



Lipids

- Lipids are composed of C, H, O
 - ◆ long hydrocarbon chain
- Diverse group
 - ◆ fats
 - ◆ phospholipids
 - ◆ steroids
- Do not form polymers
 - ◆ big molecules made of subunit smaller molecules
 - ◆ not a continuing chain

Fats

- Structure:
 - ◆ glycerol (3C alcohol) + fatty acid
 - fatty acid = long HC "tail" with COOH group at "head"

Glycerol **Fatty acid (Palmitic acid)**

dehydration synthesis

Dehydration synthesis

Glycerol
(a) Dehydration synthesis

Ester linkage

(b) Fat molecule (triacylglycerol)

Fat

- Triacylglycerol (triglycerides)
 - ◆ 3 fatty acids linked to glycerol
 - ◆ ester linkage = between OH & COOH

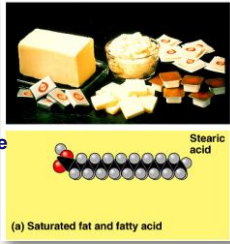
(b) Fat molecule (triacylglycerol)

Fats

- Long HC chain
 - ◆ polar or non-polar?
 - ◆ hydrophilic or hydrophobic?
- Function:
 - ◆ energy storage
 - very rich
 - 2x carbohydrates
 - ◆ cushion organs
 - ◆ insulates body
 - think whale blubber!

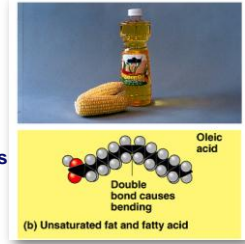
Saturated fats

- All C bonded to H
- No C=C double bonds
 - ◆ long, straight chain
 - ◆ most animal fats
 - ◆ solid at room temp.
 - contributes to cardiovascular disease (atherosclerosis) = plaque deposits



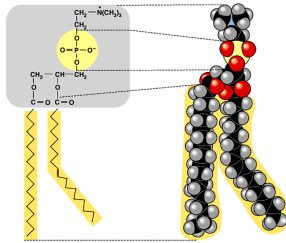
Unsaturated fats

- C=C double bonds in the fatty acids
 - ◆ plant & fish fats
 - ◆ vegetable oils
 - ◆ liquid at room temperature
 - the kinks made by double bonded C prevent the molecules from packing tightly together



Phospholipids

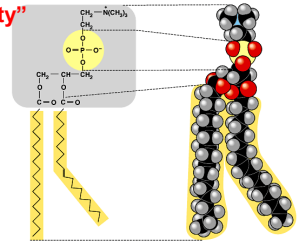
- Structure:
 - ◆ glycerol + 2 fatty acids + PO₄
 - PO₄ negatively charged
 - other small molecules may also be attached
 - ◆ adenine (ATP)



Phospholipids

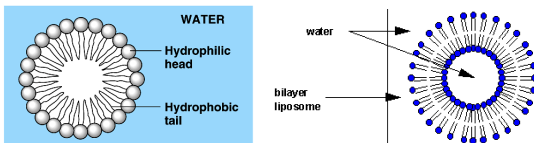
- Hydrophobic or hydrophilic?
 - ◆ fatty acid tails = hydrophobic
 - ◆ PO₄ = hydrophilic head
 - ◆ dual "personality"

interaction with H₂O is complex & very important!



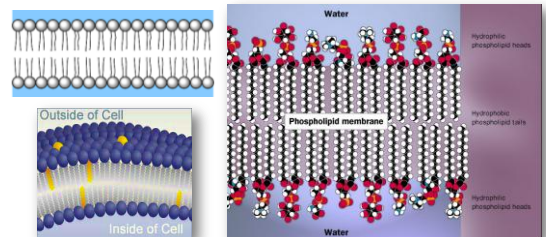
Phospholipids in water

- Hydrophilic heads attracted to H₂O
- Hydrophobic tails "hide" from H₂O
 - ◆ **self-assemble into aggregates**
 - micelle
 - liposome
 - early evolutionary stage of cell?



Why is this important?

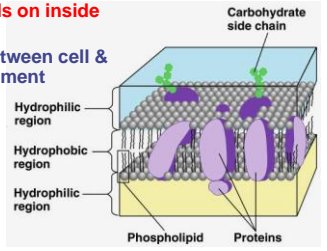
- Phospholipids define outside vs. inside
- Where do we find phospholipids in cells?
 - ◆ cell membranes



Phospholipids & cells

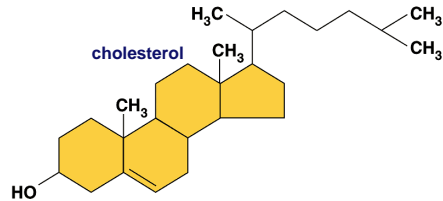
■ Phospholipids of cell membrane

- ◆ double layer = **bilayer**
- ◆ **hydrophilic heads on outside**
 - in contact with aqueous solution
- ◆ **hydrophobic tails on inside**
 - form core
- ◆ forms barrier between cell & external environment



Steroids

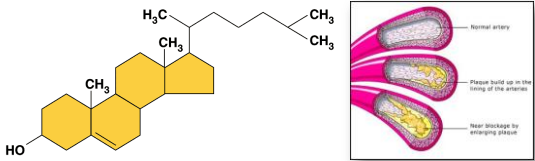
- ex: cholesterol, sex hormones
- 4 fused C rings
 - ◆ different steroids created by attaching different functional groups to rings



Cholesterol

■ Important cell component

- ◆ animal cell membranes
- ◆ precursor of all other steroids
 - including vertebrate sex hormones
- ◆ high levels in blood may contribute to cardiovascular disease



Cholesterol

From Cholesterol → Sex Hormones

■ What a big difference a little atom can make!

Cholesterol is chemically modified to produce the male and female sex hormones.

Estradiol is a female sex hormone

Testosterone is a male sex hormone

Steroid

Diversity in steroids

(a) Steroid hormones made in adrenal cortex

(b) Steroid hormones made primarily in gonads