Biomolecules

I. **Organic Compounds:** Compounds made of hydrogen and other elements covalently bonded to carbon atoms.
   a. Organisms consist mainly of oxygen, hydrogen and carbon
      i. Most of the oxygen and hydrogen are in water.
   b. Carbon has unique bonding properties
      i. Carbon can share electrons with as many as four other atoms
      ii. Consequently, it can form several different shapes
          1. Chains
          2. Rings
          3. Side branches
      iii. **Polymers**—large molecules made up of repeated units of smaller molecules called **monomers**.
      iv. **Four major groups of biomolecule polymers**
          1. Carbohydrates
          2. Lipids
          3. Proteins
          4. Nucleic Acids
   c. **Carbohydrates**
      i. Made of carbon, hydrogen and oxygen in a 1:2:1 ratio
      ii. Monomer = (CH₂O)n
      iii. **Monosaccharide:** Simple sugar
          1. Tend to have five or six carbon atoms and tend to form a ring when dissolved in cells or body fluids.
          2. Ex: Glucose, the main energy source for most organisms and the precursor of many larger sugars.
      iv. **Oligosaccharides:** Short Chained sugars
          1. Short chain of two or more sugar monomers that are bonded covalently.
          2. Ex: Sucrose: Made of one glucose and one fructose unit
      v. **Polysaccharides:** Complex sugars
          1. Straight or branched chains of many sugar monomers (100’s or 1000’s) of the same or different types.
          2. Examples
             a. Cellulose: structural polymer in plant cells
             b. Starch: Storage of glucose in plants
             c. Glycogen: The sugar storing equivalent of starch in animals
   d. **Lipids**
      i. Mostly hydrocarbon, they are quite hydrophobic.
      ii. Monomer = CH₂
      iii. They are greasy or oily to the touch
      iv. **Fats and Fatty Acids**
         1. **Fats** have one, two, or three fatty acids attached to glycerol
         2. Each **fatty acid** has a backbone of as many as 36 carbon atoms and stretches out like a flexible tail.
a. **Unsaturated** tails incorporate one or more double bonds.
   i. The bonds put kinks in the tails and therefore the **fatty acids** don’t congeal, but flow very well.

b. **Saturated** tails contain single bonds only.
   i. **Saturated** fats pack together well, because they all line up nicely.

3. **Triglycerides** are neutral fats having three fatty acid tails attached to glycerol.
   a. Make up butter, lard and vegetable oils
   b. The body’s most abundant lipids and its riches energy source.
      i. Yield twice as much energy as starches

4. **Phospholipids** have a hydrophilic ‘head’ with a phosphate group and another polar group.
   a. The main materials of cell membranes, which have two layers of lipids. Heads of one layer are dissolved in the cell’s fluid interior, and heads of the other layer are dissolved in the surroundings.

5. **Sterols** are lipids without fatty acids.
   a. All have a rigid backbone of four fused-together carbon rings.
      i. Examples
         1. Cholesterol
         2. Steroids

6. **Waxes** are long-chain fatty acids tightly packed and linked to along-chain alcohols or carbon rings.
   a. They have a firm consistency and repel water.
      i. Examples:
         1. Beeswax

e. **Proteins**
   i. Most diverse of the large biomolecules
   ii. Include
      1. **Enzymes** which catalyze metabolic reactions
      2. Structural proteins
      3. Transport proteins that move ions across the cell membrane.
   iii. Monomer = **amino acids**
      1. **Amino Acids** are small organic compounds that consists of an amino group, a carboxyl group (an acid), a hydrogen atom and one or more atoms known as its R group
      2. Amino acids are linked one after the other by **peptide bonds** to form proteins
      3. There are twenty different kinds of amino acids from which all proteins are made
a. The interaction of multiple proteins

f. **Nucleic Acids**
   i. Monomer = nucleotides, small organic compounds with major roles in metabolism.
   ii. Consist of a sugar, at least one phosphate group and a base.
      1. The sugar is either ribose or deoxyribose
      2. The bases have a single or double carbon ring structure that incorporates nitrogen.

g. 1. Nucleotides are monomers for single- or double stranded nucleic acids.
   2. **DNA** is a type of nucleic acid.
      a. Four different types of nucleic acids make up DNA, which differ only in the component base
         i. Adenine
         ii. Guanine
         iii. Thymine
         iv. Cytosine
      b. Double stranded, and the two strands are held together by double bonds between the bases
      c. Encodes protein-building instructions.
   3. **RNA**
      a. Similar to DNA but is usually only single stranded.
      b. Serve in processes by which genetic information is used to build proteins.

ii. **ATP is also a nucleotide**
   1. **Adenosine triphosphate**
      a. The energy transport molecule in cells.
      b. It has a string of three phosphate groups attached to its sugar component. ATP can readily transfer a phosphate group to many other molecules inside cells and the acceptor molecules become energized enough to enter a reaction