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Michael Crandell

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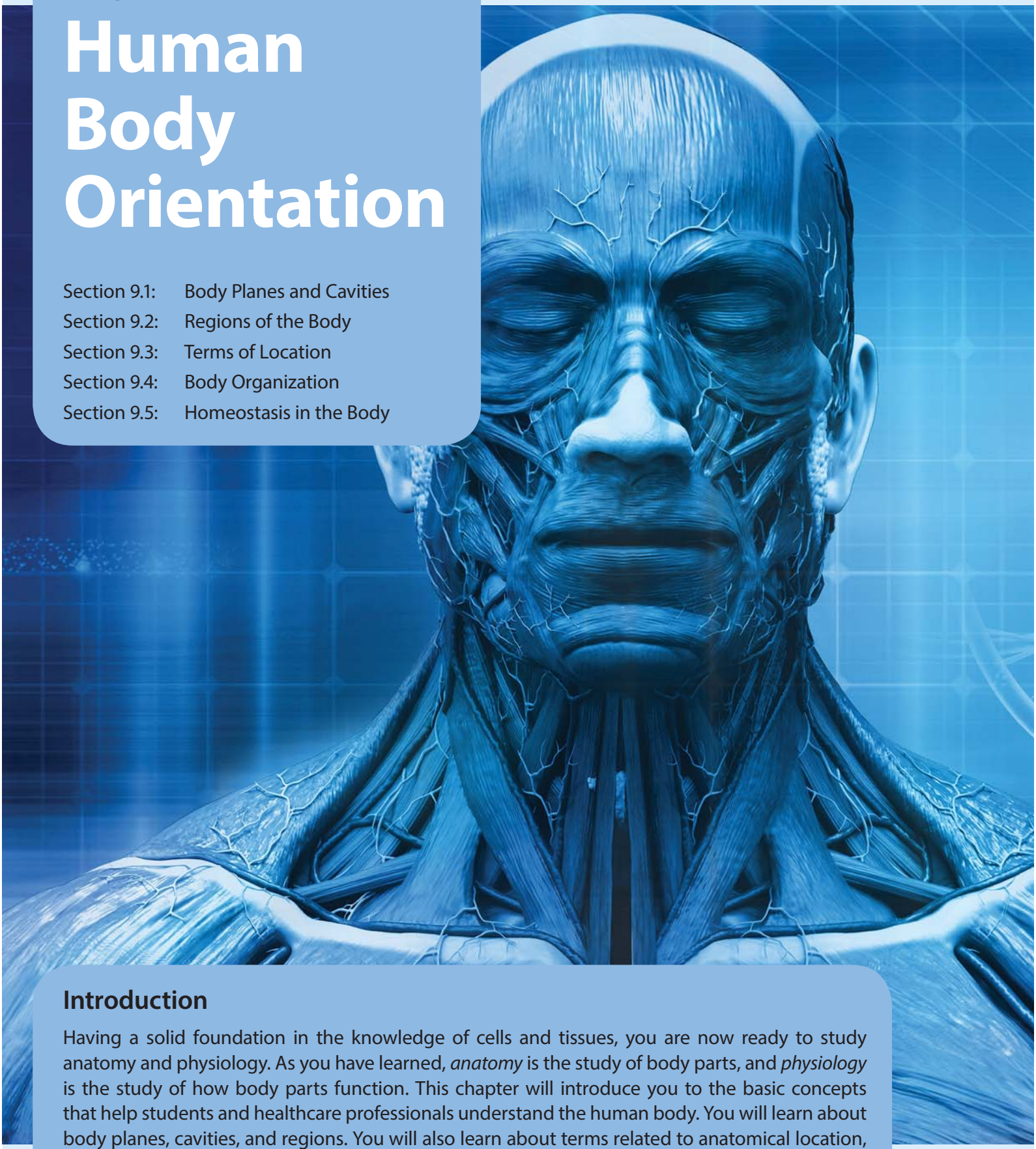
Chapter 9

Human Body Orientation

Section 9.1: Body Planes and Cavities
Section 9.2: Regions of the Body
Section 9.3: Terms of Location
Section 9.4: Body Organization
Section 9.5: Homeostasis in the Body



Introduction

Having a solid foundation in the knowledge of cells and tissues, you are now ready to study anatomy and physiology. As you have learned, *anatomy* is the study of body parts, and *physiology* is the study of how body parts function. This chapter will introduce you to the basic concepts that help students and healthcare professionals understand the human body. You will learn about body planes, cavities, and regions. You will also learn about terms related to anatomical location, the body's structural organization, and homeostasis in the body.

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Objectives

After completing this chapter, you will be able to

- describe anatomical position
- identify and understand the body planes
- list the major dorsal and ventral cavities of the body
- know the regions of the body, including regions of the head and neck, trunk, and appendages
- identify the abdominopelvic regions
- use anatomical terms related to location and position
- understand the five levels of organization in the body
- explain how homeostatic body temperature, blood glucose concentration, and blood pH are maintained in the body

Key Terms

The following terms and phrases will be introduced and explained in Chapter 9. Read through the list to become familiar with the words.

abdominal cavity
abdominal region
abdominopelvic cavity
abdominopelvic region
anatomical position
appendicular region
axial region
blood glucose concentration
body cavity
body plane
body system
body temperature
cephalic region
cervical region
cranial cavity
deep
distal
dorsal
frontal plane
glucagon
inferior
insulin
intermediate
lateral
lower limb
manus
medial
midsagittal plane
negative feedback
organism
pedal
pelvic cavity
pelvic region
proximal
pubic region
sagittal plane
spinal cavity
superficial
superior
thoracic cavity
thoracic region
transverse plane
upper limb
ventral

Section 9.1 Body Planes and Cavities

The study of anatomy and physiology is the study of body parts and their functions. In the fields of anatomy and physiology, healthcare professionals and students use body planes to describe locations and positions on the body. Body cavities also help divide the human body into sections that can be studied. In this section, you will learn about anatomical position and about body planes and cavities.

The terms below are some of those that will be introduced in Section 9.1. To become familiar with these terms, reproduce each word on the line beside it. Pronounce each term as you write it. You will learn the definitions of these words as you complete this section.

1. anatomical position _____
2. body plane _____
3. midsagittal plane _____
4. sagittal plane _____
5. frontal plane _____
6. transverse plane _____
7. body cavity _____
8. cranial cavity _____
9. spinal cavity _____
10. thoracic cavity _____
11. abdominal cavity _____
12. pelvic cavity _____
13. abdominopelvic cavity _____

Concept 1: Anatomical Position

anatomical position a body position in which a person stands upright with feet apart, arms at the sides, feet and palms facing forward, and thumbs pointing away from the body

Anatomy and physiology describe the locations and positions of body structures and body movements. *Anatomy* is the study of body parts, and *physiology* is the study of how body parts function. In anatomy and physiology, body locations are described in reference to *anatomical position*. Anatomical position is a body position in which a person stands upright with feet apart, arms at the sides, feet and palms facing forward, and thumbs pointing away from the body (**Figure 9.1**).

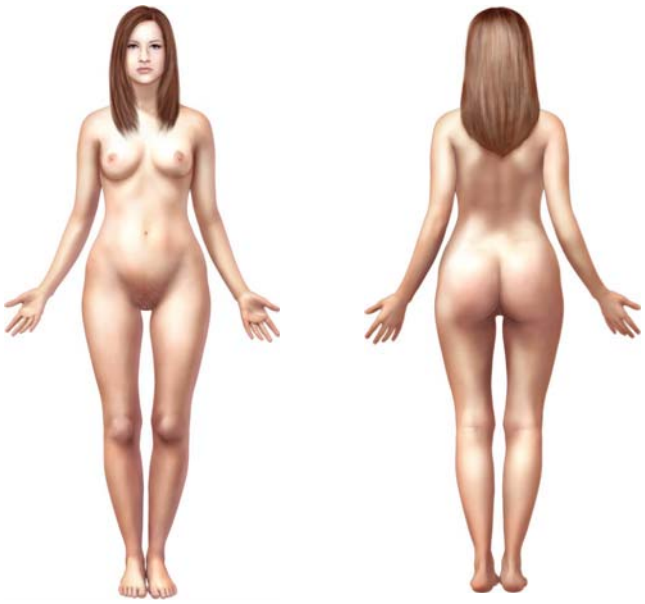

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Figure 9.1 Anatomy and physiology describe locations on the body in reference to anatomical position.

Recall Activity

1. In anatomy and physiology, body locations are described in reference to _____.
2. In anatomical position, the palms and feet face _____.
3. In anatomical position, the _____ point away from the body.

Concept 2: Body Planes

When describing locations, positions, and directions on the body, *body planes* serve as reference points. *Body planes* are imaginary, flat surfaces that divide the body into sections. They are also known as *anatomical planes*. Body planes divide the body in reference to anatomical position and divide the body into the same sections from any viewing angle (**Figure 9.2**).

body plane an imaginary, flat surface that divides the body into sections; also called an *anatomical plane*

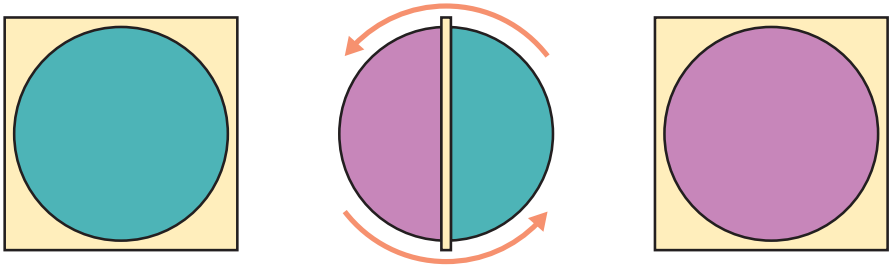

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Figure 9.2 A plane divides this ball into left and right sections. The plane divides the ball into the same sections from all three viewing angles.

Four standard body planes are used in anatomy and physiology:

- midsagittal (median) plane
- sagittal plane
- frontal (coronal) plane
- transverse plane

By dividing the body into parts, you can get a better idea of how organs are positioned inside the body.

Recall Activity

1. List the four standard body planes used in anatomy and physiology._____

   _____

2. Body _____ are imaginary, flat surfaces that divide the body into sections.
3. Body planes divide the body in reference to _____.

Concept 3: Midsagittal and Sagittal Planes

The *midsagittal* and *sagittal planes* divide the body into left and right sections. Both planes start at the top of the head and continue down through the body. The *midsagittal plane*, also known as the *median plane*, divides the body down the middle into equal left and right halves. The *sagittal plane* also divides the body into left and right sections, but not down the middle (**Figure 9.3**).

midsagittal plane a body plane that divides the body into equal left and right halves; also called the *median plane*

sagittal plane a body plane that divides the body into unequal left and right sections

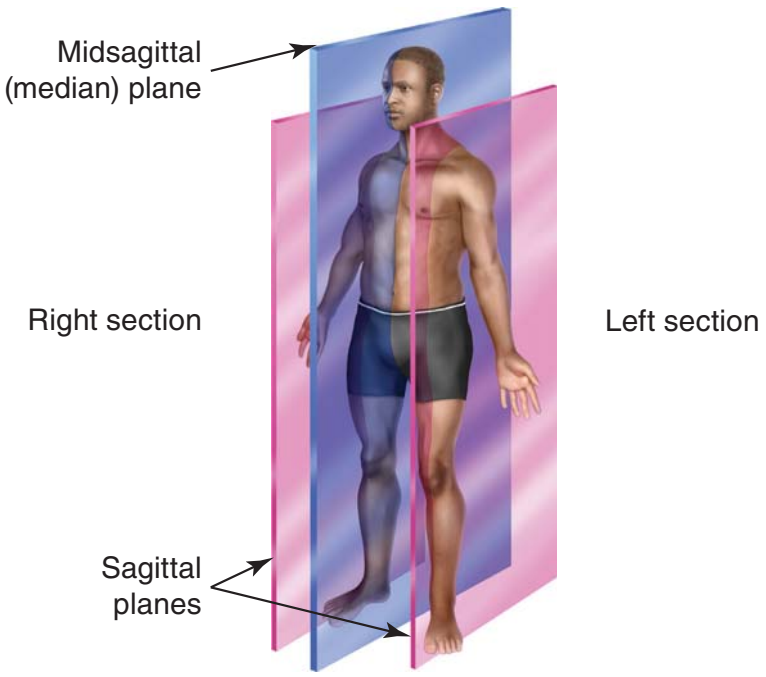

Figure 9.3 The midsagittal plane divides the body into equal left and right halves. The sagittal plane divides the body into unequal left and right sections.

Recall Activity

1. Which body plane divides the body into equal left and right halves? _____
2. Which body plane divides the body into unequal left and right sections?_____

Concept 4: Frontal Plane

The *frontal plane* divides the body into front (ventral) and back (dorsal) sections. The frontal plane starts at the top of the head and continues down through the body (**Figure 9.4**). The sections on either side of the plane are not equal. The frontal plane is also called the *coronal plane*.

frontal plane a body plane that divides the body into front (ventral) and back (dorsal) sections; also called the *coronal plane*

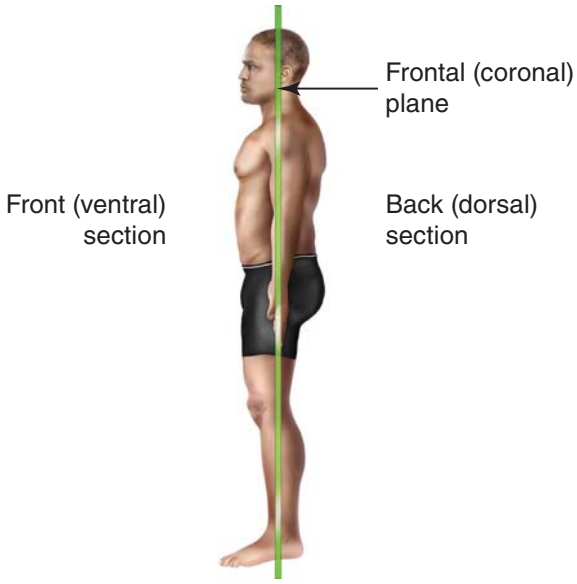

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Figure 9.4 The frontal plane divides the body into front and back sections.

Recall Activity

1. The _____ plane divides the body into front and back sections.
2. *True or False*. The sections on either side of the frontal plane are not equal. _____

Concept 5: Transverse Plane

The *transverse plane* divides the body into top and bottom sections. The transverse plane passes through the middle of the body, starting at one arm and continuing through the body to the opposite arm (**Figure 9.5**). Sections of the body divided by the transverse plane are called *cross-sections*.

transverse plane a body plane that divides the body into top and bottom sections

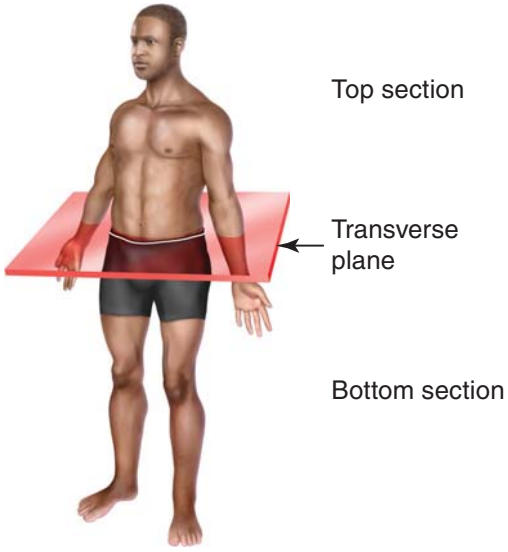

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Figure 9.5 The transverse plane divides the body into top and bottom sections.

Recall Activity

1. The transverse plane divides the body into _____ and _____ sections.
2. The transverse plane passes through the _____ of the body.
3. Sections of the body divided by the transverse plane are called _____.

Concept 6: Body Cavities

body cavity a space within the body that contains organs

A *body cavity* is a space within the body that contains organs. If you took the organs out of the body, the remaining body cavities would be empty. Some body cavities are surrounded by bone, and others are surrounded by muscle, connective tissue, or epithelial tissue. The body contains dorsal and ventral cavities.

Recall Activity

1. A body cavity is a space within the body that contains _____.
2. Some body cavities are surrounded by _____, and others are surrounded by muscle, _____ tissue, or _____ tissue.

Concept 7: Dorsal Cavities

The frontal plane divides the body into back (dorsal) and front (ventral) sections. The *dorsal* surface of the body is the back. There are two body cavities in the dorsal

section: the cranial cavity and the spinal cavity. The skull forms the *cranial cavity*, which contains the brain. The hollow spaces inside vertebrae (bone segments of the spine) form the *spinal cavity*, which protects the spinal cord (**Figure 9.6**).

cranial cavity the dorsal body cavity that contains the brain

spinal cavity the dorsal body cavity that contains the spinal cord

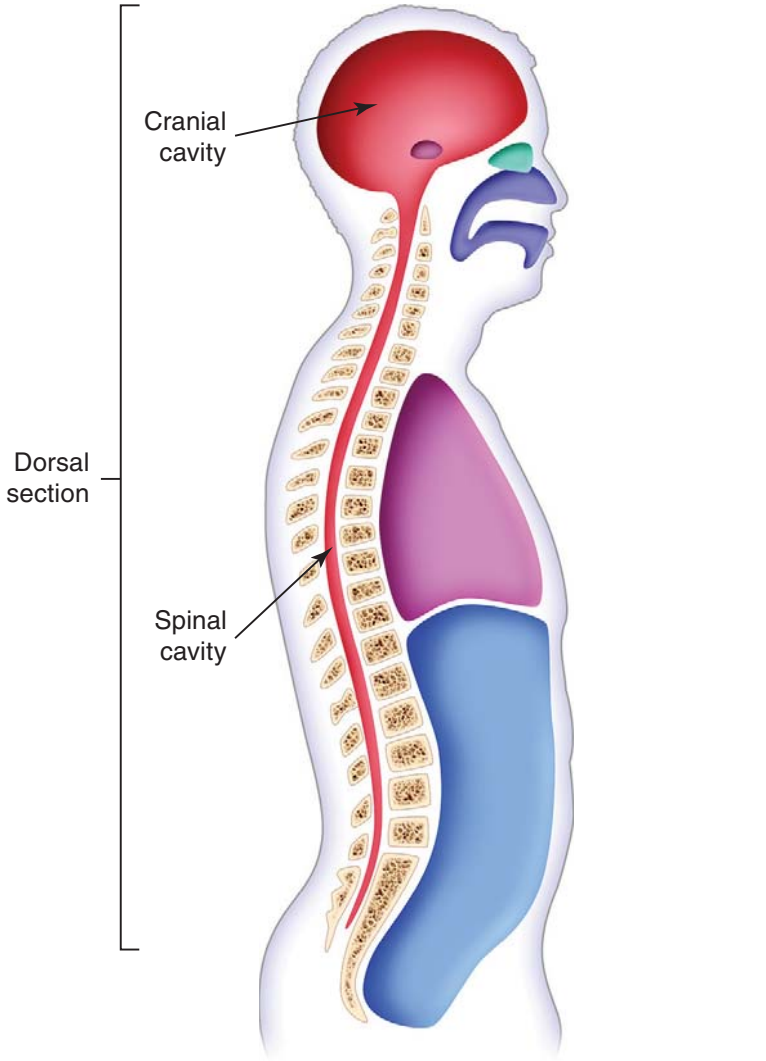

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Figure 9.6 The dorsal cavities are the cranial and spinal cavities.

Recall Activity

1. Name the two body cavities in the dorsal section. _____
2. Which body cavity protects the brain? _____

Concept 8: Ventral Cavities

The *ventral* surface of the body is the front. There are three cavities in the ventral section: the thoracic cavity, the abdominal cavity, and the pelvic cavity.

thoracic cavity the ventral body cavity that contains the heart and lungs

abdominal cavity the ventral body cavity that contains the stomach, liver, spleen, and intestines

pelvic cavity the ventral body cavity that contains the urinary bladder and some reproductive organs

abdominopelvic cavity the abdominal and pelvic cavities; contains the stomach, liver, spleen, intestines, urinary bladder, and some reproductive organs

The *thoracic cavity* is formed by the rib cage and protects the heart and lungs. A portion of the rib cage forms the upper *abdominal cavity*; the rest of the abdominal cavity is surrounded with soft tissue. The major organs of the abdominal cavity are the stomach, liver, spleen, and intestines. The *pelvic cavity* is surrounded by the bones of the pelvis and contains the urinary bladder and some reproductive organs. Sometimes the abdominal and pelvic cavities are referred to collectively as the *abdominopelvic cavity* (**Figure 9.7**).

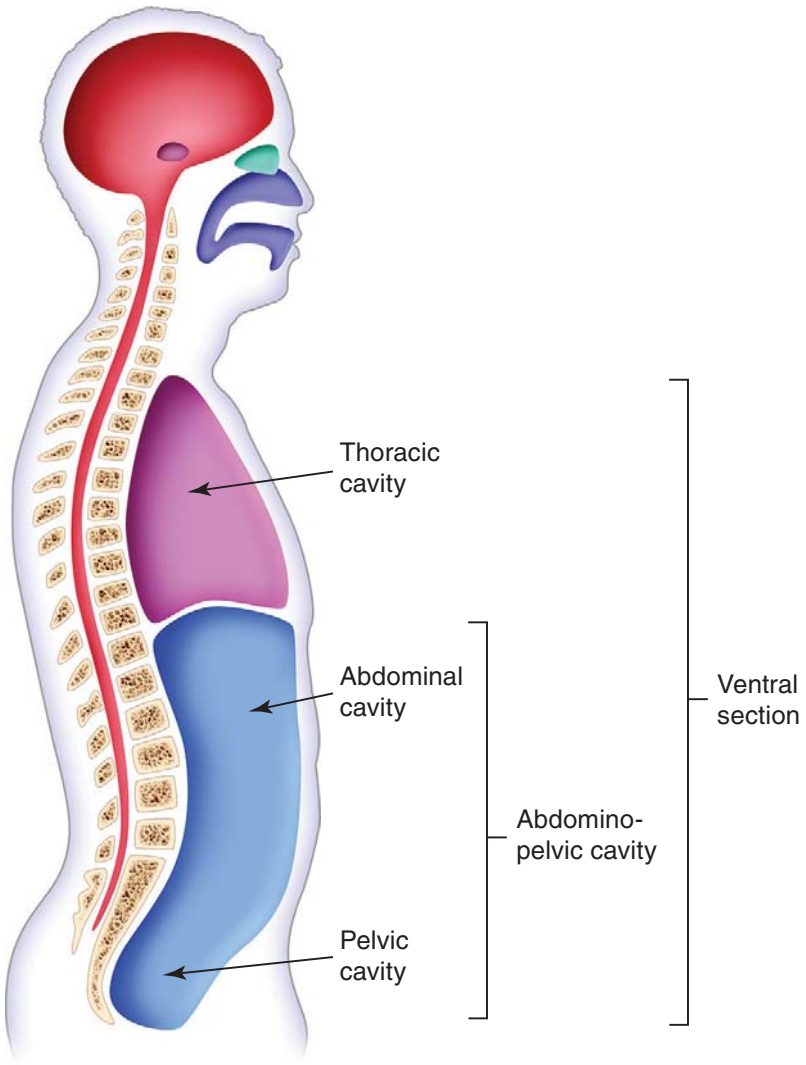

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Figure 9.7 The ventral cavities are the thoracic, abdominal, and pelvic cavities.

Recall Activity

1. The _____ cavity protects the heart and lungs.
2. The abdominal and pelvic cavities are referred to collectively as the _____ cavity.
3. The urinary bladder and some reproductive organs are housed in the _____ cavity.

Section 9.1 Reinforcement

Answer the following questions using what you learned in this section.

1. In anatomical position, the _____ and _____ face forward.
2. Which of the following body planes divides the body into equal left and right halves?
   A. sagittal plane
   B. midsagittal plane
   C. frontal plane
   D. transverse plane
3. A(n) _____ is a space within the body that contains organs.
4. *True or False*. The frontal plane is also called the *coronal plane*. _____
5. Unscramble the letters: nertlav. Define the word that is formed. _____
   _____
6. Which of the following words are misspelled?
   A. dorsal
   B. ventrile
   C. saggital
   D. median
7. Which of the following is *not* a ventral cavity?
   A. thoracic cavity
   B. spinal cavity
   C. pelvic cavity
   D. abdominal cavity
8. The two body cavities of the dorsal section are the _____ cavity and the _____ cavity.
9. *True or False*. The stomach, liver, and intestines are housed in the pelvic cavity. _____
10. Describe the difference between the midsagittal plane and the sagittal plane. _____
    _____
    _____
11. Which of the following are ventral body cavities?
    A. thoracic cavity
    B. spinal cavity
    C. pelvic cavity
    D. abdominal cavity
12. The _____ plane divides the body into front and back sections.
13. Sections of the body divided by the _____ plane are called cross-sections.
14. *True or False*. All body cavities are surrounded by bone. _____
15. Which body cavity contains the heart and lungs? _____
16. *True or False*. The term *ventral* refers to the back section of the body. _____
17. The skull forms the _____ cavity.
18. In anatomical position, which direction do the thumbs point? _____
19. Unscramble the letters: haccroti. Define the word that is formed. _____
    _____

20. Which of the following are dorsal body cavities?
    A. thoracic cavity
    B. spinal cavity
    C. pelvic cavity
    D. cranial cavity

21. Which body plane divides the body into top and bottom sections?_____

Match the following terms with their definitions.

_____ 22. A body plane that divides the body into unequal left and right sections

_____ 23. A body plane that divides the body into equal left and right halves

_____ 24. A body plane that divides the body into front and back sections

_____ 25. A body plane that divides the body into top and bottom sections

_____ 26. An imaginary, flat surface that divides the body into sections

_____ 27. A body position in which a person stands upright with feet apart, arms at the sides, feet and palms facing forward, and thumbs pointing away from the body

A. anatomical position
B. body plane
C. midsagittal plane
D. sagittal plane
E. frontal plane
F. transverse plane

Comprehensive Review (Chapters 1–9)

Answer the following questions using what you have learned so far in this book.

28. Which body plane divides the body into equal left and right halves? _____

29. The "then" portion of a hypothesis is the _____ variable.

30. Why are hydrogen bonds the weakest type of atomic bond? _____

_____

31. Science's body of knowledge is the _____ that scientists have accumulated about the natural world.

32. *True or False*. Cytoplasm is all the material found inside a cell except for the nucleus. _____

33. Which of the following word parts means "layer"?
    A. alb/o
    B. sten/o
    C. rect/o
    D. lat/o
    E. strat/o
    F. rubr/o

34. When atoms move from areas of high concentration to areas of low concentration, this is called a(n) _____ reaction.

35. The volume measurement of 1000 mL is the same as _____ L.

36. Which type of muscle tissue is voluntary? _____

Section 9.2 Regions of the Body

In anatomy and physiology, healthcare professionals and students use an array of terms to refer to specific regions of the body. In this section, you will learn about abdominopelvic regions and about anatomical terms related to the head and neck, trunk, and limbs.

The terms below are some of those that will be introduced in Section 9.2. To become familiar with these terms, reproduce each word on the line beside it. Pronounce each term as you write it. You will learn the definitions of these words as you complete this section.

1. axial region _____
2. appendicular region _____
3. cephalic region _____
4. cervical region _____
5. thoracic region _____
6. abdominal region _____
7. pelvic region _____
8. pubic region _____
9. abdominopelvic region _____
10. upper limb _____
11. manus _____
12. lower limb _____
13. pedal _____

Concept 1: Axial Versus Appendicular Regions

The body can be divided into axial and appendicular regions. The *axial region* of the body is the body's core: the head, neck, and trunk. The *appendicular region* includes the *appendages*, or limbs (arms and legs). The appendicular region is attached to the axial region, and regional terms identify specific surfaces of axial and appendicular parts (**Figure 9.8**).

axial region the head, neck, and trunk of the body

appendicular region the limbs (arms and legs) of the body

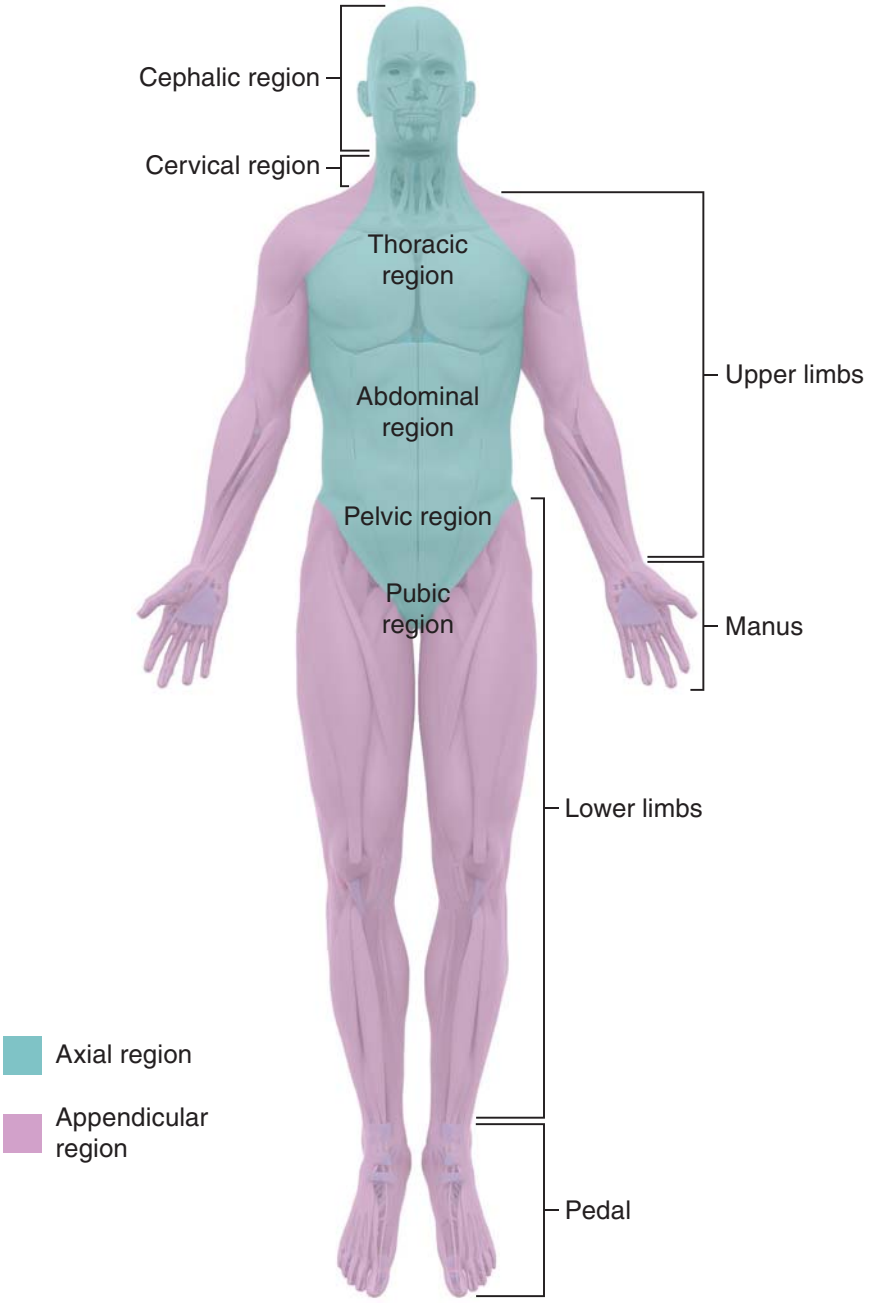

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Figure 9.8 The axial region includes the head, neck, and trunk. The appendicular region includes the limbs.

Recall Activity

1. The limbs are part of the _____ region of the body.
2. *True or False*. The axial region and the appendicular region are attached._____
3. The _____ region of the body includes the head, neck, and trunk.

Concept 2: Head and Neck

At the top of the body, the head and neck are part of the axial region. The head area is called the *cephalic region*. Some surface parts of the cephalic region include the forehead, scalp, eyes, nose, mouth, cheeks, lips, and ears. The neck area is called the *cervical region* and includes the cervical vertebrae (bone segments of the spine that make up the neck).

cephalic region the head area of the body

cervical region the neck area of the body

Recall Activity

1. The head area is called the _____ region.
2. The cervical region makes up the _____ area and includes the cervical vertebrae.
3. List three surface parts of the cephalic region. _____

Concept 3: Trunk

The *trunk* of the body encompasses the chest, thorax, and hips. The body's trunk can be divided into four regions: the thoracic region, the abdominal region, the pelvic region, and the pubic region. The *thoracic region* includes the chest or breast. The *abdominal region* encompasses the belly and navel (belly button). The *pelvic region* includes the hips, and the *pubic region* refers to the groin and genitals.

thoracic region the chest or breast area of the body

abdominal region the belly area of the body

pelvic region the hip area of the body

pubic region the groin and genital area of the body

Recall Activity

1. Which region refers to the groin and genitals? _____
2. The _____ region includes the chest or breast.
3. The abdominal region encompasses the _____ and _____.

Concept 4: Abdominopelvic Regions

The abdominal and pelvic regions encompass the *abdominal cavity* and the *pelvic cavity*, known collectively as the *abdominopelvic cavity*. The abdominopelvic cavity can be divided into nine regions, much like a tic-tac-toe box. When referring to the *abdominopelvic regions*, envision the body in anatomical position. In anatomy, *left* always refers to the body's left (not your left), and *right* always refers to the body's right (not your right). The abdominopelvic regions are organized into three rows and three columns (**Figure 9.9**).

abdominopelvic region an area of the abdominopelvic cavity

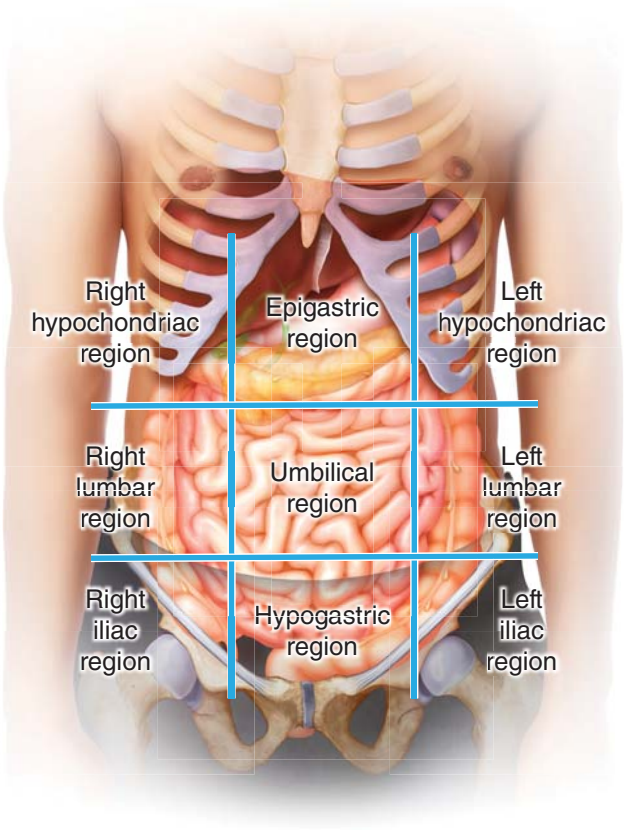

Figure 9.9 There are nine abdominopelvic regions.

Recall Activity

1. The abdominopelvic regions are organized into three _____ and three _____.
2. In anatomy, *left* always refers to _____ left, and *right* always refers to _____ right.
3. The abdominopelvic cavity is divided into _____ region(s).

Concept 5: First Row

In the first row of abdominopelvic regions are the right hypochondriac region, the epigastric region, and the left hypochondriac region. The prefix *hypo-* means "below," and the root word *chondr* (meaning "cartilage") refers to the cartilage of the rib cage. Thus, the *right hypochondriac region* and the *left hypochondriac region* refer to the abdominopelvic areas just below the rib cage. The prefix *epi-* means "upon," and the root word *gastr* refers to the stomach. Thus, the *epigastric region* encompasses the area above the stomach.

Recall Activity

1. List the three abdominopelvic regions in the first row. _____

   _____

2. Disassemble and define the word *epigastric*. _____
3. Which of the following word parts means "below"?
   A. hypo-
   B. epi-
   C. chondr
   D. gastr

Concept 6: Second Row

The second row of abdominopelvic regions contains the right lumbar region, the umbilical region, and the left lumbar region. The word *lumbar* is formed from the root word *lumb* (meaning "lower back") and the suffix *-ar* (meaning "pertaining to"). Thus, the *right lumbar region* and the *left lumbar region* refer to abdominopelvic areas of the lower back. The *umbilical region* identifies the area where the navel (the remnant of the *umbilical* cord) is located.

Recall Activity

1. The navel is the remnant of the _____ cord.
2. The second row of abdominopelvic regions contains the right _____ region, the _____ region, and the left _____ region.
3. The right lumbar region and the left lumbar region refer to abdominopelvic areas of the _____.

Concept 7: Third Row

In the third row of abdominopelvic regions are the right iliac region, the hypogastric region, and the left iliac region. The word *iliac* is formed from the root word *ili* (meaning "ilium") and the suffix *-ac* (meaning "pertaining to") and refers to the portion of the pelvis called the *ilium* (**Figure 9.10**). The *right iliac region* and the *left iliac region* encompass the area around the ilium. The prefix *hypo-* means "below," and the root word *gastr* refers to the stomach; therefore, the *hypogastric region* is the area below the stomach.

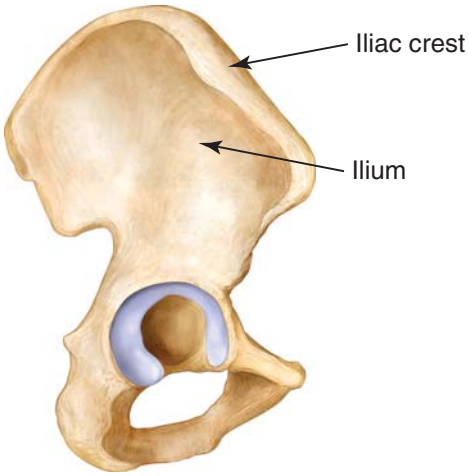

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Figure 9.10 The ilium is a portion of the pelvis.

Recall Activity

1. The hypogastric region is the area below the _____.
2. The word *iliac* refers to a portion of the pelvis called the _____.
3. List the three abdominopelvic regions in the third row. _____

_____

Concept 8: Limbs

upper limb the arm and shoulder area of the body
manus the hand area of the body
lower limb the leg and hip area of the body
pedal the foot area of the body

The limbs, or *appendages*, make up the appendicular region of the body and include the arms, hands, legs, and feet. The arms are called the *upper limbs*, and the surfaces of the upper limbs include the shoulder, upper arm, elbow (front and back), forearm, and wrist. The hands are referred to as *manus* and include the surfaces of your thumbs, palms, and digits (fingers). The *lower limbs* are the legs. The surfaces of the lower limbs are the hip, thigh, knee (front and back), calf, shin, and ankle. The feet are called *pedal* and include the surfaces of the sole, heel, and digits (toes). An easy way to distinguish between manus and pedal is that *manicures* are for your hands, and *pedicures* are for your feet.

Recall Activity

1. The hands are referred to as _____.
2. The _____ are called pedal.
3. Explain the difference between the upper and lower limbs. _____

_____

Section 9.2 Reinforcement

Answer the following questions using what you learned in this section.

1. The _____ area is called the *cephalic region*.
2. *True or False*. The navel is also known as the *belly button*. _____
3. The pubic region refers to the _____ and genitals.
4. Name the abdominopelvic regions in the second row._____

   _____
5. In which region is the chest found?
   A. pelvic region
   B. thoracic region
   C. abdominal region
   D. pubic region
6. Which body cavity is divided into nine regions? _____
7. *True or False*. The pelvic region encompasses the belly and navel. _____
8. Which of the following words are misspelled?
   A. epigastric
   B. hypochondric
   C. lumbar
   D. umbiblical
9. Name the abdominopelvic regions in the third row. _____

   _____
10. *True or False*. The term *pedal* refers to the hand._____
11. Which region of the body encompasses the head, neck, and trunk? _____
12. The _____ region of the body includes the limbs (arms and legs).
13. Which of the following is *not* an abdominopelvic region of the first row?
    A. epigastric region
    B. left hypochondriac region
    C. umbilical region
    D. right hypochondriac region
14. Unscramble the letters: schryogipta. Define the word that is formed. _____

    _____
15. The _____ area is called the *cervical region.*
16. *True or False*. The surfaces of the upper limbs include the shoulder, upper arm, elbow (front and back), forearm, and wrist. _____
17. List the four regions of the trunk. _____

    _____
18. Unscramble the letters: enaclapdipru. Define the word that is formed. _____

    _____
19. *True or False*. The prefix *hypo-* means "below."_____

20. Which of the following word parts means "stomach"?
    A. chondr
    B. gastr
    C. hypo-
    D. epi-

21. The feet are called _____ and include the surfaces of the sole, heel, and digits (toes).

Match the following terms with their definitions.

_____ 22. The hands
_____ 23. The neck area
_____ 24. The feet
_____ 25. The area containing the chest
_____ 26. The area containing the groin
_____ 27. The arms
_____ 28. The legs
_____ 29. The head, neck, and trunk
_____ 30. The head area
_____ 31. The abdominal and pelvic cavities
_____ 32. The area containing the hips
_____ 33. The area containing the belly
_____ 34. The limbs (arms and legs)

A. abdominopelvic cavity
B. axial region
C. appendicular region
D. cephalic region
E. cervical region
F. thoracic region
G. abdominal region
H. pelvic region
I. pubic region
J. upper limbs
K. manus
L. lower limbs
M. pedal

Comprehensive Review (Chapters 1–9)

Answer the following questions using what you have learned so far in this book.

35. The prefix *meso-* means "_____."
36. An explanation is supernatural if it cannot be _____.
37. Arrange the following phases of mitosis from first to last: anaphase, prophase, telophase, and metaphase.

    _____

38. A scientific law is a general statement of _____.
39. Describe anatomical position. _____

    _____

40. What is the complementary base of guanine? _____
41. Water freezes at _____°C.
42. *True or False*. A cell's plasma membrane is selectively permeable. _____
43. Which of the following body parts are made of elastic cartilage?
    A. nose
    B. mouth
    C. ear
    D. epiglottis

Section 9.3 Terms of Location

Anatomy and physiology includes many terms related to the locations of body parts. All of these terms apply only when the body is in anatomical position. Some of the terms you will learn about in this section include *superior*, *inferior*, *ventral*, *dorsal*, *medial*, *lateral*, *intermediate*, *proximal*, *distal*, *superficial*, and *deep*. By the end of this section, you will know how to use all of these terms correctly.

The terms below are some of those that will be introduced in Section 9.3. To become familiar with these terms, reproduce each word on the line beside it. Pronounce each term as you write it. You will learn the definitions of these words as you complete this section.

1. superior _____
2. inferior _____
3. ventral _____
4. dorsal _____
5. medial _____
6. lateral _____
7. intermediate _____
8. proximal _____
9. distal _____
10. superficial _____
11. deep _____

Concept 1: Describing Location

In anatomy and physiology, healthcare professionals and students often describe the locations of body parts in comparison to other body parts. Comparing the locations of body parts in relation to each other makes it easier to envision positions on the body. Note that the terms of location introduced in this section only apply to body parts when the body is in anatomical position.

Recall Activity

1. Healthcare professionals and students often describe the locations of body parts in comparison to _____.
2. Terms of location only apply to body parts when the body is in _____.
3. *True or False*. Terms of location apply to body parts when the body is in any position. _____

Concept 2: Superior and Inferior

The terms *superior* and *inferior* indicate whether a body part is closer to the head or closer to the feet. If a body part is *superior*, it is closer to the head. If a body part is *inferior*, it is closer to the feet. For example, your head is superior to your neck, and your neck is inferior to your head. Your neck is superior to your shoulder, and your shoulder is inferior to your neck (**Figure 9.11**).

superior closer to the head of the body

inferior closer to the feet of the body

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Figure 9.11 If a body part is superior, it is closer to the head. If it is inferior, it is closer to the feet.

Recall Activity

1. Which of the following body parts is most superior?
   A. hip
   B. chest
   C. ankle
   D. knee
2. Your navel is _____ to your neck.
3. Which of the following body parts is most inferior?
   A. eye
   B. nose
   C. neck
   D. shoulder
4. Your elbow is _____ to your knee.

Concept 3: Ventral and Dorsal

ventral closer to the front of the body; also called *anterior*

dorsal closer to the back of the body; also called *posterior*

Ventral and *dorsal* describe locations in relation to the front and back of the body. If a body part is *ventral*, it is closer to the front of the body. Another word for ventral is *anterior*. If a body part is *dorsal*, it is closer to the back of the body. Another word for dorsal is *posterior*. Your heart is ventral (anterior) to your spine, and your spine is dorsal (posterior) to your heart. Your sternum is ventral (anterior) to your heart, and your heart is dorsal (posterior) to your sternum (**Figure 9.12**).

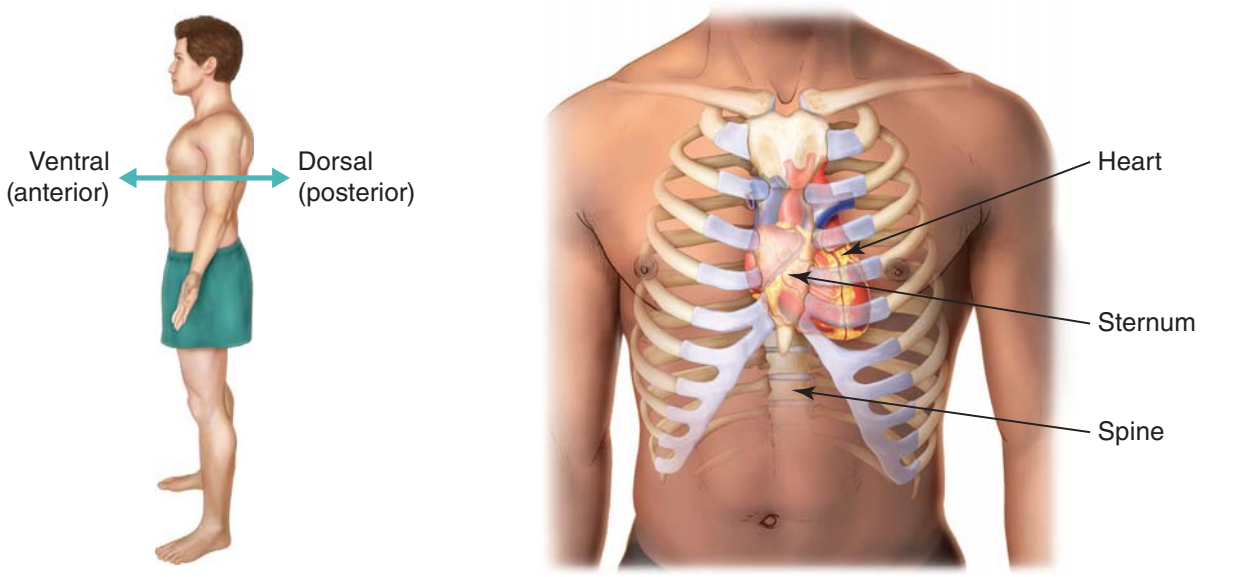


Figure 9.12 *Ventral* refers to the front of the body, and *dorsal* refers to the back.

Recall Activity

1. Ventral is to _____ as dorsal is to posterior.
2. Which body part is more ventral: the toes or the heel? _____
3. If a body part is dorsal, it is closer to the _____ of the body.
4. Which body part is more dorsal: the fingernails or the palms? _____
5. If a body part is ventral, it is closer to the _____ of the body.
6. Which body part is more anterior: the tip of the nose or the eyes? _____

Concept 4: Medial, Lateral, and Intermediate

The terms *medial*, *lateral*, and *intermediate* describe locations in reference to the middle (midsagittal plane) of the body. If a body part is *medial*, it is closer to the middle (midsagittal plane). If a body part is *lateral*, it is farther from the middle. A body part that is between one medial and one lateral body part is called *intermediate*. For example, the radial nerve of your arm is lateral to your sternum. Your sternum is medial to your arm's ulnar nerve. The ulnar nerve is intermediate to the radial nerve and the sternum (**Figure 9.13**).

medial closer to the middle (midsagittal plane) of the body

lateral farther from the middle (midsagittal plane) of the body

intermediate between one medial and one lateral body part

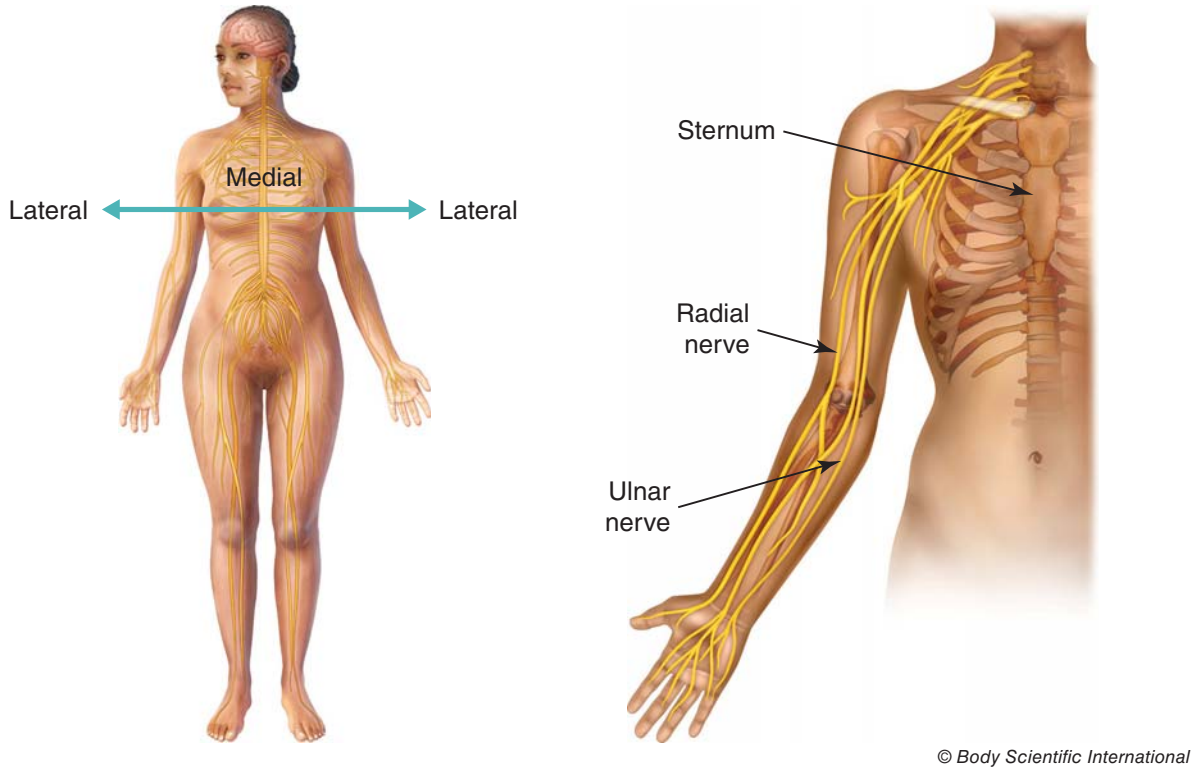


Figure 9.13 A body part is lateral if it is farther from the middle of the body. It is medial if it is closer to the middle of the body.

Recall Activity

1. Which of the following body parts is most lateral?
   A. nose C. ear
   B. eye D. neck
2. *Medial*, *lateral*, and *intermediate* describe locations in reference to the _____ plane.
3. Compared to the nose and ears, the eyes are _____.
4. Which of the following body parts is most medial?
   A. thumb C. middle finger
   B. index finger D. little finger
5. Compared to the ears and nose, the arms are _____.

Concept 5: Proximal and Distal

The terms *proximal* and *distal* only apply to limbs. If a body part is *proximal*, it is closer to the place where a limb is attached to the body's trunk. If a body part is *distal*, it is farther from the place where a limb is attached to the body's trunk. For example, the muscles of the forearm are distal to the muscles of the upper arm, and the muscles of the upper arm are proximal to the muscles of the forearm. The calf muscles are distal to the muscles of the thigh, and the muscles of the thigh are proximal to the calf muscles (**Figure 9.14**).

proximal closer to the place where a limb is attached to the body's trunk

distal farther from the place where a limb is attached to the body's trunk

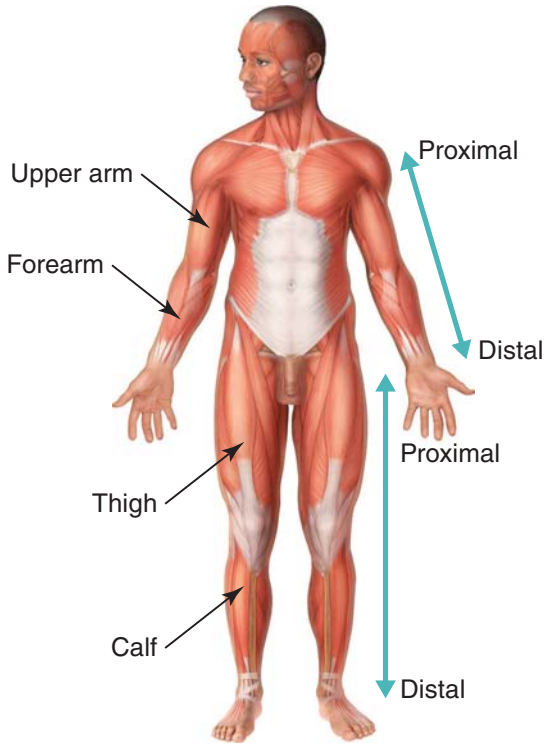


Figure 9.14 The terms *proximal* and *distal* apply to the arms and legs.

Recall Activity

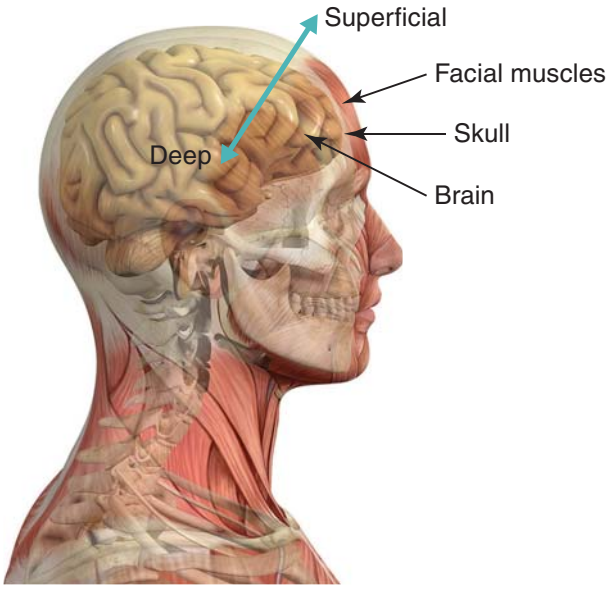
1. If a body part is _____, it is closer to the place where a limb is attached to the body's trunk.
2. The hand is _____ to the elbow.
3. If a body part is _____, it is farther from the place where a limb is attached to the body's trunk.
4. The terms *proximal* and *distal* only apply to _____.
5. The ankle is _____ to the knee.

Concept 6: Superficial and Deep

superficial closer to the surface of the body

deep farther from the surface of the body

The terms *superficial* and *deep* describe locations in relation to the surface of the body. If a body part is *superficial*, it is closer to the surface of the body. If a body part is *deep*, it is farther from the surface of the body. For example, the muscles of the face are superficial to the brain. The brain is deep to the muscles of the face. The skull is deep to the muscles of the face, but superficial to the brain (**Figure 9.15**).



AridOcean/Shutterstock.com

Figure 9.15 The terms *superficial* and *deep* describe how close a body part is to the surface.

Recall Activity

1. Which body part is deeper: the heart or the ribs? _____
2. If a body part is superficial, it is _____ to the surface of the body.
3. The terms *superficial* and *deep* describe location in relation to the _____ of the body.
4. Which body part is more superficial: the stomach or the skin? _____
5. If a body part is deep, it is _____ from the surface of the body.

Section 9.3 Reinforcement

Answer the following questions using what you learned in this section.

1. Compared to the nose and ears, the eyes are _____.
2. Which of the following terms indicates that a body part is closer to the surface?
   A. deep
   B. medial
   C. superficial
   D. dorsal
3. If a body part is _____, it is closer to the head; if a body part is _____, it is closer to the feet.
4. Which of the following body parts is most lateral?
   A. hip
   B. finger
   C. nose
   D. left eye
5. *True or False*. The term *medial* describes location in reference to the frontal plane. _____
6. *Superficial* and *deep* describe locations in relation to the _____ of the body.
7. If a body part is ventral, it is closer to the _____ of the body; if a body part is dorsal, it is closer to the _____ of the body.
8. Which of the following body parts is most medial?
   A. right hand
   B. navel
   C. left cheek
   D. left knee
9. Compared to the skin, is the brain superficial or deep? _____
10. *True or False*. The terms *proximal* and *distal* apply only to the trunk of the body. _____
11. Which of the following body parts is most superior?
    A. knee
    B. hip
    C. foot
    D. ankle
12. *Medial*, *lateral*, and *intermediate* describe locations in reference to the _____ plane.
13. Which of the following body parts is most proximal?
    A. knee
    B. hip
    C. foot
    D. ankle
14. The terms *ventral* and _____ mean that a body part is closer to the front of the body.
15. *True or False*. The term *lateral* describes location in reference to the sagittal plane. _____
16. If a body part is superior, it is closer to the _____.
17. Which of the following body parts is intermediate to the others?
    A. right thumb
    B. right forearm
    C. right collarbone

18. *True or False*. The brain is deep to the skin._____

19. Terms of location only apply to body parts when the body is in _____.

20. Which body part is deeper: the stomach or the skin?_____

21. If a body part is _____, it is farther from the middle of the body.

22. The terms *dorsal* and _____ mean that a body part is closer to the back of the body.

Match the following terms with their definitions.

_____ 23. Closer to the front of the body

_____ 24. Closer to the back of the body

_____ 25. Between medial and lateral body parts

_____ 26. Closer to the point of limb attachment

_____ 27. Farther from the point of limb attachment

_____ 28. Closer to the middle of the body

_____ 29. Farther from the middle of the body

_____ 30. Closer to the head

_____ 31. Closer to the feet

_____ 32. Closer to the surface of the body

_____ 33. Farther from the surface of the body

A. superior
B. inferior
C. ventral
D. dorsal
E. medial
F. lateral
G. intermediate
H. proximal
I. distal
J. superficial
K. deep

Comprehensive Review (Chapters 1–9)

Answer the following questions using what you have learned so far in this book.

34. Which connective tissue structure connects bone to bone?_____

35. A hemisphere is _____ of a sphere.

36. Convert 2376 g into kg. _____

37. A macromolecule made of repeating subunits is called a(n) _____.

38. *True or False*. There is always some degree of uncertainty in science._____

39. Which of the following structures make up a cell's plasma membrane?
    A. ribosomes
    B. phospholipids
    C. proteins
    D. lysosomes

40. Facts are _____ of people and opinions.

41. Describe the difference between diffusion and facilitated diffusion._____

    _____

42. Which region of the body encompasses the head, neck, and trunk? _____

Section 9.4 Body Organization

In anatomy and physiology, the body is organized into five different levels. These levels differ in complexity, from the most basic cell level to the organism level that considers cells, tissues, organs, and body systems. In this section, you will learn about body organization and about the characteristics of each organizational level.

The terms below are some of those that will be introduced in Section 9.4. To become familiar with these terms, reproduce each word on the line beside it. Pronounce each term as you write it. You will learn the definitions of these words as you complete this section.

1. body system _____
2. organism_____

Concept 1: Five Levels of Organization

The human body is organized into five levels that progress from simple to more complex. The five levels of organization are

- cells
- tissues
- organs
- body systems
- organisms

For example, *cells* make up *tissue*. Different types of tissue compose the *organs* involved in digestion, including the organs of the alimentary canal (mouth, pharynx, esophagus, stomach, small intestine, colon, rectum, and anus). The organs involved in digestion make up the body system known as the *digestive system*. Together, all of the body systems make up the human *organism* (**Figure 9.16**).

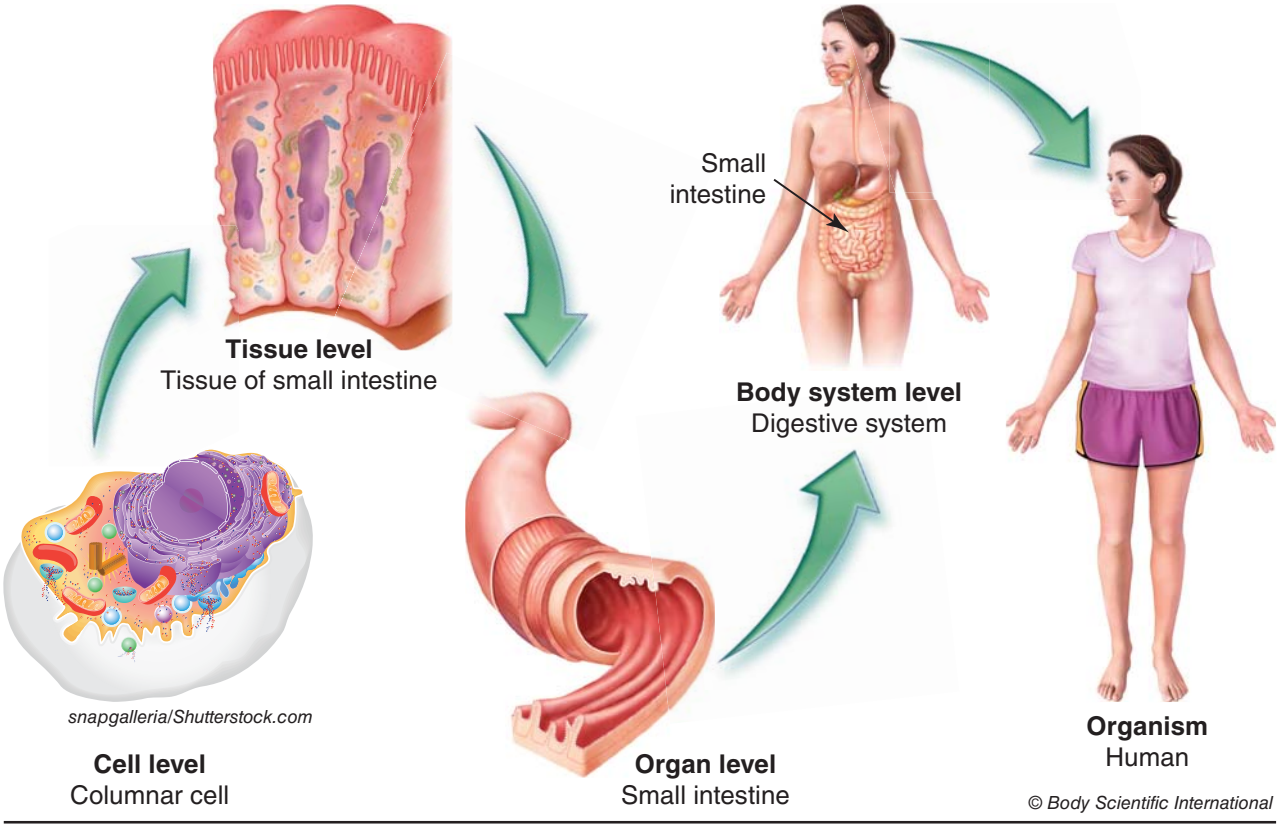


Figure 9.16 The body is organized into five different levels.

Recall Activity

1. List the five levels of organization in order of complexity from complex to simple. _____

   _____

2. Together, all of the _____ make up the human organism.

Concept 2: Cell Level

As you have learned, the *cell* is the basic unit of life. Human body cells are specialized to perform specific functions in the body. If you were to look at the body's alimentary canal on a cellular level, you would study many types of cells and their functions. For example, in the stomach, *parietal cells* release hydrochloric acid to make the environment acidic. *Chief cells* in the stomach secrete pepsinogen, which aids in digestion, and *mucous neck cells* produce mucus to protect the cells lining the stomach. *Smooth muscle cells* move food through the alimentary canal, and *simple columnar epithelial cells* with microvilli absorb digested macromolecules.

Recall Activity

1. Simple columnar epithelial cells with _____ absorb digested macromolecules.
2. Which cells in the stomach release hydrochloric acid? _____
3. Mucous neck cells produce _____ to protect the cells lining the stomach.

Concept 3: Tissue Level

A *tissue* is a group of cells that work together to do a job. On a tissue level, you study groups of cells that work with one another. In the alimentary canal, for example, muscle tissue contracts to move food through the canal. Through most of the alimentary canal, muscle tissue is composed of two sheets of muscle cells. The first sheet of smooth muscle cells is arranged in a circle around the tubelike canal. When these muscle cells contract in unison, the tube becomes smaller in diameter. The second sheet of muscle cells is perpendicular to the circular muscle cells. In the second sheet, muscle cells are arranged lengthwise around the tube. When these muscle cells contract, the tube becomes shorter in length.

Recall Activity

1. Through most of the alimentary canal, muscle tissue is composed of _____ sheet(s) of muscle cells.
2. In the alimentary canal, muscle tissue _____ to move food through the canal.
3. A(n) _____ is a group of cells working together to do a job.

Concept 4: Organ Level

An *organ* is a group of tissues that work together to do a job. An organ is composed of different types of tissue. For example, the job of the small intestine is to move food, break down food into macromolecules, and absorb macromolecules into the blood. To achieve this, the small intestine contains several types of tissue. Lining the inside of the small intestine is a layer of epithelial tissue called *mucosa*. The cells of this tissue layer have microvilli and absorb macromolecules from digested food. The mucosa is supported by a layer of connective tissue called the *lamina propria*. Two layers of muscle tissue are next. Cells in these tissue layers contract to move food through the small intestine. Finally, another layer of epithelial tissue covers the outside of the small intestine. This layer of epithelial tissue is called *serosa* (**Figure 9.17**).

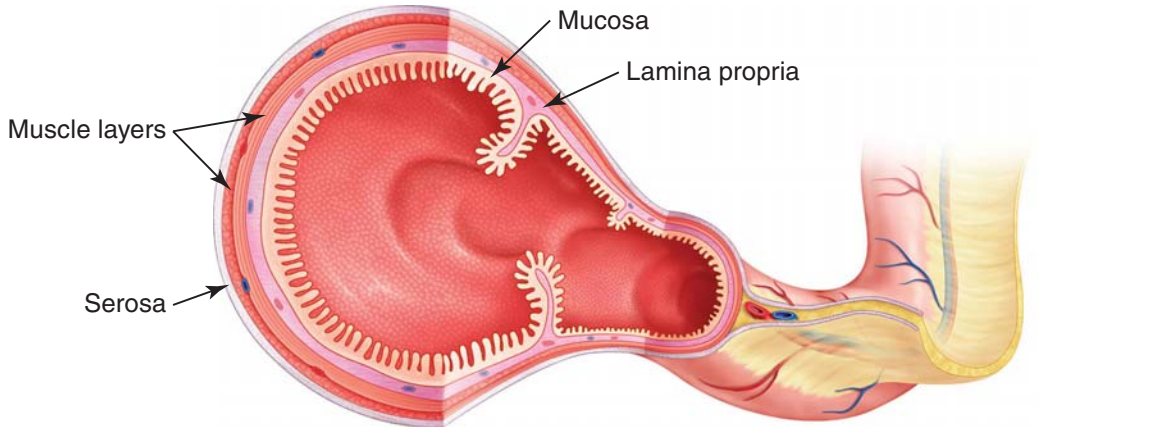


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Figure 9.17 The small intestine has four layers of tissue.

Recall Activity

1. The two layers of epithelium in the small intestine are the _____ and the _____.
2. The layer of connective tissue in the small intestine is called the _____.
3. Which tissue layer lines the inside of the alimentary canal? _____

Concept 5: Body System Level

body system a group of organs that work together to perform several functions; also called an *organ system*

Organs that work together to perform a group of functions make up a *body system* (also known as an *organ system*). For example, the organs of the alimentary canal, as well as some other organs (such as the salivary glands, liver, pancreas, and gallbladder), make up the *digestive system*. Together, all of these organs perform the functions of moving food, *digesting* food (chewing food into small pieces and breaking pieces into macromolecules), and absorbing macromolecules for use throughout the body.

The human body has 11 systems (**Figure 9.18**):

- integumentary system
- skeletal system
- muscular system
- nervous system
- endocrine system
- respiratory system
- cardiovascular system
- lymphatic system
- digestive system
- urinary system
- reproductive systems (male and female)

You will learn about the basic organs and functions of these body systems in Chapter 10.

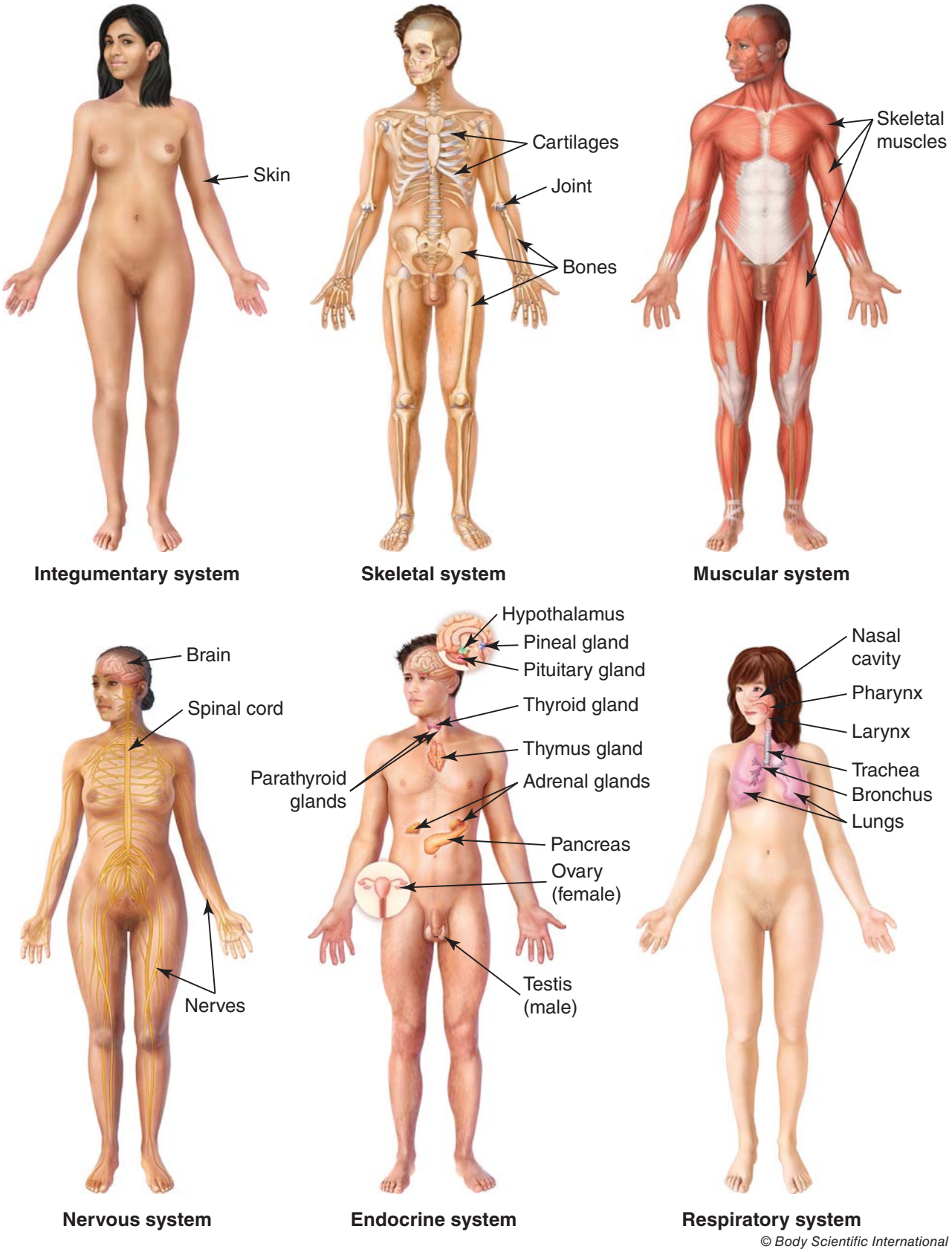

Figure 9.18 Eleven body systems make up the human body.

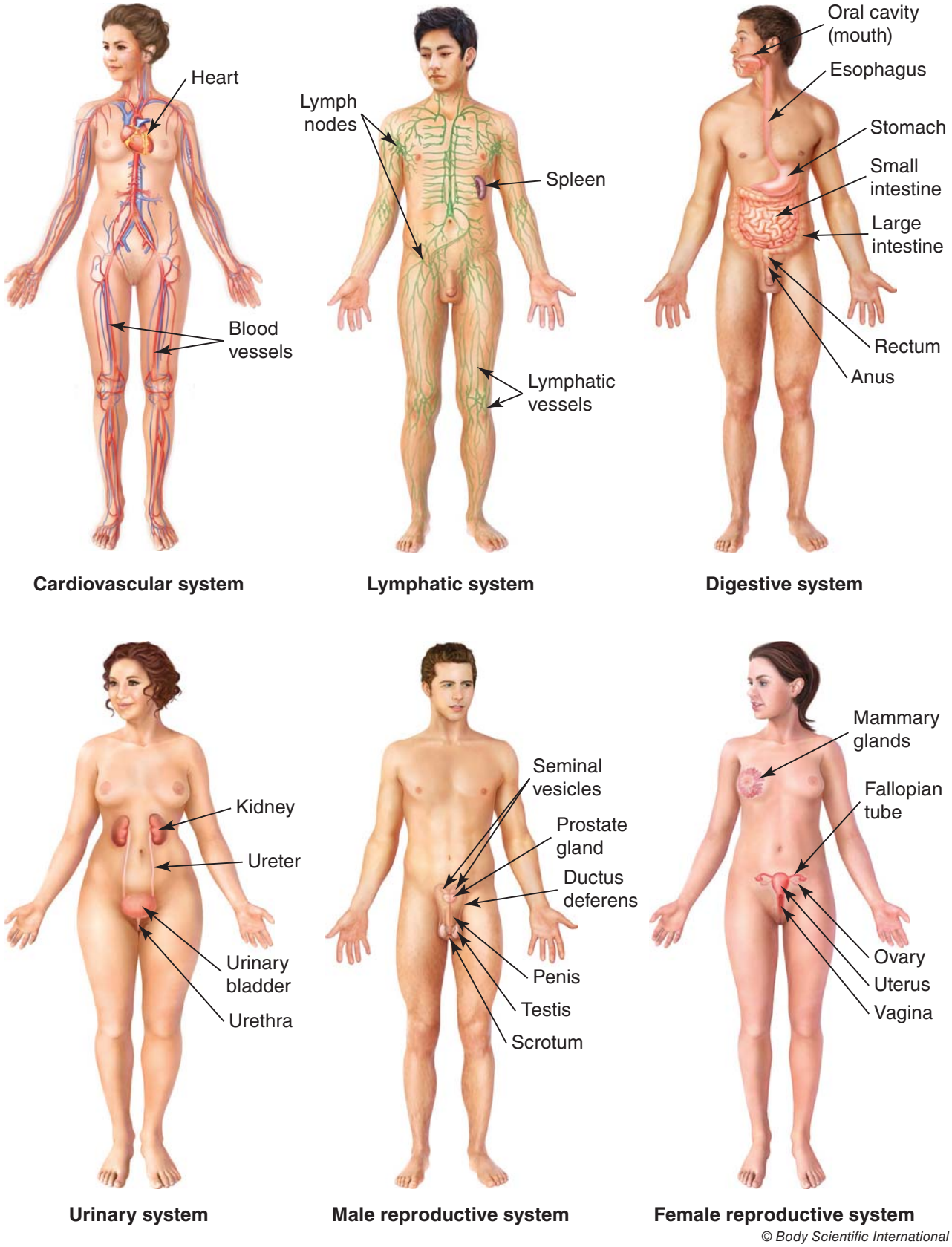

Figure 9.18 *Continued.*

Recall Activity

1. A body system is a group of _____ working together to perform several functions.
2. _____ is chewing food into small pieces and breaking pieces into macromolecules.
3. How many systems does the human body have?_____
4. List the human body systems._____

_____

_____

Concept 6: Organism Level

The most complex level of body organization is the organism level. An *organism* is a complex life form made of many interdependent parts. The human organism is a cooperative community of the 11 body systems. All of the body systems work together to maintain life.

organism a complex life form made of many interdependent parts

Recall Activity

1. The human organism is a cooperative _____ of body systems.
2. An organism is a complex life form made of many _____ parts.

Section 9.4 Reinforcement

Answer the following questions using what you learned in this section.

1. Which of the following organs is *not* part of the alimentary canal?
   A. liver
   B. stomach
   C. esophagus
   D. mouth
2. *True or False*. An organ is a group of tissues working together to do a job. _____
3. The epithelial tissue layer lining the inside of the alimentary canal is called the _____.
4. List the five levels of body organization in order of complexity from simple to complex. _____

   _____
5. Which of the following cells makes pepsinogen?
   A. chief cell
   B. goblet cell
   C. smooth muscle cell
   D. parietal cell

6. The basic unit of life is the _____.
7. Organs that work together to perform a group of functions make up a(n) _____.
8. *True or False*. The colon is not part of the alimentary canal._____
9. Unscramble the letters: stusie. Define the word that is formed._____

_____

10. *True or False*. The digestive system is composed only of organs that make up the alimentary canal.

_____

11. The cells of the mucosa have _____ that help them absorb macromolecules from digested food.
12. A group of cells working together to do a job is a(n) _____.
13. List the five levels of body organization in alphabetical order. _____

_____

14. How many body systems does the human body have?_____
15. *True or False*. The lamina propria is the muscle layer of the small intestine. _____
16. List the human body systems in alphabetical order._____

_____

_____

17. In the stomach, _____ cells release hydrochloric acid to make the environment acidic.
18. The human organism is a cooperative community of 11 _____.
19. Which of the following words are misspelled?
    A. organ
    B. alimatary
    C. salivary
    D. esophgous
20. A(n) _____ is a complex life form made of many interdependent parts.
21. Which level of body organization is concerned with several organs that work together to perform a group of functions? _____

Match the following terms with their definitions.

_____ 22. Organs working together to perform a group of functions

_____ 23. A group of cells working together to do a job

_____ 24. A group of tissues working together to do a job

_____ 25. The basic unit of life

_____ 26. A complex life form made of many interdependent parts

A. cell
B. tissue
C. organ
D. body system
E. organism

Comprehensive Review (Chapters 1–9)

Answer the following questions using what you have learned so far in this book.

27. What does the prefix *inter-* mean? _____
28. An explanation is natural if it is _____ and _____.
29. The first step in the diagnostic scientific method is _____.
30. What is the value of pi? _____
31. In a covalent bond, are electrons accepted, donated, or shared? _____
32. Which of the following body parts is most distal?
    A. knee
    B. hip
    C. foot
    D. ankle
33. *True or False*. Tight junctions prevent heart muscle cells from separating. _____
34. Which type of tissue is composed mostly of extracellular fibers with few cells? _____
35. *True or False*. Energy is required to move from low concentration to high concentration. _____

Section 9.5 Homeostasis in the Body

Homeostasis is a state of relative stability. In Section 7.7, you learned about how the cell maintains homeostasis for its continued survival. Homeostasis is also maintained in the body at large. In this section, you will learn about the body's functions for maintaining homeostasis. Understanding these functions will prepare you for anatomy and physiology.

The terms below are some of those that will be introduced in Section 9.5. To become familiar with these terms, reproduce each word on the line beside it. Pronounce each term as you write it. You will learn the definitions of these words as you complete this section.

1. negative feedback _____
2. body temperature _____
3. blood glucose concentration _____
4. insulin _____
5. glucagon _____

Concept 1: Reviewing Homeostasis

As you have learned, life can only exist within a narrow range of circumstances. For life to continue, the body and its cells must maintain *homeostasis* (a state of relative stability). The environment outside your body can constantly change. You can walk out of a warm house into the cold street outside. In the midst of

this external temperature change, your body makes adjustments to maintain a stable internal body temperature. The environment inside your body can also change. For example, if you do not eat for several hours, your body will maintain a constant blood glucose concentration to supply your cells. In both of these examples, your body is maintaining homeostasis. In Section 7.7, you learned about homeostasis inside the cell. Now you will learn about homeostasis inside the body as a whole.

Recall Activity

1. For life to continue, the body and its cells must maintain _____.
2. If you do not eat for several hours, your body will maintain a constant blood _____ concentration to supply your cells.

Concept 2: Negative Feedback

Your body is constantly monitoring the concentrations of hundreds of molecules and other factors necessary for life. When a concentration or factor falls below or climbs above a set value, your body will take action to correct the concentration or factor back to the set value. Once the set value is reached, the body will stop this action. This cycle of taking action to correct concentrations and factors inside the body is called *negative feedback*. To maintain a set value, your body signals cells to make products and perform certain actions and then signals them to stop when the set value is reached.

negative feedback the cycle of taking action to correct a concentration or factor back to its set value within the body

Recall Activity

1. In _____, the body takes action to correct a concentration or factor back to its set value.
2. Once the set value of a concentration or factor is reached, the body will _____ its action.

Concept 3: Body Temperature

The process of negative feedback enables your body to maintain homeostasis when the environment outside the body changes. An example of this is *body temperature*. In homeostasis, the body's internal temperature is 37°C (98.6°F). If you are in a cold environment, your body will lose heat to the environment. In response to this change, your hypothalamus directs your body to adjust reactions inside cells to increase the amount of heat produced and make up for heat lost. If you are in a hot environment, your body will gain heat from the environment. In response, your hypothalamus directs your body to sweat,

body temperature the temperature inside the body; in homeostasis, 37°C (98.6°F)

losing heat to the environment as sweat evaporates (**Figure 9.19**). As you might imagine, sweating upsets the homeostasis of water inside your body. This is why you need to drink water to replace water lost as sweat.

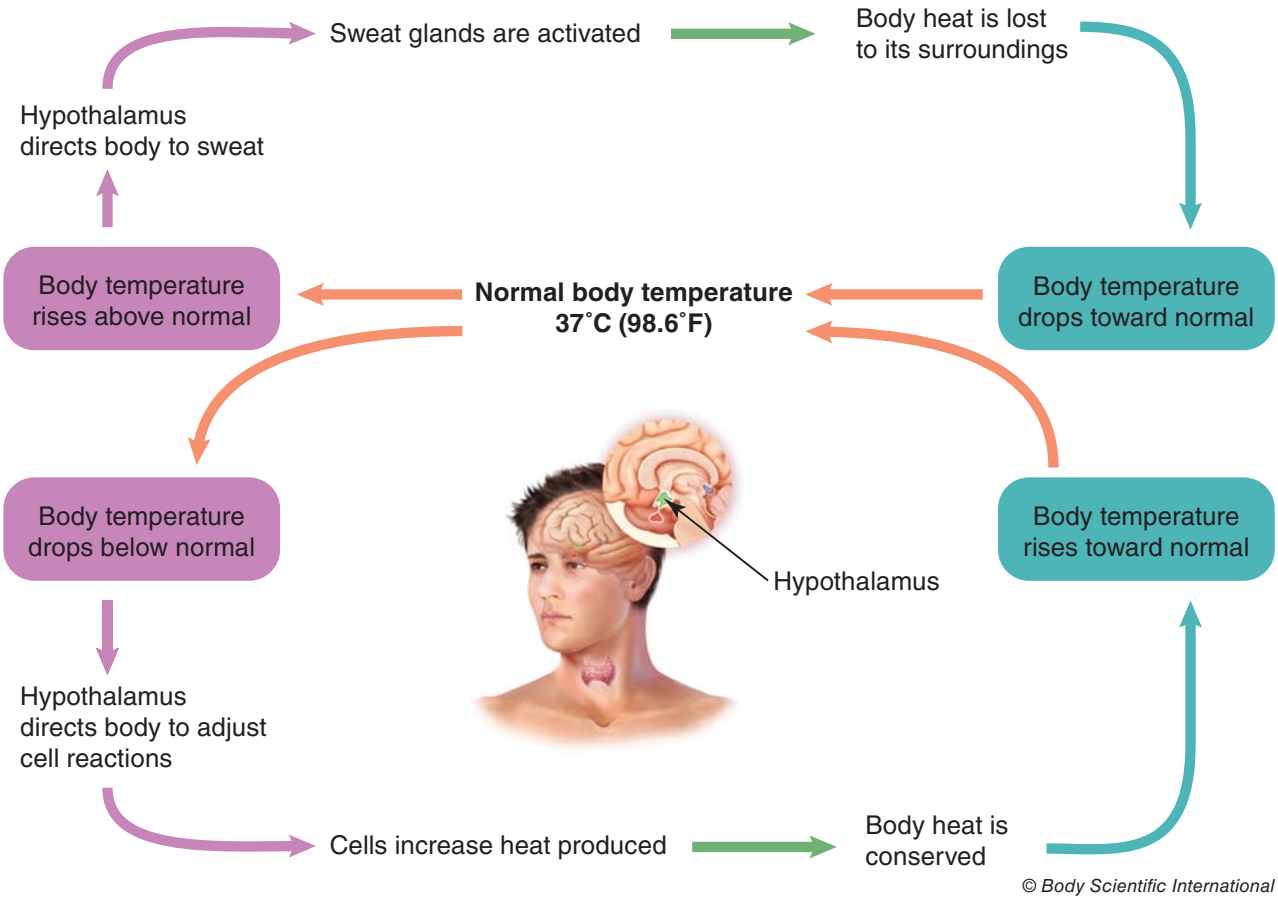

Figure 9.19 The hypothalamus maintains the homeostasis of body temperature.

Recall Activity

1. Sweating upsets the _____ of water inside your body.
2. Your body adjusts to cold by _____ the amount of heat produced by cellular reactions.
3. In homeostasis, the body's internal temperature is _____°C (_____°F).

Concept 4: Blood Glucose Concentration

Negative feedback also enables your body to maintain homeostasis when the environment *inside* the body changes. One factor that must remain stable inside the body is *blood glucose concentration*. In homeostasis, your blood maintains a glucose concentration of 90 mg/100 mL. However, the concentration of glucose in your blood is always changing. Your cells constantly take

blood glucose concentration the number of glucose molecules per a volume of blood; in homeostasis, 90 mg/100 mL

glucose out of the blood for use in cell respiration. When you eat carbohydrates, your digestive system puts glucose into the blood. In response to these changes, your body takes several actions to maintain homeostasis.

Recall Activity

1. In homeostasis, your blood maintains a glucose concentration of _____.
2. Your cells constantly take glucose out of the blood for use in cell _____.
3. When you eat carbohydrates, your digestive system puts _____ into the blood.

Concept 5: High Blood Glucose Concentration

insulin a hormone produced by the beta cells of the pancreas that signals cells to take glucose out of the blood and signals the liver to draw glucose out of the blood and store it as glycogen

When you digest carbohydrates, your digestive system breaks down the carbohydrates into glucose and puts glucose into your blood. This causes your blood glucose concentration to rise, climbing above 90 mg/100 mL. In response, your body takes action to lower blood glucose concentration, causing the beta cells in your pancreas to produce the hormone *insulin*. Insulin signals your cells to take glucose out of the blood and signals your liver to draw glucose out of the blood and store it as *glycogen*. These actions lower the concentration of glucose in your blood back to 90 mg/100 mL (**Figure 9.20**).

Recall Activity

1. When you digest carbohydrates, does your blood glucose concentration rise or fall? _____
2. Beta cells in your pancreas produce the hormone _____.
3. Insulin signals your _____ to take glucose out of the blood and signals your _____ to draw glucose out of the blood and store it as glycogen.

Concept 6: Low Blood Glucose Concentration

glucagon a hormone produced by the alpha cells of the pancreas that signals the liver to break down stored glycogen into glucose and release glucose into the blood

Because of cell respiration, your cells are constantly taking glucose out of the blood. This causes your blood glucose concentration to decrease, falling below 90 mg/100 mL. Digesting carbohydrates increases blood glucose concentration, but you are not constantly eating. Because of this, your liver stores a polysaccharide known as *glycogen* that can be broken into glucose and put into the blood if glucose concentration is low. When blood glucose concentration is too low, alpha cells in the pancreas produce the hormone *glucagon*. Glucagon signals the liver to break down stored glycogen into glucose and release glucose into the blood. These actions raise the concentration of glucose in your blood back to 90 mg/100 mL (Figure 9.20).

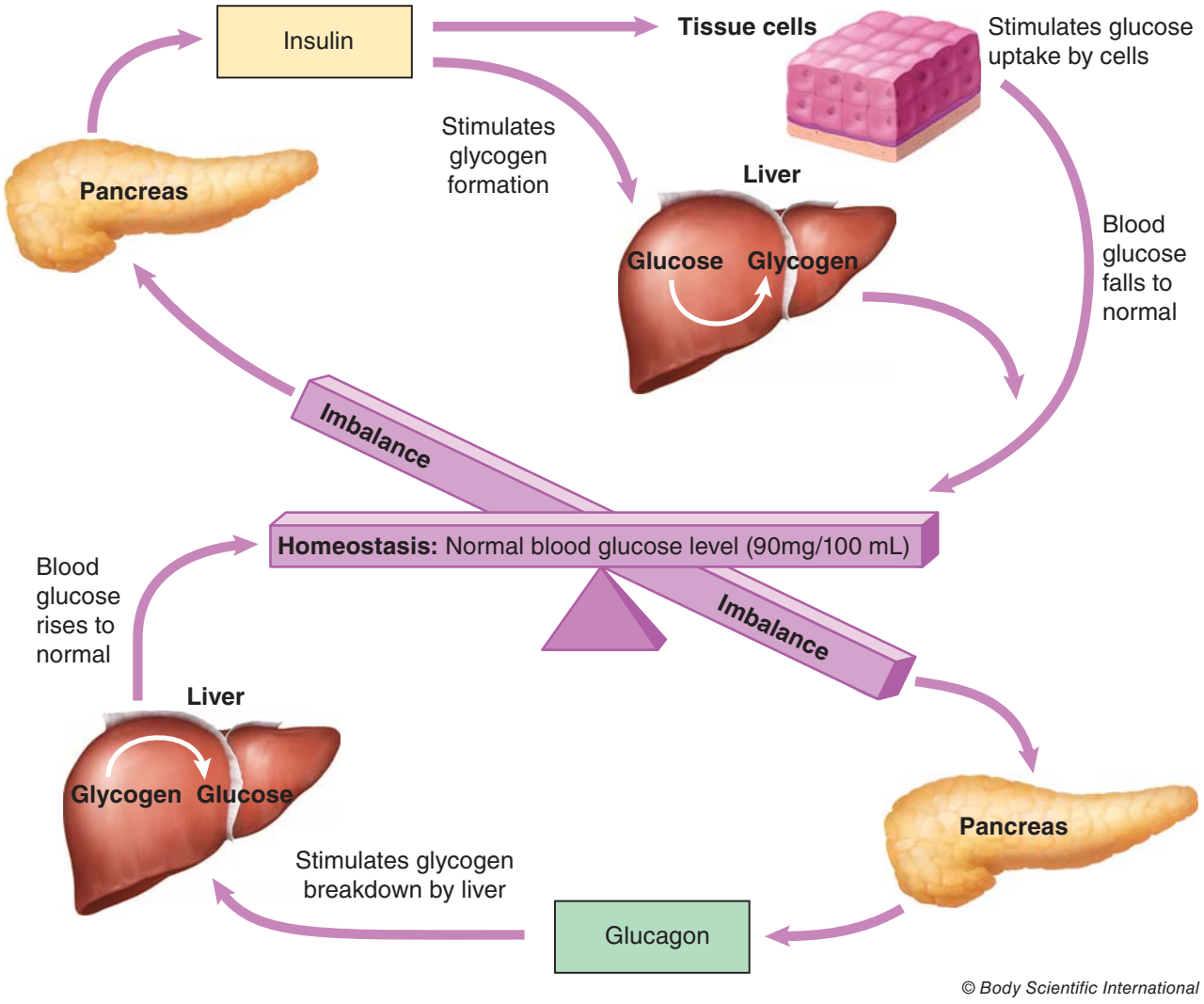

Figure 9.20 The hormones insulin and glucagon maintain homeostatic blood glucose concentration in the body.

Recall Activity

1. Alpha cells in the pancreas produce the hormone _____.
2. Glucagon signals the liver to break down stored _____ into glucose.
3. Does the action of glucagon cause blood glucose concentration to increase or decrease?

_____

Concept 7: Blood pH

pH is another factor that must be kept in homeostasis. In Section 7.7, you learned about how cells regulate internal pH. pH must also be regulated in the blood. As you have learned, pH is the measurement of acid or base in a liquid and depends on the numbers of hydrogen ions (H^+) and hydroxide ions (OH^-). In homeostasis, the pH of blood is slightly basic, between 7.35 and 7.45.

The kidneys maintain the homeostasis of blood pH. Blood is constantly entering and leaving the kidneys. In fact, every four minutes, all the blood in your body will travel through a kidney. The kidneys sort through what to keep in the blood and what to remove from the blood, and molecules and ions that are removed from the blood become *urine*. The body's metabolism is constantly producing hydrogen ions (H^+). If blood pH is too low, the kidneys will remove hydrogen ions (H^+) from the blood, raising blood pH. If blood pH is too high, the kidneys will retain hydrogen ions (H^+), and as the body continues to produce hydrogen ions (H^+), blood pH will fall.

Recall Activity

1. Removing hydrogen ions (H^+) from the blood _____ blood pH.
2. In homeostasis, the pH of blood is between _____ and _____.
3. If the kidneys retain hydrogen ions (H^+) in the blood, blood pH will _____.

Section 9.5 Reinforcement

Answer the following questions using what you learned in this section.

1. Which hormone is produced by the alpha cells of the pancreas? _____
2. Glucagon signals the _____ to break down stored glycogen into glucose.
3. When the kidneys retain hydrogen ions (H^+) in the blood, does blood pH rise or fall? _____
4. *True or False*. The body's homeostatic internal temperature is 39°C. _____
5. Which organ maintains homeostatic blood pH by choosing what to keep in the blood and what to remove from the blood? _____
6. The hormone _____ signals your cells to take glucose out of the blood.
7. *True or False*. Molecules and ions that are removed from the blood become urine. _____
8. Which hormone is produced by the beta cells of the pancreas? _____
9. Unscramble the letters: anoggclu. Define the word that is formed. _____

10. The hormone insulin signals the liver to take glucose out of the blood and store it as _____.
11. Does removing hydrogen ions (H^+) from the blood raise or lower blood pH? _____
12. The hormone _____ raises blood glucose concentration.
13. What happens in negative feedback? _____

    _____
14. *True or False*. The kidneys keep the pH of blood between 7.25 and 7.55. _____
15. To maintain a set value, your body signals cells to make _____ and perform certain _____ and then signals them to _____ when the set value is reached.
16. Which hormone causes the breakdown of glycogen in the liver? _____
17. In response to a hot environment, your body sweats, losing heat to the environment as sweat _____.
18. What is the body's homeostatic internal temperature? _____
19. Unscramble the letters: smashsootie. Define the word that is formed. _____

    _____
20. *True or False*. In homeostasis, blood glucose concentration is 90 mg/100 mL. _____
21. In homeostasis, the pH of blood is slightly _____, between _____ and _____.

Comprehensive Review (Chapters 1–9)

Answer the following questions using what you have learned so far in this book.

22. pH values range from _____ to _____.
23. Name the three types of extracellular fibers. _____
24. *True or False*. If additional evidence leads to a better explanation, science will change. _____
25. What is the second step of the experimental scientific method? _____
26. If the diameter of a circle is 100 cm, the radius is _____ mm.
27. List the three building blocks of the cytoskeleton. _____
28. The prefix _____ means "false."
29. Which will diffuse faster: a molecule containing few atoms or a molecule containing many atoms?

    _____
30. Organs that work together to perform a group of functions make up a(n) _____.

Chapter 9 Review

Answer the following questions using what you learned in this chapter.

1. List the four body planes used in anatomy and physiology. _____

   _____

2. In anatomical position, the thumbs point _____ the body.
3. *True or False*. The word *manus* refers to the hand. _____
4. Which of the following is *not* a region of the trunk?
   A. thoracic region
   B. pubic region
   C. abdominal region
   D. cervical region
5. Is your knee proximal or distal to your hip? _____
6. *True or False*. The nose is intermediate to the eyes and ears._____
7. Which of the following body parts is most superficial?
   A. liver
   B. kidney
   C. skin
   D. heart
8. Is your ankle superior or inferior to your shin?_____
9. The _____ plane divides the body into front and back sections.
10. *True or False*. Both the midsagittal plane and the sagittal plane divide the body down the middle._____
11. List the human body systems._____

    _____

    _____

12. Which of the following body parts is most medial?
    A. hip
    B. finger
    C. nose
    D. left eye
13. When you digest carbohydrates, does your blood glucose concentration rise or fall? _____
14. *True or False*. The heart is deep to the rib cage. _____
15. A(n) _____ is a group of organs working together to perform a group of functions.
16. The cranial and _____ cavities are found in the dorsal section of the body.
17. When blood glucose concentration is too high, beta cells in the pancreas produce the hormone _____.
18. Is the sternum dorsal or ventral to the spine? _____
19. *True or False*. If a body part is inferior, it is closer to the head. _____
20. In homeostasis, what is the body's blood glucose concentration?_____
21. List the five levels of body organization in order of complexity from simple to complex. _____

    _____

22. List the three abdominopelvic regions in the first row. _____

_____

23. *True or False*. The head area is called the cephalic region. _____

24. Which of the following body planes divides the body into top and bottom sections?
    A. sagittal plane
    B. midsagittal plane
    C. frontal plane
    D. transverse plane

25. What is the body's homeostatic internal temperature? _____

26. The _____ region of the body includes the limbs (arms and legs).

27. In homeostasis, the pH of blood is between _____ and _____.

Comprehensive Review (Chapters 1–9)

Using what you have learned so far in this book, match the following terms with their definitions.

_____ 28. An area of biology that studies tissues

_____ 29. A combining form that means "belly side (of the body)"

_____ 30. Facts that relate to a possible cause

_____ 31. The movement of atoms from areas of low concentration to areas of high concentration using solute pumps

_____ 32. A type of connective tissue made of cells and calcium salts reinforced with collagen fibers

_____ 33. The speed of enzymatic reactions

_____ 34. An avascular connective tissue with an extracellular matrix made of extracellular fibers, carbohydrates, and water

_____ 35. A body plane that divides the body into front and back sections

_____ 36. A combining form that means "back (of the body)"

_____ 37. Finger-like projections of the plasma membrane that increase the surface area of the cell to allow for more absorption

_____ 38. A liquid that contains more H^+ ions than OH^- ions

_____ 39. The total area of the outer surface of an object

_____ 40. A body plane that divides the body into top and bottom sections

_____ 41. The spreading out of atoms from areas of high concentration into areas of low concentration

A. evidence
B. ventr/o
C. surface area
D. turnover rate
E. microvilli
F. histology
G. diffusion
H. bone
I. frontal plane
J. dors/o
K. acid
L. cartilage
M. active transport
N. transverse plane