

## Class 2: **Lipids**

- The only class that does not form polymers
- Lipids are *hydrophobic* because they consist mostly of carbon and hydrogen
- The most biologically important lipids are **triglycerides (fats), phospholipids, and steroids**
- Purpose: fuel storage, cell membranes

# Examples of lipids

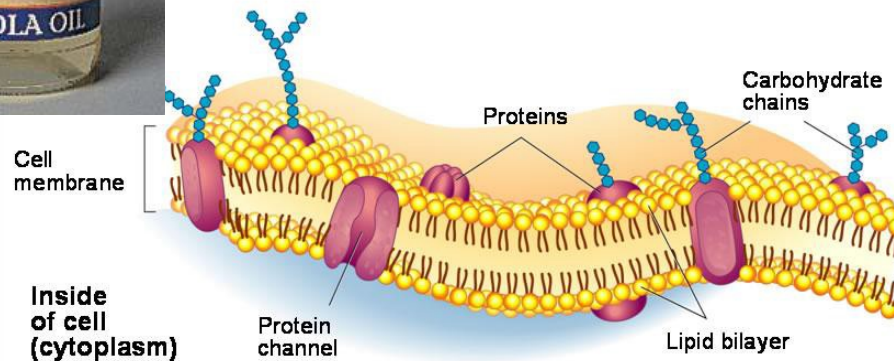
- Oils, fats, phospholipids, steroids



2007 - 240 lbs.

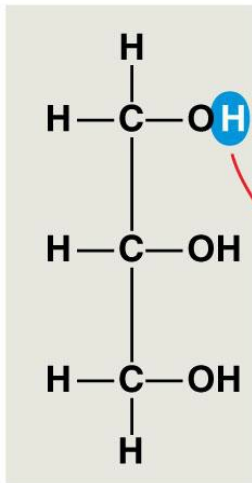


November 2007 - 200 lbs.

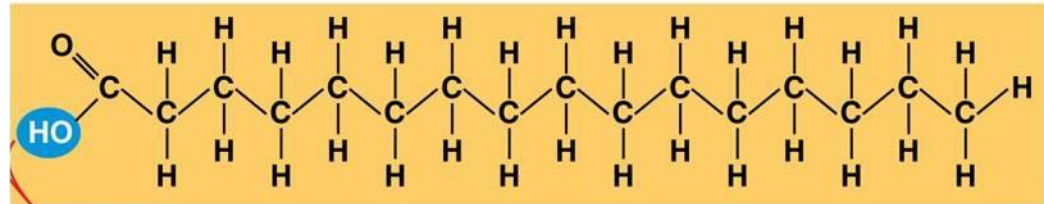


# Fats

- Two components: **glycerol** and **3 fatty acids**
- The major function of fats is **energy storage**



**Glycerol**



**Fatty acid**  
(in this case, palmitic acid)

**X3**

- Fatty acids vary in length (number of carbons) and in the number and locations of double bonds
- **Saturated fatty acids** have the maximum number of hydrogen atoms possible and no double bonds
  - Each carbon 'saturated' with hydrogens
- **Unsaturated fatty acids** have one or more double bonds



# Saturated fats

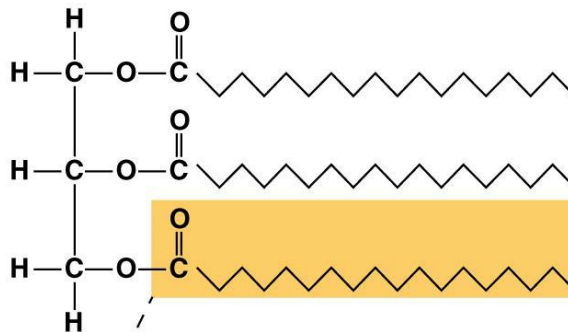
## (a) Saturated fat



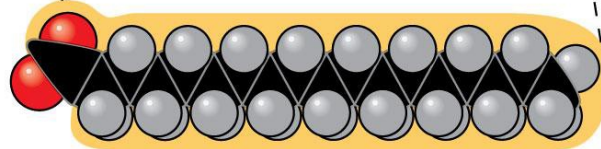
The straight hydrocarbon chains “stack” very closely together

(Think of straight pencils in a box)

**Structural formula of a saturated fat molecule**



**Space-filling model of stearic acid, a saturated fatty acid**



Because they are so densely packed, saturated fats tend to be solid at room temp

# Unsaturated Fats

- Includes polyunsaturated and monounsaturated fats on nutrition labels

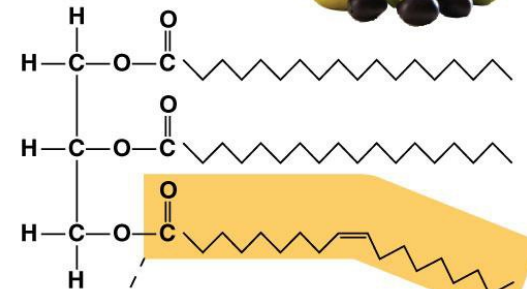
The double bond “kinks” the hydrocarbon chain and forces it to bend

The hydrocarbon chains don't stack so easily, and so are less dense. Unsaturated fats tend to be liquid at room temp

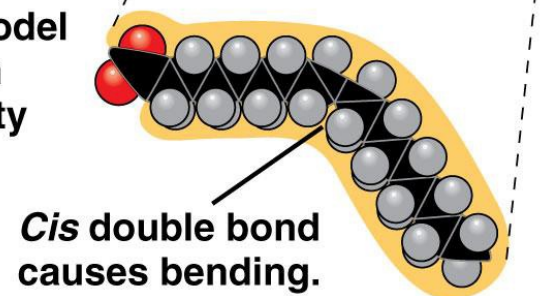
(b) Unsaturated fat



Structural formula of an unsaturated fat molecule



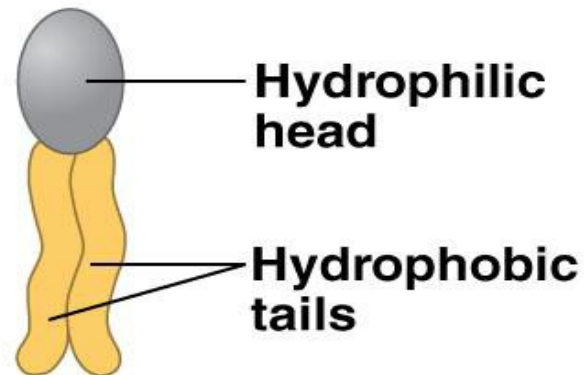
Space-filling model of oleic acid, an unsaturated fatty acid

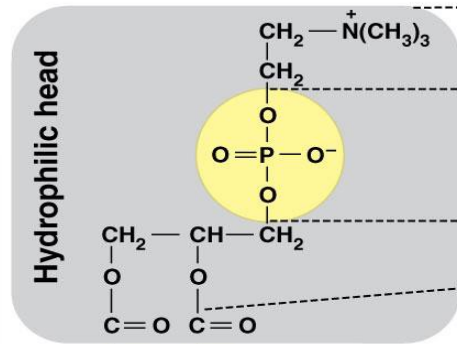
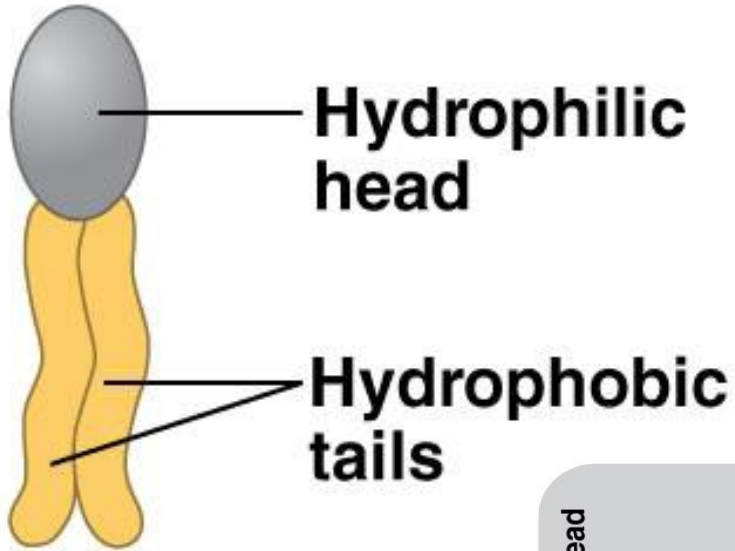


**Cis double bond causes bending.**

# Phospholipids

- **Phospholipids** are the major component of all cell membranes
- Head group and 2 fatty acids tails
- Head group is made of glycerol, phosphate group, and choline





**Choline**

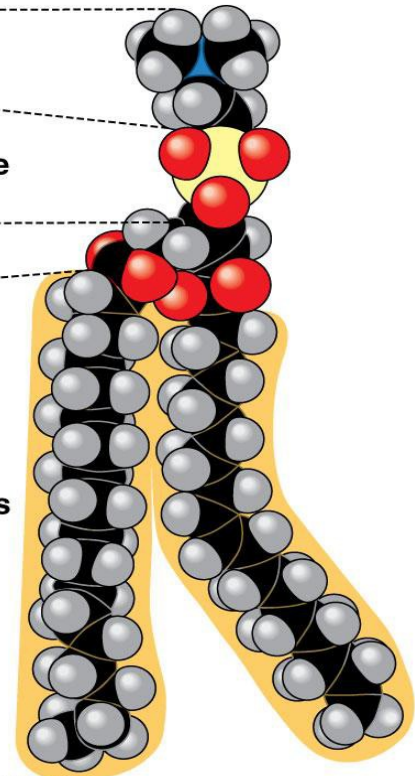
**Phosphate**

**Glycerol**

**Hydrophobic tails**



**Fatty acids**

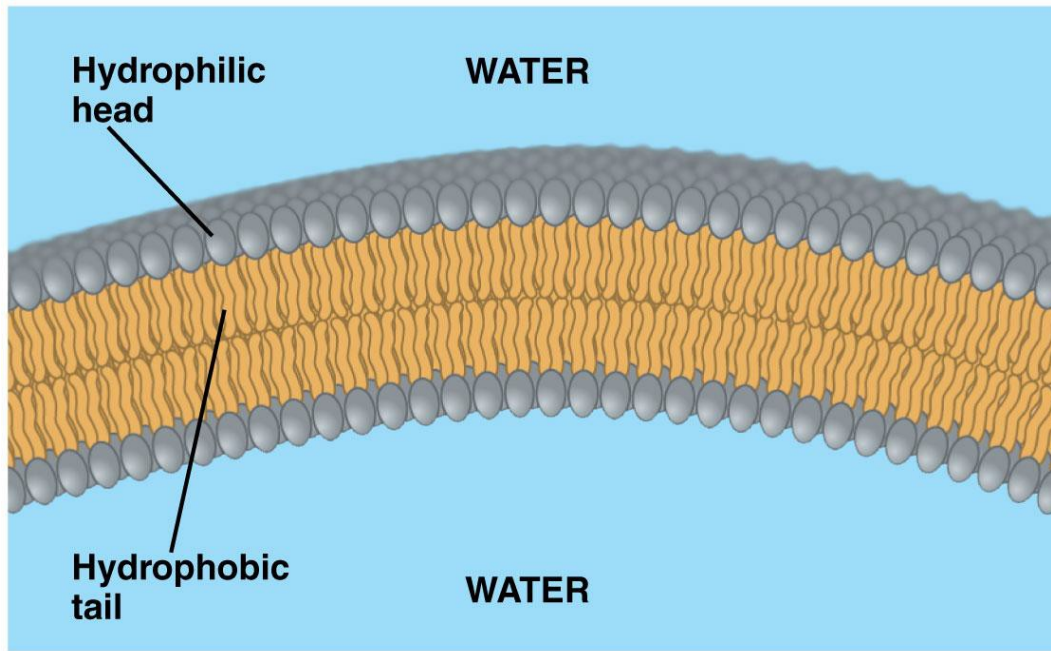


**(a) Structural formula**

**(b) Space-filling model**



# Phospholipids: the secrets of cell membranes



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- When added to water, phospholipids self-assemble into a bilayer, with the hydrophobic tails pointing toward the interior
- The structure of phospholipids results in a bilayer arrangement found in cell membranes

Fats and phospholipids have what in common?

A) They both have glycerol as at least part of their heads group

B) They both have 3 fatty acid tails

C) They both have choline head groups

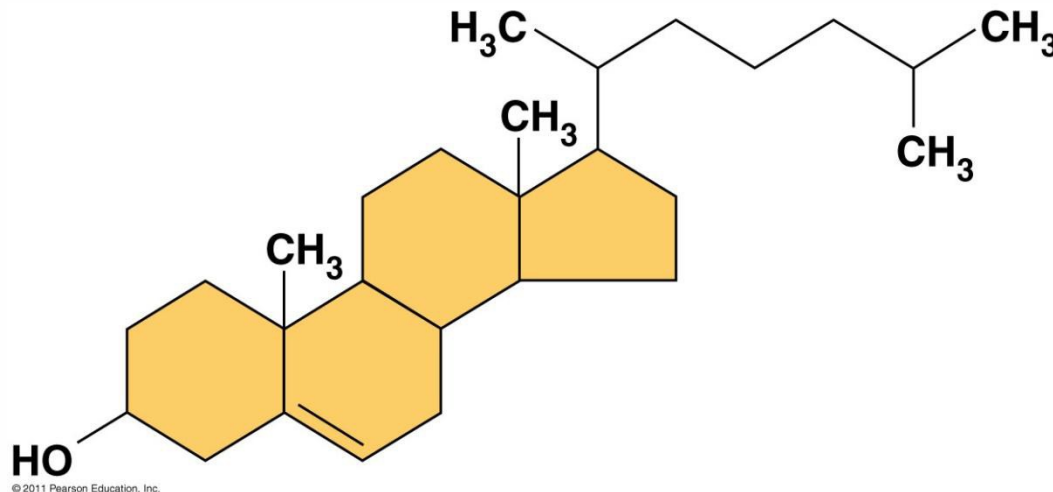
D) Both A and B

Which part of a phospholipid is hydrophilic (water loving)?

- A) The fatty acid tails
- B) The head group
- C) Neither part
- D) Both parts

# Steroids

- **Steroids** are lipids characterized by a carbon skeleton consisting of **four fused rings**
- **Cholesterol**, an important steroid, is a component in animal cell membranes



# Cholesterol: not such a bad guy?

- Too much cholesterol can damage cell walls and cause atherosclerosis
- However cholesterol is an **important precursors** to various human **hormones**

# Steroids

- Steroids are **important signaling molecules** within the body- examples: testosterone, progesterone
- **Vitamin D** is a steroid that has a significant role in calcium absorption, homeostasis, and metabolism
- They also have medical uses :  
Corticosteroids: used to treat a huge array of diseases and symptoms  
Anabolic steroids: mimic the effect of testosterone

# Describe/draw the structure and function of the three main types of lipids

	Fats	Phospholipids	Steroids
Structure			
Function			