ANSC/NUTR 618
Lipids and Lipid Metabolism
General Chemistry of Fatty Acids

I. Common Saturated Fatty Acids

NO. OF CARBONS	COMMON NAME	GENEVA NAME	STRUCTURE
4	Butyric	Tetranoic	$CH_3(CH_2)_2COOH$
6	Caproic	Hexanoic	$CH_3(CH_2)_4COOH$
8	Caprylic	Octanoic	$CH_3(CH_2)_6COOH$
10	Capric	Decanoic	$CH_3(CH_2)_8COOH$
12	Lauric	Dodecanoic	$CH_3(CH_2)_{10}COOH$
14	Myristic	Tetradecanoic	$CH_3(CH_2)_{12}COOH$
16	Palmitic	Hexadecanoic	$CH_3(CH_2)_{14}COOH$
18	Stearic	Octadecanoic	$CH_3(CH_2)_{16}COOH$
20	Arachidic	Eicosanoic	$CH_3(CH_2)_{18}COOH$

(You will need to know the common names for fatty acids.)

II. Common *Dietary* Unsaturated Fatty Acids

One Double Bond - monounsaturated

16C **Palmitoleic acid** *cis*-9-Hexadecenoic

$CH_3(CH_2)_5CH=CH(CH_2)_7COOH$

18C **Oleic acid** *cis*-9-Octadecenoic

$CH_3(CH_2)_7CH=CH(CH_2)_7COOH$

Two cis-Double Bonds - polyunsaturated

18C **Linoleic acid** *cis*-9,12-Octadecadienoic

$CH_3(CH_2)_4CH=CH\text{-}CH_2\text{-}CH=CH(CH_2)_7COOH$

Two Conjugated Double Bonds

18C **Conjugated linoleic acid** *cis*-9,*trans*-11-Octadecadienoic

$CH_3(CH_2)_4CH_2\text{-}CH=CH\text{-}CH=CH(CH_2)_7COOH$

Three Double Bonds

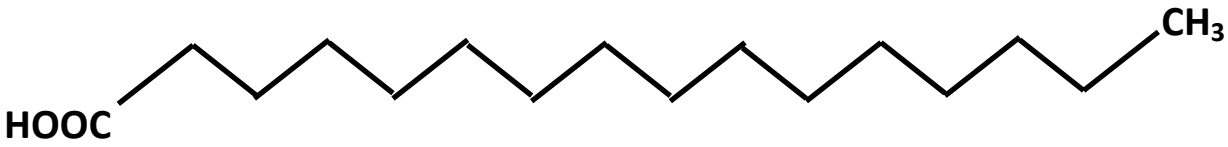
18C **α-Linolenic acid** *cis*-9,12,15-Octadecatrienoic

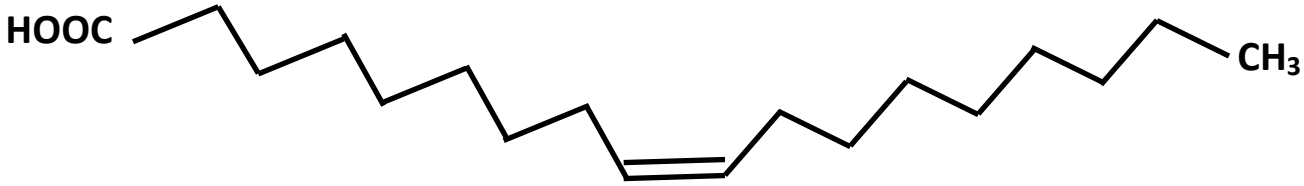
CH_3-CH_2-CH=CH-CH_2-CH=CH-CH_2-CH=CH$(CH_2)_7$COOH

Some important structures

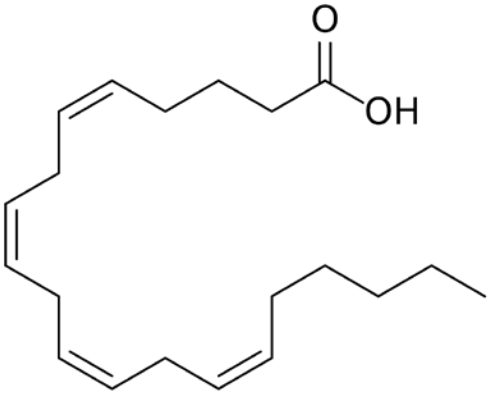
$HOOC\text{-}CH_2\text{-}(CH_2)_n\text{-}CH_2\text{-}CH_3$

Palmitic acid (16:0)

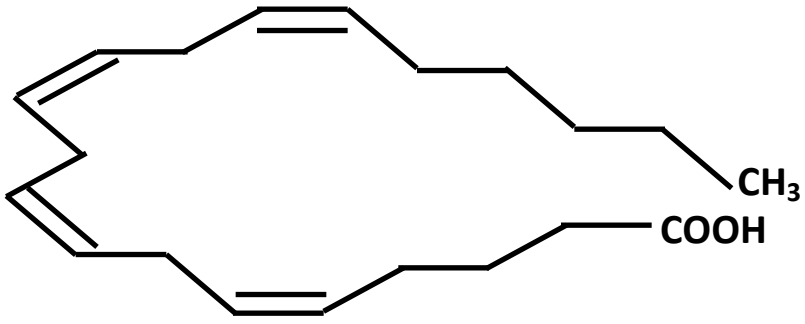


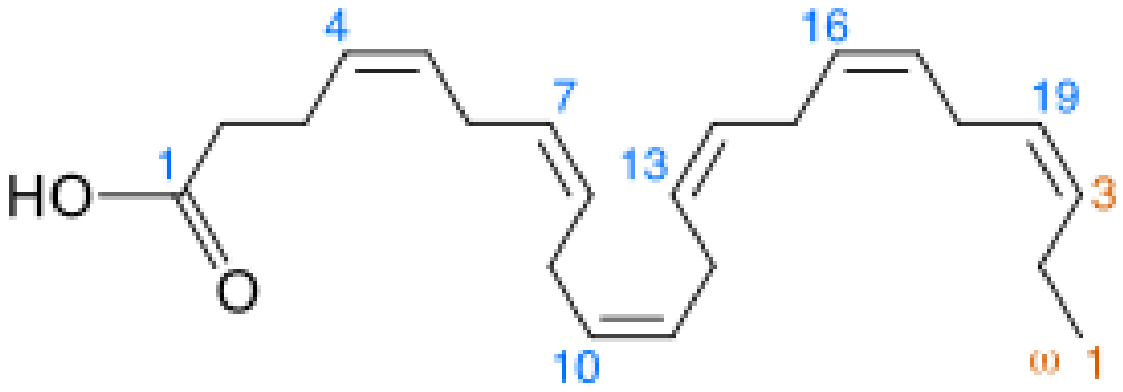


Oleic acid (18:1n-9 or 18:1*cis*-9)



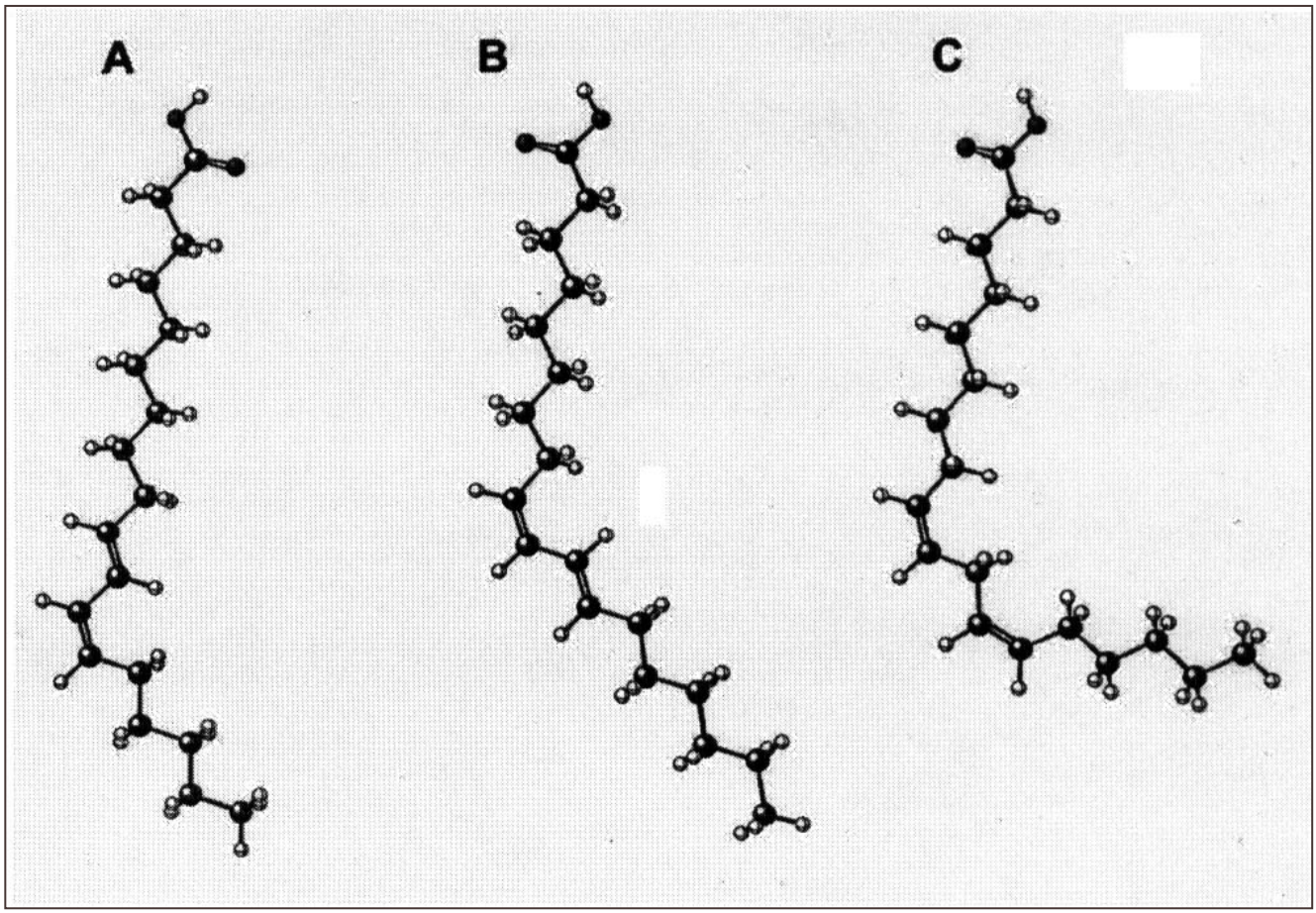
Arachidonic acid (20:4*n*-6 or 20:4*cis*-5, 8, 11, 14)





Docosahexanoic acid (22:6*n*-3 or 22:6*cis*-4, 7, 10, 13, 16, 19)

trans-10, cis-12 conjugated linoleic acid (A), cis-9, trans-11 conjugated linoleic acid (B), and cis-9, cis-12 linoleic acid (C).



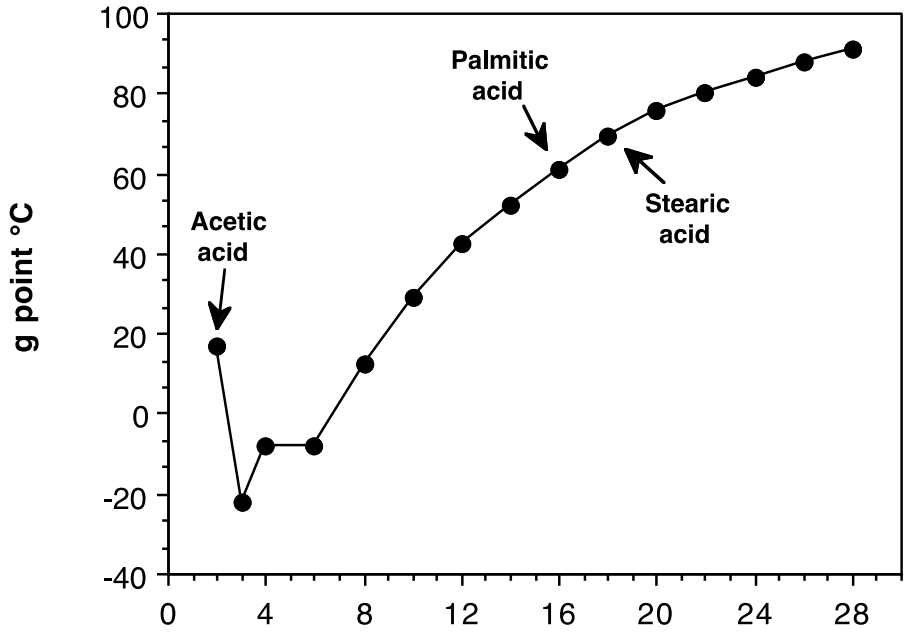
III. Melting points

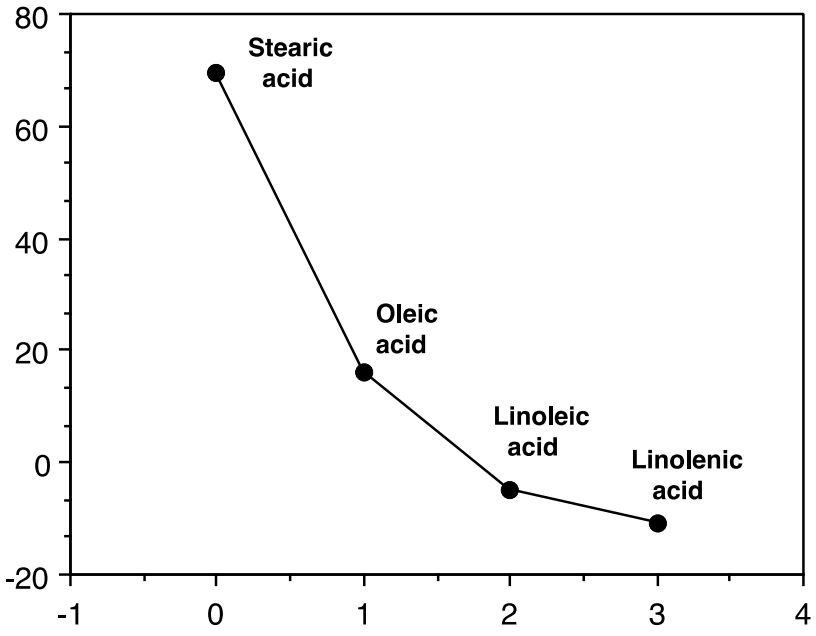
A. Increased chain length

1. Acetic acid (smallest fatty acid) is anomalous because of polarity.
2. With increased chain length (> 3 carbons), melting point increases.

B. Increased double bonds

1. As *cis*-double bonds increase, melting point decreases.
2. *trans*-double bonds do not cause a kink in the molecule, so have less effect on melting point.





C. Fatty Acid Crystals

1. Crystals of oleic acid (**at right**) have a highly ordered structure.

2. The cis double bonds are tilted in opposite directions to the plane of the molecules.

3. This configuration provides maximum van der Waals forces.