Chapter 3

**Is it Possible to Supplement Your   
Way to Better Health?   
Nutrients and Membrane Transport**

**Nutrients – Macronutrients**

* **Nutrients**: substances in foods that provide structural materials or energy
* **Macronutrients**: nutrients that are required in large amounts
* Water
  + Adults need about 3 liters per day
  + Too little leads to **dehydration**
  + Maintains blood pressure
  + Involved in all cellular activities
* Carbohydrates: main energy source
  + Simple sugars (glucose) enter our system quickly
  + Complex carbohydrates (branching chains of simple sugars) are digested more slowly
    - **Starch**: complex carbohydrate from plants
    - **Glycogen**: complex carbohydrate from animals
  + **Processed food**
    - Food that has undergo processing that has stripped it of its nutritional value
  + **Whole foods**
    - Foods that have not been stripped of their nutrition
    - **Fiber**: indigestible complex carbohydrates
      * Essential for large intestine function
      * Lowers cholesterol and reduces cancer risk
* Proteins
  + Polymers of amino acids
  + **Essential amino acids**: we cannot make these ourselves; must obtain them from food
  + **Complete proteins**: contain all the essential amino acids we need
    - Plant proteins can be combined to make them complete.
* Fats
  + Energy storage molecules
  + Acts as a cushion and insulator
  + Consist of a glycerol attached to fatty acid tails
  + **Essential fatty acids**: we cannot make these ourselves (e.g., omega-3 and omega-6)
  + **Saturated fats**: fatty acid carbons are bound to as much hydrogen as possible
  + Lack double bonds
  + Solid at room temperature
  + Most animal fats are saturated
  + **Unsaturated fats** are not bound to as much hydrogen as possible
  + Contain double bonds which give kinks in the tails
  + Liquid at room temperature
  + Most plant fats (**oils**) are unsaturated or polyunsaturated
  + **Polyunsaturated fats**
    - Have many double bonds preventing it from tightly packing
  + **Hydrogenation**
    - Process that adds hydrogen atoms to unsaturated fats to make it a solid
  + **Trans** **fats** are produced by incomplete hydrogenation and not beneficial
    - May be linked to an increased risk of heart disease and diabetes

**Nutrients – Micronutrients**

* **Micronutrients**: nutrients that are needed in small quantities
* **Vitamins:** Table 3.1 lists the various vitamins
  + organic substances which usually function as **coenzymes**
  + Vitamin D the only one we can synthesize
  + Water-soluble vitamins
    - Not stored in the body and typically the cause of deficiencies
  + Fat-soluble vitamins
    - Stored in fat and can cause problems in excess
* **Minerals**: inorganic substances
  + Do not contain carbon but essential for cell functions
  + Must be supplied through diet and are water soluble
  + Calcium is a very important mineral that plays a role in bones, clotting, muscle contraction and nerve impulses
  + Table 3.2 lists the various minerals and their functions
* **Antioxidants**
  + Found in whole foods
  + Protect cells from damage by free radicals
  + Free radicals can damage DNA and cell membranes
  + Table 3.3 describes food sources of antioxidants

**Transport Across Membranes**

* Nutrients have to move across the cell membrane in order to be used   
  by the cell.
* Plasma membrane is composed of a phospholipid bilayer & is differentially permeable
* **Diffusion**: movement of molecules from area of high concentration to low concentration
* **Passive transport**: diffusion of small hydrophobic molecules without energy
* **Facilitated diffusion**: transport of hydrophilic and charged molecules across the membrane.
  + Uses proteins embedded in the membrane
  + No input of energy required
* **Osmosis**: movement of water across a membrane, from high to low concentration.
  + When an animal cell is placed in salt water it will shrivel
  + When an animal cell is placed in distilled water it will swell and burst
* **Active transport**
  + Uses proteins to move molecules from low to high concentration
  + Powered by energy from ATP
* **Exocytosis**: a membrane-bound vesicle fuses with the membrane and expels the large molecule
* **Endocytosis**: a vesicle forms around a large molecule and brings it into the cell

**You are what you eat**

* + Food is digested into building blocks used by cells for various functions and structures