

## Chapter 14 The Digestive System

### OVERVIEW

The purpose of this chapter is to teach the anatomy and physiology of the digestive system and to present select concepts associated with pathophysiology or disease issues of the digestive system. The digestion of a cheeseburger is used as a vehicle to describe and explain digestion. A cheeseburger is used because it is something most students can relate to (whether the burger is beef, turkey, or soy), and because it clearly contains three types of organic molecules: carbohydrates (bun), protein (burger), and lipids (cheese). The chemical composition of the bun, burger, and cheese is more complex than just stated, but chemical analysis of food is not the intent here. This chapter is using the cheeseburger as a simple model for the digestion of carbohydrates, proteins, and lipids.

In other system chapters, anatomy for the whole system was covered first and then the physiology. In this chapter the anatomy is broken down by sections of the alimentary canal in the order of the cheeseburger's path. After the anatomy in each section is described the physiology of digestion in that section is explained.

Chapter figures can be found in the Online Learning Center (OLC). Discussion points, group activities, and quizzes listed in the summary table below are explained under their individual outcomes following the table. Answer keys to the text chapter review questions, workbook concept maps, and workbook review questions are located at the end of the chapter.

A review guide is also available on the OLC. This guide lists all of the learning outcomes for the chapter and gives space for students to take notes and make sketches. This can be an important tool to encourage students to pay attention to what they are learning and to use to either take initial notes or to organize their existing notes before exams.

Learning Outcome	CAAHEP Competencies	ABHES Competencies
14.1 Use medical terminology related to the digestive system.	I.C.1. Describe structural organization of the human body	3.a. Define and use entire basic structure of medical words and be able to accurately identify in the correct context, i.e., root, prefix, suffix, combinations, spelling and definitions
14.2 Differentiate between mechanical digestion and chemical digestion.	I.C.2. Identify body systems	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.3 Describe the digestive anatomy of the oral cavity.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

14.4 Explain the physiology of mechanical and chemical digestion in the mouth.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.5 Describe the digestive anatomy from the mouth to the stomach.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.6 Explain how materials move from the mouth to the stomach.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.7 Describe the digestive anatomy of the stomach.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.8 Explain the physiology of mechanical and chemical digestion in the stomach.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.9 Explain the feedback mechanism of how food moves from the stomach to the small intestine.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.10 Describe the anatomy of the digestive accessory organs connected to the duodenum by ducts.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.11 Describe the digestive anatomy of the small intestine.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.12 Explain the physiology of chemical digestion in the duodenum, including the hormones and digestive secretions involved.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.13 Explain how nutrients are absorbed in the small intestine.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.14 Describe the anatomy of the large intestine.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.15 Explain the physiology of the large intestine in terms of absorption, preparation of feces, and defecation.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.16 Summarize the types of nutrients absorbed by the digestive system from the	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their

diet.		common diseases, symptoms and etiologies.
14.17 Trace the circulation of the nutrients once they have been absorbed.	I.C.4. List major organs in each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.18 Explain the control of digestion.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.19 Summarize the functions of digestion.	I.C.5. Describe the normal function of each body system	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.20 Summarize the effects of aging on the digestive system.	I.C.10. Compare body structure and function of the human body across the life span	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.21 Describe common diagnostic tests used for digestive system disorders.	I.C.7. Analyze pathology as it relates to the interaction of body systems	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.
14.22 Describe digestive system disorders and relate abnormal function to pathology.	I.C.7. Analyze pathology as it relates to the interaction of body systems	2.b. Identify and apply the knowledge of all body systems, their structure and functions, and their common diseases, symptoms and etiologies.

SUMMARY TABLE 14

LEARNING OUTCOME	LECTURE OUTLINE	ACTIVITIES – TALKING POINTS	ASSESSMENTS
14.1 Use medical terminology related to the digestive system.		<b>Talking Point:</b> The best way to study the digestive system is to follow carbohydrates, protein, and lipids through the GI tract and discuss the structures as food passes through them.	<b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>Word Deconstruction: 1-5</li> </ul>
14.2 Differentiate between mechanical digestion and chemical digestion.	I. Overview	<b>WkBk Lab Exercises and Activities:</b> <ul style="list-style-type: none"> <li>Digestion of a cheeseburger</li> </ul> Figure 14.5 (The alimentary canal) Table 14.1 (Chemical digestion of a cheeseburger)	<b>Spot Check:</b> 1 <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>Matching: 1-3</li> <li>Completion: 2</li> </ul>

		<b>WkBk Concept Maps:</b> Figure 14.6 (Digestion begins in the mouth concept map)	
14.3 Describe the digestive anatomy of the oral cavity.	II. Anatomy and physiology of the digestive system A. Anatomy in the mouth 1. Oral cavity 2. Teeth 3. Tongue 4. Salivary glands  <b>Chapter Figures:</b> 14.2 (The alimentary canal, showing relative lengths of each section) 14.3 (The digestive system, including accessory structures) 14.4 (The oral cavity) 14.5 (Teeth of the upper jaw) 14.6 (Cadaver skull of a child, showing permanent teeth and deciduous teeth) 14.7 (Anatomy of a tooth) 14.8 (Salivary glands)	<b>WkBk Coloring Book:</b> <ul style="list-style-type: none"> <li>• Anatomy of a tooth</li> <li>• Salivary glands</li> </ul> <b>WkBk figures:</b> 14.2 (The anatomy of a tooth) 14.3 (The salivary glands)	<b>Spot Check: 2</b>  <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>• MS: 1</li> </ul>

14.4 Explain the physiology of mechanical and chemical digestion in the mouth.	B. Physiology of digestion in the mouth	<b>WkBk Lab Exercises and Activities:</b> <ul style="list-style-type: none"> <li>Digestion of a cheeseburger</li> </ul> Figure 14.5 (The alimentary canal) Table 14.1 (Chemical digestion of a cheeseburger)  <b>WkBk Concept Maps:</b> Figure 14.6 (Digestion begins in the mouth concept map)	<b>Spot Check:</b> 3  <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>MS: 2</li> </ul>
14.5 Describe the digestive anatomy from the mouth to the stomach.	C. Anatomy from the mouth to the stomach <ol style="list-style-type: none"> <li>Pharynx</li> <li>Epiglottis</li> <li>Esophagus</li> </ol> <b>Chapter Figure:</b> 14.9 (The walls of the esophagus inferior to the diaphragm) 14.10 (Swallowing)	<b>WkBk Coloring Book:</b> Figures: 14.1 (Digestive tract)	<b>Spot Check:</b> 4  <b>Quiz:</b> 1 (Covers LOs 14.3-14.5. See Individual Outcome 14.5).  <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>Completion: 3</li> </ul>
14.6 Explain how materials move from the mouth to the stomach.	D. Physiology of digestion from the mouth to the stomach  <b>Chapter Figure:</b> 14.10 (Swallowing)	<b>WkBk Concept Maps:</b> <ul style="list-style-type: none"> <li>From the mouth to the stomach</li> </ul> Figure 14.7 (From the mouth to the stomach concept map)	<b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>Completion: 4</li> </ul>
14.7 Describe the digestive anatomy of the stomach.	E. Anatomy of the stomach <ol style="list-style-type: none"> <li>Mucous cells</li> </ol>	<b>Talking Point:</b> The lack of intrinsic factor is a cause of pernicious anemia (discussed in Chapter 10).	<b>Quiz:</b> 2 (Covers LO 14.7. See Individual Outcome

	2. Endocrine cells 3. Parietal cells 4. Chief cells 5. Regenerative cells  <b>Chapter Figures:</b> 14.11 (Anatomy of the stomach) 14.12 (Gastric pits and gastric glands)		14.7.)  <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>MS: 4</li> </ul>
14.8 Explain the physiology of mechanical and chemical digestion in the stomach.	F. Physiology of digestion in the stomach	<b>WkBk Lab Exercises and Activities:</b> <ul style="list-style-type: none"> <li>Digestion of a cheeseburger</li> </ul> Figure 14.5 (The alimentary canal) Table 14.1 (Chemical digestion of a cheeseburger)  <b>WkBk Concept Maps:</b> Figure 14.8 (Digestion in the stomach concept map)	<b>Spot Check: 5</b> <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>MS: 5, 8</li> </ul>
14.9 Explain the feedback mechanism of how food moves from the stomach to the small intestine.		<b>Talking Point:</b> Many students come to the class believing that digestion takes place in the stomach. It is important to stress that chemical digestion only partially happens in the stomach.  <b>Discussion Point:</b> Stomach. See Individual Outcome 14.9.	<b>Spot Check: 7</b> <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>MS: 6</li> </ul>

		<b>WkBk Coloring Book:</b> Figures: 14.4 (Digestive tract)	
14.10 Describe the anatomy of the digestive accessory organs connected to the duodenum by ducts.	<p>G. Anatomy of digestive accessory structures</p> <ol style="list-style-type: none"> <li>1. Liver</li> <li>2. Common bile duct</li> <li>3. Gallbladder</li> <li>4. Pancreas</li> </ol> <p><b>Chapter Figures:</b></p> <p>14.13 (Gross anatomy of the liver)</p> <p>14.14 (Hepatic lobule)</p> <p>14.15 (Gross anatomy of the gallbladder, pancreas, and bile ducts)</p> <p><b>Table:</b></p> <p>14.2 (Digestive juices from the liver, gallbladder, and pancreas)</p>	<p><b>WkBk Coloring Book:</b></p> <p>Figures: 14.4 (Gallbladder, pancreas, and ducts)</p> <p><b>Talking Point:</b> Stress to students that the word “gallbladder” is one word whereas the words “urinary bladder” are two words.</p>	<p><b>Spot Check:</b> 6</p> <p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>• MS: 7</li> </ul>
14.11 Describe the digestive anatomy of the small intestine.	<p>H. Anatomy of the small intestine</p> <ol style="list-style-type: none"> <li>1. Duodenum</li> </ol>	<b>Talking Point:</b> Discuss how the small intestine does more digestion than the stomach.	<p><b>Quiz:</b> 3</p> <p>(Covers LOs 14.9-14.11. See Individual Outcome 14.11).</p>

	2. Jejunum 3. Ileum  <b>Chapter Figures:</b> 14.16 (Gross anatomy of the small intestine) 14.17 (Intestinal villi)		Figure IMQ14.3  <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>• Critical Thinking: 3</li> </ul>
14.12 Explain the physiology of chemical digestion in the duodenum, including the hormones and digestive secretions involved.	I. Physiology of digestion in the small intestine <ul style="list-style-type: none"> <li>1. hormone secretin</li> <li>2. hormone cholecystokinin (CCK)</li> </ul> <b>Chapter Figure:</b> 14.18 (Segmentation and peristalsis of the small intestine)	<b>Discussion Point:</b> Cholecystectomy. (See Individual Outcome 14.12.)  <b>WkBk Lab Exercises and Activities:</b> <ul style="list-style-type: none"> <li>• Digestion of a cheeseburger</li> </ul> Figure 14.5 (The alimentary canal) Table 14.1 (Chemical digestion of a cheeseburger)  <b>WkBk Concept Maps:</b> Figure 14.9 (Digestion in the small intestine concept map)  <b>Talking Point:</b> Perhaps the best way to keep all the digestive enzymes and digestive hormones straight, have students make a chart (columnar chart).  <b>Talking Point:</b> Be sure to remind students that just like the hormones discussed in the endocrine chapter,	<b>Spot Check:</b> 8  <b>WkBk Chapter Review Questions:</b> <ul style="list-style-type: none"> <li>• Critical Thinking: 2</li> </ul>



		<p>these hormones also follow the same concept of:</p> <p>Identify the hormone</p> <p>Identify what structure produced it</p> <p>Identify its target</p> <p>Identify its function</p>	
14.13 Explain how nutrients are absorbed in the small intestine.	3. Absorption of nutrients in the small intestine	<p><b>WkBk Concept maps:</b></p> <p>14.10 (Absorption of nutrients in the small intestine concept map)</p>	<p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>MS: 9</li> </ul>
14.14 Describe the anatomy of the large intestine.	<p>J. Anatomy of the large intestine</p> <ol style="list-style-type: none"> <li>Cecum</li> <li>Ascending colon</li> <li>Transverse colon</li> <li>Descending colon</li> <li>Sigmoid colon</li> <li>Rectum</li> </ol> <p><b>Chapter Figure:</b></p> <p>14.19 (The large intestine)</p>		<p><b>Spot Check:</b> 9</p> <p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>Critical Thinking: 3</li> </ul>
14.15 Explain the physiology of the large intestine in terms of absorption, preparation of feces, and defecation.	<p>K. Physiology of digestion in the large intestine</p> <p><b>Chapter Figure:</b></p> <p>14.20 (Reflex arc for the</p>	<p><b>WkBk Concept Maps:</b></p> <p>Figure 14.11 (Digestion in the large intestine concept map)</p> <p><b>Talking Point:</b> Discuss the issues of constipation and</p>	<p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>MS: 10</li> </ul>

	defecation reflex)	diarrhea.  <b>Talking Point:</b> Use a picture of the large intestine to discuss how a colonoscopy is performed.  <b>Talking Point:</b> Discuss (as a review) that there are bacteria living in the large intestine that are involved in producing products necessary for blood clotting.	
14.16 Summarize the types of nutrients absorbed by the digestive system from the diet.	L. Types of absorbed nutrients  1. Proteins 2. Carbohydrates 3. Lipids 4. Vitamins 5. Minerals	<b>Group Activity:</b> Trace the cheeseburger. (See Individual Outcome 14.16)  <b>Talking Point:</b> Have students ponder on this: How would a shorter small intestine affect the absorption of nutrients and how would fewer villi affect the absorption of nutrients.	<b>WkBk Chapter Review Questions:</b>  • MS: 3
14.17 Trace the circulation of the nutrients once they have been absorbed.	M. Circulation of absorbed nutrients  <b>Chapter Figure:</b> 14.21(Veins of the hepatic portal system)	<b>WkBk Concept Maps:</b> Figure 14.10 (Absorption of nutrients in the small intestine concept map)	<b>WkBk Chapter Review Questions:</b>  • Completion: 5
14.18 Explain the control of digestion.	N. Control of digestion		<b>WkBk Chapter Review Questions:</b>  • Completion:1
14.19 Summarize the functions of digestion.	O. Functions of the digestive system		<b>WkBk Chapter Review Questions:</b>  • Matching: 1-5

	1. Ingestion 2. Digestion 3. Absorption 4. Defecation  <b>Figure:</b> 14.22 (Lisa)		
14.20 Summarize the effects of aging on the digestive system.	III. Effects of aging on the digestive system		<b><i>WkBk Chapter Review Questions:</i></b> <ul style="list-style-type: none"> <li>• Critical Thinking: 1</li> </ul>
14.21 Describe common diagnostic tests used for digestive system disorders.	IV. Diagnostic tests for digestive system disorders A. Barium swallow B. Colonoscopy C. CT D. Fecal occult blood test E. Hepatic screening F. Laparoscopy G. MRI H. Proctoscopy I. Sigmoidoscopy J. Stool culture K. Ultrasound  <b>Table:</b> 14.3 (Common diagnostic		<b><i>WkBk Chapter Review Questions:</i></b> <ul style="list-style-type: none"> <li>• Matching: 6-10 1</li> </ul> <b>Case Study: 3</b>

	tests for digestive system disorders)		
14.22 Describe digestive system disorders and relate abnormal function to pathology..	<p>V. Digestive system disorders</p> <p>A. Leukoplakia</p> <p>B. Gastroenteritis</p> <p>C. Diverticular disease</p> <p>D. Abdominal hernias</p> <ol style="list-style-type: none"> <li>1. Inguinal hernia</li> <li>2. Umbilical hernias</li> <li>3. Incisional hernias</li> </ol> <p>E. Irritable bowel syndrome</p> <p>F. Crohn's disease</p> <p>G. Peptic ulcer</p> <ol style="list-style-type: none"> <li>1. Esophageal ulcers</li> <li>2. Gastric ulcers</li> <li>3. Duodenal ulcers</li> </ol> <p>H. Intussusception</p> <p>I. Cirrhosis</p> <p>J. Hepatitis</p> <ol style="list-style-type: none"> <li>1. Hepatitis A</li> <li>2. Hepatitis B</li> <li>3. Hepatitis C</li> <li>4. Hepatitis D</li> <li>5. Hepatitis E</li> </ol> <p>K. Vomiting</p>	<p><b>Group Activity:</b> Weight loss plans. (See Individual Outcome 14.21.)</p>	<p><b>WkBk Chapter Review Questions:</b></p> <ul style="list-style-type: none"> <li>• Matching: 6-10 1</li> </ul> <p><b>Case Study:</b> 1, 2, 4</p>

	<div>L. Food poisoning</div> <div>1. Staphylococcal food poisoning</div> <div>2. Salmonellosis</div> <div>3. Botulism</div> <div>M. Parasites</div> <div>1. Pinworms</div> <div>2. Tapeworms</div> <div>3. Round worms</div> <div>4. Giardia</div> <div>N. Malabsorption</div> <div><b>Figures:</b></div> <div>14.23 (Leukoplakia)</div> <div>14.24 (Diverticula in the large intestine)</div> <div>14.25 (Diverticular disease)</div> <div>14.26 (Peptic ulcers)</div> <div>14.27 (Intussusception)</div> <div>14.28 (Adult tapeworm)</div> <div>14.29 (Roundworms)</div> <div><b>Table 14.4:</b></div> <div>Summary of diseases and disorders of the digestive system)</div>		
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## INDIVIDUAL OUTCOMES

### OUTCOME 14.2

**Spot Check 1:** What would be the end result of mechanical digestion of a complex carbohydrate compared to the end result of chemical digestion of a complex carbohydrate?

*Answer: Mechanical digestion of a complex carbohydrate results in small pieces of complex carbohydrates, while chemical digestion of a complex carbohydrate results in monosaccharides.*

### OUTCOME 14.3

**Spot Check 2:** How many teeth do you have in your mouth? If you do not have 32 teeth, which teeth are missing?

*Answer: Answers will vary.*

### OUTCOME 14.4

**Spot Check 3:** Saliva is secreted when you are chewing gum. How might chewing sugarless gum prevent the formation of dental caries?

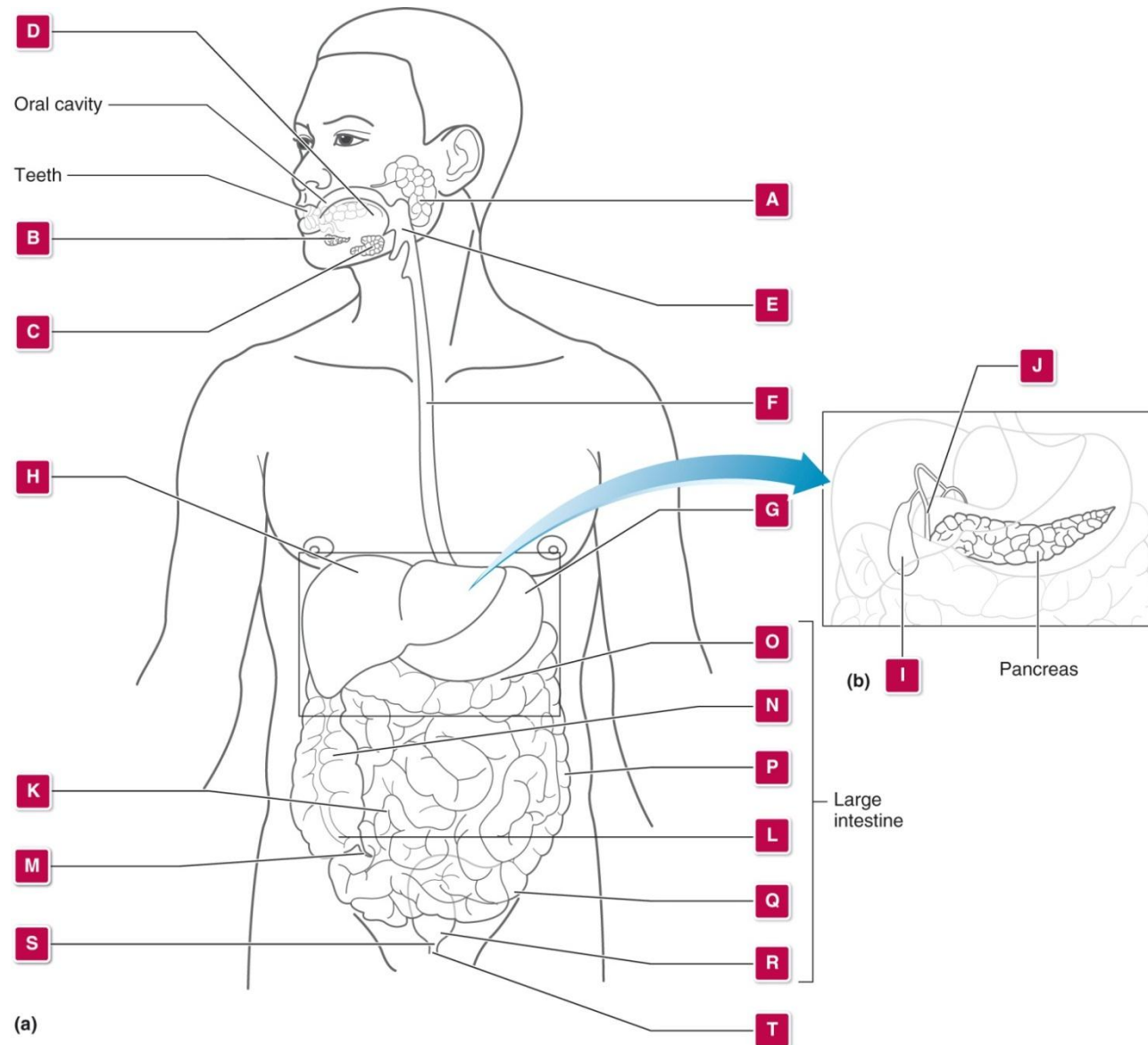
*Answer: Caries form when acids from bacteria erode a tooth's enamel. Lysozymes and antibodies in saliva inhibit bacteria growth. Chewing sugarless gum increases the amount of saliva, and therefore lysozymes and antibodies, without contributing to the feeding of bacteria.*

**OUTCOME 14.5**

**Spot Check 4:** Trace the bite of cheeseburger from the oral cavity to the stomach. What is the swallowed bite called?

*Answer: The bolus travels from the oral cavity, to the oropharynx, to the laryngopharynx, to the esophagus, and to the stomach.*

Quiz: 1





1. Identify A.
2. What does A produce that will start chemical digestion in the mouth?
3. What will that product from A partially digest?
4. What else does A produce for chemical digestion, not in the mouth?
5. What does that product from A partially digest?
6. Where will that digestion take place?
7. Why doesn't it take place in the mouth?
8. What will the food be called when it is swallowed?
9. Identify F.
10. How do materials move through F?

*Parotid gland*

*Amylase*

*Carbohydrates*

*Lingual lipase*

*Lipids*

*In the stomach*

*Lingual lipase requires a lower pH*

*Bolus*

*Esophagus*

*Peristalsis*

**OUTCOME 14.7**

**Quiz: 2**

What am I?

- |   |                      |
|---|----------------------|
| 1. I produce bile.                                | <i>Liver</i>         |
| 2. I am a cell that produces pepsinogen.          | <i>Chief cell</i>    |
| 3. I am a cell that produces HCl.                 | <i>Parietal cell</i> |
| 4. I am a cell that produces intrinsic factor.    | <i>Parietal cell</i> |
| 5. I emulsify lipids.                             | <i>Bile</i>          |
| 6. I change iron to a usable form.                | <i>HCl</i>           |
| 7. I change pepsinogen to pepsin.                 | <i>HCl</i>           |
| 8. I activate lingual lipase.                     | <i>HCl</i>           |
| 9. I tell chief cells to make their products.     | <i>Gastrin</i>       |
| 10. I tell parietal cells to make their products. | <i>Gastrin</i>       |

**OUTCOME 14.8**

**Spot Check 5:** Consider the composition of muscle tissue. What would happen to the walls of the stomach if the stomach did not have the protective mechanisms mentioned earlier?

*Answer: The lingual lipase and gastric lipase would digest cell membranes and the pepsin that forms in the stomach would begin to chemically digest the proteins of the smooth muscle walls.*

**OUTCOME 14.9**

**Spot Check 7:** How much chyme is allowed to enter the duodenum at one time?

*Answer: 3 mL.*

**Discussion Point:** Stomach. Food passes through the esophagus, but is retained in the stomach. Why? How is material kept in the stomach? What happens to it while it is in the stomach? When and how does it leave the stomach?

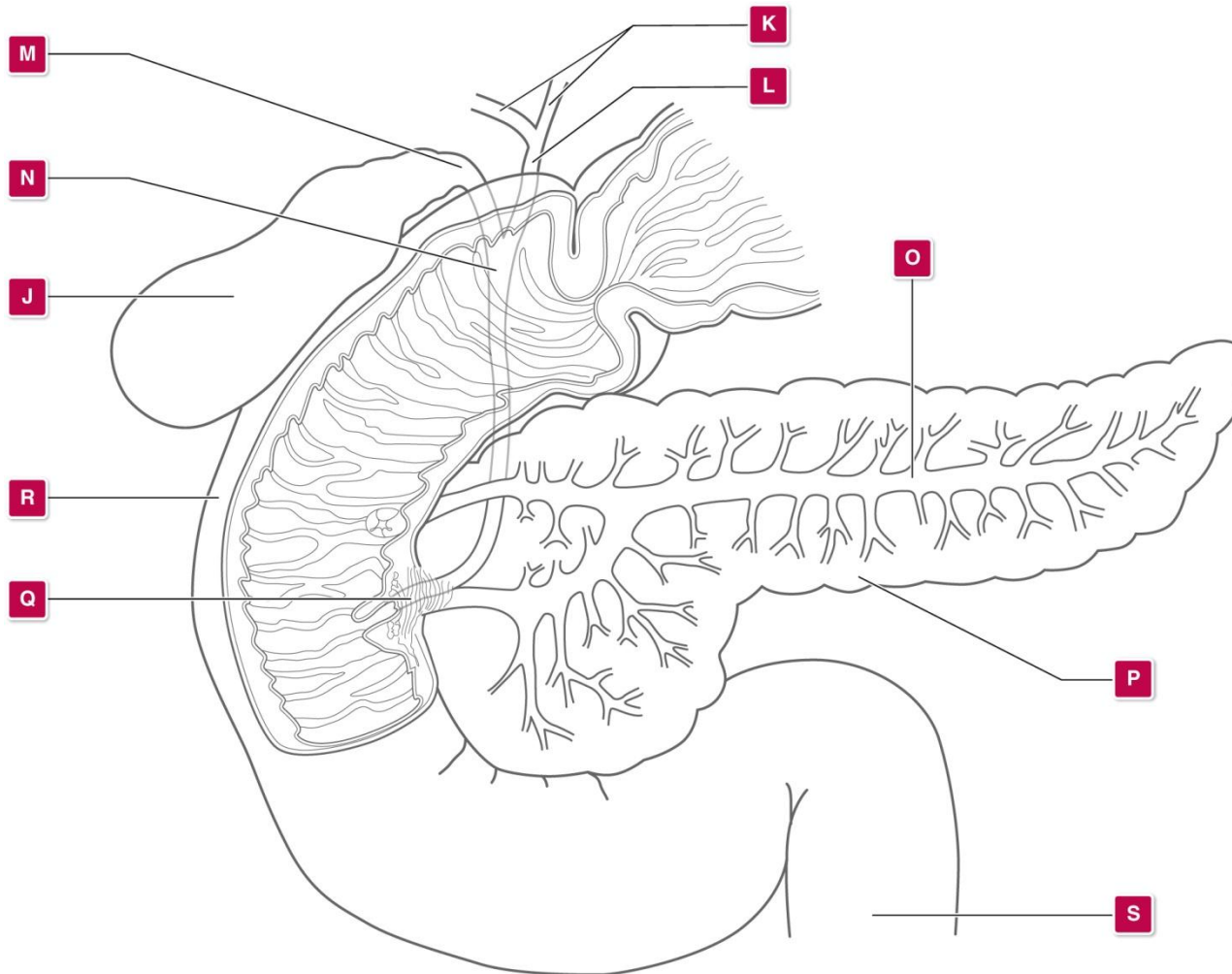
**OUTCOME 14.10**

**Spot Check 6:** What fluid(s) flow(s) through the cystic duct? What fluid(s) flow(s) through the common bile duct? What fluid(s) flow(s) through the pancreatic duct?

*Answer: Bile flows through the cystic duct. Bile flows through the common bile duct. Bicarbonate ions, and enzymes for carbohydrate, protein, and lipid digestion flow through the pancreatic duct.*

OUTCOME 14.11

Quiz: 3



## IM Ch 14

- |  |                             |
|--|-----------------------------|
| 1. Identify R.   | <i>Duodenum</i>             |
| 2. What enters R from the stomach?                             | <i>Chyme</i>                |
| 3. What is the pH of the material entering R from the stomach? | <i>Around 2</i>             |
| 4. Identify P.   | <i>Pancreas</i>             |
| 5. What does P secrete to neutralize the contents of R?        | <i>Bicarbonate ions</i>     |
| 6. Identify K.   | <i>Hepatic ducts</i>        |
| 7. What travels through K?                                     | <i>Bile</i>                 |
| 8. Identify J.   | <i>Gallbladder</i>          |
| 9. What does J secrete to aid in digestion?                    | <i>Bile</i>                 |
| 10. How does that secretion aid in digestion?                  | <i>It emulsifies lipids</i> |

### OUTCOME 14.12

**Spot Check 8:** How does cholecystokinin help the bicarbonate ions and enzymes from the pancreas reach the duodenum?

*Answer: Cholecystokinin causes the hepatopancreatic sphincter to relax so the bicarbonate ions and enzymes from the pancreas can enter the duodenum.*

**Discussion Point:** Cholecystectomy. What happens to digestion if the gallbladder is removed? How would the diet need to be modified?

*The gallbladder stores and concentrates bile, which is released when lipids enter the duodenum. Bile emulsifies lipids in the duodenum so chemical digestion can take place. A cholecystectomy removes the gallbladder, but not the source for bile, which is the liver. The liver still produces bile, but without a gallbladder, there is no storage for the bile. Therefore only small amounts of bile are available at a time. A low fat diet would be necessary.*

#### OUTCOME 14.14

**Spot Check 9:** A major function of the small intestine is to absorb nutrients. Given what you have just read about the anatomy of the large intestine, do you think the large intestine will have a similar function? Explain.

*Answer: Answers will vary. The larger diameter and lack of villi would suggest that the large intestine is not designed for nutrient absorption.*

#### OUTCOME 14.16

**Group Activity:** Trace the cheeseburger.

Divide the class into groups of three. Each group is to put their texts and notes aside and construct a list of steps a cheeseburger goes through during its digestion through this system. The list should include the anatomy encountered, the type of digestion in each location, the digestive juices involved, the absorption of nutrients, and the elimination of that which was not absorbed. Once all groups are finished, a class list is created by calling on individuals from each group.

#### OUTCOME 14.21

**Group Activity:** Weight loss plans.

Tapeworms have been used as an extreme weight loss plan in which the worm consumes the food going by, preventing it from being absorbed. Information about this and other extreme weight loss can be obtained on the Internet. Divide the class in groups. Have the class develop a list of extreme weight loss plans to be researched. Once the class list has been developed, each group selects an extreme weight loss plan from the list to research how the plan works with regard to the anatomy and physiology of the digestive system.

**Case Study 3:** What diagnostic tests are used to determine whether a patient has Crohn's disease?

*Answer: The following test might be used to determine if a patient has Crohn's disease: barium enema, colonoscopy, CT scan, endoscopy, MRI, and a sigmoidoscopy.*

**OUTCOME 14.22**

**Case Study**

1. What is Crohn's disease?

*Answer: This is an autoimmune disease that causes chronic inflammation along the gastrointestinal tract.*

2. What symptoms does the disease cause?

*Answer: Symptoms include abdominal cramping, fever, fatigue, diarrhea, and weight loss.*

4. How is Crohn's disease treated?

*Answer: Treatment involves dietary change, medication, and possibly surgery.*

## ANSWER KEYS

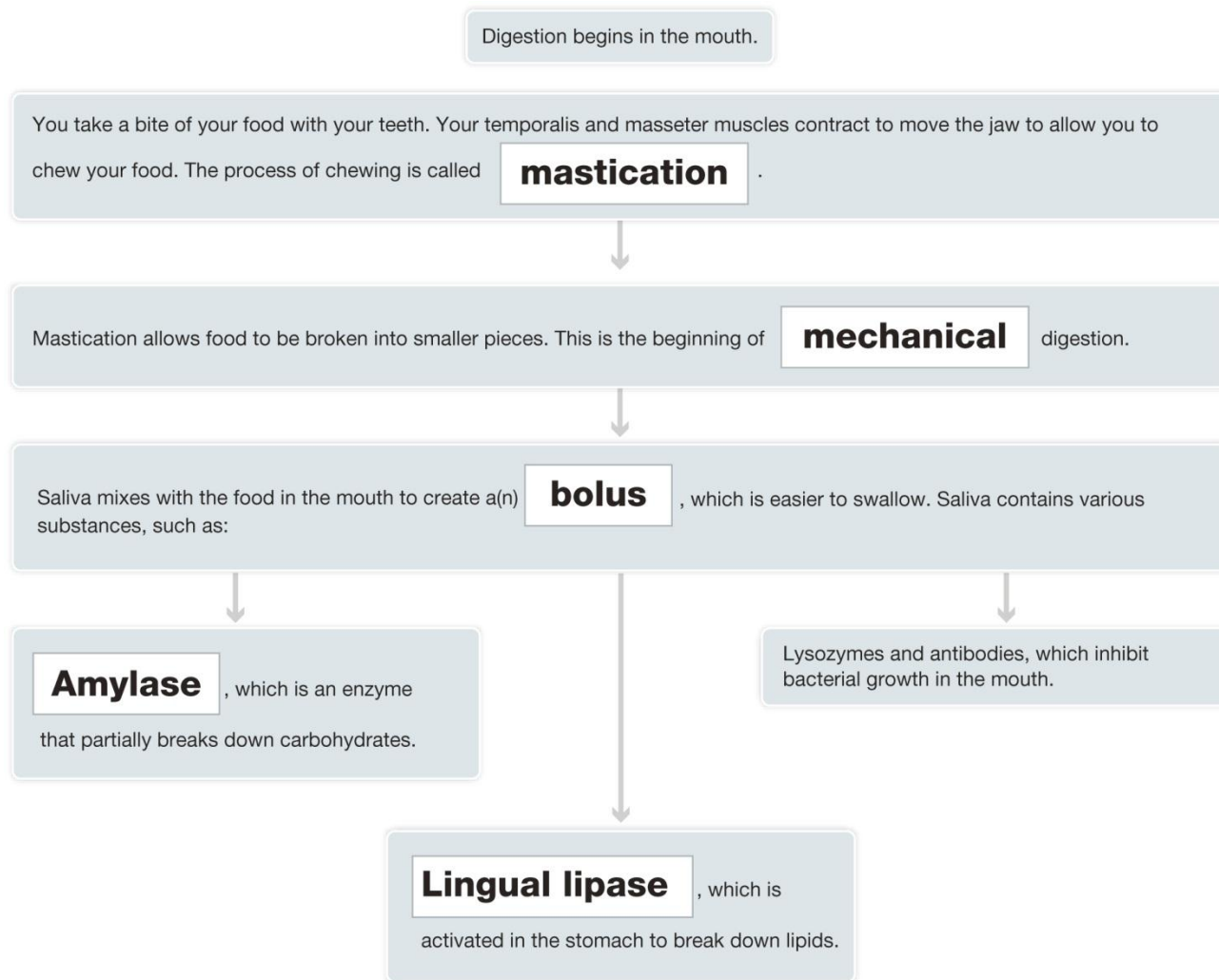
### Chapter Review Questions

1. A
2. B
3. A
4. B
5. B
6. A
7. B
8. D
9. C
10. B
11. B
12. A
13. A
14. D
15. D
16. A
17. A
18. D
19. B
20. B
21. D
22. A

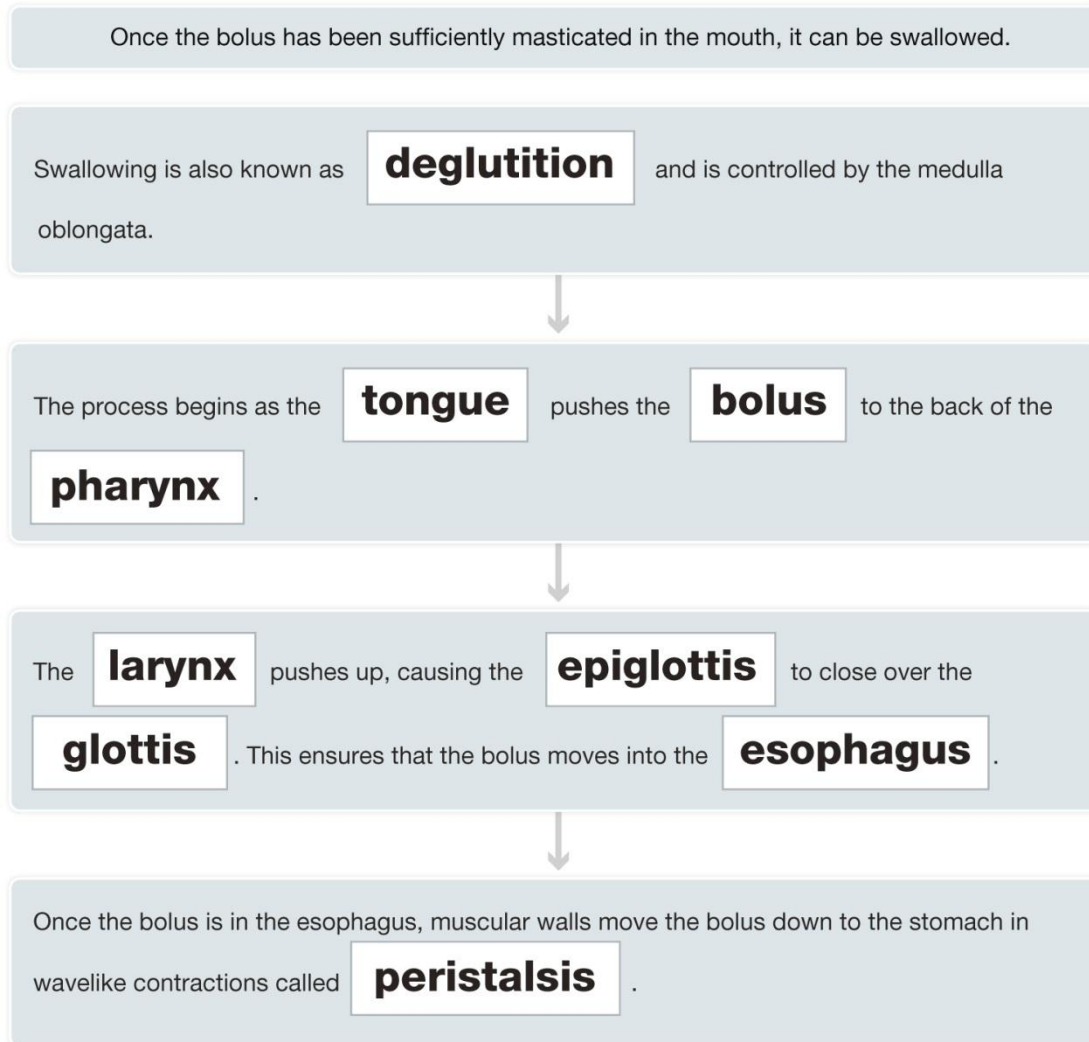


## Workbook Concept Maps

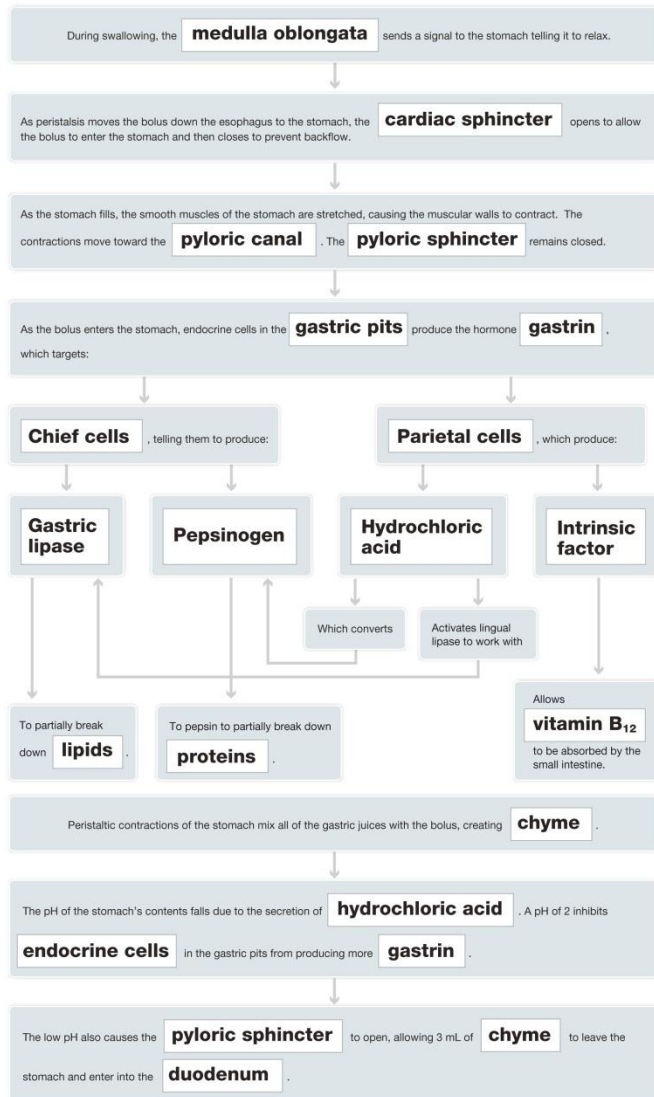
## Digestion begins in the mouth



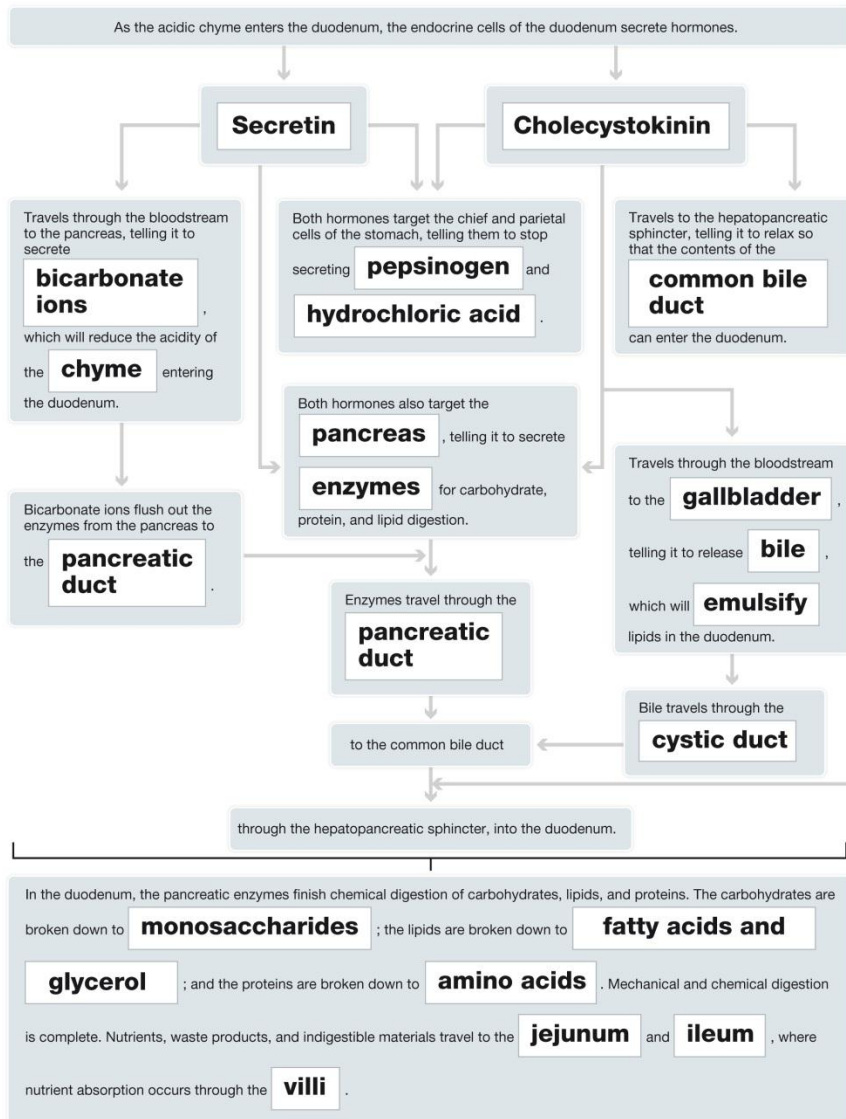
**From the mouth to the stomach**



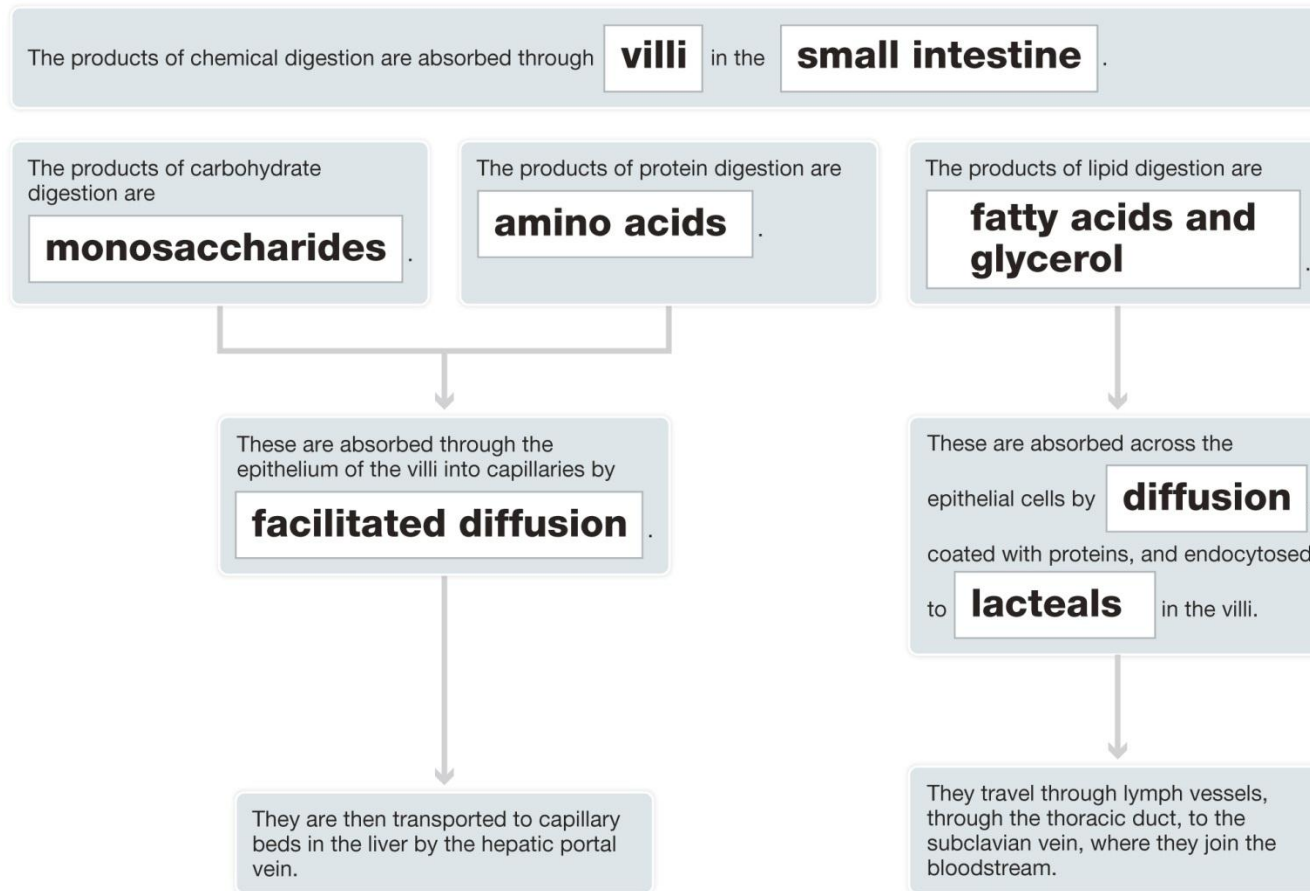
## Digestion in the stomach

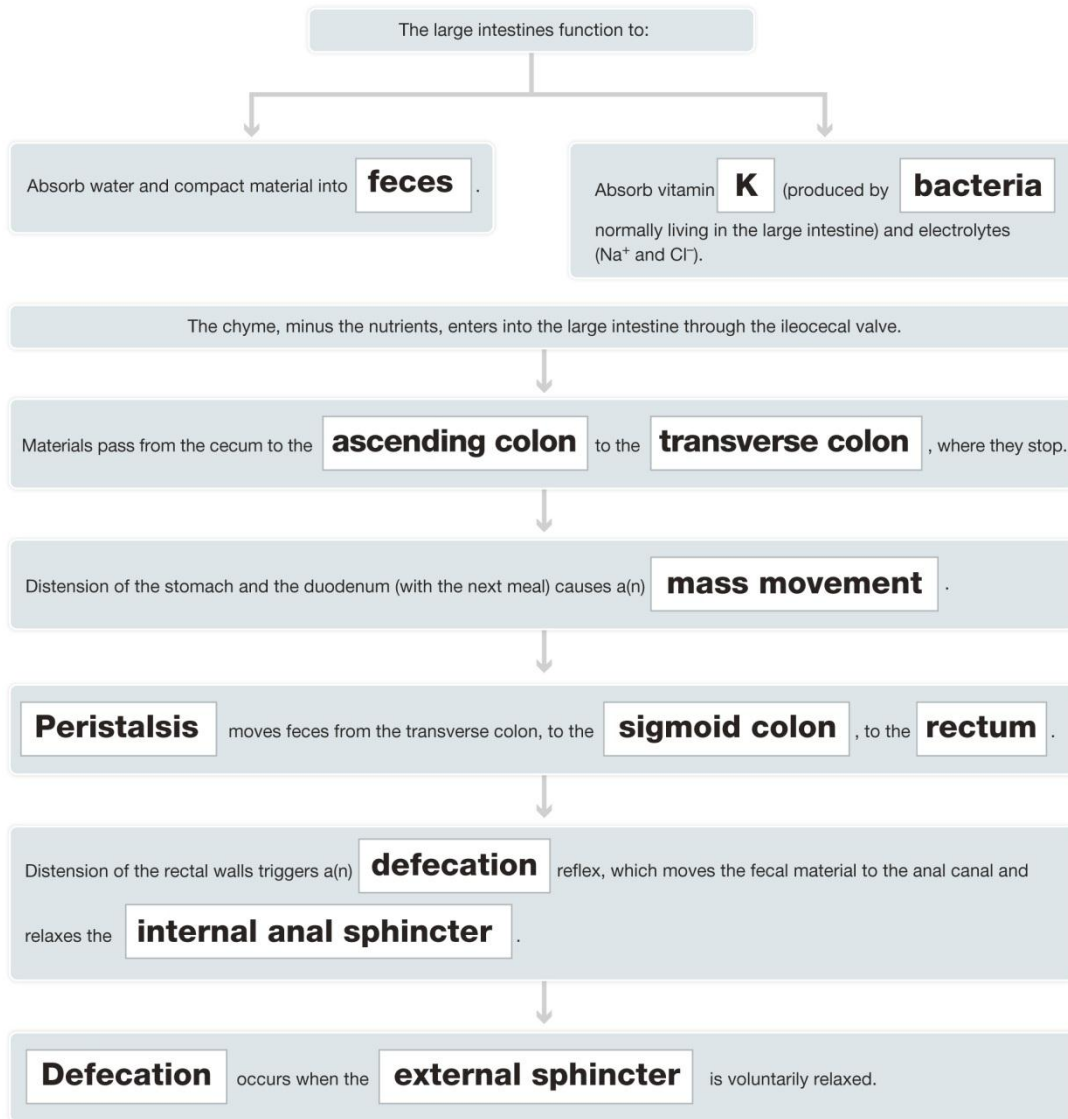


## Digestion in the small intestines



## Absorption of nutrients in the small intestine



**Digestion in the large intestine**

## WORKBOOK CHAPTER REVIEW QUESTIONS:

### Word Deconstruction:

In the textbook, you built words to fit a definition using the combining forms, prefixes, and suffixes. Here you are to break down the term into its parts (prefixes, roots, and suffixes) and give a definition. Prefixes and suffixes can be found inside the back cover of the textbook.

FOR EXAMPLE: Dermatitis: dermat/itis—inflammation of the skin

1. Emetic: Emet/ic, pertaining to vomit
2. Hepatopancreatic: Hepato/pancreat/ic, pertaining to the liver and pancreas
3. Gastroenterologist: Gastro/entero/logist, a medical professional that specializes in the diseases of the stomach and intestines
4. Dyspepsia: Dys/peps/ia, condition of painful digestion
5. Colitis: Col/itis, inflammation of the colon

### Multiple Select:

Select the correct choices for each statement. The choices may be all correct, all incorrect, or any combination of correct and incorrect.

1. What is the digestive anatomy of the oral cavity?
  - a. There are 28 teeth in a full set of permanent teeth.
  - b. A tooth fits into an alveolus.**
  - c. There is enamel in the root of a tooth.
  - d. Salivary ducts empty into the oral cavity.**

e. The uvula is an extension of the hard palate.

2. What happens in the mouth?

a. Mastication is the start of chemical digestion.

b. The chemical digestion of proteins is started.

c. Lysosomes begin chemical digestion of lipids.

d. Water is absorbed.

*e. The chemical digestion of carbohydrates is started.*

3. Which of the following types of dietary nutrients is (are) absorbed by the digestive system?

*a. Some electrolytes are absorbed throughout the small and large intestines.*

*b. Most minerals are absorbed at a constant rate.*

*c. Fat-soluble vitamins are absorbed with the products of lipid digestion.*

d. Water-soluble vitamins are absorbed through facilitated diffusion.

*e. The amount of calcium and iron absorbed by the body is regulated to meet a need.*

4. What is the anatomy of the stomach?

a. There are four layers of smooth muscle in the walls of the stomach.

*b. Gastric pits extend to form gastric glands.*

c. The opening to the stomach from the esophagus is controlled by the pyloric sphincter.



d. Rugae give extra surface area for villi in the stomach.

*e. Regenerative cells in the gastric pits and gastric glands may develop into parietal or chief cells.*

5. What happens in the stomach?

*a. Lingual lipase is activated to begin lipid digestion.*

*b. Both mechanical digestion and chemical digestion take place.*

c. Pepsin is changed to pepsinogen to start the digestion of proteins.

d. Carbohydrates are completely digested.

e. The chemical digestion of carbohydrates continues because of gastric lipase.

6. What causes chyme to move from the stomach to the small intestine?

a. An increase in pH

b. Distension of the stomach

c. Cholecystokinin

d. Secretin

*e. A decrease in pH and peristaltic contractions of the stomach*

7. Where does bile go?

*a. From hepatic ductules to the hepatic ducts*

b. From the common bile duct to the cystic duct

*c. From the cystic duct to the common bile duct*

d. From the pancreatic duct to the common bile duct

e. Through the pyloric sphincter

8. What is produced in the stomach?

*a. Chief cells produce pepsinogen.*

b. Parietal cells produce vitamin B<sub>12</sub>.

*c. Hydrochloric acid is produced by parietal cells.*

*d. Intrinsic factor is produced so that vitamin B<sub>12</sub> can be absorbed.*

e. Endocrine cells produce cholecystokinin and secretin.

9. How are nutrients absorbed in the intestine?

a. Fatty acids and glycerol are absorbed by the epithelial cells of villi through active transport.

*b. Monosaccharides are absorbed through facilitated diffusion.*

c. All nutrients are absorbed into capillaries of the villi.

d. All nutrients are absorbed by the epithelium of the villi by facilitated diffusion.

e. Only amino acids are exocytosed to lacteals.

10. What happens in the large intestine?

a. Peyer's patches destroy bacteria.

## IM Ch 14

b. Vitamin B<sub>12</sub> is produced.

**c. *Water is absorbed.***

d. Na<sup>+</sup> and Cl<sup>-</sup> are excreted.

e. Mass movements are initiated in the rectum.

### Matching:

Match the function of the digestive system to the location where it takes place. Some answers may be used more than once.

a, b, e 1. Takes place in the mouth.

a. Ingestion

b, e 2. Takes place in the stomach.

b. Mechanical digestion

b, c, e 3. Takes place in the small intestine.

c. Absorption

c, d 4. Takes place in the large intestine.

d. Defecation

d 5. Initiated in the large intestine.

e. Chemical digestion

### Matching:

Match the disorder to its description.

d 6. May result from constipation

a. *Staphylococcus*

b 7. Food poisoning resulting from a toxin

b. Botulism

c 8. Food poisoning from ingestion of bacteria

c. *Salmonella*

e 9. May result from decreased mucus production

d. Hemorrhoids

f 10. May result from a weak cardiac sphincter

e. Peptic ulcer

f. GERD

### Completion:

Fill in the blanks to complete the following statements.

1. The parasympathetic division of the autonomic nervous system stimulates digestion, and the sympathetic division inhibits digestion.
2. Mechanical digestion breaks large pieces of complex molecules into smaller pieces of complex molecules, but chemical digestion produces simpler molecules.
3. The esophagus begins with skeletal muscle, but it ends with smooth muscle in its walls.
4. A bolus moves through the esophagus because of wavelike contractions called peristalsis.
5. The products of lipid (type of organic molecule) digestion travel through the blood to the heart before traveling to the liver.

### Critical Thinking

1. What can you do to minimize the effects of aging on the digestive system?

Take good care of teeth. Eat lots of fiber.

2. Alcoholism can lead to cirrhosis of the liver and liver failure. What would be the effects on the digestive system if the liver failed to function? Which of the systems of the body (that you have studied so far) do you think would be affected the most by liver failure? Explain.

Lack of bile. Digestive system. Although the liver makes clotting factors and breaks down RBC's, there are multiple ways of clotting and the spleen can also break down RBC's. Only the liver can make bile and process the products.

3. The anatomy of the large intestine is quite different from the anatomy of the small intestine. How do the anatomical differences fit with the physiology of each of these two structures?

The small intestine is narrower and is lined by villi to maximize surface area for absorption of nutrients. The large intestine is wider and only has to absorb water, vitamin K, and some electrolyte.

**Case Study:**

1. What is Crohn's disease?

*Answer: This is an autoimmune disease of the large intestine that results in inflammation along the gastrointestinal tract.*

2. What symptoms does the disease cause?

*Answer: Some symptoms are: abdominal cramps, fever, fatigue, diarrhea, and weight loss.*

3. What diagnostic tests are used to determine whether a patient has Crohn's disease?

*Answer: Some diagnostic tests used to determine Crohn's disease are: barium swallow, colonoscopy, CT scan, endoscopy, MRI, sigmoidoscopy, and stool cultures.*

4. How is Crohn's disease treated?

*Answer: Treatments could include: change in diet, medication, and surgery.*