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Digestive System

I. Introduction to the Digestive System

☞ *Concept:* The organs of the digestive system are specialized for the digestion and absorption of food. The digestive system consists of a tubular gastrointestinal tract and accessory digestive organs.

A. Multiple Choice Questions

- ___ 1. The swallowing of food or fluid from the mouth to the esophagus is called
(a) deglutition. (c) absorption.
(b) ingestion. (d) peristalsis.
- ___ 2. The transport of food molecules across the wall of the small intestine into the blood and lymph is called
(a) hydrolysis. (d) absorption.
(b) diffusion. (e) active transport.
(c) ingestion.
- ___ 3. All of the following are accessory digestive organs *except*
(a) the teeth. (d) the pancreas.
(b) the spleen. (e) the salivary glands.
(c) the liver.

B. True–False Questions

- ___ 1. Ingested food is not technically in the body until it is absorbed.
- ___ 2. Ingested food must be digested before it can be absorbed.
- ___ 3. Absorbed molecules of food enter either the circulatory or the lymphatic system.
- ___ 4. The GI tract is approximately 9 m (30 ft) long, beginning at the esophagus and ending at the anal canal.
- ___ 5. The term *gut* is a synonym for *viscera*.

II. Serous Membranes and Tunics of the Gastrointestinal Tract

☞ *Concept:* Protective and lubricating serous membranes line the abdominal cavity and cover the visceral organs. Specialized serous membranes support the GI tract and provide a structure through which nerves and vessels pass. The wall of the GI tract is composed of four tunics.

A. Multiple Choice Questions

- ___ 1. The abdominal wall is lined with
(a) the greater omentum. (c) the mesentery.
(b) the parietal peritoneum. (d) the visceral serosa.

- _____ 2. Which of the following statements does *not* apply to the mesentery?
- (a) It supports the abdominal portion of the GI tract.
 - (b) It provides space for peristaltic movements of the small intestine.
 - (c) It provides structural support for nerves and vessels.
 - (d) It separates the small intestine from the large intestine.
- _____ 3. An incision into the lumen of the GI tract would cut the following layers, or tunics, in the sequence of
- (a) the mucosa, submucosa, muscularis, and serosa.
 - (b) the serosa, submucosa, muscularis, and mucosa.
 - (c) the serosa, muscularis, submucosa, and mucosa.
 - (d) the muscularis, submucosa, mucosa, and serosa.
- _____ 4. Which of the following word combinations relating the tunic and the epithelium is *incorrect*?
- (a) muscularis and smooth muscle
 - (b) serosa and loose connective tissue
 - (c) mucosa and simple columnar epithelium
 - (d) submucosa and vascular connective tissue
 - (e) none of the above (all are correct)

B. True–False Questions

- _____ 1. The peritoneum is composed of simple squamous epithelium and is the largest serous membrane of the body.
- _____ 2. The mesentery is a double-layered serous membrane.
- _____ 3. The lamina propria is a tunic, or layer, of the GI tract located between the submucosa and the muscularis.
- _____ 4. Stimulation of the parasympathetic fibers to the GI tract reduces peristalsis and intestinal secretions.

III. Mouth, Pharynx, and Associated Structures

☞ *Concept:* Ingested food is changed into a bolus by the mechanical action of teeth and by the chemical activity of saliva. The bolus is swallowed in the process of deglutition.

A. Multiple Choice Questions


- _____ 1. The opening between the oral cavity and the pharynx is
- (a) the vestibule.
 - (b) the vermilion.
 - (c) the oral orifice.
 - (d) the esophagus.
 - (e) the fauces.
- _____ 2. If the lingual frenulum is too short, a person may experience
- (a) a dry mouth.
 - (b) pain when chewing.
 - (c) difficulty with speech.
 - (d) crooked teeth.
 - (e) an inability to taste food.
- _____ 3. The numerous small elevations on the surface of the tongue that support taste buds and that aid in handling food are called
- (a) cilia.
 - (b) rugae.
 - (c) villi.
 - (d) gyri.
 - (e) papillae.

- _____ 4. When looking directly into the oral cavity, one would *not* be able to see
 (a) the lingual frenulum. (d) the epiglottis.
 (b) the uvula. (e) the palatal rugae.
 (c) the palatine tonsils.
- _____ 5. The teeth that are best adapted for shearing food are
 (a) the canines. (c) the molars.
 (b) the premolars. (d) the incisors.
- _____ 6. The number of permanent teeth in a full set is
 (a) 20. (d) 32.
 (b) 24. (e) 34.
 (c) 30.
- _____ 7. Which type of teeth are *not* represented in deciduous dentition?
 (a) molars (c) incisors
 (b) premolars (d) canines
- _____ 8. Tooth decay, if not treated, will progressively erode the cusp of a tooth in the sequence of
 (a) the cementum, dentin, enamel, and pulp.
 (b) the enamel, dentin, and pulp.
 (c) the cementum, enamel, dentin, and pulp.
 (d) the dentin, cementum, enamel, and pulp.
- _____ 9. Which of the following statements is *false* concerning saliva?
 (a) It aids in the formation of a bolus.
 (b) It contains digestive enzymes.
 (c) It is secreted from exocrine salivary glands.
 (d) Between 1,000 and 1,500 ml are secreted daily.
 (e) None of the above apply.
- _____ 10. The salivary gland that is positioned in front of the ear, between the skin and the masseter muscle is
 (a) the sublingual gland. (c) the submaxillary gland.
 (b) the parotid gland. (d) the submandibular gland.

B. True–False Questions

- _____ 1. The mouth and pharynx are lined with nonkeratinized stratified squamous epithelium.
- _____ 2. The upper and lower lips and the tongue are each attached to a structure within the mouth called a frenulum.
- _____ 3. The tongue is a mass of smooth muscles covered by a mucous epithelial membrane.
- _____ 4. Vallate papillae are the most numerous of the three types.
- _____ 5. As one swallows, the palatal rugae and the uvula are drawn upward, closing the nasopharynx.
- _____ 6. Paired lingual tonsils and palatine tonsils are located within the oral cavity.
- _____ 7. The formula for permanent dentition in humans is I2/2, C1/1, P2/2, M3/3=16 × 2=32 teeth.
- _____ 8. The submandibular glands contain only serous secretory cells.

IV. Esophagus and Stomach

 *Concept:* A bolus of food is passed from the esophagus to the stomach, where it is churned and mixed with gastric secretions. The chyme thus produced is sent past the pyloric sphincter of the stomach to the duodenum.


A. Multiple Choice Questions

- _____ 1. The esophageal hiatus is
(a) the opening between the pharynx and the esophagus.
(b) the junction between the larynx and the esophagus.
(c) the opening between the esophagus and the stomach.
(d) the opening through the diaphragm.
- _____ 2. During the second stage of deglutition,
(a) food is pulverized through chewing.
(b) a bolus is formed.
(c) a bolus passes through the pharynx.
(d) a bolus enters the stomach.
- _____ 3. Which of the following is *not* a function of the stomach?
(a) formation of chyme (c) storage of ingested food
(b) secretion of gastric juice (d) absorption of fats
- _____ 4. Which of the following is *not* a region of the stomach?
(a) antrum (d) body
(b) cardia (e) pylorus
(c) fundus
- _____ 5. The pyloric sphincter is a modification of
(a) the gastric rugae. (d) the circular layer of the muscularis.
(b) the gastric mucosa. (e) the oblique layer of the muscularis.
(c) the submucosa.

B. True–False Questions

- _____ 1. The esophagus is a collapsible muscular tube that connects the pharynx to the stomach.
- _____ 2. The sensation of “heartburn” results when gastric juice is regurgitated into the esophagus.
- _____ 3. Mastication and deglutition are totally voluntary processes, whereas peristalsis is an involuntary process.
- _____ 4. Elevation of the uvula prevents food or fluid from entering the glottis.
- _____ 5. The muscularis has three layers in the wall of the stomach, but it has only two in the intestinal wall.

V. Small Intestine

 *Concept:* The small intestine, consisting of the duodenum, jejunum, and ileum, is the site where digestion is completed and nutrients are absorbed. The surface area of the intestinal wall is increased by plicae circulares, villi, and microvilli.

A. Multiple Choice Questions

- _____ 1. The small intestine is supported by
(a) ligaments. (d) the mesentery.
(b) elastic fibers. (e) the diaphragm.
(c) the omentum.
- _____ 2. The common bile duct and the pancreatic duct unite to form a common entry into the duodenum called
(a) the goblet duct. (c) the mesenteric papilla.
(b) the duodenal duct. (d) the hepatopancreatic ampulla.
- _____ 3. Which of the following statements is *false* concerning the duodenum?
(a) It secretes pepsin for digestion of proteins.
(b) It receives bile and pancreatic juice.
(c) It contains specialized mucus-secreting glands.
(d) It contains villi within the mucosa.
- _____ 4. Aggregates of lymph nodules within the walls of the ileum are called
(a) plicae. (c) lacteals.
(b) cisterna chyli. (d) mesenteric patches.
- _____ 5. The brush border of the intestinal mucosa consists of
(a) hair cells. (d) flagella.
(b) villi. (e) microvilli.
(c) cilia.
- _____ 6. All of the following are structural features of the small intestine *except*
(a) villi. (d) a brush border.
(b) haustra. (e) intestinal glands.
(c) plicae circulares.

B. True–False Questions

- _____ 1. The total arterial blood supply to the small intestine comes through the superior mesenteric artery.
- _____ 2. The duodenum receives bile through an opening from the common bile duct and pancreatic juice through an opening from the pancreatic duct.
- _____ 3. The jejunum is the longest portion of the small intestine.
- _____ 4. Absorbed fat from the lumen of the small intestine enters the central lacteals to be transported through the thoracic duct to the lymphatic system.
- _____ 5. The microvilli compose the brush border within the small intestine, where they secrete brush border enzymes.
- _____ 6. Peristalsis is the only action that moves chyme through the small intestine.

VI. Large Intestine

☞ *Concept:* The large intestine receives undigested food from the small intestine, absorbs water and electrolytes from chyme, and passes feces out of the GI tract.

A. Multiple Choice Questions

- _____ 1. Which of the following statements is *false* concerning the large intestine?
- (a) It is about 1.5 m long and 6.5 cm in diameter.
 - (b) It is supported by the mesocolon along the abdominal wall.
 - (c) It absorbs water and electrolytes from undigested food.
 - (d) It forms fecal material and expels feces from the GI tract.
 - (e) None of the above apply.
- _____ 2. Undigested food passes through the large intestine in the sequence of
- (a) the cecum, ascending colon, transverse colon, descending colon, sigmoid colon, rectum, and anal canal.
 - (b) the ascending colon, transverse colon, descending colon, cecum, rectum, sigmoid colon, and anal canal.
 - (c) the sigmoid colon, cecum, ascending colon, descending colon, transverse colon, anal canal, and rectum.
 - (d) the cecum, sigmoid colon, transverse colon, ascending colon, descending colon, rectum, and anal canal.
- _____ 3. The right-angle bend of the large intestine between the transverse colon and the descending colon is called
- (a) the costal angle.
 - (b) the hepatic flexure.
 - (c) the pelvic flexure.
 - (d) the splenic flexure.
 - (e) the left colonic bend.
- _____ 4. Which of the following are *not* structural components of the large intestine?
- (a) taeniae coli
 - (b) haustra
 - (c) villi
 - (d) epiploic appendages
 - (e) goblet cells
- _____ 5. Which of the following constitutes the innervation of the large intestine?
- (a) sympathetic and parasympathetic
 - (b) visceral afferent, sympathetic, and parasympathetic
 - (c) visceral afferent and parasympathetic
 - (d) somatic efferent, sympathetic, and parasympathetic
- _____ 6. Which of the following types of movement does *not* occur within the large intestine?
- (a) pendular churning
 - (b) peristaltic movement
 - (c) haustral churning
 - (d) mass movement

B. True–False Questions

- _____ 1. The appendix is a fingerlike projection extending from the cecum.
- _____ 2. The internal anal sphincter, composed of skeletal muscle fibers, guards the opening of the anal canal.
- _____ 3. The taeniae coli are circular bands of smooth muscle that separate the haustra of the large intestine.
- _____ 4. The regularly occurring mass movement of the large intestine corresponds with the entrance of chyme through the ileocecal valve.
- _____ 5. A defecation sensation that may occur after eating a meal is an expression of the gastrocolic reflex.
- _____ 6. Relaxation of the internal anal sphincter in the defecation reflex permits movement of feces into the anal canal.

VII. Liver, Gallbladder, and Pancreas

☞ *Concept:* The liver, consisting of four lobes, processes nutrients and secretes bile, which is stored and concentrated in the gallbladder prior to discharge into the duodenum. The pancreas, consisting of endocrine (islet) cells and exocrine (acini) cells, secretes important hormones into the blood and essential digestive enzymes into the duodenum.

A. Multiple Choice Questions

- _____ 1. Which of the following is *not* a lobe of the liver?
(a) right lobe (d) caudate lobe
(b) medial lobe (e) quadrate lobe
(c) left lobe
- _____ 2. The liver is composed of millions of liver cells called
(a) hepatocytes. (d) sinusoids.
(b) Kupffer cells. (e) mast cells.
(c) portal cells.
- _____ 3. Which of the following concerning a lobule of the liver is *false*?
(a) It receives both arterial and venous blood.
(b) It consists of plates of hepatocytes no more than two cells thick.
(c) Blood travels from the periphery to the center of the lobule.
(d) Bile travels towards the periphery of the lobule between adjacent hepatocytes.
(e) None of the above apply.
- _____ 4. Which of the following is *not* a function of the liver?
(a) detoxification of blood
(b) secretion of digestive enzymes
(c) synthesis, storage, and release of vitamins
(d) synthesis, storage, and release of glycogen
(e) production of bile
- _____ 5. Bile, produced by the liver and stored and concentrated in the gallbladder, contains
(a) bilirubin. (d) urobilinogen.
(b) enterokinase. (e) albumin.
(c) triglyceride.
- _____ 6. The pancreas
(a) produces glucagon.
(b) secretes insulin into the pancreatic duct.
(c) is composed of porous sinusoids.
(d) secretes mucus into the duodenum.
- _____ 7. The exocrine secretory units of the pancreas are called
(a) islet cells. (c) acini.
(b) alpha cells. (d) beta cells.
- _____ 8. Which of the following is *not* a digestive enzyme in pancreatic juice?
(a) trypsin (d) amylase
(b) lipase (e) nuclease
(c) enterokinase

B. True–False Questions

- ___ 1. The liver attaches to the diaphragm at the ligamentum teres.
- ___ 2. Liver cells are called hepatocytes and capillary spaces in the liver are called sinusoids.
- ___ 3. Bile produced by the hepatocytes flows from the liver, passing sequentially through bile canaliculi, hepatic ducts, and finally the bile ducts.
- ___ 4. The principal function of the gallbladder is to detoxify bile before it is released into the duodenum.
- ___ 5. The cystic duct permits only one-way passage of bile.
- ___ 6. The liver and pancreas are considered mixed glands because they have both endocrine and exocrine functions.
- ___ 7. All but a portion of the head of the pancreas is positioned retroperitoneally.

VIII. Developmental Exposition of the Digestive System

A. Multiple Choice Questions

- ___ 1. The primitive gut is derived from
 - (a) ectoderm.
 - (b) mesenchyme.
 - (c) mesoderm.
 - (d) endoderm.
- ___ 2. All of the following are derived from the embryonic foregut *except*
 - (a) the esophagus.
 - (b) the pancreas.
 - (c) the stomach.
 - (d) the cecum.
- ___ 3. The cecum and the appendix develop within
 - (a) the foregut.
 - (b) the midgut.
 - (c) the hindgut.
 - (d) the cloaca.

B. True–False Questions

- ___ 1. *Gut* is an anatomical term that refers to all the abdominal visceral organs.
- ___ 2. The entire GI tract, from the mouth to the anus, is derived from endoderm.
- ___ 3. By the sixth week of development, the liver is producing red blood cells; at the ninth week, the liver represents 10% of the total weight of the fetus.

C. Matching Questions

Match the following digestive structures with the developmental region of the gut.

- ___ 1. cecum (a) foregut
- ___ 2. anal canal (b) midgut
- ___ 3. hepatic bud (c) hindgut
- ___ 4. cloaca
- ___ 5. gallbladder
- ___ 6. small intestine

IX. Clinical Considerations

A. Multiple Choice Questions

- ___ 1. Which of the following is *not* a congenital disorder of the GI tract?
(a) esophageal atresia (c) imperforate anus
(b) cleft palate (d) hepatoma
- ___ 2. Botulism is
(a) an inflammation of the intestinal mucosa.
(b) a type of food poisoning caused by a clostridium bacterium.
(c) a type of food poisoning caused by a salmonella bacterium.
(d) an exotic religion of the Far East.
- ___ 3. Inflammation of the liver is called
(a) jaundice. (c) cholelithiasis.
(b) cirrhosis. (d) hepatitis.
- ___ 4. Stenosis of the sphincter of ampulla would interfere with
(a) the transport of bile and pancreatic juice.
(b) the secretion of mucus.
(c) the passage of chyme.
(d) peristalsis.
(e) the cephalic phase of gastric regulation.
- ___ 5. Peritonitis could affect each of the following organs *except*
(a) the esophagus. (d) the cecum.
(b) the spleen. (e) the stomach.
(c) the liver.

B. Matching Questions

Match each of the following conditions or diseases with its description.

- | | |
|------------------------|--|
| ___ 1. pyorrhea | (a) intestinal flu |
| ___ 2. cirrhosis | (b) inflammation of the lips |
| ___ 3. mumps | (c) viral disease of the parotid gland(s) |
| ___ 4. chilitis | (d) varicose veins |
| ___ 5. enteritis | (e) inflammation of the gums |
| ___ 6. gingivitis | (f) retention of bilirubin in the blood |
| ___ 7. cystic fibrosis | (g) protrusion of a portion of viscera through the body wall |
| ___ 8. jaundice | (h) discharge of pus at the gingiva |
| ___ 9. hernia | (i) inflammation within the pancreas |
| ___ 10. hemorrhoids | (j) disease of the liver |

X. Chapter Review

A. Completion Questions

1. _____ is the term for the rhythmic, wavelike intestinal contractions that move food through the GI tract.
2. The digestion of ingested food is not complete until _____ has occurred through the wall of the intestine into the blood and lymph.
3. _____ is the chewing of food, while _____ is the swallowing of a bolus.
4. The developing GI tract is frequently referred to as the _____.
5. Structures within the oral cavity are derived from the _____ germ layer, whereas most of the GI tract and accessory visceral organs are derived from the _____ germ layer.
6. The _____ is a developmental region of the fetus that serves as a common opening for the developing anal canal and urinary tract.
7. Vessels and nerves pass through the _____, which is a double-layered serous membrane that supports the small intestine.
8. The _____ is the serous membrane that lines the wall of the abdominal cavity.
9. Viscera located outside of the peritoneal cavity along the posterior aspect of the abdomen are _____.
10. Simple columnar epithelium, goblet cells, and absorptive and secretory capabilities are characteristic of the _____ of the GI tract.
11. The _____ between the layers of the muscularis provides the principal innervation to the GI tract.
12. The opening between the oral cavity and the pharynx is called the _____.
13. Humans and other mammals have _____ dentition, which means that the teeth differ in shape and function.
14. The _____ permit stomach distension.
15. When the small intestine is empty of food, the _____ closes, and bile is forced up the cystic duct to the gallbladder for storage.
16. Innervation of the small intestine is from nerve fibers arising from the _____ plexus.

17. The _____ is the terminal portion of the small intestine, and also the longest (2 m).
18. Absorption within the small intestine occurs across the epithelial wall of the fingerlike _____ that project into the intestinal lumen.
19. Three longitudinal bands of muscle, called _____, run the length of the large intestine.
20. A specialized portion of the mesentery, called the _____, supports the large intestine.

B. Matching Questions

Match the digestive compound with both the location at which it is secreted and its function.

- | | | |
|--------------------------|-------------------|---|
| ___ 1. pepsin | A. salivary gland | (a) digests proteins |
| ___ 2. amylase | B. gastric mucosa | (b) emulsifies fats |
| ___ 3. hydrochloric acid | C. liver | (c) digests carbohydrates |
| ___ 4. lipase | D. pancreas | (d) activates pepsinogen |
| ___ 5. bile salts | E. intestinal | (e) converts fats into fatty acids and glycerol |
| ___ 6. trypsin | | (f) converts nucleic acids into nucleotides |
| ___ 7. nuclease | | |
| ___ 8. maltase | | |