

HEY! HEY! HEY!
A HISTORY OF
FAT

Lipids

MCC BP

Based on work by K. Foglia
www.kimurby.com

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

AP Biology

Fats

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

Glycerol

Fatty acid (Palmitic acid)

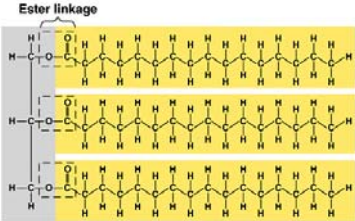
dehydration synthesis

AP Biology

2005-2006

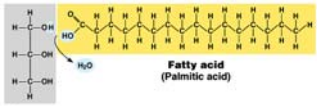
Fat

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

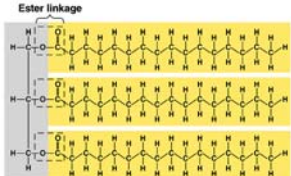


AP Biology (b) Fat molecule (triacylglycerol) :005-2006

Dehydration synthesis



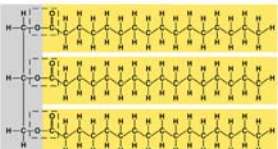
Glycerol
(a) Dehydration synthesis



(b) Fat molecule (triacylglycerol) 2005-2006

Fats

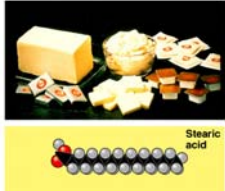
- **Long HC chain**
 - ♦ polar or non-polar?
 - ♦ hydrophilic or hydrophobic?
- **Function:**
 - ♦ energy storage
 - very rich
 - 2x carbohydrates
 - ♦ cushion organs
 - ♦ insulates body
 - think whale blubber!



"Let's go to the video tape!"
[\(play movie here\)](#)

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

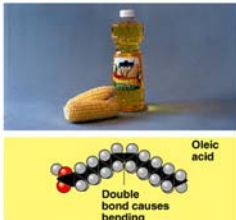


(a) Saturated fat and fatty acid

AP Biology

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

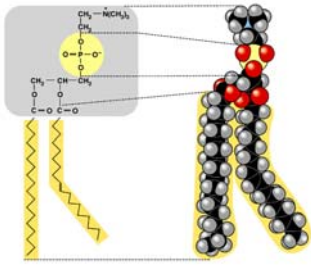


(b) Unsaturated fat and fatty acid

AP Biology

Phospholipids

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



AP Biology

Phospholipids

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

interaction with H₂O is complex & very important!

AP Biology

Phospholipids in water

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

AP Biology

Why is this important?

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

AP Biology

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

AP Biology

Steroids

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

AP Biology

Diversity in steroids

(a) Steroid hormones made in adrenal cortex

(b) Steroid hormones made primarily in gonads

AP Biology

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

AP Biology 2005-2006

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

Normal artery

Plaque build up in the lining of the arteries

Now discharge to surrounding tissue

Cholesterol

helps keep cell membranes fluid & flexible

Cholesterol Structure

Ball and stick model

Space filling model

Phospholipid head group

Fatty acid tail

Cholesterol

Plasma membrane

AP Biology 2005-2006

**Let's build some
Lipids!**

The diagram illustrates three types of lipids: **Phospholipid** (Phosphatidylcholine), **Triglyceride** (Triacylglycerol), and **Steroid** (Cholesterol). Each is shown as a ball-and-stick model. The phospholipid has a polar head and two non-polar tails. The triglyceride has a glycerol backbone and three fatty acid tails. The steroid has a characteristic four-ring structure. The word **Lipid** is centered below the models. The text 'MCC BP' is in the bottom left, and 'Based on work by K. Foglia www.kimunity.com' is in the bottom right of the diagram area.
