



Wolters Kluwer
Health

Lippincott
Williams & Wilkins

Chapter 26

The Digestive System



Digestive System

- Gastroenterology is the study of the stomach and intestine.
- Digestion
 - Catabolism
 - Absorption
 - Anabolism
- The actions of the digestive system are controlled by the nervous system. The endocrine system also exerts a major influence.



Functions of the Digestive System

- Food processing and storage
 - Mechanical digestion, chemical digestion, peristalsis
- Manufacture
 - Enzymes, hydrochloric acid, intrinsic factor, mucus, regulatory hormones in stomach, vitamin K and some B-complex vitamins
- Absorption
 - Absorption of nutrients into capillaries
- Reabsorption and elimination

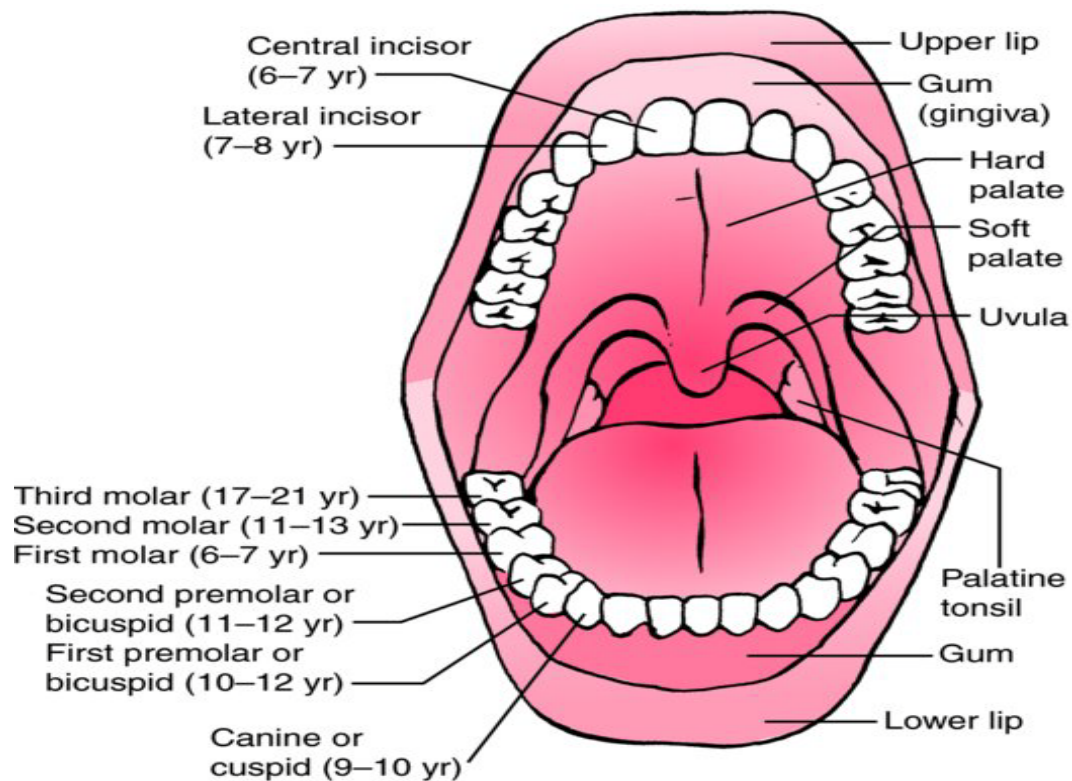


The Mouth

- Functions
 - Receive food via ingestion, prepare food for digestion, and begin the digestion of starch
- Involved in cephalic phase of digestion
 - Palate
 - Salivary glands
 - Teeth
 - Tongue



The Mouth (cont'd)





The Pharynx

- The pharynx is a passageway about 5 inches long and is used for both food and air.
 - Nasopharynx
 - Oropharynx
 - Laryngopharynx
- Epiglottis
 - Prevents aspiration of food and fluids into the lungs
- Contractions of the pharynx push food into the muscular esophagus.



The Esophagus

- The esophagus, or gullet, is approximately 10 inches in length, and serves as a passageway.
- Cardiac sphincter
 - A strong circular muscle that lies between the esophagus and stomach
 - Guards the opening of the stomach by preventing food from backing up into the esophagus
 - Waves of peristalsis push food through the lower esophagus, the LES opens (allowing food to enter) and closes (to keep food in the stomach).



Question

Is the following statement true or false?

Esophageal or gastric ulcers may develop if the LES does not close adequately.



Answer

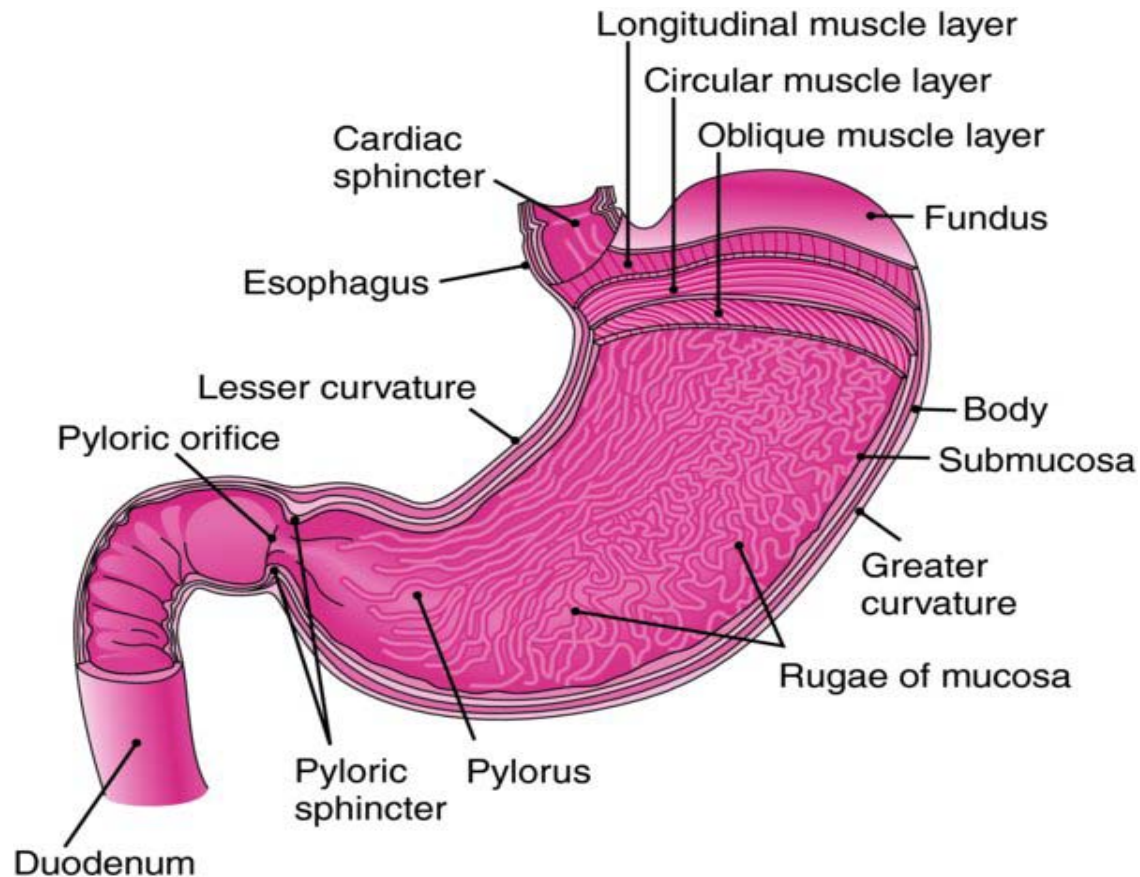
True

If the LES does not close adequately, the stomach contents can re-enter the esophagus. Acidic stomach contents cause a severe burning sensation. This condition is known as heartburn or acid reflux.

If this continues, it can lead to esophageal or gastric (stomach) ulcers. Acid reflux often can be successfully treated with medications and lifestyle changes.



The Stomach





The Stomach (cont'd)

- Layers of the stomach wall:
 - Serous membrane (outer wall)
 - Muscles: Longitudinal, horizontal, oblique
 - Submucosa: Contains nerves, blood/lymph vessels
 - Mucosa (mucous membrane): Contains gastric glands that secrete mucus, HCl, hormones, and precursors to digestive enzymes, such as pepsinogen.



The Small Intestine

- The intestinal phase of digestion begins with the small intestine.
- Areas of the small intestine
 - Duodenum
 - Mucus, bile
 - Jejunum
 - Aggregated lymphatic follicles or Peyer's patches
 - Ileum (terminal section)
- Intestinal enzymes are proteins that act as catalysts



Question

Is the following statement true or false?

Lactase is an enzyme that facilitates specific chemical reaction that converts sucrose into fructose and glucose.



Answer

False

Lactase is an enzyme that facilitates specific chemical reaction that converts lactose into galactose and glucose.

Sucrase is an enzyme that facilitates specific chemical reaction to convert sucrose into fructose and glucose.

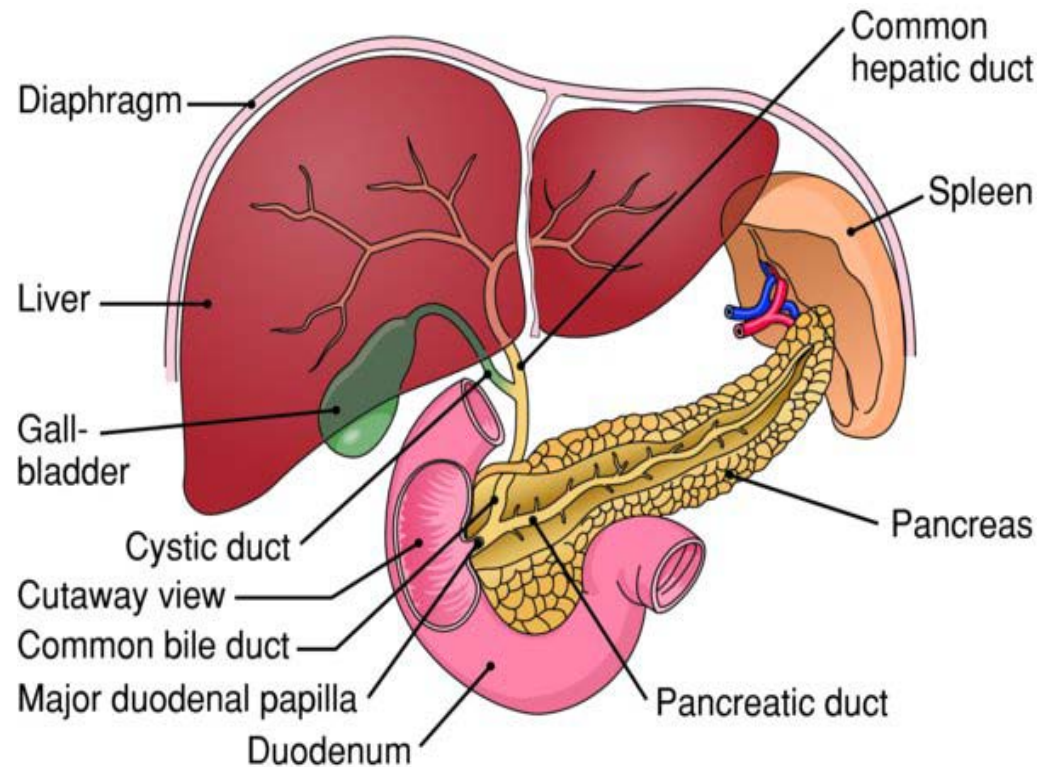


The Large Intestine

- The large intestine, as with the remainder of the GI tract, is lined with mucous membrane.
- Areas of the large intestine
 - Cecum
 - Appendix
 - Colon
 - Ascending colon, transverse colon, descending colon, sigmoid colon
 - Rectum



Accessory Organs





Accessory Organs (cont'd)

- Liver
 - Body's largest glandular organ
 - Production of bile
 - Bile aids in fat digestion and absorption of fat and fat-soluble vitamins from the small intestine.
- Secretions
 - Bile, heparin, albumin, fibrinogen, prothrombin, globulins

Accessory Organs (cont'd)

- Functions of the liver
 - Emulsifies fats and stores glucose (as glycogen)
 - Forms immunoglobulins, vitamin A
 - Breaks down fat and protein
 - Stores protein, fat, carbohydrates, and minerals, including iron, vitamins A, D, E, K, and B complex, triglycerides, and cholesterol
 - Prepares waste (urea); absorbs bilirubin
 - Regulates amino acids



Accessory Organs (cont'd)

- Gallbladder
 - Stores and releases bile; biliary apparatus
- Pancreas
 - Secretes the hormones insulin, glucagon, and somatostatin; acinar cells secrete (Pancreatic) amylase, trypsin, (Pancreatic) lipase
- Peritoneum
 - Large sheet of serous membrane that covers and protects many abdominal organs; secretes peritoneal fluid



Question

Is the following statement true or false?

The liver can take over the functions of the gallbladder.



Answer

True

Removal of the gallbladder (cholecystectomy) is a common surgical procedure. After its removal, other structures, particularly the liver, take over its functions.



Processes of Digestion

- Mechanical digestion: Physical breakdown of food
- Chemical digestion: Breakdown of the chemical bonds
- Enzymes secreted by the salivary glands, stomach, small and large intestines, liver, and pancreas
- Mucus lubricates food and protects the GI tract's lining from mechanical or chemical injury.
- Water liquefies food, making it easier to digest and absorb; participates in chemical reactions.



Digestion in the Stomach

- Fundus and body of the stomach: Storage areas
- Pylorus: Digestion
- Secretions
 - Chief cells secrete pepsinogen and gastric lipase.
 - Parietal cells secrete hydrochloric acid and intrinsic factor.
 - The hormone gastrin stimulates secretion of hydrochloric acid and pepsinogen.



Question

Is the following statement true or false?

Most digestive enzymes cannot function in the stomach.



Answer

True

Most digestive enzymes cannot function in the stomach because it is too acidic; thus, carbohydrate digestion is inhibited there.



Digestion in the Small Intestine

- Cholecystokinin (CCK) secreted in the duodenum and jejunum:
 - Activates gallbladder to release bile
 - Stimulates pancreas to secrete pancreatic juice
 - Assists inhibition of digestive processes in the stomach.
- Absorption into the body occurs across the villi and microvilli. Capillaries carry nutrients to the liver.
- Fat absorption: Micelles, lacteals



Absorption in the Large Intestine

- After “food” has been in the small intestine for about 4 to 6 hours, it passes into the large intestine and all that remains is water, electrolytes, and waste products.
- As the wastes (chyme) travel through the large intestine, the intestinal walls of the proximal colon absorb most of the remaining water back into the circulation.
- Elimination
 - Defecation reflex causes elimination of solid intestinal wastes from the colon as excreta.



Metabolism

- The liver is vital for metabolism or biotransformation.
 - Catabolism
 - Anabolism
- Energy synthesis and release
 - Energy released during catabolism is synthesized into ATP.
 - ATP is vital to the process of anabolism.
- Basal metabolism: Minimum amount of energy (calories) the body requires to maintain vital functions



Effects of Aging

- Decrease in saliva production and bony structures around the mouth; tooth loss as a result of poor nutrition and hygiene.
- Sense of taste and smell decreases.
- Cardiac sphincter relaxes.
- Gastric mucosa atrophies.
- Food stays in stomach longer.
- Peristalsis decreases.
- Occurrence of gallstones may increase.



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End of Presentation