The Structure & Function of Lipids

Fats

Waxes

Oils

The Structure & Function of Lipids

- Lipids - macromolecules that do not dissolve in water, such as fats, oils, steroids
- used for:
  - » long-term nutrient storage
  - » insulation
  - » cushioning of internal organs
  - » hormones to send messages around body
  - » important part of cell membrane (mb)

The Structure & Function of Lipids

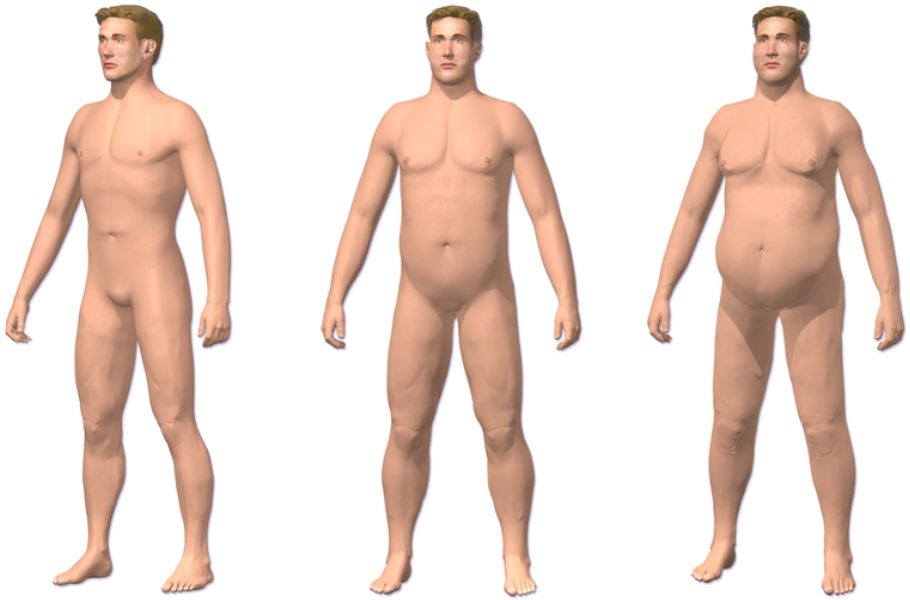
1 g fat = 2.25 x energy as 1 g carbohydrate

- more efficient at storing energy
- carbohydrate storage in cells is 6x more massive than lipids of the same energy (ie. add H2O) - birds use this as energy storage for flight
- poor conductor of heat, —> insulates

Body Mass Index

https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html

$$\mathrm{BMI} = \frac{\mathrm{mass}_{\mathrm{kg}}}{\mathrm{height}_{\mathrm{m}}{}^{2}} = \frac{\mathrm{mass}_{\mathrm{lb}}}{\mathrm{height}_{\mathrm{in}}{}^{2}} \times 703$$



Normal
<25 kg/m²

Overweight
25 – 29 kg/m²

Obese
≥ 30 kg/m²

Body Mass Index

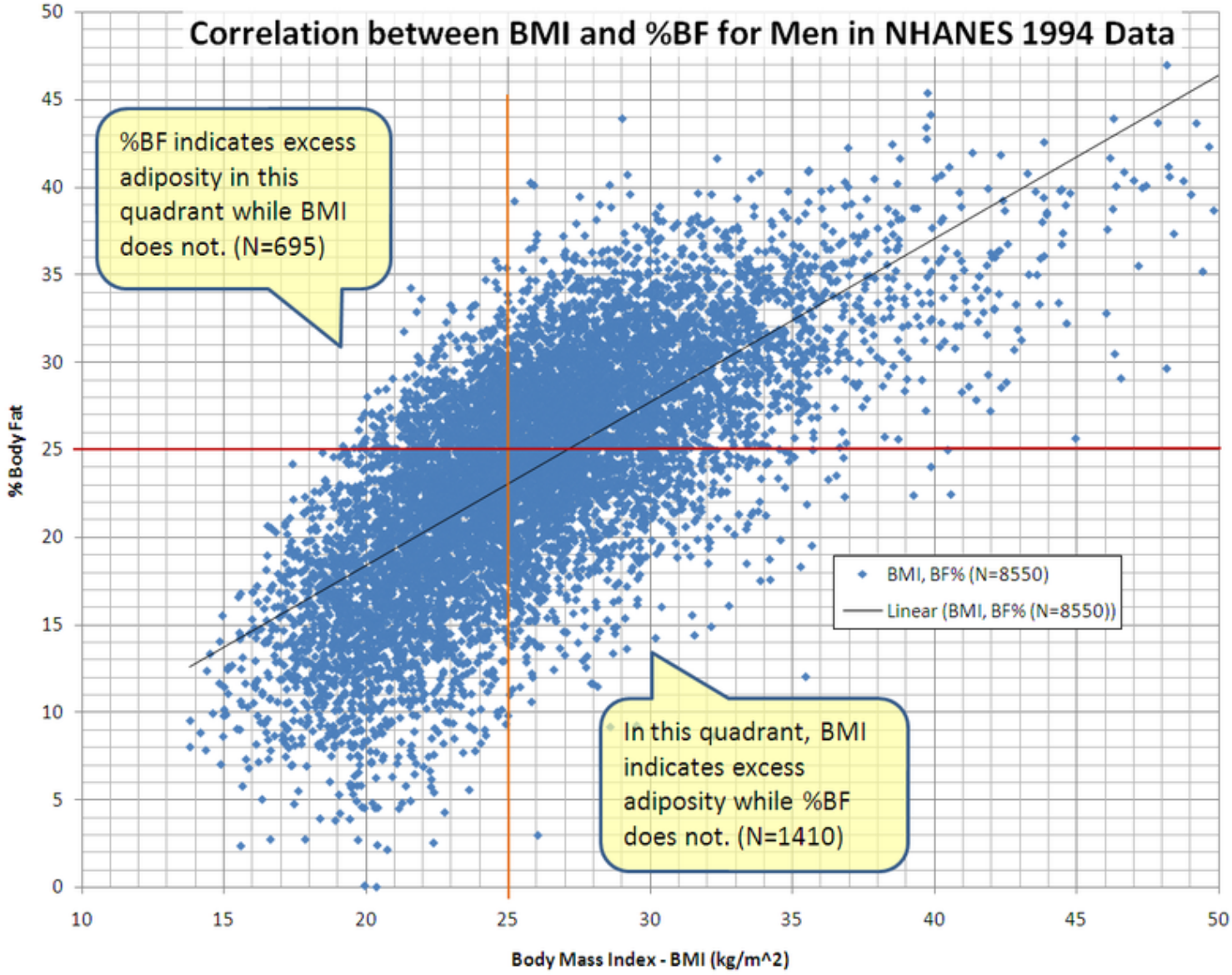
Category	BMI (kg/m^2)	
	from	to
Very severely underweight		15
Severely underweight	15	16
Underweight	16	18.5
Normal (healthy weight)	18.5	25
Overweight	25	30
Obese Class I (Moderately obese)	30	35
Obese Class II (Severely obese)	35	40

Body Mass Index

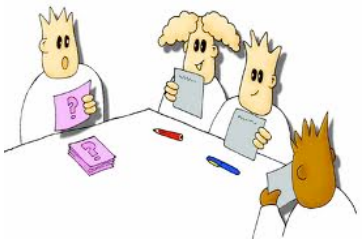
Health risks from having a high BMI

- High blood pressure (Hypertension)
- Type 2 diabetes
- Coronary heart disease
- Stroke
- Gallbladder disease
- Osteoarthritis (a breakdown of cartilage and bone within a joint)
- Sleep apnea and breathing problems
- Chronic inflammation
- Some cancers (endometrial, breast, colon, kidney, gallbladder, and liver)
- Low quality of life
- Mental illness such as clinical depression, anxiety, and other mental disorders
- Body pain and difficulty with physical functioning

Limitations to BMI

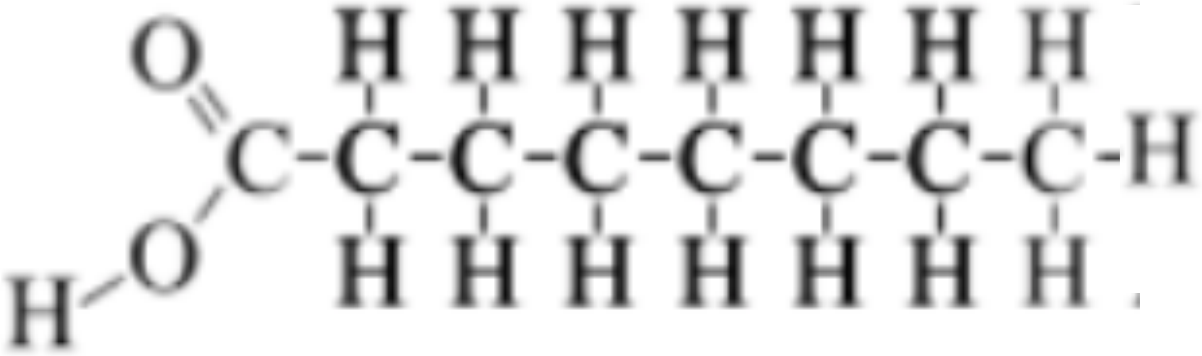


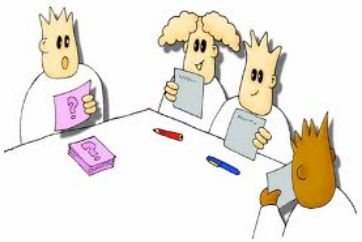
» https://www.muscleandstrength.com/tools/measure-bodyfat



1 Build a fat acid chain 8 carbons long.

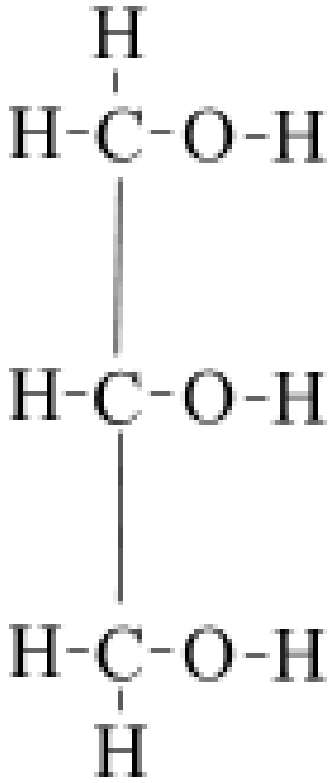
a) Describe the molecule's overall shape.

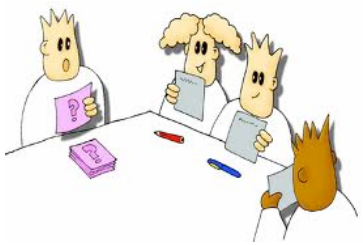




2. Build a molecule of glycerol.

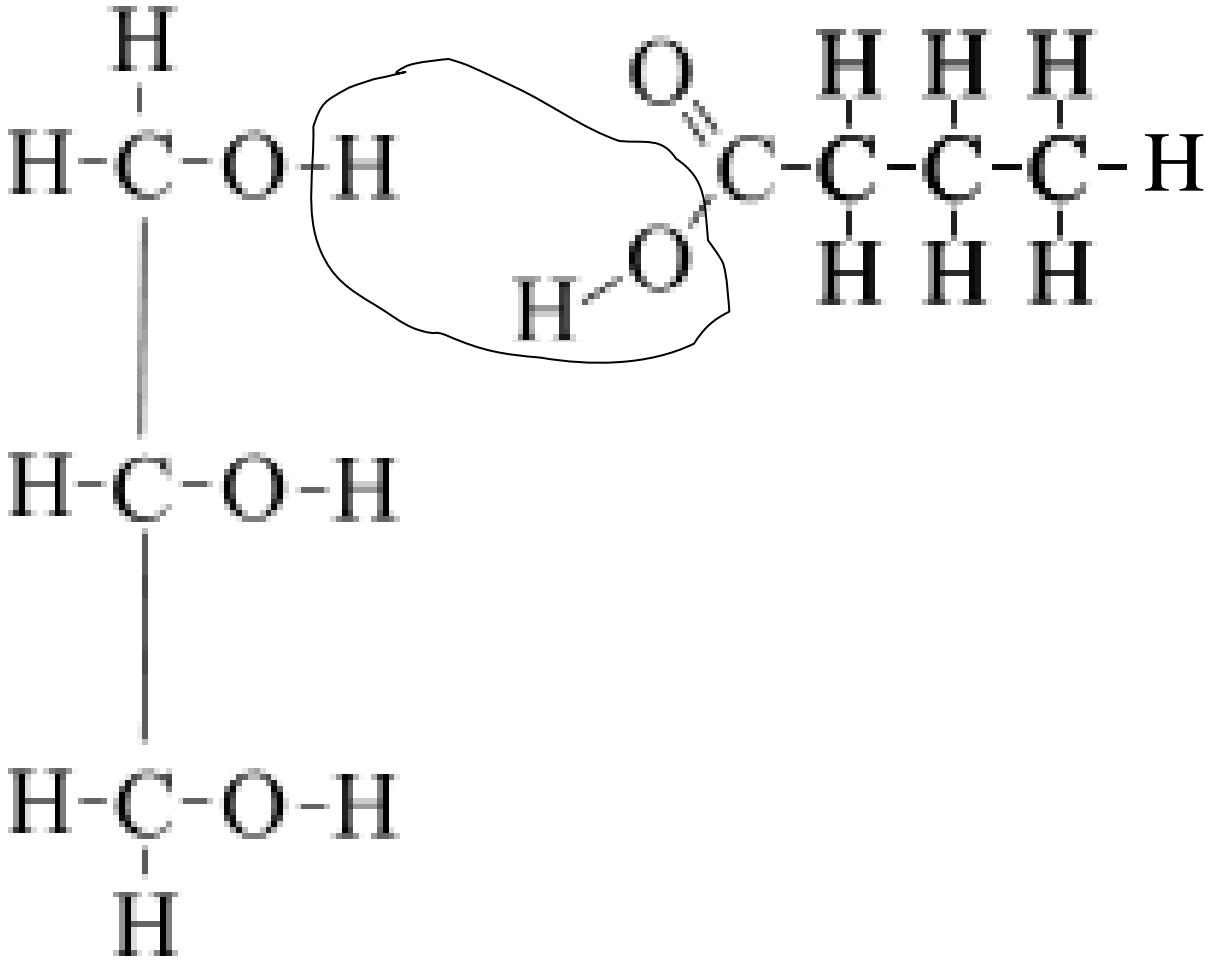
a) Describe the molecule's overall shape.





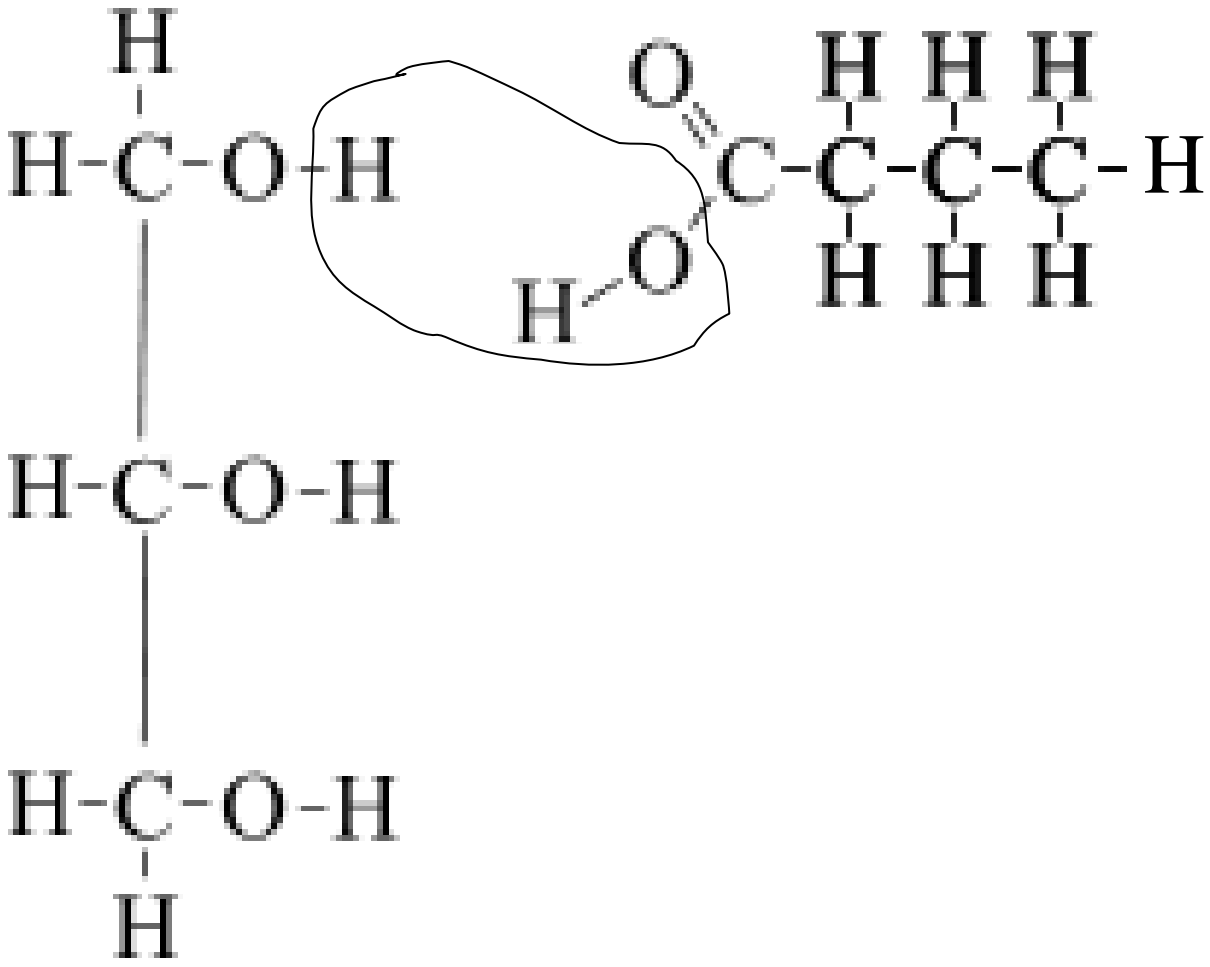
Combine the glycerol and the fatty acids as shown

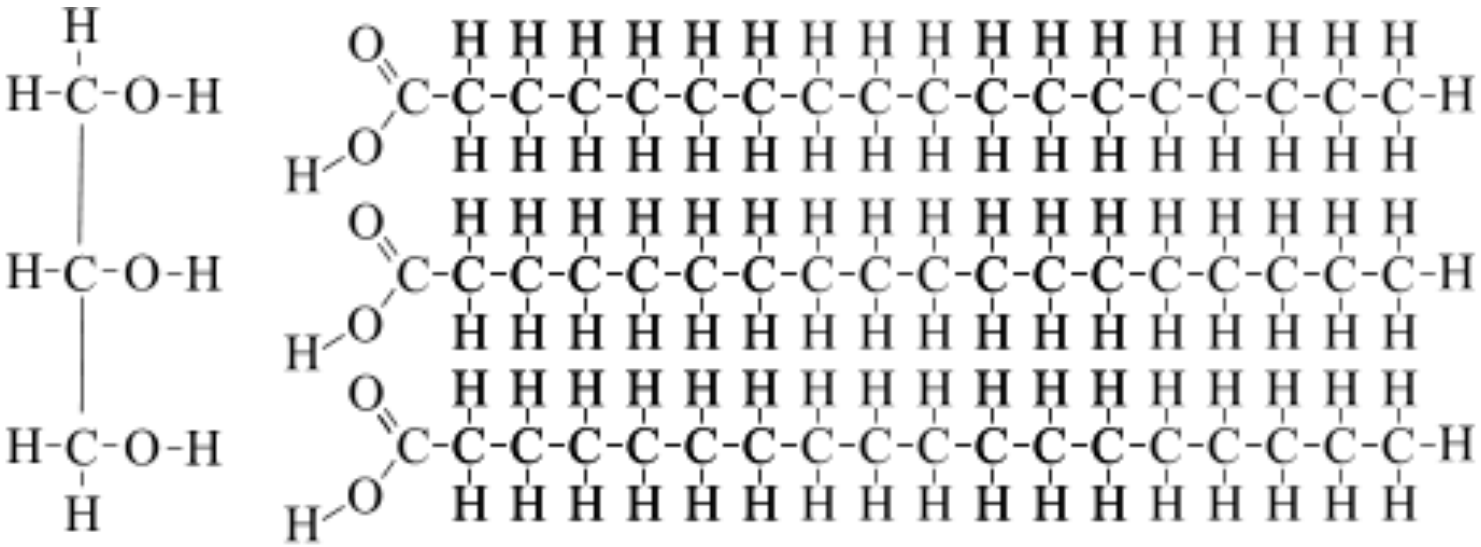
c. Make a schematic diagram of the resulting mole



e. What molecule was created as a byproduct of the synthesis of this fat?

f. What type of reaction is this?






SCIENCE

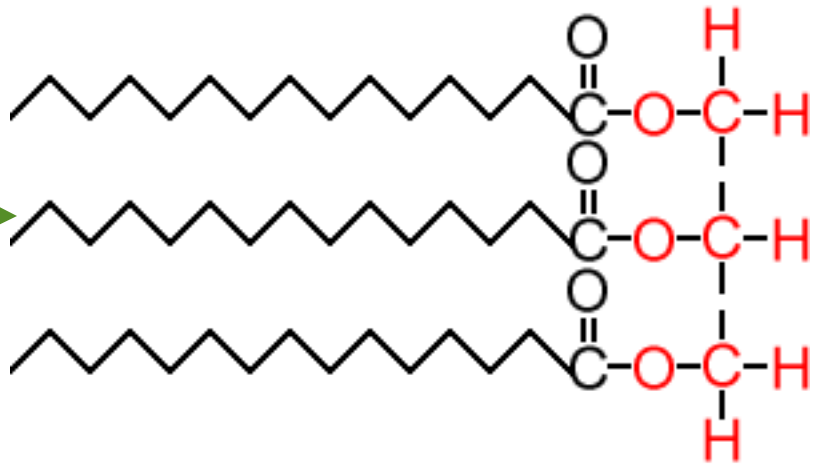

SCIENCE

The Structure & Function of Lipids

- fat molecules have 3 branched structure

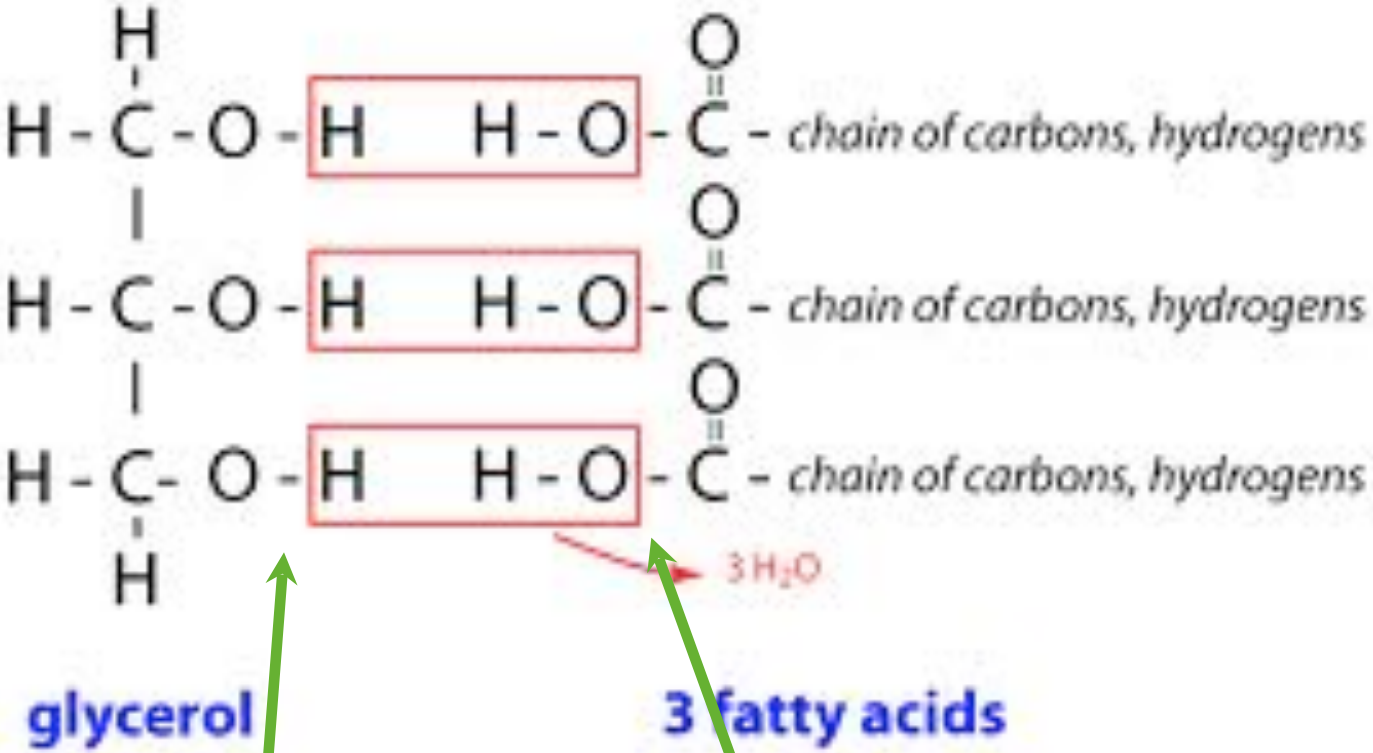
  = triglyceride

Long chains of C-H makes fatty acids non-polar



3 Fatty Acids + Glycerol

Formed by condensation reactions

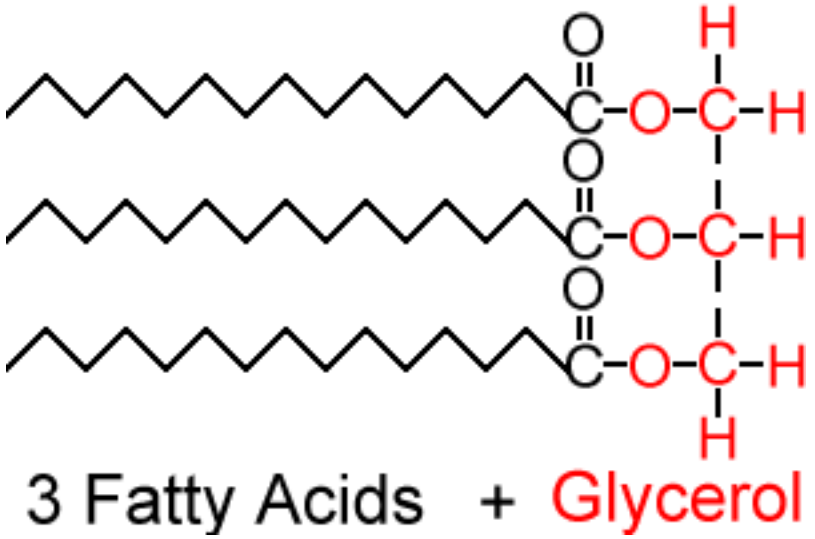


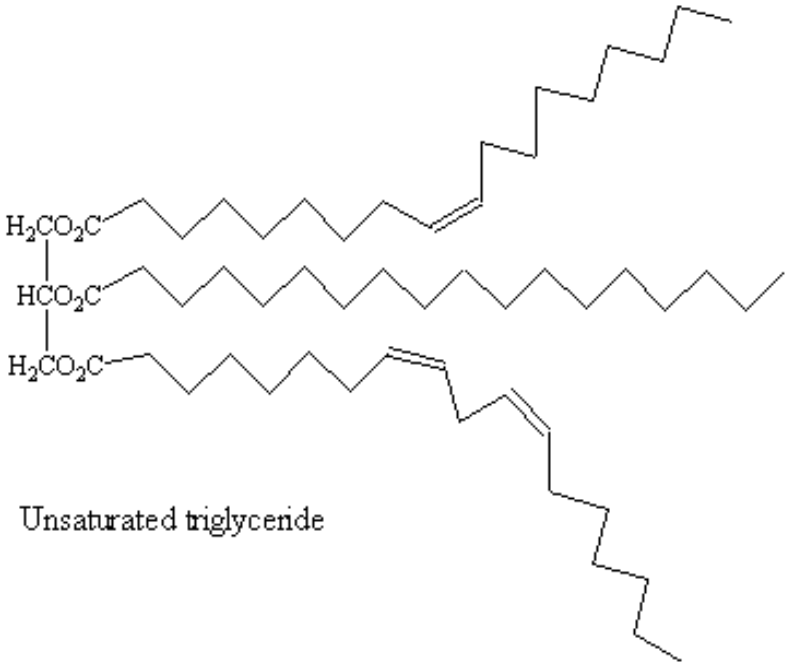
Carboxyl Functional Groups

Hydroxyl Functional Groups

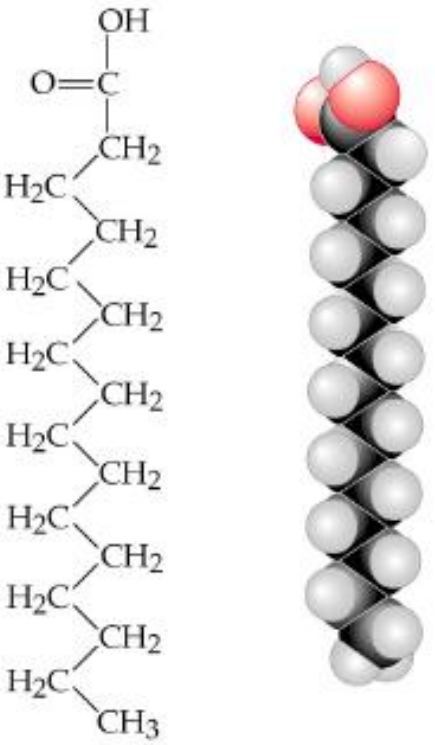
The Structure & Function of Lipids

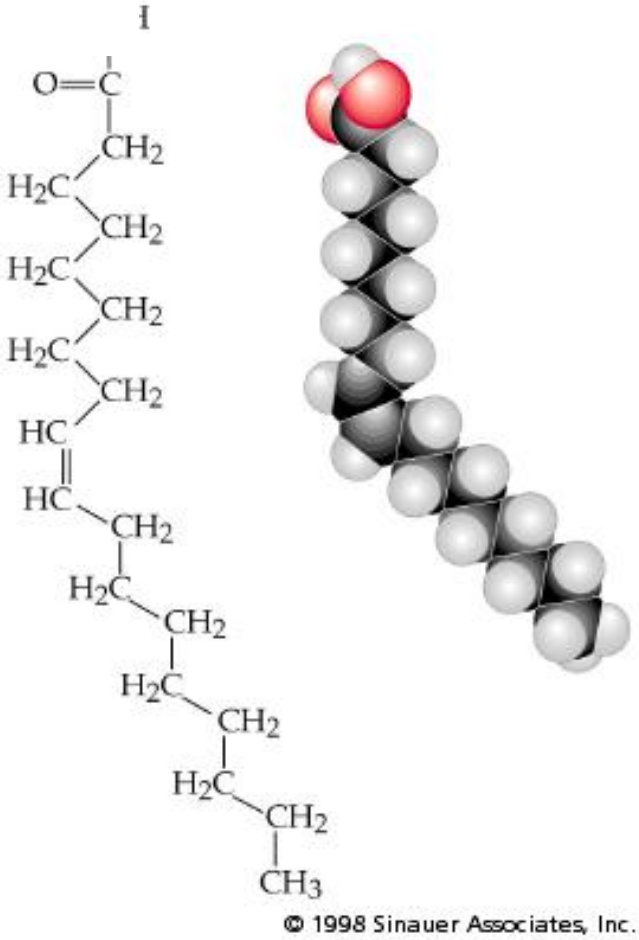
- glycerol always has the same structure but fatty acids can be saturated or unsaturated



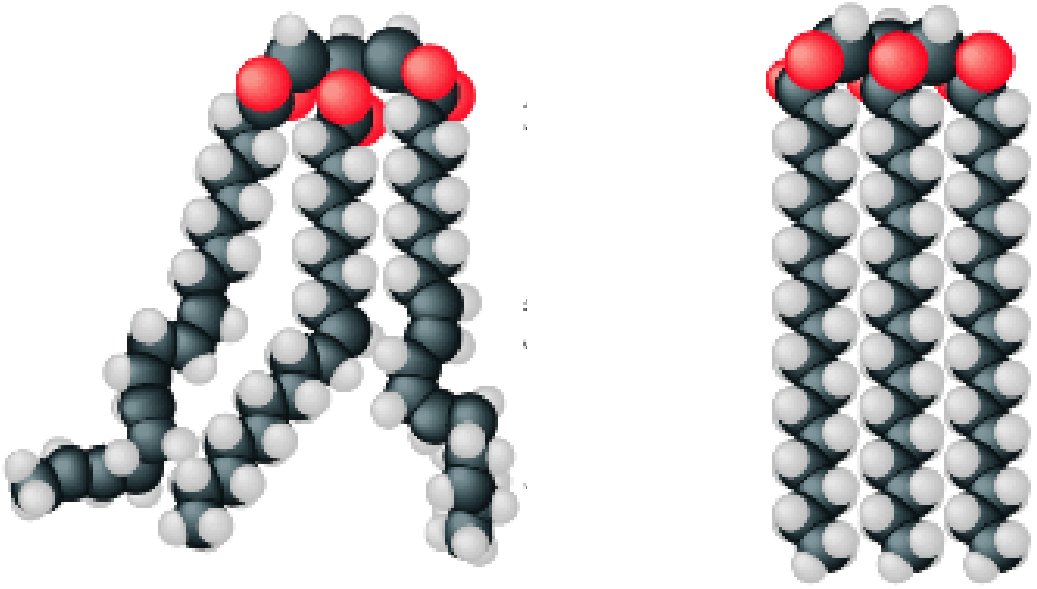


The Structure & Function of Lipids



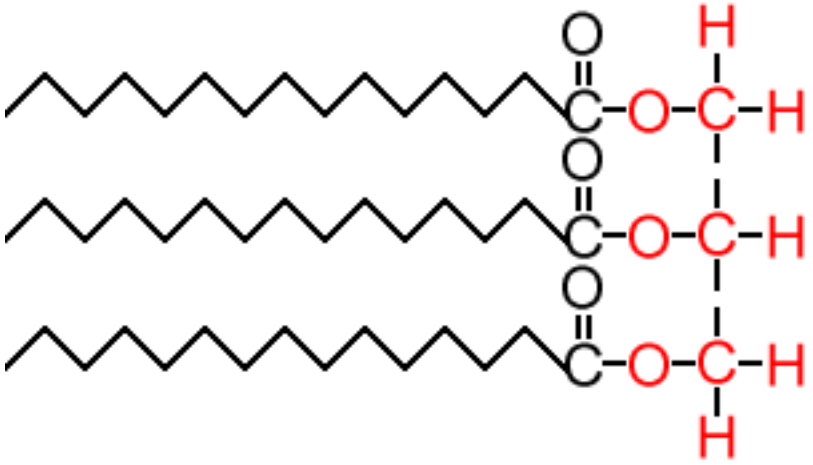


The Structure & Function of Lipids



The Structure & Function of Lipids

Saturated : all bonds between carbons are single
- solid at room temp
- eg. butter

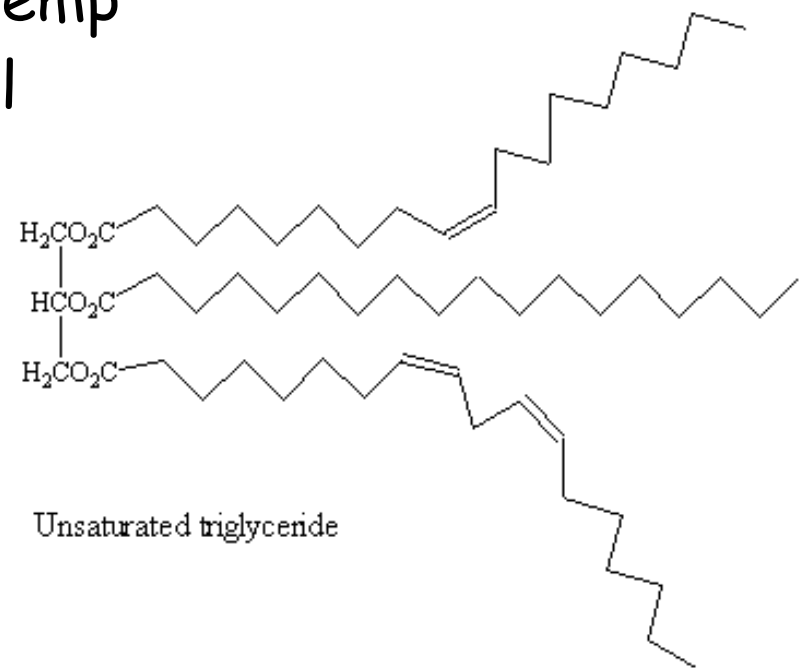


3 Fatty Acids + Glycerol

The Structure & Function of Lipids

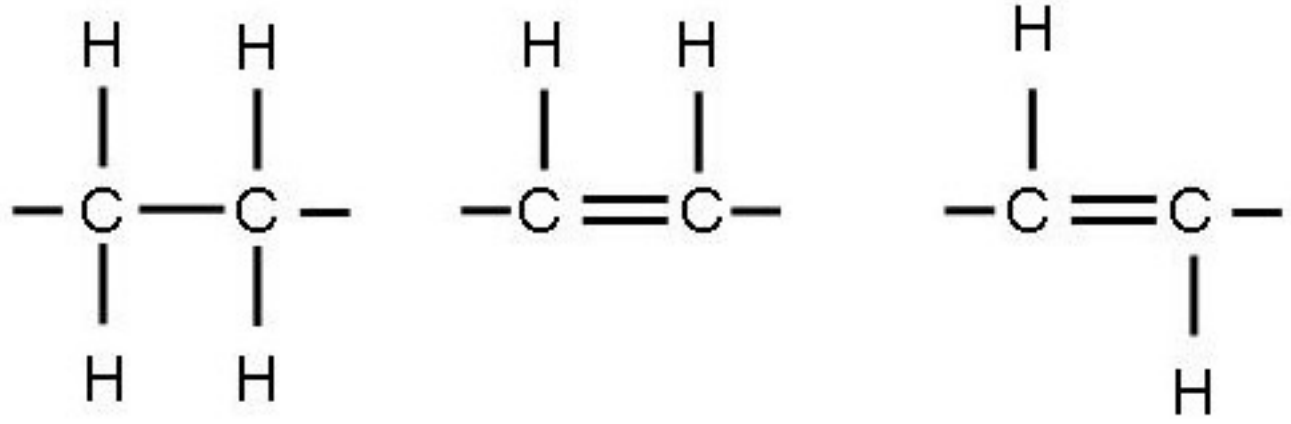
Unsaturated: at least 1 bond is double (note what a double bond does to the shape of the fatty acid)

- liquid at room temp
- eg.Vegetable oil

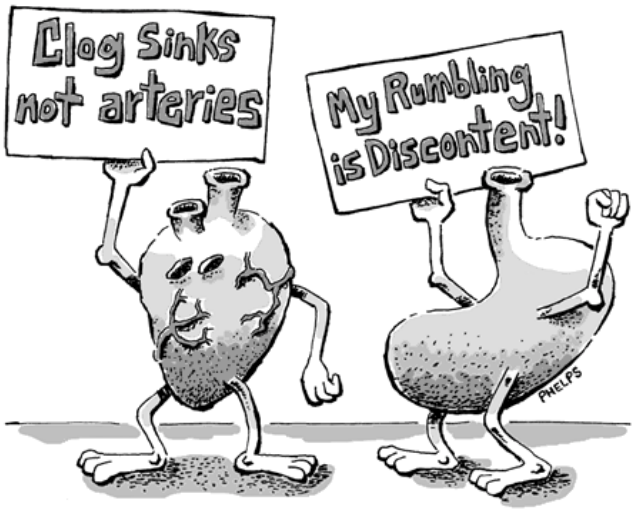


Unsaturated triglyceride

Trans Fats



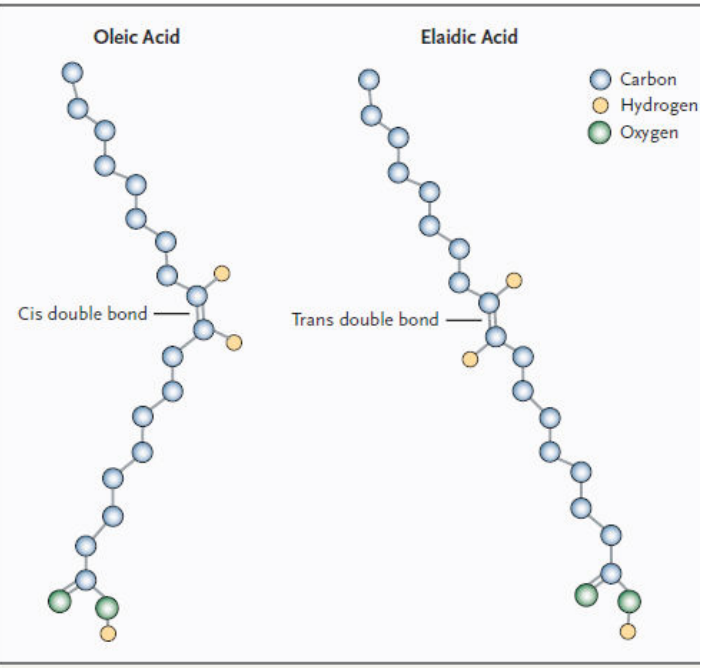
Saturated Fat Unsaturated Fat Trans fat

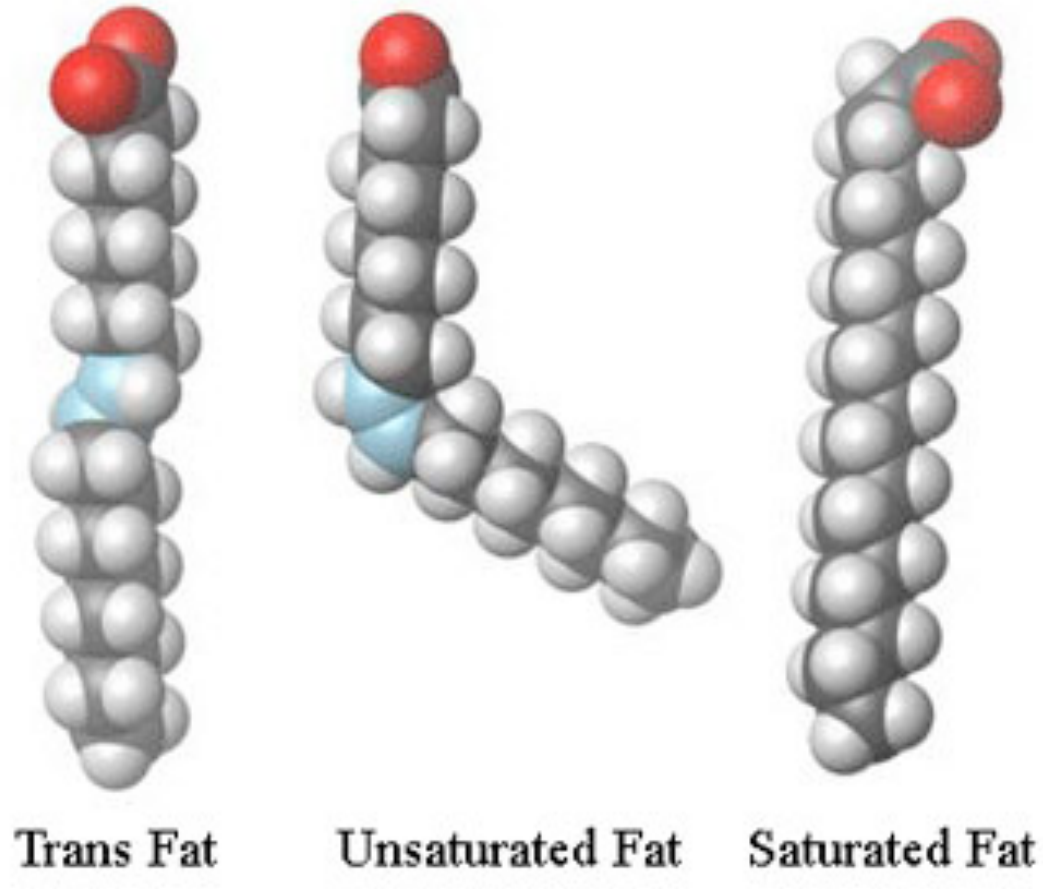


Trans Fat

Maasai Diet

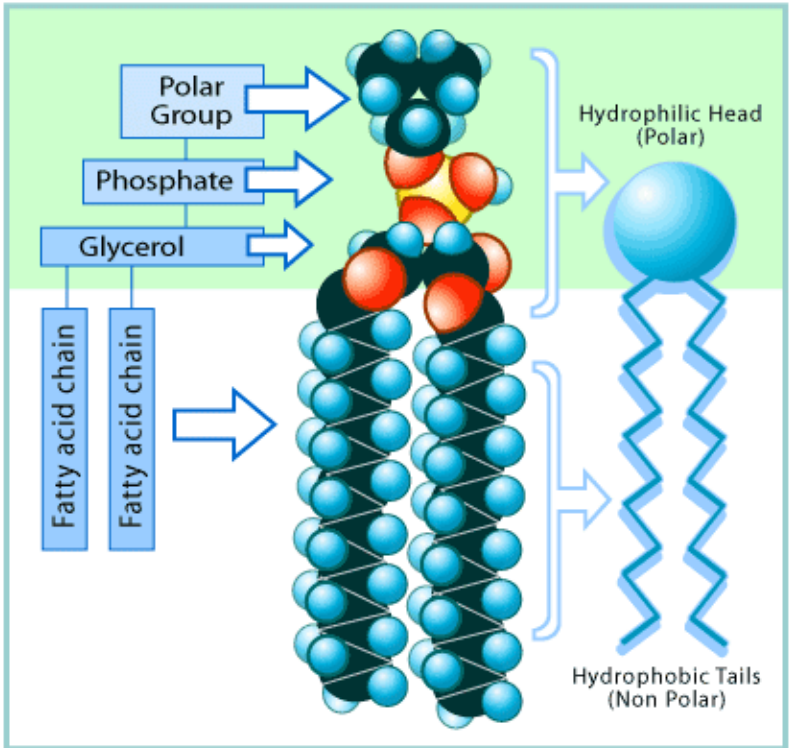
Unsaturated fats can be **Hydrogenated (adding hydrogen)** to make them (i) solid at room temperature & (ii) have a longer shelf life
-unfortunately they often become Trans-fats in the process

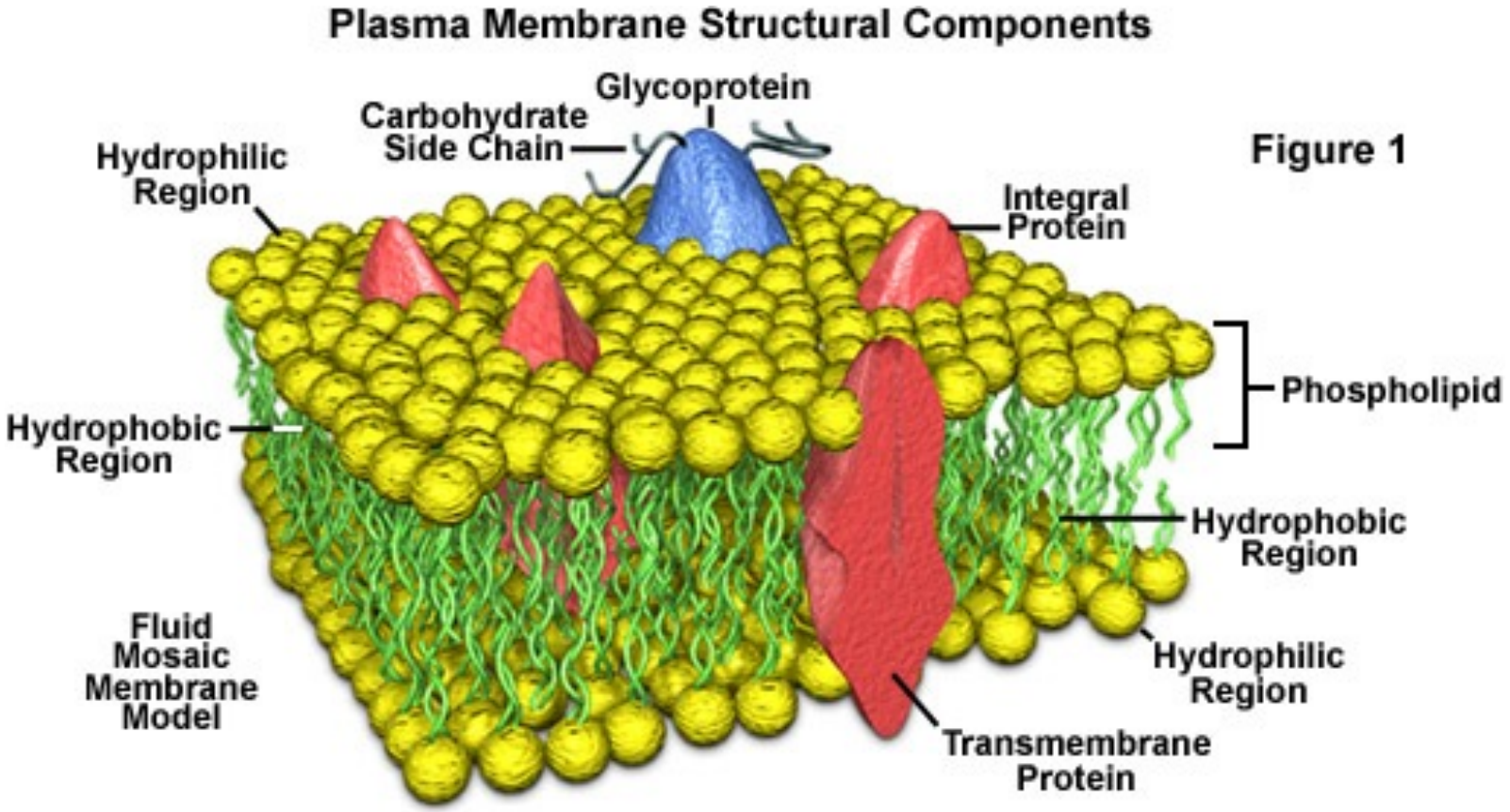




Phospholipids

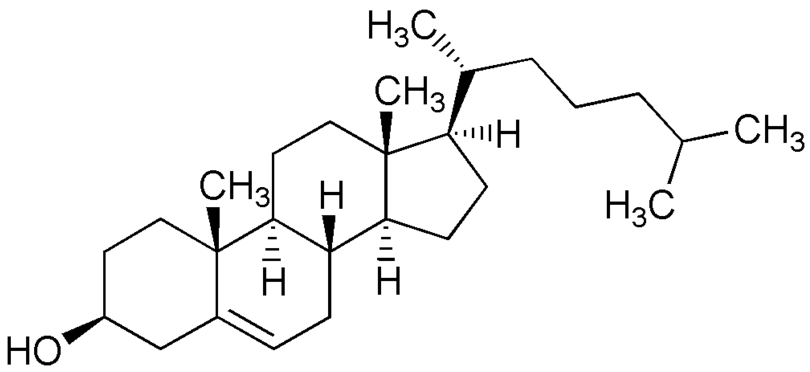
- key component of cell membranes
- 1 glycerol + 2 fatty acid chains + 1 phosphate group
- phosphate end is polar and water-soluble, fatty acid end is non-polar

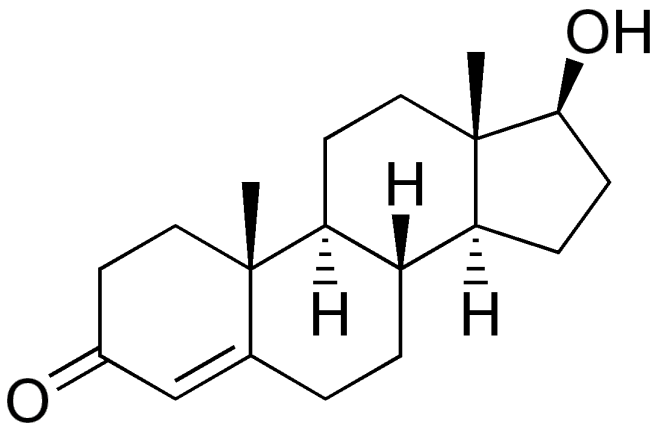



Plasma Membrane Structural Components
Glycoprotein
Carbohydrate Side Chain
Hydrophilic Region
Integral Protein
Figure 1
Phospholipid
Hydrophobic Region
Hydrophobic Region
Fluid Mosaic Membrane Model
Hydrophilic Region
Transmembrane Protein

Steroids (Sterols)

- carbon-based 4-ring structure
- used to make hormones such as estrogen and testosterone





Assignment

- Read health risks of Fat pg 83-85
    - Make concise notes of risks of:
        - Saturated
        - Unsaturated
        - Trans

    ➡ include evidence (data) that provides supports
- Complete Data Based questions on Page 85/86