

## Unit 2: The Chemical Basis for Life (2.2, 2.3, 2.4, 12.2, 13.1)

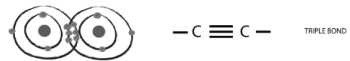
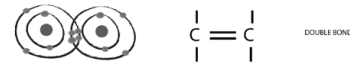
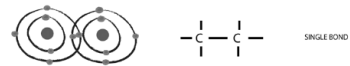
### Lesson 2: Organic Molecules: Lipids and Carbohydrates (2.3)

#### I. Carbon-Based Life Forms

##### A. Organic Compounds make up Cells and Organisms

##### 1. Organic Compounds: Always contain C bonded to H

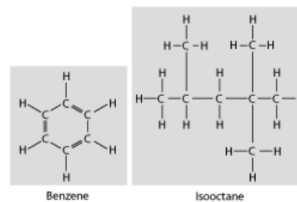
- usually contain O, as well as N, P
- large complex molecules (macromolecules)
- molecules are built using covalent bonds



##### B. Carbon

##### 1. Has 4 valence e- and ALWAYS forms 4 covalent bonds

- can make compounds with a wide variety of other atoms
- can form single covalent bonds (share 1 pair of e-)
- can form double covalent bonds (share 2 pairs of e-)
- can form triple covalent bonds (share 3 pairs of e-)
- can bond to other Carbons to make long chains, rings or other complex structures (macromolecules)



#### II. Lipids: Triglycerides (fats and oils), wax, sterols and phospholipids

\* All Lipids are non-polar, organic compounds and do not dissolve in water

\* Lipids are made up of Carbon, Hydrogen and Oxygen

##### A. Triglycerides (fats and oils)

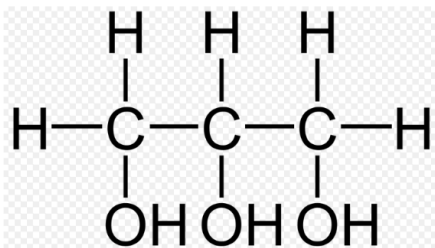
##### 1. Basic Structure:

- three fatty acids (tails): long chains of C and H with a Carboxyl group at one end
  - \* fatty acids can have single bonds or double bonds between the Carbons
  - \* carboxyl group (acid group): HO-C=O (-COOH)
- one glycerol (3 Carbon Alcohol)
- Dehydration Synthesis: the chemical reaction that bonds the three fatty acids to the glycerol.

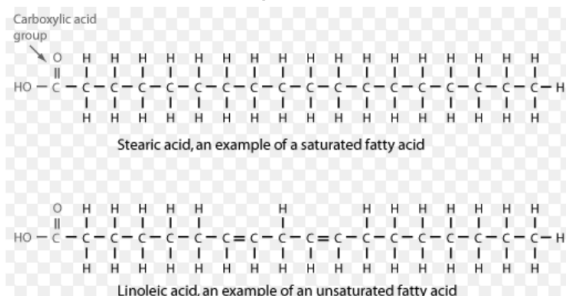
##### 2. Saturated and Unsaturated Fatty Acids

- saturated fatty acids have all single bonds between the C's in their chain
  - \* results in the maximum number of H's (saturated)
  - \* saturated fatty acids are solid at room temperature
- unsaturated fatty acids have one or more double bonds between the C's in their chain.
  - \* results in fewer H's (unsaturated)
  - \* unsaturated fatty acids are liquid at room temperature
  - \* monounsaturated fatty acids have one double bond
  - \* polyunsaturated fatty acids have two or more double bonds

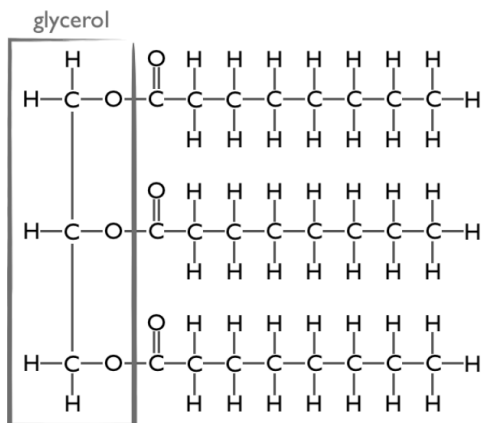
## Glycerol



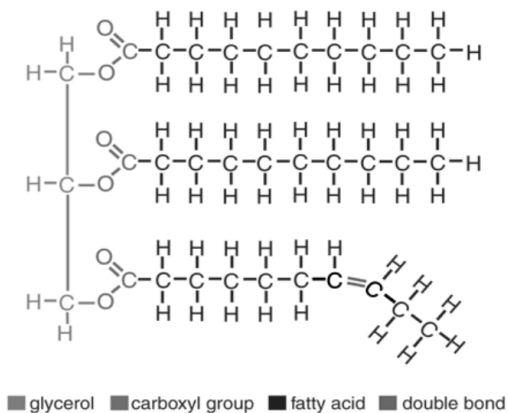
## Fatty Acids



## Saturated Fat



## Unsaturated Fat



### 3. Function of Triglycerides

- Energy: triglycerides provide 9 calories per gram
- Energy storage: energy from other compounds (Carbohydrates, Protein) can be stored as fat. Adipose Tissue: stores fat in our body
- Insulation: fat under our skin helps to keep us warm
- Protection: fat around or organs (heart, eyes) helps to protect from injury

### B. Other Important Lipids

#### 1. Phospholipids: make up cell membranes

- have a polar phosphate and glycerol group that is attracted to water (**hydrophilic**)
- have two non-polar fatty acid chains that are **hydrophobic**

#### 2. Wax: waterproof, protective substance secreted by many plants and animals

- bee wax protects developing larvae
- ear wax protects our inner ear
- cuticle on plants

#### 3. Sterols: chemical messengers and hormones

- Cholesterol is part of cell membranes and helps make steroids

