16

The Digestive System

FOCUS: The function of the digestive system is to take in food, break it down into smaller compounds, and absorb those compounds so that the body can use them. This process provides the body with water, electrolytes, and nutrients. The digestive tract consists of a hollow tube. Food enters the mouth and passes to the esophagus, stomach, small intestine, large intestine, and rectum, with undigested food exiting through the anus. Regulation of digestive tract functions is accomplished by the nervous system and hormones.

CONTENT LEARNING ACTIVITY

Anatomy and Histology of the Digestive System

"*Nearly all portions of the digestive tube consist of four layers or tunics.*"

A. Match these tunics with the correct description or definition:

Mucosa
Muscularis
Serosa or adventitia
Submucosa

_____ 1. Innermost tunic; consists of mucous epithelium, lamina propria, and muscularis mucosa.

_____ 2. Tunic just outside the mucosa; a thick layer of loose connective tissue containing nerves, blood vessels, and small glands.

_____ 3. Tunic composed of a circular layer and a longitudinal layer of smooth muscle.

_____ 4. Outermost tunic; composed of epithelium or connective tissue.

Nerve plexuses, composed of parasympathetic nerve fibers, are found in the submucosa and muscularis layers. Together, the nerve plexuses of both layers compose the intramural plexus, which is extremely important for control of digestive tract functions.

B. Match these terms with the correct parts labeled in figure 16.1:

Circular muscle
Intramural plexus
Longitudinal muscle
Mucosa
Muscularis
Serosa
Submucosa

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

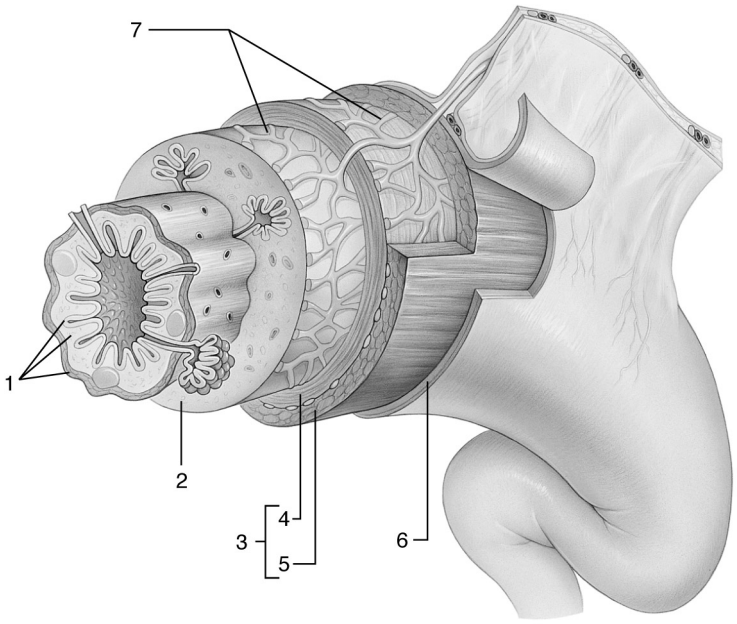

Figure 16.1

Oral Cavity

"*The oral cavity, or mouth, is the first portion of the digestive tract.*"

A. Using the terms provided, complete these statements:

Buccinator
Cheeks
Frenulum
Mastication
Orbicularis oris
Taste
Tongue

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

The oral cavity, or mouth, is bounded by the lips and cheeks, and contains the teeth and tongue. The lips are muscular structures formed mostly by the (1) muscle, and covered internally by mucosa and externally by stratified squamous epithelium. The (2) form the lateral walls of the oral cavity; most of their thickness is contributed by the (3) muscle, which flattens the cheek against the teeth. The lips and cheeks are important in the processes of (4) and speech. The (5) is a large, muscular organ that occupies most of the oral cavity. The anterior portion of the tongue is attached to the floor of the mouth by a thin fold of tissue called the (6). The tongue is important in mastication, swallowing, speech, and is a major sensory organ for (7).

B. Match these numbers with the correct statement :

One
Two
Three

_____ 1. Number of incisors in each quadrant of the adult mouth.

_____ 2. Number of canines in each quadrant of the adult mouth.

_____ 3. Number of premolars in each quadrant of the adult mouth.

_____ 4. Number of molars in each quadrant of the adult mouth.

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

Alveoli
Gingiva (gums)
Periodontal ligaments
Primary teeth
Secondary teeth

_____ 1. Deciduous teeth; also called milk teeth.

_____ 2. Teeth of the adult mouth.

_____ 3. Sockets containing the teeth.

_____ 4. Dense, fibrous connective tissue, and moist stratified squamous epithelium that cover alveolar ridges.

_____ 5. Connective tissue that holds the teeth in the alveoli.

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

Cementum
Crown
Dentin
Enamel
Neck
Pulp
Pulp cavity
Root

_____ 1. Cutting or chewing surface with one or more cusps (points).

_____ 2. Part of the tooth between the crown and the root.

_____ 3. Center of the tooth; contains blood vessels, nerves, and connective tissue.

_____ 4. Connective tissue located in the pulp cavity.

_____ 5. Living, cellular, bonelike tissue surrounding the pulp cavity.

_____ 6. Extremely hard, acellular substance that protects the tooth against acids and abrasion.

_____ 7. Substance covering dentin in the root; helps anchor teeth in the jaw.

_____ 8. Part of the tooth anchored in an alveolus by periodontal ligaments.

E. Match these terms with the correct parts labeled in figure 16.2:

Cementum
Crown
Cusp
Dentin
Enamel
Gingiva
Neck
Periodontal ligaments
Pulp cavity
Root

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

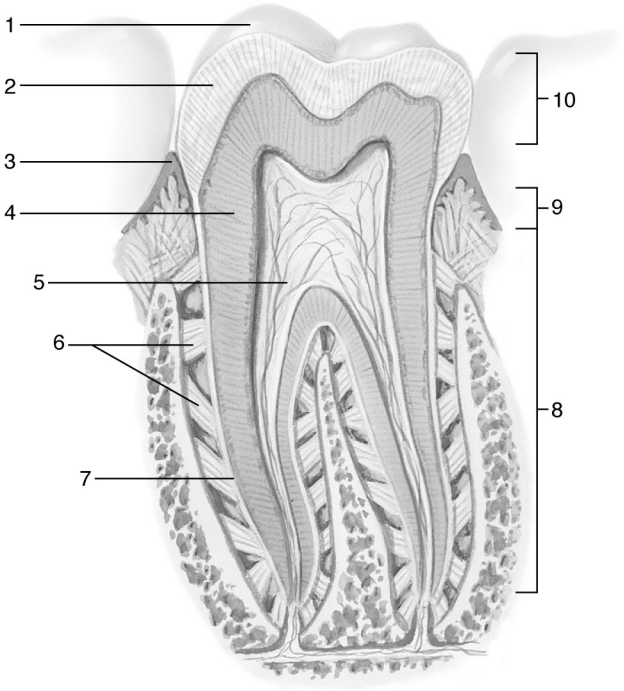

Figure 16.2

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

Hard palate
Soft palate
Tonsils
Uvula

_____ 1. Anterior bony portion of the roof of the oral cavity.

_____ 2. Posterior portion of the roof of the oral cavity, composed of skeletal muscle and connective tissue.

_____ 3. Projection from the posterior edge of the soft palate; prevents food from passing into the nasal cavity during swallowing.

_____ 4. Collection of lymphoid tissue, located in the lateral posterior walls of the oral cavity.

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

Parotid glands
Saliva
Sublingual glands
Submandibular glands

_____ 1. Mixture of serous (watery) and mucous fluids that contains digestive enzymes.

_____ 2. Serous glands located just anterior to each ear; its duct enters the oral cavity adjacent to the second upper molar.

_____ 3. Glands that produce more serous than mucous secretions, located along the inferior border of the mandible.

_____ 4. Glands that produce mainly mucus, located below the mucous membrane in the floor of the oral cavity.

Pharynx and Esophagus

"*The esophagus is a muscular tube that extends from the pharynx to the stomach.*"

Match these terms with the correct statement or definition:

Esophageal sphincters
Laryngopharynx
Nasopharynx
Oropharynx
Pharyngeal constrictors

_____ 1. Two portions of the pharynx that transmit food.

_____

_____ 2. Form posterior walls of oropharynx and laryngopharynx.

_____ 3. Circular muscles that regulate the movement of food into and out of the esophagus.

Stomach

"*The stomach is an enlarged segment of the digestive tract in the left superior abdomen.*"

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

Body
Cardiac opening
Fundus
Greater and lesser curvatures
Pyloric opening
Pyloric sphincter
Rugae

_____ 1. Opening between the esophagus and the stomach.

_____ 2. Most superior portion of the stomach.

_____ 3. Formed when the body of the stomach turns to the right.

_____ 4. Opening between stomach and small intestine.

_____ 5. Thick ring of smooth muscle that surrounds pyloric opening.

_____ 6. Large folds of the submucosa and mucosa formed when the stomach is empty.

B. Match these terms with the correct parts labeled in figure 16.3:

Body
Cardiac region
Fundus
Gastroesophageal opening
Lower esophageal sphincter
Pyloric opening
Pyloric region
Pyloric sphincter
Rugae

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

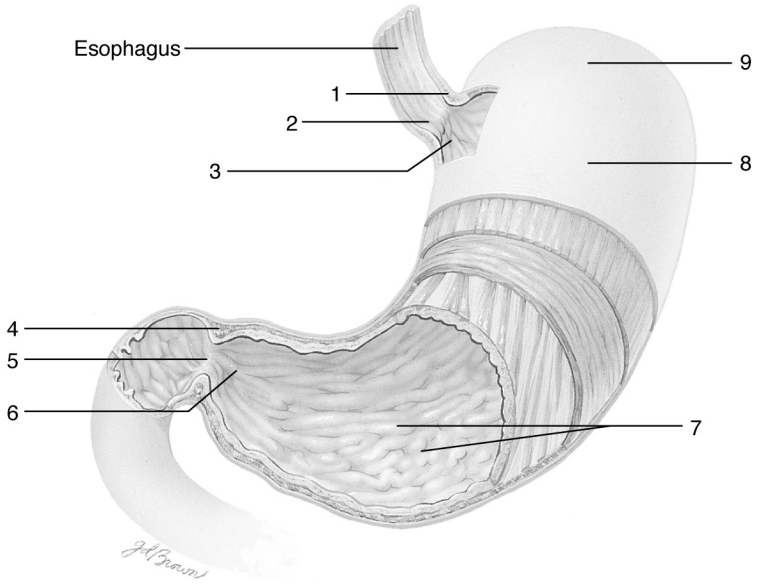

Figure 16.3

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

Chief cells
Endocrine cells
Gastric glands
Gastric pits
Mucous neck cells
Parietal cells
Surface mucous cells

_____ 1. Tubelike openings in the mucosal surface of the stomach.

_____ 2. Glands in the stomach that open into the gastric pits.

_____ 3. Mucus-producing cells on the inner surface of the stomach and lining the gastric pits.

_____ 4. Mucus-producing cells in the gastric glands.

_____ 5. Gastric gland cells that produce hydrochloric acid and intrinsic factor.

_____ 6. Gastric gland cells that produce pepsinogen.

_____ 7. Gastric gland cells that produce regulatory hormones.

Small Intestine

"*The small intestine is about 6 meters long and consists of the duodenum, jejunum, and ileum.*"

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

Circular folds
Common bile duct
Ileocecal junction
Ileocecal valve
Ileocecal sphincter
Lacteals
Microvilli
Pancreatic duct
Villi

_____ 1. Two ducts that join together and empty into the duodenum.

_____

_____ 2. Folds in mucosal and submucosal layers that run perpendicular to the long axis of the digestive tract.

_____ 3. Tiny fingerlike projections of the mucosa.

_____ 4. Cytoplasmic extensions from cells on the surface of villi.

_____ 5. Lymphatic capillaries found in villi.

_____ 6. Junction between the ileum and large intestine.

_____ 7. Ring of smooth muscle surrounding the ileocecal junction.

_____ 8. One-way valve at the junction between the ileum and small intestine.

The circular folds, villi, and microvilli function to increase surface area in the small intestine.

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

Absorptive cells
Duodenal glands
Endocrine cells
Goblet cells
Granular cells
Intestinal glands
Peyer's patches

_____ 1. Cells in duodenal mucosa with microvilli; produce digestive enzymes and absorb food.

_____ 2. Cells in duodenal mucosa that produce mucus.

_____ 3. Cells in duodenal mucosa that help protect intestinal epithelia from bacteria.

_____ 4. Cells in duodenal mucosa that produce regulatory hormones.

_____ 5. Tubular glands at the base of villi; produce epithelial cells.

_____ 6. Mucous glands in the submucosa of the duodenum.

_____ 7. Clusters of lymph nodules in the ileum.

Progressing sequentially from the duodenum to the jejunum and ileum, there is a gradual decrease in diameter of the small intestine, a decrease in thickness of the intestinal wall, and a decrease in the number of circular folds and villi.

Liver

"*The liver consists of two major lobes and two minor lobes.*"

A. Using the terms provided, complete these statements:

Common bile duct
Common hepatic duct
Cystic duct
Duodenal papilla
Gallbladder
Hepatic artery
Hepatic ducts
Hepatic portal vein
Hepatic veins

The liver has two sources of blood. The (1) brings oxygen-rich blood into the liver and the (2) carries blood that is oxygen-poor but rich in absorbed materials from the digestive tract to the liver. Blood exits the liver through (3). Right and left (4) transport bile from the liver and join to form the (5). The common hepatic duct is joined by the (6) from the gallbladder to form the (7), which joins the pancreatic duct to open into the duodenum at the (8). The (9) is a small sac on the inferior surface of the liver that stores bile.

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

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

Bile canaliculus
Central vein
Hepatic cords
Hepatocytes
Hepatic sinusoids
Lobules
Portal triads

_____ 1. Subdivisions of the liver separated by connective tissue septa.

_____ 2. Corners of a liver lobule where three vessels are commonly located.

_____ 3. Blood vessel in the center of each lobule.

_____ 4. Functional cells of the liver; produce bile.

_____ 5. Platelike groups of hepatocytes between the central vein and margins of each lobule.

_____ 6. Cleftlike opening between the cells of each hepatic cord; bile flows through this.

_____ 7. Blood channels that separate the hepatic cords.

C. Match these terms with the correct parts labeled in figure 16.4:

Bile canaliculi
Central vein
Hepatic cords
Hepatic sinusoid
Hepatocyte
Liver lobule
Portal triad

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

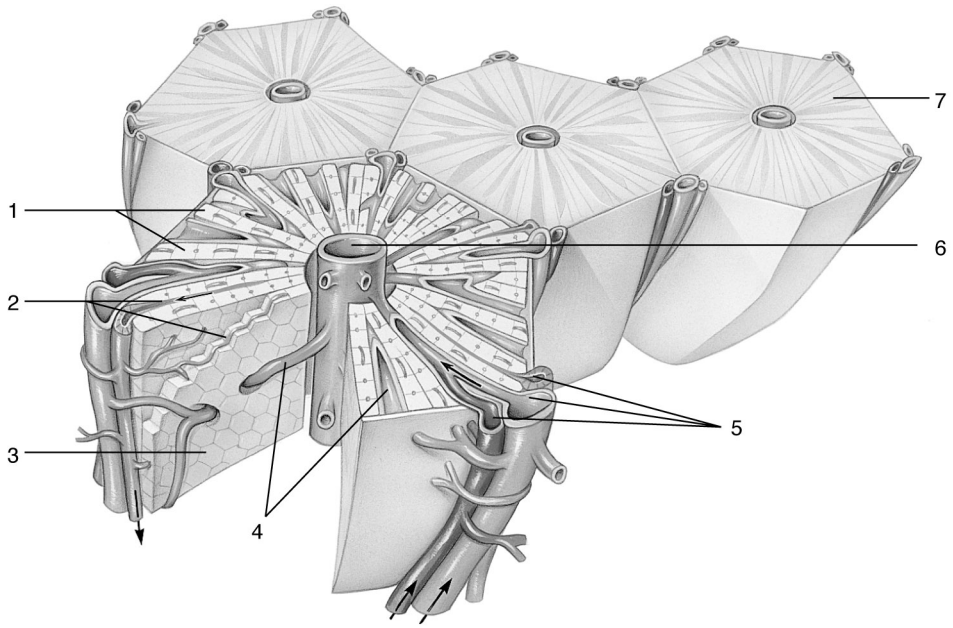

Figure 16.4

Pancreas

"*The pancreas is a complex organ composed of both endocrine and exocrine tissues.*"

Match these terms with the correct statement or definition:

Acini
Pancreatic duct
Pancreatic islets

_____ 1. Exocrine portions of pancreas; produce digestive enzymes.

_____ 2. Endocrine portion of the pancreas that produces insulin and glucagon.

_____ 3. Carries digestive enzymes; joins the common bile duct.

Large Intestine

"*The large intestine consists of the cecum, colon, rectum, and anal canal.*"

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

Appendix
Ascending colon
Cecum
Crypts
Descending colon
Sigmoid colon
Teniae coli
Transverse colon

_____ 1. Blind sac that extends inferiorly past the ileocecal junction.

_____ 2. Small blind tube attached to the cecum.

_____ 3. Part of the colon closest to the cecum.

_____ 4. Extends from the right colic flexure to the left colic flexure.

_____ 5. Extends from the left colic flexure to the pelvis.

_____ 6. S-shaped tube that ends at the rectum.

_____ 7. Straight tubular glands in the mucosal lining of the colon.

_____ 8. Three longitudinal smooth muscle bands that run the length of the colon.

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

Anal canal
External anal sphincter
Internal anal sphincter
Rectum

_____ 1. Straight, muscular tube between sigmoid colon and anal canal.

_____ 2. The last 2 to 3 cm of the digestive tract.

_____ 3. Thick involuntary smooth muscle layer at the superior end of the anal canal.

_____ 4. Voluntary skeletal muscle at the inferior end of the anal canal.

Peritoneum

"*The body walls and organs of the abdominal cavity are lined with serous membranes.*"

Match these terms with the correct statement or definition:

Greater omentum
Lesser omentum
Mesenteries
Omental bursa
Parietal peritoneum
Retroperitoneal organs
Visceral peritoneum

_____ 1. Serous membranes that cover the body wall of the abdominopelvic cavity.

_____ 2. Connective tissue sheets; hold many abdominal organs in place.

_____ 3. Mesentery connecting the lesser curvature of the stomach to the liver and diaphragm.

_____ 4. Pocket formed by the long, double fold of greater omentum.

_____ 5. Abdominal organs that lie against the abdominal wall, and have no mesenteries.

Oral Cavity, Pharynx, and Esophagus

"*Food is taken into the mouth, saliva is added, and the food is chewed and swallowed.*"

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

Lysozyme
Mucin
Salivary amylase

_____ 1. Starch-digesting enzyme in the serous portion of saliva.

_____ 2. Enzyme in the serous portion of saliva that has a weak antibacterial action.

_____ 3. Proteoglycan found in the mucous portion of saliva.

Salivary gland secretion is regulated primarily by the autonomic nervous system. Parasympathetic stimulation increases the secretion of the salivary glands, whereas sympathetic stimulation increases the mucus content of saliva.

B. Match these phases of deglutition with the correct statement or definition:

Esophageal phase
Pharyngeal phase
Voluntary phase

_____ 1. Phase of swallowing that involves forming a bolus of food and forcing it into the oropharynx.

_____ 2. Reflex that involves closing the nasopharynx, forcing food through the pharynx, and covering the opening into the larynx.

_____ 3. Phase of swallowing that uses peristaltic waves to move food from the pharynx to the stomach.

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

Epiglottis
Peristaltic waves
Pharyngeal constrictor muscles

_____ 1. Muscles that force food through the pharynx.

_____ 2. Part of the larynx that covers the opening into the larynx.

_____ 3. Wave of contraction of circular esophageal muscles preceded by a wave of relaxation.

Peristaltic contractions are sufficiently forceful to allow a person to swallow even while standing on his head.

Stomach

"*The stomach functions primarily as a storage and mixing chamber for ingested food.*"

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

Chyme
Gastrin
Hydrochloric acid
Intrinsic factor
Mucus
Pepsin
Pepsinogen

_____ 1. Semifluid mixture of food and stomach secretions.

_____ 2. Substance that lubricates and protects the epithelial cells of the stomach wall.

_____ 3. Produces a low pH in the stomach and acts as an antimicrobial agent.

_____ 4. Protein secreted by chief cells.

_____ 5. Enzyme produced from the conversion of pepsinogen by hydrochloric acid.

_____ 6. Substance that binds with vitamin B_{12} and makes it more readily absorbed in the ileum.

_____ 7. Hormone secreted by the stomach; helps regulate stomach secretions.

B. Match the phases of stomach secretion with the correct statement or definition:

Cephalic phase
Gastric phase
Intestinal phase

_____ 1. Phase of stomach secretion that responds to taste, smell, thoughts of food, and sensations of chewing and swallowing.

_____ 2. Phase of stomach secretion that is initiated by the presence of food in the stomach; greatest volume of gastric secretion.

_____ 3. Phase of stomach secretion that is controlled by the entrance of acidic chyme into the duodenum.

C. Using the terms provided, complete these statements:

Decrease(s) Increase(s)

Several mechanisms regulate gastric secretions. Through the medulla, the smell, taste, or thought of food can (1) stomach secretion. As a result of parasympathetic stimulation, gastrin is secreted, which travels through the blood back to the stomach where it further (2) gastric secretion. In the stomach, distention initiates reflexes that (3) stomach secretions. In the duodenum, if chyme has a pH of 3 or above, there is a(n) (4) in the secretion of gastrin. If the chyme has a pH of 2 or below, the hormone secretin is released, which (5) gastric secretions. Fatty acids or lipids in the duodenum cause the secretion of cholecystokinin and gastric inhibitory peptide, which also cause a (6) in gastric secretions.

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

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

Mixing waves
Peristaltic waves

_____ 1. Relatively weak contractions of the stomach that cause ingested food to be mixed with stomach secretions.

_____ 2. Powerful contractions of the stomach that force chyme toward the pyloric sphincter.

Small Intestine

"*Secretions from the mucosa of the small intestine include mucus, electrolytes, and water.*"

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

Disaccharidases Peptidases
Mucus

_____ 1. Enzymes on the surface of intestinal wall epithelial cells that break down peptides into single amino acids.

_____ 2. Enzymes on the surface of intestinal wall epithelial cells that break down disaccharides to monosaccharides.

_____ 3. Secreted by duodenal glands and goblet cells.

Secretion by duodenal glands is stimulated by the vagus nerve, secretin release, and chemical or tactile irritation of the duodenal mucosa.

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

Peristaltic contractions
Segmental contractions

_____ 1. Propagated for short distances, and function to mix intestinal contents.

_____ 2. Proceed along the small intestine for variable distances; function to move chyme along the small intestine.

Most nutrient absorption occurs in the duodenum and jejunum, although some absorption also occurs in the ileum.

Liver

"*The liver performs important digestive and excretory functions, stores and processes nutrients, synthesizes new molecules, and detoxifies harmful chemicals.*"

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

Inhibits
Stimulates

_____ 1. Effect of secretin on bile secretion.

_____ 2. Effect of cholecystokinin on contraction of the gallbladder.

_____ 3. Effect of parasympathetic stimulation on bile secretion and release.

B. Using the terms provided, complete these statements:

Bile pigments	Glycogen
Bile salts	Phospholipids
Blood proteins	Store
Conversion	Transformed
Detoxifies	Urea

Although bile does not contain digestive enzymes, it does have (1), which emulsify fats. Bile also contains excretory products such as (2), cholesterol, and fats. Another function of the liver is to (3) fat, vitamins, copper, and iron. The liver can also remove sugar from the blood and store it as (4). Another function that the liver performs is the (5) of nutrients, in which the proportion of nutrients is controlled by changing one type of nutrient into another (e.g., amino acids into glucose). Substances can be (6) to more readily usable substances within the liver. Ingested fats, for example, are combined with choline and phosphorus to produce (7). The liver also (8) many harmful substances by altering their structure, such as converting ammonia to (9). The liver can also produce its own unique new compounds, including albumins and other (10).

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

Pancreas

"*The exocrine secretions of the pancreas include bicarbonate ions and pancreatic enzymes.*"

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

Lipases
Nucleases
Pancreatic amylase
Trypsin and chymotrypsin

_____ 1. Major proteolytic enzymes secreted by the pancreas.

_____ 2. Continues polysaccharide digestion that started in the oral cavity.

_____ 3. Lipid-digesting enzymes.

_____ 4. Enzymes that break down DNA and RNA.

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

Cholecystokinin
Secretin

_____ 1. Initiates the release of watery pancreatic solution that contains bicarbonate ions.

_____ 2. Stimulates release of an enzyme-rich solution from pancreas.

_____ 3. Acidic chyme in duodenum stimulates release of this hormone.

_____ 4. Presence of fatty acids and amino acids in duodenum stimulates release of this hormone.

Large Intestine

"*While in the colon, chyme is converted to feces.*"

Match these terms with the correct statement or definition:

Defecation
Defecation reflex
Mass movement
Microorganisms
Mucus
Water and salts

_____ 1. Absorbed from chyme in the production of feces.

_____ 2. Secreted into chyme in the production of feces.

_____ 3. Responsible for vitamin K synthesis and 30% of the dry weight of feces.

_____ 4. The process of elimination of feces.

_____ 5. Strong peristaltic contractions that propel the contents of the colon considerable distances.

_____ 6. Local and parasympathetic reflexes that result in relaxation of the internal anal sphincter and contraction of the rectum.

Digestion, Absorption, and Transport

"*Digestion, absorption, and transport are components of nutrition.*"

Match these terms with the correct statement or definition:

Absorption
Amino acids
Digestion
Fatty acids and glycerol
Monosaccharides
Transport

_____ 1. Breakdown of chemical bonds of organic molecules by digestive enzymes.

_____ 2. Begins in the stomach; most occurs in the duodenum and jejunum, although some occurs in the ileum.

_____ 3. Requires a carrier molecule; may require energy.

_____ 4. Product of carbohydrate digestion.

_____ 5. Product of protein digestion.

_____ 6. Products of lipid digestion.

Carbohydrates

"*Ingested carbohydrates consist primarily of starches, glycogen, sucrose, and small amounts of lactose and fructose.*"

Match these terms with the correct statement or definition:

Disaccharidase
Glucose
Insulin
Pancreatic amylase
Polysaccharide
Salivary amylase

_____ 1. Enzyme that begins the digestion of carbohydrates in the mouth.

_____ 2. Enzyme that continues starch digestion in the duodenum.

_____ 3. Enzyme that is bound to the microvilli of intestinal epithelium.

_____ 4. Other monosaccharides are converted into this molecule by the liver; transported by the circulatory system to cells that require energy.

_____ 5. Hormone that greatly increases the rate of glucose transport into most types of cells.

Glucose enters most cells by the process of facilitated diffusion and is used as a source of energy.

Lipids

"*Lipids are molecules that are insoluble or only slightly soluble in water.*"

Using the terms provided, complete these statements:

Bile salts	Micelles
Chyle	Saturated
Emulsification	Triacylglycerols
Lipase	Unsaturated

Lipids include triacylglycerols, phospholipids, steroids, and fat-soluble vitamins. (1) (commonly called fats) consist of three fatty acids bound to glycerol. Fats are (2) if their fatty acids have only single bonds between carbon atoms, and (3) if they have one or more double bonds between carbons. The first step in lipid digestion is (4) , which is the transformation of large lipid droplets into much smaller droplets. This process is accomplished by (5) secreted by the liver. (6) secreted by the pancreas and intestinal absorptive cells digests the lipids. Bile salts form around the small lipid droplets to form (7) . The contents of these structures pass by simple diffusion into the epithelial cells of the small intestine. The digested lipids are packaged inside a protein coat and released into lacteals. The lipid-rich lymph in these structures is called (8) , which is transported through the lymphatic system to the blood. The blood transports the digested lipids to adipose tissue and to the liver.

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

Proteins

"*Proteins are found in most plant and animal products we eat.*"

Match these terms with the correct statement or definition:

Growth hormone	Peptidases
Insulin	Trypsin
Pepsin	

_____ 1. Enzyme in the stomach that breaks down proteins into smaller polypeptide chains.

_____ 2. Enzyme produced by the pancreas that continues the digestion of proteins started in the stomach; produces small peptide chains.

_____ 3. Enzymes bound to the microvilli of intestinal epithelial cells; completes the breakdown of small peptide chains to release amino acids.

_____ 4. Two hormones that stimulate the uptake of amino acids by cells.

_____

Amino acids are used to form new proteins within cells. Some amino acids may be used for energy.

Water and Minerals

"*Water can move in either direction across the wall of the small intestine.*"

Match these terms with the correct statement or definition:

Active transport
Diffusion
Into small intestine
Out of small intestine
Reabsorption

_____ 1. The direction of water movement when chyme is dilute.

_____ 2. Fate of 99% of the water that is secreted into the stomach or small intestine.

_____ 3. Method of transport of sodium, potassium, and calcium, magnesium, and phosphate ions out of the small intestine.

QUICK RECALL

1. List five functions of the digestive system.

2. Name the four layers or tunics of the digestive tract.

3. List the three large pairs of salivary glands, and name the enzyme found in saliva.

4. Name the five types of epithelial cells in the stomach, and list their secretions.

5. List three structural modifications that increase surface area in the small intestine.

6. Name the three phases of swallowing.

7. List the types of contraction (movement) that occur in the stomach, small intestine, and large intestine.

8. List the three phases of gastric secretion.

9. List four major functions of the liver in addition to the production of bile.

10. List the breakdown products of carbohydrate, protein, and lipid digestion.

11. List the locations in the digestive tract where carbohydrate, protein, and lipid digestion take place.

WORD PARTS

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

WORD PART	MEANING	EXAMPLE
bucc-	the cheek	1. _____
gingiv-	the gums	2. _____
uvul-	the palate	3. _____
rug-	wrinkle; fold	4. _____
micro-	small	5. _____
hepa-	liver	6. _____

MASTERY LEARNING ACTIVITY

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

_____ 1. Which layer of the digestive tract is in direct contact with food that is consumed?
a. mucosa
b. muscularis
c. submucosa
d. serosa or adventitia

_____ 2. The intramural plexus is found in the
a. submucosa.
b. muscularis.
c. serosa.
d. a and b
e. all of the above

_____ 3. The tongue
a. holds food in place during mastication.
b. is involved in speech.
c. assists in swallowing.
d. is a major sensory organ for taste.
e. all of the above

_____ 4. The number of premolar permanent teeth in each quadrant of the mouth is
a. 1.
b. 2.
c. 3.
d. 4.

_____ 5. Dentin
a. forms the surface of the crown of teeth.
b. holds the teeth to the periodontal ligament.
c. is found in the pulp cavity.
d. is living, calcified, cellular material.
e. is harder than enamel.

_____ 6. Which of these glands secrete saliva into the oral cavity?
a. parotid glands
b. submandibular glands
c. sublingual glands
d. all of the above

_____ 7. Which of these stomach cell types is NOT correctly matched with its function?
a. surface mucous cells: produce mucus.
b. parietal cells: produce hydrochloric acid.
c. chief cells: produce intrinsic factor.
d. endocrine cells: produce regulatory hormones

_____ 8. Which of these structures function to increase the mucosal surface of the small intestine?
a. circular folds
b. villi
c. microvilli
d. all of the above

_____ 9. Given these parts of the small intestine:
1. duodenum
2. ileum
3. jejunum

Choose the arrangement that lists the parts in the order food encounters them as the food passes through the small intestine.
a. 1,2,3
b. 1,3,2
c. 2,1,3
d. 2,3,1

_____ 10. The structures in the small intestine that produce mucus are
a. duodenal glands.
b. endocrine cells.
c. parietal cells.
d. Peyer's patches.

_____ 11. The hepatic sinusoids
a. receive blood from the hepatic artery.
b. receive blood from the hepatic portal vein.
c. empty into the central veins.
d. all of the above

_____ 12. The portion of the digestive tract in which digestion begins is the
a. oral cavity.
b. esophagus.
c. stomach.
d. duodenum.
e. jejunum.

_____ 13. During swallowing,
a. movement of food is primarily caused by gravity.
b. pharyngeal constrictor muscles push the food into the esophagus.
c. food is pushed into the esophagus during the voluntary phase.
d. the soft palate closes off the opening into the larynx.

_____ 14. Why doesn't the stomach digest itself?
a. The stomach wall isn't composed of protein, so there are no digestive enzymes to attack it.
b. The digestive enzymes in the stomach aren't strong enough.
c. The lining of the stomach is too tough to be attacked by digestive enzymes.
d. The stomach wall is protected by large amounts of mucus.

_____ 15. Which of these hormones stimulates stomach secretions?
a. cholecystokinin
b. gastric inhibitory peptide
c. gastrin
d. secretin

_____ 16. Which of these phases of stomach secretion is correctly matched?
a. Cephalic phase: the largest volume of secretion is produced.
b. Gastric phase: gastrin secretion is inhibited by distention of the stomach.
c. Gastric phase: initiated by chewing, swallowing, or thinking of food.
d. Intestinal phase (pH 2.0 or below): stomach secretions are inhibited.

_____ 17. The function of peristaltic waves in the stomach is to
a. move chyme into the small intestine.
b. increase the secretion of HCl.
c. empty the teniae coli.
d. all of the above.

_____ 18. Which of these would occur if a person suffered from a severe case of hepatitis that impaired liver function?
a. Fat digestion may be hampered.
b. Bile pigments may accumulate in the blood.
c. Blood proteins may decrease in concentration.
d. b and c
e. all of the above

_____ 19. The watery solution produced by the exocrine cells in the pancreas
a. is secreted by the pancreatic islets.
b. contains bicarbonate ions.
c. is released primarily in response to cholecystokinin.
d. all of the above

_____ 20. Defecation
a. can be initiated by stretch of the rectum.
b. can occur as a result of mass movements.
c. involves local reflexes.
d. involves parasympathetic reflexes
e. all of the above

_____ 21. The breakdown products of carbohydrate digestion are
a. monosaccharides.
b. amino acids.
c. glycerol.
d. fatty acids.

_____ 22. The enzyme responsible for the digestion of carbohydrates is produced by the
a. salivary glands and pancreas.
b. stomach and pancreas.
c. pancreas and liver.
d. liver and small intestine.

_____23. Bile salts
a. are made by the gallbladder.
b. contain breakdown products from hemoglobin.
c. emulsify fats.
d. are enzymes that digest fats.

_____24. Two enzymes involved in the digestion of proteins are
a. pepsin and lipase.
b. trypsin and hydrochloric acid.
c. pancreatic amylase and bile salts.
d. pepsin and trypsin.

_____25. Given these processes:
1. chyle carried to bloodstream
2. emulsification of fats
3. formation of micelles
4. lipids enter lacteals
5. lipids packaged in a protein coat

Arrange the processes in the correct order as fats are digested, absorbed, and transported in the body.

a. 1,2,3,4,5
b. 1,2,4,3,5
c. 2,3,4,5,1
d. 2,3,5,1,4
e. 2,3,5,4,1

FINAL CHALLENGES

Use a separate sheet of paper to complete this section.

1. You and your anatomy and physiology instructor are lost in the desert without water. Your instructor suggests that you place a pebble in your mouth. What would you do and why?

2. If a friend had a peptic ulcer, would you recommend a diet high in fats or high in proteins?

3. If a friend had a duodenal peptic ulcer, would you recommend two large meals, or six small meals per day? Explain.

4. Gallstones sometimes obstruct the common bile duct. What are the consequences of such a blockage?

5. Sometimes a gallstone can move to the pancreatic duct and block or impair the flow of pancreatic juices. What would you expect to see if this blockage occurred?