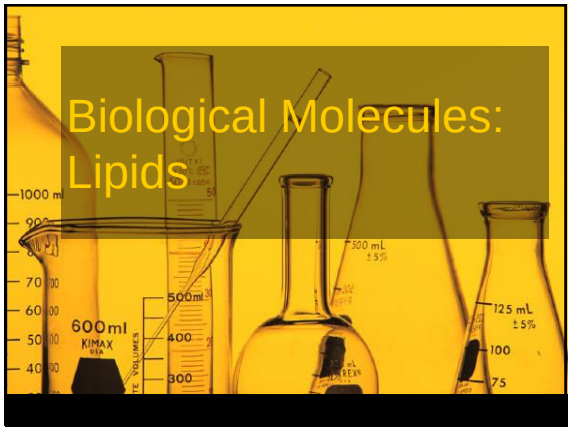
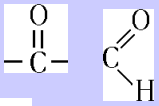
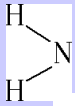
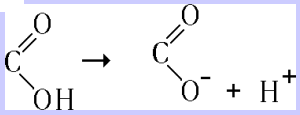


Functional Groups

1. Hydroxyl $-OH$
2. Carbonyl 
3. Amino 
4. Carboxyl 

Review of Key Terms

Collect examples as we go along

- **Macromolecule**
- **Monomer**
- **Polymer**
- **Dehydration synthesis**
- **Hydrolysis**
- **Large molecules with subunits**
- **Single subunit of a macromolecule**
- **Many subunits hooked together**
- **To put together and lose water**
- **To break apart by adding water**

Lipids - 1

C, H, O

Hydrophobic

Energy forms:

FAT, OIL
stores 2x the energy of carbs

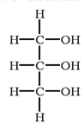
Structural:

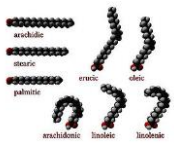
Phospholipid, wax

1. Fats store large amounts of energy

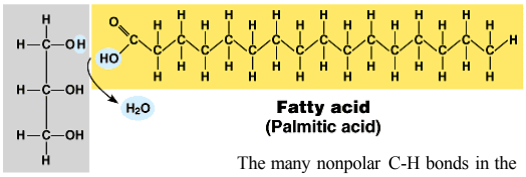
- Although fats are not strictly polymers, they are large molecules assembled from smaller molecules by **dehydration** reactions.
- A **fat** is constructed from two kinds of smaller molecules, **glycerol** and **fatty acids**.

Figure 1. Structure of Glycerol





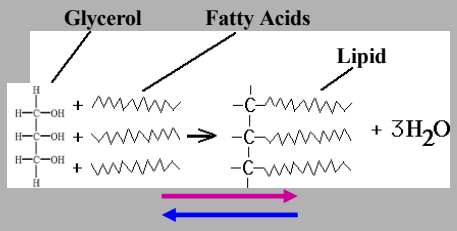
- **Glycerol** consists of a three carbon skeleton with a hydroxyl group attached to each.
- A **fatty acid** consists of a carboxyl group attached to a long hydrocarbon skeleton, often 16 to 18 carbons long.



The many nonpolar C-H bonds in the long hydrocarbon skeleton make fats **hydrophobic**.

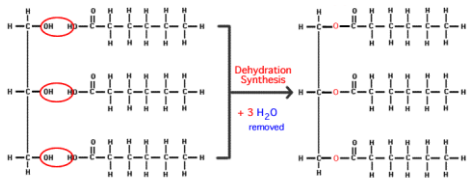
Fig. 5.10a

Lipids 2 - Makin' 'em



Dehydration Synthesis
Hydrolysis

Triglycerides!



- If there are no carbon-carbon double bonds, then the molecule is a **saturated fatty acid** - a hydrogen at every possible position.

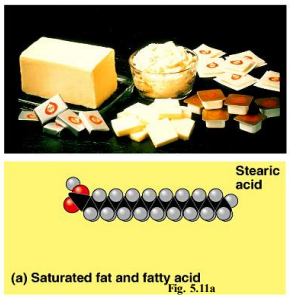
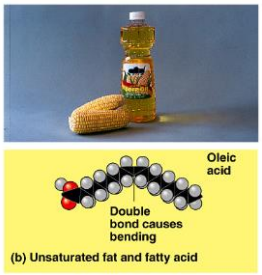
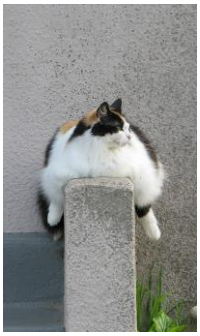


Fig. 5.11a

- If there are one or more carbon-carbon double bonds, then the molecule is an **unsaturated fatty acid** - formed by the removal of hydrogen atoms from the carbon skeleton.

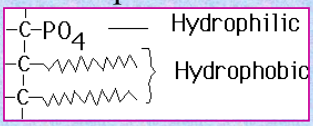


- Fats with saturated fatty acids are **saturated** fats.
  - Most **animal fats** are saturated.
  - Saturated fats are **solid** at room temperature.
  - A diet rich in saturated fats may contribute to cardiovascular disease (**atherosclerosis**) through plaque deposits.
- Fats with unsaturated fatty acids are **unsaturated** fats.
  - Plant and fish fats, known as **oils**, are liquid are room temperature.



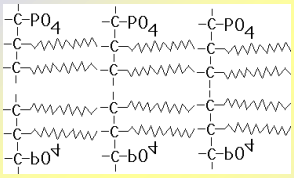
- The major function of fats is **energy storage**.
- **A gram of fat stores more than twice as much energy as a gram of a polysaccharide.**
- Fat also functions to **cushion** vital organs.
- A layer of fats can also function as **insulation**.
- This subcutaneous layer (**blubber**) is especially thick in whales, seals, and most other marine mammals.

Lipids 3



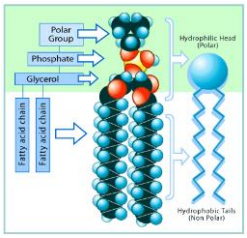
- **This is a phospholipid. Why?**
- **Phospholipids have both hydrophilic and hydrophobic regions.**
- **So, part of the molecule "dissolves" in water and part doesn't.**

Phospholipids

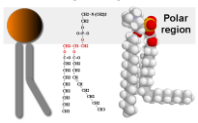


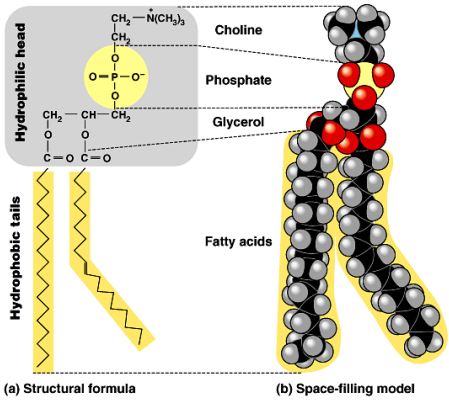
- **When phospholipids are placed in water, they spontaneously form a bilayer.**
- **Because of this, cell membranes have a phospholipid bilayer.**

- **Phospholipids** have **two fatty acids** attached to glycerol **and** a **phosphate group** at the third position.
- The phosphate group carries a negative charge.
- The fatty acid tails are hydrophobic, but the phosphate group and its attachments form a hydrophilic head.

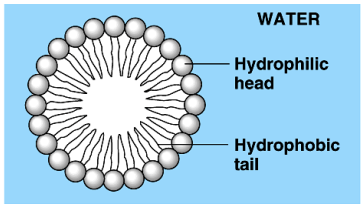


Phospholipids

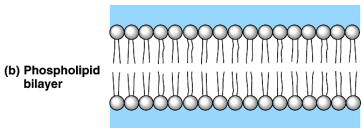


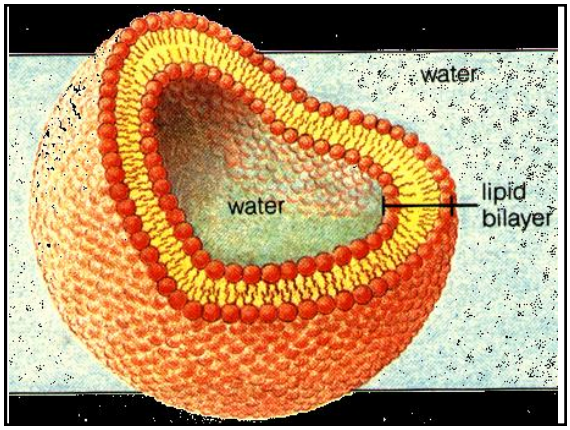


- When phospholipids are added to water, they self-assemble into clumps with the **hydrophobic tails pointing toward the center and the hydrophilic heads on the outside.**
  - This type of structure is called a micelle.



- At the surface of a cell phospholipids are arranged as a bilayer.
- Again, the hydrophilic heads are on the outside in contact with the aqueous solution and the hydrophobic tails from the core.
- The phospholipid bilayer forms a barrier between the cell and the external environment.
- They are the major component of membranes.





3. Steroids include cholesterol and certain hormones

- Steroids have four carbon rings and a chain of carbons attached.
  - Include hormones, vitamins, and other cellular components
- Cholesterol, an important steroid, is a component in animal cell membranes.
  - Cholesterol is also the precursor from which all other steroids are synthesized.
- Many of these other steroids are hormones, including the vertebrate sex hormones.
- While cholesterol is clearly an essential molecule, high levels of cholesterol in the blood may contribute to cardiovascular disease.