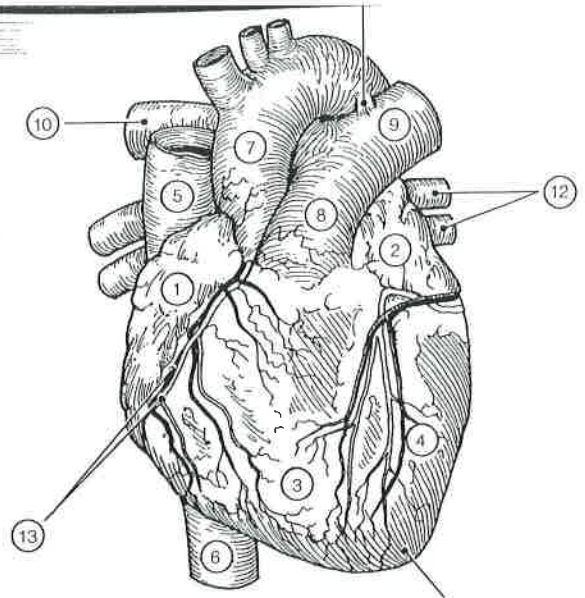


14 THE DIGESTIVE SYSTEM AND BODY METABOLISM



The digestive system processes food so that it can be absorbed and used by the body's cells. The digestive organs are responsible for food ingestion, digestion, absorption, and elimination of undigested remains from the body. In one sense, the digestive tract can be viewed as a disassembly line in which food is carried from one stage of its breakdown process to the next by muscular activity, and its nutrients are made available en route to the cells of the body. In addition, the digestive system provides for one of life's greatest pleasures—eating.

The anatomy of both alimentary canal and accessory digestive organs, mechanical and enzymatic breakdown, and absorption mechanisms are covered in this chapter. An introduction to nutrition and some important understandings about cellular metabolism (utilization of foodstuffs by body cells) are also considered in this chapter review.

ANATOMY OF THE DIGESTIVE SYSTEM

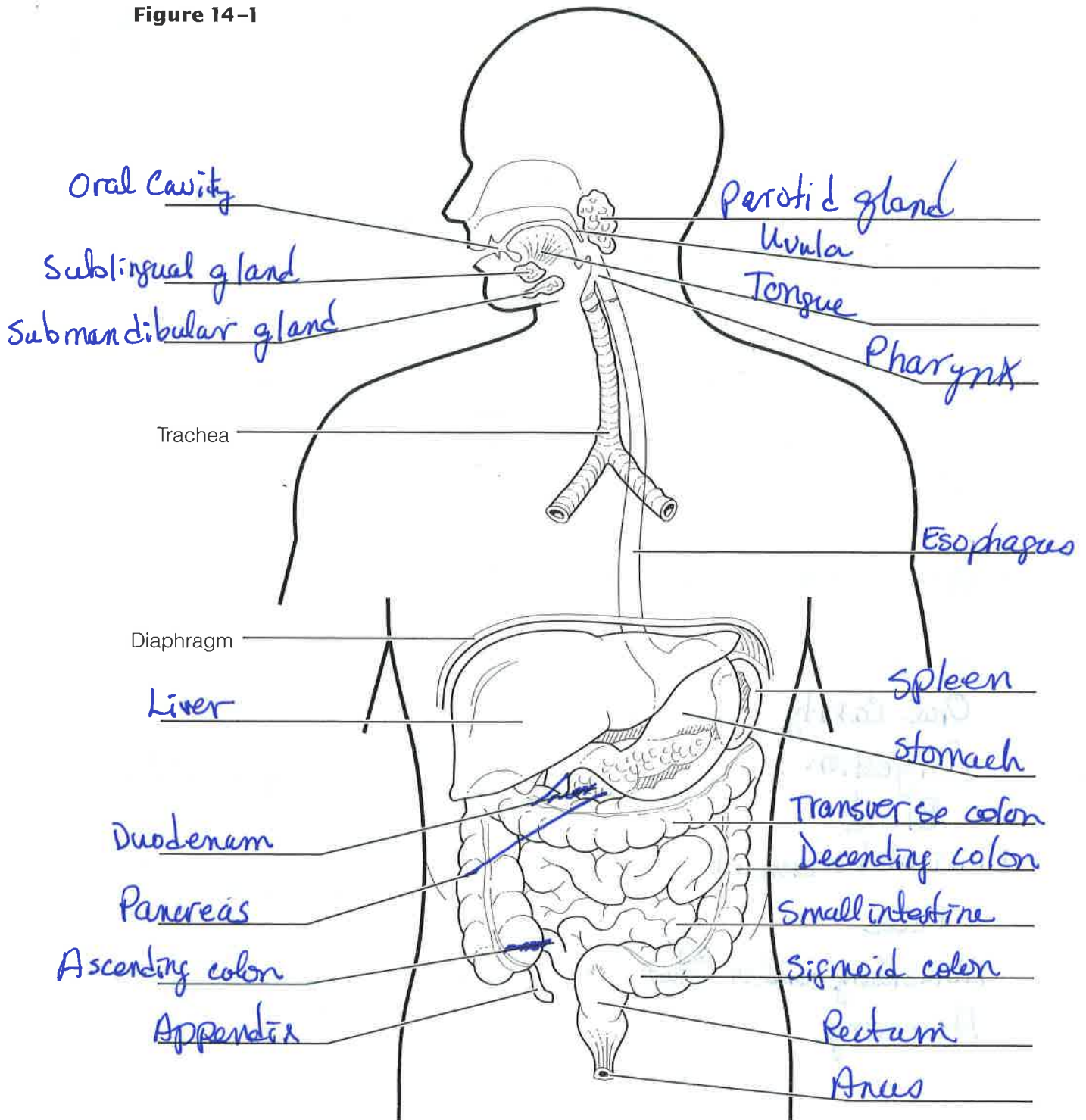
1. Complete the following statements by inserting your answers in the answer blanks.

- | | | |
|---|---|--|
| <p><u>Oral cavity</u></p> <p><u>Digestion</u></p> <p><u>Blood</u></p> <p><u>Eliminated or excreted</u></p> <p><u>Feces</u></p> <p><u>Alimentary canal or GI Tract</u></p> <p><u>Accessory</u></p> | <p>1.</p> <p>2.</p> <p>3.</p> <p>4.</p> <p>5.</p> <p>6.</p> <p>7.</p> | <p>The digestive system is responsible for many body processes. Its functions begin when food is taken into the mouth, or <u>(1)</u>. The process called <u>(2)</u> occurs as food is broken down both chemically and mechanically. For the broken-down foods to be made available to the body cells, they must be absorbed through the digestive system walls into the <u>(3)</u>. Undigestible food remains are removed, or <u>(4)</u>, from the body in <u>(5)</u>. The organs forming a continuous tube from the mouth to the anus are collectively called the <u>(6)</u>. Organs located outside the digestive tract proper, which secrete their products into the digestive tract, are referred to as <u>(7)</u> digestive system organs.</p> |
|---|---|--|

2. Figure 14-1 is a frontal view of the digestive system. First, correctly identify all structures provided with leader lines. Then select different colors for the following organs and color the coding circles and the corresponding structures of the figure.

- | | | |
|---------------------------------------|---------------------------------------|-------------------------------|
| <input type="radio"/> Esophagus | <input type="radio"/> Pancreas | <input type="radio"/> Tongue |
| <input type="radio"/> Liver | <input type="radio"/> Salivary glands | <input type="radio"/> Uvula |
| <input type="radio"/> Large intestine | <input type="radio"/> Small intestine | <input type="radio"/> Stomach |

Figure 14-1



3. Figure 14-2 illustrates oral cavity structures. First, correctly identify all structures provided with leader lines. Then color the structure that attaches the tongue to the floor of the mouth red; color the portions of the roof of the mouth unsupported by bone blue; color the structures that are essentially masses of lymphatic tissue yellow; and color the structure that contains the bulk of the taste buds pink.

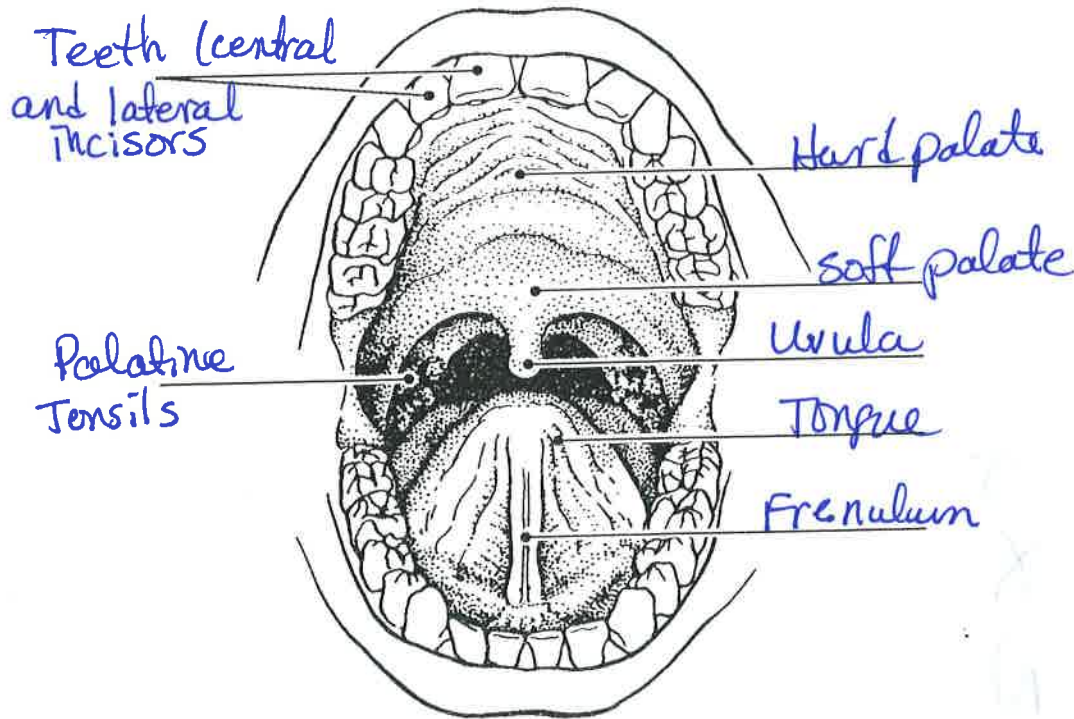


Figure 14-2

4. Various types of glands secrete substances into the alimentary tube. Match the glands listed in Column B to the functions/locations described in Column A. Place the correct term or letter response in the answer blanks.

	Column A	Column B
<u> B </u>	1. Produce an enzyme-poor "juice" containing mucus; found in the submucosa of the small intestine	A. Gastric glands
<u> E </u>	2. Secretion includes amylase, which begins starch digestion in the mouth	B. Intestinal glands
<u> D </u>	3. Ducts a variety of enzymes in an alkaline fluid into the duodenum	C. Liver
<u> C </u>	4. Produces bile, which is transported to the duodenum via the bile duct	D. Pancreas
<u> A </u>	5. Produce hydrochloric acid and pepsinogen	E. Salivary glands

5. Using the **key choices**, select the terms identified in the following descriptions by inserting the appropriate term or letter in the answer blanks.

Key Choices

- | | | |
|--------------------|------------------------------|------------------------|
| A. Anal canal | J. Mesentery | R. Rugae |
| B. Appendix | K. Microvilli | S. Small intestine |
| C. Colon | L. Oral cavity | T. Soft palate |
| D. Esophagus | M. Parietal peritoneum | U. Stomach |
| E. Greater omentum | N. Peyer's patches | V. Tongue |
| F. Hard palate | O. Pharynx | W. Vestibule |
| G. Haustra | P. Plicae circulares | X. Villi |
| H. Ileocecal valve | Q. Pyloric sphincter (valve) | Y. Visceral peritoneum |
| I. Lesser omentum | | |

- J 1. Structure that suspends the small intestine from the posterior body wall
- X 2. Fingerlike extensions of the intestinal mucosa that increase the surface area
- N 3. Collections of lymphatic tissue found in the submucosa of the small intestine
- P 4. Folds of the small intestine wall
- L or U 5. Two anatomical regions involved in the physical breakdown of food
- V 6. Organ that mixes food in the mouth
- O 7. Common passage for food and air
- E ~~or P~~ 8. Three extensions/modifications of the peritoneum
- D, I , and J
- D 9. Literally a food chute; has no digestive or absorptive role
- R 10. Folds of the stomach mucosa
- G 11. Saclike outpocketings of the large intestine wall

- K 12. Projections of the plasma membrane of a cell that increase the cell's surface area
- H 13. Prevents food from moving back into the small intestine once it has entered the large intestine
- S 14. Organ responsible for most food and water absorption
- C 15. Organ primarily involved in water absorption and feces formation
- W 16. Area between the teeth and lips/cheeks
- B 17. Blind sac hanging from the initial part of the colon
- U 18. Organ in which protein digestion begins
- F 19. Membrane attached to the lesser curvature of the stomach
- S 20. Organ into which the stomach empties
- Q 21. Sphincter controlling the movement of food from the stomach into the duodenum
- T 22. Uvula hangs from its posterior edge
- S 23. Organ that receives pancreatic juice and bile
- M 24. Serosa of the abdominal cavity wall
- A 25. Region, containing two sphincters, through which feces are expelled from the body
- F 26. Anterosuperior boundary of the oral cavity; supported by bone
- Y 27. Serous membrane forming part of the wall of the small intestine

6. Circle the ~~term that~~ term that does not belong in each of the following groupings.

1. Nasopharynx Esophagus Laryngopharynx Oropharynx
2. Villi Plicae circulares Rugae Microvilli
3. Salivary glands Pancreas Liver Gallbladder
4. Duodenum Cecum Jejunum Ileum
5. Ascending colon Haustra Circular folds Cecum
6. Mesentery Prenulum Greater omentum Parietal peritoneum
7. Parotid Sublingual Submandibular Palatine
8. Protein-digesting enzymes Saliva Intrinsic factor HCl
9. Colon Water absorption Protein absorption Vitamin B absorption

7. Figure 14-3A is a longitudinal section of the stomach. First, use the following terms to identify the regions provided with leader lines on the figure.

- | | | | | |
|--------|----------------|---|-------------------|----------------------------|
| Body | Pyloric region | - | Greater curvature | Cardioesophageal sphincter |
| Fundus | Pyloric valve | | Lesser curvature | |

Then select different colors for each of the following structures/areas and use them to color the coding circles and corresponding structures/areas on the figure.

- | | | |
|--|---|---|
| <input type="radio"/> Oblique muscle layer | <input type="radio"/> Longitudinal muscle layer | <input type="radio"/> Circular muscle layer |
| <input type="radio"/> Area where rugae are visible | <input type="radio"/> Serosa | |

Figure 14-3B shows two types of secretory cells found in gastric glands. Identify the third type called *chief cells* by choosing a few cells deep in the glands and labeling them. Then, color the hydrochloric acid-secreting cells red, color the mucus-secreting cells yellow, and color the cells that produce protein-digesting enzymes blue.

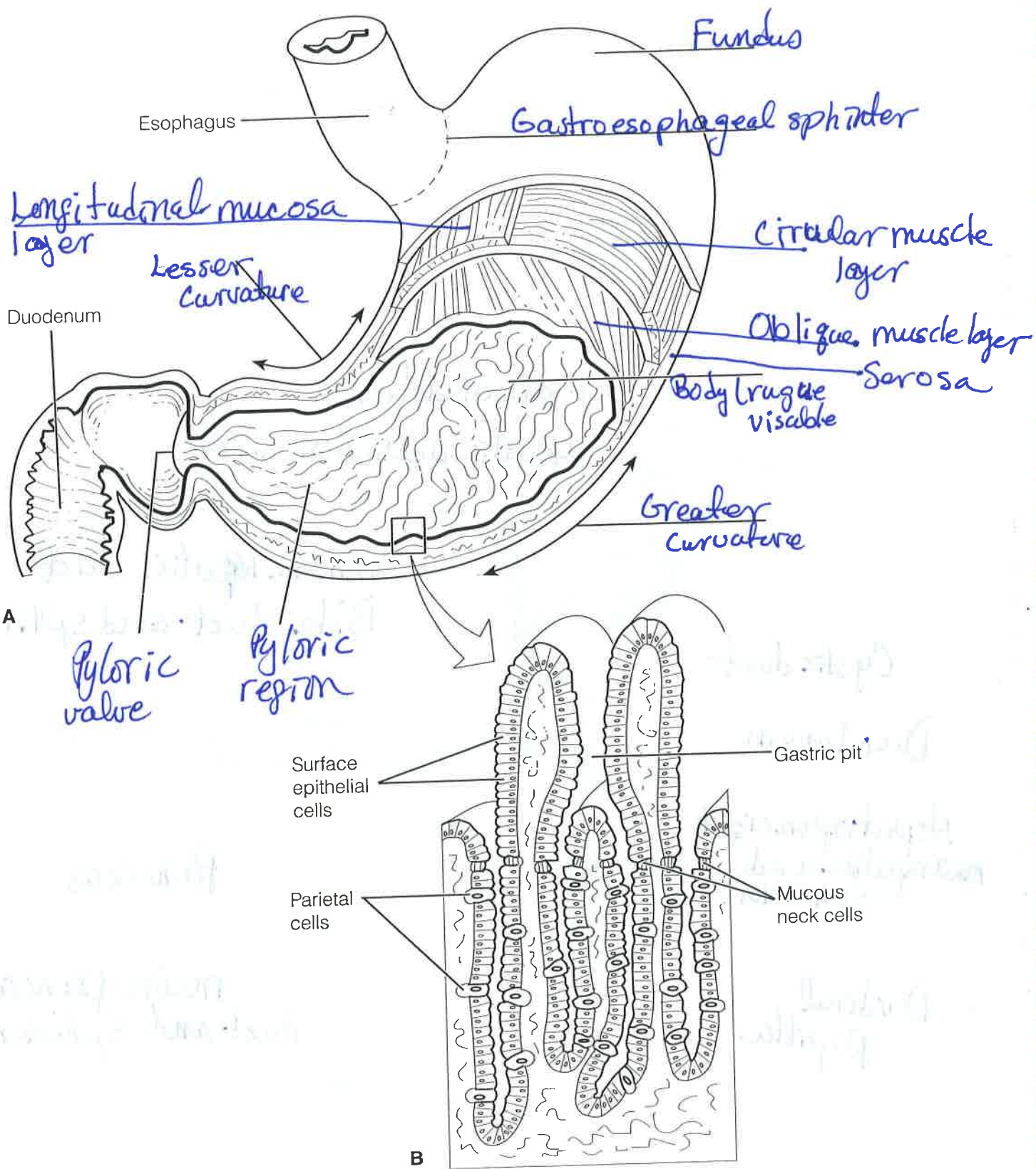


Figure 14-3

8. Figure 14-4 illustrates the relationship between the pancreas, liver, and small intestine. Identify each structure provided with a leader line by selecting a response from the key choices.

Key Choices

- | | |
|----------------------------|---|
| A. Bile duct and sphincter | F. Gallbladder |
| B. Common hepatic duct | G. Hepatic ducts from liver |
| C. Cystic duct | H. Hepatopancreatic ampulla and sphincter |
| D. Duodenal papilla | I. Main pancreatic duct and sphincter |
| E. Duodenum | J. Pancreas |

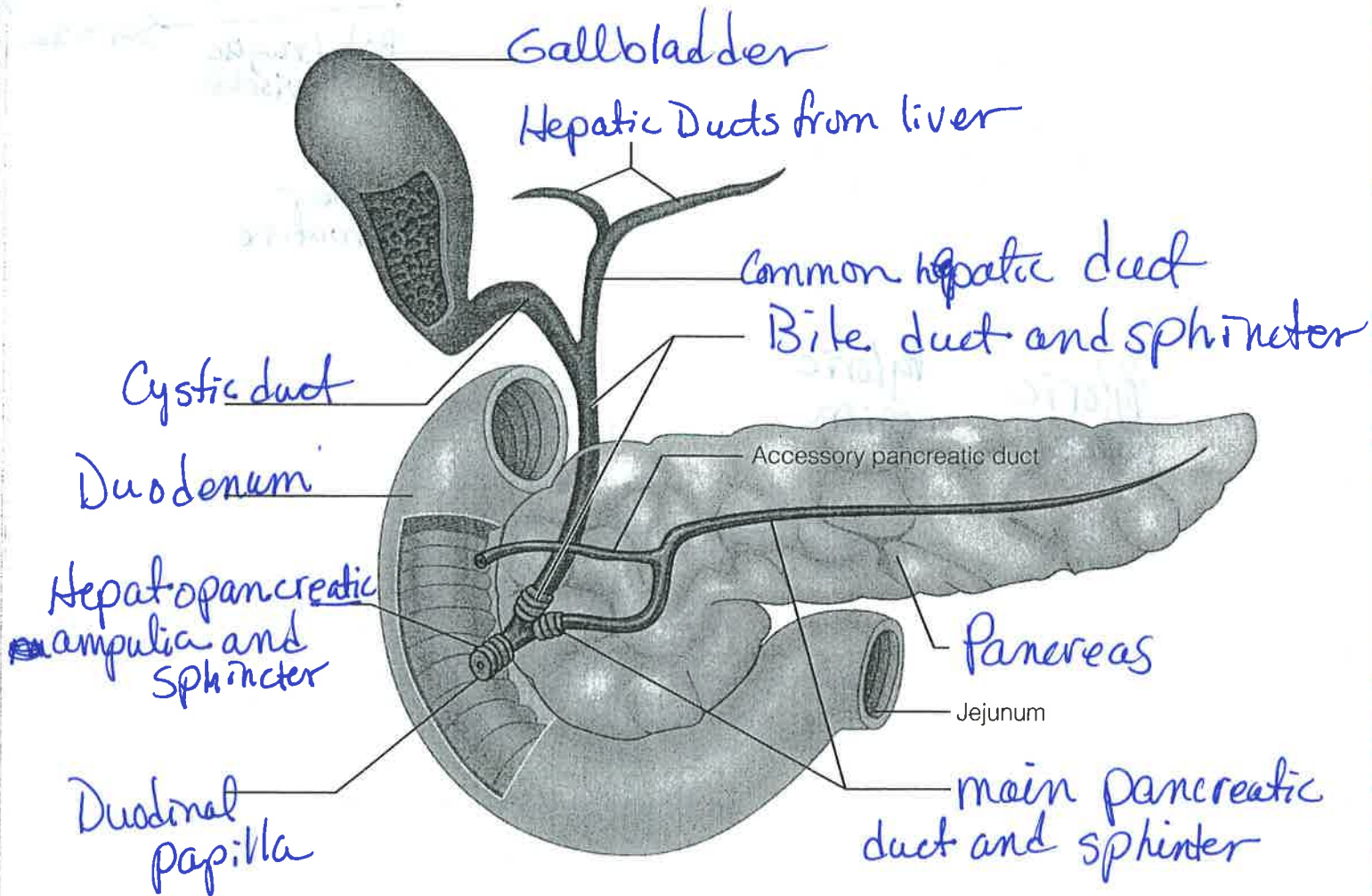


Figure 14-4

9. The walls of the alimentary canal have four typical layers, as illustrated in Figure 14-5. Identify each layer by placing its correct name in the space before the appropriate description. Then select different colors for each layer and use them to color the coding circles and corresponding structures on the figure. Finally, assume the figure shows a cross-sectional view of the small intestine and label the three structures provided with leader lines.

- Mucosa 1. The secretory and absorptive layer
- Muscularis externa 2. Layer composed of at least two muscle layers
- Submucosa 3. Connective tissue layer, containing blood, lymph vessels, and nerves
- Serosa 4. Outermost layer of the wall; visceral peritoneum

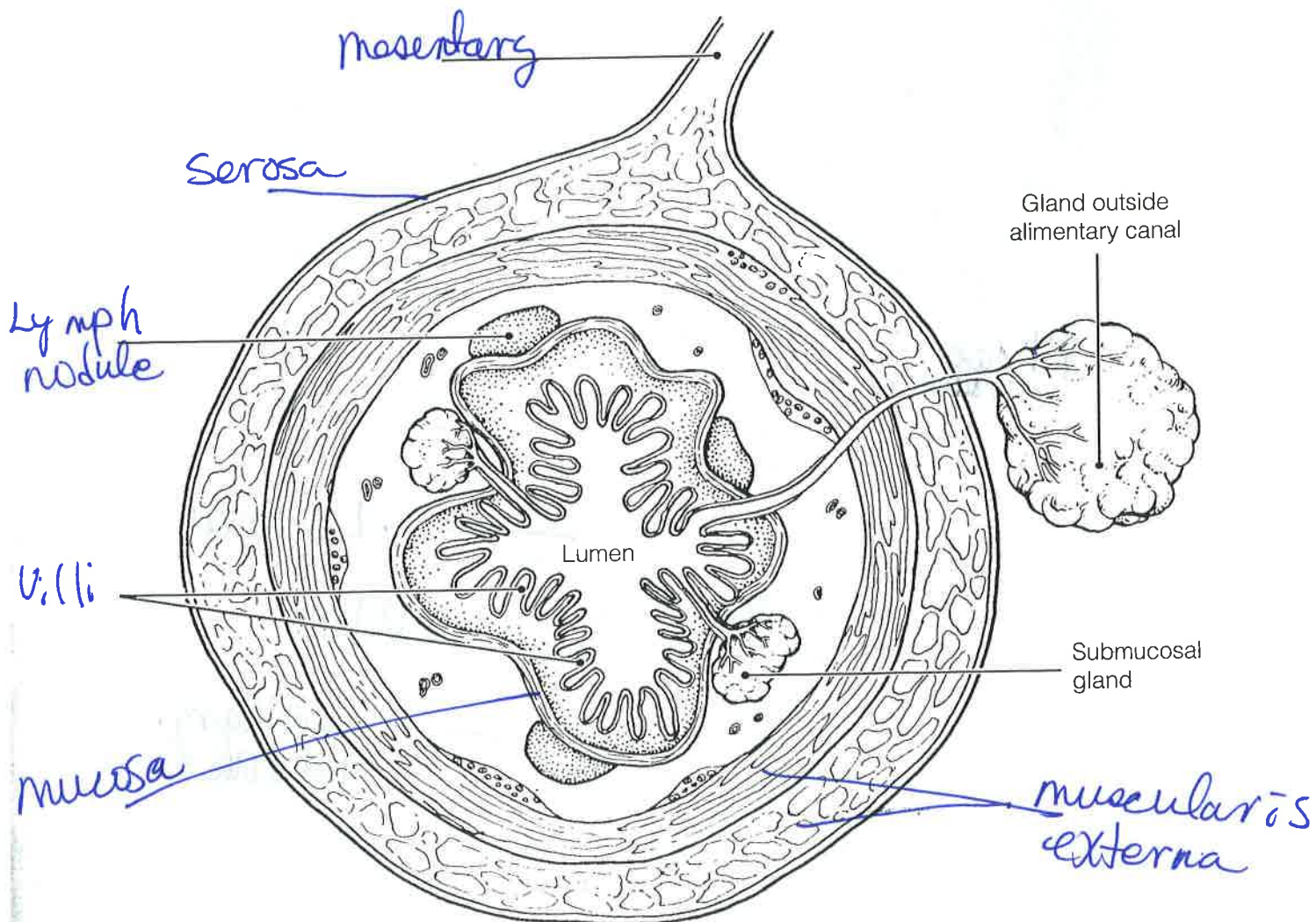


Figure 14-5

10. Figure 14-6 shows three views of the small intestine. First, label the villi in views B and C and the plicae circulares in views A and B. Then select different colors for each term listed below and use them to color in the coding circles and corresponding structures in view C.

- Surface epithelium
- Lacteal
- Capillary network

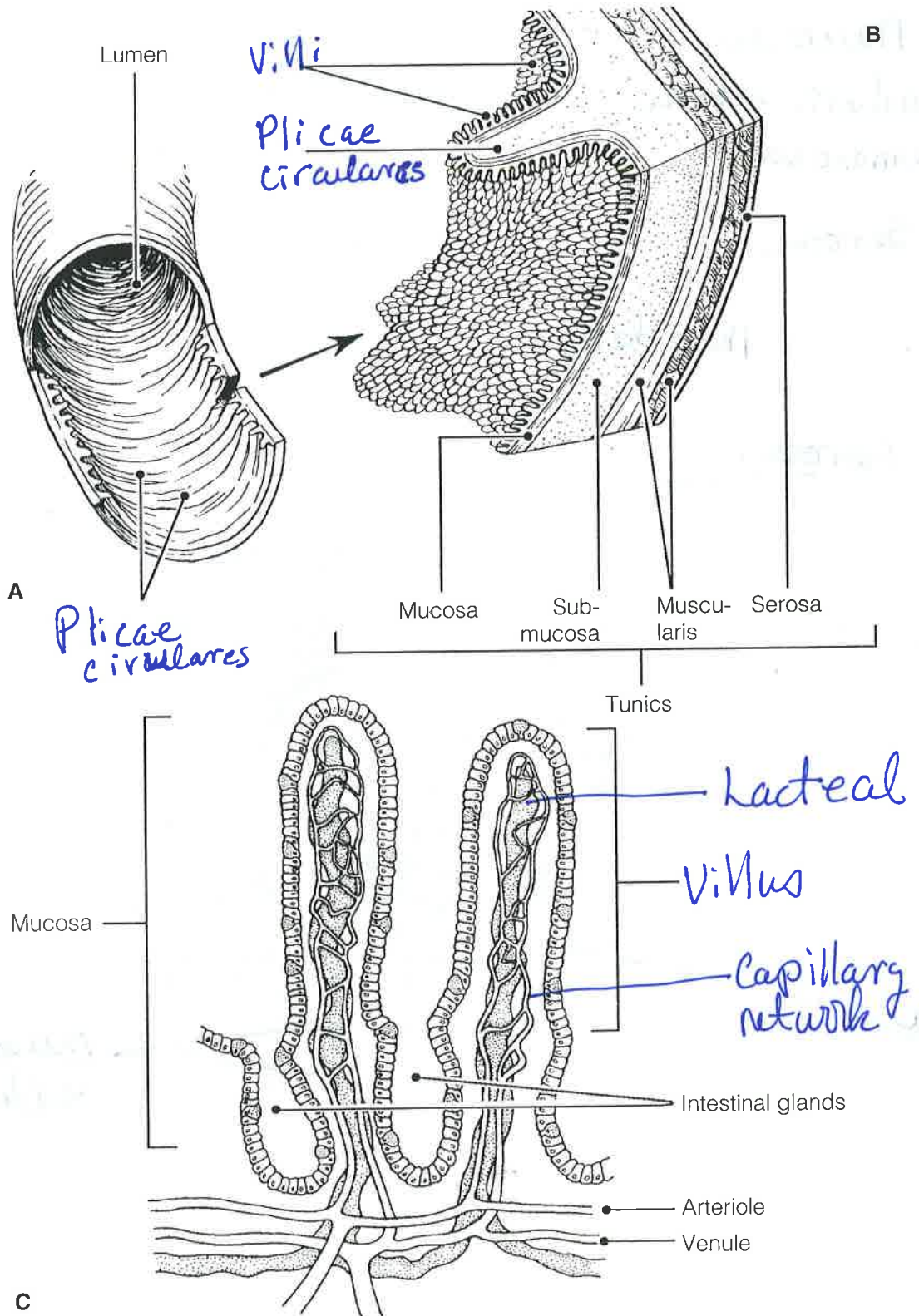


Figure 14-6

11. Three accessory organs are illustrated in Figure 14-7. Identify each of the three organs and the ligament provided with leader lines on the figure. Then select different colors for the following structures and use them to color the coding circles and the corresponding structures on the figure.

- Common hepatic duct
 Bile duct
 Cystic duct
 Pancreatic duct

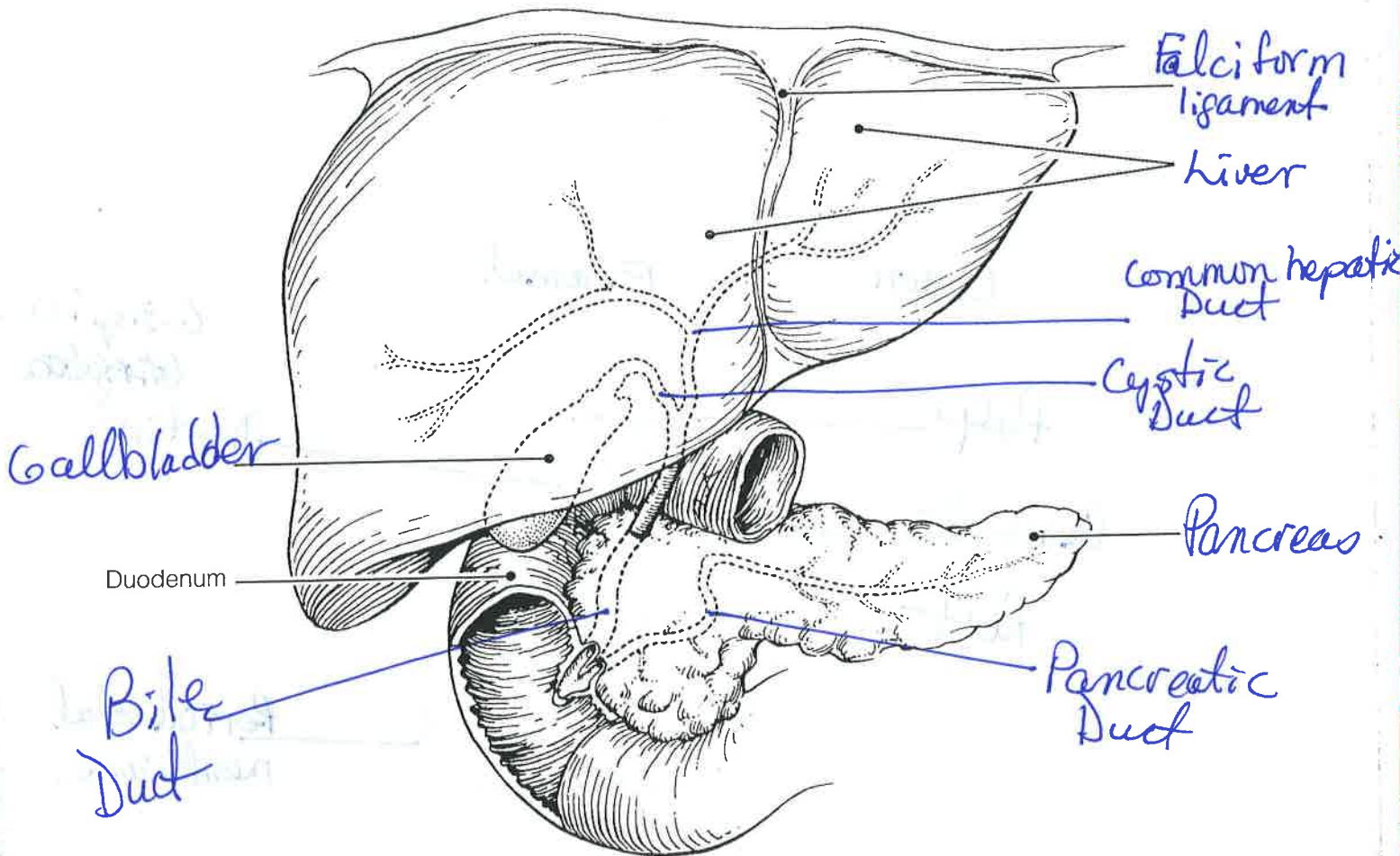


Figure 14-7

12. Complete the following statements referring to human dentition by inserting your answers in the answer blanks.

- | | | |
|--|--|---|
| <p><u>Deciduous</u> _____ 1.</p> <p><u>6 months</u> _____ 2.</p> <p><u>12 years</u> _____ 3.</p> <p><u>Permanent</u> _____ 4.</p> <p><u>32</u> _____ 5.</p> <p><u>20</u> _____ 6.</p> <p><u>Premolars</u> _____ 9.</p> | <p>The first set of teeth, called the <u>(1)</u> teeth, begin to appear around the age of <u>(2)</u> and usually have begun to be replaced by the age of <u>(3)</u>. The <u>(4)</u> teeth are more numerous; that is, there are <u>(5)</u> teeth in the second set as opposed to a total of <u>(6)</u> teeth in the first set. If an adult has a full set of teeth, you can expect to find two <u>(7)</u>, one <u>(8)</u>, two <u>(9)</u>, and three <u>(10)</u> in one side of each jaw. The most posterior molars in each jaw are commonly called <u>(11)</u> teeth.</p> | <p><u>Incisors</u> _____ 7.</p> <p><u>Molars</u> _____ 10.</p> <p><u>Canine</u> _____ 8.</p> <p><u>Wisdom</u> _____ 11.</p> |
|--|--|---|

13. First, use the key choices to label the tooth diagrammed in Figure 14-8. Second, select different colors to represent the key choices and use them to color in the coding circles and corresponding structures in the figure. Third, add labels to the figure to identify the crown, gingiva, and root of the tooth. Last, choose terms from the key choices to match the descriptions below the figure.

Key Choices

- A. Cement C. Enamel E. Pulp
 B. Dentin D. Periodontal membrane (ligament)

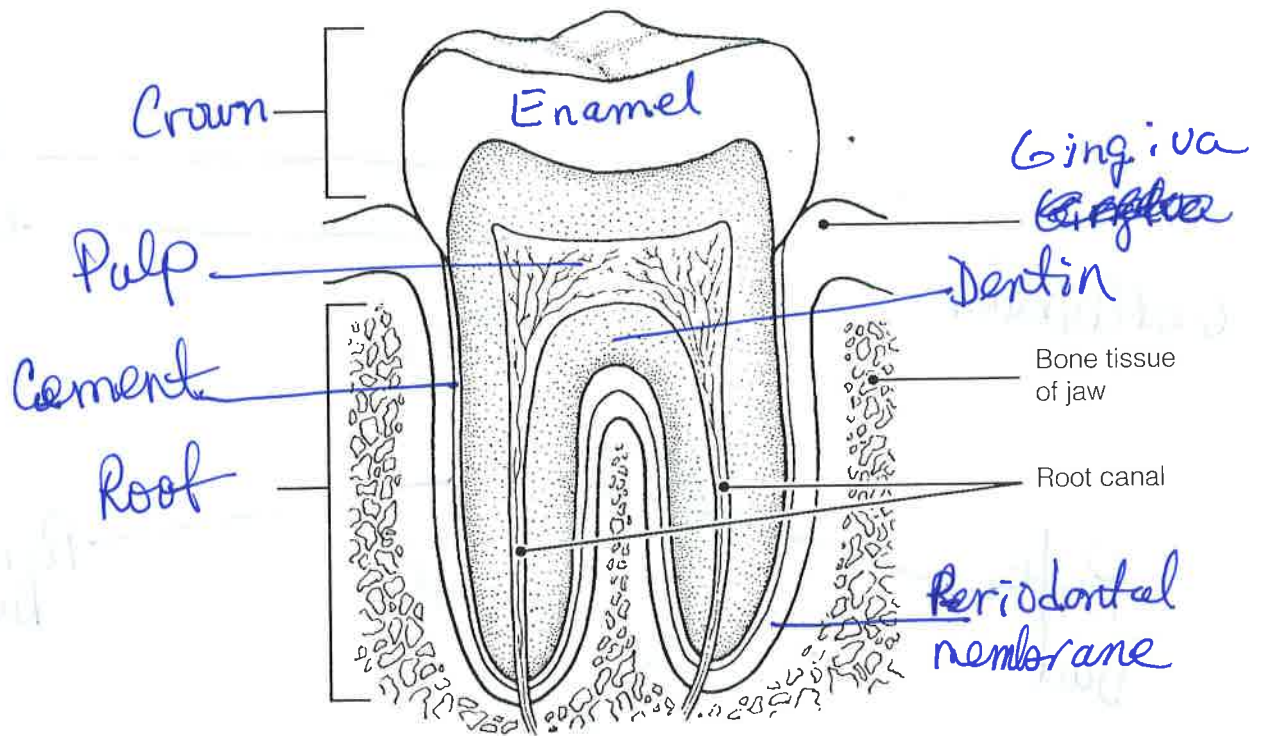


Figure 14-8

- A 1. Material covering the tooth root
B 2. Forms the bulk of tooth structure
E 3. A collection of blood vessels, lymphatics, and nerve fibers
C 4. Cells that produce this substance degenerate after tooth eruption

PHYSIOLOGY OF THE DIGESTIVE SYSTEM

14. Match the descriptions in Column B with the appropriate terms referring to digestive processes in Column A.

Column A	Column B
<u> D </u>	A. Transport of nutrients from lumen to blood
<u> G or H </u>	B. Enzymatic breakdown
<u> E or F </u>	C. Elimination of feces
<u> B </u>	D. Eating
<u> A </u>	E. Chewing
<u> C </u>	F. Churning
	G. Includes swallowing
	H. Segmentation and peristalsis

15. Identify the pathologic conditions described below by using terms from the key choices. Insert the correct term or letter in the answer blanks.

Key Choices

- | | | | |
|-----------------|---------------|--------------|----------------|
| A. Appendicitis | C. Diarrhea | E. Heartburn | G. Peritonitis |
| B. Constipation | D. Gallstones | F. Jaundice | H. Ulcer |

<u> G </u>	1. Inflammation of the abdominal serosa
<u> E </u>	2. Condition resulting from the reflux of acidic gastric juice into the esophagus
<u> F </u>	3. Usually indicates liver problems or blockage of the biliary ducts
<u> H </u>	4. An erosion of the stomach or duodenal mucosa
<u> C </u>	5. Passage of watery stools
<u> D </u>	6. Causes severe epigastric pain; associated with prolonged storage of bile in the gallbladder
<u> B </u>	7. Inability to pass feces; often a result of poor bowel habits

16. This section ~~relates~~ to food breakdown in the digestive tract. Using the key choices, select the appropriate terms to complete the following statements. Insert the correct letter or term in the answer blanks.

Key Choices

- | | | |
|---------------------------|------------------------|---------------------------|
| A. Bicarbonate-rich fluid | F. HCl | K. Mucus |
| B. Bile | G. Hormonal stimulus | L. Pepsin |
| C. Brush border enzymes | H. Lipases | M. Psychological stimulus |
| D. Chewing | I. Mechanical stimulus | N. Rennin |
| E. Churning | J. Mouth | O. Salivary amylase |

- O 1. Starch digestion begins in the mouth when (1) is ducted in by the salivary glands.
- G 2. Gastrin, which prods the stomach glands to produce more enzymes and HCl, represents a (2).
- M 3. The fact that the mere thought of a relished food can make your mouth water is an example of (3).
- I 4. Many people chew gum to increase saliva formation when their mouths are dry. This type of stimulus is a (4).
- L 5. Protein foods are largely acted on in the stomach by (5).
- F 6. For the stomach protein-digesting enzymes to become active, (6) is needed.
- K 7. Considering living cells of the stomach (and everywhere) are largely protein, it is amazing that they are not digested by the activity of stomach enzymes. The most important means of stomach protection is the (7) it produces.
- N 8. A milk protein-digesting enzyme found in children but uncommon in adults is (8).
- E 9. The third layer of smooth muscle found in the stomach wall allows mixing and mechanical breakdown by (9).
- C 10. Important intestinal enzymes are the (10).
- A 11. The small intestine is protected from the corrosive action of hydrochloric acid in chyme by (11), which is ducted in by the pancreas.
- H 12. The pancreas produces protein-digesting enzymes, amylase, and nucleases. It is the only important source of (12).
- B 13. A nonenzyme substance that causes fat to be dispersed into smaller globules is (13).

17. Hormonal stimuli are important in digestive activities that occur in the stomach and small intestine. Using the key choices, identify the hormones that function as described in the following statements. Insert the correct term or letter response in the answer blanks.

Key Choices

- A. Cholecystokinin B. Gastrin C. Secretin

- A or C 1. These two hormones stimulate the pancreas to release its secretions.
- B 2. This hormone stimulates increased production of gastric juice.
- A 3. This hormone causes the gallbladder to release stored bile.
- C 4. This hormone causes the liver to increase its output of bile.

18. Various types of foods are ingested in the diet and broken down to their building blocks. Use the key choices to complete the following statements according to these understandings. Insert the correct term or letter in the answer blanks. In some cases, more than one choice applies.

Key Choices

- A. Amino acids D. Galactose G. Maltose
- B. Fatty acids E. Glucose H. Starch
- C. Fructose F. Lactose I. Sucrose

- C 1. The building blocks of carbohydrates are monosaccharides, or simple sugars. The three common simple sugars in our diet are , , and .
- D
- E
- F 2. Disaccharides include , , and .
- G
- I
- A 3. Protein foods must be digested to before they can be absorbed.
- B 4. Fats are broken down to two types of building blocks, and glycerol.
- E 5. Of the simple sugars, is most important; it is the sugar referred to as "blood sugar."

19. Dietary substances capable of being absorbed are listed next. If the substance is *most often* absorbed from the digestive tract by active transport processes, put an *A* in the blank. If it is usually absorbed passively (by diffusion or osmosis), put a *P* in the blank. In addition, circle the substance that is *most likely* to be absorbed into a lacteal rather than into the capillary bed of the villus.

- | | | |
|-------------------------|---------------------------|--------------------------|
| <u>P</u> 1. Water | <u>A</u> 3. Simple sugars | <u>A</u> 5. Electrolytes |
| <u>A</u> 2. Amino acids | <u>P</u> 4. Fatty acids | |

20. Complete the following statements that describe mechanisms of food mixing and movement. Insert your responses in the answer blanks.

- | | |
|---------------------------------|--|
| <u>Deglutition</u> 1. | Swallowing, or <u>(1)</u> , occurs in two major phases—the <u>(2)</u> and <u>(3)</u> . During the voluntary phase, the <u>(4)</u> is used to push the food into the throat, and the <u>(5)</u> rises to close off the nasal passageways. As food is moved involuntarily through the pharynx, the <u>(6)</u> rises to ensure that its passageway is covered by the <u>(7)</u> so that ingested substances do not enter respiratory passages. It is possible to swallow water while standing on your head because the water is carried along the esophagus involuntarily by the process of <u>(8)</u> . The pressure exerted by food on the <u>(9)</u> valve causes it to open so that food can enter the stomach. |
| <u>Buccal</u> 2. | |
| <u>Pharyngeal-esophageal</u> 3. | |
| <u>Tongue</u> 4. | |
| <u>Uvula</u> 5. | |
| <u>Larynx</u> 6. | |
| <u>Epiglottis</u> 7. | The two major types of movements that occur in the small intestine are <u>(10)</u> and <u>(11)</u> . One of these movements, the <u>(12)</u> , acts to continually mix the food with digestive juices, and (strangely) also plays a major role in propelling foods along the tract. Still another type of movement seen only in the large intestine, <u>(13)</u> occurs infrequently and acts to move feces over relatively long distances toward the anus. Presence of feces in the <u>(14)</u> excites stretch receptors so that the <u>(15)</u> reflex is initiated. Irritation of the gastrointestinal tract by drugs or bacteria might stimulate the <u>(16)</u> center in the medulla, causing <u>(17)</u> , which is essentially a reverse peristalsis. |
| <u>Peristalsis</u> 8. | |
| <u>Cardioesophageal</u> 9. | |
| <u>Peristalsis</u> 10. | |
| <u>Segmental</u> 11. | |
| <u>Segmental</u> 12. | |
| <u>Mass movement</u> 13. | |
| <u>Rectum</u> 14. | |
| <u>Defecation</u> 15. | |
| <u>Emetic</u> 16. | |
| <u>Vomiting</u> 17. | |

NUTRITION AND METABOLISM

Nutrients Used by Body Cells

21. Using the key choices, identify the foodstuffs used by cells in the cellular functions described below. Insert the correct term or key letter in the answer blanks.

Key Choices

- A. Amino acids B. Carbohydrates C. Fats

- B 1. The most used substance for producing the energy-rich ATP
- C 2. Important in building myelin sheaths and cell membranes
- A 3. Tend to be conserved by cells
- C 4. The second most important food source for making cellular energy
- C 5. Form insulating deposits around body organs and beneath the skin
- A 6. Used to make the bulk of cell structure and functional substances such as enzymes

22. Identify the nutrients described by using the key choices. Insert the correct letter(s) in the answer blanks.

Key Choices

- A. Bread/pasta D. Fruits G. Starch
- B. Cheese/cream E. Meat/fish H. Vegetables
- C. Cellulose F. Minerals I. Vitamins

- A, D, H 1. Examples of *carbohydrate-rich foods* in the diet.
- B, B 2. Fatty foods ingested in the normal diet include ____.
- G 3. The only important *digestible* polysaccharide.
- C 4. An *indigestible* polysaccharide that aids elimination because it adds bulk to the diet is ____.
- B or E 5. *Protein-rich foods* include ____ and ____.
- I 6. Most examples of these nutrients, which are found largely in vegetables and fruits, are used as coenzymes.
- F 7. Include copper, iron, and sodium.

Metabolic Processes

23. Figure 14-9 depicts the three stages of cellular respiration. Label the figure by placing the following terms on the appropriate answer blanks. Color the diagram as suits your fancy, and then answer the questions below the figure.

- | | | |
|-----------------|--------------------------|---------------|
| ATP | Glucose | Mitochondrion |
| Carbon dioxide | Glycolysis | Pyruvic acid |
| Chemical energy | Electron transport chain | Water |
| Cytosol | Krebs cycle | |

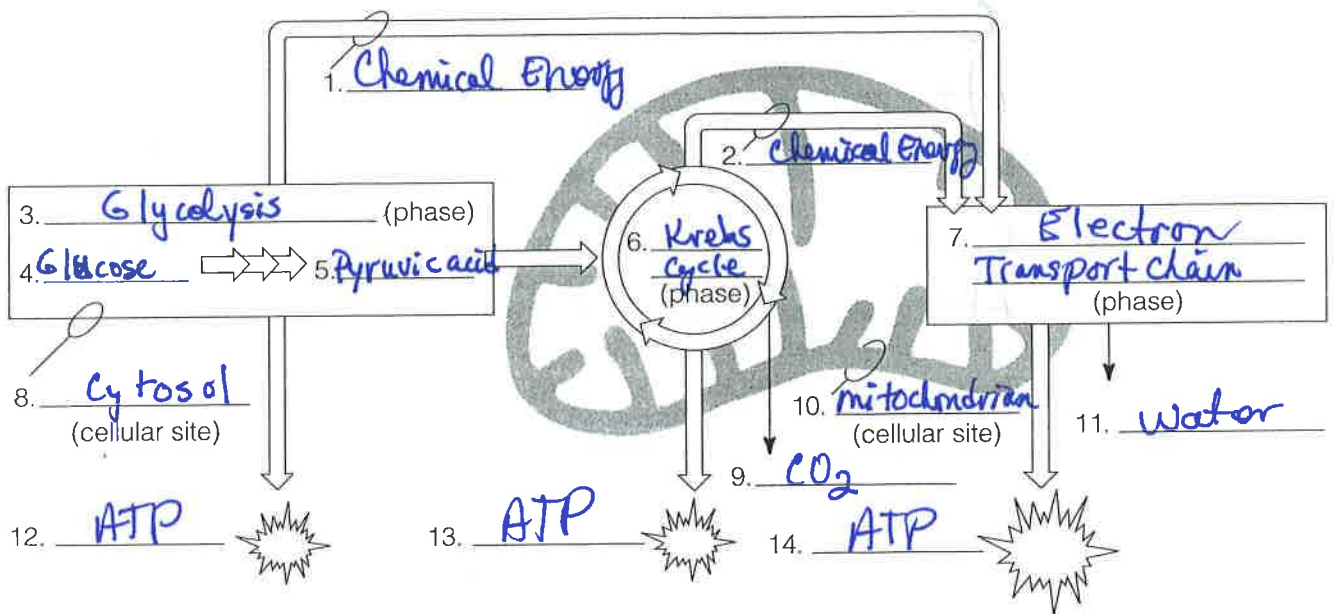


Figure 14-9

1. Which of the oxidative phases does not require oxygen?

Glycolysis (#3) does not require O_2

2. Which phases do require oxygen?

Krebs cycle (#6) and the ETC (#7) require O_2

3. In what form is chemical energy transferred from the first two phases to the third phase?

In the form of H atoms bearing high-energy e^-

4. Which of the phases produces the largest amount of ATP?

ETC

5. Which phase combines energetic H atoms with molecular oxygen?

ETC

24. This section considers the process of cellular metabolism. Insert the correct word(s) from the key choices in the answer blanks.

Key Choices

- | | | |
|---------------------|-------------------------------|-------------------------------|
| A. ATP | G. Basal metabolic rate (BMR) | M. Ketosis |
| B. Acetic acid | H. Carbon dioxide | N. Monosaccharides |
| C. Acetoacetic acid | I. Essential | O. Oxygen |
| D. Acetone | J. Fatty acids | P. Total metabolic rate (TMR) |
| E. Amino acids | K. Glucose | Q. Urea |
| F. Ammonia | L. Glycogen | R. Water |

- | | | |
|------------------|-----|--|
| <u> K </u> | 1. | The key "fuel" used by body cells is <u>(1)</u> . The cells break this fuel molecule apart piece by piece. The hydrogen |
| <u> O </u> | 2. | removed is combined with <u>(2)</u> to form <u>(3)</u> , while its carbon leaves the body in the form of <u>(4)</u> gas. The |
| <u> R </u> | 3. | importance of this process is that it provides <u>(5)</u> , a form of energy that the cells can use to power all their activities. For |
| <u> H </u> | 4. | carbohydrates to be oxidized, or burned for energy, they must first be broken down to <u>(6)</u> . When carbohydrates are |
| <u> A </u> | 5. | unavailable to prime the metabolic pump, intermediate products of fat metabolism such as <u>(7)</u> and <u>(8)</u> accumulate in |
| <u> N </u> | 6. | the blood, causing <u>(9)</u> and low blood pH. Amino acids are actively accumulated by cells because protein cannot be made |
| <u> C </u> | 7. | unless all amino acid types are present. The amino acids that <i>must</i> be taken in the diet are called <u>(10)</u> amino acids. |
| <u> D </u> | 8. | When amino acids are oxidized to form cellular energy, their amino groups are removed and liberated as <u>(11)</u> . In the |
| <u> M </u> | 9. | liver, this is combined with carbon dioxide to form <u>(12)</u> , which is removed from the body by the kidneys. |
| <u> F </u> | 10. | |
| <u> F </u> | 11. | |
| <u> Q </u> | 12. | |

25. Circle the term that does not belong in each of the following groupings.

- | | | | |
|-----------------|-------------------------|-------------------------|----------------------|
| 1. BMR | <u>TMR</u> | Rest | Postabsorptive state |
| 2. Thyroxine | Iodine | <u>↓ Metabolic rate</u> | ↑ Metabolic rate |
| 3. Obese person | ↓ Metabolic rate | Women | <u>Child</u> |
| 4. 4 kcal/gram | <u>Fats</u> | Carbohydrates | Proteins |
| 5. Radiation | <u>Vasoconstriction</u> | Evaporation | Vasodilation |

26. The liver has many functions in addition to its digestive function. Complete the following statements that elaborate on the liver's function by inserting the correct terms in the answer blanks.

- Albumin 1.
Clotting proteins 2.
Cholesterol 3.
Hyperglycemia 4.
Glycogen 5.
Hypoglycemia 6.
Glycogenolysis 7.
Gluconeogenesis 8.
Detoxification 9.
Phagocyte 10.
Lipoproteins 11.
Insoluble 12.
LDLs 13.
Membranes 14.
Steroid hormones 15.
Liver 16.
Bile salts 17.
Atherosclerosis 18.
A 19.
Iron 20.

The liver is the most important metabolic organ in the body. In its metabolic role, the liver uses amino acids from the nutrient-rich hepatic portal blood to make many blood proteins such as (1), which helps to hold water in the bloodstream, and (2), which prevent blood loss when blood vessels are damaged. The liver also makes a steroid substance that is released to the blood. This steroid, (3), has been implicated in high blood pressure and heart disease. Additionally, the liver acts to maintain homeostatic blood glucose levels. It removes glucose from the blood when blood glucose levels are high, a condition called (4), and stores it as (5). Then, when blood glucose levels are low, a condition called (6), liver cells break down the stored carbohydrate and release glucose to the blood once again. This latter process is termed (7). When the liver makes glucose from noncarbohydrate substances such as fats or proteins, the process is termed (8). In addition to its processing of amino acids and sugars, the liver plays an important role in the processing of fats. Other functions of the liver include the (9) of drugs and alcohol. Its (10) cells protect the body by ingesting bacteria and other debris.

The liver forms small complexes called (11), which are needed to transport fatty acids, fats, and cholesterol in the blood because lipids are (12) in a watery medium. The function of (13) is transport of cholesterol to peripheral tissues, where cells use it to construct their plasma (14) or to synthesize (15). The function of high-density lipoproteins (HDLs) is transport of cholesterol to the (16), where it is degraded and secreted as (17), which are eventually excreted. High levels of cholesterol in the plasma are of concern because of the risk of (18).

Two other important functions of the liver are the storage of vitamins (such as vitamin (19) needed for vision) and of the metal (20) (as ferritin).

27. Using the key choices, select the terms identified in the following descriptions. Insert the appropriate term(s) or letter(s) in each answer blank.

Key Choices

- | | | |
|---------------------------------------|-----------------|--------------|
| A. Blood | E. Hyperthermia | I. Radiation |
| B. Constriction of skin blood vessels | F. Hypothalamus | J. Pyrogens |
| C. Frostbite | G. Hypothermia | K. Shivering |
| D. Heat | H. Perspiration | |

- D 1. By-product of cell metabolism
- B or K 2. Means of conserving/increasing body heat
- A 3. Means by which heat is distributed to all body tissues
- F 4. Site of the body's thermostat
- J 5. Chemicals released by injured tissue cells and bacteria, causing resetting of the thermostat
- C 6. Death of cells deprived of oxygen and nutrients, resulting from withdrawal of blood from the skin circulation when the external temperature is low
- H or I 7. Means of liberating excess body heat
- G 8. Extremely low body temperature
- E 9. Fever

