CONCEPT: FATTY ACIDS

●*Fatty Acids* (_____): *hydrocarbon* chains of varying length with a terminal _____ *acid*.

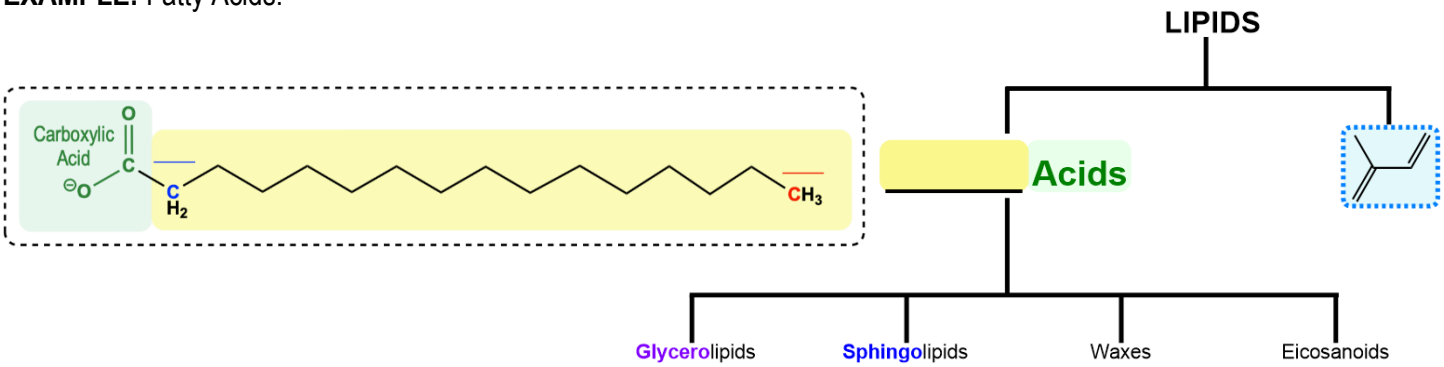
□ Used as *building blocks* for more complex lipids (ex. glycerolipids, sphingolipids, etc.).

●Carbon atoms of fatty acids are *usually* _____ *starting* at the carboxyl carbon.

□ *Alpha Carbon* (α): carbon atom _____ to the carboxyl carbon.

□ *Omega Carbon* (ω): carbon atom _____ from the carboxyl carbon.

EXAMPLE: Fatty Acids.



PRACTICE: Which fatty acid chain would you expect to be least soluble in water?

a) 16-Carbon fatty acid. b) 14-Carbon fatty acid. c) 22-Carbon fatty acid. d) 12-Carbon fatty acid.

Saturated vs. Unsaturated Fatty Acids

●Fatty acids are categorized into _____ groups based on their *hydrocarbon chains*:

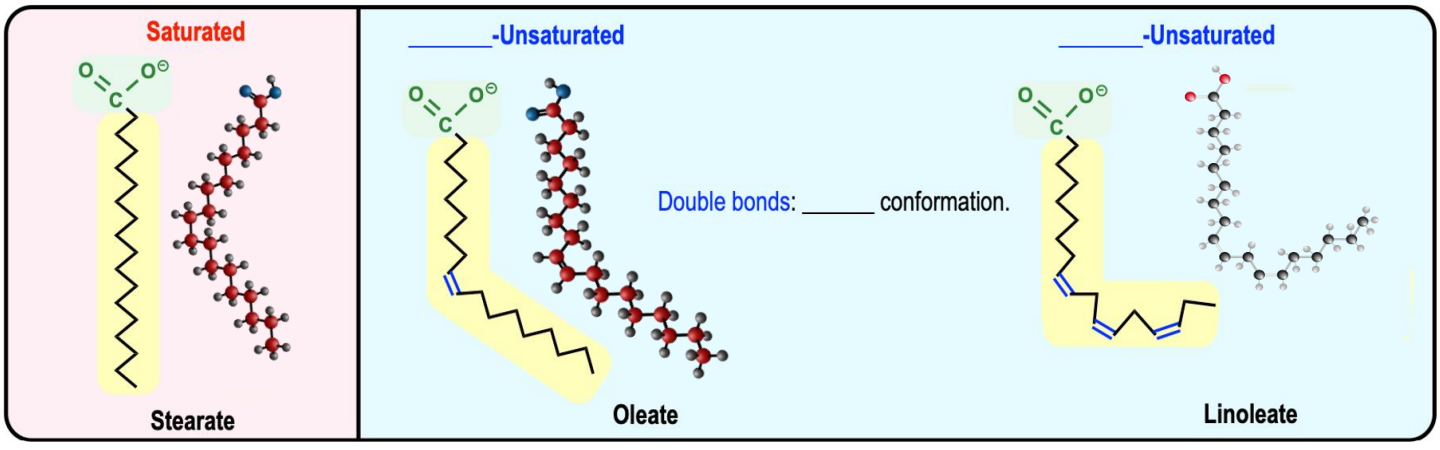
1) *Saturated Fatty Acids*: fully _____ with hydrogens (only contains C-C _____ bonds).

2) ***Un****saturated Fatty Acids*: _____ fully saturated with hydrogens due to presence of ≥ 1 C=C _____ bond.

□ "Mono-" & "Poly-" prefixes respectively indicate just _____ or _____ 1 double bond.

□ Unsaturated fatty acids *double bonds* are *almost always* in the _____ conformation (creating *kinks*).

EXAMPLE: Saturated vs. Unsaturated Fatty Acids.



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PRACTICE: What is the molecular formula of Linolenic acid, an 18-carbon polyunsaturated fatty acid with 3 double bonds?

a) $C_{18}H_{32}O_2$ b) $C_{18}H_{30}O_2$ c) $C_{28}H_{30}O_2$ d) $C_{18}H_{34}O_2$

Melting Points of Fatty Acids

●_____ primary factors affect the strength of _____ *interactions* & thus the _____ *point* of fatty acids.

1) *Length of the hydrocarbon chains* (*longer* chains mean _____ melting point)

2) Degree of saturation of hydrocarbon chains (*more double-bonds* means _____ melting point).

●Therefore, ____saturated fatty acids (with *kinks* in their chains) have *lower* melting points than saturated fatty acids.

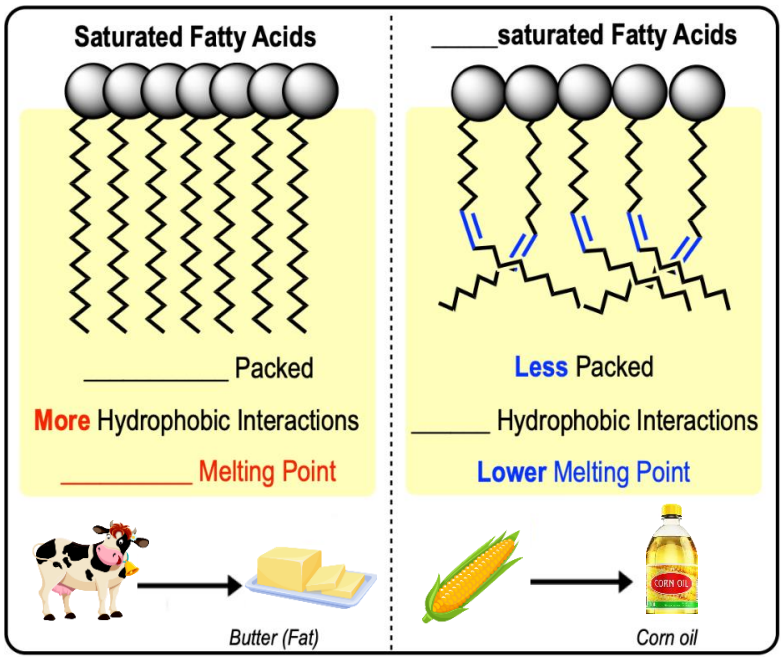
EXAMPLE:

Table 1

Fatty Acid	# of Carbons	Melting Point (°C)
Myristate	14	58
Palmitate	16	63
Stearate	18	71
Arachidate	20	77

Table 2

Fatty Acid	# of Double Bonds	Melting Point (°C)
Oleate	1	16
Linoleate	2	-5
Linolenate	3	-11
Arachidonate	4	-50



□ _____: *solids* at room temperature.

□ _____: *liquids* at room temperature

PRACTICE: What aspect of each of the 18-carbon fatty acids in the table below is correlated with their melting point?

a) The charge of the carboxylic acid group.

b) The length of the hydrocarbon chain.

c) The number of double bonds.

d) The polar hydrocarbon chains.

Fatty Acid	Melting Temp.
Stearic Acid	71 °C
Oleic Acid	16 °C
Linoleic Acid	-5 °C
Linolenic Acid	-11 °C

CONCEPT: FATTY ACIDS

PRACTICE: What happens to the melting point in fatty acids as the hydrocarbon length increases?

a) It increases. b) It decreases. c) It stays the same. d) There is no direct correlation.

PRACTICE: Unsaturated fatty acids:

a) Usually contain a double bond with cis stereochemistry.
b) Are found in both plants and animals.
c) Sometimes contain multiple double bonds.
d) Have lower melting points than the analogous saturated fatty acids.
e) All of the above are correct.

PRACTICE: Which of the following are correct with regard to saturated fatty acids?

a) They are generally solid at room temperature.
b) The carbon backbone contains at least one double bond, creating a kink in the chain.
c) Come primarily from vegetable products.
d) They are only hydrocarbon chains, making them liquids at room temperature.
e) Cannot be present in other lipids, such as phospholipids.

PRACTICE: Match each of the fatty acids with the appropriate melting point:

a) $CH_3(CH_2)_{18}COOH$ _____
b) $CH_3(CH_2)_{14}COOH$ _____
c) $CH_3(CH_2)_{10}COOH$ _____
d) $CH_3(CH_2)_7CH{=}CH(CH_2)_7COOH$ _____
e) $CH_3(CH_2)_4CH{=}CH\text{-}CH_2\text{-}CH{=}CH(CH_2)_7COOH$ _____

Melting Points:
13°C
45°C
-5°C
76°C
63°C

Room Temperature:
25°C