LIPIDS

- The word lipid is derived from the greek word **'lipos'** meaning **fat.**
- **Insoluble in water but soluble in non-polar solvents.**
- Lipids occur in plants and animals as **storage and structural components.**
- Supply over twice as much energy per unit weight as proteins or carbohydrates.
- Lipids are essential for the effective absorption of **fat soluble** vitamins i.e. A, D, E and K from intestine.

FATTY ACIDS

- Fatty acids are building block of fat.
- These are **carboxylic acids with hydrocarbon chains.**
- Chemical formula **: R-(CH2)nCOOH.**
- More than **200** fatty acids have been isolated from plants.

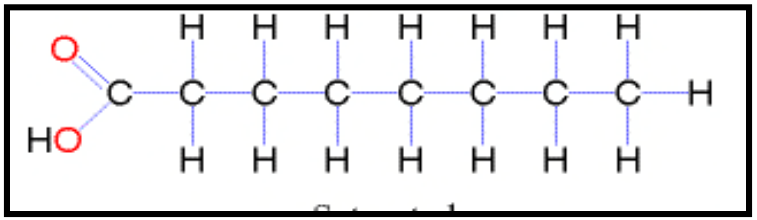
Essential fatty acids: Not synthesized in body but essential for normal growth and development.

E.g. **Linoleic acid, Linolenic acids**

Saturated & Unsaturated Fatty Acids

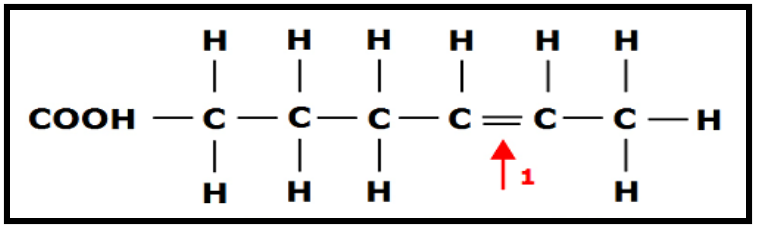
- **Saturated fatty acid** contains single bond and are solid at room temperature.

  E.g. Lauric acid, palmatic acid



- **Unsaturated fatty acids** possesses at least one double bond. Liquid at room temperature.

  E.g. Linoleic acid, Linolenic acid

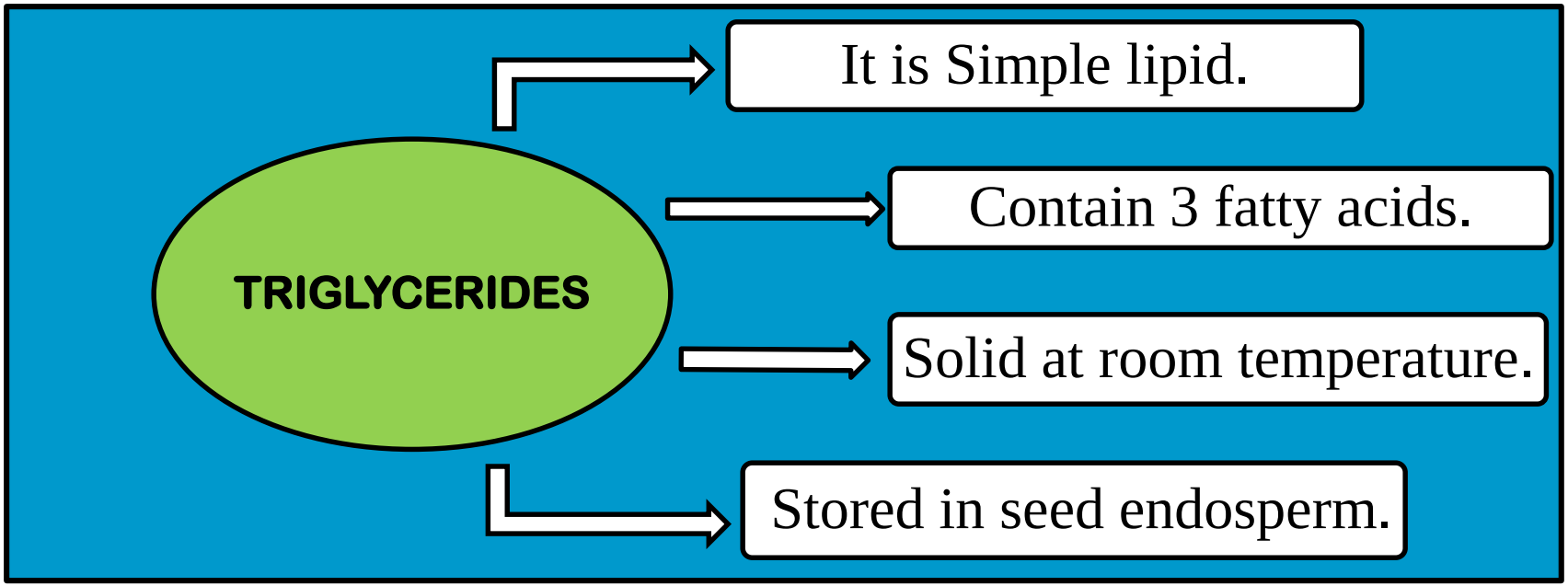


Types of Lipids

1. **Simple Lipids**: contain only fatty acids and glycerol.
   - It includes **fats** and **oil.**

FATS :- Rich in saturated fatty acids.

OIL :- Rich in Unsaturated fatty acids.



Types of Lipids

2. **Compound lipids :** contain chemical group in addition to fatty acids and glycerol.

   E.g. Glycolipids, Phospholipids, Lipoproteins.

3. **Derived lipids** : Substances derived from simple and compound lipids by hydrolysis of alcohol, fatty acids, hydrocarbon etc.

Wax: Esters of fatty acids and alcohol.
e.g. beeswax is esters of palmatic acid.

Storage lipids: Excess lipids after used for nutrition and energy stored in body.

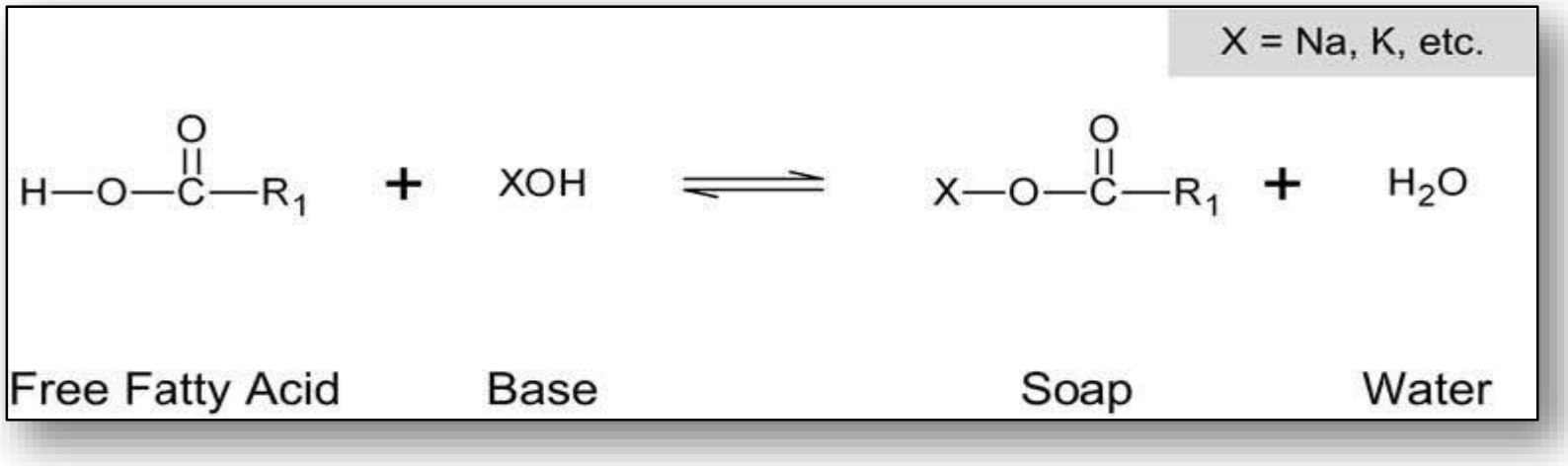
- Lipids are stored in the form of triglycerides, fats and oil

PROPERTIES OF LIPIDS

- **Emulsification :** Fats broken down into smaller droplets dispersed in water.

  E.g. milk and egg yolk

- **Saponification:** Hydrolysis of fat to yield alkali.



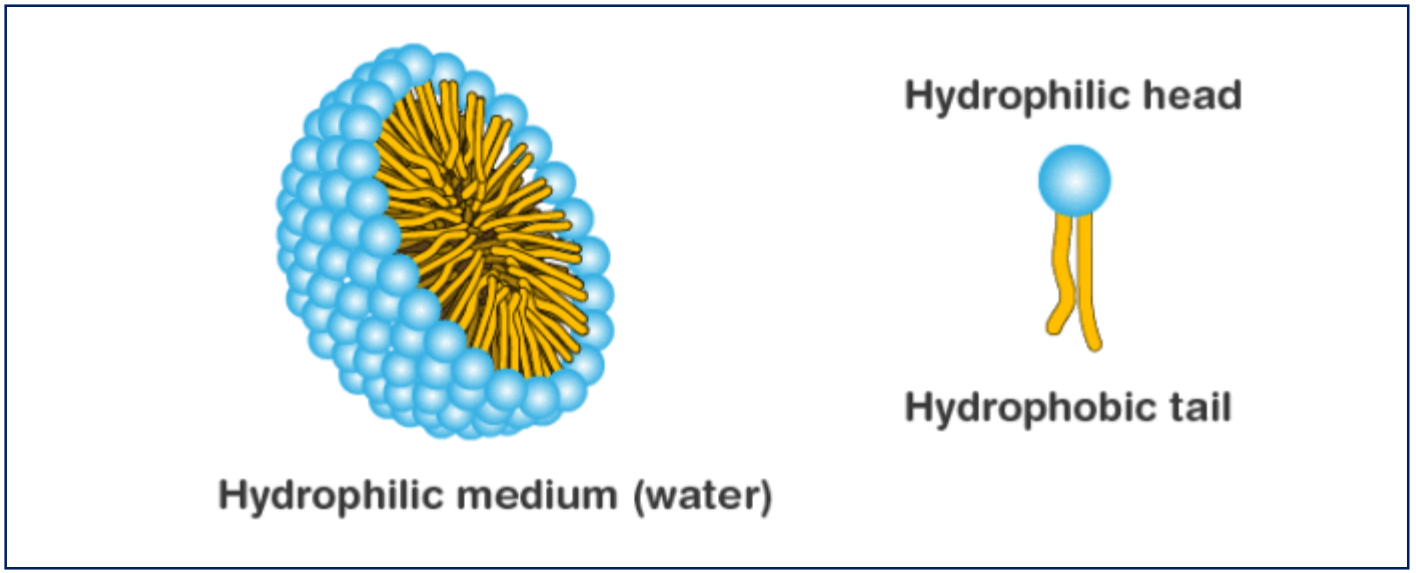
  - Potassium soap are soft and soluble as compared to sodium soap.

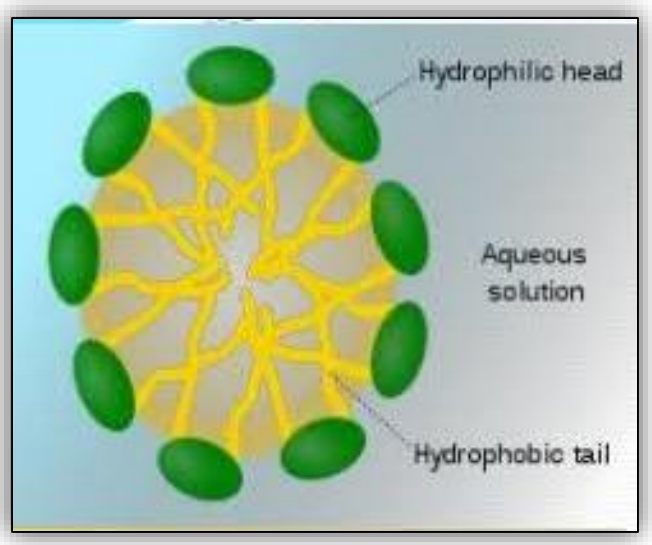
PROPERTIES OF LIPIDS

- **Rancidity:** Development of unpleasant odour and taste in fats or oil upon storage.

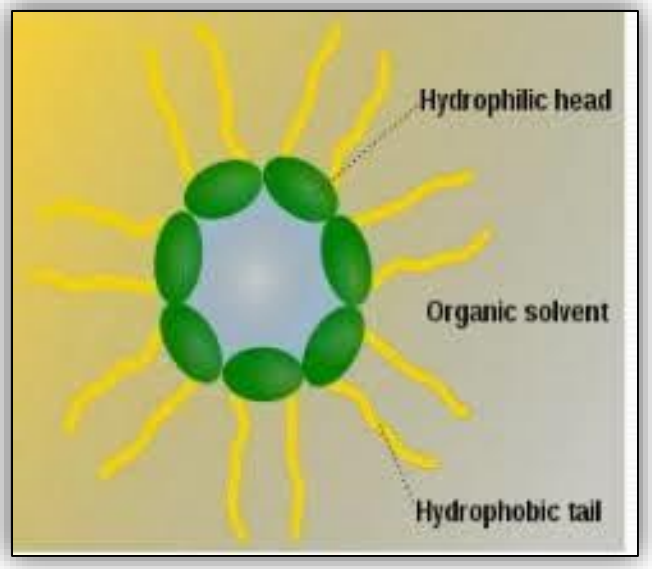
  It is due to hydrolysis of ester bond **(hydrolytic rancidity)** or oxidation of fatty acids **(oxidative rancidity).**

- **Micelle:** lipid molecule that arrange themselves in spherical form in water. Due to formation of amphipathic molecule.





Oil in Water



Water in oil

Beta oxidation

- Breakdown of fatty acid to acetyl coA.
- Occur in mitochondria.
- Process is aerobic.
- After production acetyl-coA is directly fed to kreb cycle.
- It involve three stages: 1. activation of fatty acid, 2. transport, 3. beta oxidation proper.

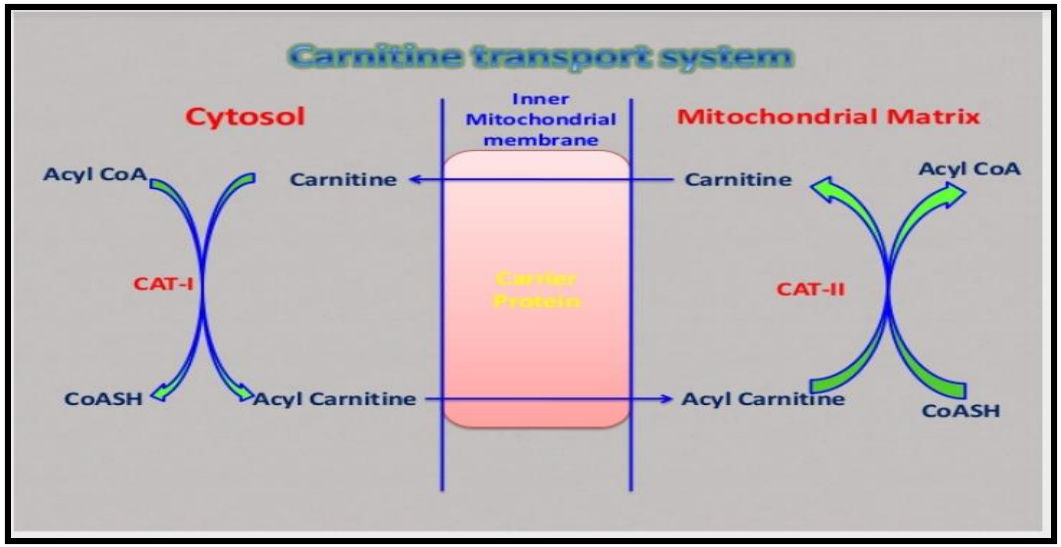
1 gram fat gives 9 kcal energy

Beta Oxidation

1. **Activation of fatty acid:** This reaction proceeded by thiokinase.

Fatty acid + CoA + ATP → acyl-CoA + AMP + 2Pi

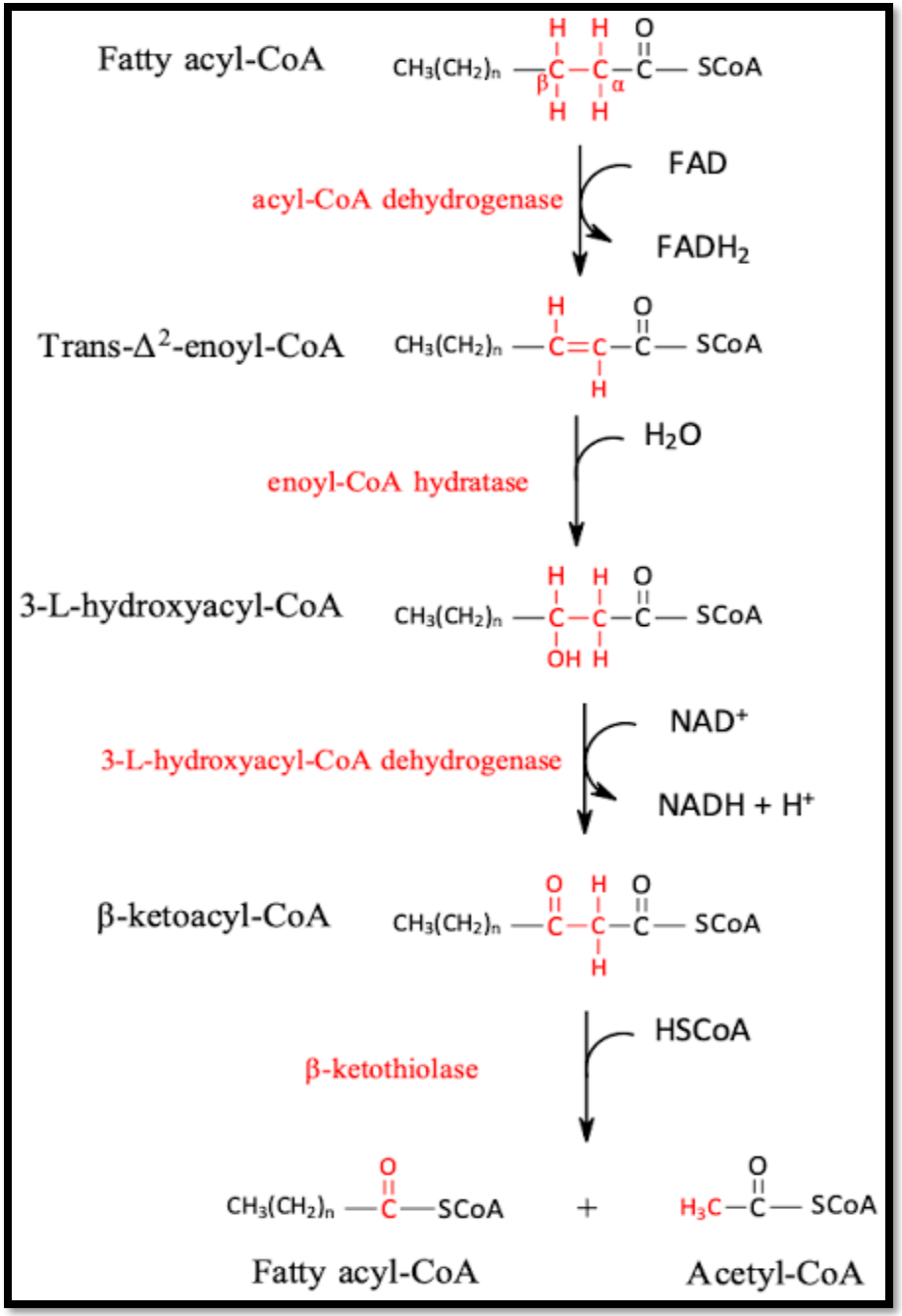
2. **Transportation:** Acyl-CoA transported to inner membrane of mitochondria by mechanism called carnitine shuttle.



Beta Oxidation

3. **β – Oxidation Proper:** Occur in 4 steps.

- Oxidation: by acyl-CoA dehydrogenase.
- Hydration: by enoyl- CoA hydrase.
- Oxidation: by dehydrogenase and product formed is β–ketoacyl CoA.
- Cleavage: by thiolase.



- β-oxidation of palmatic acid will repeats 7 cycle producing 8 molecule of acetyl-CoA.
- Net energy gain through beta oxidation is **129ATP**.

THANK YOU