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