Chapter 29: Nutrition and Digestion

Nutrient Classifications:

1) **Carbohydrates**: Energy source (~46% for humans)
   - Energy storage (short-term): *Glycogen* (liver / muscles)

2) **Lipids**: Energy source (~38% for humans)
   - Energy storage (long-term): *Fats*
   - Provide building materials (e.g. phospholipids, cholesterol)

3) **Proteins**: Energy source (~16% for humans)
   - Provide building materials (amino acids)
   - *Essential amino acids*: Can not be synthesized by body (9 / 20 amino acids)

4) **Minerals** (Elements / Inorganic molecules - Table 29.3):
   - Structural material (e.g. calcium, iron, iodine)
   - Assist in physiological functions (e.g. sodium, potassium, calcium)

5) **Vitamins** (Organic compounds - diverse group):
   - **Water-soluble**: Cleared from body (urine)
     - *Vitamin C*: Maintenance of connective tissues
   - **Water-insoluble**: Stored in body (fat)
     - *Vitamin A*: Produces visual pigments
     - *Vitamin K*: Regulates blood clotting

Digestion: Mechanical and chemical breakdown of food
- Required to absorb nutrients (complex → simple)

Tasks of Digestive System:
1) **Ingestion** = Food enters system (mouth)
2) **Mechanical Breakdown** = Food physically broken down
3) **Chemical Breakdown** = Food broken down via enzymes
4) **Absorption** = Nutrients from digestive cavity into body
5) **Elimination** = Indigestible material cleared

2) Human Digestive System (COMPLEX):

(Figure 29.8)
Process of Human Digestion:

2) Esophagus conveys food to stomach
   - Peristalsis: Rhythmic contraction of smooth muscle; propels food
   - Bolus: Compacted food

3) Stomach:
   - Stores food (2 - 4 liters = 0.5 - 1 gallon)
   - Mechanically breaks down food (smooth muscle → churns)
   - Chemically breaks down food
     - Acidic environment (pH 1 - 3 → HCl secretion)
     - Pepsin: Enzyme → Proteins
       - Bleeding Ulcers
   - Chyme = Thick, acidic liquid
   - Water, Alcohol, Drugs (e.g. aspirin) absorbed through stomach wall

4) Small Intestine = Chemical digestion & absorption:
   - Longest portion of digestive system (~ 3.5 m)
   - Chemical Digestion:
     - Pancreas (pancreatic juice)
       - Bicarbonate ion = neutralizes chyme
     - Amylase = Enzyme → carbohydrates
     - Lipase = Enzyme → lipids
     - Proteases = Enzymes → proteins
     - Liver (bile)
       - Bile stored / concentrated in gallbladder
         - Bile salts = Assist in breakdown of fats
   - Absorption:
     - Large surface area (2200 square feet)
     - Villi: Finger-like projections tube surface
     - Microvilli: Projections of cell membrane
     - Blood / lymph vessels (lacteals) run up villi (nutrient absorption)
     - Requires energy (ATP)
   - Movements:
     - Segmentation (mixing)
     - Peristalsis (propulsion)
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Process of Human Digestion:
5) Large Intestine = absorption & elimination:
   • ~ 1.5 m long (colon & rectum):
     • Contain bacteria:
       • Produce Vitamin B complexes and Vitamin K
       • Absorbs water, vitamins, salts
       • Movement via peristalsis & defecation
     • Feces = Indigestible waste (semi-solid)

Control of Digestion:
1) Nervous System:
   • Food stimuli activates digestive system (e.g. smell, taste, stretch)
     • Secretes saliva (mouth), HCl (stomach)
2) Endocrine System:
   • Gastrin (stomach): Stimulates HCl secretion (stomach)
   • Secretin (s.intestine): Stimulates bicarbonate release (pancreas)
   • Cholecystokinin (s.intestine): Stimulates bile release (gallbladder)
     • Stimulates pancreatic enzymes (pancreas)