Esterification

- Alcohols and carboxylic acids react to form esters in a reaction known as esterification.
- The reverse reaction is hydrolysis.
- Hydrolysis means "splitting with water".

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\begin{align*}
\text{CH}_3\text{C}^\text{O} \text{OH} + \text{H}^\text{OCH}_2\text{CH}_3 & \rightleftharpoons \text{CH}_3\text{C}^\text{OCH}_2\text{CH}_3 + \text{H}^\text{O} \text{H} \\
\text{Acetic acid} & \text{Ethanol} & \text{Ethyl acetate} & \text{Water}
\end{align*}
\]
Lipids

• Lipids are naturally occurring molecules in plants and animals. They are mostly nonpolar hydrocarbons and contain few polar groups.
• Three major roles of lipids:
  – Lipids reside in fat cells where they store energy left over from metabolism of food.
  – As a part of cell membranes they help to separate the inside of a cell from the outside.
  – They serve as chemical messengers.
Fatty Acids

- Fatty acids have a long hydrocarbon ‘tail’ with a carboxylic acid functional group as the ‘head’.
  - Saturated fatty acids: recall that a saturated hydrocarbon is "saturated" with H.
  - Monounsaturated fatty acids: contain one C=C double bond, the rest are single bonds; double bonds are naturally of the cis conformation.
  - Polyunsaturated fatty acids: contain more than one C=C double bond. The essential fatty acids are all polyunsaturated fatty acids; double bonds are naturally of the cis conformation.
Triglycerides (aka: triacylglycerides)

• 3 fatty acids form an ester bond to glycerol; fatty acids in nature are part of triglycerides and are 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.
Hydrogenation

- The food industry uses hydrogenation or partial hydrogenation to convert unsaturated fats into saturated or more saturated fats, respectively.
- This is used for preservative purposes, and also to give a better texture to foods.
- This is how trans fats end up in our foods. You should beware of hydrogenated and partially hydrogenated foods as trans fats are not essential to our diet and have been linked to heart disease, increased “bad” and decreased “good” cholesterol, and type II diabetes.
Prostaglandins and Pain

Arachadonic acid is synthesized from an essential omega-6-fatty acid that must be obtained from diet. Arachadonic acid is used by the body to make prostaglandins. Cyclooxygenase (COX) enzymes are needed for these reactions to occur. Since prostaglandin production is responsible for inflammation, pain and fever in the event of injury, inhibiting the synthesis of prostaglandins can decrease inflammation, pain and fever. Many pain medications are enzyme inhibitors that target the COX enzymes.