1

Introduction to The Human Body

FOCUS: The human organism is often examined at seven structural levels: chemical, organelle, cell, tissue, organ, organ system, and the organism. Anatomy examines the structure of the human organism, and physiology investigates its processes. Structures and processes interact to maintain homeostasis through negative-feedback mechanisms.

CONTENT LEARNING ACTIVITY

Anatomy and Physiology

"*Anatomy is the scientific discipline that investigates the structure of the body.*"

Match these terms with the correct statement or definition:

Anatomical imaging
Physiology
Regional anatomy
Surface anatomy
Systemic anatomy

_____ 1. Study of the body's structures by systems such as the nervous and muscular systems.

_____ 2. Study of the body's organization by areas; the approach used in most medical schools.

_____ 3. Study of external features that serve as landmarks to locate deeper structures.

_____ 4. Use of x-rays, ultrasound, and magnetic resonance imaging to create pictures of internal structures.

_____ 5. The scientific discipline that deals with the processes or functions of living things.

Structural and Functional Organization

"*The body can be studied at seven structural levels.*"

A. Match these terms with the correct statement or definition:

Cell
Chemical
Organ
Organism
Organelle
Organ system
Tissue

_____ 1. A structure within a cell that performs one or more specific functions.

_____ 2. The basic living unit of all plants and animals.

_____ 3. A group of cells with similar structure and function plus the extracellular substances located between them.

_____ 4. Two or more tissue types that together perform one or more common functions.

B. Match these terms with the correct statement or definition:

Cardiovascular
Digestive
Endocrine
Integumentary
Lymphatic
Muscular
Nervous
Reproductive
Respiratory
Skeletal
Urinary

_____ 1. Organ system that consists of skin, hair, and nails; protects and prevents water loss.

_____ 2. Organ system that consists of the brain, spinal cord, and nerves; detects sensation and controls movements.

_____ 3. Organ system that consists of the lungs; exchanges gases between blood and the air.

_____ 4. Organ system that consists of the kidneys and urinary bladder; removes waste products from the circulatory system.

_____ 5. Organ system that consists of the mouth, pharynx, esophagus, stomach, and intestines; breaks down and absorbs nutrients.

_____ 6. Organ system that consists of bones and cartilage; protects and supports the body, and produces blood cells.

_____ 7. Organ system that consists of the heart, blood vessels, and blood; transports nutrients, wastes, and gases.

_____ 8. Organ system that consists of glands such as the pituitary and thyroid glands; a major regulatory system.

_____ 9. Organ system that consists of muscles attached to the skeleton; allows body movement, maintains posture, and produces body heat.

Characteristics of Life

"*The most important common feature of all organisms is life.*"

Match these terms with the correct statement or definition:

Differentiation	Organization
Growth	Reproduction
Metabolism	Responsiveness

_____ 1. The parts of an organism have specific relationships to each other and the parts interact to perform specific functions.

_____ 2. The ability to use energy to perform vital functions such as growth.

_____ 3. The ability to sense changes in the environment and make the adjustments that help to maintain life.

_____ 4. Results in an increase in size; can be caused by an increase in cell number, cell size, or the amount of substance surrounding cells.

_____ 5. Change in cell structure and function from generalized to specialized.

_____ 6. The formation of new cells or new organisms.

Homeostasis

"*Homeostasis is the existence and maintenance of a relatively constant environment within the body.*"

A. Match these terms with the correct statement or definition:

Control center	Receptor
Effector	Set point
Normal range	Variable

_____ 1. Condition, such as body temperature, that can change in value.

_____ 2. The ideal, normal value of a variable maintained by homeostatic mechanisms.

_____ 3. Slight increase or decrease of a variable around its set point.

_____ 4. Monitors the value of a variable such as blood pressure.

_____ 5. Establishes the set point around which the value of a variable is maintained; part of the brain is an example.

_____ 6. Can change the value of a variable; for example, the heart can change blood pressure.

B. Match these terms with the correct statement or definition:

Negative feedback
Positive feedback

_____ 1. Maintains homeostasis by resisting or reducing any deviation from the set point.

_____ 2. When a deviation from a normal value occurs, the response is to make the deviation even greater.

_____ 3. Medical therapy seeks to overcome illness by aiding this type of feedback.

_____ 4. Increases heart rate in response to a decrease in blood pressure.

_____ 5. Decreases the ability of the heart to pump following blood loss.

_____ 6. Stretch of the uterus causes uterine contractions during delivery.

Directional Terms

"*Directional terms refer to the body in the anatomical position.*"

Match these terms with the correct statement or definition:

Anterior	Medial
Deep	Posterior
Distal	Proximal
Inferior	Superficial
Dorsal	Superior
Lateral	Ventral

_____ 1. Lower than.

_____ 2. Toward the back of the body (two terms).

_____

_____ 3. Toward the front of the body (two terms).

_____

_____ 4. Farther from the point of attachment to the body than another structure.

_____ 5. Away from the midline.

_____ 6. Away from the surface.

Planes

"*A plane is an imaginary flat surface passing through the body or an organ.*"

A. Match these terms with the correct statement or definition:

Frontal (coronal) plane
Longitudinal section
Oblique section
Sagittal plane
Transverse plane
Transverse (cross) section

_____ 1. Runs vertically through the body and divides it into right and left parts.

_____ 2. Runs parallel to the surface of the ground and divides the body into superior and inferior parts.

_____ 3. Runs vertically through the body and divides it into anterior and posterior parts.

_____ 4. A cut through the long axis of an organ.

_____ 5. A cut at a right angle to the long axis of an organ.

_____ 6. A cut across the long axis of an organ at any angle other than a right angle.

A midsagittal section divides the body into equal right and left halves.

B. Match these terms with the correct planes labeled in figure 1.1:

Frontal (coronal) plane
Midsagittal plane
Transverse plane

1. _____
2. _____
3. _____

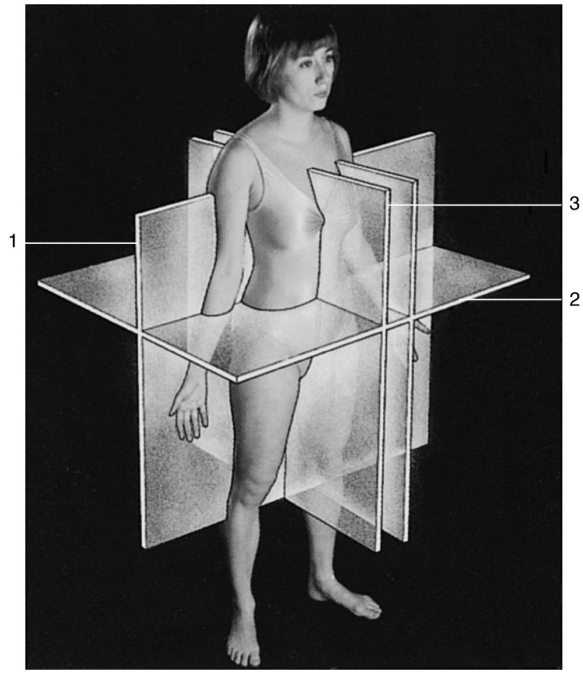


Figure 1.1

C. Match these terms with the correct part labeled in figure 1.2:

Longitudinal section
Oblique section
Transverse (cross) section

1. _____
2. _____
3. _____

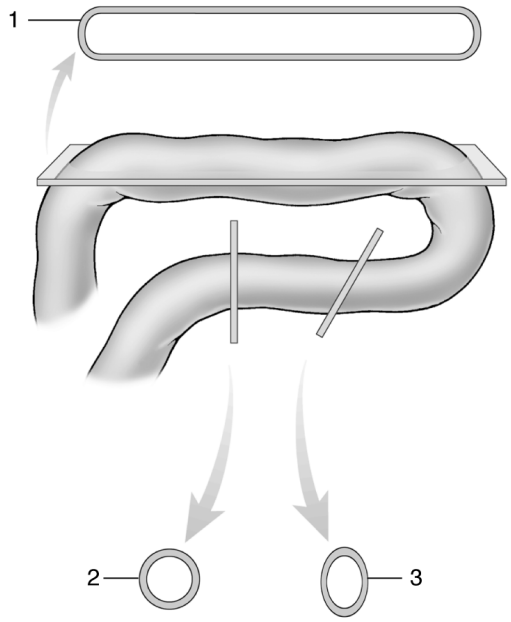


Figure 1.2

Body Regions

"*The body is commonly divided into several regions.*"

Using the terms provided, complete these statements.

Abdomen
Arm
Forearm
Leg
Lower limb
Pelvis
Thigh
Thorax
Upper limb

The _(1)_ consists of the arm, forearm, wrist, and hand. The _(2)_ extends from the shoulder to the elbow, and the _(3)_ extends from the elbow to the wrist. The _(4)_ consists of the thigh, leg, ankle, and foot. The _(5)_ extends from the hip to the knee, and the _(6)_ extends from the knee to the ankle. The trunk consists of the _(7)_, _(8)_, and _(9)_.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____

The abdominal region can be subdivided into four quadrants or nine regions by imaginary lines. The quadrants or regions can be used as reference points for locating underlying organs.

Body Cavities

"*The body contains several large trunk cavities that do not open to the exterior of the body.*"

A. Match these terms with the correct statement or definition:

Abdominal cavity
Pelvic cavity
Thoracic cavity

_____ 1. Cavity surrounded by the rib cage, bounded inferiorly by the diaphragm, and divided into right and left parts by the mediastinum.

_____ 2. Cavity bounded primarily by the abdominal muscles and the superior bones of the pelvis.

_____ 3. Small space enclosed by the bones of the pelvis.

_____ 4. Cavity containing the heart and lungs.

_____ 5. Cavity containing the stomach and kidneys.

_____ 6. Cavity containing the urinary bladder and internal reproductive organs.

There is no physical separation between the abdominal and pelvic cavities. These cavities are sometimes collectively called the abdominopelvic cavity.

B. Match these terms with the correct parts labeled in figure 1.3:

Abdominal cavity
Abdominopelvic cavity
Diaphragm
Mediastinum
Pelvic cavity
Pericardial cavity
Pleural cavity
Thoracic cavity

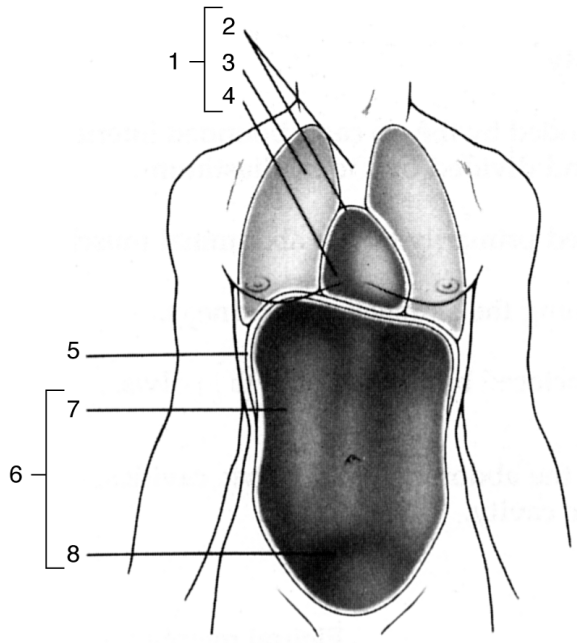


Figure 1.3

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Serous Membranes

"*Serous membranes line the trunk cavities and cover the organs of these cavities.*"

A. Match these terms with the correct statement or definition:

Mesentery
Parietal
Pericardial membrane
Peritoneal membrane
Pleural membrane
Retroperitoneal
Visceral

_____ 1. Portion of a serous membrane in contact with an organ.

_____ 2. Portion of a serous membrane that lines a trunk cavity.

_____ 3. Serous membrane that surrounds the lungs and lines the thoracic cavity.

_____ 4. Serous membrane that lines the abdominal and pelvic cavities and covers their organs.

_____ 5. Double-layered serous membrane that anchors some abdominal organs to the body wall.

_____ 6. Location of organs covered only by parietal peritoneum.

A potential space or cavity is located between the visceral and parietal serous membranes. The cavity is filled with serous fluid that reduces friction between the visceral and parietal serous membranes.

B. Match these terms with the correct part labeled in figure 1.4:

Mesentery
Parietal peritoneum
Peritoneal cavity
Retroperitoneal
Visceral peritoneum

1. _____
2. _____
3. _____
4. _____
5. _____

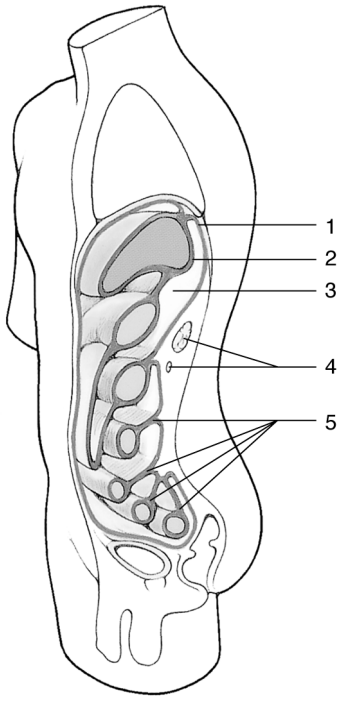


Figure 1.4

QUICK RECALL

1. Arrange the seven structural levels of the body in order, from the smallest to the largest.

2. List the four primary tissue types.

3. List six characteristics of life.

4. List the two kinds of feedback mechanisms found in living organisms.

5. Describe the anatomical position.

6. List the three major planes used to section the human body. List the three major planes used to section an organ of the human body.

7. Name the three trunk cavities of the human body and list the three serous membranes that line these cavities and cover their organs.

8. List four retroperitoneal organs.

WORD PARTS

Give an example of a new vocabulary word that contains each word part.

WORD PART	MEANING	EXAMPLE
homeo-	the same; steady	1. _____
-stasis	standing; staying	2. _____
sagitt-	an arrow	3. _____
peri-	around	4. _____
pariet-	wall	5. _____
retro-	behind; back of	6. _____

MASTERY LEARNING ACTIVITY

Place the letter corresponding to the correct answer in the space provided.

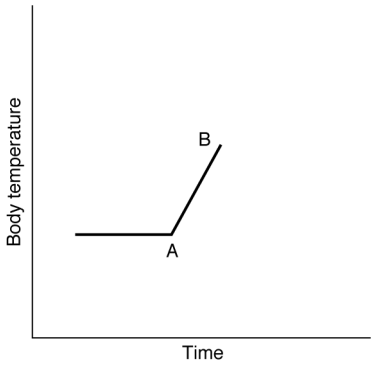
_____ 1. Physiology
- a. deals with the processes or functions of living things.
- b. is the scientific discipline that investigates the body's structure.
- c. is concerned with organisms and does not deal with different levels of organization such as cells and systems.
- d. recognizes the unchanging (as opposed to dynamic) nature of living things.

_____ 2. An organ is
- a. a small structure within a cell that carries out a specific function.
- b. at a lower level of organization than a cell.
- c. two or more tissues that perform a common function.
- d. a group of cells with similar structure and function.

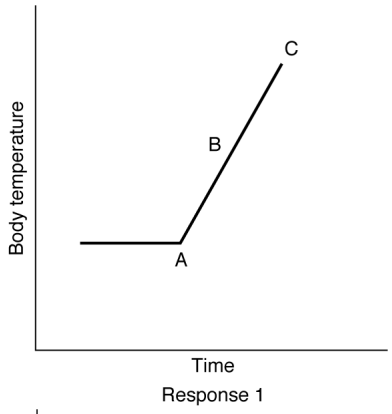
_____ 3. The systems that are most important in the regulation or control of the other systems of the body are the
- a. circulatory and muscular systems.
- b. circulatory and endocrine systems.
- c. nervous and muscular systems.
- d. nervous and endocrine systems.

_____ 4. Negative-feedback mechanisms
- a. make deviations from normal smaller.
- b. maintain homeostasis.
- c. cause heart rate to increase when blood pressure decreases.
- d. all of the above

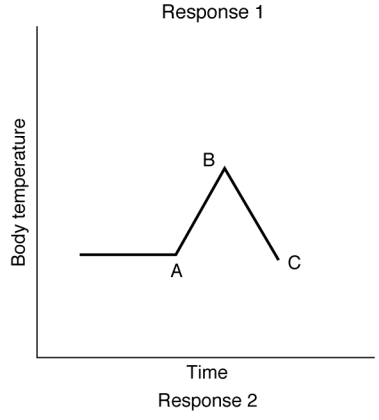
_____ 5. Body temperatures were measured during an experiment. On the graph below at point A, the subject moved from a cool room into a hot sauna. As a result, body temperature increased to point B.



Graphed below are two possible responses to the increase in body temperature.



Response 1



Response 2

Which of the responses graphed above represents a negative-feedback mechanism?
a. Response 1
b. Response 2

_____ 6. Which of the following terms mean the same thing when referring to a human in the anatomical position?
a. superior and dorsal
b. deep and distal
c. anterior and ventral
d. proximal and medial

_____ 7. The chin is _____ to the umbilicus (belly button).
a. lateral
b. posterior
c. distal
d. superior

_____ 8. A plane that divides the body into anterior and posterior portions is a
a. frontal plane.
b. sagittal plane.
c. transverse plane.

_____ 9. Which of the following terms is correctly defined?
a. The arm is that part of the upper limb between the shoulder and wrist.
b. The leg is that part of the lower limb between the knee and ankle.
c. The thorax extends from the neck to the pelvis.
d. An abdominal region is one of four subdivisions of the abdomen.

_____ 10. The thoracic cavity is separated from the abdominal cavity by the
a. diaphragm.
b. mediastinum.
c. mesentery.
d. rib cage.

_____ 11. The pelvic cavity contains the
a. kidneys.
b. liver.
c. stomach.
d. spleen.
e. urinary bladder.

_____ 12. The heart is
a. part of the mediastinum.
b. surrounded by the pericardial cavity.
c. found within the thoracic cavity.
d. all of the above

_____ 13. Given the following characteristics:
1. reduce friction between organs
2. line fluid-filled cavities
3. line trunk cavities that open to the exterior of the body

Which of the characteristics describe serous membranes?
a. 1, 2
b. 2, 3
c. 3, 2
d. 1, 2, 3

_____ 14. Given the following organ and cavity combinations:
1. heart and pericardial cavity
2. lungs and pleural cavity
3. stomach and peritoneal cavity
4. kidney and peritoneal cavity

Which of the organs is correctly paired with a space that surrounds that organ?
a. 1, 2
b. 1, 2, 3
c. 1, 2, 4
d. 2, 3, 4
e. 1, 2, 3, 4

_____ 15. Given the following body cavity and membrane combinations:
1. abdominal cavity and peritoneum
2. thoracic cavity and pleural membrane
3. pericardial cavity and pericardial membrane
4. pelvic cavity and peritoneum

Which of the body cavities are correctly paired with a membrane lining that body cavity?
a. 1, 2
b. 2, 3
c. 3, 4
d. 1, 2, 3
e. 1, 2, 3, 4

Use a separate sheet of paper to complete this section.

1. Complete the following statements, using the correct directional term for a human being.
   a. The knee is _____ to the ankle.
   b. The ear is _____ to the nose.
   c. The nose is _____ to the lips.
   d. The lips are _____ to the teeth.
   e. The heart is _____ to the sternum (breastbone).

2. The esophagus is a tube that connects the throat (pharynx) and the stomach. What planes through the body make a longitudinal section through the esophagus? A cross section?

3. When blood sugar levels decrease, the hunger center in the brain is stimulated. Is this part of a negative or positive feedback system? Explain.

4. A man has been shot in the abdomen. The bullet passed through the abdominal wall, the stomach, and lodged in the kidney. Name, in order, the serous membranes through which the bullet passed.

ANSWERS TO CHAPTER 1

CONTENT LEARNING ACTIVITY

Anatomy and Physiology
1. Systemic anatomy; 2. Regional anatomy; 3. Surface anatomy; 4. Anatomic imaging; 5. Physiology

Structure and Functional Organization
A. 1. Organelle; 2. Cell; 3. Tissue; 4. Organ
B. 1. Integumentary; 2. Nervous; 3. Respiratory; 4. Urinary; 5. Digestive; 6. Skeletal; 7. Cardiovascular; 8. Endocrine; 9. Muscular

Characteristics of Life
1. Organization; 2. Metabolism; 3. Responsiveness; 4. Growth; 5. Differentiation; 6. Reproduction

Homeostasis
A. 1. Variable; 2. Set point; 3. Normal range; 4. Receptor; 5. Control center; 6. Effector
B. 1. Negative feedback; 2. Positive feedback; 3. Negative feedback; 4. Negative feedback; 5. Positive feedback; 6. Positive feedback

Directional Terms
1. Inferior; 2. Posterior and dorsal; 3. Anterior and ventral; 4. Distal; 5. Lateral; 6. Deep

Planes
A. 1. Sagittal plane; 2. Transverse plane; 3. Frontal (coronal) plane; 4. Longitudinal section; 5. Transverse (cross) section; 6. Oblique section
B. 1. Frontal (coronal) plane; 2. Transverse plane; 3. Midsagittal plane
C. 1. Longitudinal section; 2. Transverse (cross) section; 3. Oblique section

Body Regions
1. Upper limb; 2. Arm; 3. Forearm; 4. Lower limb; 5. Thigh; 6. Leg; 7. Thorax; 8. Abdomen; 9. Pelvis

Body Cavities
A. 1. Thoracic cavity; 2. Abdominal cavity; 3. Pelvic cavity; 4. Thoracic cavity; 5. Abdominal cavity; 6. Pelvic cavity
B. 1. Thoracic cavity; 2. Mediastinum; 3. Pleural cavity; 4. Pericardial cavity; 5. Diaphragm; 6. Abdominopelvic cavity; 7. Abdominal cavity; 8. Pelvic cavity

Serous Membranes
A. 1. Visceral; 2. Parietal; 3. Pleural membrane; 4. Peritoneal membrane; 5. Mesentery; 6. Retroperitoneal
B. 1. Parietal peritoneum; 2. Visceral peritoneum; 3. Peritoneal cavity; 4. Retroperitoneal; 5. Mesentery

QUICK RECALL

1. Chemical, organelle, cell, tissue, organ, organ system, organism
2. Epithelial, connective, muscular, and nervous tissues
3. Organization, metabolism, responsiveness, growth, differentiation, and reproduction.
4. Negative and positive feedback
5. A person standing erect with the feet pointing forward, arms hanging to the sides, and the palms of the hands facing forward
6. Sagittal, transverse (horizontal), and frontal (coronal) planes of the body; Longitudinal, transverse (cross), and oblique sections of organs
7. Thoracic, abdominal, and pelvic cavities; pericardial, pleural, and peritoneal membranes
8. Kidneys, adrenal glands, pancreas, portions of the intestines, and urinary bladder

WORD PARTS

1. homeostasis
2. homeostasis
3. sagittal; midsagittal
4. pericardium; peritoneum; retroperitoneal
5. parietal
6. retroperitoneal

MASTERY LEARNING ACTIVITY

1. A. Physiology deals with the processes or functions of living things. It is divided according to the organisms involved or the levels of organization within a given organism. Physiology emphasizes the dynamic nature of living things.

2. C. An organ is two or more tissues that perform a common function. An organelle is a small structure within a cell. Organelles are at a lower level of organization than a cell, but organs are at a higher level. A tissue is a group of cells with similar structure and function.

3. D. The nervous and endocrine systems are the most important regulatory systems of the body. The circulatory system transports gases, nutrients, and waste products. The muscular system is responsible for movement.

4. D. Negative-feedback mechanisms maintain homeostasis by making deviations from normal smaller. When blood pressure decreases, a negative-feedback mechanism causes heart rate to increase, causing an increase in blood pressure that helps to maintain homeostasis.

5. B. First, you must be able to interpret the graphs. For response 1, body temperature increased still further from the normal value, and for response 2 body temperature returned to normal. Next, the definitions of positive and negative feedback must be applied to the graphs. Negative-feedback mechanisms resist further change or return the values to normal (homeostasis) as in response 2. Positive-feedback mechanisms increase the difference between a value and its normal level as in response 1.

6. C. Anterior (toward the front of the body) and ventral (toward the belly) can be used interchangeably.

7. D. The chin is superior to (higher than) the umbilicus.

8. A. A frontal plane divides the body into anterior and posterior portions. A sagittal plane divides the body into left and right portions, and a transverse plane divides the body into superior and inferior portions.

9. B. The lower limb includes the thigh (hip to knee), leg (knee to ankle), ankle, and foot. The upper limb includes the arm (shoulder to elbow), forearm (elbow to wrist), wrist, and hand. The thorax extends from the neck to the abdomen, and the abdomen is between the thorax and pelvis. An abdominal region is one of nine subdivisions of the abdomen. An abdominal quadrant is one of four abdominal subdivisions.

10. A. The diaphragm separates the thoracic cavity from the abdominal cavity. The mediastinum divides the thoracic cavity into left and right parts.

11. E. The pelvic cavity contains the urinary bladder, the internal reproductive organs, and the lower part of the digestive tract. The other organs listed are found in the abdominal cavity.

12. D. The mediastinum is a partition containing the heart, trachea, esophagus, and other structures. The heart is surrounded by the pericardial cavity. The mediastinum, pericardial cavity, and heart are found in the thoracic cavity.

13. A. Serous membranes line cavities into which they secrete serous fluid. The serous fluid reduces friction between organs. Serous membranes line cavities that do NOT open to the exterior of the body.

14. B. The kidneys are retroperitoneal; therefore they are NOT surrounded by the peritoneal cavity.

15. E. The abdominal and pelvic cavities are lined by the peritoneum, the thoracic cavity by the pleural membrane, and the pericardial cavity by the pericardial membrane.

FINAL CHALLENGES

1. a. Proximal or superior
   b. Lateral and posterior
   c. Superior
   d. Anterior
   e. Posterior (dorsal) or deep

2. A sagittal or frontal plane through the body also makes a longitudinal section through the esophagus. A transverse plane makes a cross section.

3. It is part of a negative-feedback system. Stimulation of the hunger center can result in eating, and the ingested food causes blood sugar levels to increase (return to homeostasis).

4. After passing through the abdominal wall, the parietal peritoneum is the first membrane pierced. In passing through the stomach, the visceral peritoneum on one side of the stomach, the stomach itself, and the visceral peritoneum on the other side of the stomach are penetrated. To enter the kidney, which is retroperitoneal, the bullet passes through the parietal peritoneum.