

# Lecture 4: Biological Molecules



What are the two main types of polysaccharides? What are some examples of each?

## 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, phospholipids, and steroids**
- Purpose: fuel storage, cell membranes

# Examples of lipids

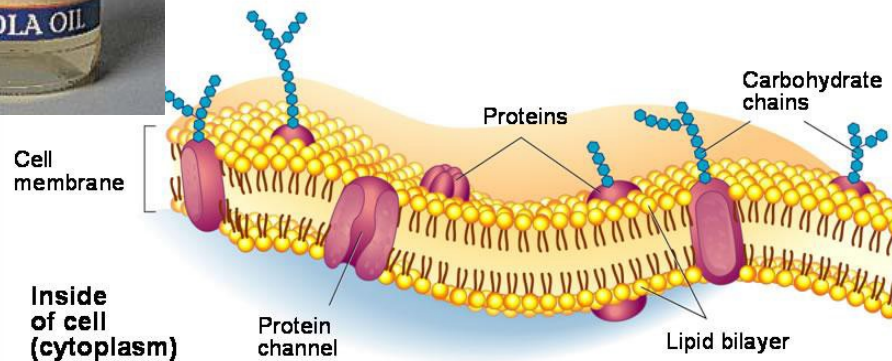
- Oils, fats, phospholipids, steroids



2007 - 240 lbs.

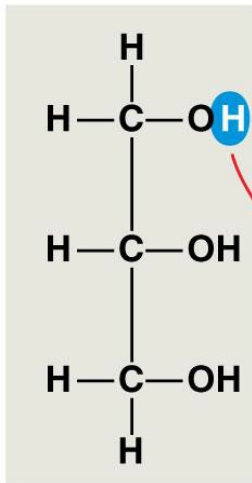


November 2007 - 200 lbs.

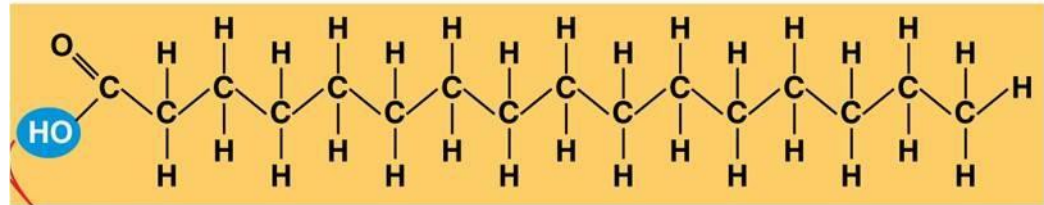


# Fats

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



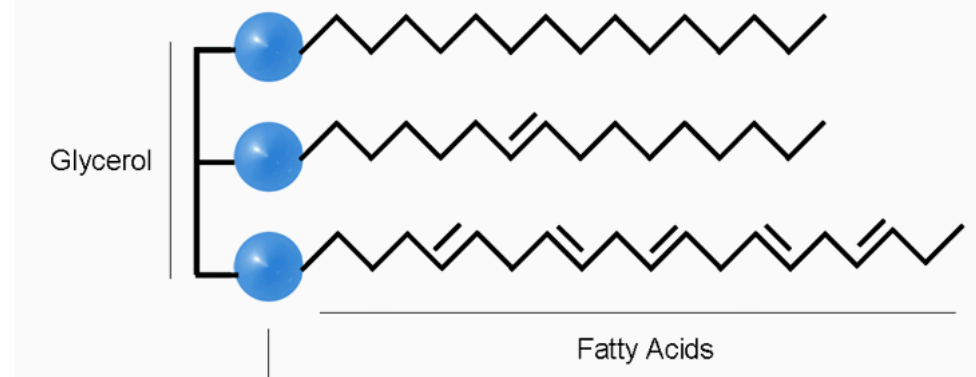
Glycerol



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







# Unsaturated Fats

- Includes polyunsaturated and monounsaturated fats on nutrition labels

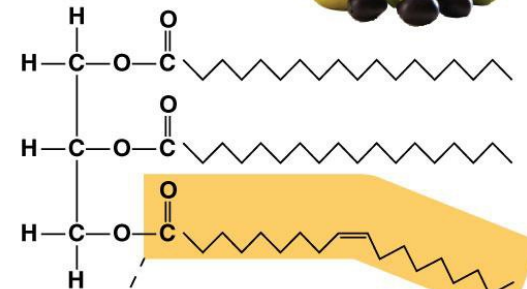
The double bond “kinks” the hydrocarbon chain and forces it to bend

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

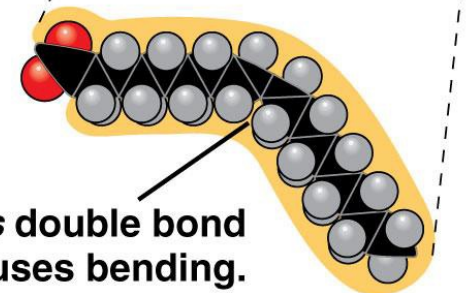


Structural formula of an unsaturated fat molecule



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

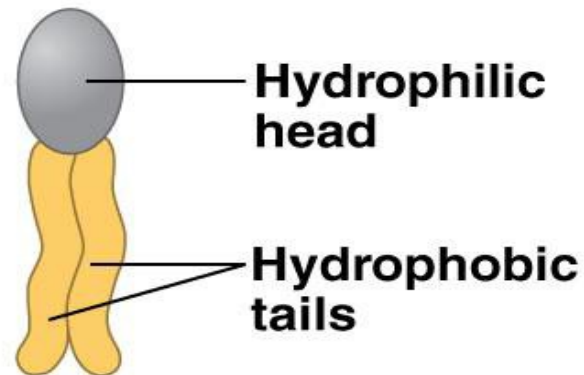
*Cis* double bond causes bending.

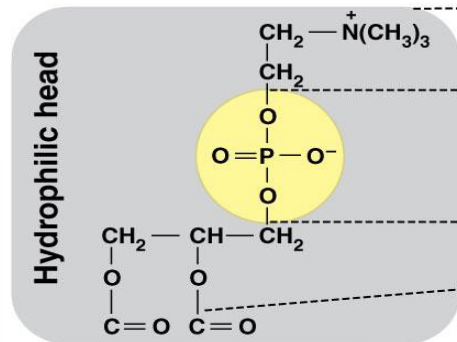
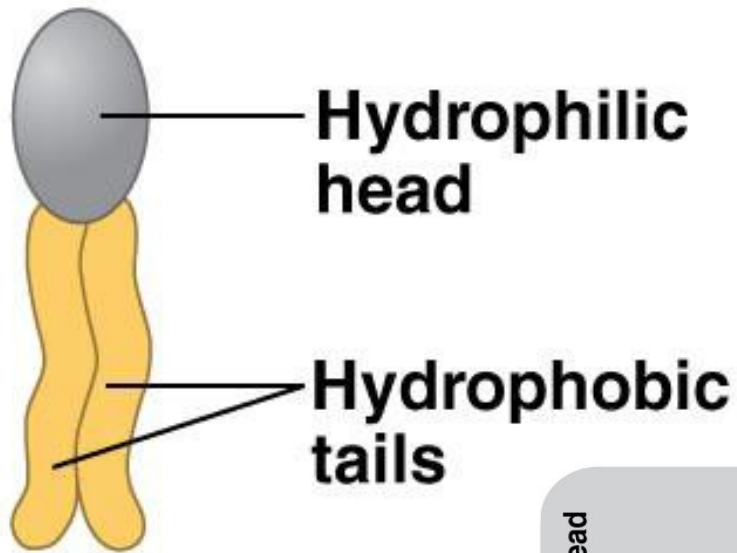




# Phospholipids

- 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



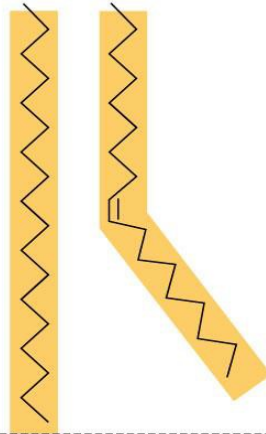


**Choline**

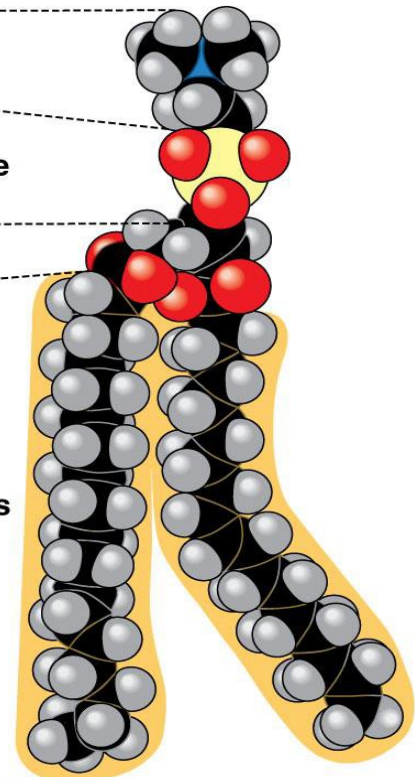
**Phosphate**

**Glycerol**

**Hydrophobic tails**



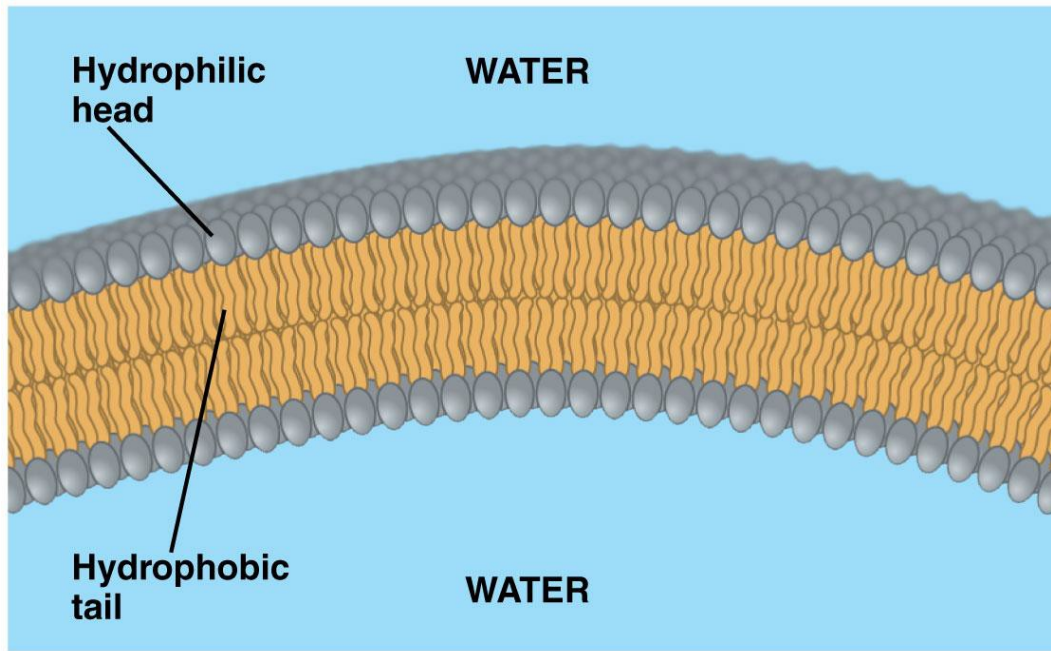
**Fatty acids**



**(a) Structural formula**

**(b) Space-filling model**

# Phospholipids: the secrets of cell membranes

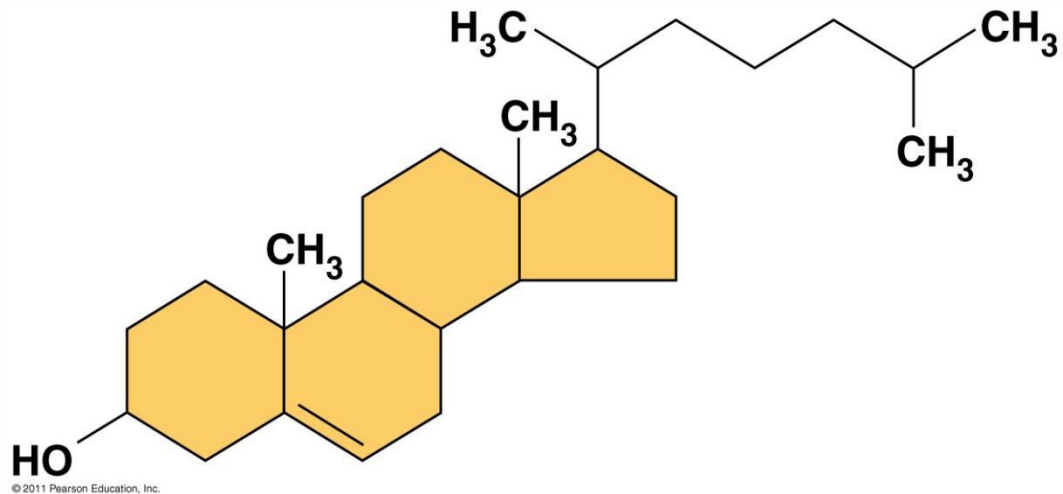


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- When added to water, phospholipids self-assemble into a bilayer, with the hydrophobic tails pointing toward the interior
- The structure of phospholipids results in a bilayer arrangement found in cell membranes

# 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

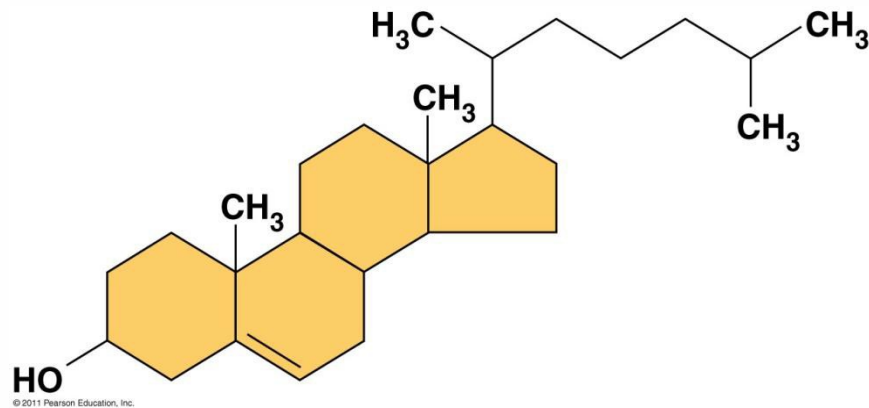


# Cholesterol: not such a bad guy?

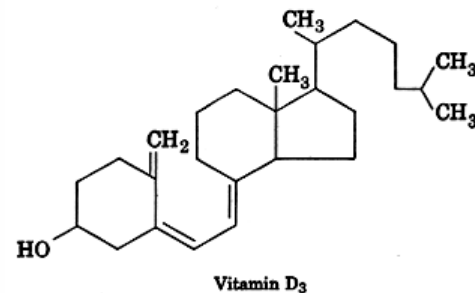
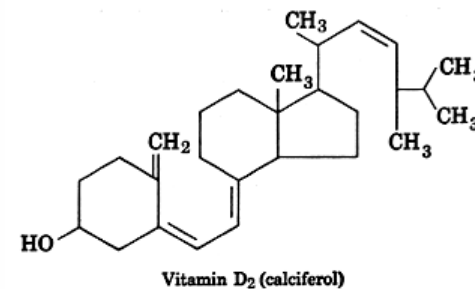
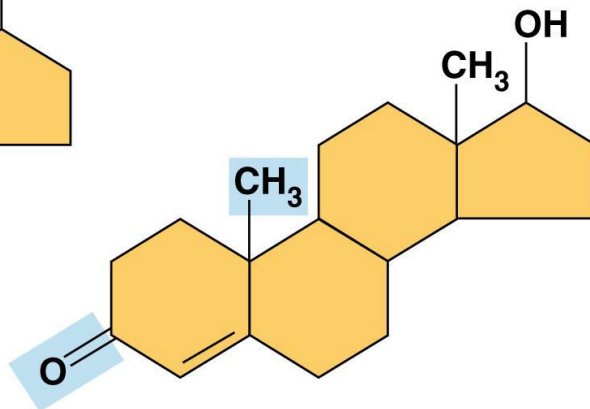
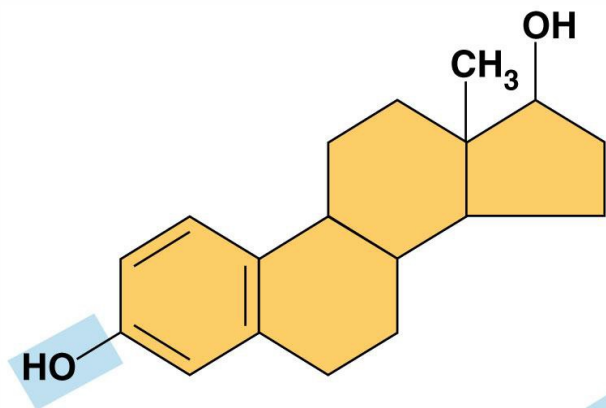
- Too much cholesterol can damage cell walls and cause atherosclerosis
- However cholesterol is an important precursor to various human hormones

# Cholesterol as a chemical precursor

Cholesterol



Enzymatic reactions



# Steroids in medicine

- Corticosteroids: used to treat a huge array of diseases and symptoms
- Anabolic steroids: mimic the effect of testosterone
  - Increase the rate of protein synthesis in cells
  - Result in increased muscle mass and secondary sex characteristics



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

	Fats	Phospholipids	Steroids
Structure			
Function			