

Lipids

- Organic, heterogenous substances in plants & animal
- Insoluble in water (hydrophobic) but soluble in non-polar solvents
- Building blocks - fatty acids, glycerol, sphingosine & sterols

Classification of Lipids

A] Simple Lipids: consist of following subgroups:

- **Fats** (Esters of fatty acids with glycerol)
- **Waxes** (Esters of fatty acids with alcohols other than glycerol (high mol.wt. monohydric alcohols))

B] Compound or Complex Lipids

Esters of fatty acids containing groups in addition to an alcohol & a fatty acid

- **Phospholipids:** contain an alcohol, fatty acid (s) & a phosphoric acid residue
- **Glycolipids:** contain sphingosine, a fatty acid & carbohydrate
- **Sulpholipids:** contain sphingosine; a fatty acid, a sugar & a sulfate group
- **Lipoproteins:** These are complexes of lipids with proteins.

C] Derived, Precursor or Associated Lipids

- Hydrolytic products of **above-mentioned** compounds
- include diglycerides, fatty acids, alcohols including glycerol, sterols, vitamins D, E, K

FATTY ACIDS (FA)

- Acids occurring in natural triglycerides (FATs)
- Monocarboxylic acids, (a single carboxylic group at the end of a hydrocarbon chain which makes them acids)
- Most contain even number of C atoms, 4 to 24 carbon atoms, Majority of FA have 16 & 18 C atoms
- Waxes, FA have 34 C atoms, Some bacterial waxes - complex fatty acids that may contain as many as 90 C atoms

Nutritionally Essential Fatty Acids

Certain FA must be taken in food by man because these FA cannot be synthesized in the body (example: Polyunsaturated FA)

Saturated Fatty Acids (SFA)

Symbols of SFA have two numbers;

1. First no. represents no. of C atoms
2. Second no. denotes no. of double bonds which is zero in SFA

Common name	Systemic name	Formula	Symbol
Butyric acid	(butanoic acid):	$\text{CH}_3(\text{CH}_2)_2\text{COOH}$	<u>C4:0</u>
Palmitic acid	(hexadecanoic acid):	$\text{CH}_3(\text{CH}_2)_{14}\text{COOH}$	<u>C16:0</u>
Stearic acid	(octadecanoic acid):	$\text{CH}_3(\text{CH}_2)_{16}\text{COOH}$	<u>C18:0</u>

Palmitic acid & Stearic acid are the most abundant SFA in humans

Unsaturated Fatty Acids (USFA)

More reactive than SFA

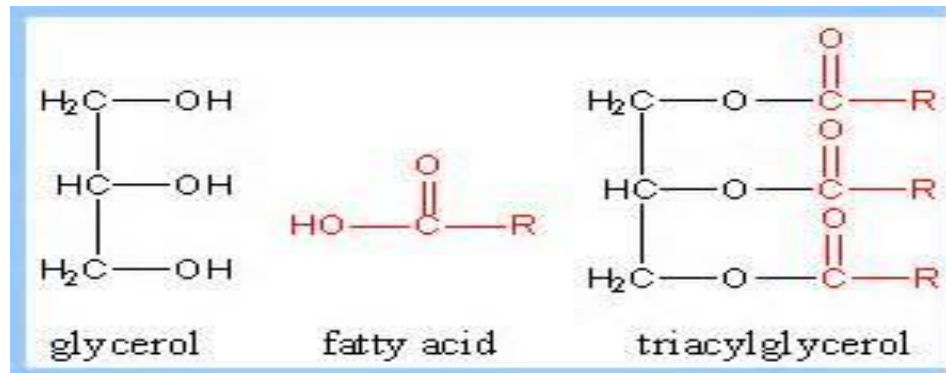
- 1 double bond = monounsaturated (or monoenoic) fatty acids (MUFA)
- > than 1 double bond = Polyunsaturated, i.e. polyenoic fatty acids (PUFA)

Common name	Formula	Symbol
Palmitoleic acid	$C_{15}H_{29}COOH$	<u>16:1</u> Δ^9
Oleic acid	$C_{17}H_{33}COOH$	<u>18:1</u> Δ^9
Linoleic acid	$C_{17}H_{33}COOH$	<u>18:2</u> $\Delta^{9,12}$
Linolenic acid	$C_{17}H_{29}COOH$	<u>18:3</u> $\Delta^{9,12,15}$

Oleic acid & palmitoleic acid are the most abundant MUFA in humans

Neutral Fats or Triglycerides or Triacylglycerols

- Neutral fats (fats) are FA esters of glycerol, i.e. triglycerides (triacylglycerols; TAGs)
- .Most common & widespread class of lipids in nature being specially abundant in nuts, seeds, fat depots of animals
- Triglycerides (TAGs) represent the storage form of lipids



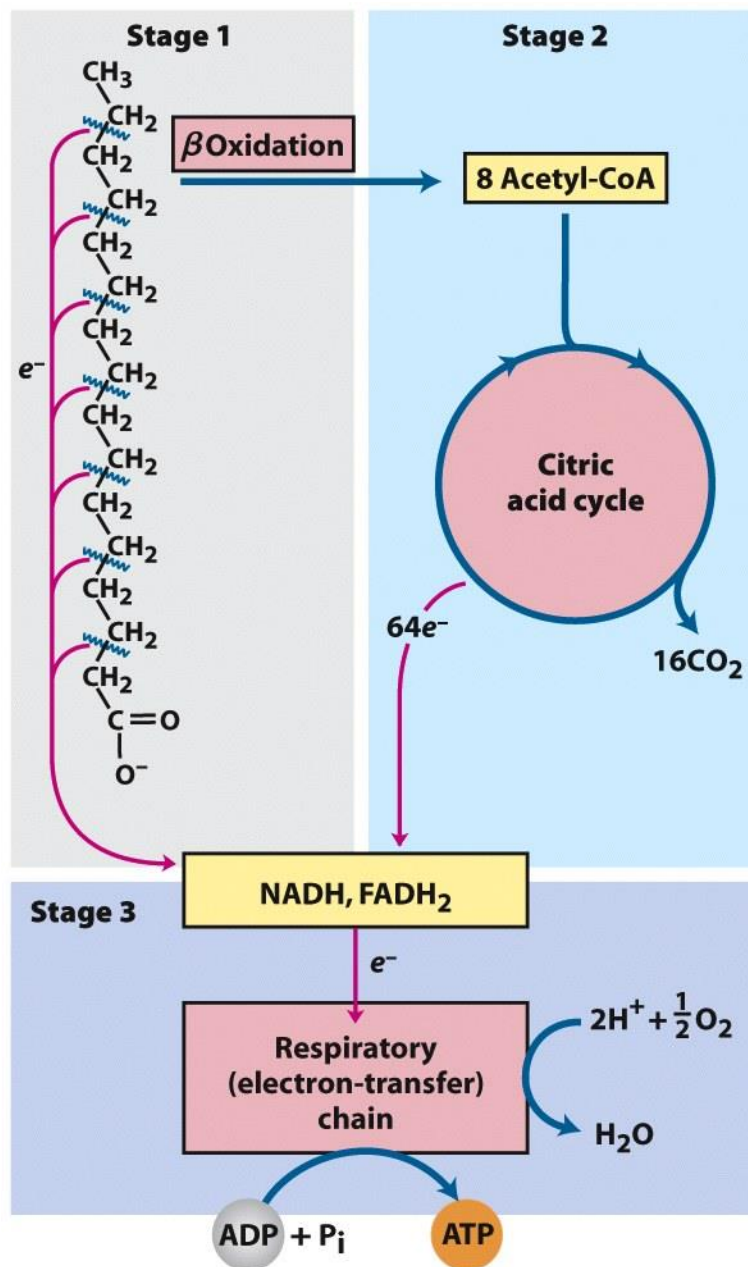


Figure 17-7
Lehninger Principles of Biochemistry, Fifth Edition
© 2008 W. H. Freeman and Company