

Digestive Physiology

[\[Section 23.7: Chemical Digestion and Absorption: A Closer Look\]](#)

[\[Figures 23.28, 23.29, 23.30, 23.31, 23.32, 23.33\]](#)

Note: You will notice while studying this lab that much of the material repeats from the previous lab, especially many of the anatomical descriptions of some organs. We do want you to study the material again as you learn more about the physiology of mechanical and chemical digestion. We feel that the repeated material is necessary for you to understand the context of where the physiological events take place in the alimentary canal. We do want you to study these structures again for the next practical. We also want you to study the material included in the handout that details the activities you will perform in lab.

Physiology of the Alimentary Canal

Salivary Glands

- secrete saliva into the oral cavity
 - saliva = mucous + salivary amylase
 - salivary amylase starts starch / carbohydrate digestion
- Three main glands:
 - Parotid (*serous* gland)
 - Submandibular (*mucous + serous* gland)
 - Sublingual (*mucous + serous* gland)
- Secrete in response to *parasympathetic* activity (sympathetic activity inhibits salivation)

Stomach

- chyme – mixture of food, enzymes, and hydrochloric acid in the stomach
- acids in the stomach denature proteins into shorter fragments and can create a pH of 1 or 2
- Enzymes, such as trypsin and pepsin, start protein digestion

Duodenum

- Receives digestive secretions (bile, enzymes, and buffers) from the liver, gall bladder, and pancreas to aid in digestion and to raise the pH to ~7
- Lipid / Fat digestion begins here using lipases from the pancreas
 - lipid digestion is optimized by bile from liver/gallbladder
- Nucleic acid digestion begins with nucleases from the pancreas

Jejunum

- Site of most nutrient absorption

Ileum

- contains Peyer's patches to aid in immune defense

Large Intestine

- major function is absorption of water, vitamins, and solutes & the formation of feces
- Appendix is accessory organ with no known function, but may have some immune function

Accessory Organs

Liver

- processes digestive material from the vessels returning blood from the intestines
- has a role in either moving nutrients into the bloodstream or storing them in the liver tissue
- Have *Kupffer cells (stellate macrophages)* that destroy foreign bodies entering
- In the lobules, cells called hepatocytes secrete bile, which emulsifies fat in the ingested food.
- Blood from the hepatic artery and from the hepatic portal vein drain into spaces in the lobules called *sinusoids*, surrounded by hepatocytes and Kupffer cells to filter blood, and the sinusoids then empty into a central vein, which carries filtered blood to the hepatic veins into systemic circulation via the Inferior Vena Cava.
- Hepatocytes lining the sinusoids phagocytize worn blood cells.
- Sinusoids: location for O₂ rich blood from hepatic artery & nutrient-rich blood from hepatic portal vein

Gall Bladder

- releases bile into the duodenum
- used for bile storage
- the bile breaks lipids into smaller droplets

Pancreas

- secretes many digestive enzymes and buffers, which neutralize the stomach acids
- has islets of Langerhans
- endocrine function
- insulin & glucagon

Digestion and Absorption of Food Components

Carbohydrates

- Digestion starts in oral cavity with salivary amylase
- Water soluble
- Absorption in small intestines through blood capillaries → superior / inferior mesenteric vein → hepatic portal vein → liver → hepatic vein → IVC → heart → systemic circulation

Proteins

- Digestion starts in stomach with breakdown by acid and enzymes
- Also water soluble, so follows the same pathway as carbs

Lipids

- Digestion starts in duodenum with bile and lipases
- Fat soluble, so insoluble in GI tract
- Bile and lipases breakdown fats into smaller fat globules and keep them from combining into larger droplets
- Still too big for absorption into blood capillaries
- Absorbed by lacteal (larger than blood capillaries with open valves for absorption) → lymphatic vessel → lymphatic system (filters the fats carried in lymph) → thoracic duct → left subclavian vein → left brachiocephalic vein → SVC → heart → systemic circulation