ANSWERS TO CHAPTER 16

CONTENT LEARNING ACTIVITY

Anatomy and Histology of the Digestive System
A. 1. Mucosa; 2. Submucosa; 3. Muscularis; 4. Serosa or adventitia
B. 1. Mucosa; 2. Submucosa; 3. Muscularis; 4. Circular muscle; 5. Longitudinal muscle; 6. Serosa; 7. Intramural plexus

Oral Cavity
A. 1. Orbicularis oris; 2. Cheeks; 3. Buccinator; 4. Mastication; 5. Tongue; 6. Frenulum; 7. Taste
B. 1. Two; 2. One; 3. Two; 4. Three
C. 1. Primary teeth; 2. Secondary teeth; 3. Alveoli; 4. Gingiva (gums); 5. Periodontal ligaments
D. 1. Crown; 2. Neck; 3. Pulp cavity; 4. Pulp; 5. Dentin; 6. Enamel; 7. Cementum; 8. Root
E. 1. Cusp; 2. Enamel; 3. Gingiva; 4. Dentin; 5. Pulp cavity; 6. Periodontal ligaments; 7. Cementum; 8. Root; 9. Neck; 10. Crown
F. 1. Hard palate; 2. Soft palate; 3. Uvula 4. Tonsils
G. 1. Saliva; 2. Parotid glands; 3. Submandibular glands; 4. Sublingual glands

Pharynx and Esophagus
1. Oropharynx and laryngopharynx;
2. Pharyngeal constrictors; 3. Esophageal sphincters

Stomach
A. 1. Cardiac opening; 2. Fundus; 3. Greater and lesser curvatures; 4. Pyloric opening; 5. Pyloric sphincter; 6. Rugae
B. 1. Lower esophageal sphincter; 2. Gastroesophageal opening; 3. Cardiac region; 4. Pyloric sphincter; 5. Pyloric opening; 6. Pyloric region; 7. Rugae; 8. Body; 9. Fundus
C. 1. Gastric pits; 2. Gastric glands; 3. Surface mucous cells; 4. Mucous neck cells; 5. Parietal cells; 6. Chief cells; 7. Endocrine cells

Small Intestine
A. 1. Common bile duct and pancreatic duct; 2. Circular folds; 3. Villi; 4. Microvilli; 5. Lacteals; 6. Ileocecal junction; 7. Ileocecal sphincter; 8. Ileocecal valve
B. 1. Absorptive cells; 2. Goblet cells; 3. Granular cells; 4. Endocrine cells; 5. Intestinal glands; 6. Duodenal glands; 7. Peyer's patches

Liver
A. 1. Hepatic artery; 2. Hepatic portal vein; 3. Hepatic veins; 4. Hepatic ducts; 5. Common hepatic duct; 6. Cystic duct; 7. Common bile duct; 8. Duodenal papilla; 9. Gallbladder
B. 1. Lobules; 2. Portal triads; 3. Central vein; 4. Hepatocytes; 5. Hepatic cords; 6. Bile canaliculus; 7. Hepatic sinusoids;
C. 1. Hepatic cords; 2. Bile canaliculi; 3. Hepatocyte; 4. Hepatic sinusoid; 5. Portal triad; 6. Central vein; 7. Liver lobule

Pancreas
1. Acini; 2. Pancreatic islets; 3. Pancreatic duct

Large Intestine
A. 1. Cecum; 2. Appendix; 3. Ascending colon; 4. Transverse colon; 5. Descending colon; 6. Sigmoid colon; 7. Crypts; 8. Teniae coli
B. 1. Rectum; 2. Anal canal; 3. Internal anal sphincter; 4. External anal sphincter

Peritoneum
1. Parietal peritoneum; 2. Mesenteries; 3. Lesser omentum; 4. Omental bursa; 5. Retroperitoneal organs

Oral Cavity, Pharynx, and Esophagus
A. 1. Salivary amylase; 2. Lysozyme; 3. Mucin
B. 1. Voluntary phase; 2. Pharyngeal phase; 3. Esophageal phase
C. 1. Pharyngeal constrictor muscles; 2. Epiglottis; 3. Peristaltic waves

Stomach
A. 1. Chyme; 2. Mucus; 3. Hydrochloric acid; 4. Pepsinogen; 5. Pepsin; 6. Intrinsic factor; 7. Gastrin
B. 1. Cephalic phase; 2. Gastric phase; 3. Intestinal phase
C. 1. Increase; 2. Increases; 3. Increase; 4. Increase; 5. Decreases; 6. Decrease
D. 1. Mixing waves; 2. Peristaltic waves

Small Intestine
A. 1. Peptidases; 2. Disaccharidases; 3. Mucus
B. 1. Segmental contractions; 2. Peristaltic contractions

Liver
A. 1. Stimulates; 2. Stimulates; 3. Stimulates
B. 1. Bile salts; 2. Bile pigments; 3. Store; 4. Glycogen; 5. Conversion; 6. Transformed; 7. Phospholipids; 8. Detoxifies; 9. Urea; 10. Blood proteins

Pancreas
A. 1. Trypsin and chymotrypsin; 2. Pancreatic amylase; 3. Lipases; 4. Nucleases
B. 1. Secretin; 2. Cholecystokinin; 3. Secretin; 4. Cholecystokinin

Large Intestine
1. Water and salts; 2. Mucus; 3. Microorganism; 4. Defecation; 5. Mass movement; 6. Defecation reflex

Digestion, Absorption, and Transport
1. Digestion; 2. Absorption; 3. Transport; 4. Monosaccharides; 5. Amino acids; 6. Fatty acids and glycerol

Carbohydrates
1. Salivary amylase; 2. Pancreatic amylase; 3. Disaccharidase; 4. Glucose; 5. Insulin

Lipids
1. Triacylglycerols; 2. Saturated; 3. Unsaturated; 4. Emulsification; 5. Bile salts; 6. Lipase; 7. Micelles; 8. Chyle

Proteins
1. Pepsin; 2. Trypsin; 3. Peptidases; 4. Insulin and growth hormone

Water and Minerals
1. Out of small intestine; 2. Reabsorption; 3. Active transport

QUICK RECALL

1. Take in food, break down food, absorb digested molecules, provide nutrients, and eliminate wastes
2. Mucosa, submucosa, muscularis, and serosa or adventitia.
3. Parotid glands, submandibular glands, and sublingual glands; salivary amylase
4. Surface mucous cells and mucous neck cells—mucus; parietal cells—hydrochloric acid and intrinsic factor; chief cells—pepsin, and endocrine cells—gastrin
5. Circular folds, villi, and microvilli.
6. Voluntary, pharyngeal, and esophageal
7. Stomach: mixing waves and peristaltic waves; small intestine: segmental contractions and peristaltic contractions; colon: mass movements.
8. Cephalic, gastric, and intestinal
9. Remove and store blood sugar as glycogen, conversion of nutrients, detoxification, transformation of substances, and formation of blood proteins
10. Carbohydrates: monosaccharides; Protein: amino acids; Lipids: fatty acids and glycerol
11. Carbohydrates: mouth and small intestine; Proteins: stomach and small intestine; Lipids: small intestine

WORD PARTS

1. buccinator
2. gingiva
3. uvula
4. rugae
5. microvilli
6. hepatic; hepatocyte

MASTERY LEARNING ACTIVITY

1. A. From the inner lining of the digestive tract to the outer layers are the mucosa, submucosa, muscularis, and serosa or adventitia layers.

2. D. Nerve plexuses from the submucosa and muscularis layers are collectively called the intramural plexus.

3. E. The tongue moves food about and helps (with the lips and cheeks) to hold the food between the teeth during mastication. The tongue also aids in swallowing, is involved with speech, and contains taste buds, which are involved with the sense of taste.

4. B. Each quadrant of the adult mouth has two incisors, one canine, two premolars, and three molars (if the "wisdom teeth" are present).

5. D. Dentin is living, calcified, cellular material that surrounds the pulp cavity, and lies beneath the enamel found on the crown. Periodontal ligaments hold the teeth in place.

6. D. Parotid glands, submandibular glands, and sublingual glands are all pairs of salivary glands.

7. C. Chief cells produce pepsinogen, which is transformed by hydrochloric acid into pepsin. Pepsin is an enzyme that breaks down proteins.

8. D. All of the structures listed increase the mucosal surface area of the small intestine.

9. B. Food passes from the stomach into the duodenum, then into the jejunum, into the ileum, and then into the large intestine.

10. A. Duodenal glands in the lining of the small intestine secrete mucus. Endocrine cells secrete hormones, parietal cells secrete hydrochloric acid in the stomach, and Peyer's patches are aggregations of lymph nodules, which are numerous in the ileum.

11. D. Blood from the hepatic artery and hepatic portal vein mixes in the hepatic sinusoids and then flows to the central veins. The central veins join the hepatic veins, which exit the liver.

12. A. Both mechanical and chemical digestion begin in the oral cavity. Mastication begins the process of mechanical digestion, and salivary amylase begins the process of chemical digestion.

13. B. Although gravity may have some effect, it is not as important as the muscular contractions of the pharyngeal constrictor muscles during the pharyngeal stage, and peristalsis during the esophageal stage. During the voluntary phase, the tongue and cheeks are used to push the food into the pharynx. During the pharyngeal phase, the soft palate and uvula close off the nasopharynx, and the epiglottis closes off the opening into the larynx.

14. D. The stomach is protected from digestive enzymes and hydrochloric acid by the large amount of mucus that is secreted by the epithelial cells of the stomach lining.

15. C. Gastrin stimulates hydrochloric acid secretion by parietal cells. The other hormones inhibit gastric secretions.

16. D. The intestinal phase first stimulates (when pH is 3.0 or above), then inhibits (when pH is 2.0 or below) gastric secretions. The cephalic phase occurs as a result of chewing, swallowing, or thinking of food. The gastric phase produces the largest volume of secretions.

17. A. Peristaltic waves in the stomach move chyme from the stomach into the small intestine. The mixing waves of the stomach function to mix the secretions of the stomach and the food within it. Teniae coli are found in the large intestine, not the stomach.

18. E. The liver functions to produce many blood proteins, it produces bile, which is important in fat emulsification in the small intestine, and it eliminates pigments that are byproducts of hemoglobin breakdown in the bile. Therefore all of the conditions listed could occur if the liver were inflamed and its functioning impaired.

19. B. The watery component contains bicarbonate ions that neutralize stomach acid. It is released in response to secretin. The enzymatic component contains digestive enzymes, and is released in response to cholecystokinin.

20. E. Stretch of the rectum initiates local and parasympathetic reflexes that result in defecation. Often the stretch is caused by the movement of feces into the rectum as a result of mass movements.

21. A. Carbohydrates are broken down into monosaccharides, proteins into amino acids, and lipids into fatty acids and glycerol.

22. A. Amylase, which digests carbohydrates, is produced by the salivary glands and pancreas.

23. C. Bile salts function to emulsify fats. They are produced by the liver. Bile pigments are breakdown products of hemoglobin, and lipase digests fats.

24. D. Pepsin produced in the stomach, and trypsin produced in the pancreas are responsible for protein digestion. Lipase digests fats and amylase digests carbohydrates.

25. E. Fats are first emulsified by combining with bile salts, and are digested by lipase. Bile salts then aggregate around digested lipids to form micelles. Lipids pass from the micelles into epithelial cells in the small intestine. Inside these epithelial cells, lipids are packaged in a protein coat, then leave the epithelial cells and pass into the lacteals. Chyle is lymph containing large amounts of lipids, and the lymphatic system carries chyle to the bloodstream.

FINAL CHALLENGES

1. It is probably a good idea to accept the suggestion. Tactile stimulation in the mouth increases saliva production, making the mouth feel less dry, and decreasing the sensation of thirst.

2. A diet high in fats is the most logical, because fatty acids in the duodenum stimulate the secretion of gastric inhibitory peptide and cholecystokinin, both of which inhibit gastric secretion. On the other hand, proteins (amino acids and polypeptides) in the stomach stimulate the release of gastrin, which increases gastric secretions.

3. Large meals are not recommended because distention of the stomach promotes acid secretion and rapid stomach emptying. This results in large amounts of acidic chyme entering the duodenum and aggravating the duodenal peptic ulcer. With smaller meals there is less acid production, slower movement of chyme into the duodenum, and an increased ability to neutralize the chyme once it enters the duodenum. Note, however, that although these arguments seem logical, there is at present no conclusive proof that spreading meals throughout the day is truly effective.

4. Lack of bile caused by blockage of the common bile duct could result in jaundice (because of an accumulation of bile pigments in the blood) and clay-colored stools (caused by a lack of bile pigments in the feces). Fat breakdown is impaired producing a loose, bulky stool. Lack of fat absorption reduces the absorption of fat soluble vitamins such as vitamin K, resulting in bleeding problems.

5. Lack of pancreatic juice results in inadequate digestion of fats, proteins, and carbohydrates. Malnutrition accompanied by abundant, fatty stools would be expected. It is also possible that pancreatic enzymes would digest the tissues of the pancreas and the pancreatic duct, resulting in severe inflammation of the pancreas, i.e., pancreatitis.