- Lipids are organic substances occurring in plant and animal tissues and belong to a very heterogeneous group of substances which have only few properties in common, which include:
- They are water insoluble
- Their building blocks are fatty acids , alcohols (glycerol, sphingosine) and sterols
- They can be utilized by the living organisms

Classification of lipids:

- Simple lipids.
- Complex lipids.
- Precursor and derived lipids.

Classification of lipids:

1. Simple lipids:

They are esters of fatty acids with alcohols:

1. Fats and oils: esters of fatty acids with glycerol (triacylglycerols).

2. Waxes: esters of fatty acids with high molecular weight monohydric alcohol.

2. Complex lipids:

Esters of fatty acids with alcohols and molecules with other groups.

Phospholipids:

Lipids containing:

- Fatty acids
- Alcohol
- Phosphoric acid residue.

Glycolipids (glycosphingolipids):

Lipids containing:

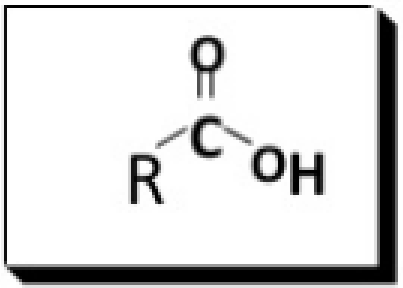
- Fatty acid
- Sphingosine
- Carbohydrate.

3. Precursor and derived lipids:

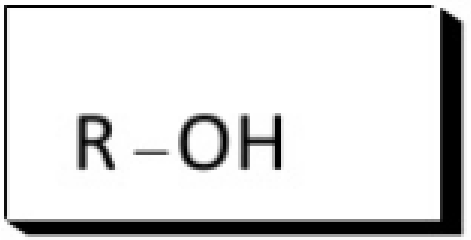
- This group includes:
  - Fatty Acids.
  - Glycerol.
  - Cholesterol.
  - Steroid hormones.
  - Fatty aldehydes.
  - Fat soluble vitamins [A D E K].
  - Some other alcohols.

SIMPLE LIPIDS

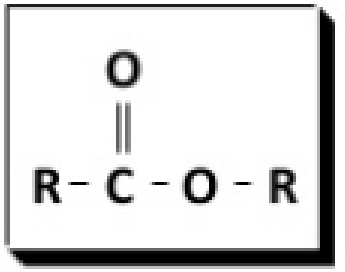
Esters of Alcohols and Carboxylic Acids



Carboxylic Acid



Alcohol



Ester

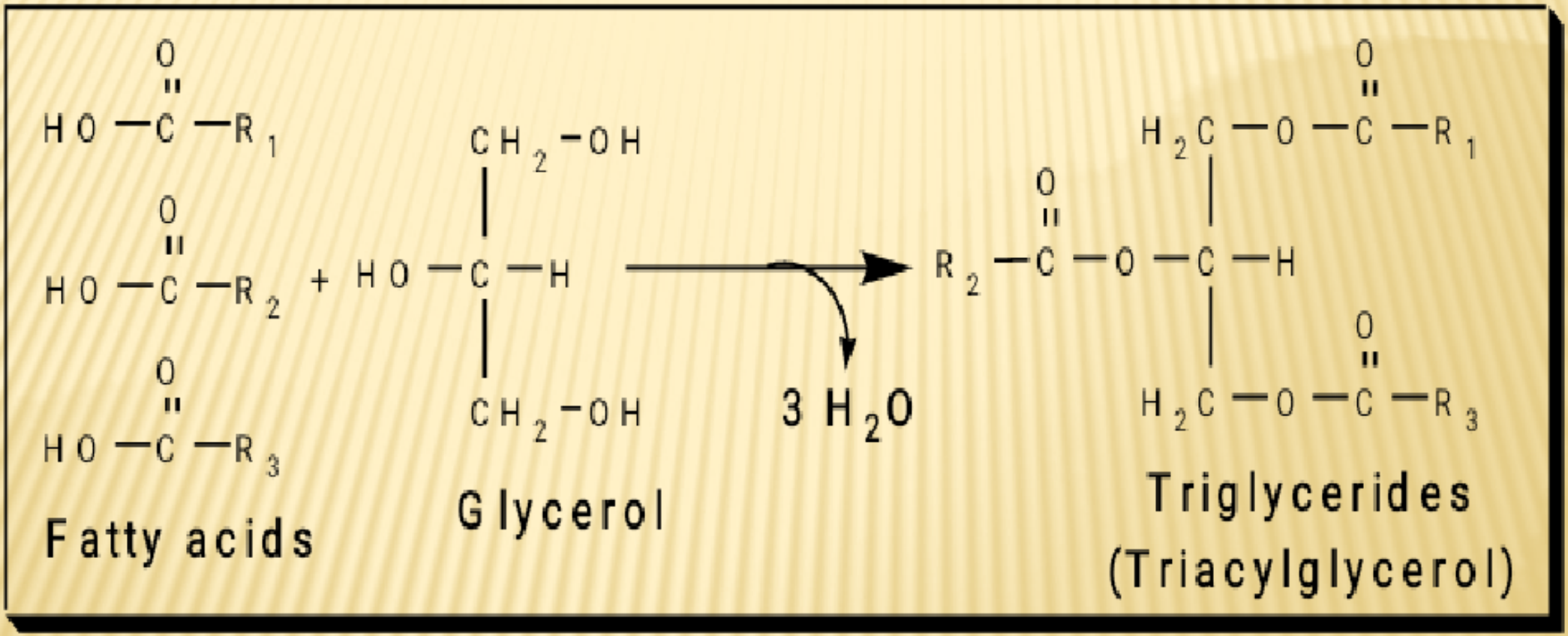
A-NEUTRAL FATS AND OILS (TRIGLYCERIDES)

- They are called neutral because they are uncharged due to absence of ionizable groups in it.
- The neutral fats are the most abundant lipids in nature.
- They constitute about 98% of the lipids of adipose tissue, 30% of plasma or liver lipids, less than 10% of erythrocyte lipids.

DEFINITION

- They are esters of glycerol with various fatty acids. Since the 3 hydroxyl groups of glycerol are esterified, the neutral fats are also called **"Triglycerides"**.

- Esterification of glycerol with one molecule of fatty acid gives **monoglyceride**, and that with 2 molecules gives **diglyceride**.


Fatty acids
Glycerol
3 H2O
Triglycerides
(Triacylglycerol)

- The commonest fatty acids in animal

fats are **palmitic, stearic and oleic acids.**

- The main difference between fats and oils is for **oils being liquid** at room temperature, whereas, **fats are solids.**

- This is mainly due to presence of larger percentage of **unsaturated** fatty acids in oils than fats that has mostly **saturated** fatty acids.

B-WAXES

- **Definition**: Waxes are solid simple lipids containing a monohydric alcohol (with a higher molecular weight than glycerol) esterified to long-chain fatty acids. Examples of these alcohols are **palmitoyl alcohol, cholesterol, vitamin A or D.**

- **Properties of waxes**: Waxes are insoluble in water, but soluble in fat solvents and are negative for acrolein test.
- Waxes are not easily hydrolyzed as the fats and are indigestible by lipases and are very resistant to rancidity.
- Thus they are of no nutritional value.

TYPE OF WAXES:

- Waxes are widely distributed in nature

such as the secretion of certain insects as

bees-wax, protective coatings of the skins

and furs of animals and leaves

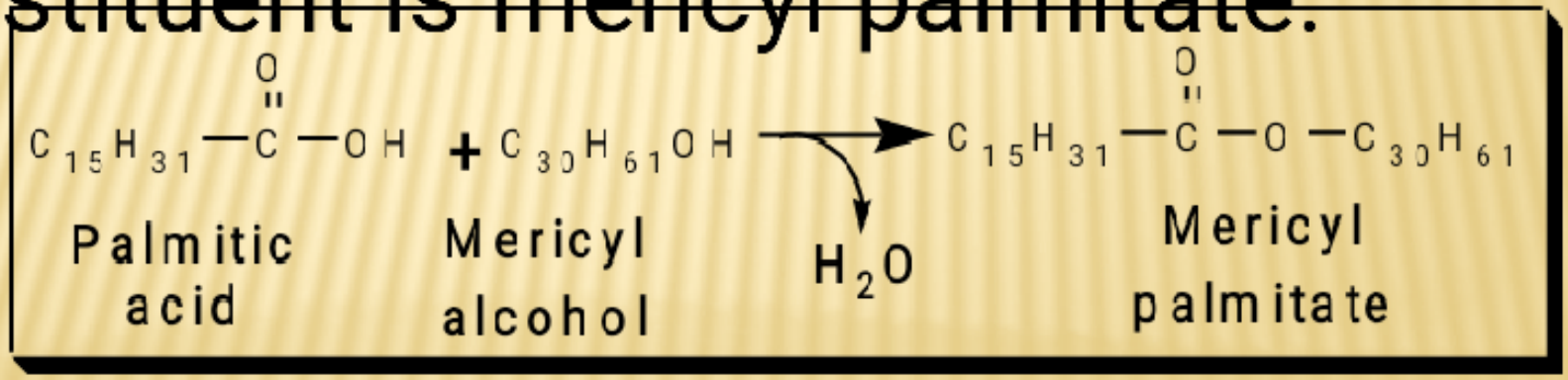
and fruits of plants.

A-True waxes: include:

Bees-wax is secreted by the honeybees that

use it to form the combs.

It is a mixture of waxes with the chief constituent is mericyl palmitate.



B-WAX-LIKE COMPOUNDS:

- **Cholesterol esters**: Lanolin (or wool fat) is prepared from the wool-associated skin glands and is secreted by sebaceous glands of the skin.
- It is very complex mixture, contains both free and esterified cholesterol, e.g.,cholesterol-**palmitate and other sterols**.

DIFFERENCES BETWEEN NEUTRAL LIPIDS AND WAXES:

	Waxes	Neutral lipids
1. **Digestibility:**	Indigestible (not hydrolyzed by lipase).	Digestible (hydrolyzed by lipase).
2-Type of alcohol:	Long-chain monohydric alcohol + one fatty acid.	Glycerol (trihydric) + 3 fatty acids
3-Type of fatty acids:	Fatty acid mainly palmitic or stearic acid.	Long and short chain fatty acids.
4-Acrolein test	Negative.	Positive.
5-Rancidability:	Never get rancid.	Rancidible.
6-Nature at room temperature	Hard solid.	Soft solid or liquid.
7-Saponification	Nonsaponifiable.	Saponifiable.
8-Nutritive value:	No nutritive value.	Nutritive.
9-Example:	Bee & carnuba waxes.	Butter and vegetable oils.