

Organ Systems and Body Cavities

EXERCISE

2

Objectives

After completing this exercise, you should be able to:

- Name the organ systems and describe the functions of each
- Name the major organs of each organ system and identify them on models or charts
- Describe the location of the body cavities and name the organs they contain
- Describe the structure and location of the serous membranes
- Identify the abdominopelvic quadrants and the organs found in each
- Identify the abdominopelvic regions and the major organs found in each

Materials

- human torso models or charts
- male and female human reproductive models or charts
- articulated skeleton
- one-gallon zippered plastic bags (2 per group)
- masking tape

A. Overview of Organ Systems

The body stays alive due to the interaction of different organ systems. An **organ system** is a group of organs performing a common function that helps provide the cells of the body with an optimal environment. All organ systems cooperate to maintain this optimal environment through a process called **homeostasis** (*homeo-* = same; *-stasis* = standing). Failure to maintain homeostasis results in disorders and disease. Organ system functions and major organs are summarized in Table 2.1.

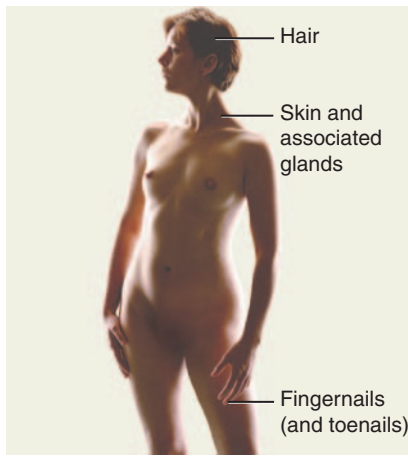
ACTIVITY 1 Identifying Organ Systems

Identify the organ systems in Figure 2.1 using the organ system list provided. Refer to Table 2.1.

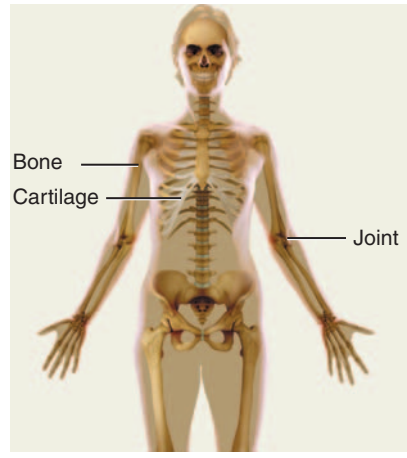
16 EXERCISE 2 ORGAN SYSTEMS AND BODY CAVITIES**TABLE 2.1** Functions and Major Organs of the Organ Systems

ORGAN SYSTEM	FUNCTION
Cardiovascular	Transports nutrients, chemical messengers, gases, and wastes in blood. Major organs: heart and blood vessels
Respiratory	Adds oxygen to blood and removes carbon dioxide from blood; maintenance of carbon dioxide levels helps regulate pH. Major organs: nose, pharynx (throat), trachea, bronchi, lungs
Digestive	Breaks down food into units that can be absorbed into the body; eliminates wastes and nondigestible fiber in food. Major organs: mouth, pharynx, esophagus, stomach, intestines, pancreas, liver, gallbladder
Urinary	Removes nitrogenous wastes; maintains body fluid volume, pH, and electrolyte levels through urine production. Major organs: kidneys, ureters, urinary bladder, urethra
Integumentary	Provides a protective barrier for the body and aids in production of vitamin D; contains sensory receptors for pain, touch, and temperature; thermoregulation. Major organs: skin and skin structures (hair, nails, sweat glands, oil glands)
Lymphatic and Immune	Returns fluid to cardiovascular system; detects, filters, and eliminates disease-causing organisms, including cancer cells. Major organs: lymphatic vessels, lymph nodes, spleen, thymus, bone marrow
Skeletal	Protects major organs; provides levers and support for body movement. Major organs: bones
Muscular	Moves bones and maintains posture. Major organs: skeletal muscles
Nervous	Controls cell function with electrical signals; helps control body homeostasis. Major organs: brain, spinal cord, nerves
Endocrine	Controls cell function with hormones; helps control body homeostasis. Major organs: hypothalamus, pituitary, thyroid, pancreas, adrenal glands, ovaries, testes
Reproductive	Produces gametes; female uterus provides environment for development of fetus. Major organs in the male: testes, epididymis, ductus deferens, prostate penis Major organs in the female: ovaries, uterine tubes, uterus, vagina

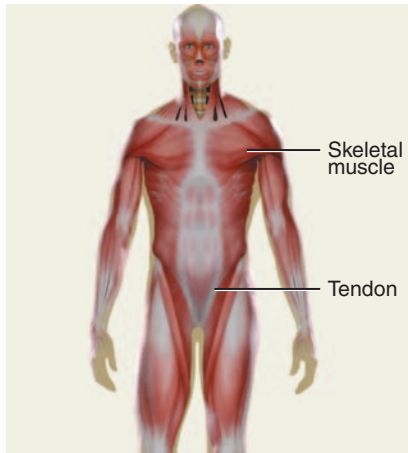
EXERCISE 2 ORGAN SYSTEMS AND BODY CAVITIES 17



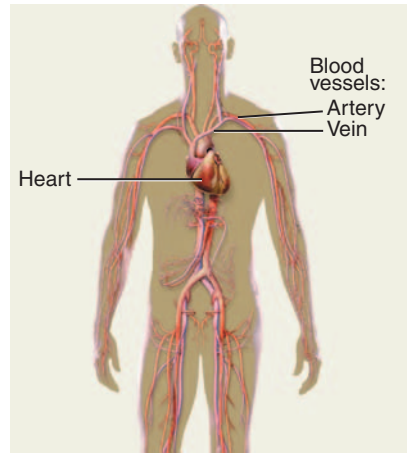
1 _____



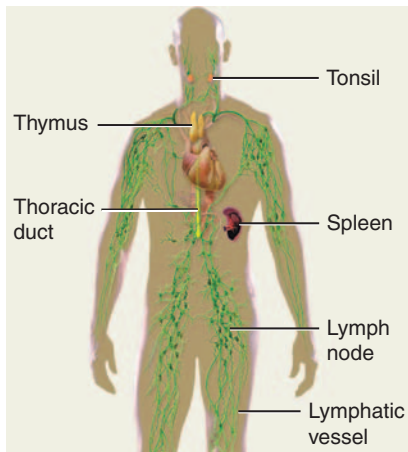
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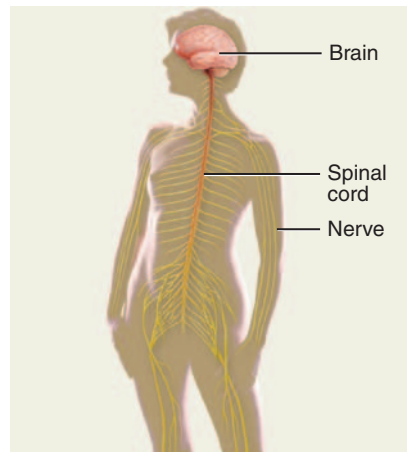
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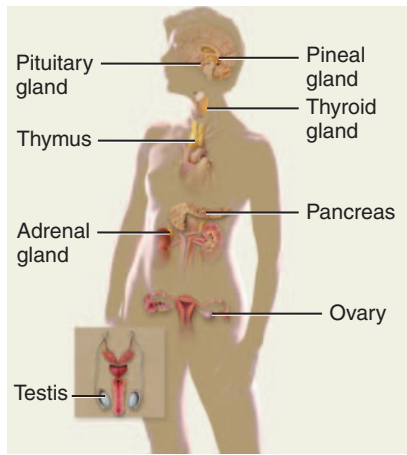
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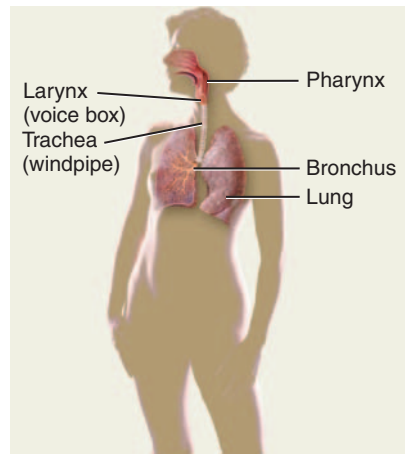
6 _____

FIGURE 2.1 Organ systems and selected organs.

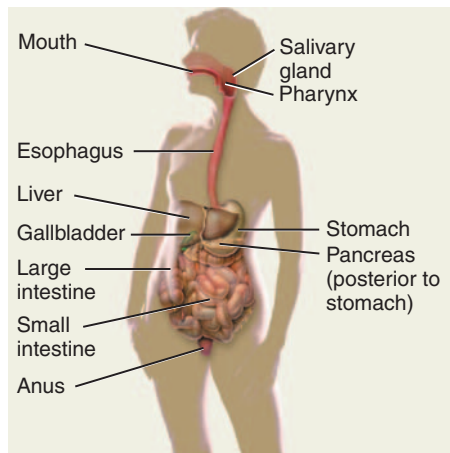
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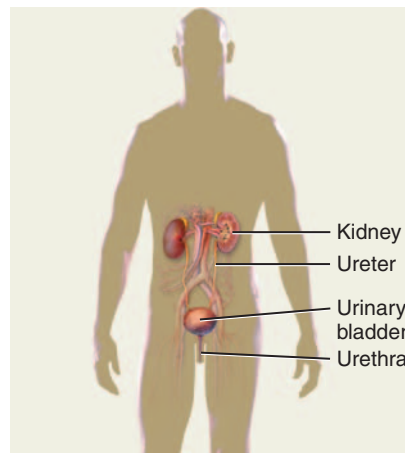
7 _____



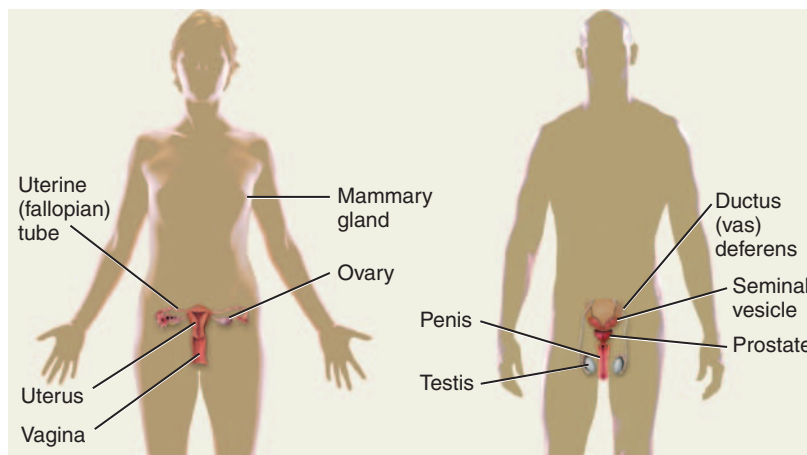
8 _____



9 _____



10 _____



11 _____

FIGURE 2.1 Organ systems and selected organs, *continued*.

B. Identification of Major Organs on a Torso Model

You will be identifying organs from anterior to posterior on a torso and answering questions concerning their position relative to the organs around them.

ACTIVITY 2 Identification of Organs

- 1 Identify the following organs on the anterior surface of a torso model. Identify all the organs without removing any organs from the model.
 - brain
 - trachea
 - heart
 - lungs
 - liver
 - stomach (left side of torso)
 - small intestine
 - large intestine (colon)
- 2 Remove the lungs, heart, liver, and stomach. Locate the gallbladder on the inferior surface of the liver.
- 3 Identify the following organs on the human torso model or chart.
 - esophagus
 - bronchi (right and left)
 - inferior vena cava
 - pancreas (posterior to stomach)
 - spleen
- 4 Remove the small intestine and large intestine. Locate the appendix at the inferior right end of the large intestine.
- 5 Identify the following organs on the human torso model.
 - abdominal aorta
 - adrenal glands (superior surface of kidneys)
 - kidneys
 - ureters
 - urinary bladder
- 6 Identify the female reproductive organs on a female reproductive model or chart. Observe the position of the urinary bladder relative to the uterus.
 - ovaries
 - uterus
 - urinary bladder
- 7 Identify the male reproductive organs on a male reproductive model or chart.
 - penis
 - scrotum (skin covering testes)
 - testes
- 8 Answer the questions about the position of each organ.
 1. The stomach is _____ to the small intestine.
 - a. superior b. inferior c. medial d. lateral
 2. The liver is _____ to the lungs.
 - a. superior b. inferior c. medial d. lateral
 3. The lungs are _____ to the heart.
 - a. superior b. inferior c. medial d. lateral
 4. The trachea is _____ to the esophagus.
 - a. medial b. inferior c. anterior d. posterior
 5. The pancreas is _____ to the stomach.
 - a. superior and medial b. superior and anterior
 - c. anterior and lateral d. posterior and inferior
 6. The gallbladder is on the _____ surface of the liver.
 - a. superior b. inferior c. posterior d. lateral
 7. The stomach is _____ to the spleen.
 - a. lateral b. medial c. superior d. inferior
 8. The abdominal aorta and inferior vena cava are _____ to the kidneys.
 - a. medial b. lateral c. superior d. inferior
 9. The kidneys are _____ to the small intestine.
 - a. anterior b. posterior c. superior d. inferior
 10. The urinary bladder is _____ to the uterus.
 - a. posterior and superior b. anterior and inferior
 - c. medial and superior d. lateral and posterior

20 EXERCISE 2 ORGAN SYSTEMS AND BODY CAVITIES**C. Body Cavities**

The two major cavities of the body are the dorsal and ventral body cavities. The **dorsal body cavity** is located near the posterior surface of the body and has two main subdivisions: the **cranial cavity** that contains the brain and the **vertebral** (*vertebra* = back) **canal** that contains the spinal cord. The cranial cavity and the vertebral canal are continuous.

The **ventral body cavity** is located near the anterior surface of the body and has two subdivisions, the thoracic cavity and the abdominopelvic cavity, which are separated by the **diaphragm**. The **thoracic cavity** is a space enclosed by the ribs, sternum, and vertebral column. This cavity contains three small cavities: the **pericardial cavity** (*peri-* = around; *-cardia* = heart) and two **pleural cavities** (*pleuro-* = side or rib). The pericardial cavity surrounds the heart, and each pleural cavity contains a lung. The **mediastinum** (*media-* = middle; *-stinum* = partition), a central area within the thoracic cavity, extends from the neck to the diaphragm and from the sternum to the vertebral column. The organs located in the mediastinum are the heart, thymus gland, esophagus, trachea and bronchi. The pleural cavities are located on either side of the mediastinum.

The **abdominopelvic cavity** consists of two continuous cavities: the abdominal cavity and the pelvic cavity. The **abdominal cavity** is the superior portion located between

the diaphragm superiorly and the brim of the pelvis inferiorly. This cavity contains the stomach, liver, gallbladder, pancreas, spleen, small intestine, kidneys, appendix, and part of the large intestine. The **pelvic cavity**, located between the pelvic brim superiorly and the body wall inferiorly, is the inferior portion of the abdominopelvic cavity. The pelvic cavity contains part of the large intestine, rectum, urinary bladder, female reproductive organs (ovaries, uterine tubes, uterus, vagina), and male reproductive organs (prostate, part of ductus deferens). It is important to note that the testes and penis are not located in the ventral body cavity but are outside the body wall.

ACTIVITY 3 Body Cavities

- 1 Label the dorsal and ventral body cavities, their subdivisions, and the diaphragm on Figure 2.2(a) and (b).
- 2 Locate the dorsal body cavity and its subdivisions on a skeleton and torso model.
- 3 Locate the ventral body cavity, its subdivisions, and the diaphragm on a torso model.
- 4 Locate the mediastinum (meed-ee-uh-STINE-um) on a torso model.
- 5 Using a torso model, complete Table 2.2 by listing the major organ(s) found in each body cavity.

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(a) Lateral view

(b) Anterior view

(a) Lateral view

- abdominal cavity
- abdominopelvic cavity
- cranial cavity
- diaphragm
- dorsal cavity
- pelvic cavity
- thoracic cavity
- ventral cavity
- vertebral canal

(b) Anterior view

- abdominal cavity
- abdominopelvic cavity
- brim of pelvis
- diaphragm
- pelvic cavity
- thoracic cavity

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

9 _____

10 _____

11 _____

12 _____

13 _____

14 _____

15 _____

FIGURE 2.2 Body cavities.

TABLE 2.2 Body Cavities

BODY CAVITY	ORGANS
Dorsal body cavity	
Cranial cavity	1. _____
Vertebral canal	2. _____
Ventral body cavity	
Thoracic cavity	
Pleural cavities (2)	3. _____
Mediastinum	4. (Within pericardial cavity) _____ 5. _____
	6. _____ 7. _____ 8. _____
Abdominopelvic cavity	
Abdominal cavity	9. _____ 10. _____ 11. _____
	12. _____ 13. _____ 14. _____
	15. _____ 16. _____ 17. _____
Pelvic cavity	18. _____ 19. _____ 20. _____
	21. _____ 22. _____ 23. _____
	24. _____ 25. _____ 26. _____

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D. Serous Membranes

Most of the organs in the ventral body cavity are covered with **serous** (*serum* = any clear, watery fluid) **membranes**, which are composed of two layers: a visceral layer and a parietal layer. The **visceral** (*viscera* = internal organs) **layer** covers the organ, whereas the **parietal** (*paries* = wall) **layer** attaches to and covers the ventral body wall. These two layers comprise one continuous sheet that folds to form a sac. Between the two layers is a small amount of serous fluid secreted by the membranes. The clear, watery **serous fluid** prevents friction as the organs move within the ventral body cavity. For example, the heart has movement within the thoracic cavity as it fills with and ejects blood.

Serous membranes are named for the cavities they surround. Thoracic serous membranes include the **pleura**, which covers the lungs, and the **pericardium**, which covers the heart. The serous membrane that covers the abdominal organs is the **peritoneum** (*peri-* = around; *teinein* = to stretch). Although most abdominal organs are positioned within the peritoneal cavity, a few organs are **retroperitoneal** (*retro-* = backward), or located posterior to the peritoneum. These organs are the pancreas, kidneys, adrenal glands, and portions of the large intestine, small intestine, aorta, and inferior vena cava. The peritoneum has three major double-layered folds called the mesentery, the greater omentum, and the lesser omentum. The **mesentery** encircles and holds the small intestine to the dorsal body wall. The **greater omentum** is suspended from the inferior portion of the stomach and covers the intestines in a similar manner to an apron. The **lesser omentum** suspends the superior portion of the stomach to the liver.

ACTIVITY 4 Serous Membranes

- 1 Label the serous membranes and cavities in the thoracic cavity in Figures 2.3(a) and (b).
- 2 Label the serous membranes and cavities in the abdominal cavity in Figures 2.4(a) and (b).
- 3 Make a replica or model of a serous membrane with your lab group. (This can be done as a demonstration.)
 - Obtain 2 one-gallon zippered plastic bags.
 - Make sure all the air is out of the first bag and then rezip the bag.
 - In the second bag, add about 40 to 50 mL of water and push out the extra air before reziping.
 - Have a lab partner place a fist (simulating an organ) on the bottom edge of the first bag and push up into the bag.
 - Now have the same lab partner place a fist on the bottom edge of the second bag and push up into the bag.
- 4 Visit www.wiley.com/college/allen to observe human serous membranes.
- 5 Answer the discussion questions with your lab partners.

? DISCUSSION QUESTIONS: SEROUS MEMBRANES

- 1 Was it easier to push a fist into the bag with no water or into the bag with water? Explain.
- 2 In the bag with water, what is the name of the simulated serous membrane layer that is touching the fist?
- 3 In the same bag, what is the name of the simulated outer serous membrane layer?
- 4 What does the water represent?

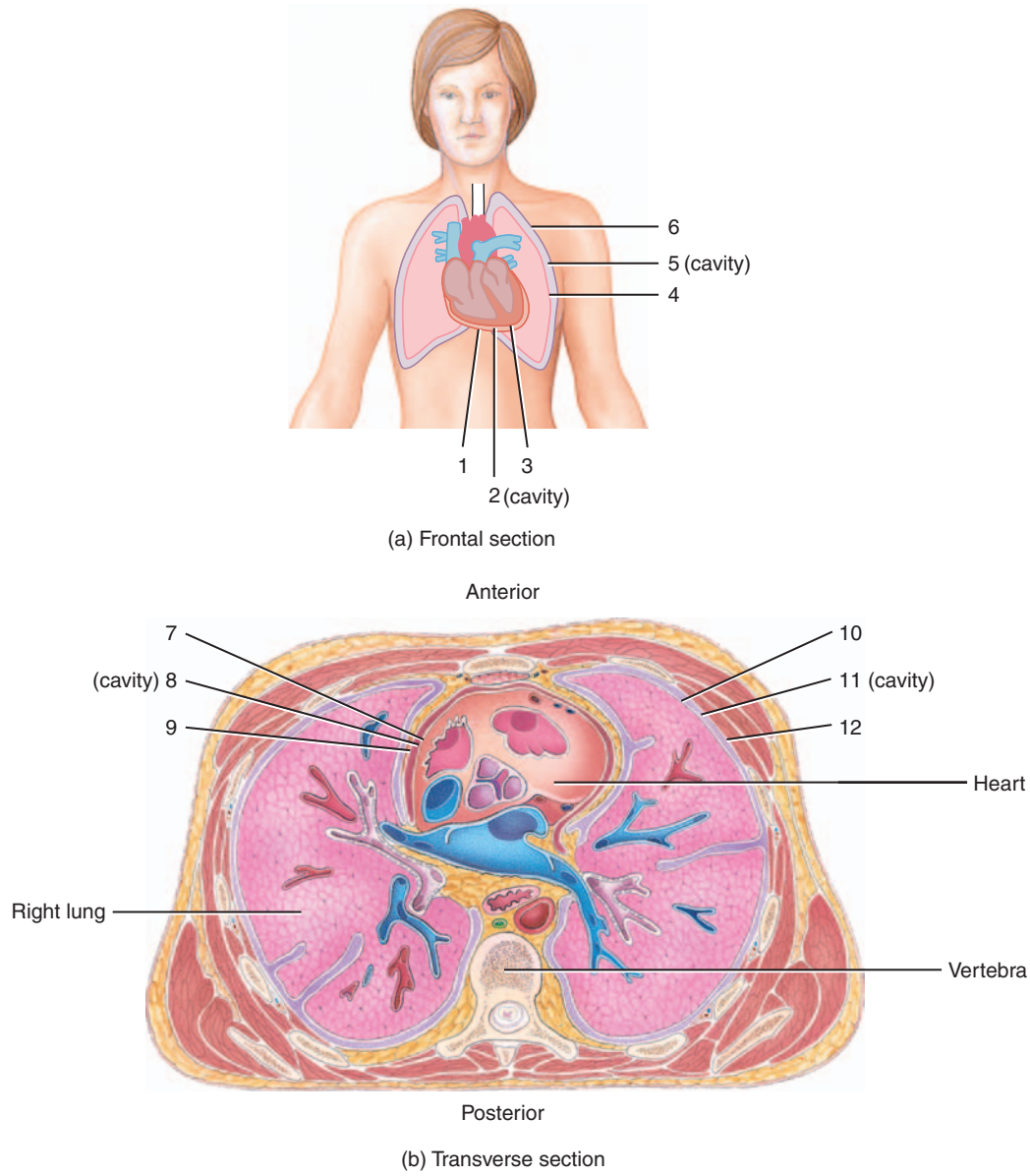
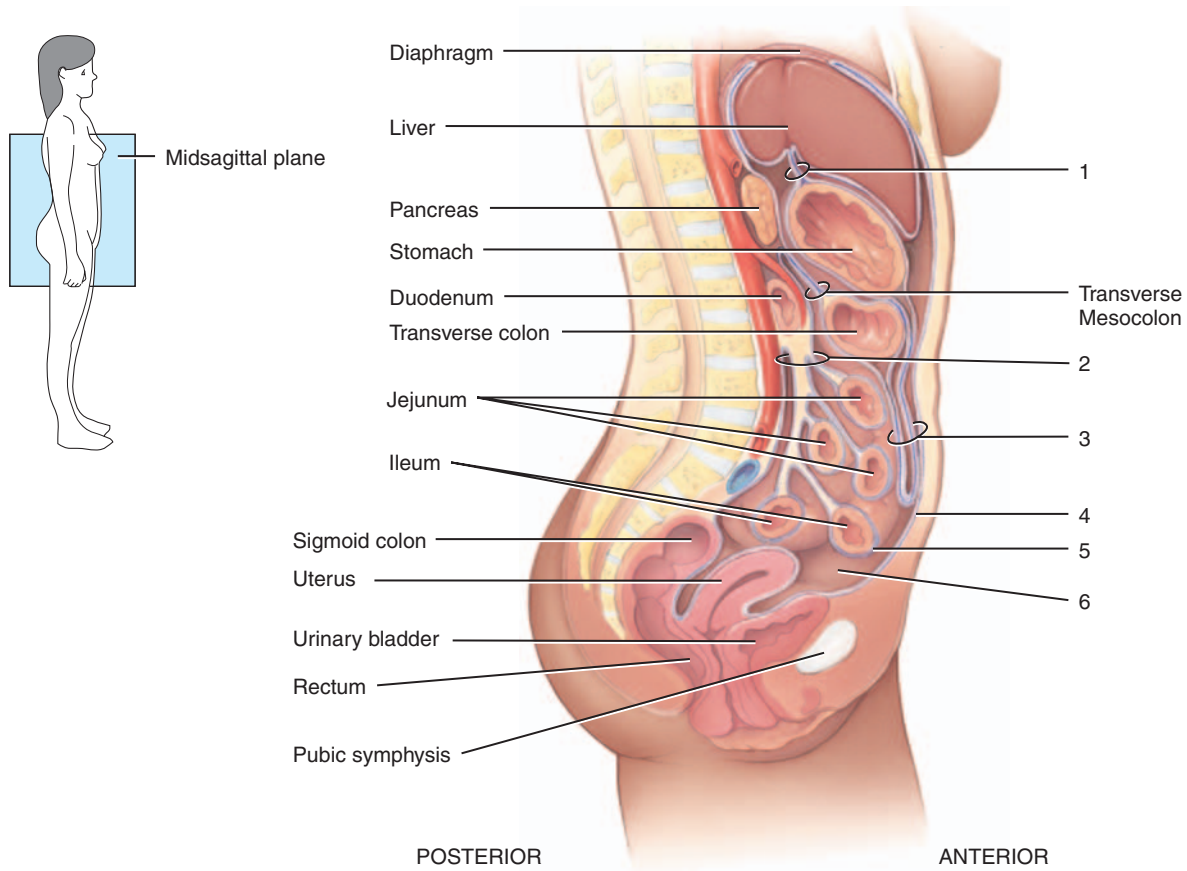
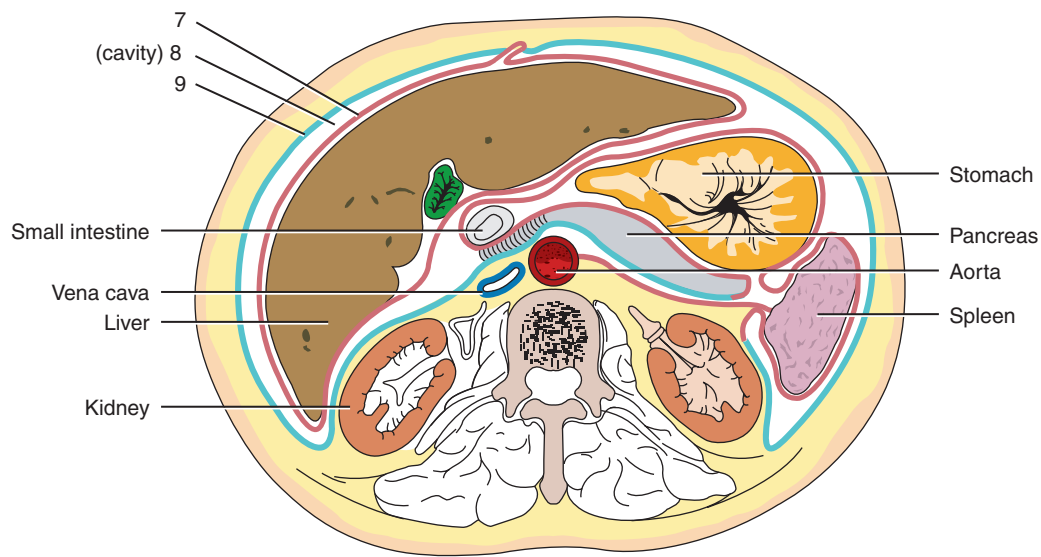


FIGURE 2.3 Serous membranes of the thoracic cavity.

(a) Frontal section	1 _____	(b) Transverse section	7 _____
• parietal pericardium (pa-RYE-e-tul per- i-CAR-dee-um)	2 _____	• parietal pericardium	8 _____
• parietal pleura (PLEUR-uh)	3 _____	• parietal pleura	9 _____
• pericardial cavity (peri- CAR-dee-ul)	4 _____	• pericardial cavity	10 _____
• pleural cavity	5 _____	• pleural cavity	11 _____
• visceral pericardium (VIH-sir-ul)	6 _____	• visceral pericardium	12 _____
• visceral pleura		• visceral pleura	



(a) Sagittal section through the lower body



(b) Transverse section through abdomen

FIGURE 2.4 Serous membranes of the abdominal cavity.

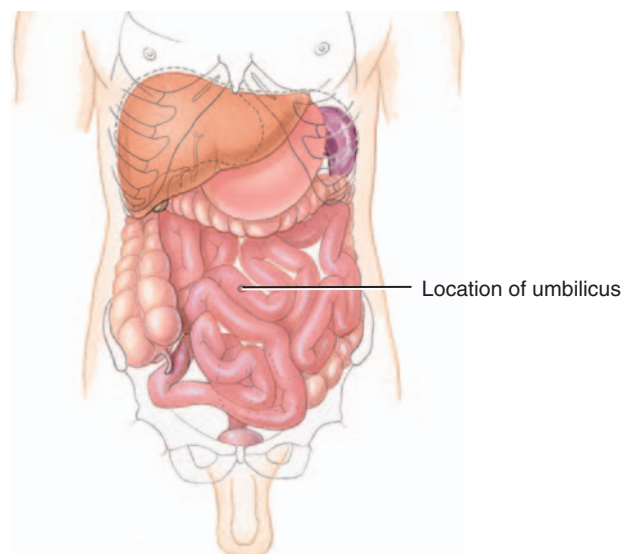
(a) Sagittal section	1 _____	(b) Transverse section	7 _____
• greater omentum	2 _____	• parietal peritoneum	8 _____
• lesser omentum	3 _____	• peritoneal cavity	9 _____
• mesentery	4 _____	• visceral peritoneum	
• parietal peritoneum (per-i-toe-NEE-um)	5 _____		
• peritoneal cavity (per-i-toe-NEE-ul)	6 _____		
• visceral peritoneum			

E. Abdominopelvic Regions and Quadrants

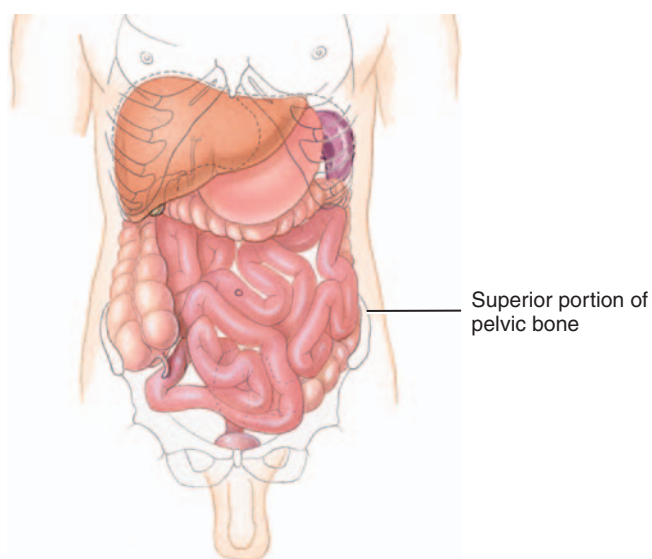
Anatomists divide the abdominopelvic cavity into nine **regions** using two vertical and two horizontal lines in a tic-tac-toe grid so that the location of any organ is simple to describe. The two vertical lines are drawn midclavicular (mid-collar bone) and just medial to the nipples beginning at the diaphragm and extending inferiorly through the pelvic area. The upper horizontal line is drawn across the abdomen inferior to the ribs and across the inferior portions of the liver and stomach. The lower horizontal line is drawn a little inferior to the superior portion of the pelvic bones. These nine regions from the top right to the lower left are: **right hypochondriac** (*hypo-* = under; *chondro-* = cartilage), **epigastric** (*epi-* = upon; *gastro-* = stomach), **left hypochondriac**, **right lumbar** (*lumbar* = loin), **umbilical**, **left lumbar**, **right inguinal** or **iliac** (*inguinal* = groin), **hypogastric** or **pubic**, and **left inguinal** or **iliac**.

Clinicians are more apt to divide this cavity into four **quadrants** that are formed by transverse and sagittal planes running through the umbilicus (navel). These quadrants are useful clinically when one is trying to describe abnormalities or to determine which organ may be the cause of pain. The four quadrants are: **right upper quadrant (RUQ)**, **left upper quadrant (LUQ)**, **right lower quadrant (RLQ)**, and **left lower quadrant (LLQ)**.

- 2 Using four pieces of masking tape, divide the abdominopelvic cavity of a human torso into regions.
- 3 Using the torso model (or chart), identify in which abdominopelvic region each organ is primarily located.
 - a. appendix _____
 - b. gallbladder _____
 - c. right ovary _____
 - d. bifurcation of the abdominal aorta _____
 - e. spleen _____
 - f. stomach (majority of) _____



(a) Quadrants



(b) Regions

ACTIVITY 5 Abdominopelvic Quadrants and Regions

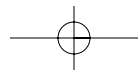
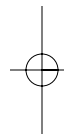
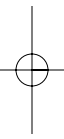
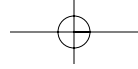
Quadrants

- 1 Draw lines on Figure 2.5(a) separating the abdominopelvic cavity into quadrants and label the quadrants.
- 2 Using two pieces of masking tape, divide the abdominopelvic cavity of a human torso into quadrants.
- 3 Using the torso model (or chart), identify in which abdominopelvic quadrant(s) each organ is primarily located. Use the abbreviations RUQ, LUQ, RLQ, and LLQ.
 - a. appendix _____
 - b. large intestine or colon _____
 - c. liver _____
 - d. ovaries _____
 - e. pancreas _____
 - f. small intestine _____
 - g. spleen _____
 - h. stomach _____

Regions

- 1 Draw lines on Figure 2.5(b) separating the abdominopelvic cavity into regions and label the regions.

FIGURE 2.5 Abdominopelvic cavity.



Name _____ Date _____ Section _____

EXERCISE

Reviewing Your Knowledge



A. Functions of Organ Systems

Identify the organ system whose function is described below.

- _____ 1. Maintains blood oxygen and carbon dioxide levels.
- _____ 2. Controls muscles and glands by electrical impulses; helps control homeostasis.
- _____ 3. Causes movement of bones.
- _____ 4. Waterproof barrier that blocks the entrance of pathogens into the body and the loss of water from the body.
- _____ 5. Transports nutrients, oxygen, and carbon dioxide throughout the body.
- _____ 6. Changes food into absorbable nutrients; expels wastes.
- _____ 7. Regulates composition of blood by eliminating nitrogenous wastes, excess water, and minerals.
- _____ 8. Uses hormones to control cell function; helps control homeostasis.
- _____ 9. Provides framework for the body and protects body organs.
- _____ 10. Produces gametes (sperm and egg).
- _____ 11. Returns fluid to the bloodstream and provides protection against pathogens that have entered the body.

B. Organ Identification

Identify the correct organ system for the following organs.

- | Organ System | Organ |
|--------------|------------------|
| _____ | 1. spleen |
| _____ | 2. liver |
| _____ | 3. trachea |
| _____ | 4. blood vessels |
| _____ | 5. hair |

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- _____ 6. kidney
- _____ 7. uterus
- _____ 8. pituitary gland
- _____ 9. spinal cord
- _____ 10. testes (2 systems)
- _____ 11. prostate gland
- _____ 12. large intestine
- _____ 13. pancreas (2 systems)
- _____ 14. adrenal gland
- _____ 15. thyroid

C. Body Cavities

Identify all the cavities for each organ as follows: dorsal (D), ventral (VN), cranial (C), vertebral (VR), thoracic (T), pleural (PL), pericardial (PC), peritoneal (PT), abdominal (A), or pelvic (P). All structures are present in more than one cavity, and some are in three cavities.

- | | |
|--------------------------|---------------------------|
| _____ 1. brain | _____ 7. spinal cord |
| _____ 2. small intestine | _____ 8. liver |
| _____ 3. heart | _____ 9. kidneys |
| _____ 4. lungs | _____ 10. uterus |
| _____ 5. bronchi | _____ 11. urinary bladder |
| _____ 6. stomach | _____ 12. ovaries |

D. Serous Membranes

Write the term the phrase describes.

- _____ 1. Extends from the stomach and drapes over the intestines.
- _____ 2. Attaches the heart to the body cavity.
- _____ 3. Covers the surface of the lungs.
- _____ 4. Covers the surface of abdominal organs.
- _____ 5. The lubricating liquid in serous cavities.
- _____ 6. Extends between the superior part of the stomach and the liver.

- _____ 7. Attaches the small intestine to the posterior body wall.
- _____ 8. Circle the organs that are found within the peritoneal cavity: pancreas, liver, kidney, spleen, adrenal glands, abdominal aorta, inferior vena cava, stomach.

E. Abdominopelvic Quadrants and Regions

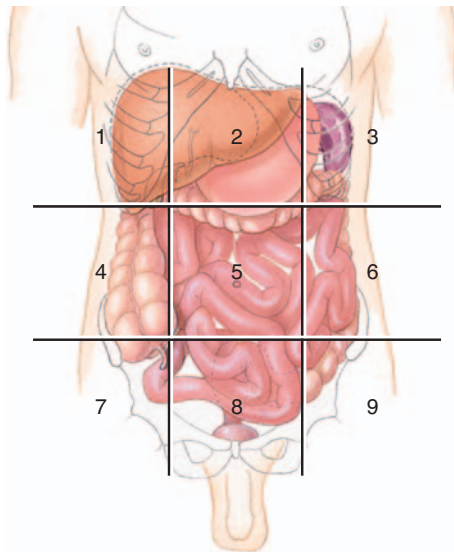
Quadrants

Name the quadrant(s) that the following organs predominantly occupy: RUQ, LUQ, RLQ, and LLQ.

- | | |
|------------------------------|----------------------|
| _____ 1. liver | _____ 6. appendix |
| _____ 2. stomach | _____ 7. left kidney |
| _____ 3. spleen | _____ 8. right ovary |
| _____ 4. right adrenal gland | _____ 9. uterus |
| _____ 5. gallbladder | _____ 10. pancreas |

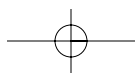
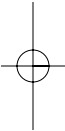
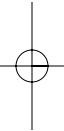
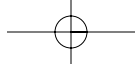
Regions

Label the abdominopelvic regions in Figure 2.6.



- | | |
|---|-------|
| 1 | _____ |
| 2 | _____ |
| 3 | _____ |
| 4 | _____ |
| 5 | _____ |
| 6 | _____ |
| 7 | _____ |
| 8 | _____ |
| 9 | _____ |

FIGURE 2.6 Abdominopelvic regions.



Name _____ Date _____ Section _____

EXERCISE

2

Using Your Knowledge

A. Homeostatic Imbalances of Organ Systems

Using your textbook, identify the organ system that is homeostatically imbalanced in the following diseases or disorders.

Organ System Disease

- _____ 1. muscular dystrophy
- _____ 2. multiple sclerosis
- _____ 3. myocardial ischemia
- _____ 4. infectious mononucleosis

B. Body Cavities

Identify *all* the cavities entered for each procedure, beginning with the largest cavity and ending with the most specific body cavity. Abdominal (A); cranial (C); dorsal (D); pelvic (P); pericardial (PC); pleural (PL); peritoneal (PT); thoracic (T); ventral (VN); and vertebral (VR).

- _____ 5. coronary bypass surgery
- _____ 6. cholecystectomy (gallbladder removal)
- _____ 7. spinal tap

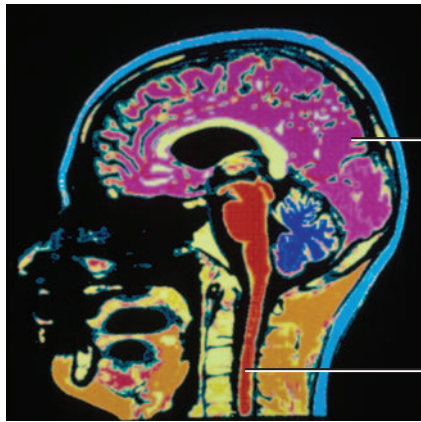
C. Serous Membranes and Abdominopelvic Quadrants

8. A 44-year-old man went to the emergency room complaining of severe pain in his RLQ. The doctor palpated the area and determined that the pain was originating from an organ in that quadrant. Which organ might be involved?
- (a) liver (b) appendix (c) gallbladder (d) spleen (e) stomach
9. A 23-year-old woman went to the doctor with the chief complaint of RLQ pain. Which organ is most likely the cause.
- (a) adrenal gland (b) ovary (c) gallbladder (d) pancreas (e) kidney

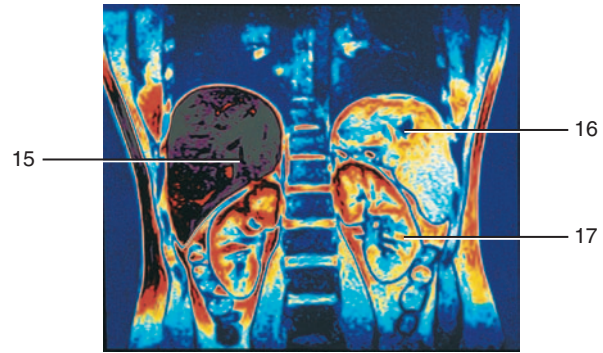
32 EXERCISE 2 ORGAN SYSTEMS AND BODY CAVITIES

D. Organ Identification

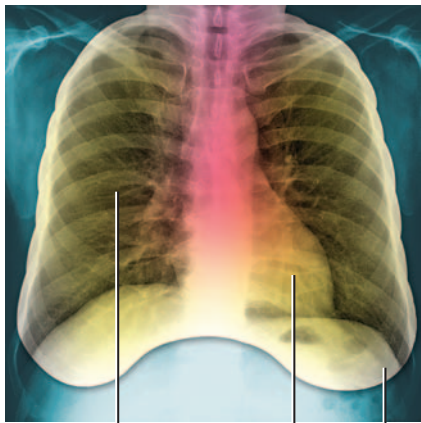
Identify the organs in the color enhanced medical images in Figure 2.7.



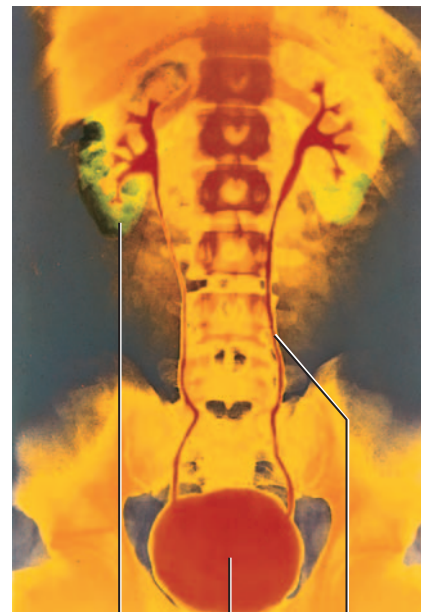
(a) MRI of head and neck.



(c) Radiograph of trunk.



(b) Radiograph of thorax.



(d) Radiograph of urinary tract organs.

FIGURE 2.7 Identification of organs on medical images.

10 _____	14 _____	18 _____
11 _____	15 _____	19 _____
12 _____	16 _____	20 _____
13 _____	17 _____	