CHAPTER 3: THE HUMAN BODY – ARE WE REALLY WHAT WE EAT?

Food provides us with (1) energy for body processes, (2) heat for body temperature regulation and (3) the building blocks for growth and maintenance of body tissues.

Food is intimately connected to our sense of taste, but also stimulates our senses of sight, smell, touch and hearing.

Appetite is the psychological desire to eat certain foods. Strong cravings even when we're not hungry are due to appetite. Hunger is the physiological sensation that prompts us to eat. Satiety is the feeling of being full. The signals that prompt us to eat include:

- Nerve receptors (sensors) in the stomach wall send signals to the brain to indicate if the stomach is full or empty.
- Blood glucose levels trigger the release of hormones called insulin and glucagon.
- The hypothalamus of the brain includes special neurons (" appestat") that receive these hunger-related signals.

Hormones are chemicals produced in specialized glands that travel in the bloodstream to target organs in other parts of the body. Some hormones stimulate food intake. Some hormones produce a feeling of satiety.

Atoms are the smallest units of matter. Atoms bond to each other to form molecules. Molecules are groups of atoms bonded in specific configurations. For example: water is \( \text{H}_2\text{O} \), carbon dioxide is \( \text{CO}_2 \). Carbohydrates, proteins, fats and vitamins are large organic molecules.

The goals of digestion are (1) to break these large molecules down to smaller molecules and (2) absorb the smaller molecules into the cells of the body. Molecules are the building blocks of cells. Cells are the smallest units of life. Molecules that result from the digestion of food are used to build the cells of the body.

The cell membrane is an outer layer enclosing each cell of the body. The cell membrane is composed of two layers of phospholipids. One part of each phospholipid molecule is "water-loving" (hydrophilic), and the other part is "water-fearing" (hydrophobic). Cholesterol is embedded in the membrane. The cell membrane is selectively permeable allowing it to control the passage of materials into and out of the cell. The cell membrane encloses the cytoplasm (the fluid within the cell) and the organelles (the tiny structures that perform many different cellular functions, such as mitochondria and Golgi bodies).

Cells join together to form tissues. Tissues are group of cells acting together to perform a common function. Examples include muscle, nerve, blood, bone and epithelial tissues. Different tissues combine to form organs. An organ is a sophisticated organization of tissues that perform a specific function, such as the heart or stomach. Organ systems are groups of organs working together for a particular function, such as the GI tract.

The foods we eat undergo three processes: (1) digestion, (2) absorption and (3) elimination. These processes occur in the gastrointestinal tract. Gastrointestinal (GI) tract is a series of organs arranged as a long tube. The GI tract includes:

- Organs such as the mouth, esophagus, stomach and intestines.
- Sphincters (muscles that control the passage of material from one organ to the next).
Digestion is the process of breaking large food molecules down to smaller molecules. Digestion includes: (1) mechanical digestion, which is the physical breakdown of food and (2) chemical digestion, which includes the enzymatic reactions that break down large food molecules. Digestion begins in the mouth. Chewing is the mechanical digestion that breaks food into smaller pieces. Some chemical digestion takes place. Salivary amylase is an enzyme produced by the salivary glands that begins the chemical digestion of carbohydrates.

The epiglottis covers the opening to the trachea during swallowing. The uvula prevents food from entering the sinuses and nose. Food travels from the mouth to the stomach through the esophagus. Peristaltic waves of muscle contraction move food through the GI tract. The gastroesophageal sphincter separates the esophagus from the stomach. The cardiac and pyloric sphincters keep food in the stomach during processing.

Digestion in the stomach includes: (1) extensive mechanical digestion to mix food with gastric juice and (2) the chemical digestion of proteins and fats. Gastric juice contains (1) hydrochloric acid (HCl) - to denature proteins and activate pepsin, (2) pepsin - an enzyme to digest protein, (3) gastric lipase - an enzyme to digest fat and (4) mucus - to protect the stomach lining.

Chyme is a semi-solid product of mechanical and chemical digestion in the stomach. From the stomach, chyme is slowly released through the pyloric sphincter to the small intestine. Chemical digestion continues in the small intestine using pancreatic enzymes and bile.

Absorption is the process of taking molecules across a cell membrane and into cells of the body. A small amount of absorption occurs in the stomach. Most absorption of nutrients occurs in the small intestines. The lining of the GI tract has special structures (villi) to facilitate absorption. Villi are folds in the lining that are in close contact with nutrient molecules. The brush border is composed of microvilli, which greatly increase the surface area. Undigested food components move through a sphincter called the ileocecal valve to the large (colon) intestine.

Material is stored in the colon up to 12-24 hours prior to elimination. Water and some nutrients are absorbed. The lining of the stomach is designed to cope with hydrochloric acid but other regions of the GI tract are not.

Accessory organs of the GI tract include the liver, pancreas, gall bladder and salivary glands.

Regulatory hormones include secretin, gastrin and CCK.

Review these digestive-related disorders:

- Celiac disease
- Constipation
- Diarrhea
- Diverticulosis
- Food allergies
- Food intolerance
- GERD
- Heartburn
- Hiatal hernia
- IBS
- Ulcers