



# CHEMISTRY 2

## Biochemistry

Lipids Lec. 1b

Course prof.

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# Saturated fatty acids (no double )

A-Short chain Saturated F.A. (2-10 carbon).

B-Long chain Saturated F.A.(more the10 carbon)

## Fatty Acids Commonly Found in Lipids

Sat. Fatty Acids	Formula	Melting Point (°C)
Butyric	$C_4H_8O_2$	Liquid
Palmitic	$C_{16}H_{32}O_2$	63
Stearic	$C_{18}H_{36}O_2$	70
Unsat. Fatty Acids	Formula	Melting Point (°C)
Oleic	$C_{18}H_{34}O_2$	Liquid
Linoleic	$C_{18}H_{32}O_2$	Liquid
Linolenic	$C_{18}H_{30}O_2$	Liquid



# 1-Monounsaturated fatty acids:

## 1-Palmitoleic acid :

It is found in all fats.

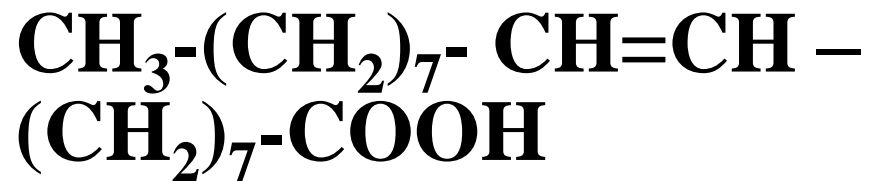
It is C16:1 $\Delta$ 9, i.e., has 16 carbons and one double bond located at carbon number 9 and involving carbon 10.



## 2-Oleic acid

**Is the most common fatty acid in natural fats.**

**It is C18:1 $\Delta$ 9, i.e., has 18 carbons and one double bond located at carbon number 9 and involving carbon 10.**



## 3-Nervonic acid

**(Unsaturated lignoceric acid).**

**It is found in cerebrosides.**

**It is C<sub>24</sub>:1 $\Delta$ 15, i.e., has 24 carbons and one double bond located at carbon number 15 and involving carbon 16.**



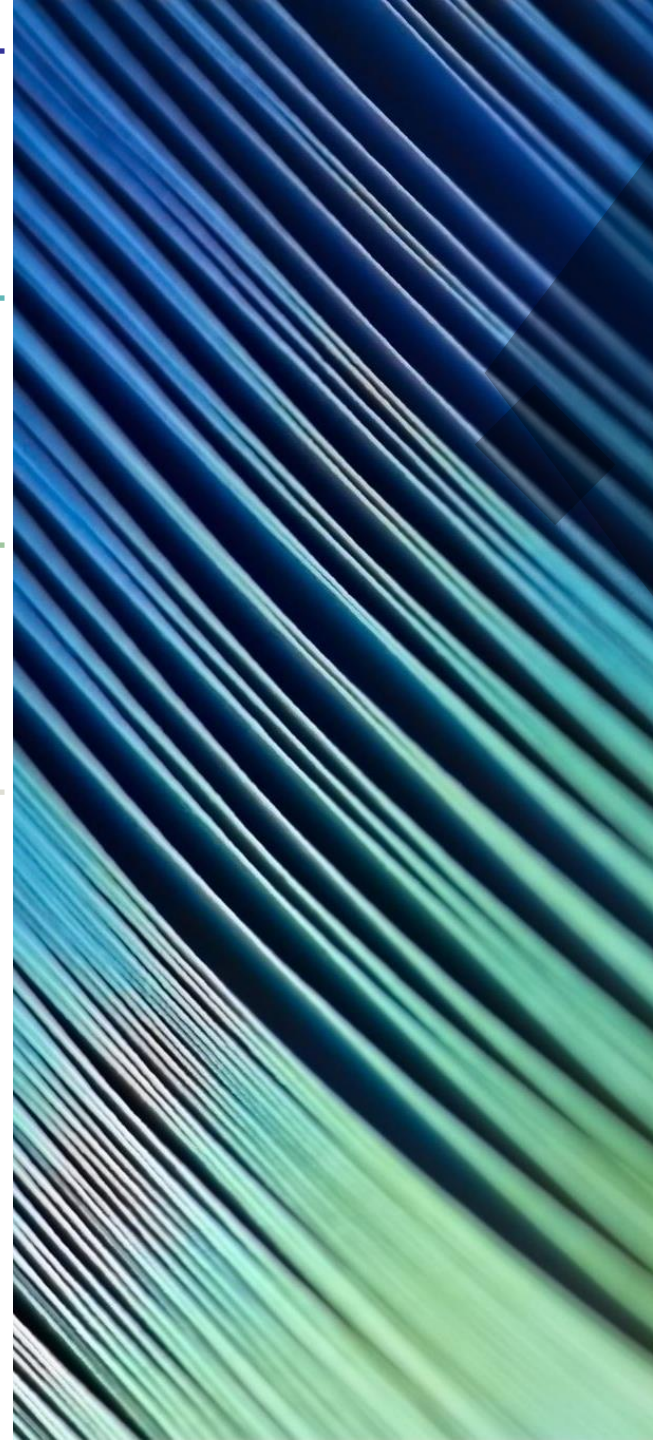
## **2-Polyunsaturated fatty acids:**

**(Essential fatty acids):**

**Definition:**

**They are essential fatty acids that can not be synthesized in the human body and must be taken in adequate amounts in the diet.**

**They are required for normal growth and metabolism**





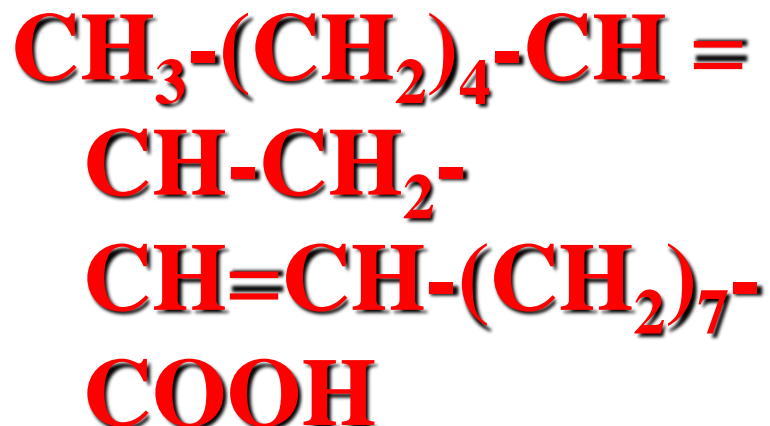
**Source: vegetable oils** such as corn oil, linseed oil, peanut oil, olive oil, cottonseed oil, soybean oil and many other plant oils, cod liver oil and animal fats.

**Deficiency: Their deficiency in the diet leads to nutrition deficiency disease.**

**Its symptoms include: poor growth and health with susceptibility to infections, dermatitis, decreased capacity to reproduce, impaired transport of lipids, fatty liver, and lowered resistance to stress.**

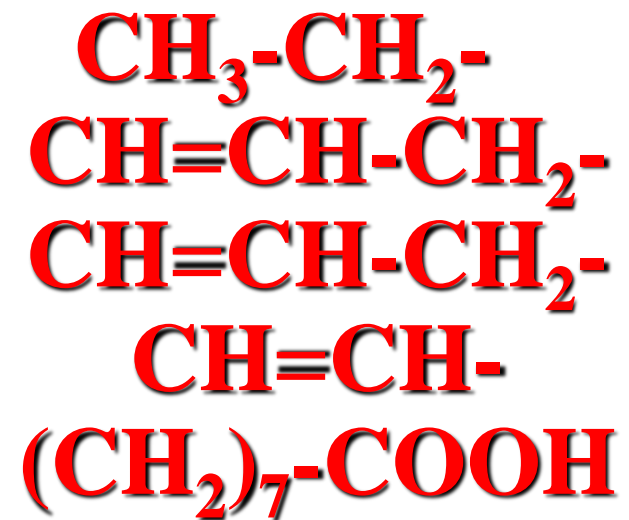
## 1-Linoleic:

- **C18:2 $\Delta$ 9, 12.**
- **It is the most important since other essential fatty acids can be synthesized from it in the body.**



## 2-Linolenic acid:

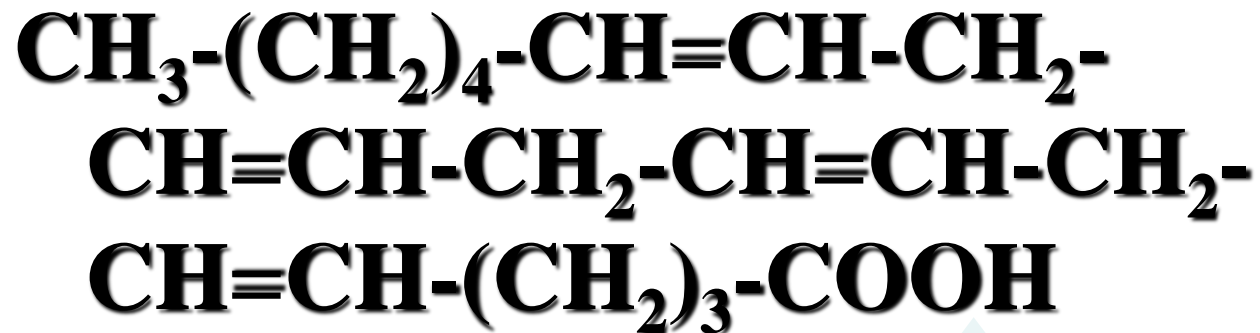
- **C18:3 $\Delta$ 9, 12, 15,**
- **in corn, linseed, peanut, olive, cottonseed and soybean oils.**





### 3-Arachidonic acid:

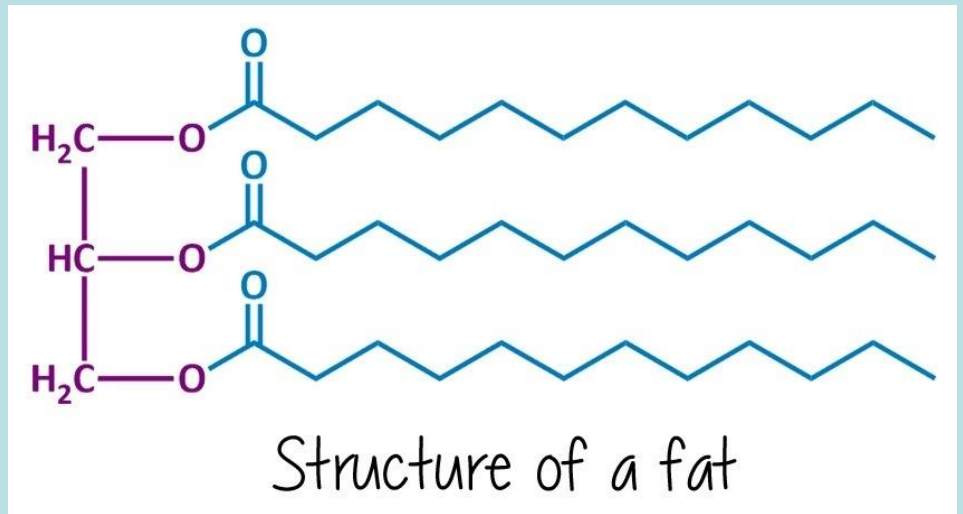
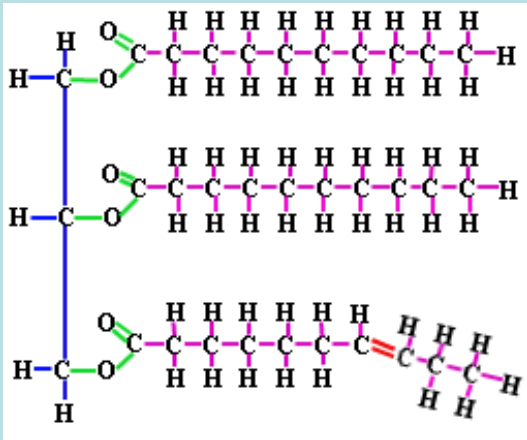
- C20:4 $\Delta$ 5, 8, 11, 14.
- It is an important component of phospholipids in animal and in peanut oil from which prostaglandins are synthesized.



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.





# Stereoisomers

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**These two stereoisomers can be distinguished in the following way:**

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**In a cis stereoisomer, two similar groups attached to the carbon double bond are found on the same side.**

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**In a trans stereoisomer, two similar groups attached to the carbon double bond are found on opposite sides.**

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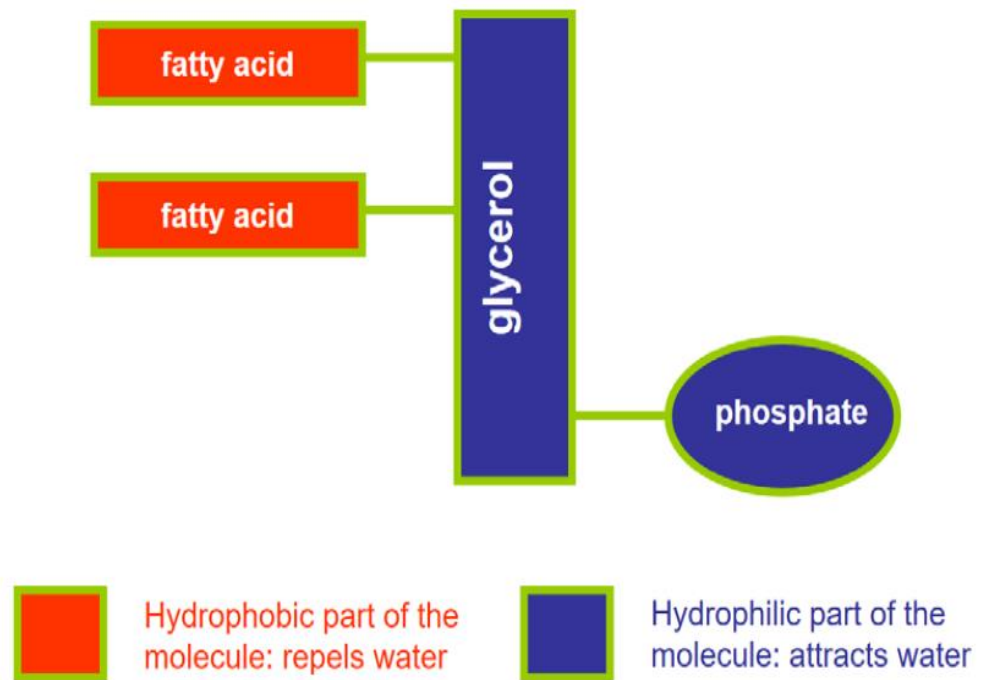
**Most naturally occurring unsaturated fatty acids have cis double bonds.**

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**Elaidic acid is the trans isomer of oleic acid.**

# Phospholipids (structural lipids)

- Contribute in the composition of cell membrane of organelles
- Components:
- Glycerides.
- Saturated fatty acids.
- Unsaturated fatty acids
- Phosphoric acids.
- Amine alcohol.



# Health Effects of Lipids

- omega-3 fats help to reduce risk of **heart disease** and stroke.
- Balance omega-6 and omega-3 intakes.
- Cancer - Fat does not initiate cancer development but may be a **promoter** once cancer has developed



# Lipids

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graph TD; Lipids[Lipids] --- FattyAcids[Fatty acids]; Lipids --- Glycerides[Glycerides]; FattyAcids --- Saturated[Saturated]; FattyAcids --- Unsaturated[Unsaturated]; Glycerides --- Neutral[Neutral glycerides]; Glycerides --- Phospho[Phospho glycerides]; Lipids --- Nonglyceride[Nonglyceride lipids]; Lipids --- Complex[Complex lipids]; Nonglyceride --- N1[ ]; Nonglyceride --- N2[ ]; Nonglyceride --- N3[ ]; Complex --- Arrow[ ]
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Fatty acids

Saturated

Unsaturated

Glycerides

Neutral glycerides

Phospho glycerides

Nonglyceride lipids

Complex lipids



A person with dark hair, wearing large white over-ear headphones and a brown ribbed sweater, is shown in profile from the back, looking at a laptop screen. The laptop screen is bright and shows a white background. The background is a warm, out-of-focus indoor setting.

<https://www.youtube.com/watch?v=kNDh1Ba0U9k>

<https://www.youtube.com/watch?v=NAGcZpq2h7k>



# References:

- <https://nios.ac.in/media/documents/dmlt/Biochemistry/Lesson-05.pdf>
- [https://www.rsb.org.uk/images/05\\_Lipids.pdf](https://www.rsb.org.uk/images/05_Lipids.pdf)
- <http://science.marshall.edu/castella/chm204/chap19.pdf>
- [https://www.google.com/search?q=Lipids&source=lnms&tbn=isch&sa=X&ved=2ahUKEwif2PK-0YP0AhUPAGMBHXqsADwQ\\_AUoAXoECAEQAw&biw=1366&bih=600&dpr=1](https://www.google.com/search?q=Lipids&source=lnms&tbn=isch&sa=X&ved=2ahUKEwif2PK-0YP0AhUPAGMBHXqsADwQ_AUoAXoECAEQAw&biw=1366&bih=600&dpr=1)



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