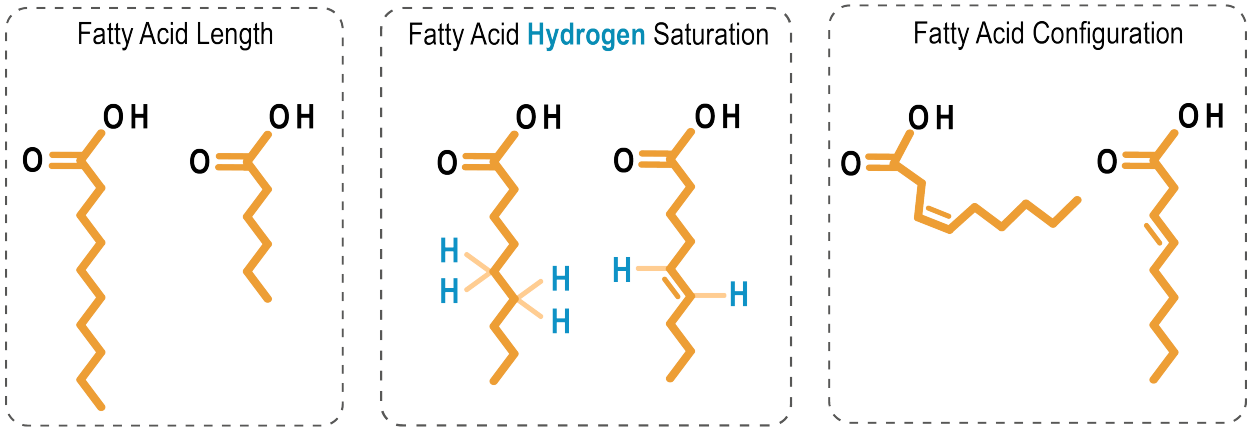
TOPIC: FATTY ACIDS

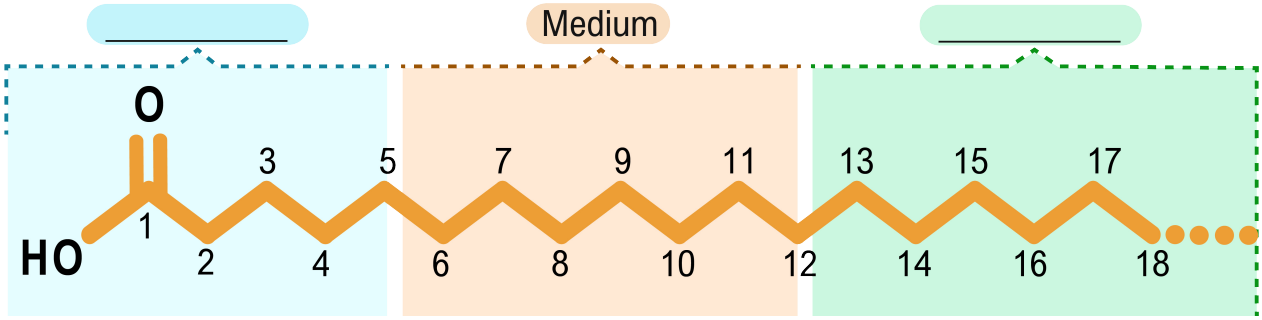
Fatty Acids

- Recall: most dietary lipids, including triglycerides & phospholipids, are made of units called *fatty acids*.
  - **Fatty Acid (FA):** *hydrocarbon* chain with a *carboxylic* _____ group (-COOH) at one end.
- The physical/chemical properties of fatty acids can impact their healthiness:



Length of Fatty Acid Chains

- Fatty acids can vary in _____ (# of carbon atoms in the hydrocarbon chain).
  - Chain length determines how the fat is digested, absorbed, & transported.
  - _____ fatty acids are less common in the diet but tend to be digested/absorbed more *quickly*.



NOTE: The net health effect of a fatty acid depends more on its hydrogen saturation than on its chain length.

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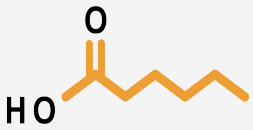
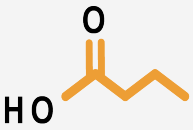
PRACTICE

Which of the following fatty acids is most likely to be absorbed by our bodies most quickly?

a) 

c) 

b) 

d) 

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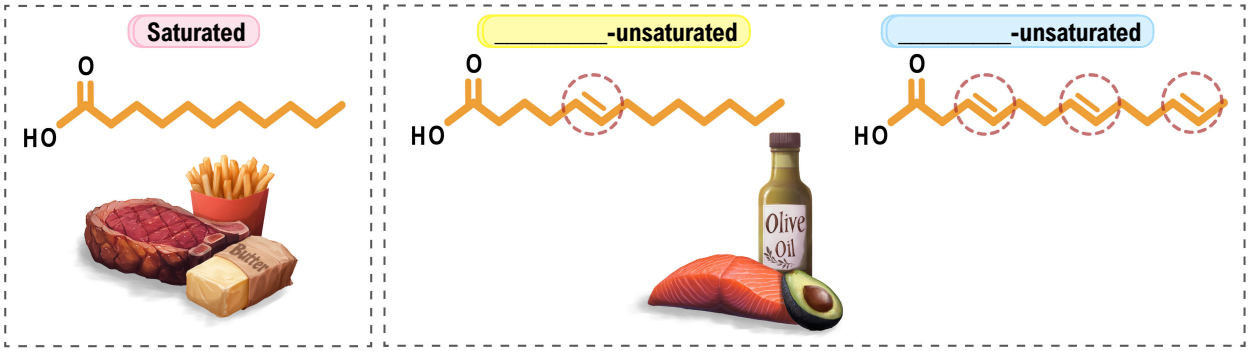
Hydrogen Saturation of Fatty Acids

◆ Fatty acids are *more* saturated with hydrogens when they have *fewer* _____ bonds.

- **Saturated Fatty Acids (SFA):** contain _____ *double bonds*; often *solids* & more abundant in *animals*.
- **Unsaturated Fatty Acids (UFA):** contain ≥1 double bond; often _____ & more abundant in *plants*.
  - ***Mono*unsaturated Fatty Acids (MUFA):** contain only _____ double bond.
  - ***Poly*unsaturated Fatty Acids (PUFA):** contain _____ double bonds.

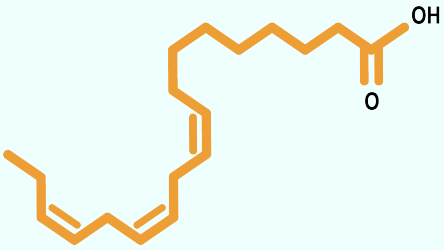


NOTE: Saturated fats generally have more health risks, while unsaturated fats offer more health benefits.

EXAMPLE

Which of the following terms corresponds to the molecule in the image?

a) Saturated fatty acid.
b) Monounsaturated fatty acid.
c) Polyunsaturated fatty acid.
d) Triglyceride.



PRACTICE

The properties of fatty acids are determined by:

a) The length of the hydrocarbon chain.
b) The degree of saturation (how many double bonds there are between carbons).
c) The position & configuration of double bonds between carbons.
d) All of the above.

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PRACTICE

A triglyceride with 3 long, saturated fatty acids is likely to be:

a) Solid at room temperature.

b) Liquid at room temperature.

c) Very healthy for you.

d) Polyunsaturated.

PRACTICE

A fatty acid with 6 carbon atoms is likely to be:

a) Digested & absorbed slower than longer fatty acids.

b) Digested & absorbed quicker than longer fatty acids.

c) Indigestible.

d) Found in most foods that you eat.

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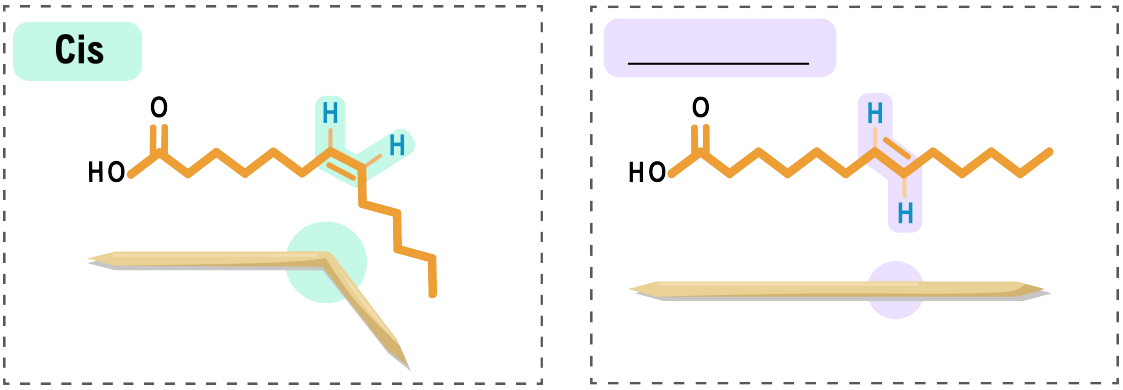
Trans Fatty Acids

◆ Unsaturated fatty acids can have one of two *configurations* (3D arrangements): _____ or _____.

- **Cis:** hydrogen atoms are on the _____ side of double bond (causes a _____ in the chain).
- **Trans:** hydrogen atoms are on _____ sides of double bond (makes the chain *straight*).
  - Trans fats are the most _____ fat, greatly increasing risk of cardiovascular disease.



EXAMPLE

Most trans fats were produced as partially hydrogenated oils (PHOs) in a process called hydrogenation. PHOs are now banned; which of the following is a possible reason for this?

a) Hydrogenation is very expensive & it was economically unsustainable.

b) Food scientists found a more efficient way of producing trans fats.

c) Food companies found that cis fats could be used instead of trans fats.

d) There is a strong link between the consumption of trans fats & risk of cardiovascular disease.

PRACTICE

Consuming trans fats may _____.

a) Lower the risk of heart disease.

b) Increase the risk of heart disease.

c) Lower blood pressure.

d) Be produced in food manufacturing by a process called transamination.

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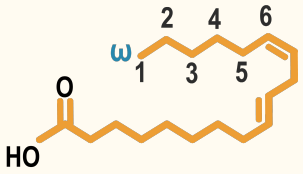
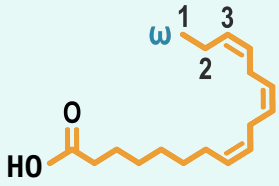
Essential Fatty Acids

◆ **Essential Fatty Acids (EFAs):** *required* in the diet because the human body does _____ synthesize them.

- Often are PUFA with a double bond close to the _____ (ω) carbon (carbon *furthest* from carboxylic acid).
  - **Omega-6 Fatty Acids:** have a double bond _____ carbons from ω carbon (e.g. linoleic acid).
  - **Omega-3 Fatty Acids:** have a double bond _____ carbons from ω carbon; (e.g. alpha-linoleic acid).

Essential Fatty Acid	Sources	Precursors
Linoleic **A**cid (Omega- ___) 	Vegetable oils (soybean, peanut, sunflower, corn), nuts/seeds and eggs. 	_____ is a precursor to arachidonic acid & eicosanoids.
Alpha-**L**inoleic **A**cid (Omega- ___) 	Plants, Flaxseeds (or flaxseed oil), canola oil, chia seeds & walnuts. 	_____ is a precursor to EPA & DHA (found in fish). 

EXAMPLE

Essential fatty acids are important for many reasons, including that they can serve as precursors to a set of biologically important molecules called eicosanoids, which can act as hormones & regulate many body processes. Considering this, which of the following statements about essential fatty acids is true?

a) Humans can synthesize eicosanoids without consuming essential fatty acids.

b) We don't need to consume essential fatty acids if we take eicosanoid supplements.

c) It is important that we consume essential fatty acids as part of a healthful diet, because our bodies cannot synthesize them.

d) If you eat enough essential fatty acids, you will never be susceptible to hormone imbalances.

PRACTICE

Which of the following foods is NOT a good source of essential fatty acids?

a) Walnuts.

b) Flaxseeds.

c) Oily fish (e.g. salmon, sardines).

d) Oranges.

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PRACTICE

In linoleic acid, where would you expect to find a double bond?

a) 6 carbons away from the alpha end of the chain.

b) 6 carbons away from the omega end of the chain.

c) 3 carbons away from the omega end of the chain.

d) On the 6 closest carbons to the omega end of the chain.

e) 6 carbons away from the carboxylic acid group at the end of the chain.