• **Definition:** A lipid is an organic molecule of biological origin that is insoluble in water and soluble in non-polar solvents.

• **Properties:** Lipids are hydrophobic (water fearing) also considered lipophilic (fat loving) due to their large non-polar regions.

• **Categories:** There are eight categories of lipids, but we are only responsible for the following seven categories in the Chemistry 14C course:

1. **Fatty acid:**
   - **Definition:** carboxylic acid with long un-branched hydrocarbon chain
   - Fatty acids have an even number of carbons (usually between 12 and 20 are most common)
   - Two types:
     a) **Unsaturated fatty acids:** feature one or more C=C (where cis is more common than trans)
        - **Monounsaturated:** one C=C
        - **Polyunsaturated:** more than one C=C
     b) **Saturated fatty acids:** do not feature a C=C
   - **Biological Importance:**
     a) Precursor to other lipids
     b) Energy Storage
   - **Example:** Lauric acid (12 carbons) (saturated)

2. **Example:** Oleic acid (18 carbons) (unsaturated) (cis)
2. Wax:
   - **Definition:** esters derived from a fatty acid and long-chain alcohol
   - Esters derived from a fatty acid and a long-chain alcohol
   - **Biological Importance:**
     a) Water Barrier
        - Minimizes water evaporation in leaves
        - Minimizes wetting in feathers
   - **Example:** Generic structure

3. Triacylglycerol (triglyceride):
   - **Definition:** fatty acid triester of glycerol
   - Most abundant of the natural lipids
   - Yields soap upon hydrolysis
   - Fat if solid at room temperature; oil if liquid
   - **Biological Importance:**
     a) Energy Storage
     b) Hydrolysis of animal fat yields soap
   - **Example:** Generic structure
4. **Phospholipid:**
   - **Definition:** glycerol esterified with two fatty acids and one phosphate group
   - Second most abundant group of natural lipids
   - Features the **hydrophobic effect** (hydrophobic tails avoid water)
   - **Biological Importance:**
     a) Membrane component
     b) Forms the phospholipid bi-layer

   **Example:** Phosphatidic acid

   ![Phosphatidic Acid](image)

   **Example:** Main component to look for:

   ![Phosphatidic Acid](image)

5. **Prostaglandin:**
   - **Definition:** molecule with the prostanoic acid skeleton (see chart)
   - Different prostaglandins have similar structures but different functions
   - **Biological Importance:**
     a) Messenger molecule
     b) Regulates other regulatory molecules such as inflammatory mediation, calcium movement, hormones
     c) May occur at wound sites and lead to inflammation
     d) Has a short half-life within the organism of about 5 minutes or less

   **Example:** Prostanoic acid generic structure

   ![Prostanoic Acid](image)
6. Steroid:
   - **Definition:** molecule having a 6-6-6-5 membered ring system
   - Features a flat core
   - Different steroids have similar structures but different functions
   - Four classes:
     a) **Bile acid:** aid in digestion by emulsifying fats
     b) **Sex hormone:** signal molecules that control various aspects of sexuality
     c) **Mineralocorticoid:** regulates electrolyte levels
     d) **Glucocorticoid:** regulates blood glucose levels
   - **Biological Importance:**
     a) Messenger molecule that controls functions such as:
        - Sex-related traits
        - Metabolic processes
        - Regulates inflammation
        - Regulates glucose metabolism
     b) Aids in digestion by emulsifying fats

   - **Example:** Generic structure

![Steroid Structure Diagram](image)

7. Lipophilic vitamin:
   - **Definition:** an organic compound, other than fat, protein, or carbohydrate, required for the normal growth and maintenance of animals
   - Features a broad range of structures and functions
   - There is no set structure to memorize for vitamins so the best way to classify them is by process of elimination.
   - **Biological Importance:**
     a) Examples of various functions and effects include:
        - Vitamin A is essential to vision.
        - Vitamin C is an antioxidant.
References:


All images (found in Lecture Supplement or Illustrated glossary)
http://www.chem.ucla.edu/harding/index.html