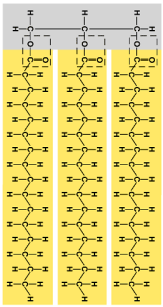
Chapter 3.4 Lipids

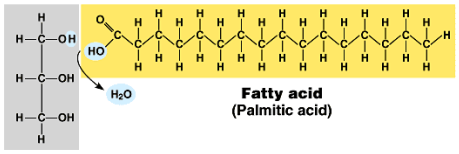
Lipids

- 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



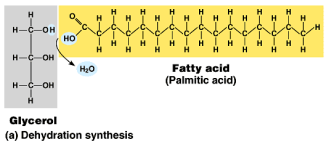
Fats

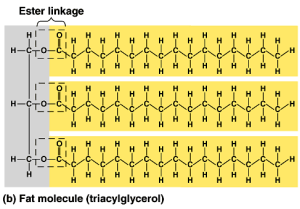
- Structure:
  - glycerol (3C alcohol) + fatty acid
    - fatty acid = long HC "tail" with COOH group at "head"



dehydration synthesis

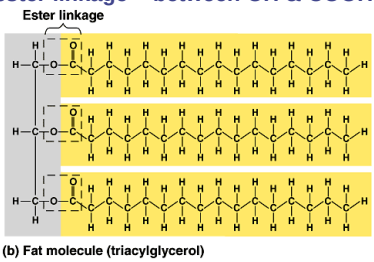
Dehydration synthesis





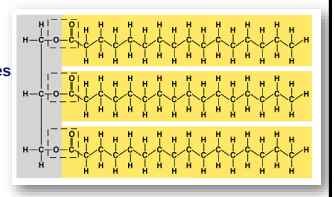
Fat

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



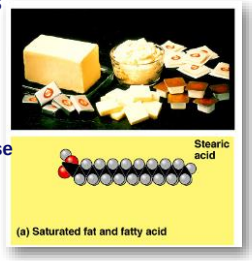
Fats

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



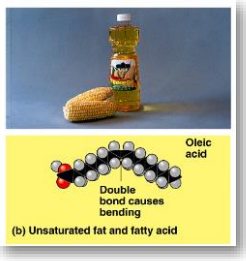
Saturated fats

- 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



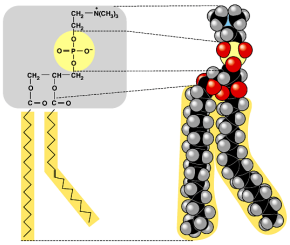
Unsaturated fats

- 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

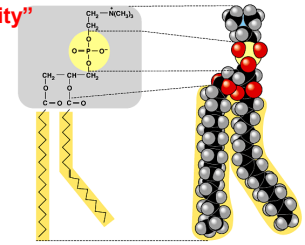
- Structure:
  - glycerol + 2 fatty acids + PO_4
    - PO_4 negatively charged
    - other small molecules may also be attached
      - adenine (ATP)



Phospholipids

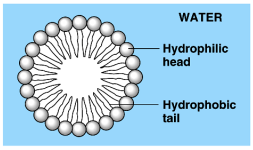
- Hydrophobic or hydrophilic?
  - fatty acid tails = hydrophobic
  - PO_4 = hydrophilic head
  - dual "personality" (amphipathic)

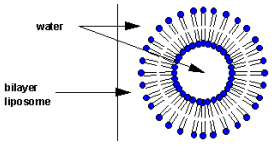
interaction with H_2O is complex & very important!



Phospholipids in water

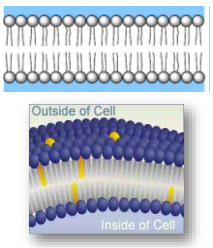
- Hydrophilic heads attracted to H_2O
- Hydrophobic tails "hide" from H_2O
  - self-assemble into aggregates
    - micelle
    - liposome
    - early evolutionary stage of cell?

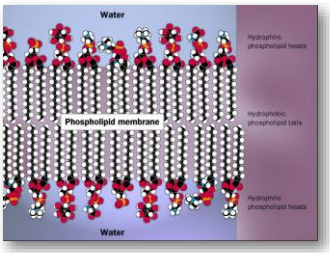




Why is this important?

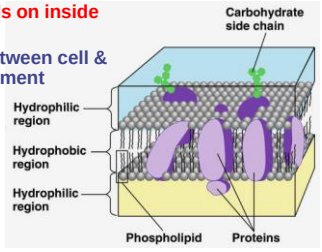
- Phospholipids define outside vs. inside
- Where do we find phospholipids in cells?
  - cell membranes





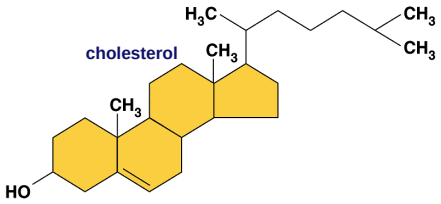
Phospholipids & cells

- 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



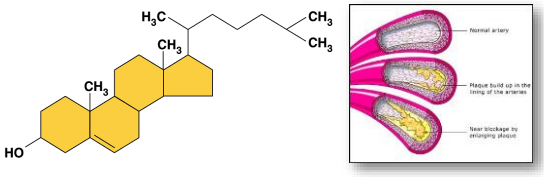
Steroids

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

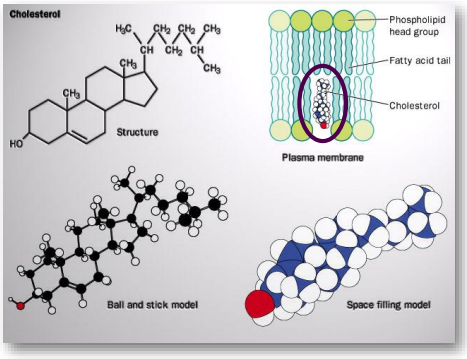


Cholesterol

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

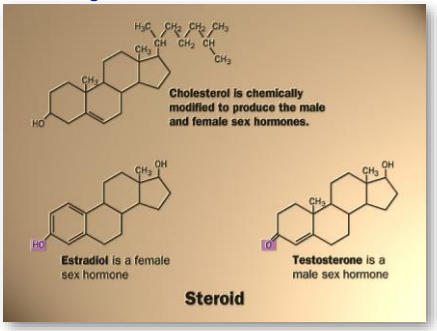


Cholesterol



From Cholesterol → Sex Hormones

- What a big difference a little atom can make!



Diversity in steroids