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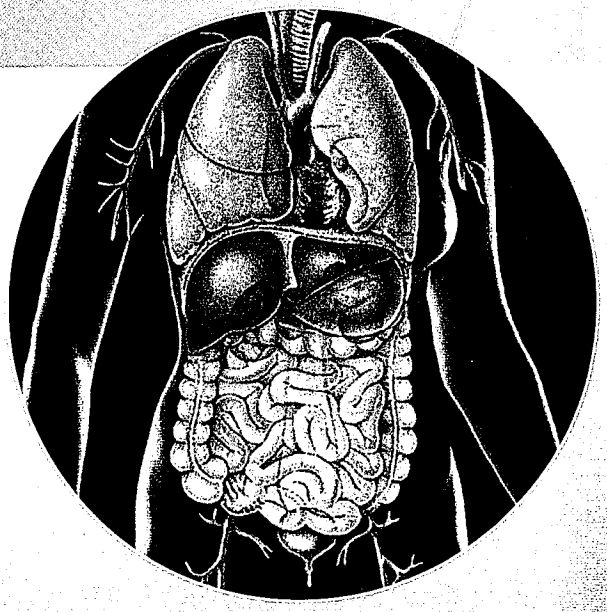
An Introduction to the Structure and Function of the Body



Appendixes

Outline

Objectives

AFTER YOU HAVE COMPLETED THIS CHAPTER, YOU SHOULD BE ABLE TO:

1. Define the terms *anatomy* and *physiology.*
2. List and discuss in order of increasing complexity the levels of organization of the body.
3. Define the term *anatomical position.*
4. List and define the principal directional terms and sections (planes) used in describing the body and the relationship of body parts to one another.
5. List the nine abdominopelvic regions and the abdominopelvic quadrants.
6. List the major cavities of the body and the subdivisions of each.
7. Discuss and contrast the axial and the appendicular subdivisions of the body. Identify a number of specific anatomical regions in each area.
8. Explain the meaning of the term *homeostasis* and give an example of a typical homeostatic mechanism.

There *are many* wonders in our world, but none is more wondrous than the human body. This is a textbook about that incomparable structure. It deals with two very distinct and yet interrelated sciences: **anatomy** and **physiology.** As a science, anatomy is often defined as the study of the structure of an organism and the relationships of its parts. The word *anatomy* is derived from two Greek words that mean "a cutting up." Anatomists learn about the structure of the human body by cutting it apart. This process, called **dissection,** is still the principal technique used to isolate and study the structural components or parts of the human body. Physiology is the study of the functions of living organisms and their parts. It is a dynamic science that requires active experimentation. In the chapters that follow, you will see again and again that anatomical structures seem designed to perform specific functions. Each has a particular size, shape, form, or position in the body related directly to its ability to perform a unique and specialized activity.

Structural Levels of Organization

Before you begin the study of the structure and function of the human body and its many parts, it is important to think about how those parts are organized and how they might logically fit together into a functioning whole. Examine Figure 1-1. It illustrates the differing levels of organization that influence body structure and function. Note that the levels of organization progress from the least complex (chemical level) to the most complex (body as a whole).

Organization is one of the most important characteristics of body structure. Even the word *organism,* used to denote a living thing, implies organization.

Although the body is a single structure, it is made up of trillions of smaller structures. Atoms and molecules are often referred to as the **chemical level** of organization (see Appendix A). The existence of life depends on the proper levels and proportions of many chemical substances in the cells of the body. Many of the physical and chemical phenomena that play important roles in the life process will be reviewed in the next chapter. Such information provides an understanding of the physical basis for life and for the study of the next levels of organization so important in the study of anatomy and physiology—cells, tissues, organs, and systems.

Cells are considered to be the smallest "living" units of structure and function in our body. Although long recognized as the simplest units of living matter, cells are far from simple. They are extremely complex, a fact you will discover in Chapter 2.

Tissues are somewhat more complex than cells. By definition a tissue is an organization of many similar cells that act together to perform a common function. Cells are held together and surrounded by varying amounts and varieties of gluelike, nonliving intercellular substances.

Organs are more complex than tissues. An organ is a group of several different kinds of tissues arranged so that they can together act as a unit to perform a special function. For instance, the lungs shown in Figure 1-1 are an example of organization at the organ level.

Systems are the most complex units that make up the body. A system is an organization of varying numbers and kinds of organs arranged so that they can together perform complex functions for the body. The organs of the respiratory system shown in Figure 1-1 permit air to enter the body and travel to the lungs, where the eventual exchange of oxygen and carbon dioxide occurs. Organs of the respiratory system include the nose, the windpipe or trachea, and the complex series of bronchial tubes that permit passage of air into the lungs.

The **body as a whole** is all the atoms, molecules, cells, tissues, organs, and systems that you will study in subsequent chapters of this text. Although capable of being dissected or broken down into many parts, the body is a unified and complex assembly of structurally and functionally interactive components, each working together to ensure healthy survival.

Anatomical Position

Discussions about the body, the way it moves, its posture, or the relationship of one area to another assume that the body as a whole is in a specific position called the **anatomical position.** In this reference position (Figure 1-2) the body is in an erect or standing posture with the arms at the sides and palms turned forward. The head and feet also point forward. The anatomical position is a reference position that gives meaning to the directional terms used to describe the body parts and regions.

Supine and **prone** are terms used to describe the position of the body when it is not in the anatomical position. In the supine position the body is lying face upward, and in the prone position the body is lying face downward.

Anatomical Directions

When studying the body, it is often helpful to know where an organ is in relation to other struc-

FIGURE 1-1

Structural levels of organization in the body.

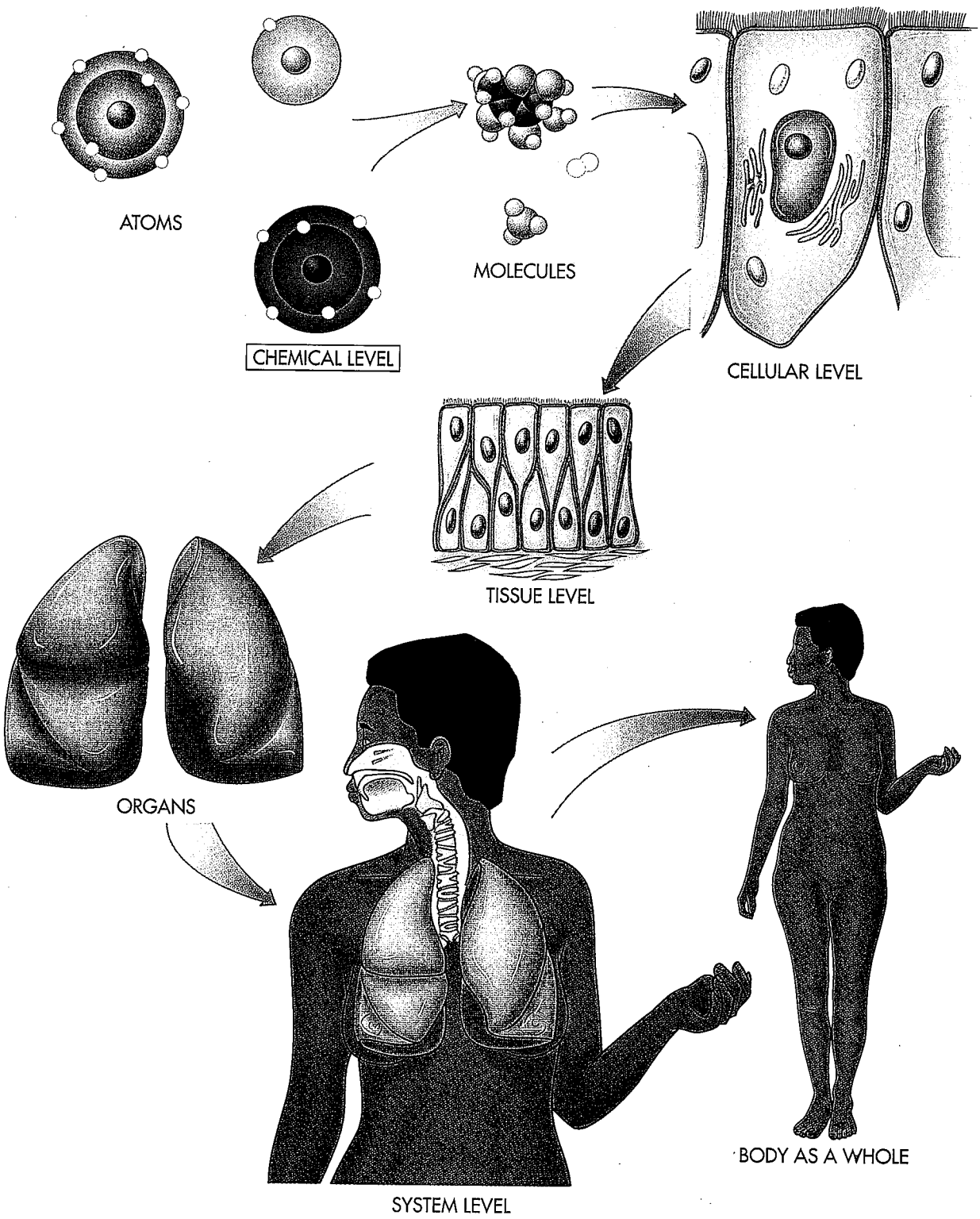
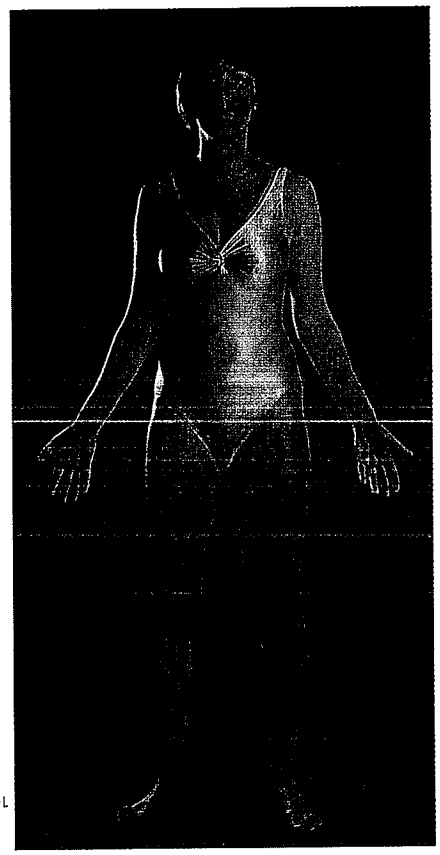


FIGURE 1-2

Anatomical position. The body is in an erect or standing posture with the arms at the sides and the palms forward. The head and feet also point forward. The anatomical compass rosette is explained at the bottom of the second column on this page.



tures. The following directional terms are used in describing relative positions of body parts:

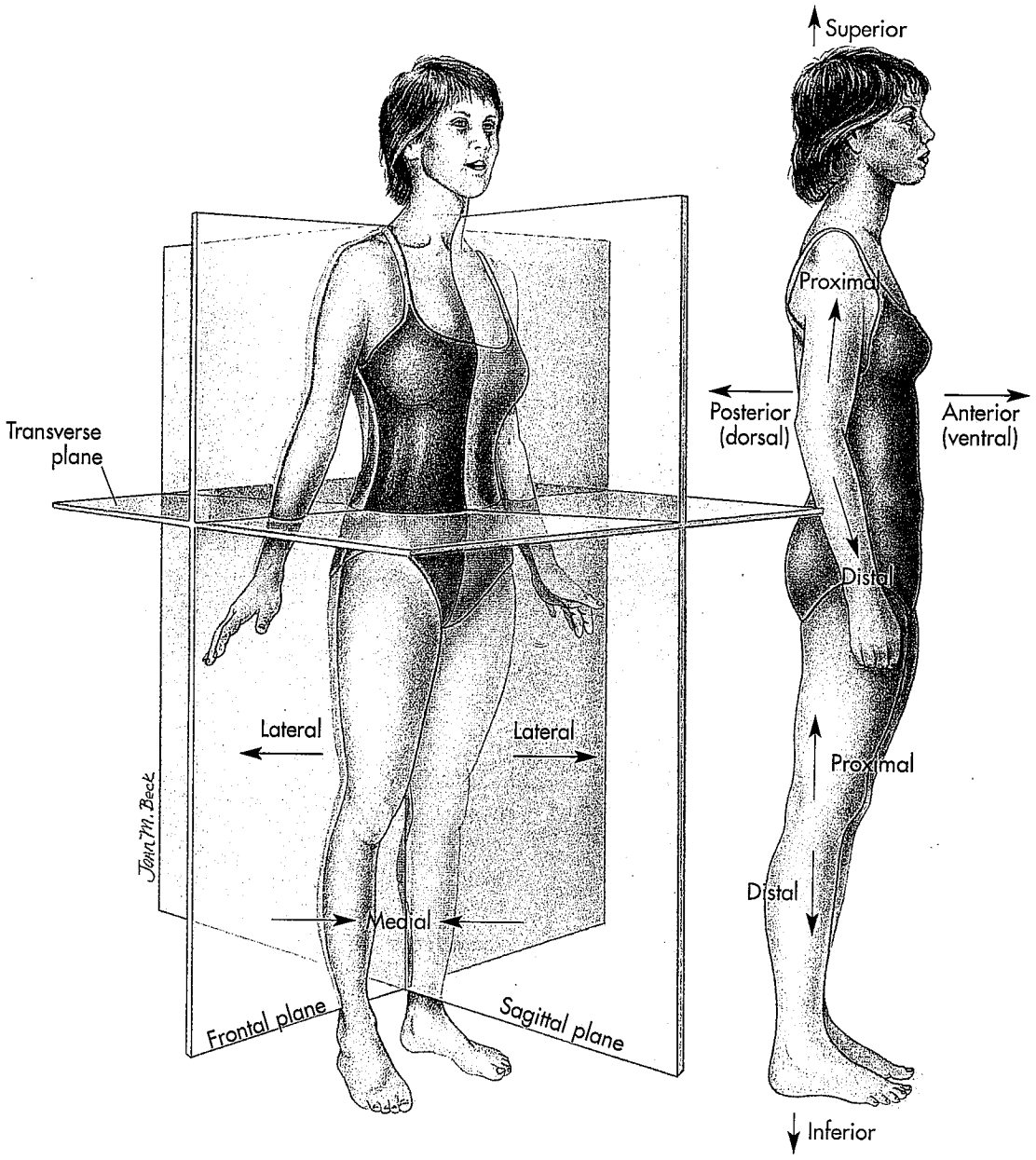
1. **Superior** and **inferior** (Figure 1-3)—*superior* means "toward the head," and *inferior* means "toward the feet." *Superior* also means "upper" or "above," and *inferior* means "lower" or "below." For example, the lungs are located superior to the diaphragm, whereas the stomach is located inferior to it (check Figure 1-7 if you are not sure where these organs are).
2. **Anterior** and **posterior** (Figure 1-3)—*anterior* means "front" or "in front of"; *posterior* means "back" or "in back of." In humans, who walk in an upright position, *ventral* (toward the belly) can be used in place of anterior, and *dorsal* (toward the back) can be used for posterior. For example, the nose is on the anterior surface of the body, and the shoulder blades are on its posterior surface.
3. **Medial** and **lateral** (Figure 1-3)—*medial* means "toward the midline of the body"; *lateral* means "toward the side of the body or away from its midline." For example, the great toe is at the medial side of the foot, and the little toe is at its lateral side. The heart lies medial to the lungs, and the lungs lie lateral to the heart.
4. **Proximal** and **distal** (Figure 1-3)—*proximal* means "toward or nearest the trunk of the body, or nearest the point of origin of one of its parts"; *distal* means "away from or farthest from the trunk or the point of origin of a body part." For example, the elbow lies at the proximal end of the lower arm, whereas the hand lies at its distal end.
5. **Superficial** and **deep**—*superficial* means nearer the surface; *deep* means farther away from the body surface. For example, the skin of the arm is superficial to the muscles below it, and the bone of the upper arm is deep to the muscles that surround and cover it.

To make the reading of anatomical figures a little easier for you, we have used an anatomical compass rosette throughout this book. On many figures, you will see a small compass rosette like you might see on a geographical map. Instead of being labeled **N, S, E,** or **W,** the anatomical rosette is labeled with abbreviated anatomical directions. For example, in Figure 1-2, the rosette is labeled **S** (for superior) on top and **I** (for inferior) on the bottom. Notice that in Figure 1-2 the rosette shows **R** (right) on the subject's right—not your right. Here are the directional abbreviations used with the rosettes in this book:

A = Anterior
D = Distal
I = Inferior
L (opposite M) = Lateral
L (opposite R) = Left
M = Medial
P (opposite A) = Posterior
P (opposite D) = Proximal
R = Right
S = Superior

FIGURE 1-3

Directions and planes of the body.



Planes or Body Sections

To facilitate the study of individual organs or the body as a whole, it is often useful to subdivide or "cut" it into smaller segments. To do this, body planes or sections have been identified by special names. Read the following definitions and identify each term in Figure 1-3.

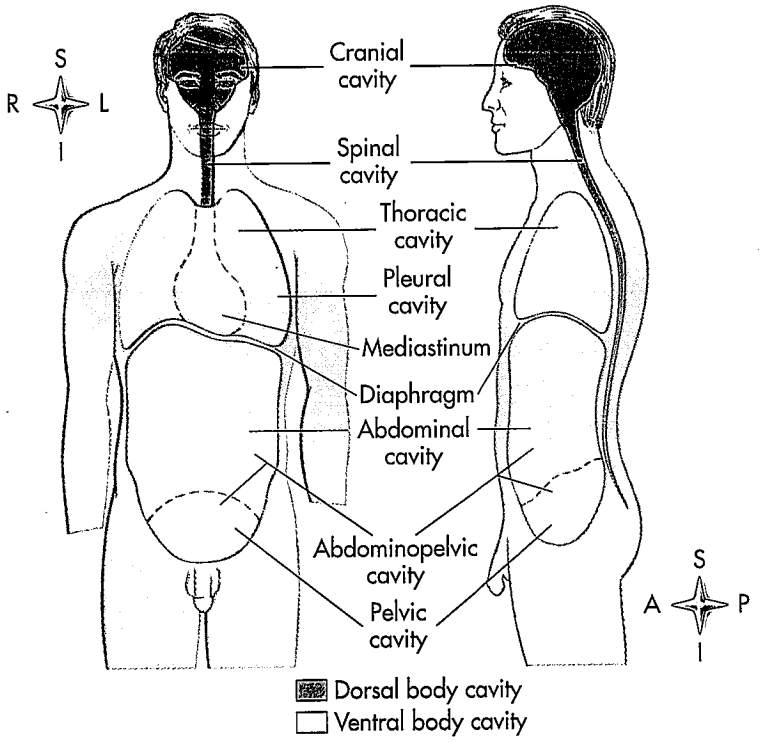
1. **Sagittal**—a sagittal cut or section is a lengthwise plane running from front to back. It divides the body or any of its parts into right and left sides. The sagittal plane shown in Figure 1-3 divides the body into two *equal halves.* This unique type of sagittal plane is called a **midsagittal plane.**
2. **Frontal**—a frontal *(coronal)* plane is a lengthwise plane running from side to side. As you can see in Figure 1-3, a frontal plane divides the body or any of its parts into anterior and posterior (front and back) portions.
3. **Transverse**—a transverse plane is a horizontal or crosswise plane. Such a plane (Figure 1-3) divides the body or any of its parts into upper and lower portions.

Body Cavities

Contrary to its external appearance, the body is not a solid structure. It is made up of open spaces or cavities that in turn contain compact, well-ordered arrangements of internal organs. The two major body cavities are called the **ventral** and **dorsal body cavities.** The location and outlines of

FIGURE 1-4

Body cavities. Location and subdivisions of the dorsal and ventral body cavities as viewed from the front (anterior) and from the side (lateral).



the body cavities are illustrated in Figure 1-4. The ventral cavity includes the **thoracic cavity,** a space that you may think of as your chest cavity. Its midportion is a subdivision of the thoracic cavity, called the **mediastinum;** its other subdivisions are called the right and left **pleural cavities.** The ventral cavity in Figure 1-4 is broken down into an **abdominal cavity** and a **pelvic cavity.** Actually, they form only one cavity, the **abdominopelvic cavity,** because no physical partition separates them. In Figure 1-4 a dotted line shows the approximate point of separation between the abdominal and pelvic subdivisions. Notice, however, that an actual physical partition, represented in the figure as a wide band, separates the thoracic cavity from the abdominal cavity. This muscular partition is the **diaphragm.** It is dome-shaped and is the most important muscle for breathing.

To make it easier to locate organs in the large abdominopelvic cavity, anatomists have divided the abdominopelvic cavity into the nine regions shown in Figure 1-5 and defined them as follows:

1. Upper abdominopelvic regions—the **right** and **left hypochondriac regions** and the **epigastric region** lie above an imaginary line across the abdomen at the level of the ninth rib cartilages.
2. Middle regions—the **right** and **left lumbar regions** and the **umbilical region** lie below an imaginary line across the abdomen at the level of the ninth rib cartilages and above an imaginary line across the abdomen at the top of the hip bones.
3. Lower regions—the **right** and **left iliac** (or **inguinal**) **regions** and the **hypogastric region** lie below an imaginary line across the abdomen at the level of the top of the hip bones.

Another, perhaps easier, way to divide the abdominopelvic cavity is shown in Figure 1-6. This method is frequently used by health professionals and is useful for locating pain or describing the location of a tumor. As you can see in Figure 1-6, the midsagittal and transverse planes, which were described in the previous section, pass through the navel (umbilicus) and divide the abdominopelvic region into the following **four quadrants:** right upper or superior, right lower or inferior, left upper or superior, and left lower or inferior.

The dorsal cavity shown in Figure 1-4 includes the space inside the skull that contains the brain; it is called the **cranial cavity.** The space inside the spinal column is called the **spinal cavity;** it contains the spinal cord. The cranial and spinal cavities are **dorsal cavities,** whereas the thoracic and abdominopelvic cavities are **ventral cavities.**

Some of the organs in the largest body cavities are visible in Figure 1-7 and are listed in Table 1-1. Find each body cavity in a model of the

FIGURE 1-5

The nine regions of the abdominopelvic cavity. The most superficial organs are shown. Look at Figure 1-7 (p. 9). Can you identify the deeper structures in each region?

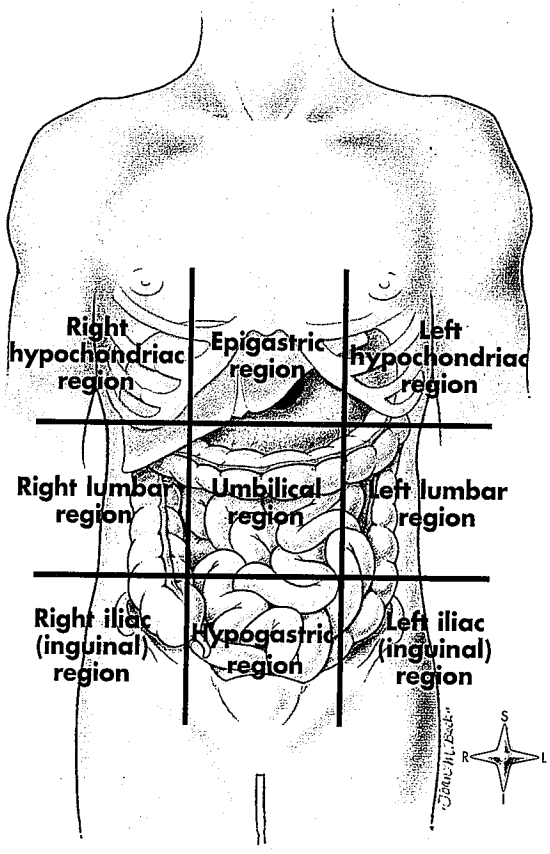
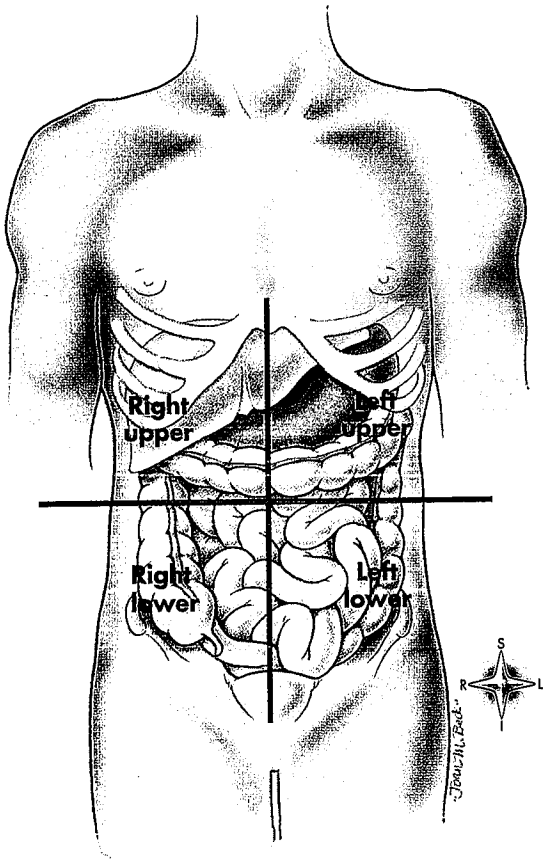


FIGURE 1-6

Division of the abdominopelvic cavity into four quadrants. Diagram showing relationship of internal organs to the four abdominal quadrants.



human body if you have access to one. Try to identify the organs in each cavity, and try to visualize their locations in your own body. Study Figures 1-4 and 1-7.

BODY REGIONS

To recognize an object, you usually first notice its overall structure and form. For example, a car is recognized as a car before the specific details of its tires, grill, or wheel covers are noted. Recognition of the human form also occurs as you first identify overall shape and basic outline. However, for more specific identification to occur, details of size, shape, and appearance of individual body areas must be described. Individuals differ in overall appearance because specific body areas such as the face or torso have unique identifying characteristics. Detailed descriptions of the human form require that specific regions be identified and appropriate terms be used to describe them.

The ability to identify and correctly describe specific body areas is particularly important in the health sciences. For a patient to complain of pain in the head is not as specific and therefore not as useful to a physician or nurse as a more specific and localized description. Saying that the pain is facial provides additional information and helps to more specifically identify the area of pain. By using correct anatomical terms such as forehead, cheek, or chin to describe the area of pain, attention can be focused even more quickly on the specific anatomical area that may need attention. Fa-

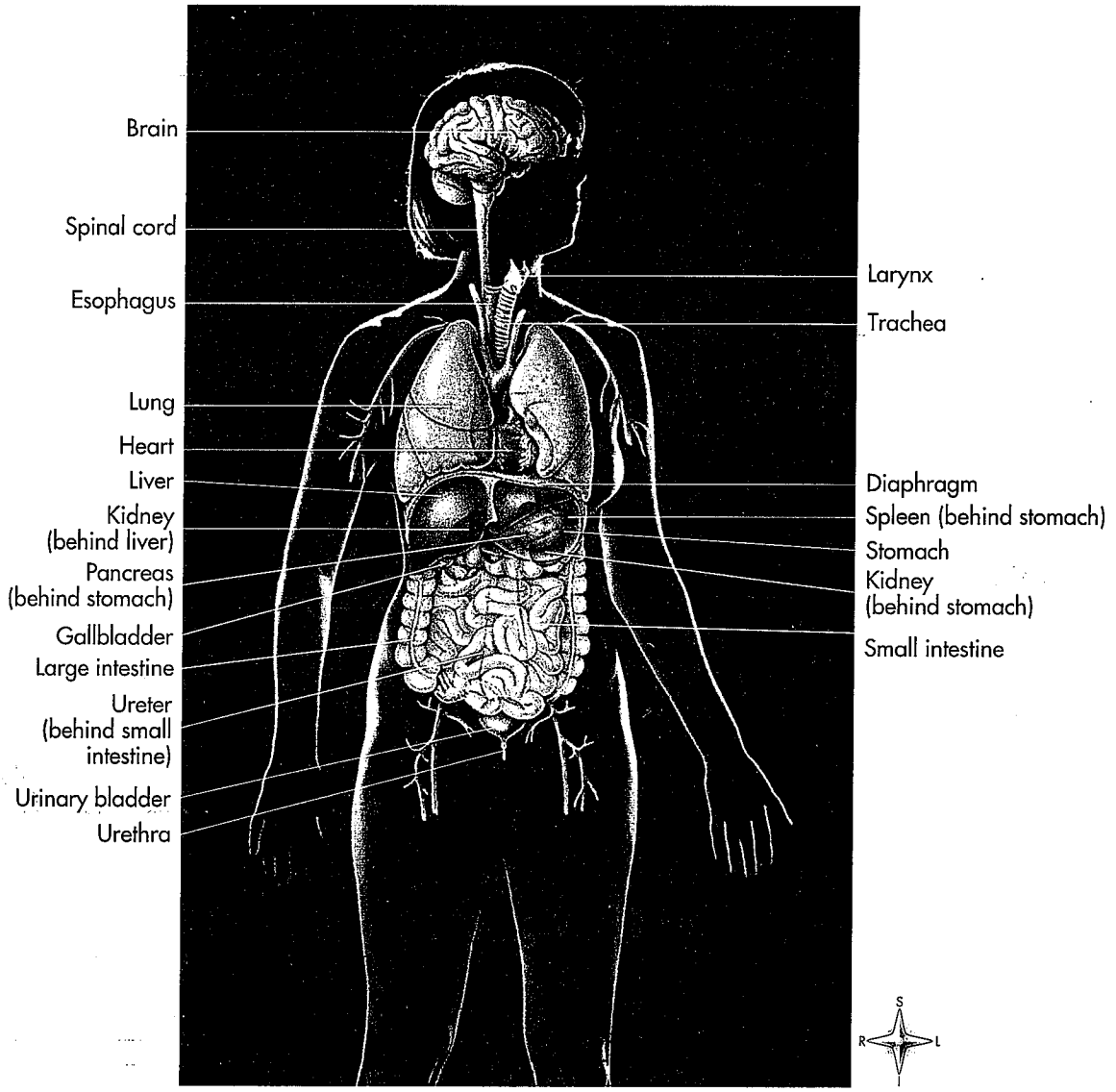
TABLE 1-1

Body Cavities

BODY CAVITY	ORGAN(S)
VENTRAL BODY CAVITY	
Thoracic cavity	
Mediastinum	Trachea, heart, blood vessels
Pleural cavities	Lungs
Abdominopelvic cavity	
Abdominal cavity	Liver, gallbladder, stomach, spleen, pancreas, small intestine, parts of large intestine
Pelvic cavity	Lower (sigmoid) colon, rectum, urinary bladder, reproductive organs
DORSAL BODY CAVITY	
Cranial cavity	Brain
Spinal cavity	Spinal cord

FIGURE 1-7

Organs of the major body cavities. A view from the front.



iliarize yourself with the more common terms sed to describe specific body regions identified in igure 1-8 and listed in Table 1-2.

The body as a whole can be subdivided into wo major portions or components: **axial** and **ap-endicular.** The axial portion of the body consists of the head, neck, and torso or trunk; the appendicular portion consists of the upper and lower extremities. Each major area is subdivided as shown in Figure 1-8. Note, for example, that the torso is composed of thoracic, abdominal, and pelvic areas, and the upper extremity is divided into arm,

FIGURE 1-8

Axial and appendicular divisions of the body. Specific body regions are labeled. Notice how the axial and appendicular regions of the body frame are distinguished by contrasting colors.

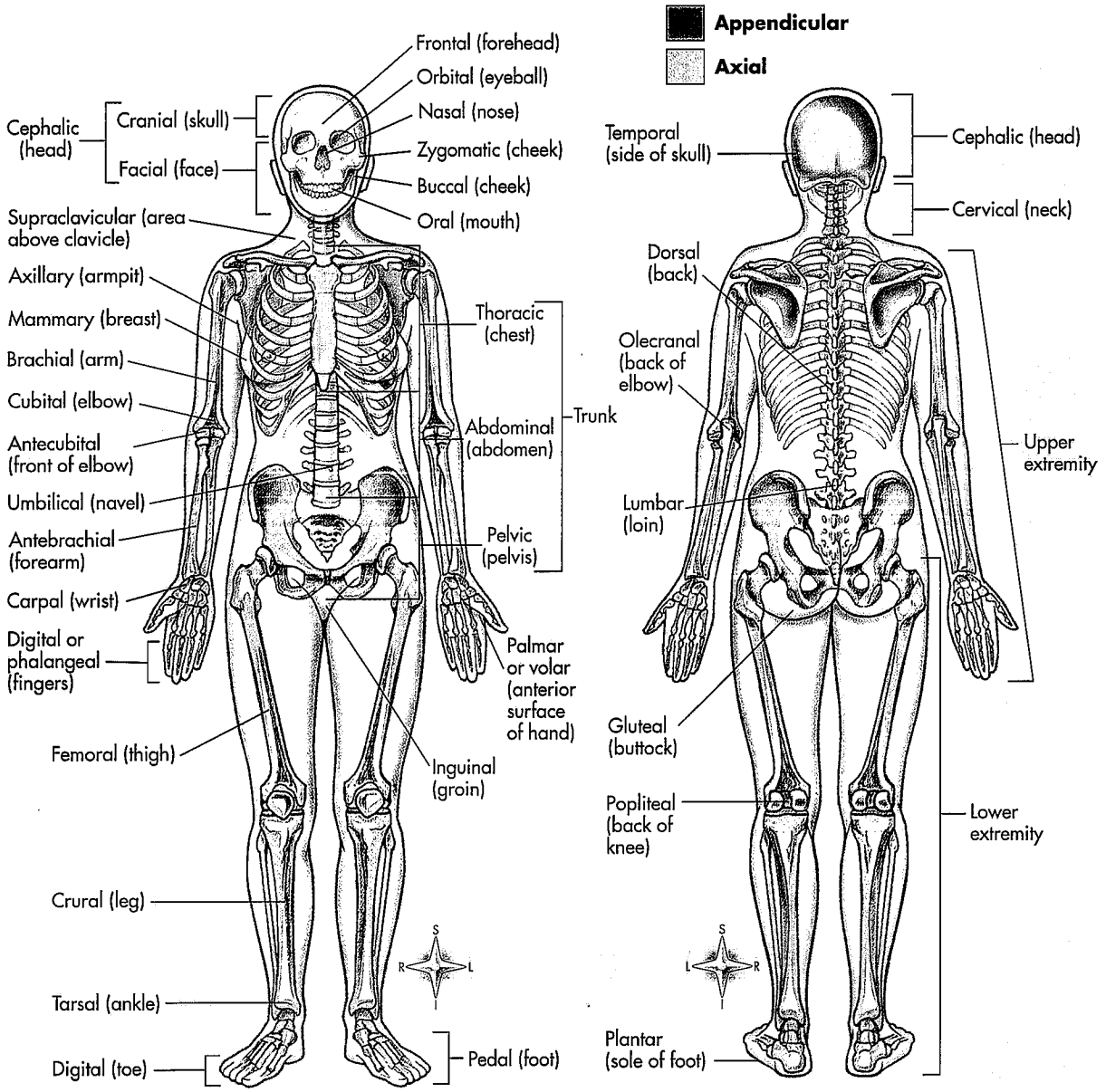


TABLE 1-2

Descriptive Terms for Body Regions

BODY REGION	AREA OR EXAMPLE
Abdominal (ab-DOM-in-al)	Anterior torso below diaphragm
Antebrachial (an-tee-BRAY-kee-al)	Forearm
Antecubital (an-tee-KYOO-bi-tal)	Depressed area just in front of elbow
Axillary (AK-si-lair-ee)	Armpit
Brachial (BRAY-kee-al)	Arm
Buccal (BUK-al)	Cheek
Carpal (KAR-pal)	Wrist
Cephalic (se-FAL-ik)	Head
Cervical (SER-vi-kal)	Neck
Cranial (KRAY-nee-al)	Skull
Crural (KROOR-al)	Leg
Cubital (KYOO-bi-tal)	Elbow
Cutaneous (kyoo-TANE-ee-us)	Skin (or body surface)
Digital (DIJ-i-tal)	Fingers or toes
Dorsal (DOR-sal)	Back
Facial (FAY-shal)	Face
Frontal (FRON-tal)	Forehead
Nasal (NAY-zal)	Nose
Oral (OR-al)	Mouth
Orbital or **ophthalmic** (OR-bi-tal or op-THAL-mik)	Eyes
Facial, cont'd **Zygomatic** (zye-go-MAT-ik)	Upper cheek
Femoral (FEM-or-al)	Thigh
Gluteal (GLOO-tee-al)	Buttock
Inguinal (ING-gwi-nal)	Groin
Lumbar (LUM-bar)	Lower back between ribs and pelvis
Mammary (MAM-er-ee)	Breast
Occipital (ok-SIP-i-tal)	Back of lower skull
Olecranal (oh-LEK-kra-nal)	Back of elbow
Palmar (PAHL-mar)	Palm of hand
Pedal (PED-al)	Foot
Pelvic (PEL-vik)	Lower portion of torso
Perineal (pair-i-NEE-al)	Area (perineum) between anus and genitals
Plantar (PLAN-tar)	Sole of foot
Popliteal (pop-li-TEE-al)	Area behind knee
Supraclavicular (soo-pra-kla-VIK-yoo-lar)	Area above clavicle
Tarsal (TAR-sal)	Ankle
Temporal (TEM-por-al)	Side of skull
Thoracic (tho-RAS-ik)	Chest
Umbilical (um-BILL-ih-kal)	Area around navel or umbilicus
Volar (VO-lar)	Palm or sole

forearm, wrist, and hand components. Although most terms used to describe gross body regions are well understood, misuse is common. The word *leg* is a good example: it refers to the area of the lower extremity between the knee and ankle and not to the entire lower extremity.

The structure of the body changes in many ways and at varying rates during a lifetime. Before young adulthood, it develops and grows; after young adulthood, it gradually undergoes degenerative changes. With advancing age, there is a generalized decrease in size or a wasting away of

many body organs and tissues that affects the structure and function of many body areas. This degenerative process is called **atrophy.** Nearly every chapter of this book will refer to a few of these changes.

The Balance of Body Functions

Although they may have very different structures, all living organisms maintain mechanisms that ensure survival of the body and success in propagating its genes through its offspring.

Survival depends on the body maintaining relatively constant conditions within the body. **Homeostasis** is what physiologists call the relative constancy of the internal environment. The cells of the body live in an internal environment made up mostly of water combined with salts and other dissolved substances. Like fish in a fishbowl, the cells are able to survive only if the conditions of their watery environment remain stable. The temperature, salt content, acid level (pH), fluid volume and pressure, oxygen concentration, and other vital conditions must remain within acceptable limits. To maintain constant water conditions in a fishbowl, one may add a heater, an air pump, and filters. Likewise, the body has mechanisms that act as heaters, air pumps, and the like, to maintain conditions of its internal fluid environment.

Because the activities of cells and external disturbances are always threatening internal stability, or homeostasis, the body must constantly work to maintain or restore that stability. To accomplish this self-regulation, a highly complex and integrated communication control system is required. The basic type of control system in the body is called a **feedback loop.** The idea of a feedback loop is borrowed from engineering. Figure 1-9, *A*, shows how an engineer would describe the feedback loop that maintains stability of temperature in a building. Cold winds outside a building may cause a decrease in building temperature below normal. A **sensor,** in this case a thermometer, detects the change in temperature. Information from the sensor *feeds back* to a **control center**—a thermostat in this example—that compares the actual temperature to the normal temperature and responds by activating the building's furnace. The furnace is called an **effector** because it has an effect on the controlled condition (temperature). Because the sensor continually feeds information back to the control center, the furnace will be automatically shut off when the temperature has returned to normal.

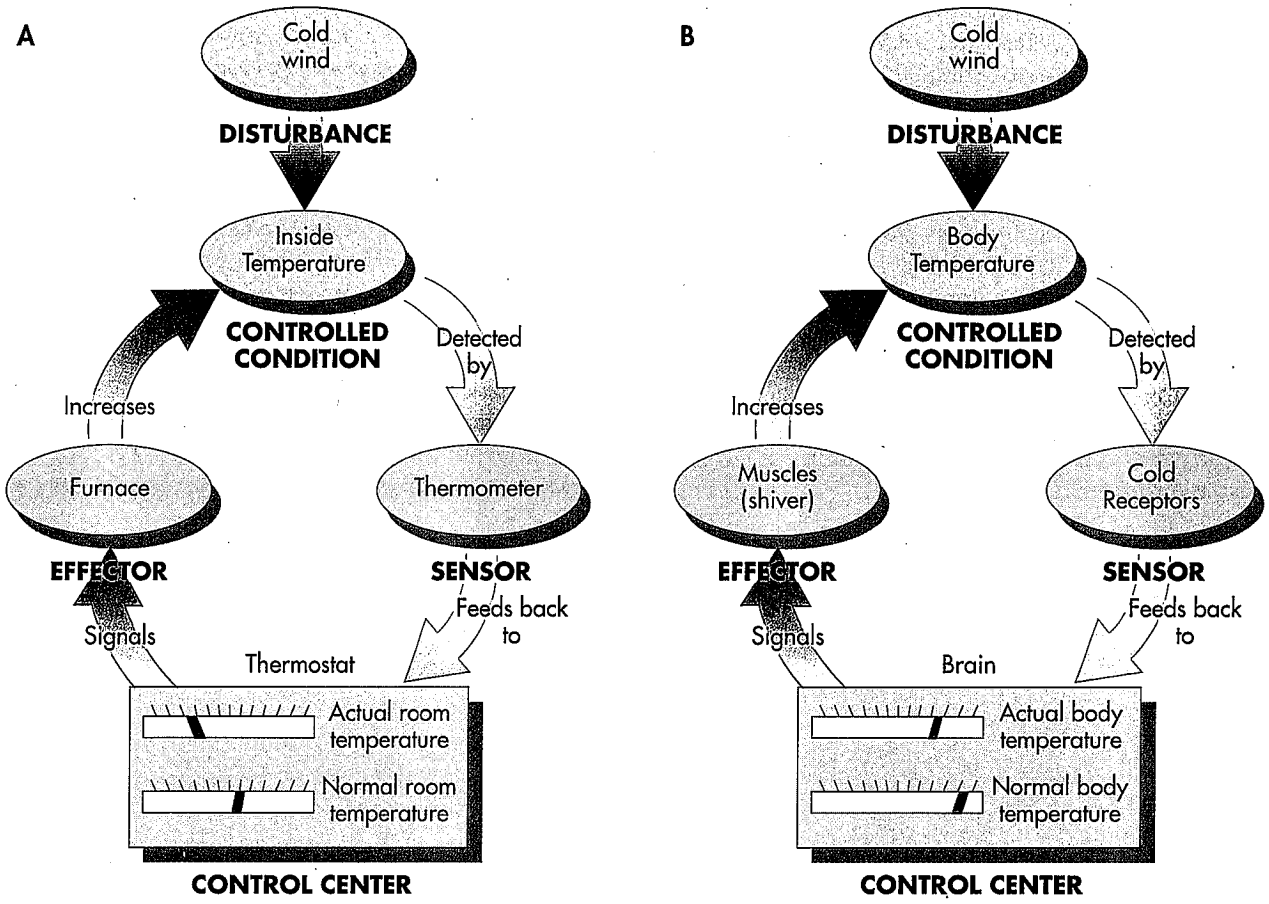
As you can see in Figure 1-9, *B*, the body uses a similar feedback loop in restoring body temperature when we become chilled. Nerve endings that act as temperature sensors feed information to a control center in the brain that compares actual body temperature to normal body temperature. In response to a chill, the brain sends nerve signals to muscles that shiver. Shivering produces heat that increases our body temperature. We stop shivering when feedback information tells the brain that body temperature has increased to normal.

Feedback loops such as those shown in Figure 1-9 are called **negative feedback loops** because they oppose, or negate, a change in a controlled condition. Most homeostatic control loops in the body involve negative feedback because reversing changes back toward a normal value tends to stabilize conditions—exactly what homeostasis is all about. An example of a negative feedback loop occurs when decreasing blood oxygen concentration caused by muscles using oxygen during exercise is counteracted by an increase in breathing to bring the blood oxygen level back up to normal. Another example is the excretion of larger than usual volumes of urine when the volume of fluid in the body is greater than the normal, ideal amount.

Although not common, **positive feedback loops** exist in the body and are involved in normal function. Positive feedback control loops are stimulatory. Instead of opposing a change in the internal environment and causing a "return to normal," positive feedback loops temporarily amplify the change that is occurring. This type of feedback loop causes an ever-increasing rate of events to occur until something stops the process. An example of a positive feedback loop includes

FIGURE 1-9

Negative feedback loops. A, An engineer's diagram showing how a relatively constant room temperature *(controlled condition)* can be maintained. A thermostat *(control center)* receives feedback information from a thermometer *(sensor)* and responds by counteracting a change from normal by activating a furnace *(effector)*. **B,** A physiologist's diagram showing how a relatively constant body temperature *(controlled condition)* can be maintained. The brain *(control center)* receives feedback information from nerve endings called cold receptors *(sensors)* and responds by counteracting a change from normal by activating shivering by muscles *(effectors)*.



the events that cause rapid increases in uterine contractions before the birth of a baby. Another example is the increasingly rapid sticking together of blood cells called *platelets* to form a plug that begins formation of a blood clot. In each of these cases, the process increases rapidly until the positive feedback loop is stopped suddenly by the birth of a baby or the formation of a clot. In the long run, such normal positive feedback events also help maintain constancy of the internal environment.

It is important to realize that homeostatic control mechanisms can only maintain a *relative* constancy. All homeostatically controlled condi-

tions in the body do not remain absolutely constant. Rather, conditions normally fluctuate near a normal, ideal value. Thus body temperature, for example, rarely remains exactly the same for very long; it usually fluctuates up and down near a person's normal body temperature.

Because all organs function to help maintain homeostatic balance, we will be discussing negative and positive feedback mechanisms often throughout the remaining chapters of this book.

Before leaving this brief introduction to physiology, we must pause to state the important principle that maintaining the balance of body functions is related to age. During childhood, homeostatic functions gradually become more and more efficient and effective. They operate with maximum efficiency and effectiveness during young adulthood. During late adulthood and old age, they gradually become less and less efficient and effective. Changes and functions occurring during the early years are called *developmental processes;* those occurring after young adulthood are called *aging processes.* In general, developmental processes improve efficiency of functions; aging processes usually diminish it.

HEALTH & WELL-BEING

Exercise Physiology

Exercise physiologists study the effects of exercise on the body organ systems. They are especially interested in the complex control mechanisms that preserve or restore homeostasis during or immediately after periods of strenuous physical activity. Exercise, defined as any significant use of skeletal muscles, is a normal activity with beneficial results. However, exercise disrupts homeostasis. For example, when muscles are worked, the core body temperature rises and blood CO_2 levels increase. These and many other body functions quickly deviate from "normal ranges" that exist at rest. Complex control mechanisms must then "kick in" to restore homeostasis.

As a scientific discipline, exercise physiology attempts to explain many body processes in terms of how they maintain homeostasis. Exercise physiology has many practical applications in therapy and rehabilitation, athletics, occupational health, and general wellness. This specialty concerns itself with the function of the whole body, not just one or two body systems.

Outline Summary

STRUCTURAL LEVELS OF ORGANIZATION (Figure 1-1)

A Organization is an outstanding characteristic of body structure

B The body is a unit constructed of the following smaller units:
- 1 Cells—the smallest structural units; organizations of various chemicals
- 2 Tissues—organizations of similar cells
- 3 Organs—organizations of different kinds of tissues
- 4 Systems—organizations of many different kinds of organs

ANATOMICAL POSITION (Figure 1-2)

Standing erect with the arms at the sides and palms turned forward

ANATOMICAL DIRECTIONS

A Superior—toward the head, upper, above
Inferior—toward the feet, lower, below

B Anterior—front, in front of (same as ventral in humans)
Posterior—back, in back of (same as dorsal in humans)

C Medial—toward the midline of a structure
Lateral—away from the midline or toward the side of a structure

D Proximal—toward or nearest the trunk, or nearest the point of origin of a structure
Distal—away from or farthest from the trunk, or farthest from a structure's point of origin

E Superficial—nearer the body surface
Deep—farther away from the body surface

PLANES OR BODY SECTIONS (Figure 1-3)

A Sagittal plane—lengthwise plane that divides a structure into right and left sections

B Midsagittal—sagittal plane that divides the body into two equal halves

C Frontal (coronal) plane—lengthwise plane that divides a structure into anterior and posterior sections

D Transverse plane—horizontal plane that divides a structure into upper and lower sections

BODY CAVITIES (Figure 1-4)

A Ventral cavity
- 1 Thoracic cavity
  - a Mediastinum—midportion of thoracic cavity; heart and trachea are located in mediastinum
  - b Pleural cavities—right lung located in right pleural cavity, left lung is in left pleural cavity
- 2 Abdominopelvic cavity
  - a Abdominal cavity contains stomach, intestines, liver, gallbladder, pancreas, and spleen
  - b Pelvic cavity contains reproductive organs, urinary bladder, and lowest part of intestine
  - c Abdominopelvic regions (Figures 1-5 and 1-6)
    - (1) Nine regions
    - (2) Four quadrants

B Dorsal cavity
- 1 Cranial cavity contains brain
- 2 Spinal cavity contains spinal cord

BODY REGIONS (Figure 1-8)

A Axial region—head, neck, and torso or trunk

B Appendicular region—upper and lower extremities

THE BALANCE OF BODY FUNCTIONS

A Survival of the individual and of the genes is the body's most important business

B Survival depends on the maintenance or restoration of homeostasis (relative constancy of the internal environment; Figure 1-9); the body uses negative feedback loops and, less often, positive feedback loops to maintain or restore homeostasis

C All organs function to maintain homeostasis

D Body functions are related to age; peak efficiency is during young adulthood, diminishing efficiency occurs after young adulthood

New Words

abdominopelvic quadrants (4)
abdominopelvic regions (9)
anatomical position
anatomy
atrophy
cavities
abdominal
cranial
pelvic
pleural
spinal
thoracic
control center
directional terms
superior
inferior
anterior
posterior
ventral
dorsal
medial
lateral
proximal
distal
superficial
deep
effector loop
feedback
homeostasis
mediastinum
negative feedback
organization
(structural levels)
chemical
cellular
tissue
organ
system
physiology
planes of section
sagittal
midsagittal
frontal
transverse
positive feedback
prone
sensor
supine

Review Questions

1. Define *anatomy* and *physiology.*
2. List and explain the levels of organization in a living thing.
3. Describe the *anatomical position.*
4. Name and explain the three planes or sections of the body.
5. List two organs of the mediastinum, two organs of the abdominal cavity, and two organs of the pelvic cavity.
6. From the upper left to the lower right, list the nine regions of the abdominopelvic cavity.
7. Name the two subdivisions of the dorsal cavity. What structures does each contain?
8. Explain the difference between the terms *lower extremity, thigh,* and *leg.*
9. List four conditions in the cell that must be kept in homeostatic balance.
10. List the three parts of a negative feedback loop and give the function of each.

Critical Thinking

11. Name a structure that is inferior to the heart, superior to the heart, anterior to the heart, posterior to the heart, and lateral to the heart.
12. The maintenance of body temperature and the birth of a baby are two body functions that are regulated by feedback loops. Explain the different feedback loops that regulate each process.
13. If a person complained of a pain in the epigastric region, what organs could be involved?

Chapter Test

1. _____ is a term derived from two Greek words meaning "cutting up."
2. _____ means the study of the function of living organisms and their parts.
3. _____, _____, _____, _____, and _____ are the five organizational levels of a living thing.
4. _____ and _____ are terms used to describe the body position when it is not in anatomical position.
5. A _____ section cuts the body or any of its parts into upper and lower portions.
6. A _____ section cuts the body or any of its parts into front and back portions.
7. A _____ section cuts the body or any of its parts into left and right portions.
8. If the body is cut into equal right and left sides, the cut is called a _____ section or plane.
9. The body portion that consists of the head, neck, and torso is called the _____ portion.
10. The body portion that consists of the upper and lower extremities is the _____ portion.
11. The two major cavities of the body are the:
    a. thoracic and abdominal
    b. abdominal and pelvic
    c. dorsal and ventral
    d. anterior and posterior
12. The structure that divides the thoracic cavity from the abdominal cavity is the:
    a. mediastinum
    b. diaphragm
    c. lungs
    d. stomach
13. The epigastric region of the abdominopelvic cavity:
    a. is inferior to the umbilical region
    b. is lateral to the umbilical region
    c. is medial to the umbilical region
    d. none of the above
14. The hypogastric region of the abdominopelvic cavity:
    a. is inferior to the umbilical region
    b. is lateral to the left iliac region
    c. is medial to the right iliac region
    d. both a and c
15. The following is an example of a positive feedback loop:
    a. maintaining a constant body temperature
    b. contractions of the uterus during childbirth
    c. maintaining a constant volume of water in the body
    d. both a and c

Match the directional terms in column B with its opposite term in column A.

COLUMN A	COLUMN B
16. ___ superior	a. posterior
17. ___ distal	b. superficial
18. ___ anterior	c. medial
19. ___ lateral	d. proximal
20. ___ deep	e. inferior

Study Tips

There are a number of topics introduced in the chapter that will be important throughout the rest of the course. The most important one is probably homeostasis. The word itself tells you what it means: *homeo* means "the same," *stasis* means "staying." Homeostasis is the balance the body tries to maintain by keeping its internal environment "staying the same." Make sure you understand this concept. Become familiar with the directional terms. You will see them in almost every diagram in the text and in the names of several body structures (superior vena cava, distal convoluted tubule). They are easier to learn because they are in opposite pairs, so if you know one term you almost automatically know its opposite. Flash cards will help in learning them. Table 1-2 and Appendix B are helpful resources to keep in mind when you see an unfamiliar term. The chapter also introduces you to levels of organization. This organizational structure should help you with the big picture as you go through the rest of the text.

In your study groups try to come up with examples of negative feedback loops that help maintain a balance. Be creative; don't just use the furnace example. Go over your directional flash cards or photocopy Figure 1-3 and blacken out the terms and use it to quiz each other. Go over the questions in the back of the chapter and discuss possible test questions.