

UNIT-I

Biochemistry of Lipid

Lipids are:

Organic substances relatively insoluble in water but soluble in organic solvents (chloroform, ether, alcohol, benzene etc.), actually or potentially related to fatty acid and utilized by living cells

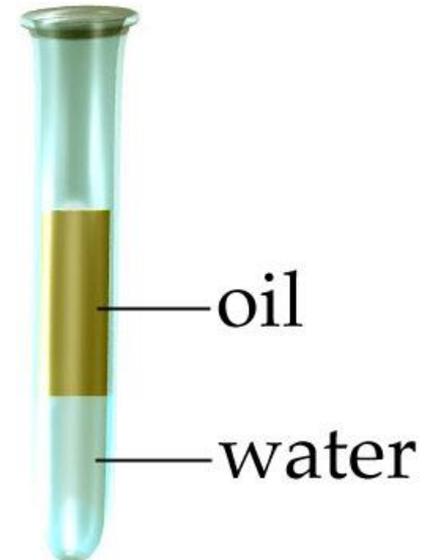


The term 'lipid' defines compounds:

- *not on the basis of structural similarity*

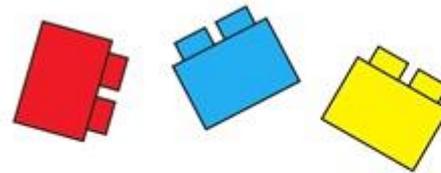
BUT

- *in terms of their solubility*

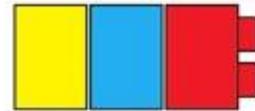


Lipids do not form polymers. **Why?**

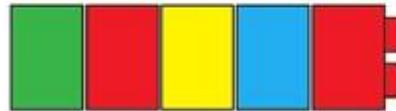
Not made of monomers.



Monomers



Polymer of three monomers



Polymer of five monomers

Lipids are:

- ✓ structurally
- ✓ functionally



DIVERSE

According to Bloor

Lipids are compounds that have following characters

1. insoluble in water
2. soluble in organic solvent
3. relationship to fatty acid
4. possibility of utilization by living system

Classification by Bloors

1. Simple Lipids

- a) Fats and Oils
- b) Waxes

2. Compound Lipids

- a) Phospholipids

Glycerophospholipids

Sphingophospholipis

- b) Glycolipids

- c) Lipoprotein

d. Other complex lipids-sulfolipid, aminolipid and lipopolysaccharide

3. Derived Lipids

- a) Fatty acids
- b) Alcohol
- c) Sterols
- d) ketone bodies

4. Miscellaneous lipid: carotenoids, squalene

SIMPLE LIPIDS

They are esters of FA with various alcohols

D/U the type of alcohols these are subclassified as

Neutral fats or oils

Alcohol is
GLYCEROL

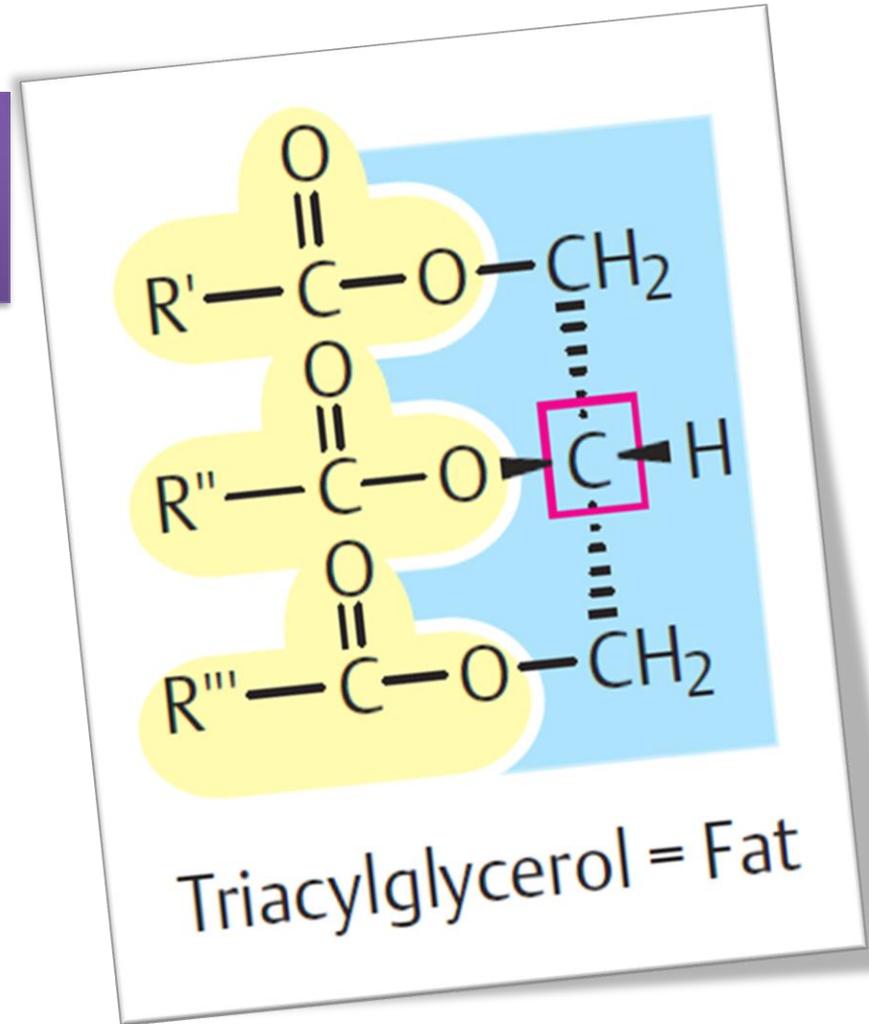
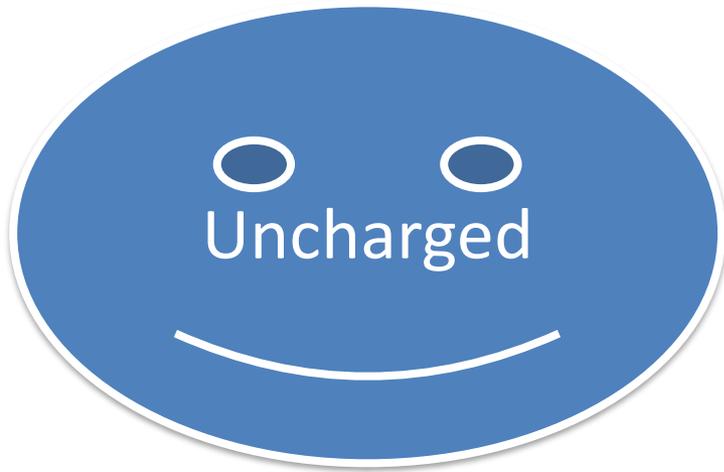
Waxes

Alcohol is
other than
glycerol

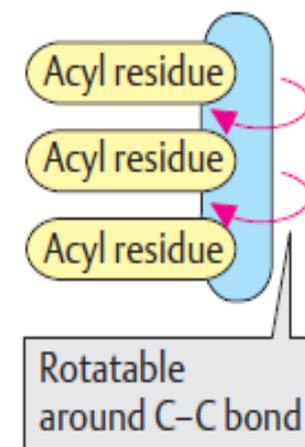
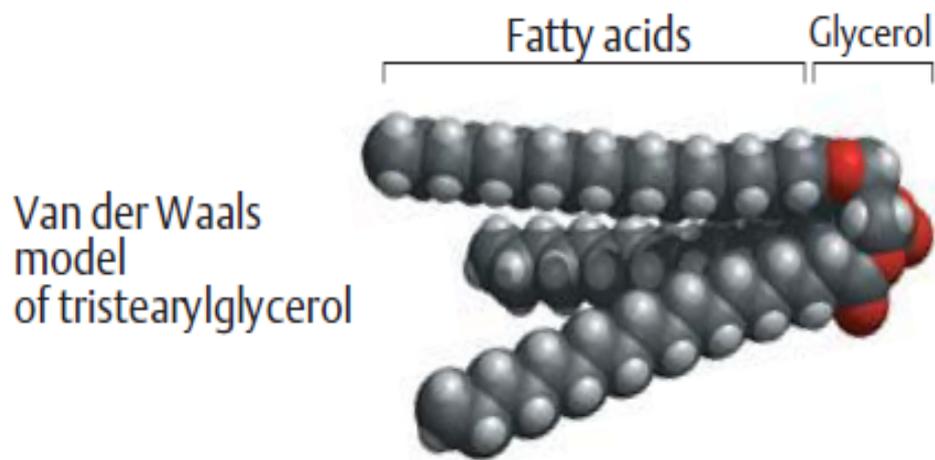
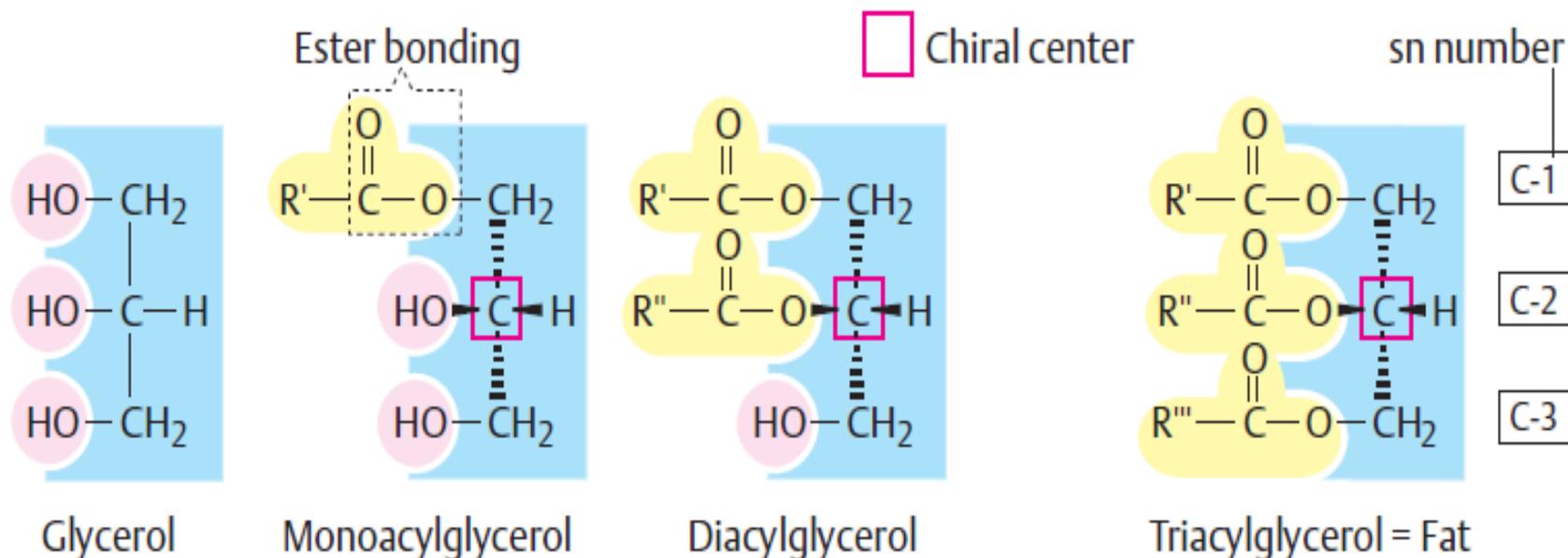
- (a). Bee waxes-cetyl alcohol
- (b). Cholesteryl ester
- (c). Vit- A, D esters

NEUTRAL FATS OR OILS

Esters of FA with alcohol
GLYCEROL

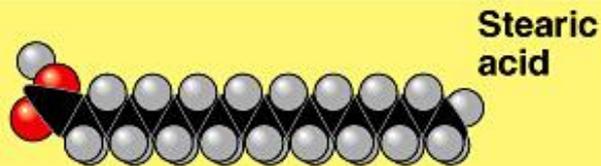


B. Structure of fats

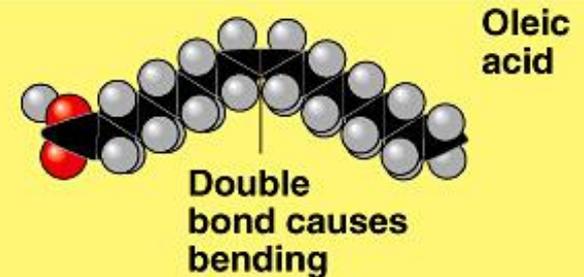


What is the difference between a fat and an oil?

- **fats - solid at 20°C**
- **oils - liquid at 20°C**



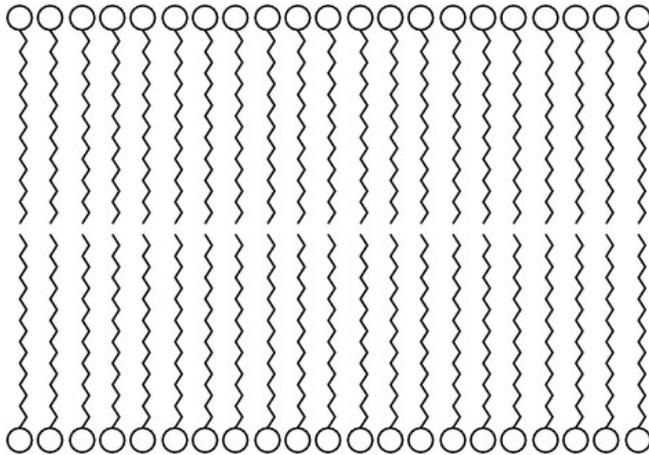
(a) Saturated fat and fatty acid



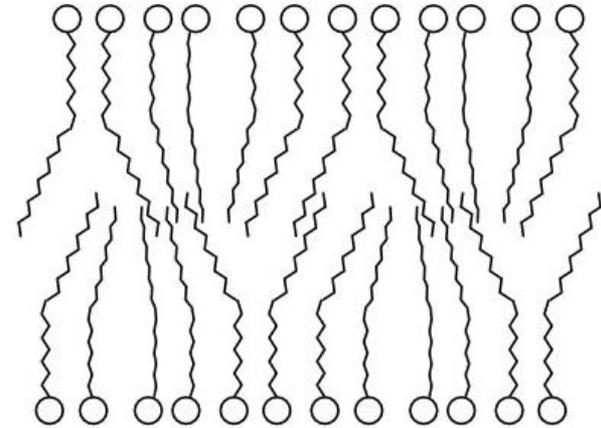
(b) Unsaturated fat and fatty acid

Why are fats solid and oils liquid at room temperature?

Saturated fat



Unsaturated fat



Molecule has kinks, keeping the fatty acids apart and as a result, oil is liquid at room temperature.

WAXES

Esters of FA with
higher molecular
weight
monohydric
alcohols

EXAMPLES

- ✓ Lanolin
- ✓ Beeswax
- ✓ Whale sperm oil

Waxes are mainly for **Waterproofing**

e.g.

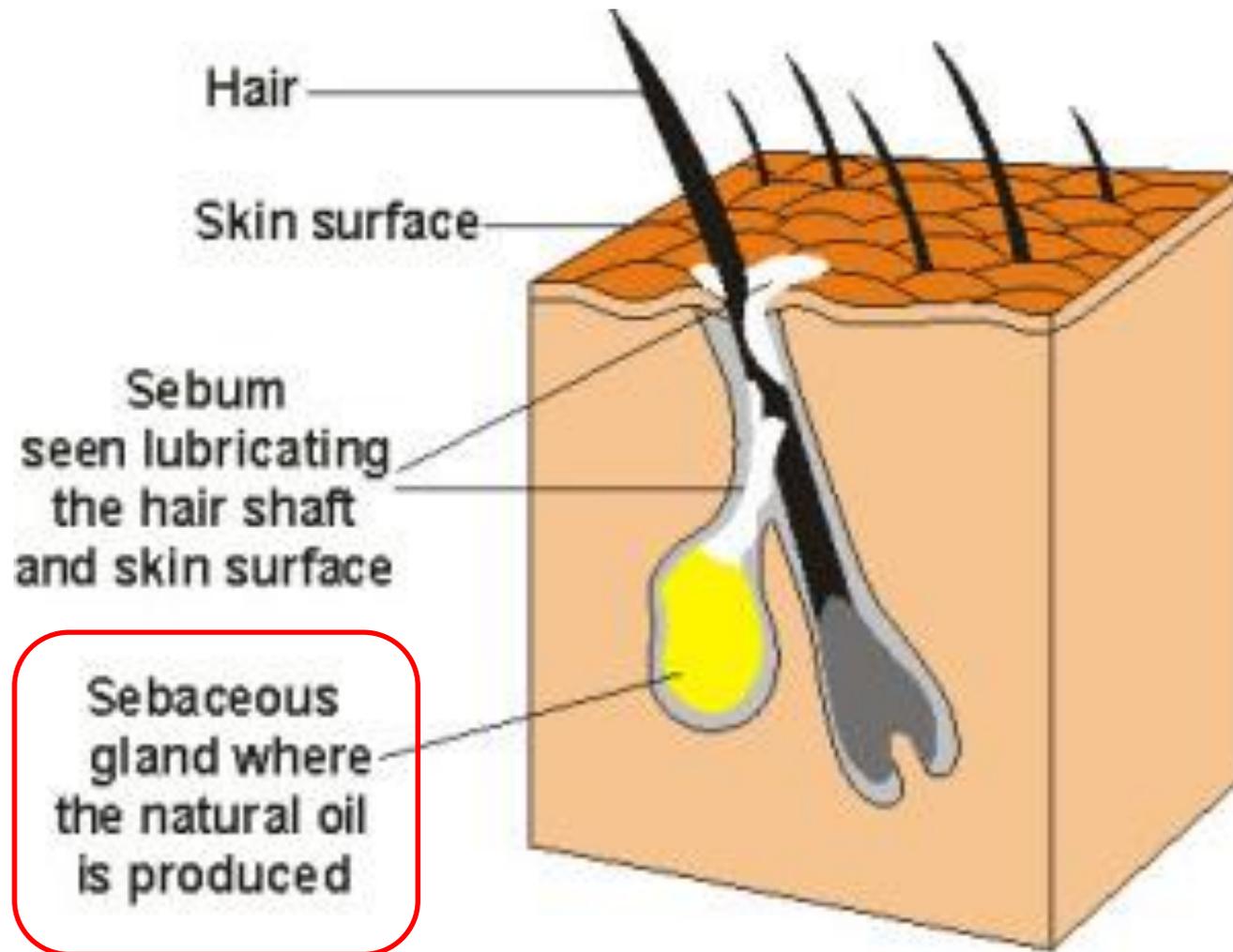
cutin makes up the waxy cuticle of leaves



fruits produce a waxy coating to keep from drying out



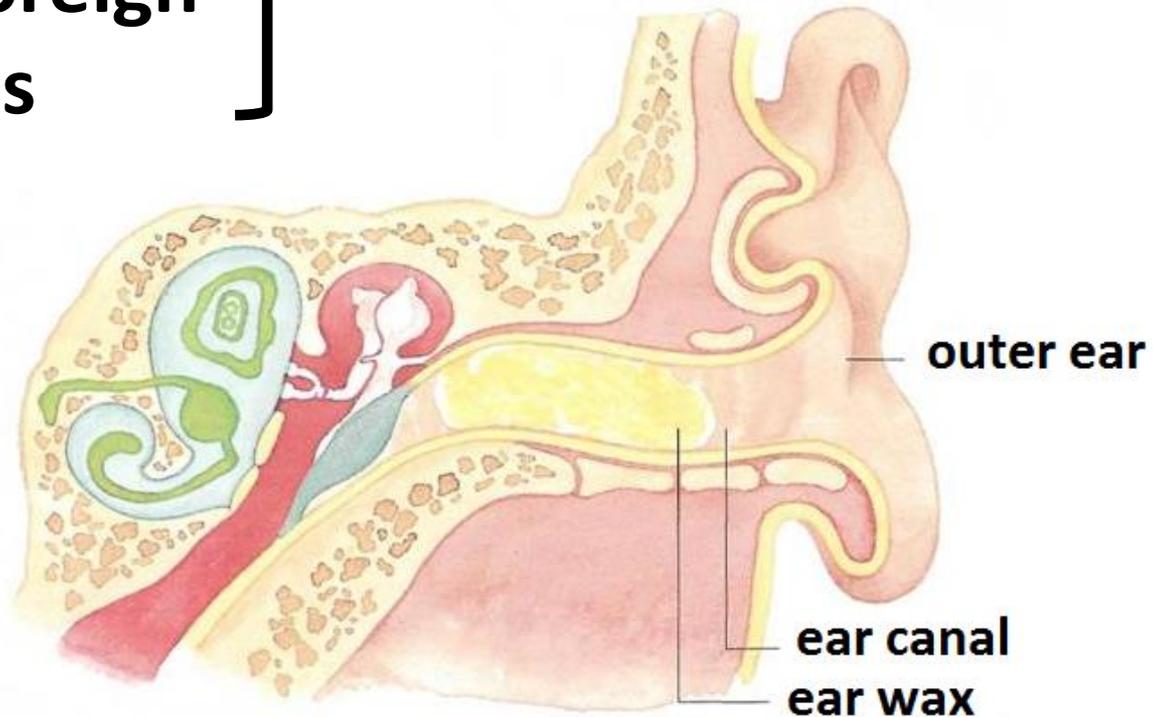
sebum in mammalian skin



wax in ears traps:

- dust
- sand
- other foreign particles

do not go deeper into the ear and cause no damage



COMPLEX LIPIDS

These are esters of FA with alcohol containing additional[prosthetic] groups.

Subclassified according to the type of prosthetic group

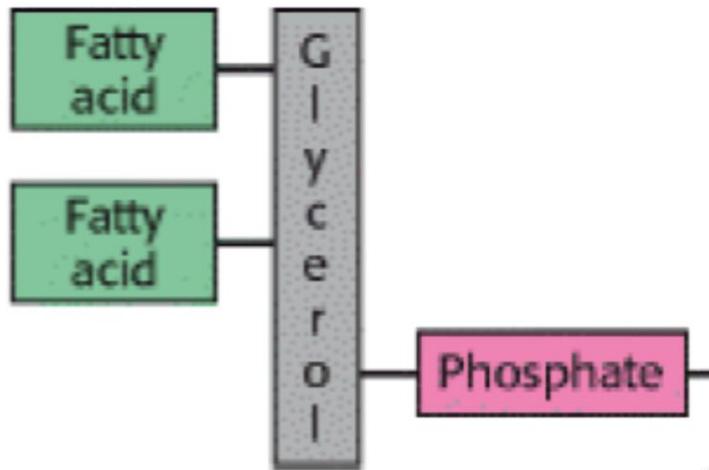
Phospholipids

Glycolipids

Lipoproteins

PHOSPHOLIPIDS

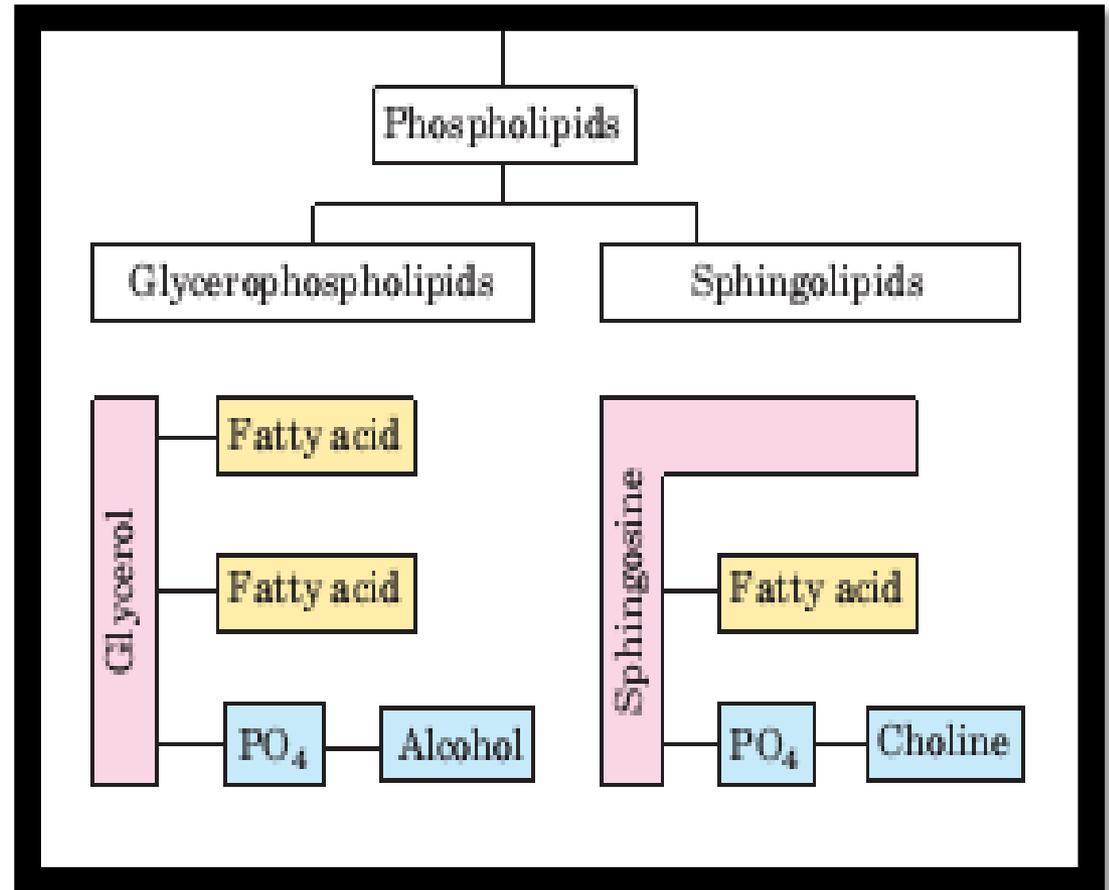
FA + ALCOHOL + PHOSPHORIC ACID



They frequently have nitrogen containing bases

PHOSPHOLIPIDS

Phospholipids may be classified on the basis of the type of alcohol present



A. Glycerophospholipids

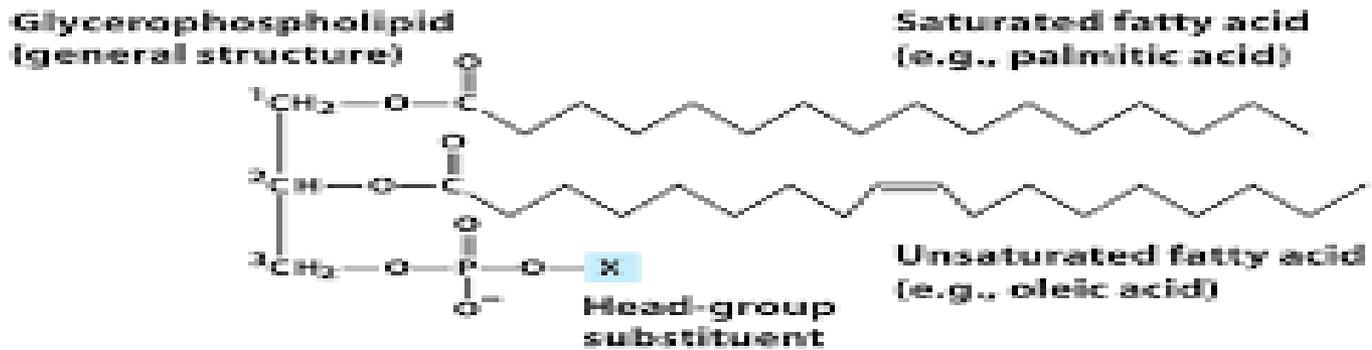
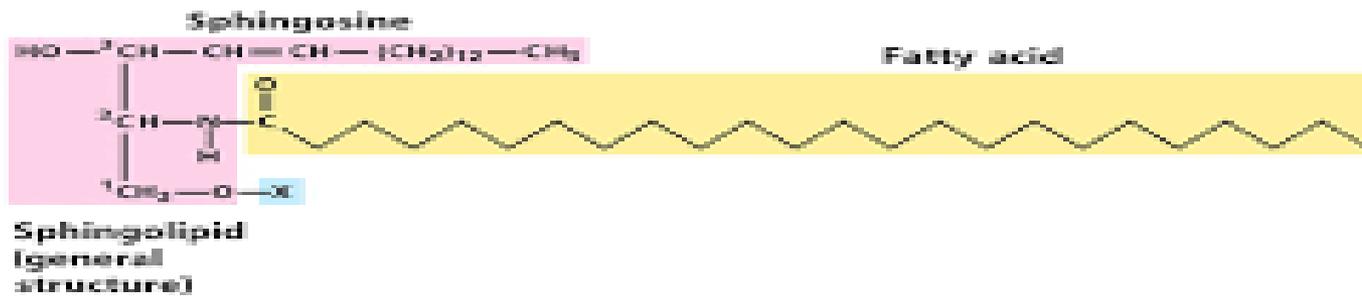
ALCOHOL IS GLYCEROL

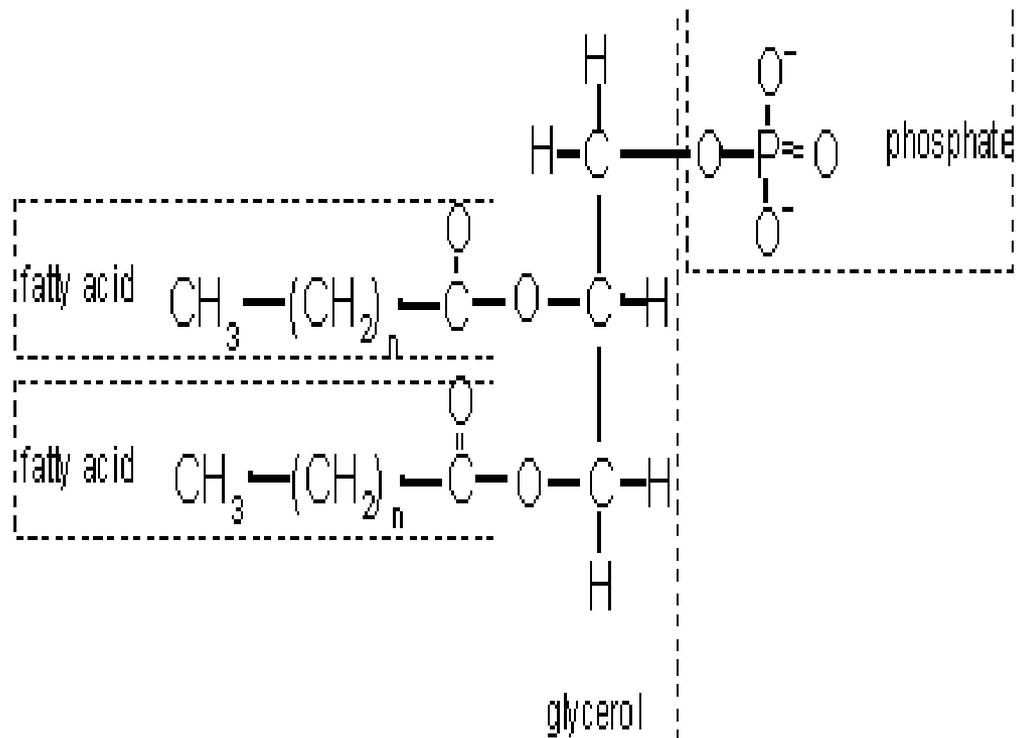
- ✓ Phosphatidylcholine
- ✓ Phosphatidyl ethanolamine
- ✓ Phosphatidyl serine
- ✓ Phosphatidyl inositol
- ✓ Plasmalogens
- ✓ Cardiolipins

B. Spingophospholipids

ALCOHOL IS SPINGOSINE

- ✓ Spingomyelins





Phosphopathidic acid

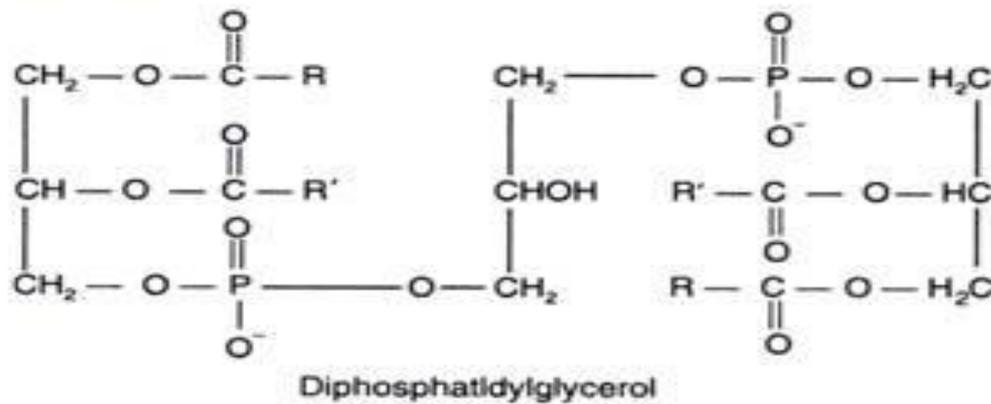
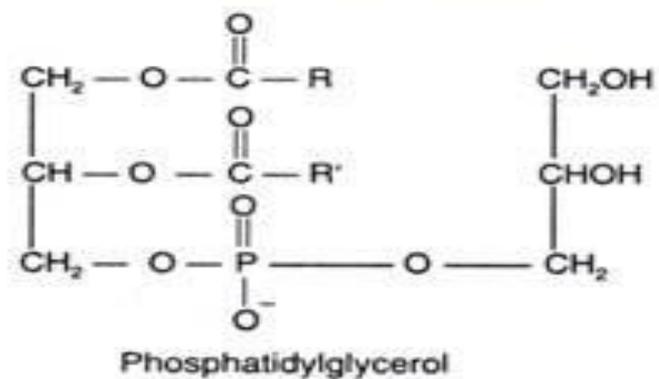
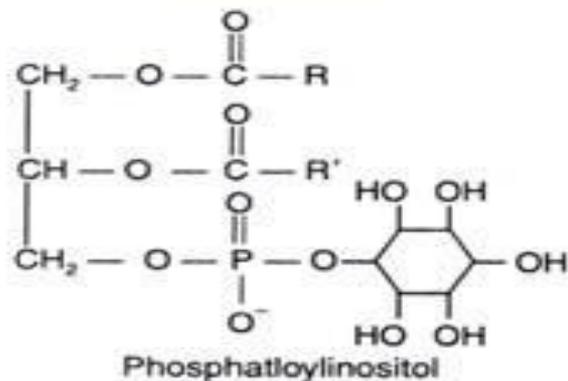
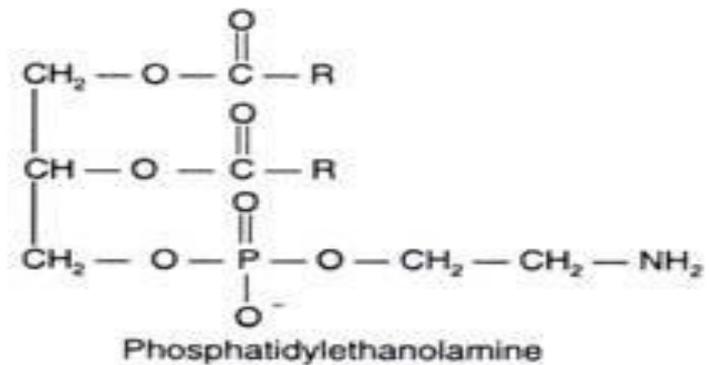
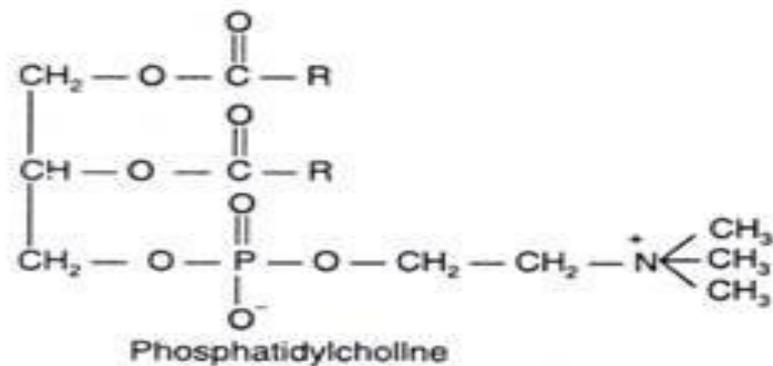


Fig. 14.4. Structures of commonly occurring phospholipids (R, R' = long chain fatty acids residues).

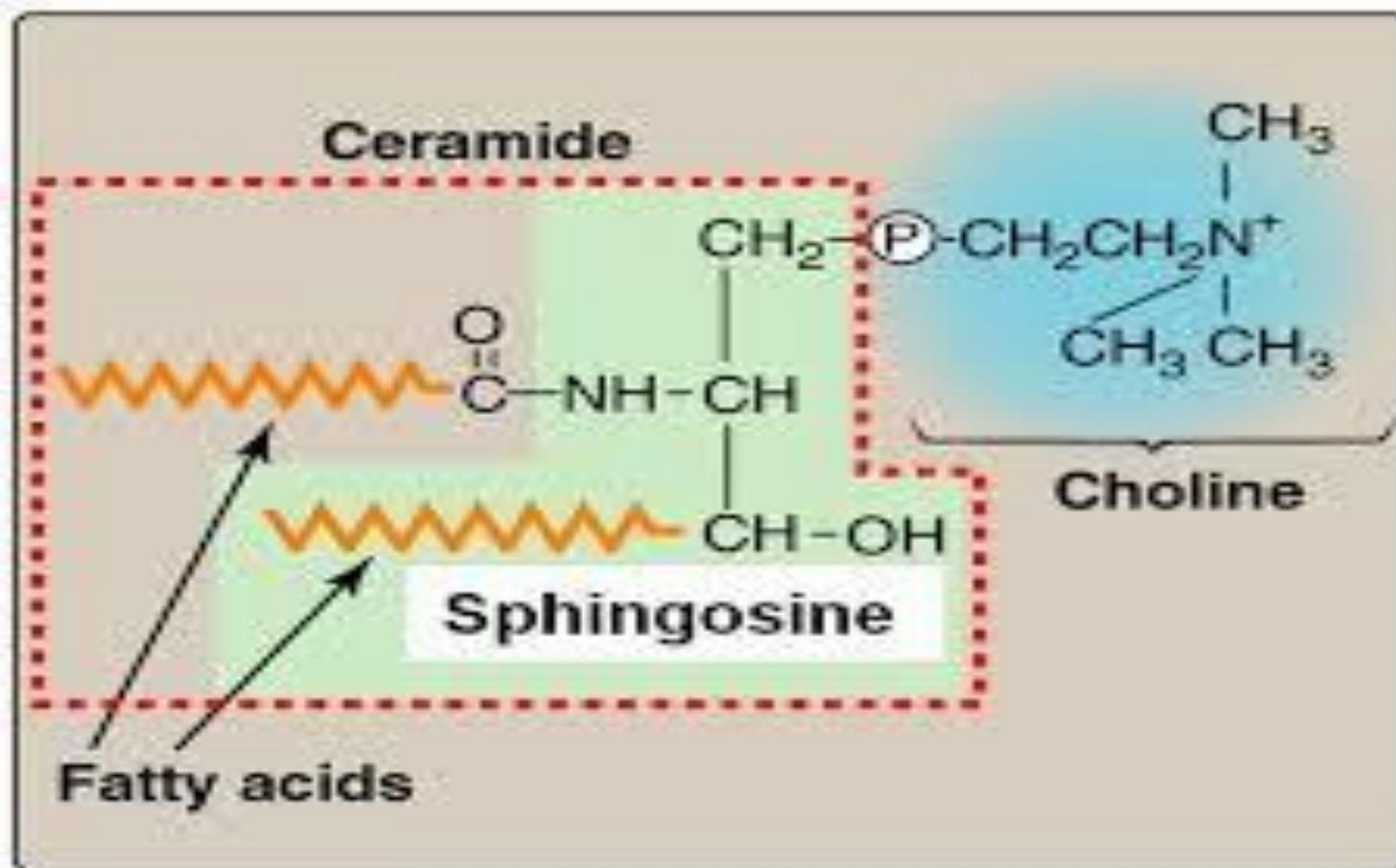
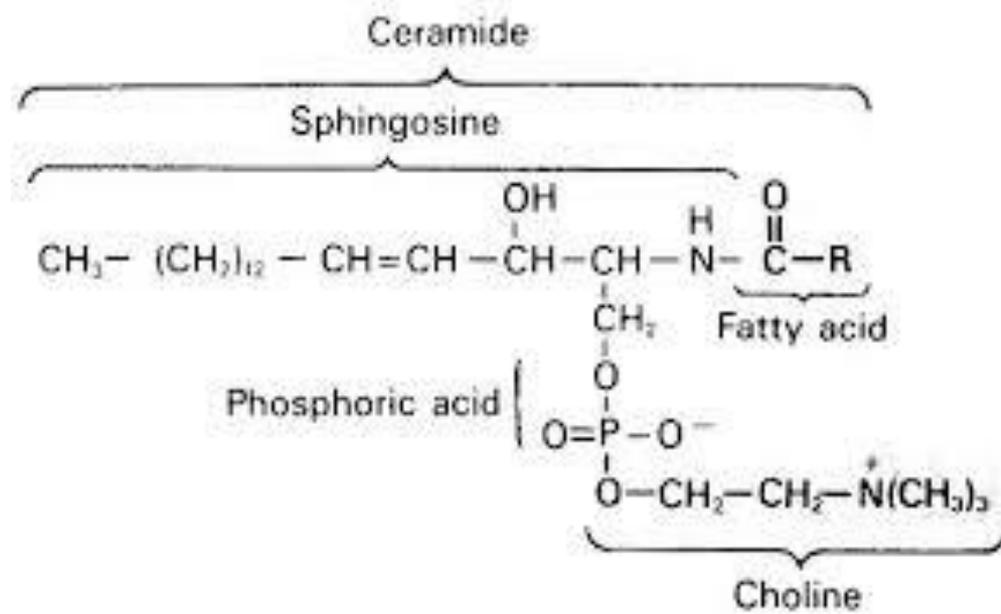


Figure 17.4

Structure of sphingomyelin, showing sphingosine (in green box) and ceramide components (in dashed box).



GLYCOLIPIDS

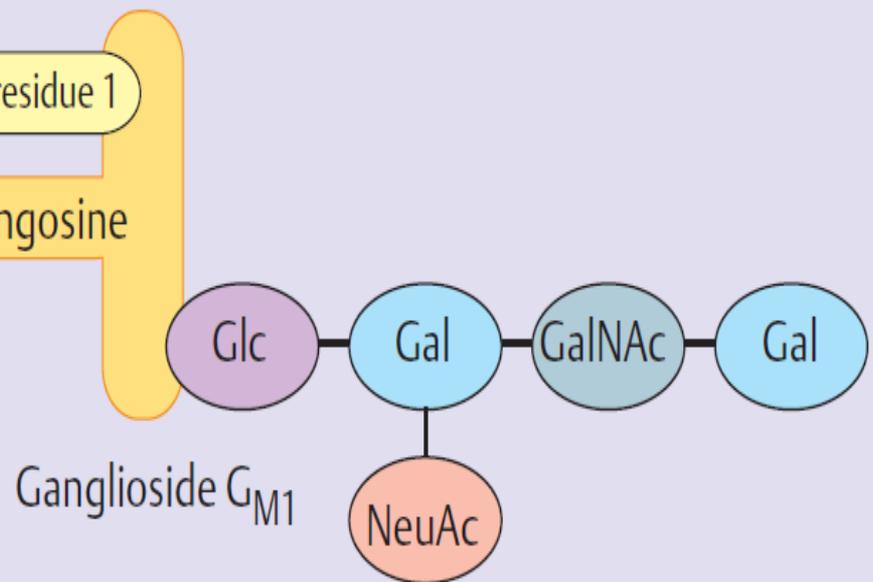
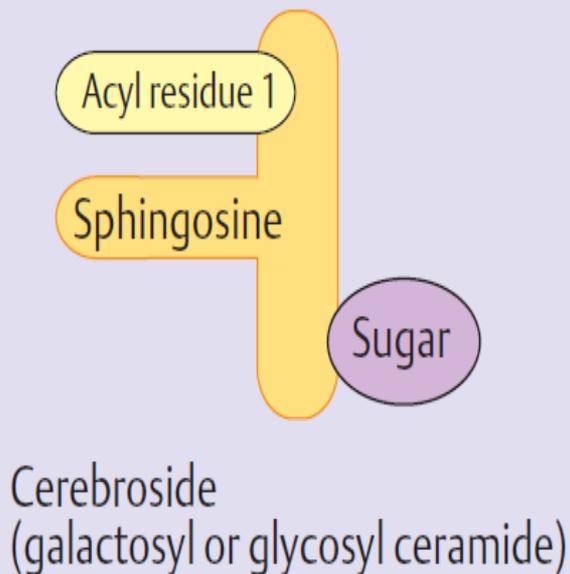
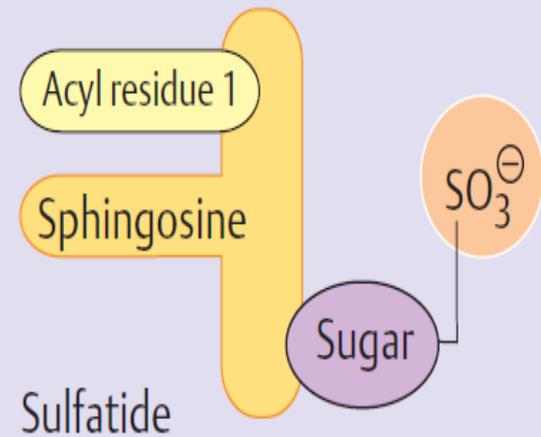
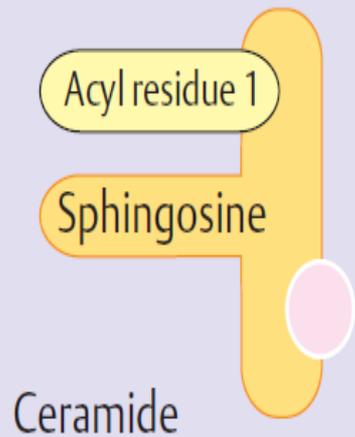
FA + ALCOHOL[SPINGOSINE] + CARBOHYDRATE
WITH NITROGEN BASE

❑ They do not contain phosphate group

Example

- ✓ Cerebrosides
- ✓ Gangliosides

GLYCOLIPIDS



3. Sphingolipids

LIPOPROTEINS

Lipid with
prosthetic
group PROTEIN

- ✓ Chylomicrons
- ✓ Very low density lipoprotein (VLDL)
- ✓ Low density lipoprotein (LDL)
- ✓ High density lipoprotein (HDL)

DERIVED LIPIDS

Derived from lipids (simple or complex) or precursors of lipids

Example

Fatty acids

Steroids

Cholesterol

Vitamin A
and D

Function

- 1. As membrane structural components (Phospholipid and cholesterol)**
- 2. As intracellular storage depots of metabolic fuel (Triacyl glycerol)**
- 3. As regulatory substances (Steroid hormones and prostaglandin)**
- 4. Source of fat soluble vitamins (A, D, E and K)**
- 5. Lipid protect internal organs, serves as insulating materials and give shape and smooth appearance to body**