

38 EXERCISE

Anatomy of the Digestive System



Time Allotment: 2 hours.



Multimedia Resources: See Appendix B for Guide to Multimedia Resource Distributors.

Digestive System: Your Personal Power Plant (FHS: 34 minutes, DVD, 3-year streaming webcast)

The Human Digestive System (DE: 18 minutes, DVD) and CD-ROM

Interactive Physiology® 10-System Suite: Digestive System (PE: CD-ROM, Website)

Practice Anatomy Lab™ 3.0 (PAL) (PE: DVD, Website)

Laboratory Materials

Ordering information is based on a lab size of 24 students, working in groups of 4. A list of supply house addresses appears in Appendix A.

24 prepared microscope slides of each of the following: mixed salivary glands, liver, longitudinal sections of the gastroesophageal junction and a tooth, and cross sections of the stomach, duodenum, ileum, and large intestine

24 compound microscopes and/or hand lenses, lens paper, lens cleaning solution
Anatomical charts of the human digestive system
Jaw model and/or human skull

Dissectible torso model
3-D model of a villus (if available)
3-D model of liver lobules (if available)

Advance Preparation

1. Set out the dissectible torso model and anatomical charts of the human digestive system.
2. Set out models of a villus and the liver, if available; a jaw model; and/or a human skull.
3. Set out slides of liver, mixed salivary glands, longitudinal sections of the gastroesophageal junction and a tooth; cross sections of the stomach, duodenum, ileum, and large intestine; lens paper and lens cleaning solution. Have compound microscopes and/or hand lenses available.

Answers to Pre-Lab Quiz (pp. 573–574)

1. d, all of the above
2. Absorption
3. a, mucosa
4. esophagus
5. d, peristalsis
6. d, stomach
7. true
8. descending colon
9. d, root
10. b, liver

Answers to Activity Questions

Activity 2: Studying the Histological Structure of Selected Digestive System Organs (p. 579)

1. *Stomach*

The extra layer of smooth muscle produces the churning movement because of the additional planes in which contraction can take place.

2. *Gastroesophageal Junction*

The esophagus is lined with stratified squamous epithelium, while the stomach is lined with simple columnar epithelium. The esophagus is designed to handle abrasion. The stomach lining has secretory and some absorptive functions. The stomach is designed to resist acid and the esophagus is not.

Activity 3: Observing the Histological Structure of the Small Intestine (pp. 582–583)

1. *Duodenum*

Simple columnar epithelium lines the duodenum.

2. *Ileum*

Peyer's patches are lymphatic tissue.

Activity 4: Examining the Histologic Structure of the Large Intestine (p. 584)

Mucus in the large intestine helps the contents to pass along the tract more easily.

Name _____

Lab Time/Date _____

Anatomy of the Digestive System

General Histological Plan of the Alimentary Canal

1. The general anatomical features of the alimentary canal are listed below. Fill in the table to complete the information.

Wall layer	Subdivisions of the layer (if applicable)	Major functions
mucosa	1) epithelium; 2) lamina propria; 3) muscularis mucosa	absorption secretion
submucosa	(not applicable)	vascular supply for mucosa; protection
muscularis externa	1) circular layer 2) longitudinal layer	churning; mixing; propulsion of food along the tract
serosa or adventitia	(not applicable)	protection and anchoring for adventitia; reduction of friction for abdominal organs by serosa

Organs of the Alimentary Canal

2. The tubelike digestive system canal that extends from the mouth to the anus is known as the alimentary canal or the gastrointestinal (GI) tract.

3. How is the muscularis externa of the stomach modified? It has a third (obliquely oriented) muscle layer.

How does this modification relate to the function of the stomach? Vigorous churning activity occurs here.

4. What transition in epithelial type exists at the gastroesophageal junction? Changes from stratified squamous (esophagus) to simple columnar (stomach)

How do the epithelia of these two organs relate to their specific functions? The esophagus is subjected to constant abrasion (stratified squamous is well adapted for this). The stomach has secretory (and some absorptive) functions and is better protected from acid.

5. Differentiate between the colon and the large intestine. The large intestine includes the colon, but also includes the cecum, vermiform appendix, rectum, and anal canal.

6. Match the items in column B with the descriptive statements in column A. The items in column B may be used more than once.

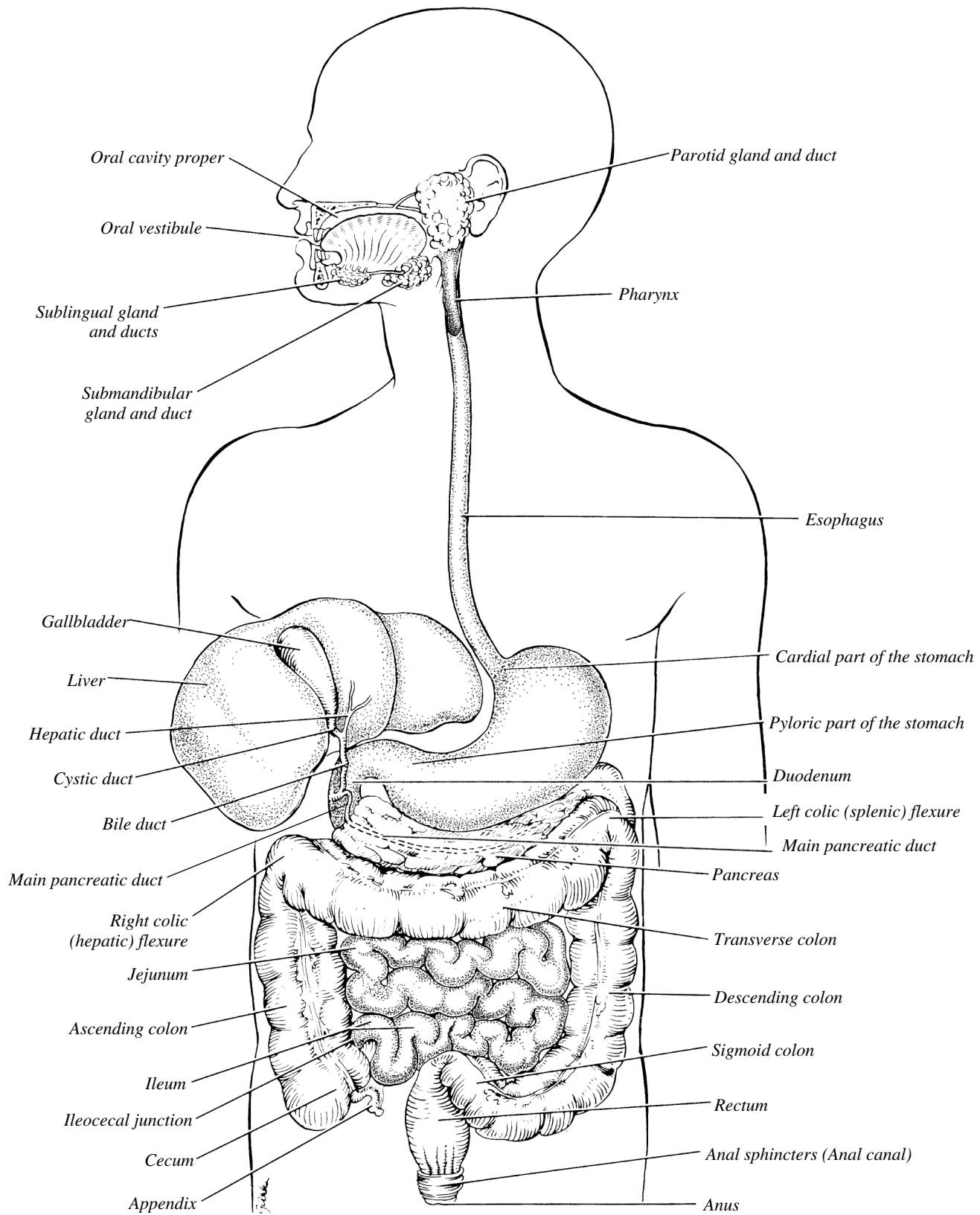
Column A

- l.* _____ 1. structure that suspends the small intestine from the posterior body wall
- y.* _____ 2. fingerlike extensions of the intestinal mucosa that increase the surface area for absorption
- q.* _____ 3. large collections of lymphoid tissue found in the submucosa of the small intestine
- c.* _____ 4. deep folds of the mucosa and submucosa that extend completely or partially around the circumference of the small intestine
- n.* _____, *w.* _____ 5. regions that break down foodstuffs mechanically
- x.* _____ 6. mobile organ that manipulates food in the mouth and initiates swallowing
- r.* _____ 7. conduit for both air and food
- f.* _____, *k.* _____, *l.* _____ 8. three structures continuous with and representing modifications of the peritoneum
- d.* _____ 9. the “gullet”; no digestive/absorptive function
- t.* _____ 10. folds of the gastric mucosa
- h.* _____ 11. pocketlike sacs of the large intestine
- m.* _____ 12. projections of the plasma membrane of a mucosal epithelial cell
- i.* _____ 13. valve at the junction of the small and large intestines
- u.* _____ 14. primary region of food and water absorption
- e.* _____ 15. membrane securing the tongue to the floor of the mouth
- j.* _____ 16. absorbs water and forms feces
- o.* _____ 17. area between the teeth and lips/cheeks
- b.* _____ 18. wormlike sac that outpockets from the cecum
- w.* _____ 19. initiates protein digestion
- k.* _____ 20. structure attached to the lesser curvature of the stomach
- u.* _____ 21. organ immediately distal to the stomach
- s.* _____ 22. valve controlling food movement from the stomach into the duodenum
- v.* _____ 23. posterosuperior boundary of the oral cavity
- u.* _____ 24. location of the hepatopancreatic sphincter through which pancreatic secretions and bile pass
- p.* _____ 25. serous lining of the abdominal cavity wall
- j.* _____ 26. principal site for the synthesis of vitamin K by microorganisms
- a.* _____ 27. region containing two sphincters through which feces are expelled from the body
- g.* _____ 28. bone-supported anterosuperior boundary of the oral cavity

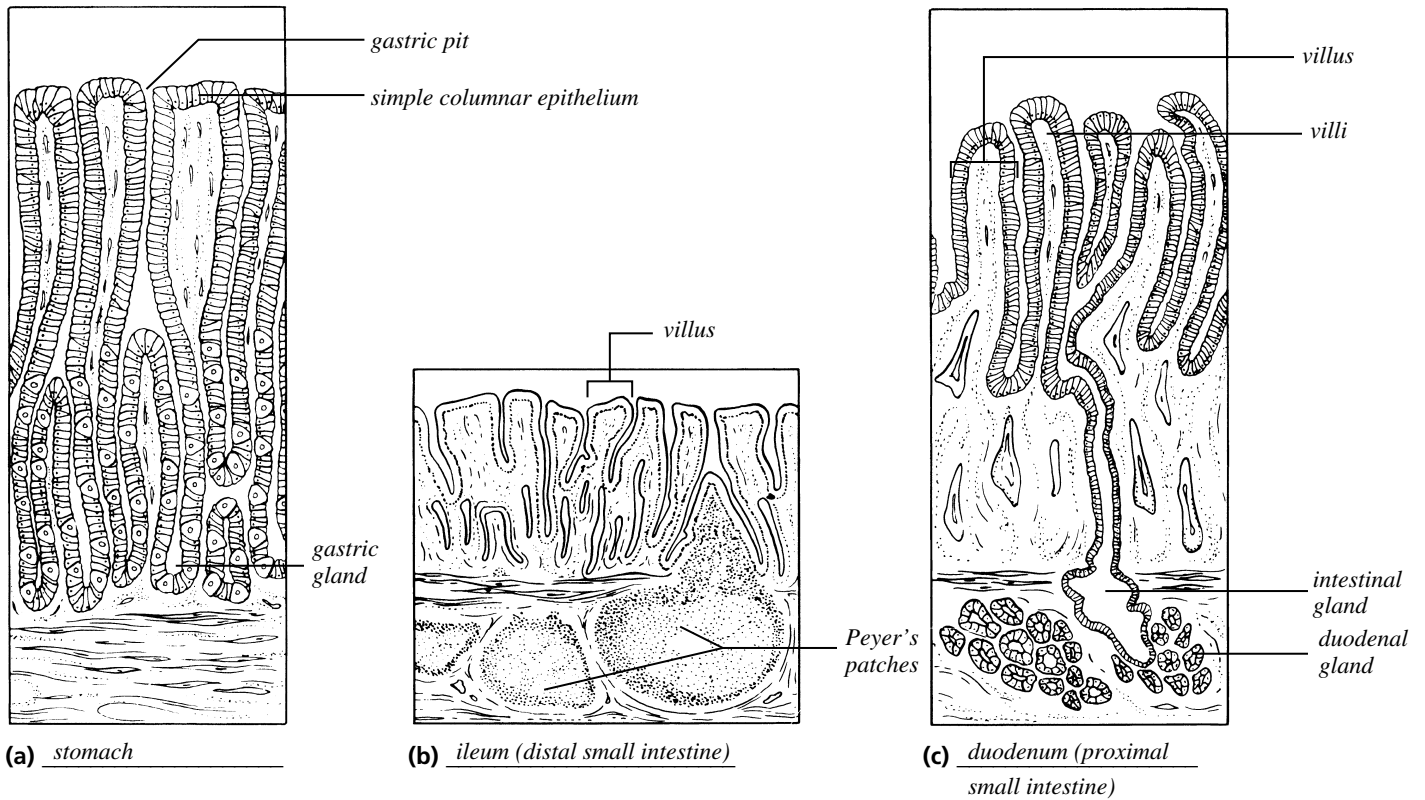
Column B

- a. anus
- b. appendix
- c. circular folds
- d. esophagus
- e. frenulum
- f. greater omentum
- g. hard palate
- h. haustra
- i. ileocecal valve
- j. large intestine
- k. lesser omentum
- l. mesentery
- m. microvilli
- n. oral cavity
- o. oral vestibule
- p. parietal peritoneum
- q. Peyer’s patches
- r. pharynx
- s. pyloric valve
- t. rugae
- u. small intestine
- v. soft palate
- w. stomach
- x. tongue
- y. villi
- z. visceral peritoneum

7. Correctly identify all organs depicted in the diagram below.

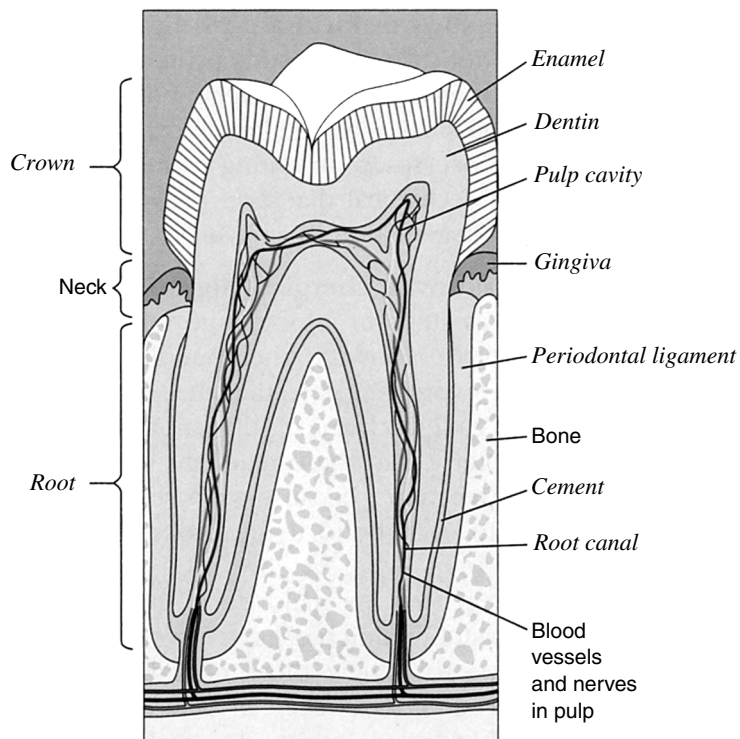


8. You have studied the histologic structure of a number of organs in this laboratory. Three of these are diagrammed below. Identify and correctly label each.



Accessory Digestive Organs

9. Correctly label all structures provided with leader lines in the diagram of a molar below. (Note: Some of the terms in the key for question 10 may be helpful in this task.)



10. Use the key to identify each tooth area described below.

- c _____ 1. visible portion of the tooth in situ
- b _____ 2. material covering the tooth root
- e _____ 3. hardest substance in the body
- h _____ 4. attaches the tooth to bone and surrounding alveolar structures
- j _____ 5. portion of the tooth embedded in bone
- d _____ 6. forms the major portion of tooth structure; similar to bone
- g _____ 7. produces the dentin
- i _____ 8. site of blood vessels, nerves, and lymphatics
- a _____ 9. entire portion of the tooth covered with enamel

- Key:
- a. anatomical crown
 - b. cement
 - c. clinical crown
 - d. dentin
 - e. enamel
 - f. gingiva
 - g. odontoblast
 - h. periodontal ligament
 - i. pulp
 - j. root

11. In the human, the number of deciduous teeth is 20; the number of permanent teeth is 32

12. The dental formula for permanent teeth is $\frac{2,1,2,3}{2,1,2,3} \times 2$

Explain what this means. There are 2 incisors, 1 canine, 2 premolars, and 3 molars in each jaw (upper and lower) from the median line posteriorly.

What is the dental formula for the deciduous teeth? $\frac{2, 1, 0, 2}{2, 1, 0, 2} \times 2 = 20$

13. Which teeth are the “wisdom teeth”? The number 3 (most posterior) molars

14. Various types of glands form a part of the alimentary tube wall or duct their secretions into it. Match the glands listed in column B with the function/locations described in column A.

Column A

- a _____ 1. produce(s) mucus; found in the submucosa of the small intestine
- f _____ 2. produce(s) a product containing amylase that begins starch breakdown in the mouth
- e _____ 3. produce(s) many enzymes and an alkaline fluid that is secreted into the duodenum
- d _____ 4. produce(s) bile that it secretes into the duodenum via the bile duct
- b _____ 5. produce(s) HCl and pepsinogen
- c _____ 6. found in the mucosa of the small intestine; produce(s) intestinal juice

Column B

- a. duodenal glands
- b. gastric glands
- c. intestinal crypts
- d. liver
- e. pancreas
- f. salivary glands

15. Which of the salivary glands produces a secretion that is mainly serous? Parotid

16. What is the role of the gallbladder? To store and concentrate bile made by the liver
17. Name three structures always found in the portal triad regions of the liver. Branch of the bile duct,
branch of hepatic artery, and branch of hepatic portal vein
18. Where would you expect to find the stellate macrophages of the liver? Lining the sinusoids
What is their function? Phagocytosis of debris and worn-out blood cells
19. Why is the liver so dark red in the living animal? Because it is a blood reservoir
20. The pancreas has two major populations of secretory cells—those in the islets and the acinar cells. Which population serves the digestive process? Acinar cells