.6**).

A **sagittal** (saj' ĭ-tal) **section** is a cut along the lengthwise, or longitudinal, plane of the body, dividing the body into right and left parts. If the cut is down the median plane of the body and the right and left parts are equal in size, it is called a **median**, or **midsagittal, section**. All other sagittal sections are parasagittal sections (para = near).

A **frontal section** is a cut along a lengthwise plane that divides the body (or an organ) into anterior and posterior parts. It is also called a **coronal** (ko-ro' nal, “crown”) **section**.

A **transverse section** is a cut along a horizontal plane, dividing the body or organ into superior and inferior parts. It is also called a **cross section**.

Sectioning a body or one of its organs along different planes often results in very different views. For example, a transverse section of the body trunk at the level of the kidneys would show kidney structure in cross section very nicely; a frontal section of the body trunk would show a different view of kidney anatomy; and a midsagittal section would miss the kidneys completely. Information on body organ positioning that can be gained by taking magnetic resonance imaging (MRI) scans along different body planes is illustrated in Figure 1.6. (MRI scans are described further in “A Closer Look” on pp. 10–11).

Q: Which section type would separate the two eyes?

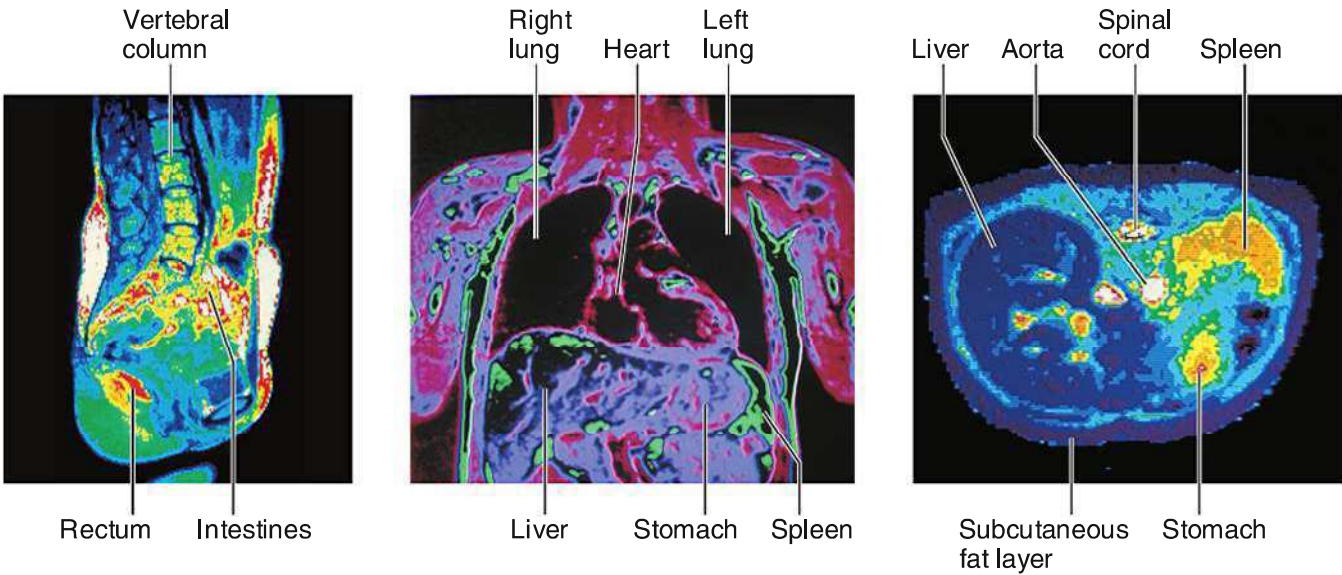
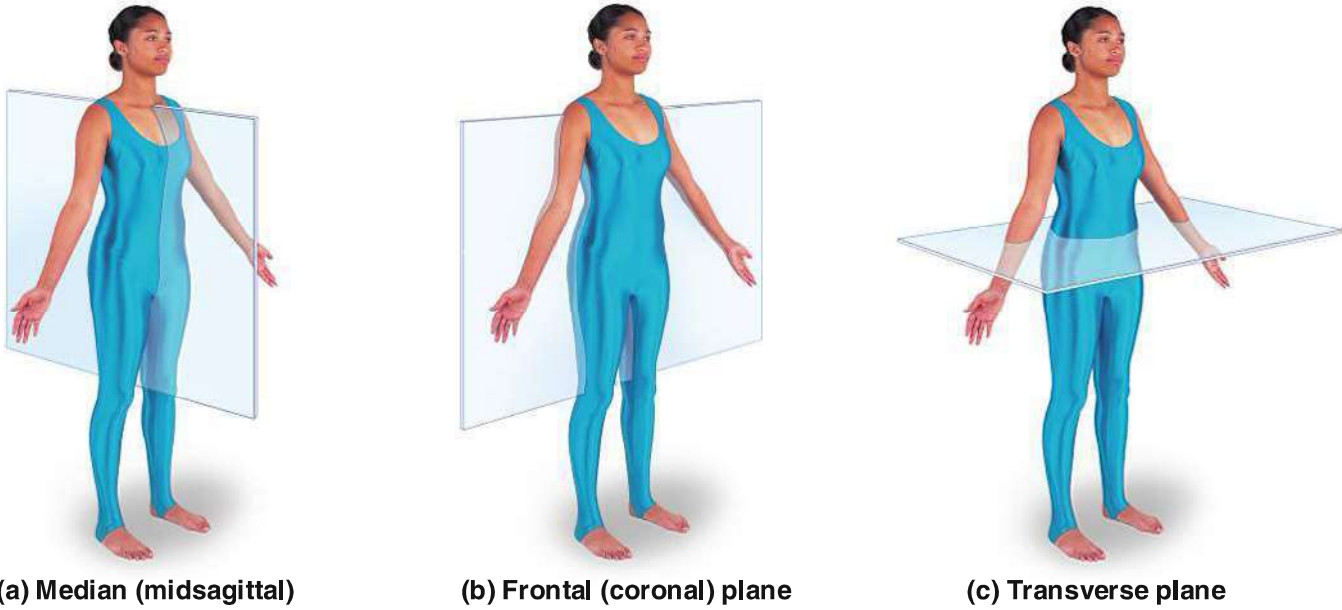


Figure 1.6 The anatomical position and planes of the body—median, frontal, and transverse with corresponding MRI scans.

Body Cavities

Anatomy and physiology textbooks typically describe two sets of internal body cavities, called the dorsal and ventral body cavities, that provide different degrees of protection to the organs within them (Figure 1.7). Because these cavities differ in

their mode of embryological development and in their lining membranes, many anatomy reference books do not identify the dorsal, or neural, body cavity as an internal body cavity. However, the idea of two major sets of internal body cavities is a useful learning concept, so we will continue to use it here.

A: A midsagittal section would separate the two eyes.

Dental Hygienist

Dental hygienists need thorough training in human anatomy and physiology to properly care for their patients.

Feel a bit nervous when getting your teeth cleaned? Many people do. Maybe you'll feel better after you hear how well trained your dental hygienist is.

Dental hygienists are licensed oral health professionals who provide educational, clinical, and therapeutic services to the public. Take Robin Mendica, a hygienist for 15 years, who holds an associate's degree in dental hygiene. Mendica's course work included training in whole-body anatomy and physiology, plus specialized classes focusing on head and neck anatomy. "We learned every nerve and blood vessel above the shoulders," she recalls. "This is important because dental hygienists can give injections of anesthetic for deep cleaning and root cleaning procedures. You have to know where the nerves are to minimize pain and avoid injuries that could lead to facial paralysis."

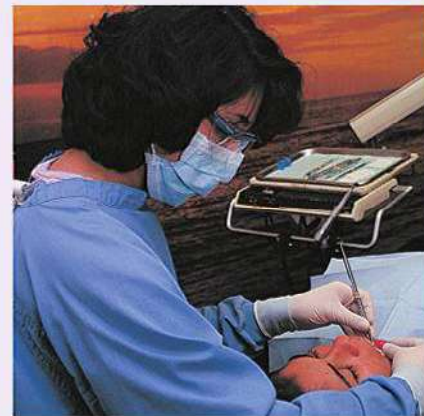
When patients come into the office, Mendica conducts a preliminary examination: "I look at their dental X-ray films and their charts to remind myself of any problems or concerns they may have. Then I examine the mouth and check their teeth, tongue, crowns, and fillings for signs of tooth decay." Then Mendica polishes patients' teeth, removing stains, tartar, and plaque (a soft, sticky deposit of bacteria that leads to periodontal problems) in

preparation for the dentist's examination.

Mendica plays an important role in alerting the dentist to symptoms of dental problems and other health conditions. "Untreated dental conditions can lead to trouble in other parts of the body; I've seen tooth abscesses spread into the sinuses and cause bad infections. People who have lost a lot of teeth can't chew food properly, and that can cause digestive problems. In school we also learned to recognize nodules, precancerous conditions, and oral cancer."

What does Mendica enjoy most about her work? "I love dealing with people. Every patient is different, and I love teaching them about good oral hygiene and motivating them to take care of their teeth." She tells of many patients she has helped, such as the man who tried to "glue" a rotten molar back in his mouth with bubble gum, or the hapless woman who attempted to brighten stained bridge work with white nail polish. "I consider patient education an important part of my job, because I'm a big advocate of regular dental exams. Getting your teeth cleaned every six months is an investment in your lifelong health."

Dental hygiene education generally lasts two to four years beyond high school (or equivalent). Two-year programs offer a diploma, certificate, or associate's degree; four-year programs offer a bachelor's degree. Master's degrees are available for students interested in education, research, or administration.



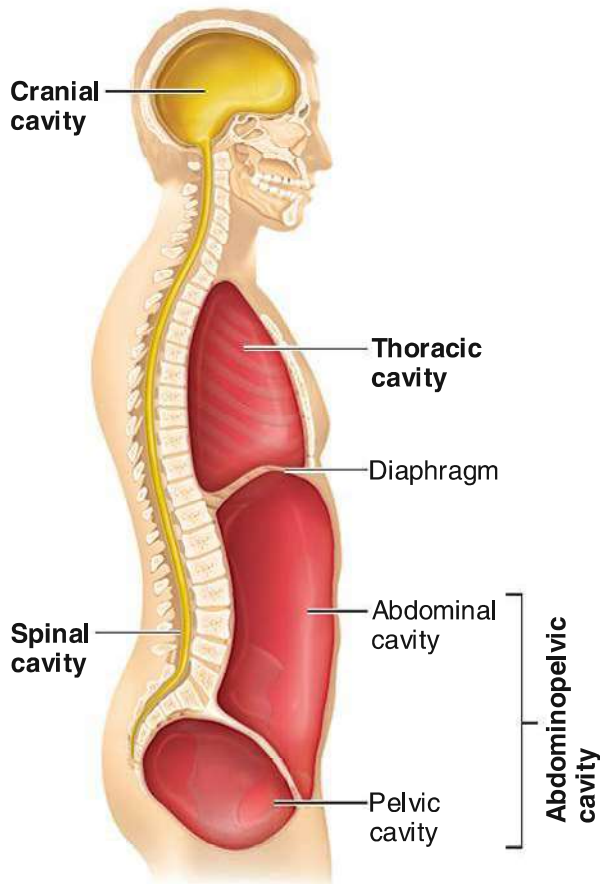
We learned every nerve and blood vessel above the shoulders.

An accredited dental hygiene program requires supervised clinical instruction and courses in anatomy, physiology, chemistry, and microbiology. Dental hygienists must be licensed by the state in which they practice. State licensing requirements vary but usually include successful completion of a regional or state clinical board examination.

To learn more, contact the American Dental Hygienists Association (ADHA) at

444 N. Michigan Avenue
Suite 3400, Chicago, IL 60611
(312) 440-8900
<http://www.adha.org>

For additional information on this career, click the Focus on Careers link at www.anatomyandphysiology.com.

**KEY:**

■ Dorsal body cavity ■ Ventral body cavity

Figure 1.7 Body cavities. Notice the angular relationship between the abdominal and pelvic cavities.

Dorsal Body Cavity

The **dorsal body cavity** has two subdivisions, which are continuous with each other. The **cranial cavity** is the space inside the bony skull. The brain is well protected because it occupies the cranial cavity. The **spinal cavity** extends from the cranial cavity nearly to the end of the vertebral column. The spinal cord, which is a continuation of the brain, is protected by the vertebrae, which surround the spinal cavity.

Ventral Body Cavity

The **ventral body cavity** is much larger than the dorsal cavity. It contains all the structures within the chest and abdomen, that is, the visceral organs in those regions. Like the dorsal cavity, the ventral body cavity is subdivided. The superior **thoracic cavity** is separated from the rest of the ventral cavity by a dome-shaped muscle, the **diaphragm** (di'ah-fram).

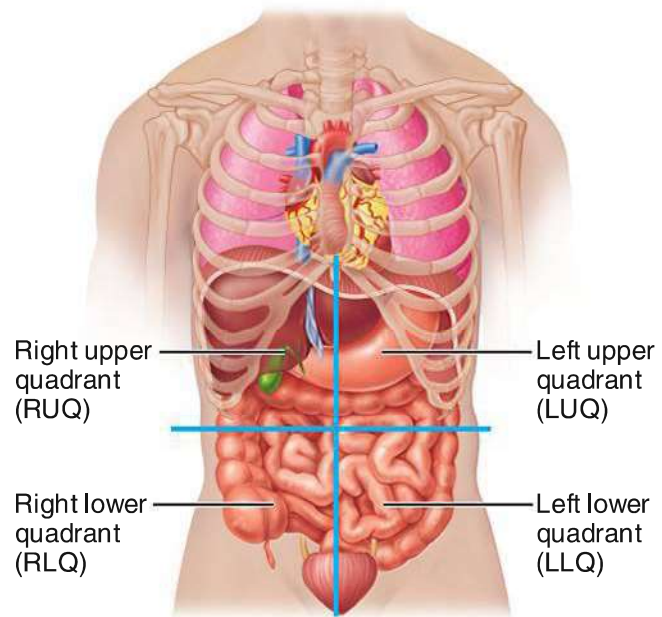


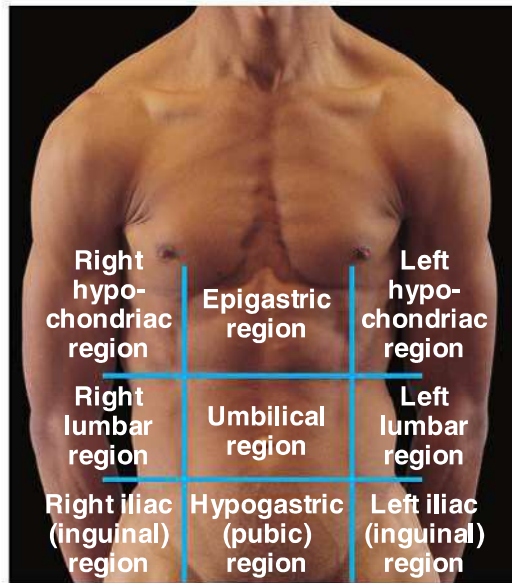
Figure 1.8 The four abdominopelvic quadrants. In this scheme, the abdominopelvic cavity is divided into four quadrants by two planes.

The organs in the thoracic cavity (lungs, heart, and others) are somewhat protected by the rib cage. A central region called the **mediastinum** (me'de-as-ti'num) separates the lungs into right and left cavities in the thoracic cavity. The mediastinum itself houses the heart, trachea, and other visceral organs.

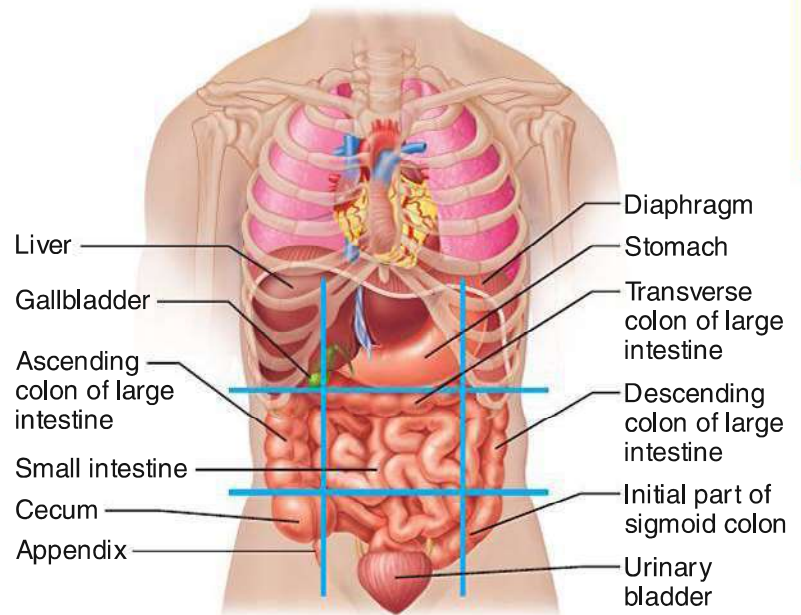
The cavity inferior to the diaphragm is the **abdominopelvic** (ab-dom'i-no-pel'vik) **cavity**. Some prefer to subdivide it into a superior **abdominal cavity**, containing the stomach, liver, intestines, and other organs, and an inferior **pelvic cavity**, with the reproductive organs, bladder, and rectum. However, there is no actual physical structure dividing the abdominopelvic cavity. If you look carefully at Figure 1.7, you will see that the pelvic cavity is not continuous with the abdominal cavity in a straight plane, but that it tips away from the abdominal cavity in the posterior direction.

**HOMEOSTATIC IMBALANCE**

When the body is subjected to physical trauma (as often happens in an automobile accident, for example), the most vulnerable abdominopelvic organs are those within the abdominal cavity. The reason is that the abdominal cavity walls are formed only of trunk muscles and are not reinforced by bone. The pelvic organs receive a somewhat greater degree of protection from the bony pelvis in which they reside. ▶



(a) Nine regions delineated by four planes



(b) Anterior view of the nine regions showing the superficial organs

Figure 1.9 The nine abdominopelvic regions. In (a) the superior transverse plane is just superior to the ribs; the inferior transverse plane is just superior to the hip bones; and the parasagittal planes lie just medial to the nipples.

Because the abdominopelvic cavity is quite large and contains many organs, it helps to divide it up into smaller areas for study. A scheme commonly used by medical personnel divides the abdominopelvic cavity into four more or less equal regions called *quadrants*. The quadrants are then simply named according to their relative positions—that is, right upper quadrant (RUQ), right lower quadrant (RLQ), left upper quadrant (LUQ), and left lower quadrant (LLQ) (Figure 1.8).

Another system, used mainly by anatomists, divides the abdominopelvic cavity into nine separate *regions* by four planes, as shown in Figure 1.9a. Although the names of the nine regions are unfamiliar to you now, with a little patience and study they will become easier to remember. As you locate these regions in the figure, notice the organs they contain by referring to Figure 1.9b.

- The **umbilical region** is the centermost region, deep to and surrounding the umbilicus (navel).
- The **epigastric** (ep" ĭ-gas' trik) **region** is located superior to the umbilical region (*epi* = upon, above; *gastric* = stomach).

- The **hypogastric (pubic) region** is inferior to the umbilical region (*hypo* = below).
- The **right** and **left iliac, or inguinal, regions** are lateral to the hypogastric region (*iliac* = superior part of the hip bone).
- The **right** and **left lumbar regions** lie lateral to the umbilical region (*lumbus* = loin).
- The **right** and **left hypochondriac** (hi"po-kon'dre-ak) **regions** flank the epigastric region and contain the lower ribs (*chondro* = cartilage).

Other Body Cavities

In addition to the large closed body cavities, there are several smaller body cavities. Most of these are in the head and open to the body exterior. With the exception of the middle ear cavities, the body regions that house these cavities are all shown in Figure 1.5.

- **Oral and digestive cavities.** The oral cavity, commonly called the mouth, contains the teeth and tongue. This cavity is part of and continuous with the cavity of the digestive organs, which opens to the exterior at the anus.

- **Nasal cavity.** Located within and posterior to the nose, the nasal cavity is part of the respiratory system passageways.
- **Orbital cavities.** The orbital cavities (orbits) in the skull house the eyes and present them in an anterior position.
- **Middle ear cavities.** The middle ear cavities carved into the skull lie just medial to the eardrums. These cavities contain tiny bones that transmit sound vibrations to the hearing receptors in the inner ears.

DID YOU GET IT?

11. If you wanted to separate the thoracic cavity from the abdominal cavity of a cadaver, which type of section would you make?
12. Of the spinal cord, small intestine, uterus, and heart, which are in the dorsal body cavity?
13. Joe went to the emergency room where he complained of severe pains in the lower right quadrant of his abdomen. What might be his problem?

For answers, see Appendix D.

Summary

➤ Access more review material and fun learning activities online—visit www.anatomyandphysiology.com and select Essentials of Human Anatomy & Physiology, 10th edition. In addition, references to Interactive Physiology are included below.

iP = Interactive Physiology

An Overview of Anatomy and Physiology (pp. 1–2)

1. Anatomy is the study of structure. Observation is used to see the sizes and relationships of body parts.
2. Physiology is the study of how a structure (which may be a cell, an organ, or an organ system) functions or works.
3. Structure determines what functions can occur; therefore, if the structure changes, the function must also change.

Levels of Structural Organization (pp. 2–7)

1. There are six levels of structural organization. Atoms (at the chemical level) combine, forming the unit of life, the cell. Cells are grouped into tissues, which in turn are arranged in specific ways to form organs. A number of organs form an organ system that performs a specific function for the body (which no other organ system can do). Together, all of the organ systems form the organism, or living body.
2. For a description of organ systems naming the major organs and functions, see pp. 3–7.

Maintaining Life (pp. 7–12)

1. To sustain life, an organism must be able to maintain its boundaries, move, respond to stimuli, digest

nutrients and excrete wastes, carry on metabolism, reproduce itself, and grow.

2. Survival needs include food, oxygen, water, appropriate temperature, and normal atmospheric pressure. Extremes of any of these factors can be harmful.

Homeostasis (pp. 12–14)

1. Body functions interact to maintain homeostasis, or a relatively stable internal environment within the body. Homeostasis is necessary for survival and good health; its loss results in illness or disease.
2. All homeostatic control mechanisms have three components: (1) a receptor that responds to environmental changes, (2) a control center that assesses those changes and produces a response by activating (3) the effector.
3. Most homeostatic control systems are negative feedback systems, which act to reduce or stop the initial stimulus.

The Language of Anatomy (pp. 14–22)

1. Anatomical terminology is relative and assumes that the body is in the anatomical position (erect, palms facing forward).
2. Directional terms
 - a. Superior (cranial, cephalad): above something else, toward the head.
 - b. Inferior (caudal): below something else, toward the tail.
 - c. Ventral (anterior): toward the front of the body or structure.
 - d. Dorsal (posterior): toward the rear or back of the body or structure.

- e. Medial: toward the midline of the body.
 f. Lateral: away from the midline of the body.
 g. Proximal: closer to the point of attachment.
 h. Distal: farther from the point of attachment.
 i. Superficial (external): at or close to the body surface.
 j. Deep (internal): below or away from the body surface.
3. Regional terms. Visible landmarks on the body surface may be used to specifically refer to a body part or area. See pp. 14–17 for terms referring to anterior and posterior surface anatomy.
4. Body planes and sections
 a. Sagittal section: separates the body longitudinally into right and left parts.
 b. Frontal (coronal) section: separates the body on a longitudinal plane into anterior and posterior parts.
 c. Transverse (cross) section: separates the body on a horizontal plane into superior and inferior parts.
5. Body cavities
 a. Dorsal: well protected by bone; has two subdivisions.
 (1) Cranial: contains the brain.
 (2) Spinal: contains the spinal cord.
 b. Ventral: less protected than dorsal cavity; has two subdivisions.
 (1) Thoracic: The superior cavity that extends inferiorly to the diaphragm; contains heart and lungs, which are protected by the rib cage.
 (2) Abdominopelvic: The cavity inferior to the diaphragm that contains the digestive, urinary, and reproductive organs. The abdominal portion is vulnerable because it is protected only by the trunk muscles. The pelvic portion is protected somewhat by the bony pelvis. The abdominopelvic cavity is often divided into four quadrants or nine regions (see Figures 1.8 and 1.9).
 c. Smaller open body cavities include the oral, nasal, orbital, and middle ear cavities.
- a. 1, 2, 3, 4, 5, 6 d. 1, 4, 2, 3, 6, 5
 b. 1, 4, 2, 5, 3, 6 e. 4, 1, 3, 2, 6, 5
 c. 3, 1, 2, 4, 6, 5
2. Which of the following is (are) involved in maintaining homeostasis?
 a. Effector d. Feedback
 b. Control center e. Lack of change
 c. Receptor
3. Which is not essential to survival?
 a. Water d. Atmospheric pressure
 b. Oxygen e. Nutrients
 c. Gravity
4. Using the terms listed below, fill in the blank with the proper term.
 anterior superior medial proximal superficial
 posterior inferior lateral distal deep
 The heart is located _____ to the diaphragm.
 The muscles are _____ to the skin.
 The shoulder is _____ to the elbow.
 In anatomical position, the thumb is _____ to the index finger.
 The vertebral region is _____ to the scapular region.
 The gluteal region is located on the _____ surface of the body.
5. Match the proper anatomical term (column B) with the common name (column A) for the body regions listed below.
- | Column A | Column B |
|-----------------------|-----------------|
| ___ 1. buttocks | a. inguinal |
| ___ 2. back | b. frontal |
| ___ 3. shoulder blade | c. dorsal |
| ___ 4. front of elbow | d. lumbar |
| ___ 5. toes | e. gluteal |
| ___ 6. groin | f. antecubial |
| ___ 7. forehead | g. plantar |
| ___ 8. lower back | h. digital |
| ___ 9. sole of foot | i. scapular |
6. Anatomical terms that apply to the backside of the body in the anatomical position include
 a. ventral and anterior.
 b. back and rear.
 c. posterior and dorsal.
 d. head and lateral.

Review Questions

Multiple Choice

More than one choice may apply.

1. Consider the following levels: (1) chemical; (2) tissue; (3) organ; (4) cellular; (5) organismal; (6) systemic. Which of the following choices has the levels listed in order of increasing complexity?

7. A neurosurgeon orders a spinal tap for a patient. Into what body cavity will the needle be inserted?
 - a. Ventral
 - b. Thoracic
 - c. Dorsal
 - d. Cranial
 - e. Pelvic
8. Which of the following groupings of the abdominopelvic regions is medial?
 - a. Hypochondriac, hypogastric, umbilical
 - b. Hypochondriac, lumbar, inguinal
 - c. Hypogastric, umbilical, epigastric
 - d. Lumbar, umbilical, iliac
 - e. Iliac, umbilical, hypochondriac

Short Answer Essay

9. Define *anatomy* and *physiology*.
10. List the 11 organ systems of the body, briefly describe the function of each, and then name two organs in each system.
11. Explain the meaning of *homeostasis* as applied to the living organism.
12. What is the consequence of loss of homeostasis, or homeostatic imbalance?
13. Many body structures are symmetrical. Are the kidneys symmetrical? What about the stomach?
14. On what body surface is each of the following located: nose, calf of leg, ears, umbilicus, fingernails?
15. Which of the following organ systems—digestive, respiratory, reproductive, circulatory, urinary, or muscular—are found in *both* subdivisions of the ventral body cavity? Which are found in the thoracic cavity only? In the abdominopelvic cavity only?



Critical Thinking and Clinical Application Questions

16. A nurse informed John that she was about to take blood from his antecubital region. What part of his body was she referring to? Later, she came back and said that she was going to give him an antibiotic shot in the deltoid region. Did he take off his shirt or drop his pants to get the shot? Before John left the office, the nurse noticed that his left sural region was badly bruised. What part of his body was black and blue?
17. How is the concept of homeostasis (or its loss) related to disease and aging? Provide examples to support your reasoning.
18. Jennie Dip fell off her motorcycle and tore a nerve in her axillary region. She also tore ligaments in her cervical and scapular regions and broke the only bone of her right brachial region. Explain where each of her injuries is located.
19. Mr. Petros is behaving abnormally, and doctors strongly suspect he has a brain tumor. Which medical imaging device—conventional X ray, DSA, PET, ultrasound, or MRT—would be best for precisely locating a tumor within the brain? Explain your choice.
20. Parathyroid hormone (PTH) is secreted in response to a drop in calcium levels in the blood. The secretion of PTH is regulated by a negative feedback mechanism. What can you expect to happen to calcium blood levels as increased amounts of PTH are secreted, and why?