

chapter 15 digestive system study guide answers

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Chapter 15 Digestive System Study Guide Answers

Welcome to the definitive study guide for Chapter 15 of your anatomy and physiology course, which covers the digestive system. Whether you're preparing for a mid term, final exam, or simply looking to deepen your understanding of how the body processes food, this article provides clear, concise, and well structured answers to the most common questions. It also offers study tips, key concepts, and sample questions to help you master the material. By the end of this guide you will have a solid grasp of the digestive tract's anatomy, physiology, and clinical relevance.

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Chapter Overview

Chapter 15 introduces the complex interplay between the gastrointestinal tract and the body's metabolic needs. The digestive system's primary roles are:

- Mechanical and chemical breakdown of food.
- Absorption of nutrients and water.
- Excretion of indigestible waste.
- Coordination of secretions and motility through neural and hormonal signals.

Understanding these processes requires knowledge of the major organs, the types of digestion, and the regulatory mechanisms that maintain homeostasis. The chapter also discusses how disorders such as gastroesophageal reflux disease (GERD), peptic ulcers, and inflammatory bowel disease disrupt normal function.

Digestive System Anatomy

1. Oral Cavity and Salivary Glands

The mouth initiates digestion through mechanical chewing and chemical action of salivary enzymes. Key structures include:

- Salivary Glands: Parotid, submandibular, and sublingual glands secrete saliva containing amylase (starch breaking enzyme) and lipase (fat breaking enzyme).
- Hard and Soft Palate: Separate oral from nasal cavities.
- Pharynx and Esophagus: Pathways that transport food to the stomach.

2. Stomach

The stomach is a muscular reservoir that mixes food with gastric juices. Important features:

- Fundus, Body, Antrum: Regions that perform different roles in mixing, acid secretion, and chyme formation.
- Oxyntic (Parietal) Cells: Secrete hydrochloric acid (HCl), creating an acidic environment (pH ~2).
- Chief Cells: Release pepsinogen, which converts to pepsin in the presence of HCl.
- G Cells: Produce gastrin, stimulating acid secretion.

3. Small Intestine

Divided into duodenum, jejunum, and ileum, the small intestine is the primary site of nutrient absorption.

- Duodenum: Receives chyme from the stomach and digestive enzymes from the pancreas and bile from the liver.
- Jejunum: Major site of carbohydrate, protein, and fat absorption.
- Ileum: Absorbs vitamin B12, bile salts, and remaining nutrients.
- Villi and Microvilli: Increase surface area for absorption.

4. Large Intestine

Also known as the colon, it absorbs water and electrolytes, forming feces.

- Ascending, Transverse, Descending, Sigmoid Colon: Segments that gradually reduce chyme volume.
- Rectum: Stores feces until defecation.
- Anal Canal: Controlled by internal and external sphincters.

5. Accessory Organs

These organs secrete substances that aid digestion.

- Pancreas: Produces digestive enzymes (trypsin, chymotrypsin, lipase, amylase) and bicarbonate to neutralize stomach acid.
- Liver: Synthesizes bile, which emulsifies fats.
- Gallbladder: Stores and concentrates bile; releases it into the duodenum.

Physiology of Digestion

1. Mechanical Digestion

Physical processes that break food into smaller particles:

- Chewing (Mastication): Reduces food size and mixes it with saliva.
- Peristalsis: Rhythmic contractions that move food along the tract.
- Segmentation: In the small intestine, creates mixing movements for better contact with enzymes.

2. Chemical Digestion

Enzymatic reactions that convert macromolecules into absorbable units.

- Carbohydrates: Amylase (salivary and pancreatic) !' maltose, glucose.
- Proteins: Pepsin (stomach), trypsin, chymotrypsin, and carboxypeptidase (pancreas) !' amino acids.
- Fats: Lipase (pancreas) !' fatty acids, glycerol.

3. Absorption

Transport of nutrients across the intestinal epithelium into the bloodstream.

- Passive Diffusion: Small molecules like water and simple sugars.

- Active Transport: Glucose and amino acids via sodium glucose linked transporters (SGLT1) and peptide transporters.
- Facilitated Diffusion: Fatty acids via fatty acid transport proteins (FATP).

4. Excretion

Formation of feces and elimination of indigestible material.

- Water Reabsorption: Large intestine absorbs water, concentrating waste.
- Microbiome: Fermentation of fibers produces short chain fatty acids and gases.
- Defecation: Controlled by internal (smooth muscle) and external (skeletal muscle) anal sphincters.

Neural and Hormonal Regulation

1. Enteric Nervous System (ENS)

Often called the “second brain,” the ENS coordinates local reflexes.

- Intrinsic Afferent Neurons: Detect mechanical and chemical stimuli.
- Intrinsic Efferent Neurons: Modulate motility and secretion.
- Interneurons: Integrate signals and generate reflex patterns.

2. Autonomic Nervous System

The sympathetic and parasympathetic divisions influence digestive activity.

- Parasympathetic (Vagus Nerve): Increases motility and secretions.
- Sympathetic: Decreases motility and secretions; prepares the body for “fight or flight.”

3. Hormonal Control

Key hormones that regulate digestion:

- Gastrin: Stimulates gastric acid secretion.
- Secretin: Releases pancreatic bicarbonate; inhibits gastrin.
- Cholecystokinin (CCK): Stimulates gallbladder contraction and pancreatic enzyme release.
- Motilin: Regulates migrating motor complex during fasting.
- Ghrelin: Hunger hormone produced by the stomach; stimulates appetite.

Common Digestive Disorders

1. Gastroesophageal Reflux Disease (GERD)

Acid reflux from the stomach into the esophagus due to lower esophageal sphincter dysfunction.

- Symptoms: heartburn, regurgitation, chest pain.
- Treatment: lifestyle changes, proton pump inhibitors, H2 blockers.

2. Peptic Ulcer Disease

Sores in the stomach or duodenum caused by H. pylori infection or NSAID use.

- Symptoms: epigastric pain, nausea, bloating.
- Treatment: antibiotics, acid suppression, avoidance of irritants.

3. Inflammatory Bowel Disease (IBD)

Chronic inflammation of the gastrointestinal tract, including Crohn's disease and ulcerative colitis.

- Symptoms: abdominal pain, diarrhea, weight loss, blood in stool.

- Treatment: immunosuppressants, biologics, surgery.

4. Irritable Bowel Syndrome (IBS)

A functional disorder with abdominal pain and altered bowel habits.

- Symptoms: cramping, bloating, constipation, or diarrhea.
- Treatment: dietary changes, fiber supplements, antispasmodics.

Effective Study Strategies

1. Use Concept Maps: Visualize organ relationships and digestive pathways.
2. Teach Back Method: Explain concepts to a peer or yourself aloud.
3. Flashcards: Key terms, hormones, and enzyme functions.
4. Practice Questions: Focus on application and integration.
5. Chunking: Break the chapter into manageable sections (oral cavity, stomach, small intestine, etc.).
6. Review Clinical Correlations: Linking pathologies to normal physiology reinforces retention.

Sample Questions & Answers

Multiple Choice

1. Which enzyme is primarily responsible for the initial breakdown of dietary starch in the mouth?
Answer: Salivary amylase.
2. What hormone stimulates the release of pancreatic bicarbonate into the duodenum?
Answer: Secretin.
3. Which segment of the small intestine is most involved in vitamin /B12 absorption?
Answer: Ileum.
4. What is the main function of the gallbladder?
Answer: To store and concentrate bile.

True/False

1. True or False: The stomach's parietal cells secrete pepsinogen.
Answer: False. Parietal cells secrete HCl; chief cells secrete pepsinogen.
2. True or False: The enteric nervous system operates independently of the central nervous system.
Answer: True.

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