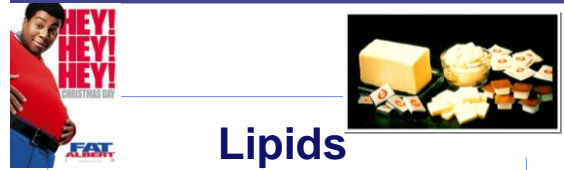


## Lipids: Fats & Oils



AP Biology



## Lipids

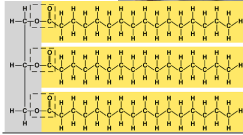
long term energy storage  
concentrated energy



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## Lipids

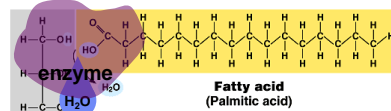
- Lipids are composed of C, H, O
  - ◆ long hydrocarbon chains (H-C)
- “Family groups”
  - ◆ fats
  - ◆ phospholipids
  - ◆ steroids
- Do not form polymers
  - ◆ big molecules made of smaller subunits
  - ◆ not a continuing chain



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## Fats

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



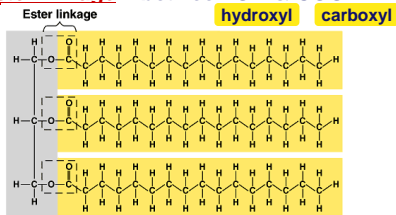
Glycerol

**dehydration synthesis**

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## Building Fats

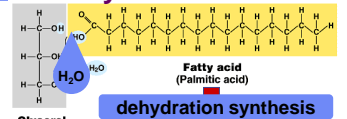
- Triacylglycerol
  - ◆ 3 fatty acids linked to glycerol
  - ◆ ester linkage = between OH & COOH



(b) Fat molecule (triacylglycerol)

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## Dehydration synthesis



Glycerol

enzyme

enzyme

enzyme

enzyme

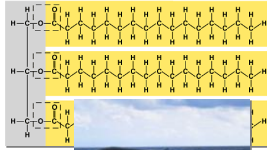
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## Fats store energy

Why do humans like fatty foods?



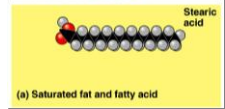
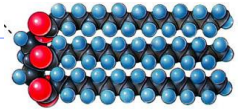
- Long HC chain
  - polar or non-polar?
  - hydrophilic or hydrophobic?
- Function:
  - energy storage
    - concentrated
      - all H-C!
    - 2x carbohydrates
  - cushion organs
  - insulates body
    - think whale blubber!



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## Saturated fats

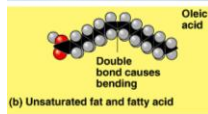
- All C bonded to H
- No C=C double bonds
  - long, straight chain
  - most animal fats
  - solid at room temp.
    - contributes to cardiovascular disease (atherosclerosis) = plaque deposits



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## 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

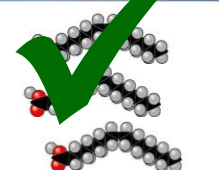


mono-unsaturated?  
poly-unsaturated?

## Saturated vs. unsaturated

saturated

unsaturated

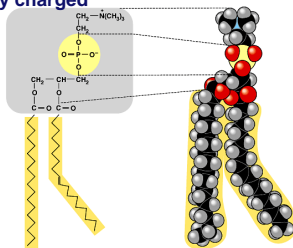


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## Phospholipids

- Structure:
  - glycerol + 2 fatty acids + PO<sub>4</sub>
    - PO<sub>4</sub> = negatively charged

It's just like a penguin...  
A head at one end & a tail at the other!

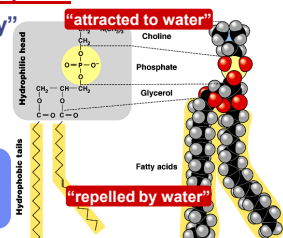


## Phospholipids

- Hydrophobic or hydrophilic?
  - fatty acid tails = hydrophobic
  - PO<sub>4</sub> head = hydrophilic
  - split "personality"

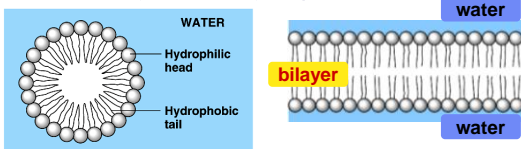
Come here,  
No, go away!  
Come here,  
No, go away!

interaction with H<sub>2</sub>O is complex & very important!



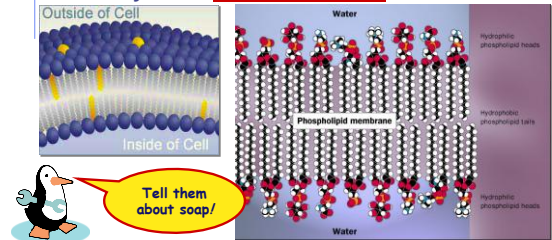
## Phospholipids in water

- **Hydrophilic heads** “attracted” to  $H_2O$
- **Hydrophobic tails** “hide” from  $H_2O$ 
  - ♦ can self-assemble into “bubbles”
    - bubble = “micelle”
  - can also form a **phospholipid bilayer**
  - early evolutionary stage of cell?



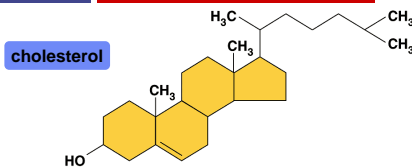
## Why is this important?

- Phospholipids create a barrier in water
  - ♦ define outside vs. inside
  - ♦ they make **cell membranes!**



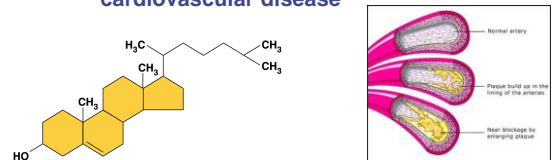
## Steroids

- **Structure:**
  - ♦ 4 fused C rings + ??
    - different steroids created by attaching different **functional groups** to rings
    - different structure creates different function
  - ♦ **examples: cholesterol, sex hormones**



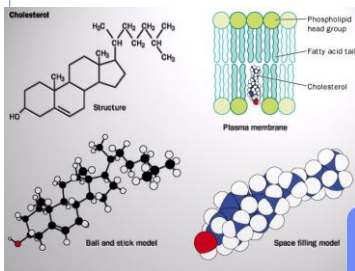
## Cholesterol

- **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

### Important component of cell membrane

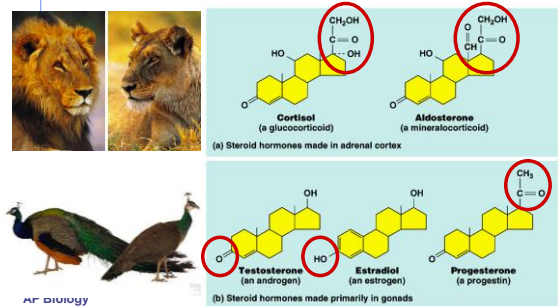


helps keep cell membranes fluid & flexible

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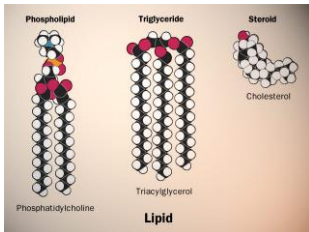
## From Cholesterol → Sex Hormones

- What a big difference a few atoms can make!



Let's build some

# Lipids!



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Remember this from Biology?

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## Phospholipids & cells

### Phospholipids of cell membrane

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



Tell them about soap!

