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# Lipid Compounds of Physiological Significance

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Foundation block



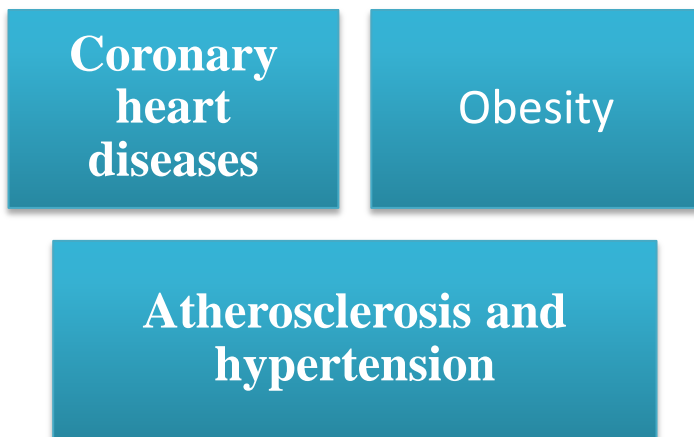
## Objectives:

- ❖ Functions of lipid compounds.
- ❖ Clinical problems.
- ❖ Lipid compounds of physiological importance.
- ❖ Complex lipids.
- ❖ Phospholipids, glycolipids and lipoproteins.

## Functions of lipid compounds:

- ❖ Major energy source for the body
- ❖ Structural component of cell membranes
- ❖ Important regulatory molecules: e.g.,
  - Fat-soluble vitamins
  - Steroid hormones
  - Prostaglandins
  - Signaling molecules: Inositol triphosphate (IP3)

## Lipids and clinical problems:



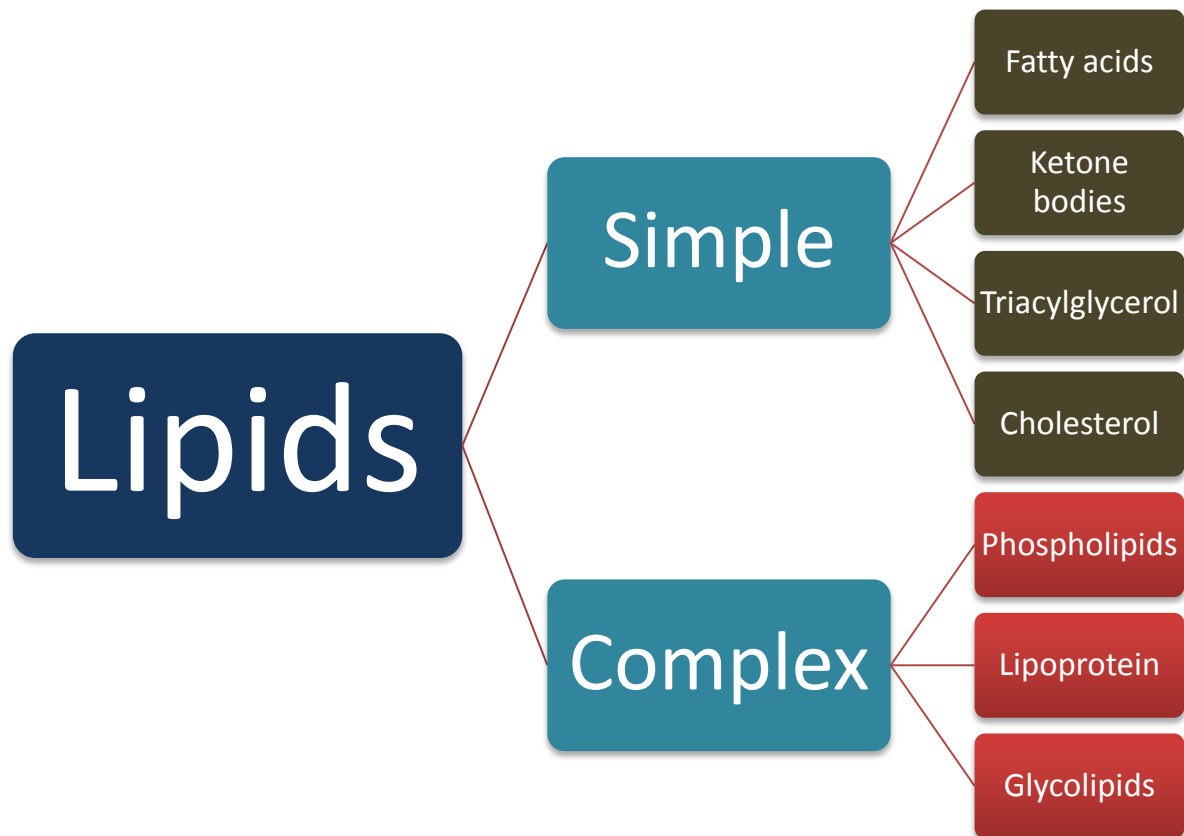
Obesity: maybe genetic, endocrine stimulate.

Atherosclerosis: is elastic fiber becomes rigid

## Lipids:

- ❖ Heterogeneous (various) group.
- ❖ Relatively water-insoluble (Exception ketone bodies).
- ❖ Soluble in non-polar solvents.

Main characteristic for lipid is fats are insoluble in water. But some fats are soluble or part of soluble in water



## Simple:

- **Fatty acids:**

- Amphipathic: Both hydrophobic & hydrophilic parts.
- Fatty acids are classified by:

1. **Chain length:**

- ✓ Short-chain and medium chain

- ✓ Long-chain

E.g., Palmitic acid 16:0 (16 refers to carbon number and 0 refers to double bound)

- ✓ Very long chain

E.g., Nervonic acid 24:1 (24 refers to carbon number and 1 refers to double bound)

Short (4-10) chain

Long (10-18)

Very long (more 20)

## 2. Degree of saturation

- ✓ Saturated: no double bond
- ✓ Unsaturated: mono- (one double bond) or poly- (more than one double bond)

## 3. Essential fatty acid:

- ✓ Linoleic acid, 18:2 (18 carbon atom and 2 double bonds)
- ✓ Linolenic acid, 18:3 (18 carbon atom and 3 double bonds)

\* The precursor of prostaglandins, arachidonic acid 20:4, is also considered essential fatty acid if linoleic acid is deficient from diet.

Essential lipids: the body can't synthesize or synthesize with small amount.

Arachidonic is semi-essential fatty acid.

## 4. Plasma of fatty acid:

- ✓ Esterified form: in triacylglycerol, cholesterol ester, phospholipids (as part of lipoproteins)
- ✓ Free-form (unesterified): in  
Transported in association with albumin.

Free form is the active form.  
Esterified form is for transforming.

## ● Triacylglycerols:

- ✓ Storage form in adipose tissue
- ✓ ~ 90% of dietary lipids
- ✓ Contain from Glycerol + 3 fatty acids
- ✓ Blood transport: Chylomicrons and VLDL.

Triacylglycerol is the storage form in human body.

## ● Ketone bodies:

- ✓ **Water-soluble.**

Ketone bodies are the only lipid soluble in water (Lipid alone) because phospholipid and lipoprotein kind of soluble in water.

- ✓ Diabetic ketoacidosis: results from a shortage of insulin; in response the body switches to burning fatty acids and producing acidic ketone bodies.
- ✓ Examples of Ketone bodies:
  - Acetone
  - Acetoacetate
  - $\beta$ -Hydroxybutyrate

## ● Cholesterol:

- ✓ Major sterol of animal tissues.
- ✓ Component of cell membranes.
- ✓ Precursor for:
  - Bile acids & salts.
  - Vitamin D.
  - **Hypercholesterolemia**(increase cholesterol level in blood): **causes** Atherosclerosis & CAD (cardiac artery disease)
  - Steroid hormones:
    1. Mineralocorticoids (Aldosterone)
    2. Glucocorticoids (Cortisol)
    3. Sex hormones (Testosterone, Estrogen and Progesteron)

# Complex:

- **Phospholipids:** divided to:

1. Glycerophospholipids:

Glycerol-containing phospholipids:

- Phosphatidylcholine (Lecithin) e.g., Surfactant (Dipalmitoylecithin)
- Phosphatidyl inositol (signaling molecule)
- In membrane: Parent compound is Phosphatidic acid (it's exist in every molecules in membrane) [CLICK HERE TO SEE PICTURE](#)

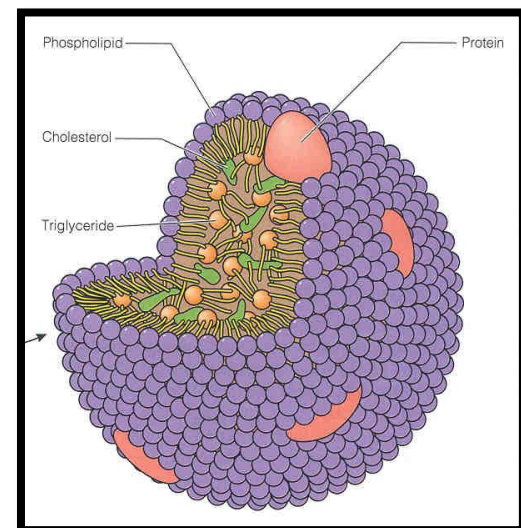
2. Sphingo-phospholipids:

Sphingosine-containing phospholipids. e.g., sphingomyelin (Myelin sheath)

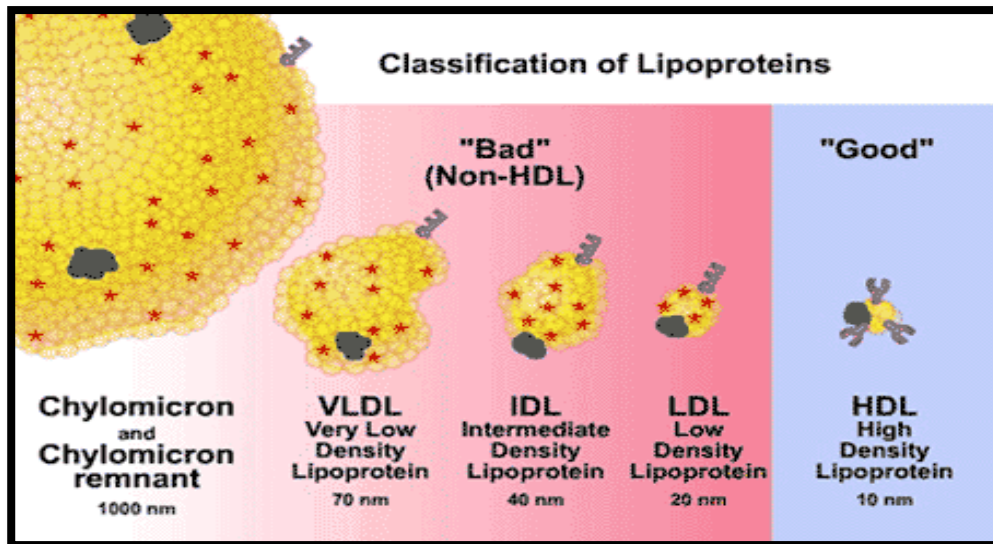
- **Lipoprotien:**

It consists from two parts:

- ✓ Protein part: Apoproteins ( it called apolipoproteins too). Its functions: Structural, transport, Enzymatic function and Ligands for receptors
- ✓ Lipid part: the type of lipids depend on the type of lipoproteins.
- ✓ Composition of lipoprotein



1		Chylomicrons
2	VLDL	Very low density Lipoprotein
3	LDL	Low density Lipoprotein
4	HDL	High density Lipoprotein



✓ Lipoprotein in human bodies:

➤ Triacylglycerol transport:

1. **Chylomicrons**: Triacylglycerol of dietary origin(exogenous).

2. **VLDL**: Triacylglycerol of endogenous synthesis.

➤ Cholesterol transport:

3. **LDL**: mainly free cholesterol.

4. **HDL**: mainly esterified cholesterol.



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## Extra links:

Talking about Lipids in general



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