

CHAPTER

3

Third Canadian Edition

nutrition

a functional approach

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The Human Body: Are We Really What We Eat? and In Depth

Why Do We Eat?

Food provides us with

- Energy for body processes
- Heat for body temperature regulation
- Building blocks for growth and maintenance of body tissues

Why Do We Want to Eat?

- Hunger:
- Appetite:

Why Do We Want to Eat?

Food is intimately connected to our sense of **taste**, but also stimulates our senses of

- Sight
- Smell
- Touch
- Hearing

Factors Affecting Hunger & Satiety

The **hypothalamus** region of the brain is the feeding centre

- Nerve cells in stomach and small intestine sense food and send message to hypothalamus
- Hormones relay messages to the hypothalamus
- Amount and type of food consumed influence satiety

Why Do We Want to Eat?

The signals that prompt us to eat include

- Nerve receptors in the stomach send signals to the hypothalamus to indicate if the stomach is full or empty
- Blood glucose levels trigger the release of hormones

Why Do We Want to Eat?

Hormones: chemicals produced in specialized glands that travel in the bloodstream to target organs in other parts of the body

- Some hormones stimulate hunger
- Some hormones produce a feeling of satiety

Why Do We Want to Eat?

Foods have differing effects on our feelings of hunger and satiety

- Proteins have the highest satiety value
- Carbohydrates have a lower satiety value than fats
- Bulky foods provide a sense of satiety
- Solid foods are more filling than semisolid foods or liquids

Organization of the Body

Atoms: the smallest units of matter

- Atoms bond to each other to form molecules

Molecules: groups of atoms bonded in specific configurations

Organization of the Body

Molecules are the building blocks of cells

Cells: the smallest unit of life

Organization of the Body

Cell membrane: outer layer enclosing each cell of the body

- Composed of 2 layers of phospholipids
- Long lipid “tails” face each other toward the interior of the membrane
- Phosphate “heads” line the interior and exterior surfaces of the membrane
- Cholesterol and proteins are embedded in the membrane

Organization of the Body

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**
- **organelles**

Organization of the Body

Cells join together to form tissues

Tissue

Different tissues combine to form organs

Organ

Organ systems

What Happens to the Food We Eat?

Gastrointestinal (GI) tract: series of organs arranged as a long tube through which the food passes

The GI tract includes

- Organs such as the stomach and intestines
- **Sphincters:** muscles that control the passage of material from one organ to the next

Digestion

First step:

- Hunger and appetite combine to prepare GI tract to digest food
- Nervous system stimulates release of digestive juices

Digestion: The Mouth

Digestion begins in the mouth

- Chewing is the mechanical digestion that breaks food into smaller pieces
- Some chemical digestion takes place in the mouth
 - Salivary amylase

Digestion: The Mouth

Digestion begins in the mouth
(continued)

- The **epiglottis** covers the opening to the trachea during swallowing
- Food (“bolus”) travels from the mouth to the stomach through the **esophagus**
- **Peristalsis** is the muscular contractions moving food through the GI tract

Digestion: Stomach

The **gastroesophageal sphincter** separates the esophagus from the stomach

- Prevents the flow of food from the stomach back into the esophagus

Digestion in the stomach includes

- Mechanical digestion
- Chemical digestion

Digestion: Stomach

Gastric juice contains

- Hydrochloric acid (HCl)
- Pepsin
- Gastric lipase
- Mucus

Chyme: semisolid product of mechanical and chemical digestion in the stomach

Digestion: Small Intestine

Most digestion and absorption occur in the small intestine

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

Digestion: Accessory Organs

Surrounding the GI tract are several accessory organs

- Liver
- Pancreas
- Gall bladder

Absorption

Absorption: 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 3 sections of the small intestine

Absorption

The lining of the GI tract has special structures to facilitate absorption

- Villi
- Brush border

Absorption

Water-soluble nutrients (carbohydrate, protein, minerals, and some vitamins) enter the **portal vein**

Fat-soluble nutrients (lipids and some vitamins) enter the **lymphatic vessels**

Elimination

Undigested food components move through a sphincter called the **ileocecal valve** to the large intestine

In the large intestine

- Very little digestion takes place
- Material is stored 12–24 hours prior to elimination
- Water and some nutrients are absorbed

Disorders Related to Digestion

The lining of the stomach is designed to cope with hydrochloric acid but other regions of the GI tract are not

Heartburn is caused by hydrochloric acid in the esophagus

Gastroesophageal reflux disease (GERD) is painful, persistent heartburn

Disorders Related to Digestion

Peptic ulcers are regions of the GI tract that have been eroded by HCl and pepsin

The bacterium *Helicobacter pylori* contributes to the production of both gastric and duodenal ulcers

Disorders Related to Digestion

Diarrhea

- Can be caused by
 - Food intolerances
 - Infection of the GI tract
 - Stress
 - Bowel disorders
- Can lead to severe dehydration
- Is more dangerous for children and the elderly

Constipation

- No stool passed for 2 or more days

Disorders Related to Digestion

Irritable bowel syndrome (IBS) is a disorder that interferes with normal colon function

Symptoms of IBS include

- Abdominal cramps and bloating
- Either diarrhea or constipation

Disorders Related to Digestion

Inflammatory Bowel Disease (IBD)

- Term used to describe 2 autoimmune disorders
 - Crohn's disease
 - Ulcerative colitis

In Depth: Disorders Related to Foods

Food intolerance

Food allergy

In Depth: Disorders Related to Foods

Celiac disease (aka Celiac sprue)

- Complete intolerance for gluten, a protein found in wheat, rye, barley, and triticale
- Can damage the small intestine, leading to poor absorption of nutrients
- Requires a diet lacking wheat, rye, barley & triticale
- There may be a genetic component to the disease
- Classified as an autoimmune disease