

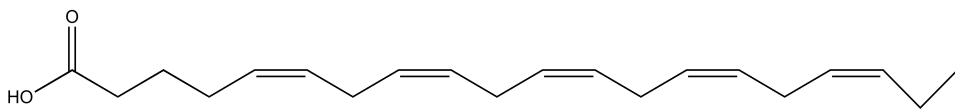
Tutorial 21: Lipids

Goals:

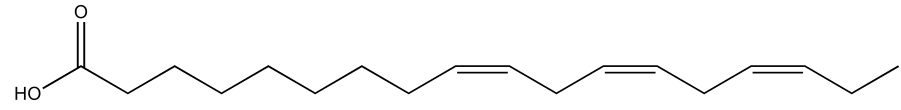
- ✓ To understand the general structures of fatty acids, triglycerides and sterols.
- ✓ To understand the fundamental roles lipids play in the body.
- ✓ To learn the difference between saturated and unsaturated fatty acids, including monounsaturated and polyunsaturated fatty acids.
- ✓ To understand the major source of trans fats in our foods.

Lipids

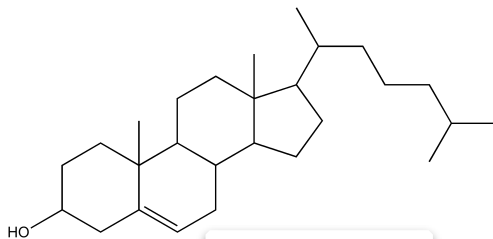
- Lipids are naturally occurring molecules in plants and animals. They are mostly nonpolar hydrocarbons and contain few polar groups.
- The three major roles of lipids include:
 - Lipids reside in fat cells where they store energy left over from metabolism of food.
 - Lipids help to separate the inside of a cell from the outside.
 - Some lipids serve as chemical messengers.



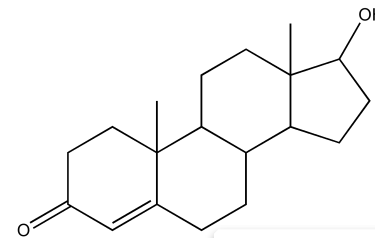
EPA (eicosapentaenoic acid)



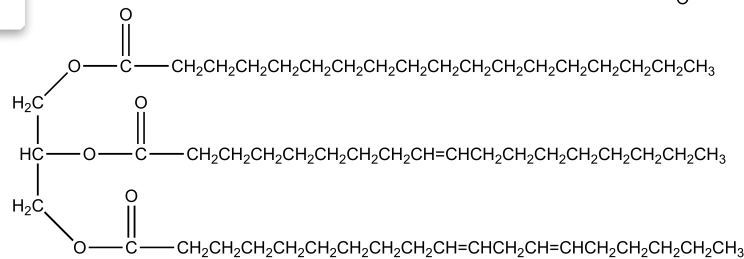
ALA (alpha-linolenic acid)



Cholesterol



Testosterone



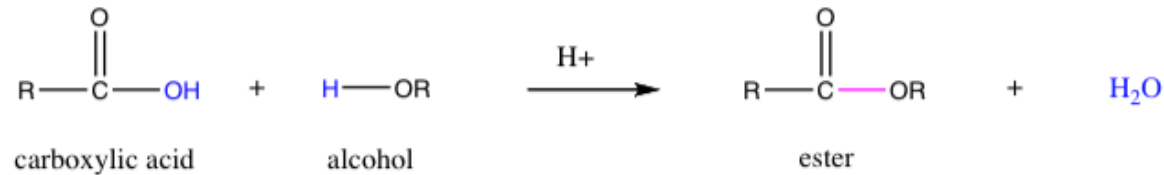
Triglyceride containing palmitic, oleic and linoleic acid

Fatty Acids

- **Fatty acids** have a long hydrocarbon 'tail' attached to a carboxylic acid.
 - **Saturated fatty acids:** Recall that a saturated hydrocarbon is “saturated” with H. Saturated fatty acids have only C-C single bonds.
 - **Monounsaturated fatty acids:** Monounsaturated fatty acids contain one C=C double bond. In nature, the double bond is normally cis.
 - **Polyunsaturated fatty acids:** Polyunsaturated fatty acids contain more than one C=C double bond. The essential fatty acids are polyunsaturated fatty acids. In nature, the double bonds are normally cis.

Triglycerides

- Carboxylic acids react with alcohols to form esters. Notice that the reverse reaction is hydrolysis (splitting with water).



- Three fatty acids are bound to a glycerol unit via three ester links, the result is a triglyceride. Fatty acids in nature are part of triglycerides as either fats or oils.
 - Fats are from animal sources. They are solid at room temperature due to the stronger IFAs that form when the carbon chains stack together.
 - Oils are from plant sources. They are liquid at room temperature due to the weaker IFAs that form since the carbon chains cannot stack together due to the kinks about the cis double bonds.

Trans Fats

- The food industry uses hydrogenation to convert unsaturated fatty acid units of oils into saturated fatty acid units. This makes the oil turn to a solid (fat). These processed fats are known as hydrogenated oils or partially hydrogenated oils, and a byproduct of this process is the creation of trans fat.
- You should be aware of hydrogenated and partially hydrogenated oils in your food since trans fats are not essential to our diet, and there is a suspected link to heart disease, increased “bad” and decreased “good” cholesterol, and obesity. At this time, the FDA has set a deadline of 2018 for food companies to eliminate trans fats from their products.

