Digestive System
Objectives

• Identify the major organs of the digestive system in order
• Identify the function of the digestive system
• Distinguish between mechanical and chemical digestion.
Introduction

• The function of the digestive system is to help convert foods into simpler molecules that can be absorbed and used by the cells of the body

• The digestive system is built around a one-way tube that passes through the body called the **alimentary canal**
  – Also called the gastrointestinal tract
Introduction

• The major structures of the digestive system are:
  – Mouth
  – Pharynx
  – Esophagus
  – Stomach
  – Small intestine
  – Large intestine

• Additional structures that add secretions include:
  – Salivary glands
  – Pancreas
  – Liver
Mouth

- Chewing begins the process of mechanical digestion
- **Mechanical digestion** – physical breakdown of large pieces of food into smaller pieces
- Teeth tear and crush food into a fine paste until it is ready to be swallowed
Mouth

- Salivary glands secrete saliva, which helps moisten food to make it easier to chew.
- Saliva also begins the process of chemical digestion:
  - **Chemical digestion** – change in the chemical nature of nutrients
- Saliva contains amylase:
  - **Amylase** – an enzyme that breaks bonds in starches and release sugars
- Saliva also contains lysozyme:
  - **Lysozyme** – an enzyme that fights infection by digesting the cell walls of many bacteria
Esophagus

- Chewed food (bolus) is forced into the pharynx when you swallow.
- Bolus then passes through the esophagus:
  - **Esophagus** — food tube connecting the mouth to the stomach.
- Contraction of muscles squeeze food through the esophagus into the stomach.
- A ring of muscles, the cardiac sphincter, prevents the stomach contents from coming back up through the esophagus.
Stomach

- **Stomach** – large muscular sac that continues mechanical and chemical digestion of food
- Has 3 layers of smooth muscle
  - Muscles alternate contractions which churn and mix the food you swallow
Stomach

• Lining contains millions of microscopic gastric glands which release substances into stomach
  – Mucus – lubricates and protects stomach wall
  – Hydrochloric acid – lowers pH to 1.5 – 2.5
  – Enzymes – break proteins down into smaller polypeptide fragments

• HCl and enzymes released by stomach and other organs form acidic mixture used in chemical digestion
Notes Review

• Identify the major organs of the digestive system in order
  – Mouth
  – Pharynx
  – Esophagus
  – Stomach
  – Small intestine
  – Large intestine
Notes Review

• Identify the function of the digestive system
  – The function of the digestive system is to help convert foods into simpler molecules that can be absorbed and used by the cells of the body
Notes Review

• Distinguish between mechanical and chemical digestion.
  – Mechanical digestion is the physical breakdown of large pieces of food into smaller pieces
• Chemical digestion is the change in the chemical nature of nutrients
Chemical Digestion
Objectives

• Explain the roles of the pancreas, liver, small intestine, and large intestine in digestion.
Chemical Digestion

- Chemical digestion is the breakdown of food by chemical means
- Gastric fluids carry out chemical digestion
  - Low pH converts the enzyme pepsinogen into pepsin
  - Pepsin breaks proteins down into smaller polypeptide fragments
- The churning of the stomach produces a mixture of food and gastric fluids called **chyme**
Pancreas

- Gland that produces hormones that regulate blood sugar
- Produces enzymes that break down carbohydrates, proteins, lipids, and nucleic acids
- Produces sodium bicarbonate
  - $\text{NaHCO}_3$ neutralizes chyme so that the digestive enzymes can work properly
    - Stomach acid denatures most enzymes
    - Chyme is acidic when it leaves the stomach
Liver

- Located above and to the right of the stomach
- Produces bile
  - Bile is a fluid loaded with lipids and salts
- Bile dissolves and disperses droplets of fat found in foods
  - Makes it easier for enzymes to reach and break down fats
- Extra bile is stored in the gallbladder
Small Intestine

- Digestive organ in which most chemical digestion takes place
- Divided into
  - Duodenum
  - Jejunum
  - Ileum
- Most nutrient absorption takes place in small intestine
  - Nutrients absorbed into circulatory and lymphatic systems
Small Intestine

• After an hour or two, chyme passes through the pyloric valve and into duodenum
• Chyme mixes with fluids from pancreas and liver
• **Villi** – folded projections that increase the surface area of the small intestine
  – Digested carbs and proteins are absorbed into the capillaries of the villi
  – Undigested fat and fatty acids are absorbed by lymph vessels
Small Intestine

**Figure 38-14  The Small Intestine**

The lining of the small intestine consists of folds that are covered with tiny projections called villi. Within each villus there is a network of blood capillaries and lymph vessels that absorb and carry away nutrients. **Applying Concepts** How do the folds in the small intestine help in absorption?

Villi (magnification: 32×)
Large Intestine

- Organ that removes water from the undigested materials that pass through it
  - Also called the colon
- Bacteria in the large intestine produce nutrients and vitamins the body is able to use
Notes Review

• Explain the roles of the pancreas, liver, small intestine, and large intestine in digestion.
  – Pancreas produces enzymes that break down carbohydrates, proteins, lipids, and nucleic acids. It also produces sodium bicarbonate, which neutralizes chyme.
  – Liver produces bile, which dissolves and disperses fat droplets in food.
  – Small intestine is the site where most chemical digestion and nutrient absorption occurs.
  – Large intestine removes most of the water from undigested materials and absorbs nutrients from bacteria.