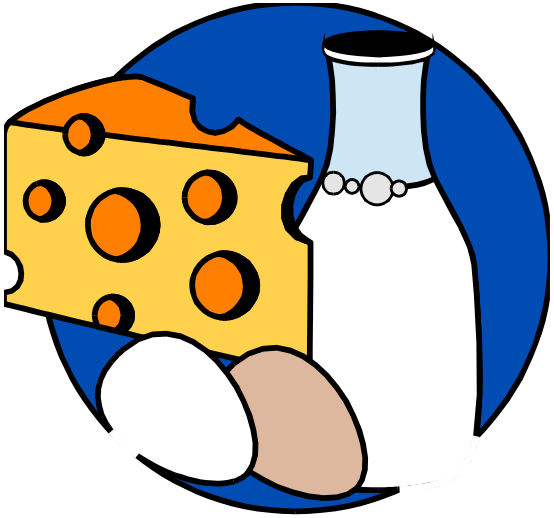
Lipids

Types of Lipids

Fatty Acids

Fats, and Oils

Chemical Properties of Triglycerides

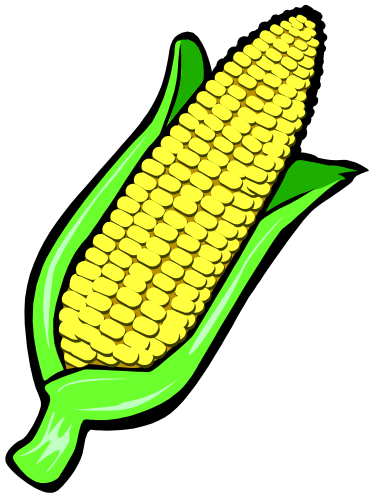


Types of Lipids

- **Lipids with fatty acids**
  - **Waxes**
  - **Fats and oils (trigycerides)**
  - **Phospholipids**
  - **Sphingolipids**
- **Lipids without fatty acids**
  - **Steroids**

Fatty Acids

- **Long-chain carboxylic acids**
- **Insoluble in water**
- **Typically 12-18 carbon atoms (even number)**
- **Some contain double bonds**



corn oil contains 86% unsaturated fatty acids and 14% saturated fatty acids

Saturated and Unsaturated Fatty Acids

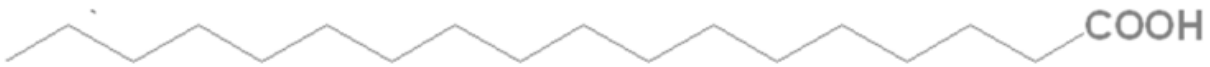
Saturated = C–C bonds

Unsaturated = one or more C=C bonds

saturated fatty acid

Palmitic acid

$CH_3(CH_2)_{14}COOH$
(hexadecanoic acid

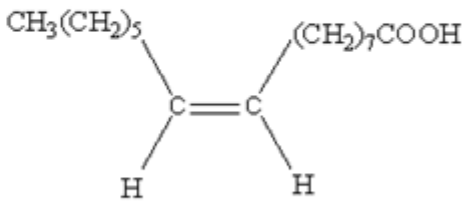


Stearic acid

$CH_3(CH_2)_{16}COOH$
(octadecanoic acid

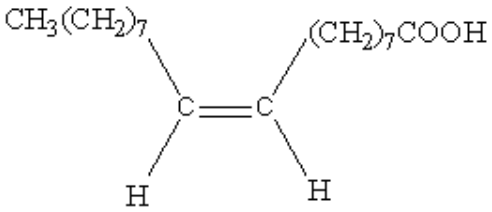
unsaturated fatty acid

palmitoleic acid,



(*cis*-9-hexadecenoic acid)

Oleic acid



(*cis*-9-octadecenoic acid)

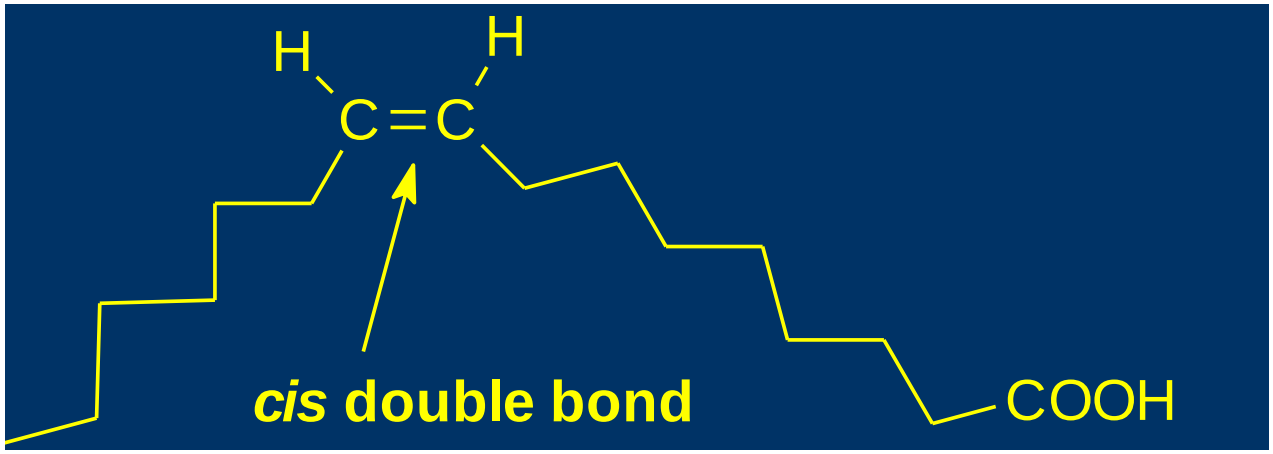
Structures

Saturated fatty acids

- **Fit closely in regular pattern**

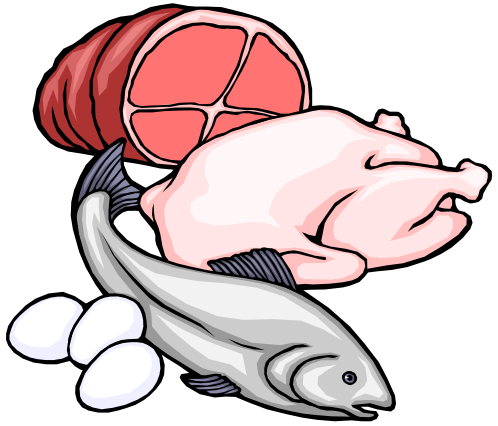
Unsaturated fatty acids

- **Cis double bonds**



Properties of Saturated Fatty Acids

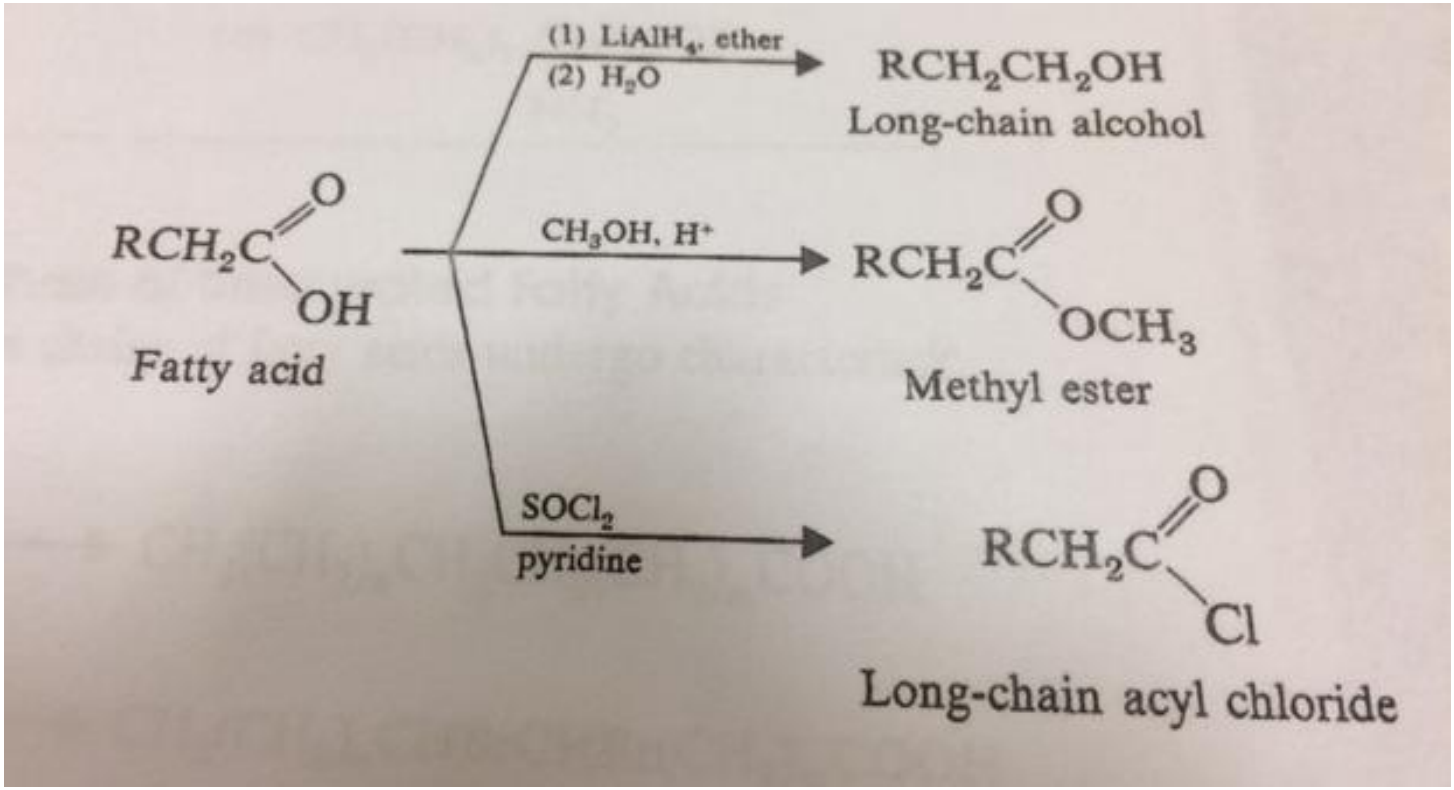
- Contain only single C–C bonds
- Closely packed
- Strong attractions between chains
- High melting points
- Solids at room temperature



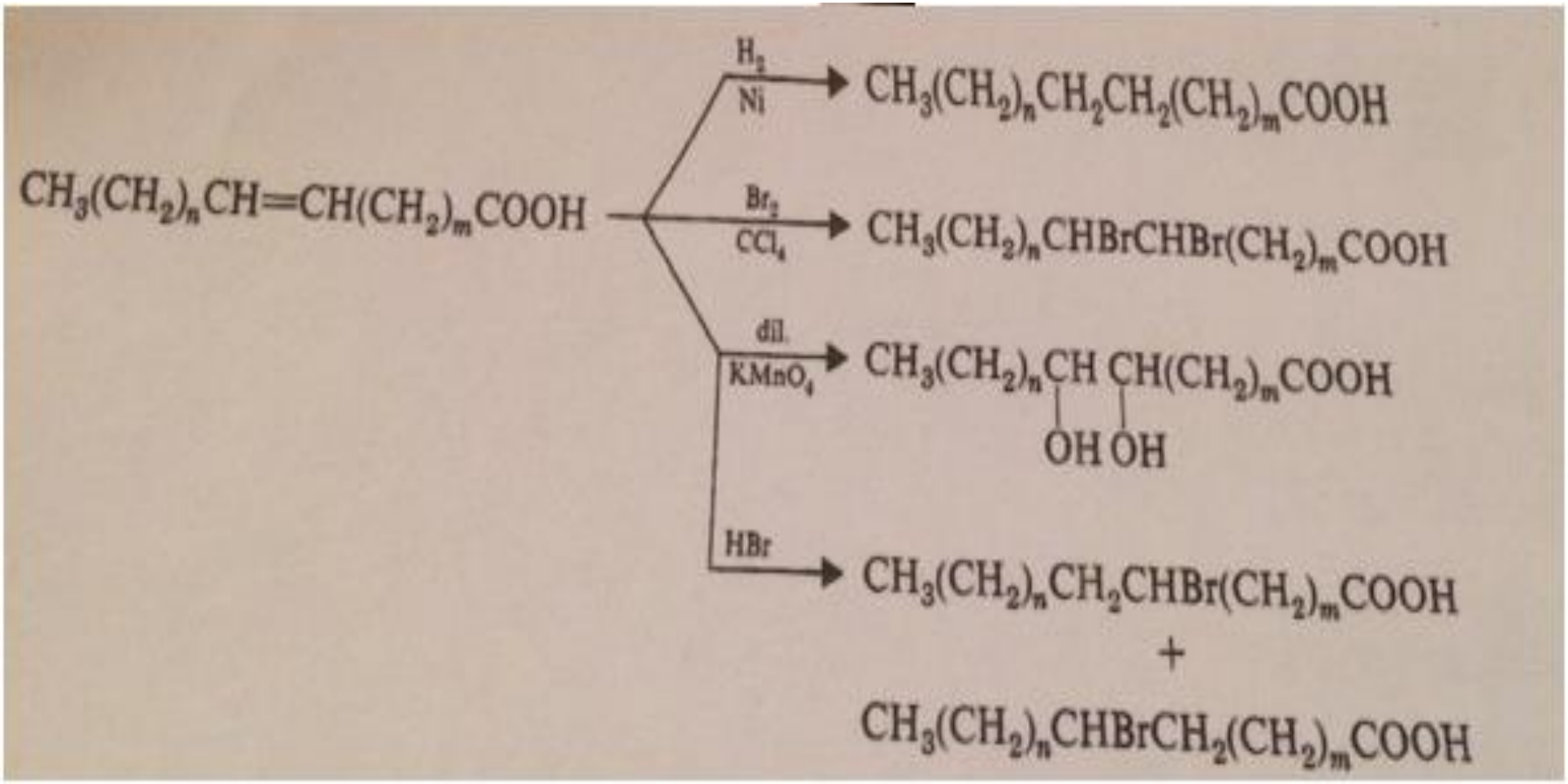
Properties of Unsaturated Fatty Acids

- Contain one or more double C=C bonds
- Nonlinear chains do not allow molecules to pack closely
- Few interactions between chains
- Low melting points
- Liquids at room temperature

Reactions of carboxyl group of fatty acids

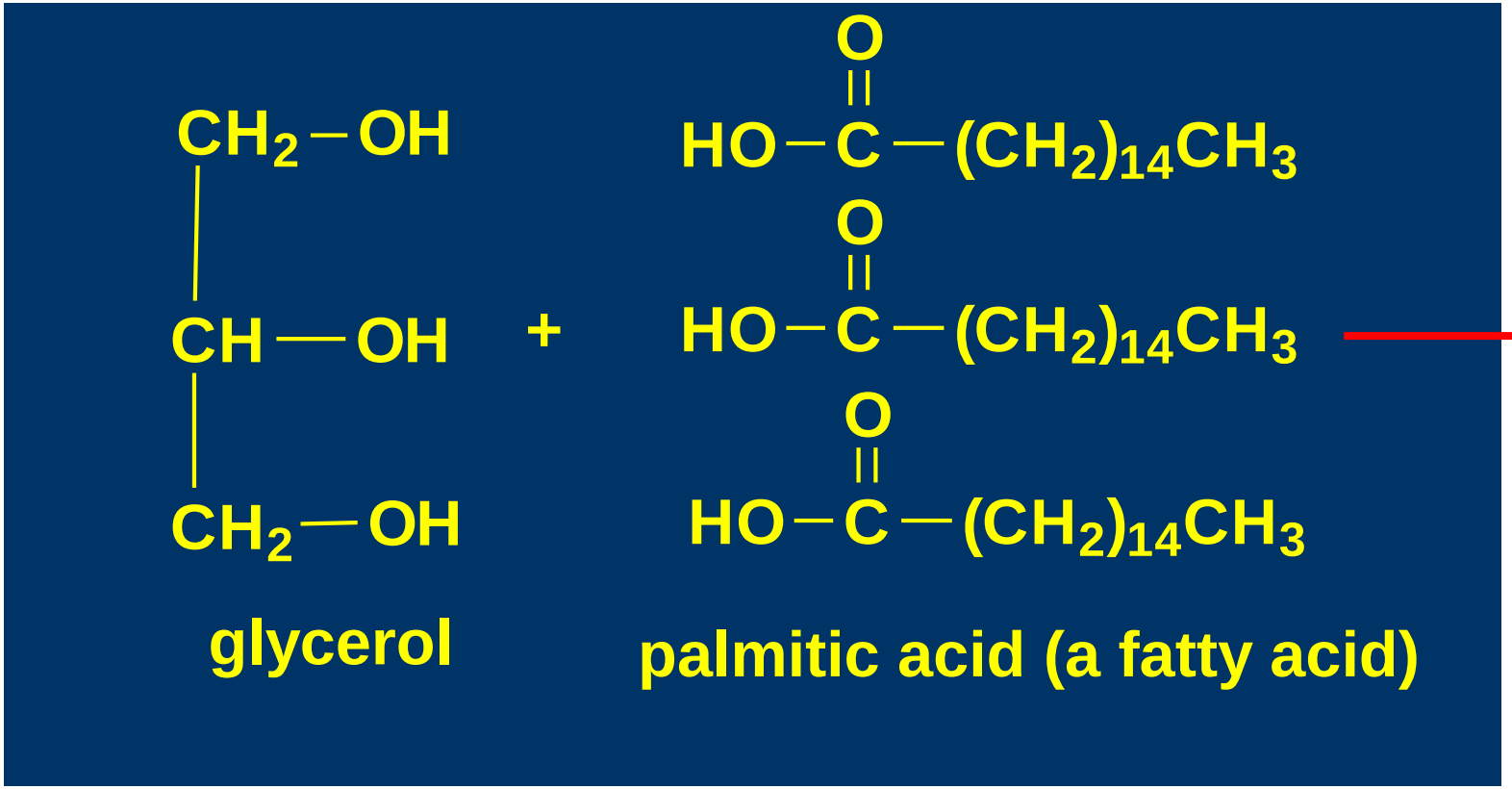


Reactions of alkenyl chain of unsaturated fatty acids



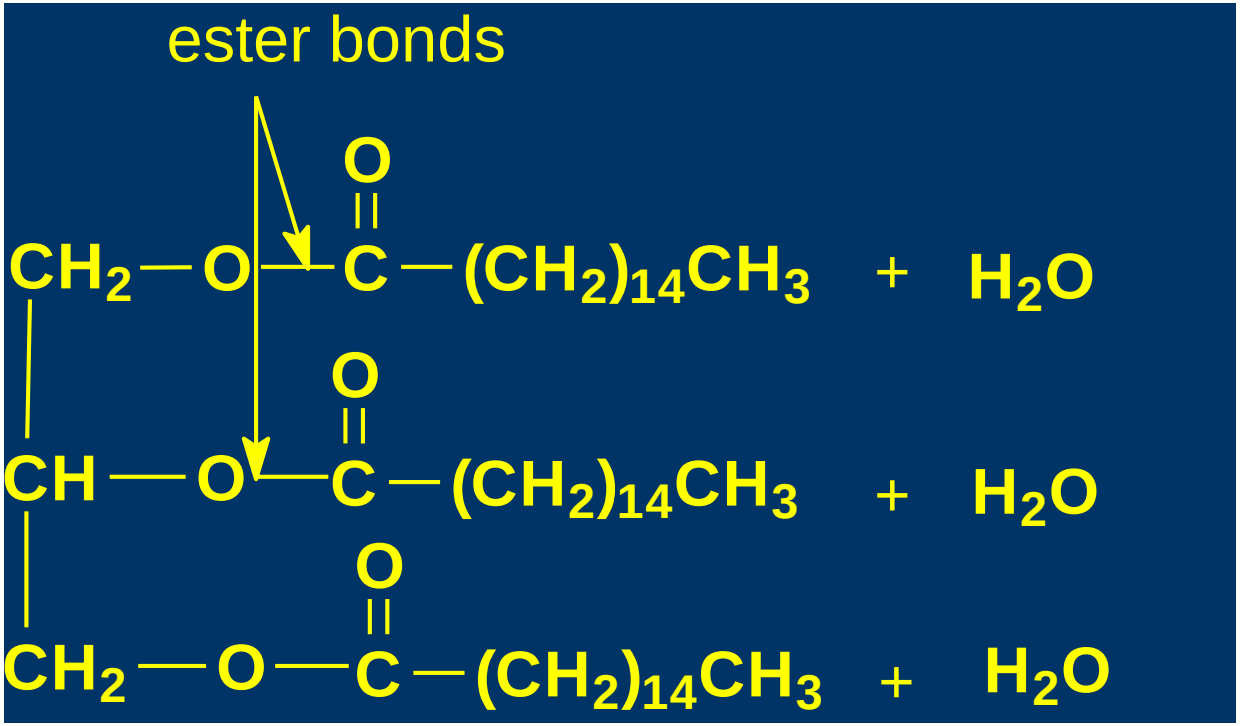
Fats and Oils

Formed from glycerol and fatty acids



Triglycerides (triacylglycerols)

Esters of glycerol and fatty acids



Saponification and Soap

- **Hydrolysis with a strong base**
- **Triglycerides split into glycerol and the salts of fatty acids**
- **The salts of fatty acids are “soaps”**
- **KOH gives softer soaps**

Saponification