Chapter 15
Digestion

Introduction
A. Digestion refers to the mechanical and chemical breakdown of foods so that nutrients can be absorbed by cells.
B. The digestive system carries out the process of digestion.
C. The digestive system consists of the alimentary canal, leading from mouth to anus, and several accessory organs whose secretions aid the processes of digestion.
B. Structure of the Wall
1. The wall of the alimentary canal consists of the same four layers throughout its length, with only slight variations according to the functions of specific sections of the canal.
   a. Mucosa (epithelium)
   b. Submucosa (connective tissue)
   c. Muscularis (smooth muscle)
   d. Serosa (epithelium)

C. Movements of the Tube
1. The motor functions of the alimentary canal are of two types—mixing movements and propelling movements.
2. Mixing movements occur when smooth muscles contract rhythmically in small sections of the tube.
3. Propelling movements include a wavelike motion called **peristalsis**, which is caused by contraction behind a mass of food as relaxation allows the mass to enter the next segment of the tube.

**Mouth**

A. The **mouth** is the first portion of the alimentary canal; it functions to receive food and begins mechanical digestion by chewing or **mastication**.
E. Teeth

1. Two sets of teeth develop in sockets within the alveolar processes of the maxillary and mandibular bones.

2. The 20 primary teeth are shed in the order they appeared and are replaced by 32 secondary teeth.

3. Through the actions of chewing, teeth break food into smaller pieces, beginning mechanical digestion.
Salivary Glands
A. The salivary glands secrete saliva, which moistens and dissolves food particles, binds them together, allows tasting, helps to cleanse the mouth and teeth, and begins carbohydrate digestion.

Pharynx and Esophagus
A. The pharynx is a cavity lying behind the mouth, and the esophagus is a muscular tube leading to the stomach.
D. **Esophagus**
1. The *esophagus* is a straight, collapsible passageway leading to the stomach, through a diaphragm opening (*esophageal hiatus*).
2. Mucous glands are scattered throughout the submucosa of the esophagus and produce mucus to moisten and lubricate the inner lining of the tube.
3. The *lower esophageal sphincter* helps to prevent regurgitation of the stomach contents into the esophagus.

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**Stomach**

A. The *stomach* is a J-shaped muscular organ that receives and mixes food with digestive juices, and propels food to the small intestine.

B. The stomach produces gastric juice consisting of enzymes, acid (HCl), and mucous. It also produces the hormone *gastrin*, which helps regulate digestion (that is released into the blood, not the stomach).
F. Mixing and Emptying Actions

1. Following a meal, mixing actions of the stomach turn the food into **chyme** and pass it toward the pyloric region using peristaltic waves.

2. The rate at which the stomach empties depends on the fluidity of the chyme and the type of food.

3. As chyme fills the duodenum, accessory organs—the pancreas, liver, and gallbladder—add their secretions.

Pancreas

A. The pancreas has an exocrine function of producing pancreatic juice with many enzymes that aid digestion.
Liver

A. The reddish-brown liver, located in the upper right quadrant of the abdominal cavity, is the body’s largest internal organ.
Liver Functions
A. The liver carries on many diverse functions for the body.
B. The liver is responsible for many metabolic activities, such as the metabolism of carbohydrates, lipids, and proteins.
C. The liver also stores glycogen, vitamins A, D, and B₁₂, iron, and blood.

4. The liver filters the blood, removing damaged red blood cells and foreign substances, and removes toxins.
5. The liver's role in digestion is to secrete bile which helps digest fats.

Gallbladder
A. The gallbladder is a pear-shaped sac lying on the interior surface of
B. A sphincter muscle controls the release of bile from the common bile duct.
Small Intestine

A. The lengthy small intestine receives secretions from the pancreas and liver, completes digestion of the nutrients in chyme, absorbs the products of digestion, and transports the remaining residues to the large intestine.

B. Parts of the Small Intestine.
1. The small intestine consists of the duodenum, jejunum, and ileum.
2. The duodenum is the shortest and most fixed portion of the small intestine; the rest is mobile and lies free in the peritoneal cavity.
3. The small intestine is suspended from the posterior abdominal wall by a double-layered fold of peritoneum called mesentery.
C. Absorption in the Small Intestine
   1. The small intestine is the major site of absorption within the alimentary canal.
   2. The small intestine carries on segmentation and peristaltic waves.

Large Intestine
A. The large intestine absorbs water and electrolytes and forms and stores feces.
B. Parts of the Large Intestine
1. The large intestine consists of the cecum (pouch at the beginning of the large intestine with the appendix projecting downward from it), colon (ascending, transverse, descending, and sigmoid regions), the rectum, and the anal canal.
2. The anal canal opens to the outside as the anus; it is guarded by an involuntary internal anal sphincter and a voluntary external anal sphincter muscle.

C. Functions of the Large Intestine
1. The large intestine does not digest or absorb nutrients, but it does secrete mucus.
2. The large intestine absorbs electrolytes and water.
3. The large intestine contains important bacteria (intestinal flora) which synthesize vitamins and use cellulose.

D. Movements of the Large Intestine
1. The movements of the large intestine are similar to those of the small intestine.
2. Peristaltic waves (mass movements) happen only two or three times during the day.
3. Defecation is stimulated by a defecation reflex that forces feces into the rectum where they can be expelled.
E. Feces
1. Feces are composed of undigested material, water, electrolytes, mucus, and bacteria.
2. Both the color of feces and its odor is due to the action of bacteria.