

**Chapter 38 Digestive and Excretory Systems****Summary****38-1 Food and Nutrition**

Cells use the chemical energy stored in food to meet their energy needs. The amount of energy in food is measured in Calories. The number of Calories you need each day depends on your size and level of activity.

Nutrients are substances in food that supply the energy and raw materials the body uses for growth, repair, and maintenance. Nutrients include water, carbohydrates, fats, proteins, vitamins, and minerals.

Every cell in the human body needs water, because many of the body's processes take place in water. Carbohydrates are the main source of energy for the body. Carbohydrates include sugars, starches, and fiber. Fats are formed from fatty acids. The body needs fatty acids to make cell membranes and certain hormones. Proteins are formed from amino acids. Proteins supply raw materials for growth and repair of the body. In addition, many proteins are hormones. Vitamins are organic molecules that help regulate body processes. They include vitamins C and D. Minerals are inorganic nutrients that the body needs, usually in small amounts. Examples of minerals are calcium and iron.

The Food Guide Pyramid can help people select a balanced diet. The pyramid classifies foods into six groups. It also indicates how many servings from each group should be eaten every day to maintain a healthy diet. Foods at the base of the pyramid should make up the major portion of the diet. Foods at the top of the pyramid should be used in small amounts.

**38-2 The Process of Digestion**

The function of the digestive system is to break down food into simpler molecules that can be absorbed and used by the cells.

The human digestive system is a one-way tube that includes the mouth, pharynx, esophagus, stomach, small intestine, and large intestine. Other structures—including the salivary glands, pancreas, and liver—add secretions to the digestive system.

Digestion starts in the mouth. The teeth tear and crush food. This begins the process of mechanical digestion. Mechanical digestion is the physical breakdown of large pieces of food into smaller pieces. Salivary glands in the mouth secrete saliva, which contains the enzyme amylase. Amylase breaks down starches into sugars. This begins the process of chemical digestion. Chemical digestion is the breakdown of large food molecules into smaller molecules.

The chewed clump of food that is swallowed is called a bolus. It passes through the pharynx and into the esophagus. The esophagus is a tube that connects the throat with the stomach. Muscle contractions, called peristalsis, squeeze the food through the esophagus.

Food from the esophagus empties into the stomach. The stomach is a large muscular sac. Both chemical and mechanical digestion take place in the stomach. Glands in the lining of the stomach produce an acid and the enzyme pepsin. The acid and pepsin work together to begin the chemical digestion of protein. Stomach muscles also contract to churn and mix the stomach contents. This mechanical digestion produces a liquid mixture called chyme.

From the stomach, chyme passes into the small intestine. Most of the chemical digestion and absorption of food occur in the small intestine. Enzymes from the pancreas help digest starch, protein, and fat. A liquid called bile from the liver dissolves and breaks up fat droplets. The lining of the small intestine also produces several enzymes that help break down carbohydrates and proteins. Nutrients are absorbed by cells lining the surface of the small intestine.

The surface area is greatly increased by tiny fingerlike projections called villi (singular: villus). By the time chyme reaches the end of the small intestine, virtually all the nutrients have been absorbed.

Chyme next enters the large intestine. The primary function of the large intestine is to remove water from the undigested material. After most of the water has been removed, the remaining waste passes out of the body.

Digestive system disorders include peptic ulcers, diarrhea, and constipation. Peptic ulcers are caused by bacteria. Diarrhea occurs when too little water is removed from waste in the large intestine. Constipation occurs when too much water is removed.

### 38-3 The Excretory System

During normal metabolism, cells produce wastes such as carbon dioxide and urea. Excretion is the process by which the body eliminates these wastes. The main organs of excretion are the kidneys. The kidneys play an important role in homeostasis. They remove waste products from blood, maintain blood pH, and control water content of blood.

The two kidneys are located in the lower back. Blood containing wastes enters the kidneys. The kidneys remove urea, excess water, and other substances from the blood. Some of the substances are later returned to the blood. The wastes are excreted. The purified blood leaves the kidneys and returns to circulation. The basic unit of function of a kidney is the nephron. Each nephron is a small independent processing unit.

Blood goes through two separate processes in a nephron: filtration and reabsorption. Filtration removes wastes from the blood. It occurs in a structure of the nephron known as the glomerulus. The glomerulus is enclosed within another structure called Bowman's capsule. Reabsorption returns some of the filtered materials back to the blood. These materials include food molecules and water.

The fluid that remains is called urine. Urine contains urea, excess salts, and other substances. Some of the water is removed from the urine in a structure called the loop of Henle. A tube, called the ureter, leaves each kidney and carries urine to the urinary bladder. The urinary bladder is a saclike organ that stores urine until it can be released from the body. Urine passes from the body through a tube called the urethra.

The kidneys are controlled by hormones and by the composition of the blood. If the blood becomes too concentrated, the kidneys return more water to the blood. If the blood becomes too diluted, the kidneys return less water to the blood.

A person can survive with only one kidney. If both kidneys fail, the person must receive a kidney transplant or undergo dialysis in order to survive. Dialysis purifies the blood by passing it through a filtering machine.