

# lipids

1. Like all lipids, a triglyceride is ***insoluble in water*** because ***it lacks*** many \_\_\_\_\_ functional groups.
2. Triglycerides are made from two subunits:  
a single molecule of \_\_\_\_\_  
*plus three molecules of* \_\_\_\_\_
3. Lipids, which includes triglycerides, phospholipids and steroids, are used by the body for \_\_\_\_\_ , \_\_\_\_\_ , *and* \_\_\_\_\_ (*in addition to many other things*).

*Hydrophobic*

*Hydrophilic*

*Fatty acids*

*Glycerol*

*Amino acid*

*Glycogen*

*Long-term energy storage*

*Quick and ready source of energy*

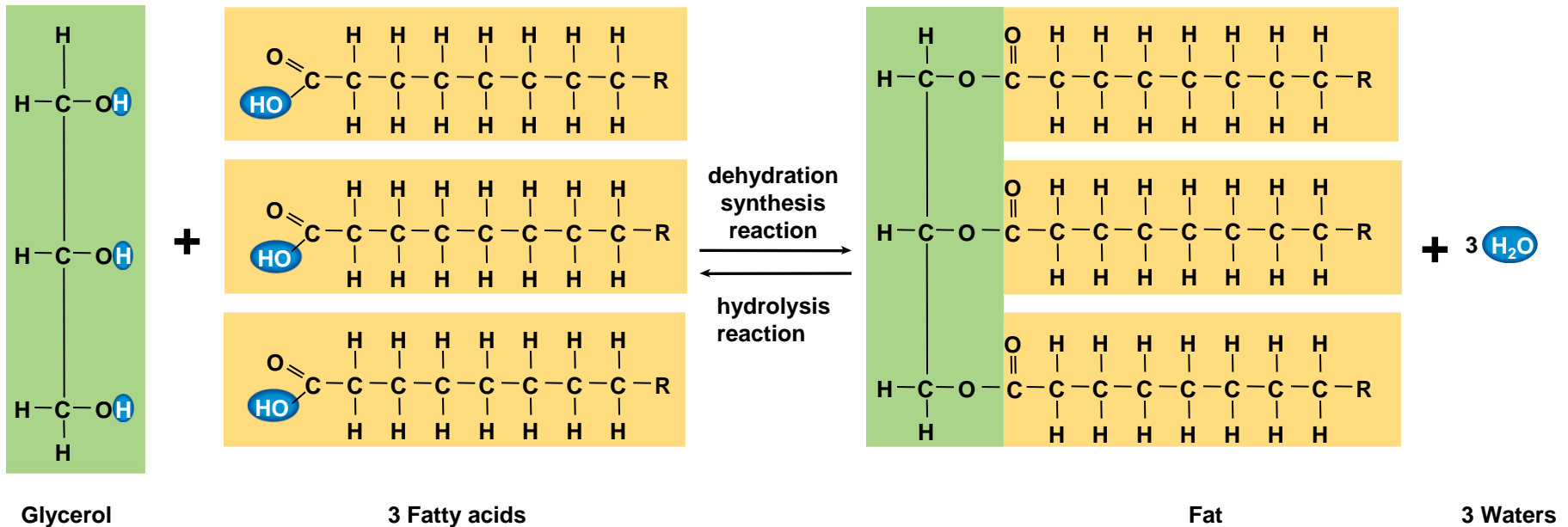
*Storing genetic information*

*Making the cell membrane*

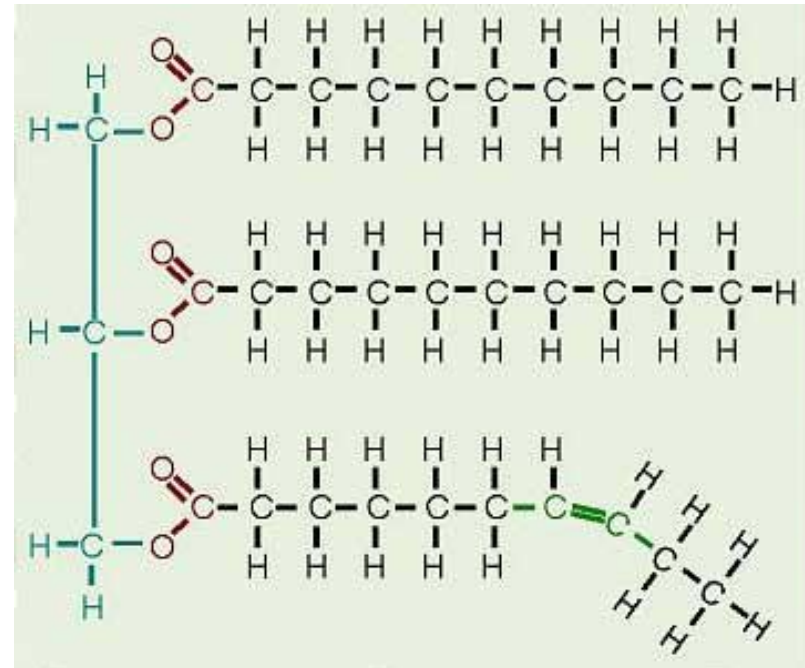
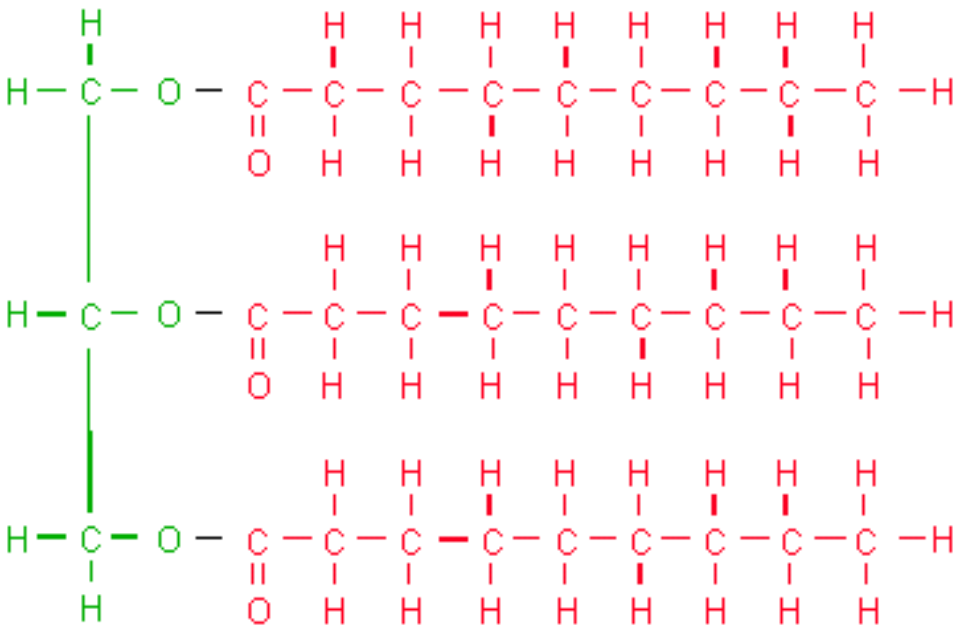
*sending messages between different parts of the body through the blood*

# Figure 3.12 Synthesis and breakdown of fat

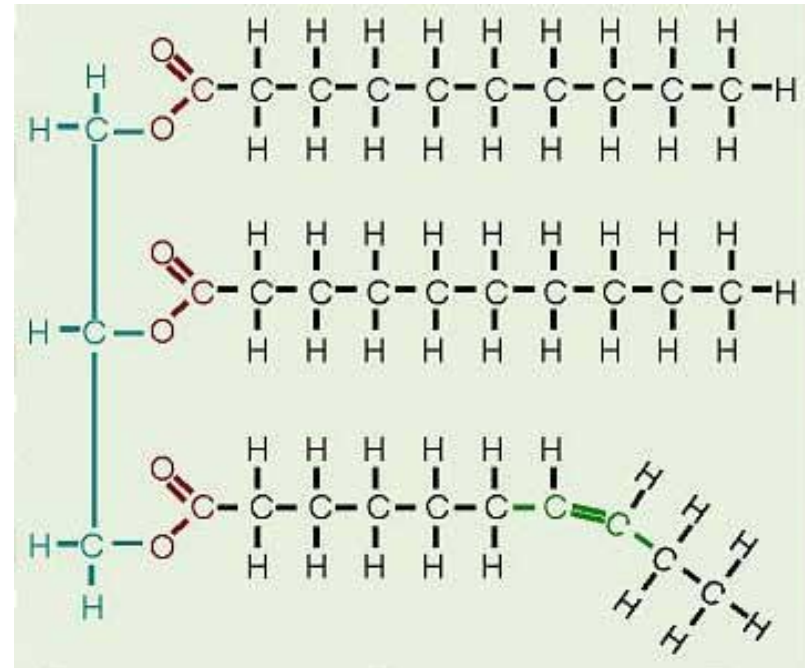
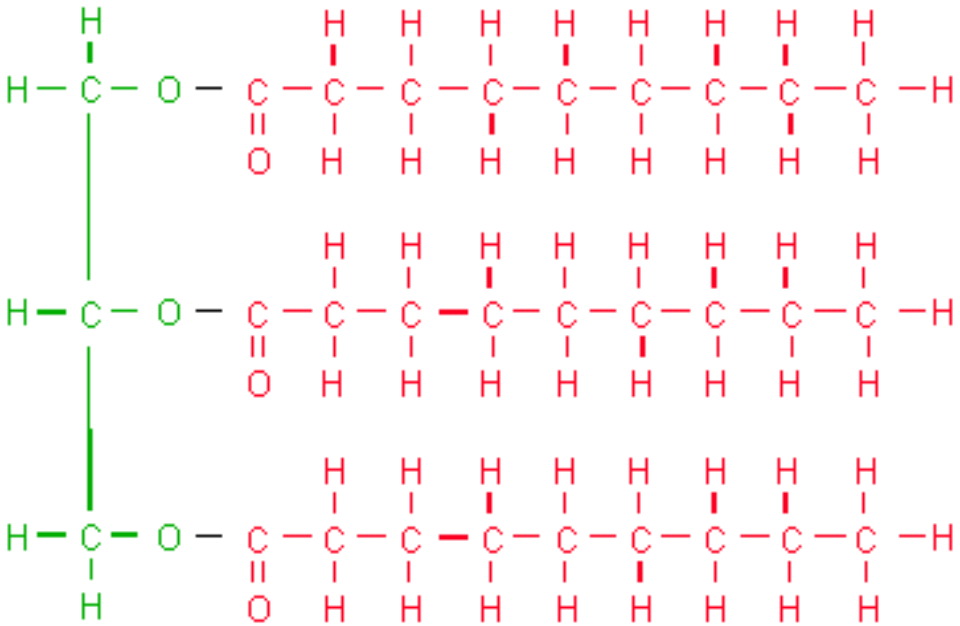
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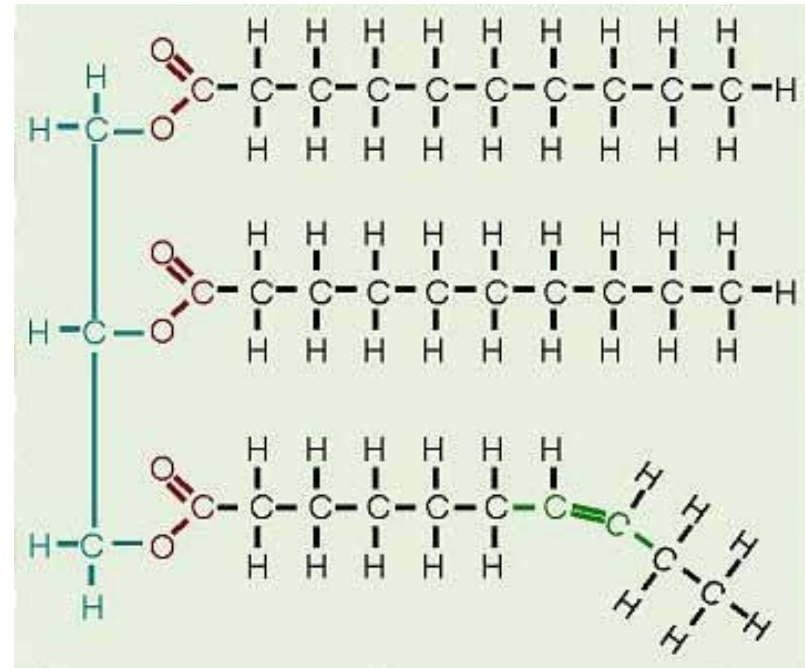
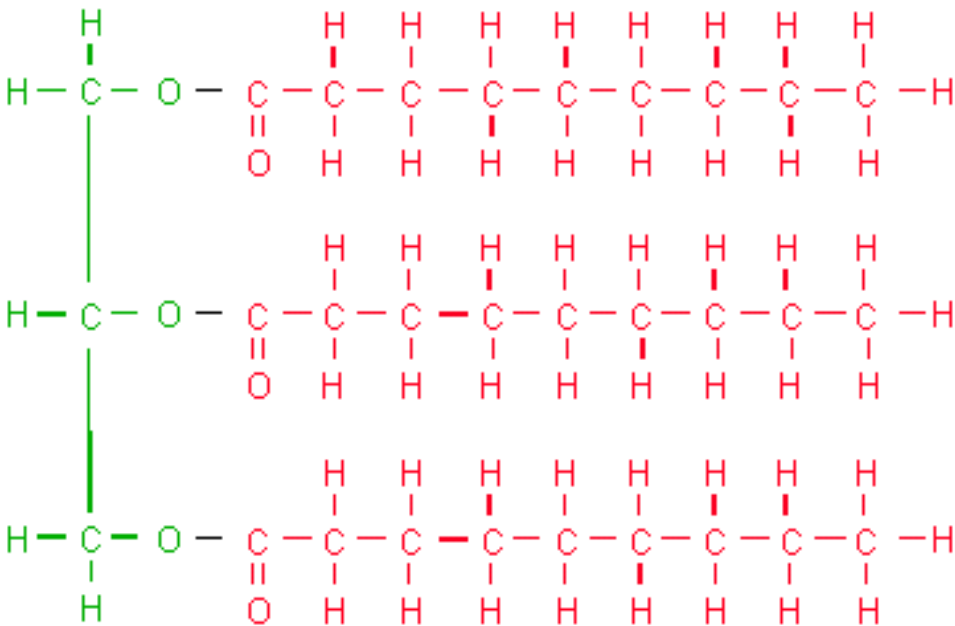
# Saturated or unsaturated ?



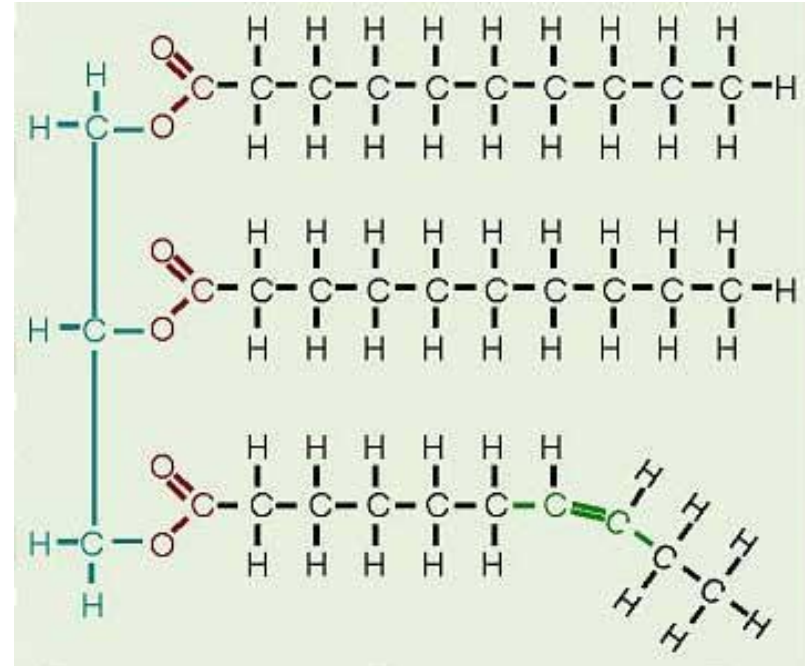
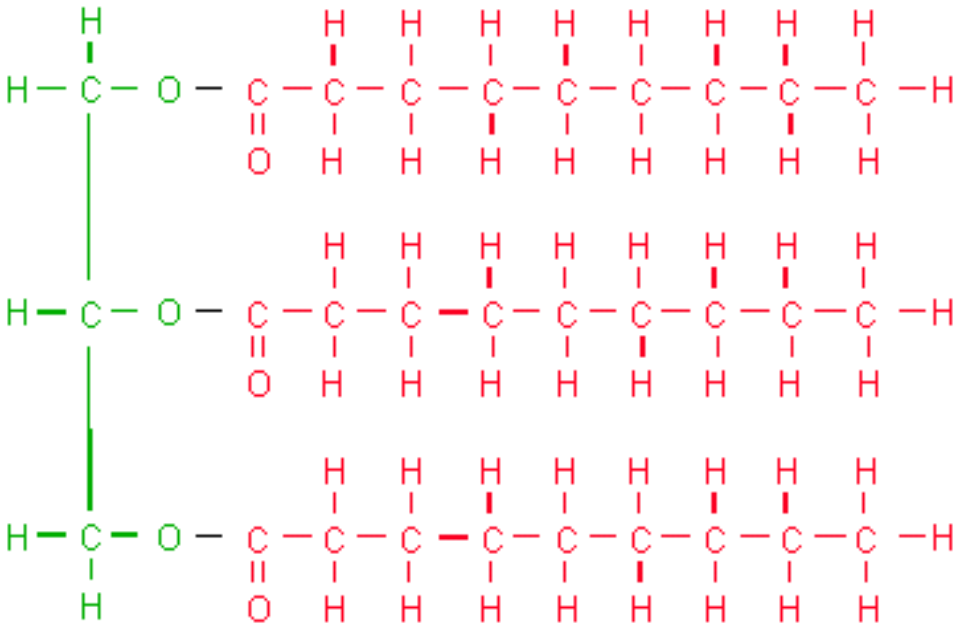
straight or bent ?



stacks well or not stack well ?.



solid or liquid ?

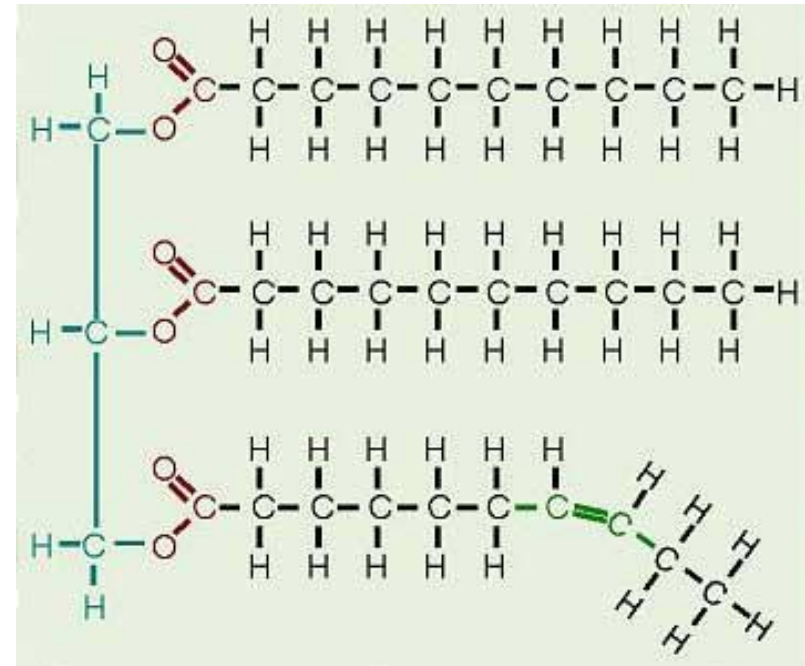
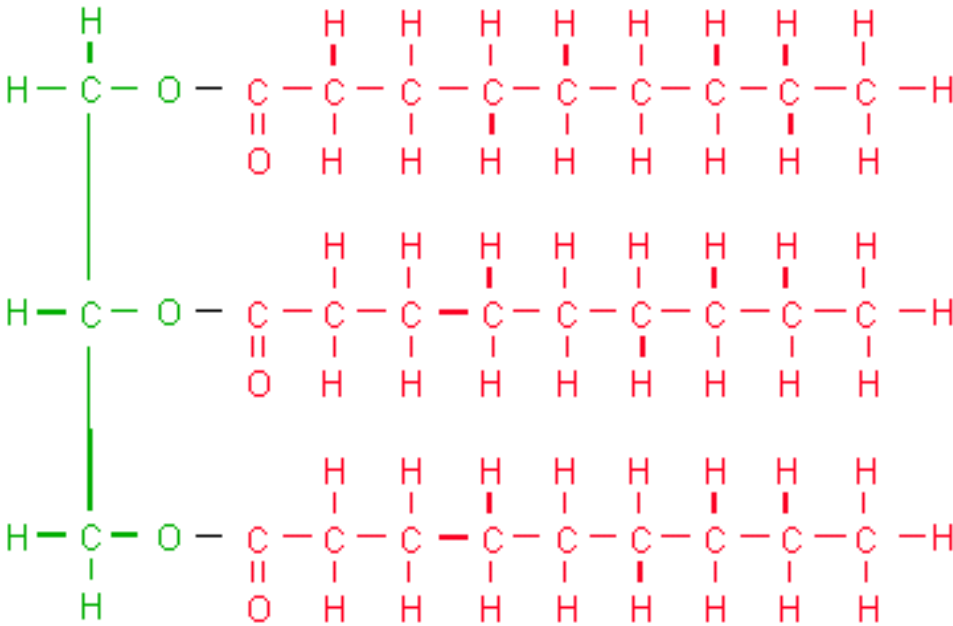


**Saturated** vs. unsaturated

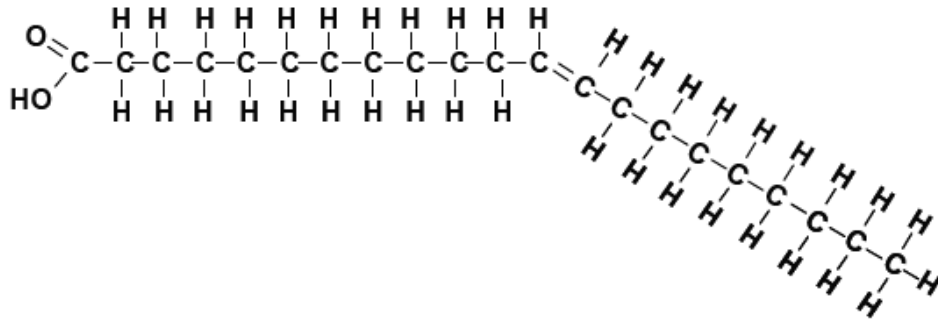
**straight** vs. bent

**stacks well** vs. not stack well

**solid** vs. liquid



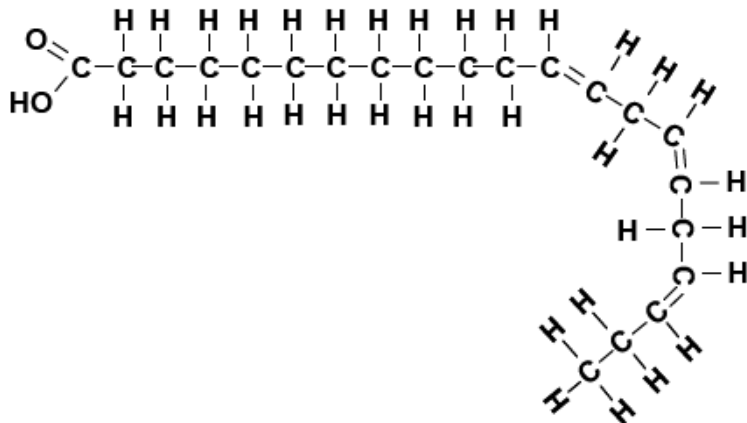
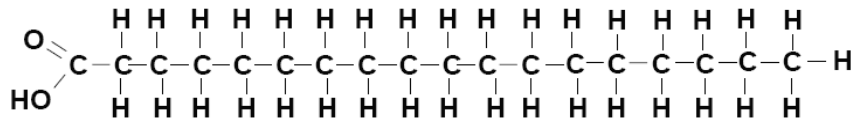
# Match structure on left with item on right



saturated

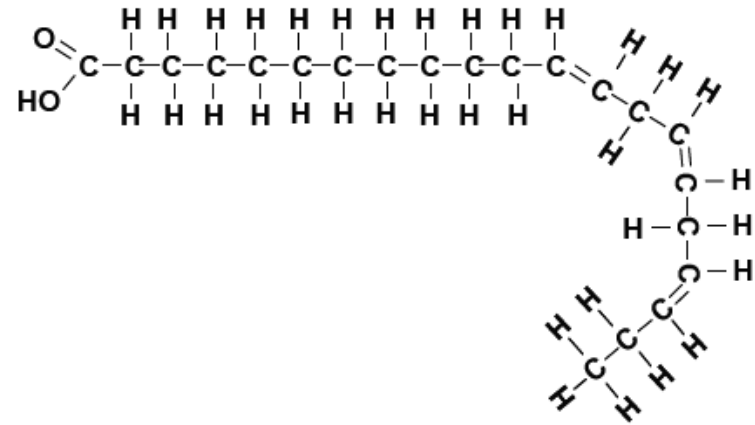
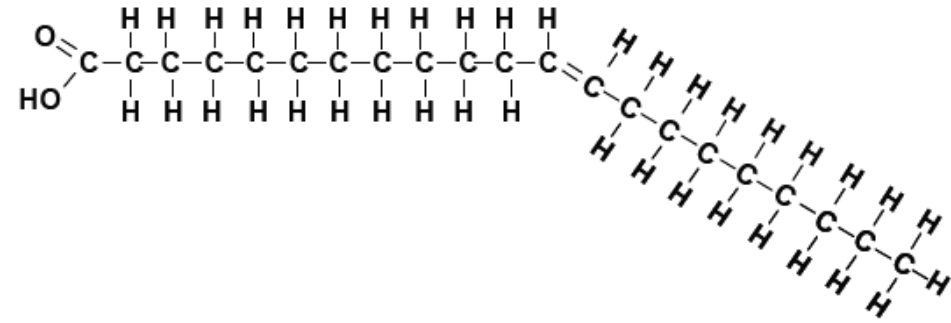
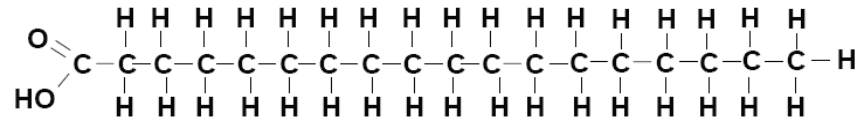
Unsaturated

(poly or mono?)

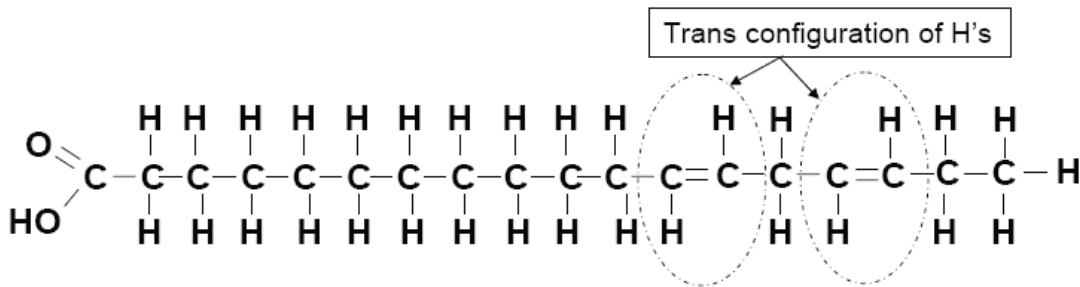
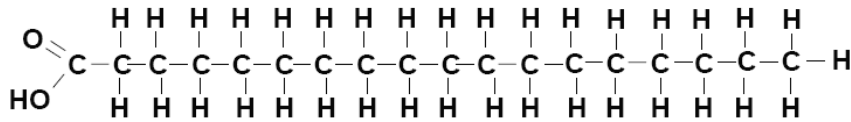
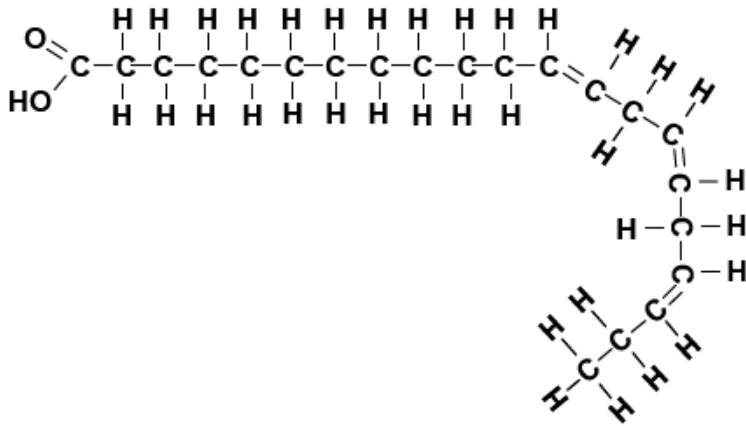




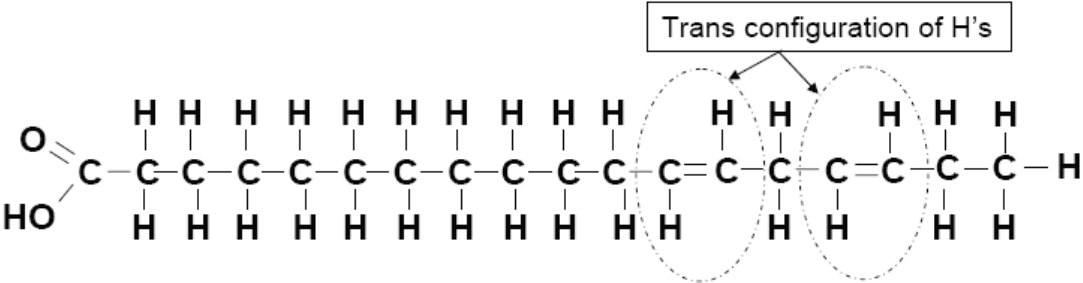
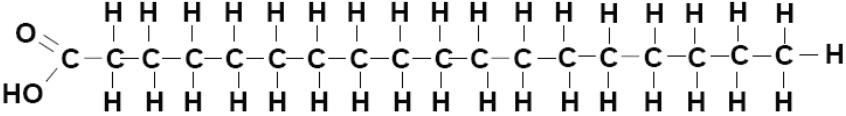
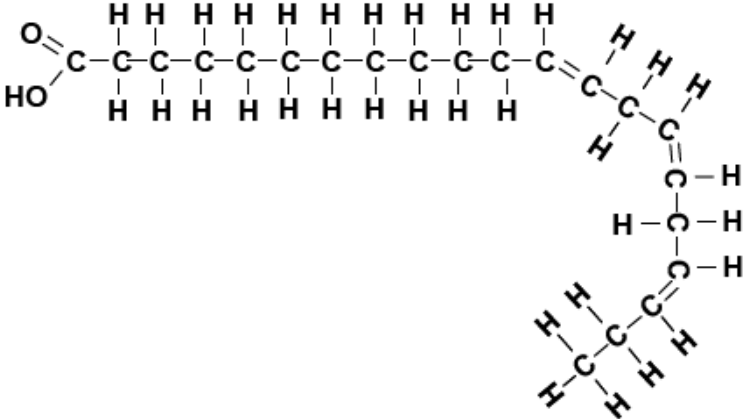
# Saturated vs unsaturated



# Match structure on left with item on right



# Match structure on left with item on right



# Extra Credit

1. **Explain** one negative health effect associated with eating foods that contains trans fat.

Restriction: get answer from the Harvard School of Public Health website listed on the reading list).

2. Identify **three** foods you've eaten in the past week that have trans fat added to them. If you are already health-conscious and avoid trans fat, list three foods you avoid because of their trans fat.

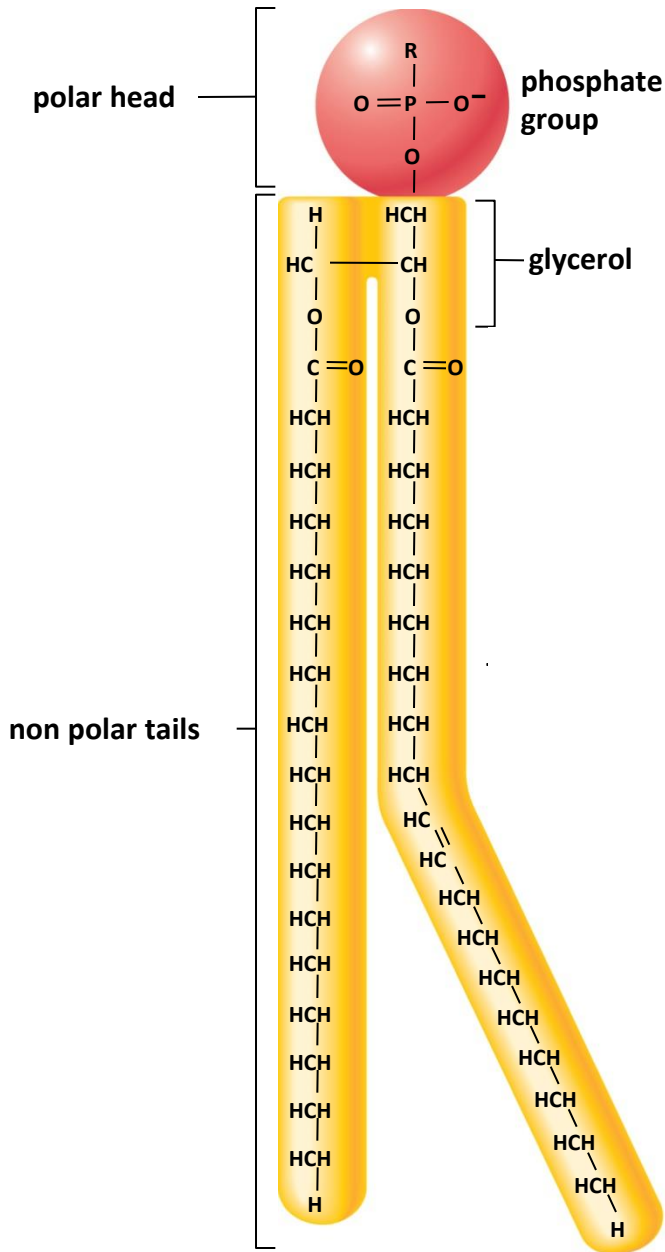
*Do not include natural foods that contain small amounts of natural trans fat, such as beef and dairy.*

...and again, from Harvard School of Public Health website listed on the Unit 1 reading list:

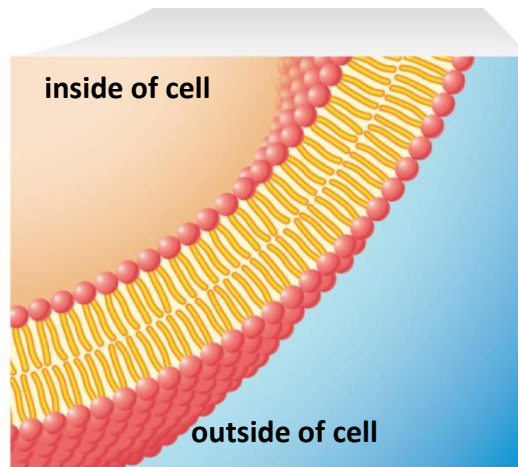
3. **Describe** one positive health effect of eating omega-3-fatty acids.

4. Identify three **whole foods** (*not pills or spreads*) that contain omega-3-fatty acids that you would realistically eat.

# Figure 3.14 Phospholipids from membranes

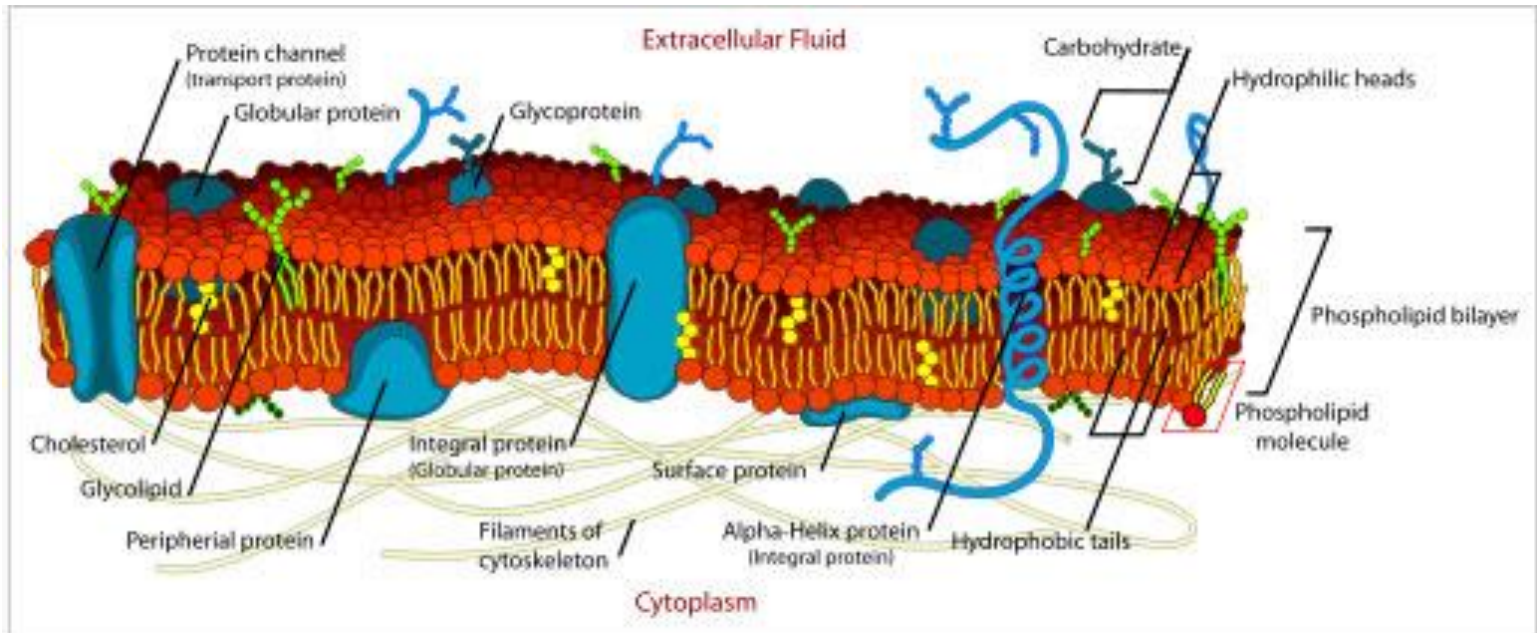
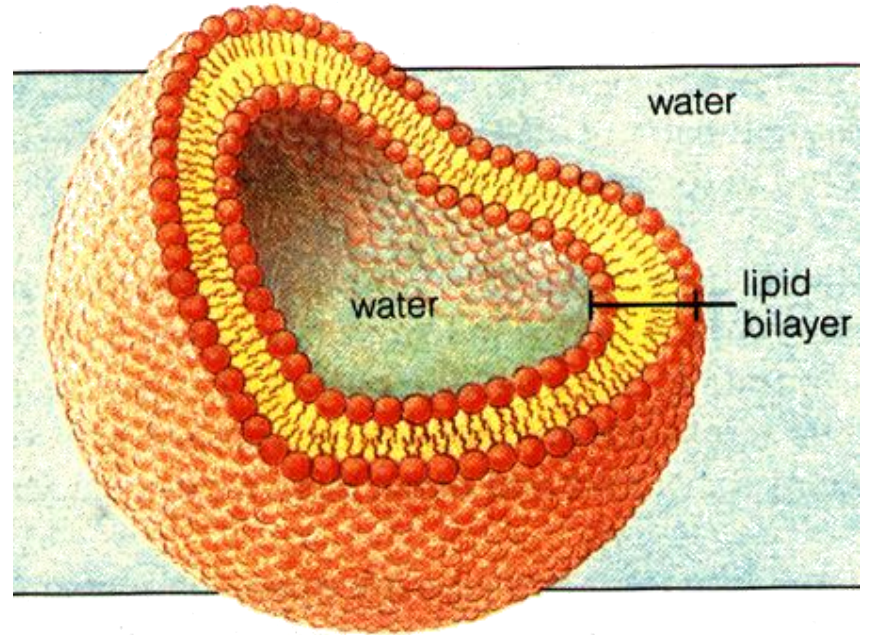
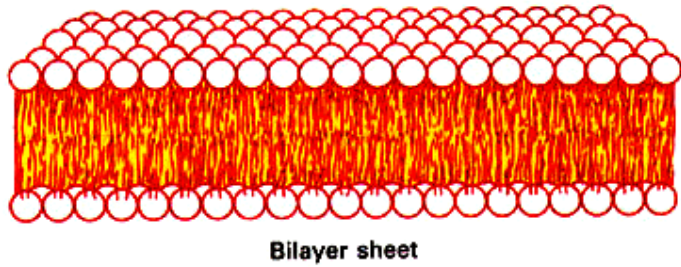
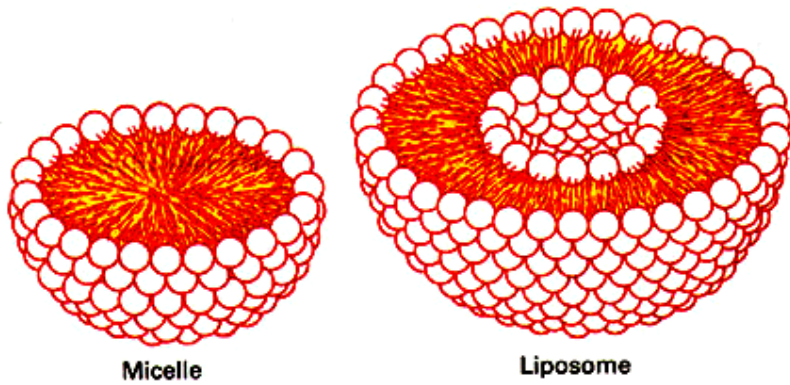


a. Phospholipid structure



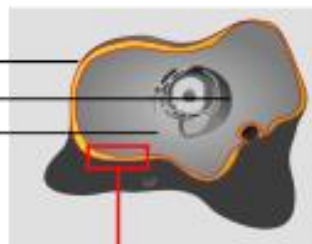
b. Plasma membrane of a cell



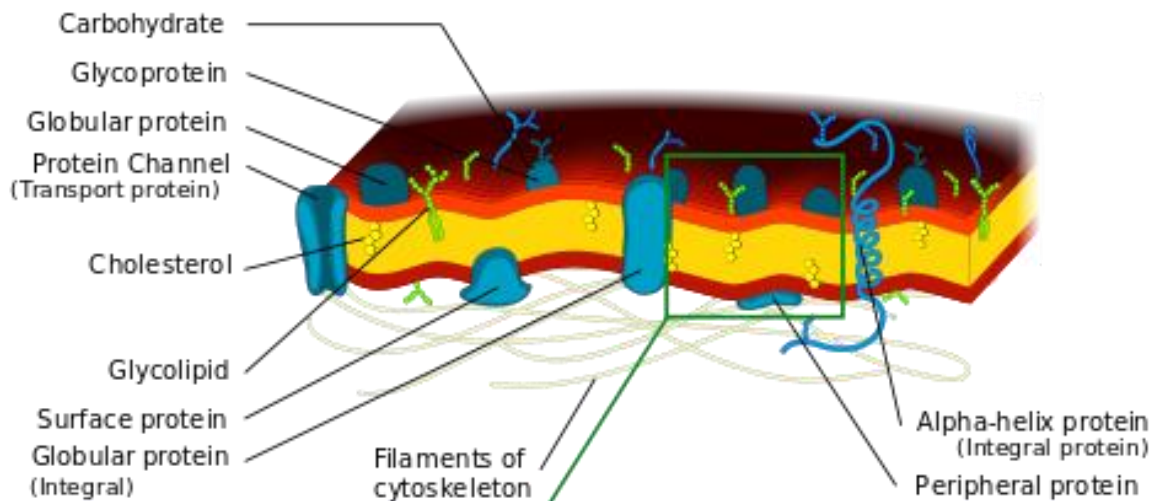


# Cell

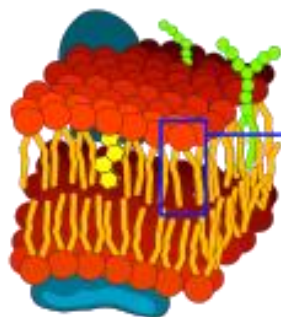
Extracellular fluid  
Nucleus  
Cytoplasm



## Cell membrane



## Phospholipid bilayer



## Phospholipid (Phosphatidylcholine)



Hydrophilic head

Hydrophobic tail

# lipids

1. Like all lipids, a triglyceride is ***insoluble in water*** because ***it lacks*** many \_\_\_\_\_ functional groups.
2. Triglycerides are made from two subunits:  
a single molecule of \_\_\_\_\_  
*plus three molecules of* \_\_\_\_\_
3. Lipids, which includes triglycerides, phospholipids and steroids, are used by the body for \_\_\_\_\_ , \_\_\_\_\_ , *and* \_\_\_\_\_ (*in addition to many other things*).

*Hydrophobic*

*Hydrophilic*

*Fatty acids*

*Glycerol*

*Amino acid*

*Glycogen*

*Long-term energy storage*

*Quick and ready source of energy*

*Storing genetic information*

*Making the cell membrane*

*sending messages between different parts of the body through the blood*



Review last time: Gameshow

# 1. All lipids...

- a) are made from glycerol and fatty acids.
- b) contain nitrogen.
- c) have low energy content.
- d) are acidic when mixed with water.
- e) do not dissolve well in water.
- f) are hydrophilic.

2. Assuming the fluidity of fish oils is comparable when observed in their natural habitat conditions, then oils from arctic fish will have \_\_\_\_\_ than tropical fish oils.

- a) more unsaturated fatty acids.
- b) more cholesterol.
- c) fewer unsaturated fatty acids.
- d) more trans-unsaturated fatty acids.
- e) more hydrogenated fatty acids.

3. A trans fatty acid is one

a. that has no carbon-carbon double bonds directly adjacent to each other.

b. that is a major component of phospholipids in cell membranes.

c. in which the hydrogens attached to adjacent carbons in a carbon-carbon double covalent bond are on opposite sides of the molecule.

d. in which the hydrogens attached to adjacent carbons in a carbon-carbon double covalent bond are on the same side of the molecule.

e. that is saturated with hydrogens.

4. Types of polyunsaturated fatty acids that are necessary in the human diet because they cannot be synthesized by the body are called \_\_\_\_\_ fatty acids.

- a. essential
- b. important
- c. trans
- d. omega-3
- e. hydrophobic

5. Generations of Americans were introduced to trans fats in their diet in the form of \_\_\_\_\_ which was hailed as a healthy alternative to the saturated fats found in butter and lard.

- a. Coconut oil
- b. Olive oil
- c. Margarine
- d. Canola oil
- e. Beef tallow

6. HDL stands for

- a. Highly dense lipid.
- b. Hydrogenated dark lipid.
- c. High density lipid.
- d. Hydrogenated dense lipoprotein.
- e. High density lipoprotein.

7. A triglyceride is composed of glycerol and three fatty acids. What type of reaction is used to link each of the fatty acids to a glycerol molecule?
- a. Dehydration
  - b. Hydrolysis
  - c. Dehydrohalogenation
  - d. Hydrogenation
  - e. Hydroxylation

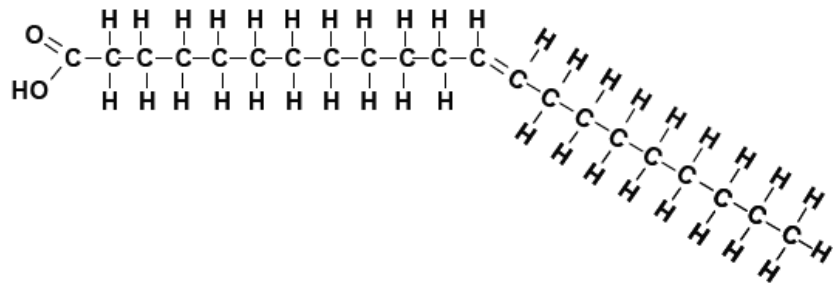


8. Which one of the following would be solid at room temperature?
- a. Cis fatty acids
  - b. Corn oil
  - c. Peanut oil
  - d. Saturated fats such as lard (pig fat)
  - e. Unsaturated fats

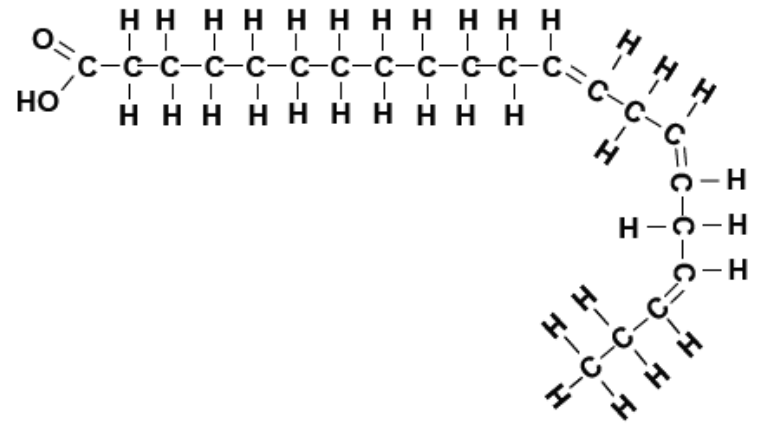
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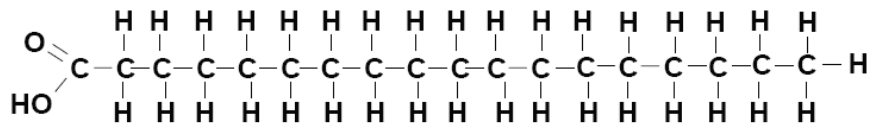
(a)



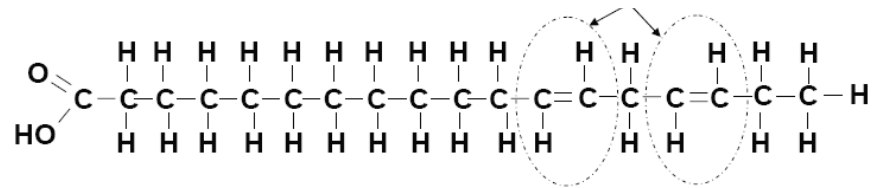
(b)



(c)



(d)



(e) None of the above

11. Food companies can tag their products on the nutrition label as having 0g of trans fats if they have <0.5g of trans fat per serving. What could be found in the ingredients list that is probably a better indicator of the presence of trans fats in foods than the trans fat line on the nutrition label?

- a. Lard
- b. Hydrogenated oils
- c. Palm oil
- d. Olive oil
- e. Almonds

12. Consumption of which of the following is most likely to raise your HDL and also lower your LDL levels?
- a. Trans fats
  - b. Saturated fats
  - c. Lard
  - d. Polyunsaturated fats
  - e. Margarine

# 1. All lipids...

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- b) contain nitrogen.
- c) have low energy content.
- d) are acidic when mixed with water.
- e) **do not dissolve well in water.**
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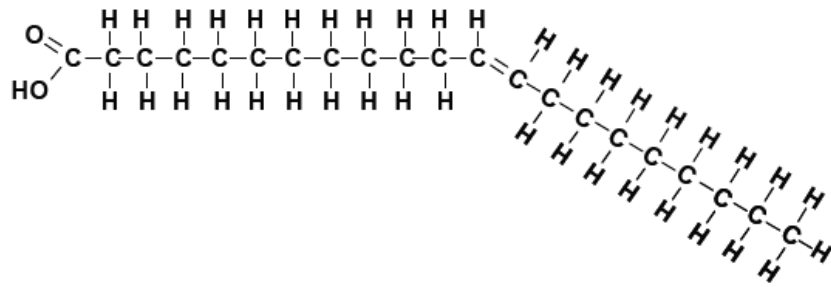
**d. Saturated fats such as lard (pig fat)**

e. Unsaturated fats

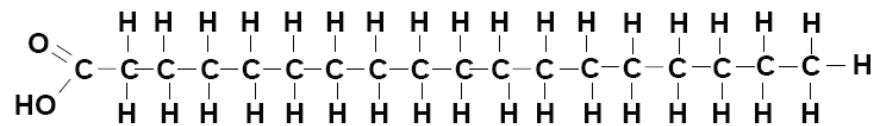
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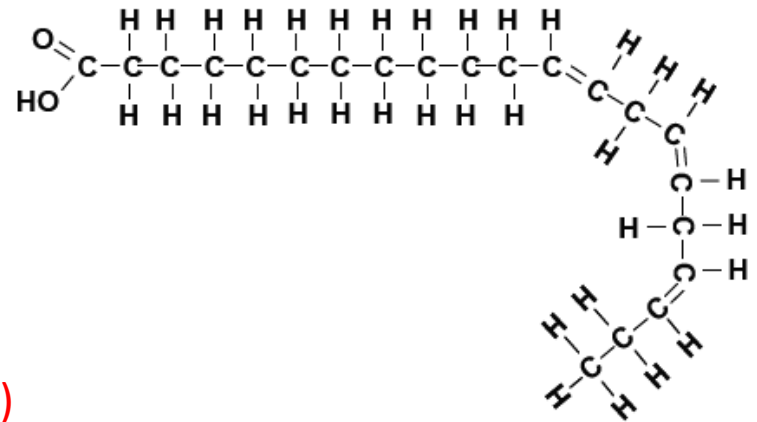
(a)



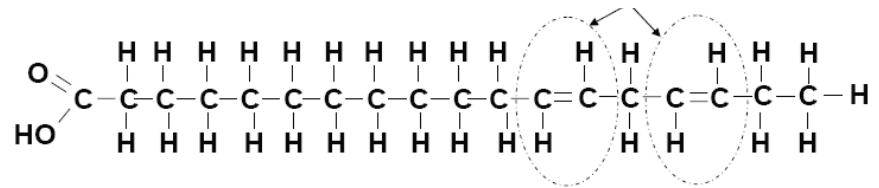
10. (c)



(b)



9. (d)



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  - c. Lard
  - d. Polyunsaturated fats**
  - e. Margarine

# Cholesterol and its many uses

## Cell membranes

Used to make other things :

**Bile:** fat absorption

**Vitamin D** (a hormone)

**Corticosteroids** (hormones):

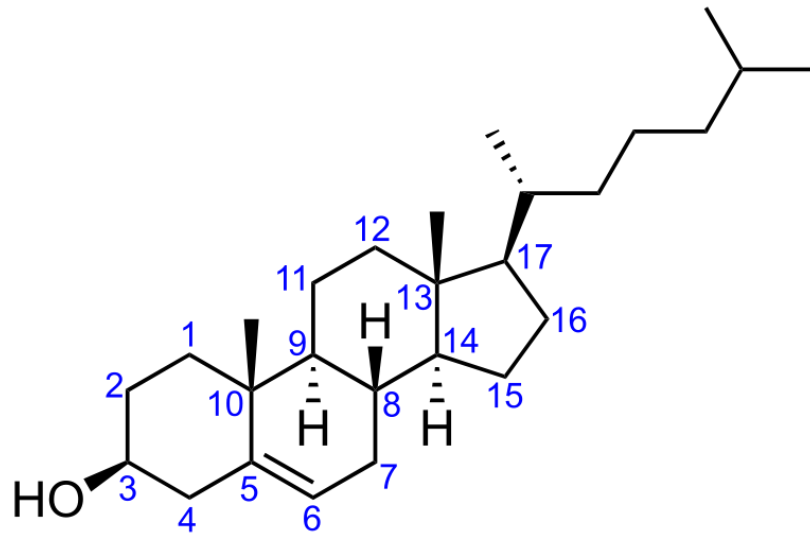
*Mineralocorticoids:*  
control electrolyte and  
water levels

*Glucocorticoids:*  
Immune system;  
Inflammation;  
carbohydrate, fat and  
protein metabolism

**Sex steroids**  
(hormones)



# Cholesterol and its many uses:



## Cell membranes

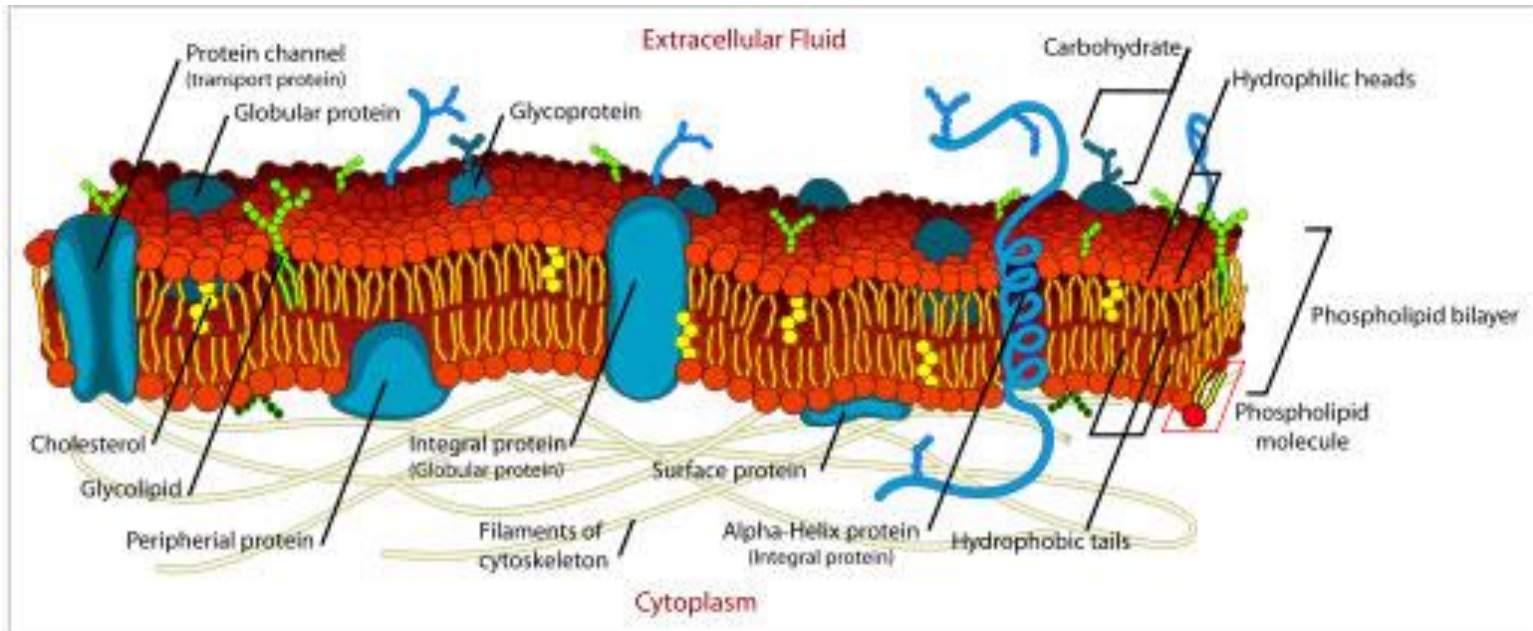
Makes membranes more flexible.

Is there cholesterol in *animal* cell membranes?

Hint: animals have no cell wall

Is there cholesterol in *plant* cell membranes?

Hint: plants do have cell wall



# Cholesterol and its many uses

## Cell membranes

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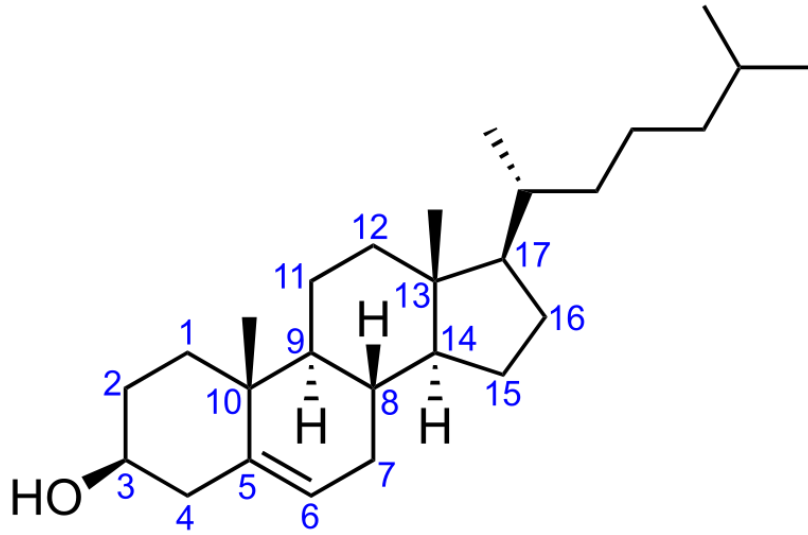
*Mineralocorticoids:*  
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Immune system;  
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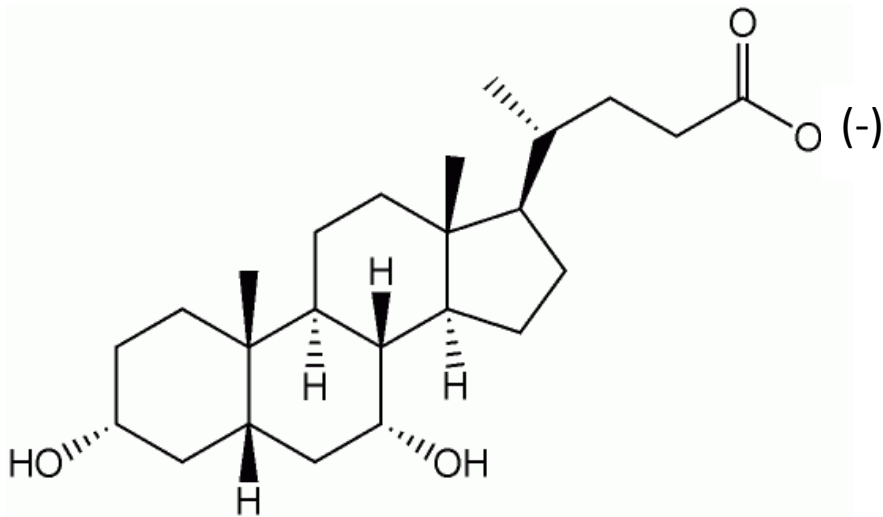
**Sex steroids**  
(hormones)

# Cholesterol and its many uses:

Cholesterol used to make  
**Bile:** fat absorption



cholesterol

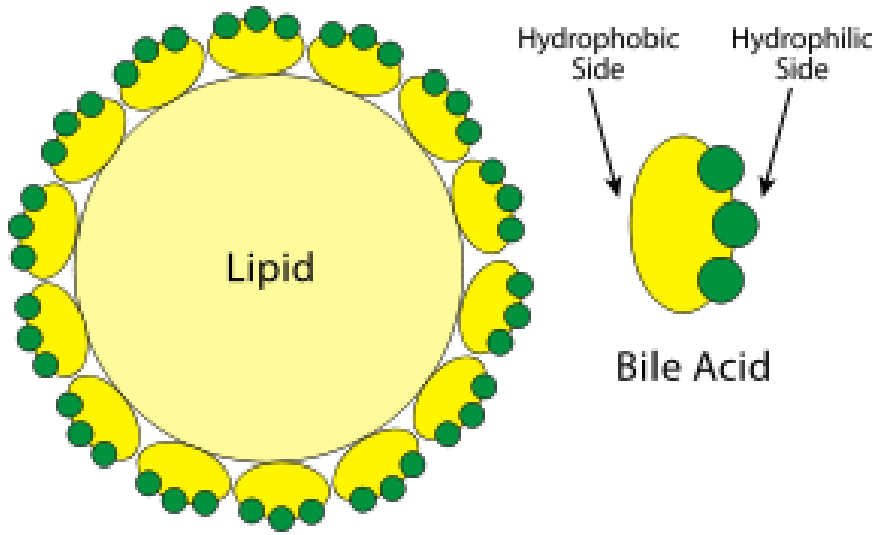
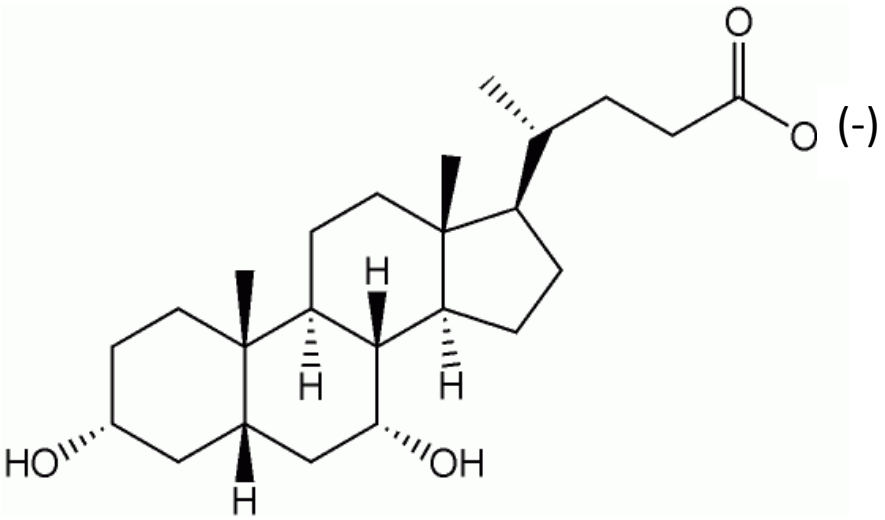
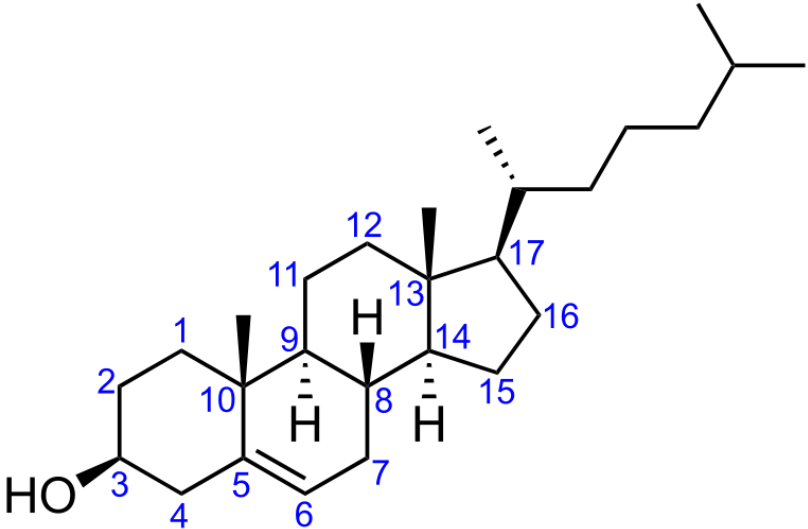


Bile acid: (-) charged

Made in liver  
stored in gall bladder  
Dumped into small intestine

# Cholesterol and its many uses:

Cholesterol used to make  
**Bile:** fat absorption



# Cholesterol and its many uses

## Cell membranes

Used to make other things :

**Bile:** fat absorption

**Vitamin D:** (a hormone)

**Corticosteroids** (hormones):

*Mineralocorticoids:*  
control electrolyte and  
water levels

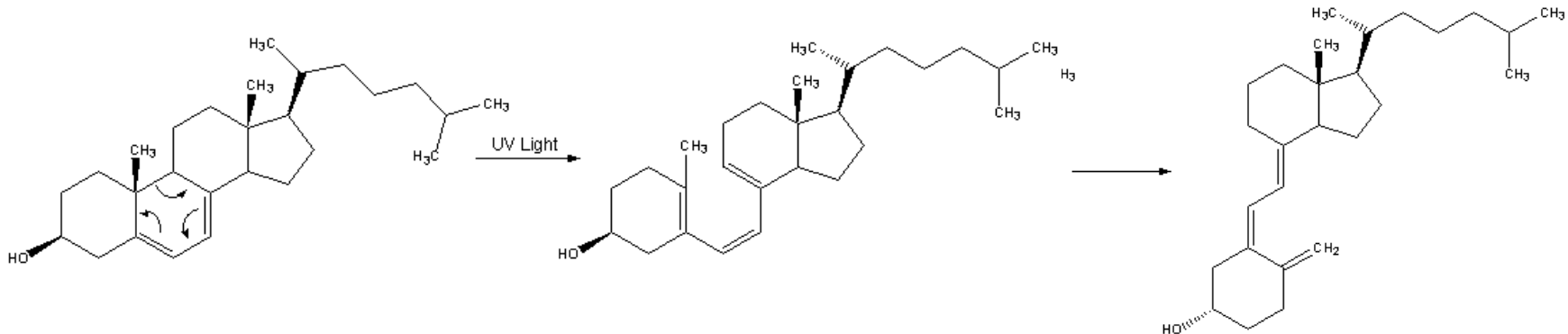
*Glucocorticoids:*  
Immune system;  
Inflammation;  
carbohydrate, fat and  
protein metabolism

**Sex steroids**  
(hormones)

# Cholesterol and its many uses:

cholesterol used to make

**Vitamin D**



Vitamin D is a hormone that signals intestine cells to make the protein ion channels and pumps that allow absorption of calcium (and phosphate) from diet.

Vitamin D deficiency results in rickets - osteomalacia  
Rickets is among the most frequent [childhood diseases](#)  
in many developing countries suffering from severe  
[malnutrition](#), usually resulting from [famine](#) or [starvation](#).

Darker-skinned people need to be exposed longer to the  
[ultraviolet rays](#).



ASAP science

Cholesterol to Vitamin D

**What If You Stopped Going Outside?**

# Cholesterol and its many uses

Cell membranes

Used to make other things :

**Bile:** fat absorption

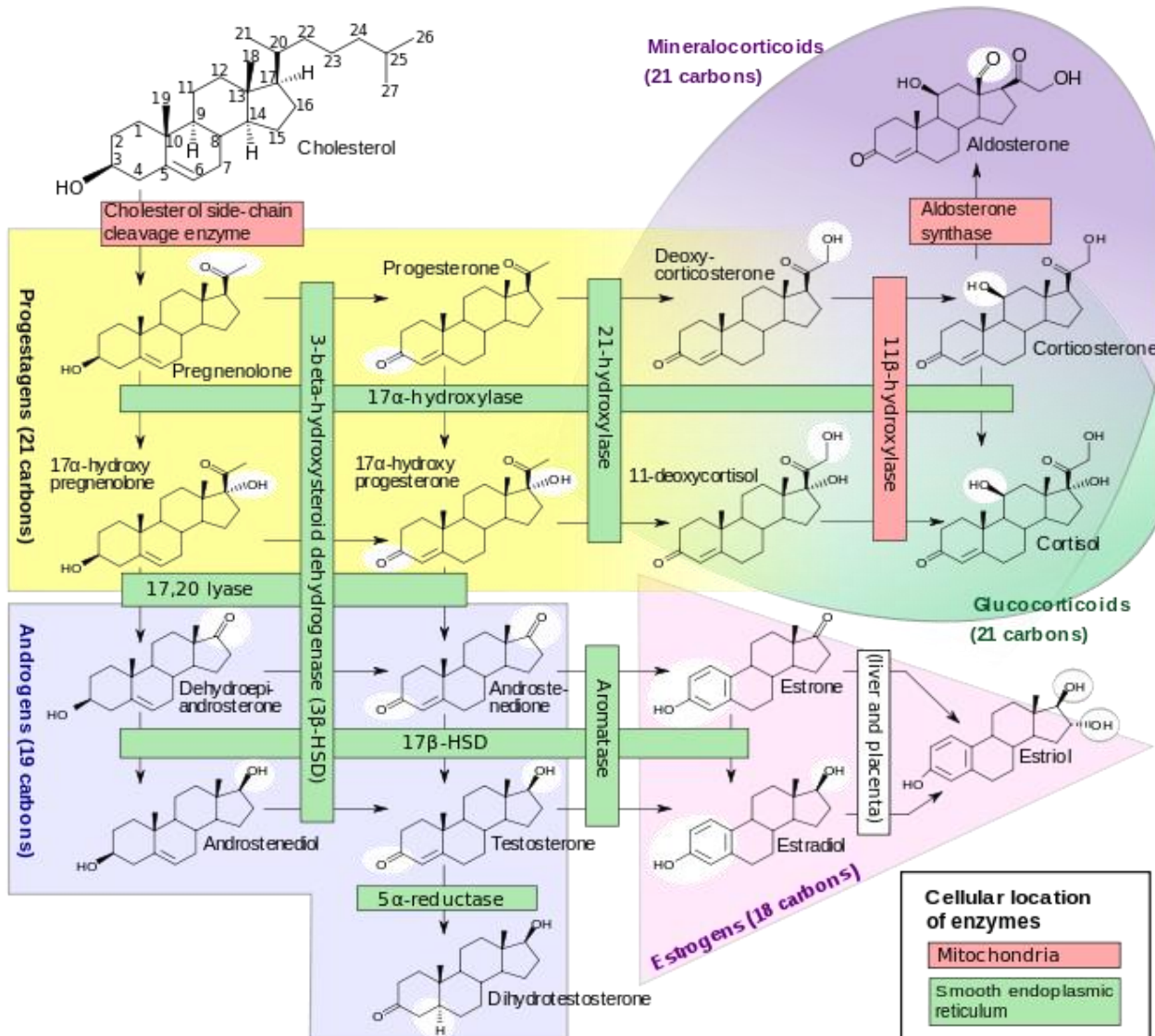
**Vitamin D**

**Corticosteroids (hormones):**

*Mineralocorticoids:*  
control electrolyte and water levels

*Glucocorticoids:*  
Immune system;  
Inflammation;  
carbohydrate, fat and protein metabolism

**Sex steroids**  
(hormones)

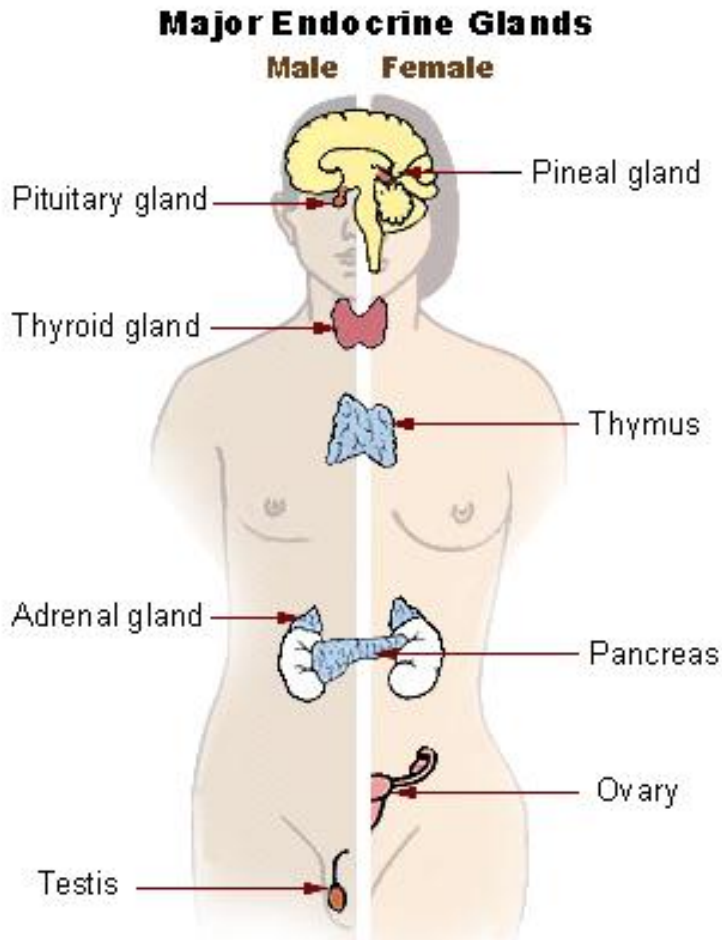




# Cholesterol and its many uses:

cholesterol used to make

**Corticosteroids**



**Corticosteroids** (hormones):

*Mineralocorticoids:*  
control electrolyte and  
water levels (blood osmolarity)

*Glucocorticoids:*  
Immune system;  
Inflammation;  
carbohydrate, fat and  
protein metabolism

Made in the adrenal cortex -  
part of the adrenal gland (above kidney)

# Cholesterol and its many uses

Cell membranes

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**Bile:** fat absorption

**Vitamin D**

**Corticosteroids** (hormones):

*Mineralocorticoids:*  
control electrolyte and water levels

*Glucocorticoids:*  
Immune system;  
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**Sex steroids**  
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