# Digestion, Absorption, and Metabolism

## Digestion

- Digestion
  - Process by which food is broken down into smaller parts, chemically changed and moved through the gastrointestinal tract
- Two types of action
  - Mechanical digestion
  - Chemical digestion

## Mechanical Digestion

- Food broken into smaller pieces by teeth
- Moved through GI tract through esophagus, stomach, and intestines
- Process of peristalsis
- Helps prepare food for chemical digestion by breaking into smaller pieces

## Chemical Digestion

- Changes the composition of CHO, proteins and fats
- Food broken down to molecules that the blood can absorb
  - Hydrolysis
- Enzymes essential

## Digestion in the Mouth

- Food broken into smaller pieces by teeth and mixed with saliva
  - Saliva contains water, salts and digestive enzyme salivary amylase
    - Acts on complex carbohydrates (starch)

## Digestion in the Esophagus

- Food moved by peristalsis and gravity
- Cardiac sphincter located at the lower end of the esophagus

## Digestion in the Stomach

- Three sections of stomach:
  - Fundus
  - Body
  - Pylorus
- Transformation of food into chyme
- Gastric juices
  - Hydrocholoric acid
  - Pepsin
  - Mucus

## Functions of the Stomach

- Temporary storage of food
- Mixing of food with gastric juices
- Regulation of a slow, controlled emptying of food into the intestine
- Secretion of the intrinsic factor for vitamin B12
- Destruction of most bacteria inadvertently consumed

## Digestion in the Small Intestine

- Acidity of chyme neutralized
  Bile released by gallbladder to emulsify fat
- Chyme triggers pancreas to secrete pancreatic juice containing enzymes:
  - Pancreatic proteases
  - Pancreatic amylase
  - Pancreatic lipase
- Small intestine produces enzymes
  - Lactase
  - Maltase
  - Sucrase

## Digestion in the Large Intestine

- Primary function to absorb water and salts form undigested food
- Absorption of fatty acids
- Digested food travels out of the body

## Absorption

- Passage of nutrients into the blood or lymphatic system
- To be absorbed nutrients must by in their simplest forms:
  - Carbohydrates into simple sugars
  - Proteins to amino acids
  - Fats to fatty acids and glycerol

## Absorption in Small Intestine

- Most absorption of nutrients occurs here
- Surface area increased through mucosal folds, villi, microvilli
  - Blood capillaries
  - Lacteals
- Villi absorb nutrients from chyme

## Absorption in the Large Intestine

- Absorb water
- Synthesize some B vitamins and vitamin K
- Collect food residue
- Undigested food is excreted as feces by way of rectum
- In healthy people, 99% of CHO, 95% of fat, and 92% of proteins are absorbed

## Metabolism

- After digestion and absorption nutrients carried by blood to the cells
- Within cells nutrients changed into energy through the process of metabolism
  - Aeorbic metabolism
  - Anaerobic metabolism

## Metabolism

- As nutrients oxidize energy is released
  - Anabolism
  - Catabolism

## Metabolism and the Thyroid Gland

- Metabolism governed primarily by hormones secreted by the thyroid gland
  - T3
  - T4
- Hyperthyroidism
- hypothyroidism

## Basal Metabolic Rate

- Energy necessary to carry on all involuntary vital processes while the body is at rest
  - Respiration
  - Circulation
  - Regulation of body temperature
  - Cell activity and maintenance
- Known as BMR
  - Also referred to as resting energy expenditure (REE)

## Basal Metabolic Rate

- Affected by
  - Lean body mass
  - Body size
  - Sex
  - Age
  - Heredity
  - Physical condition
  - climate

## Lean Body Mass

- Muscle as opposed to fat tissue
- Large body frames require more calories
- Men require more energy than women
- Children require more calories per pound
- BMR increase during fever
- BMR decreases during starvation or severely decreased calorie intake

## Estimating BMR

## Energy Balance