Take notes while watching the following video tutorials to prepare for the "Lipids Activity".

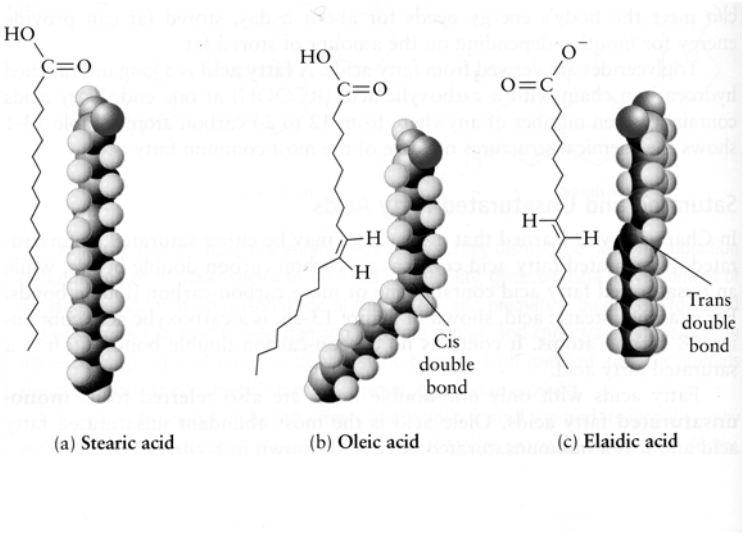
Lipids Part 1: Fatty Acids, Fats, and Oils

Fatty Acids – Review

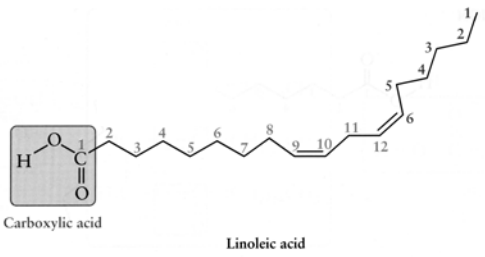
Draw the skeletal-line structure of a palmitic acid – $CH_3(CH_2)_{14}CO_2H$

Apply the following terms to the fatty acids below.

Saturated Fatty Acids ; Unsaturated Fatty Acids; or Polyunsaturated Fatty Acids



(a) Stearic acid (b) Oleic acid (c) Elaidic acid



(d) Linoleic acid

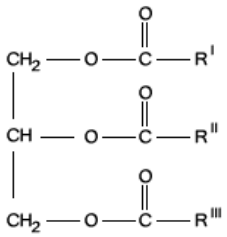
Arrange the fatty acids above in order of decreasing melting point.

Name the linoleic acid using both the omega and delta classification systems.

Fats & Oils – Triglycerides (Triacylglcerols or TAGs)

Box the glycerine back bone and circle the ester groups.

Explain how the R groups affect the physical state of a TAG.



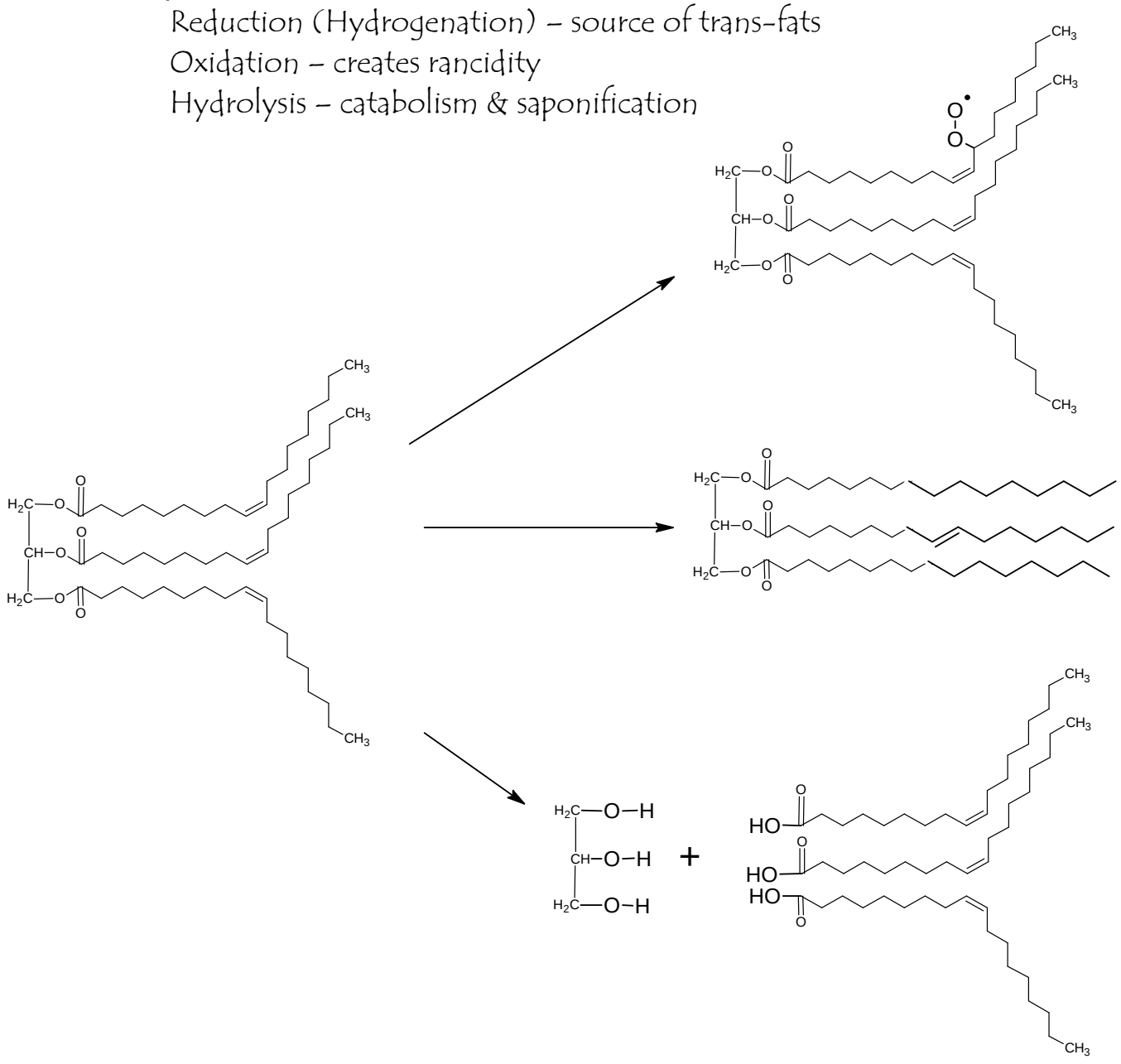
Fats & Oils – reactions of triglycerides

Classify the reactions below:

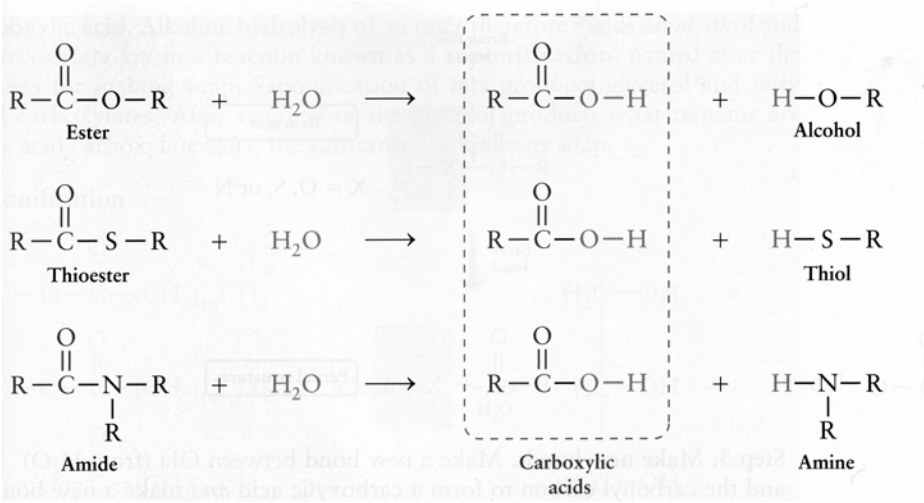
Reduction (Hydrogenation) – source of trans-fats

Oxidation – creates rancidity

Hydrolysis – catabolism & saponification



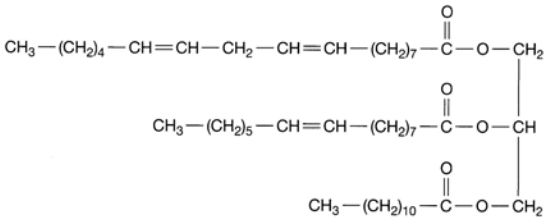
The 3 reactions below all share the same classification. What is this reaction classification name?



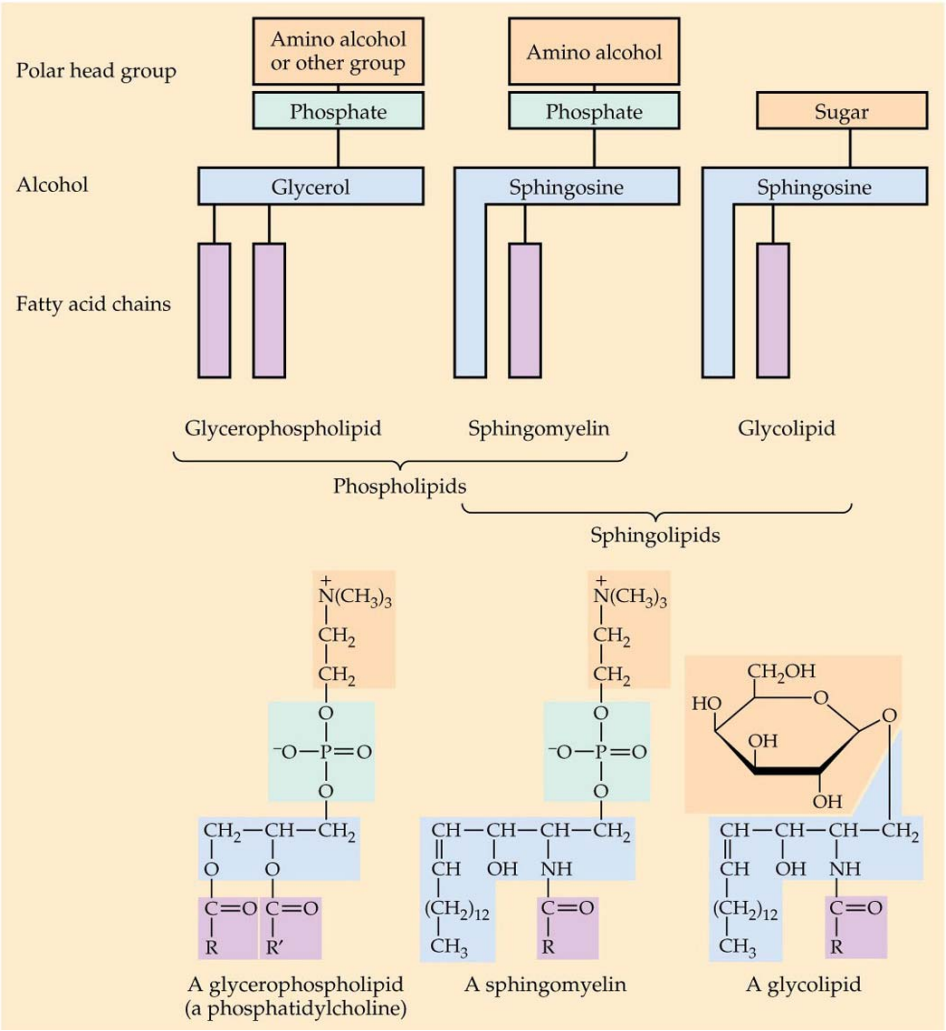
2. Predict the products for the reaction below.

   a) If there is 1 mole of triglyceride, how many moles of water are needed? Add this information to the reaction below.

   b) Label the reaction products as glycerol or fatty acid.



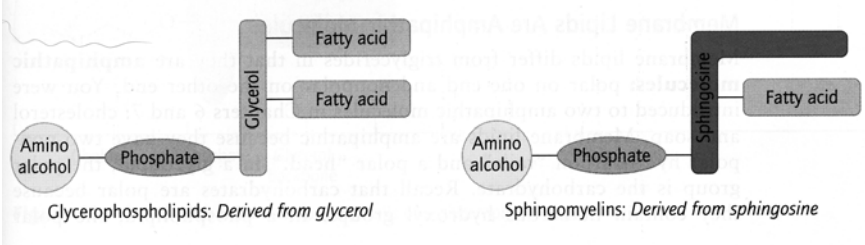
Lipids Part 2: Membrane Lipids
Phospholipids, Sphingolipids, and Cholesterol



Phospholipids & Glycolipids

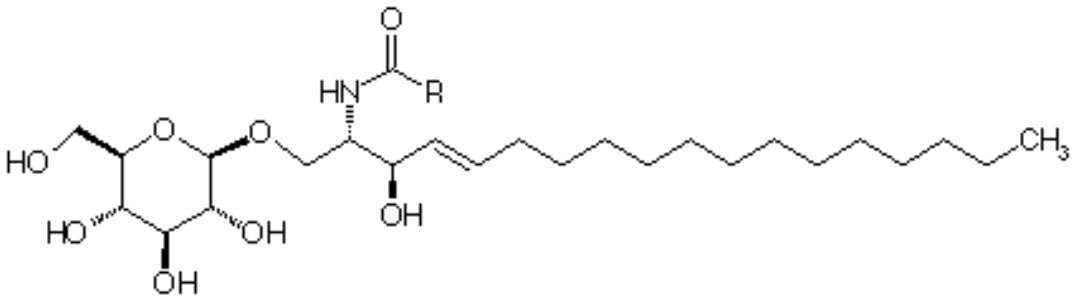
Glycolipids have a sphingosine backbone and contain a carbohydrate group instead of a phosphate. The carbohydrate portion of the glycolipid extends into the fluid surrounding the cells functioning as a receptor or cell marker.

Glycerophospholipids & Sphingolipids

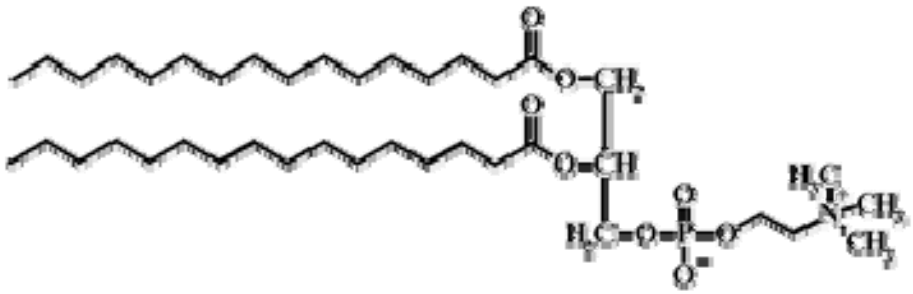


Classify the following membrane lipids as glycerophospholipids, sphingomyelin, or glycolipid

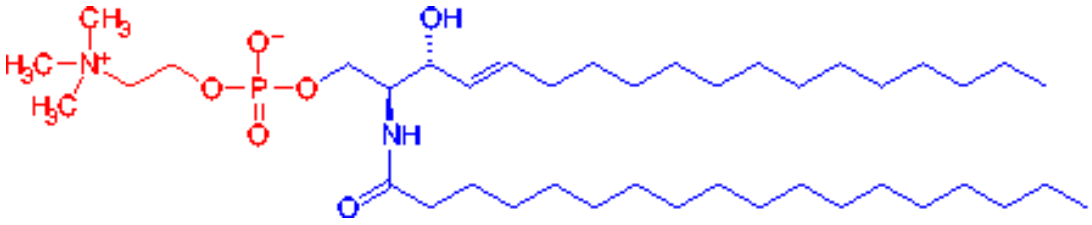
a)



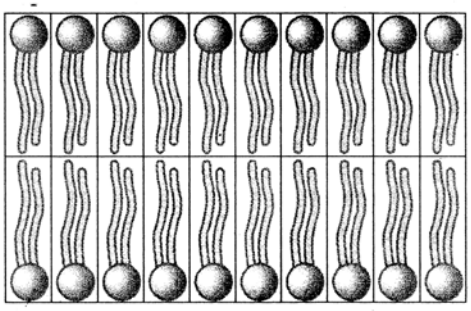
b)



c)



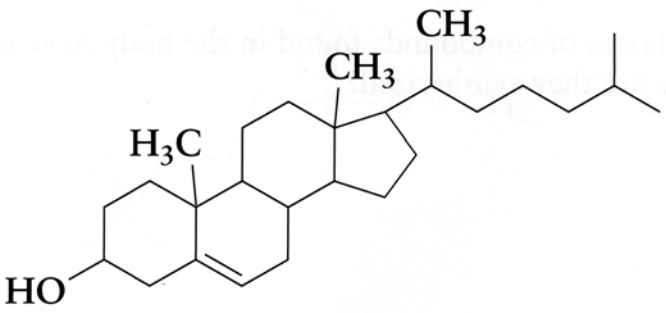
The Amphipathic character of membrane lipids creates a lipid bilayer.



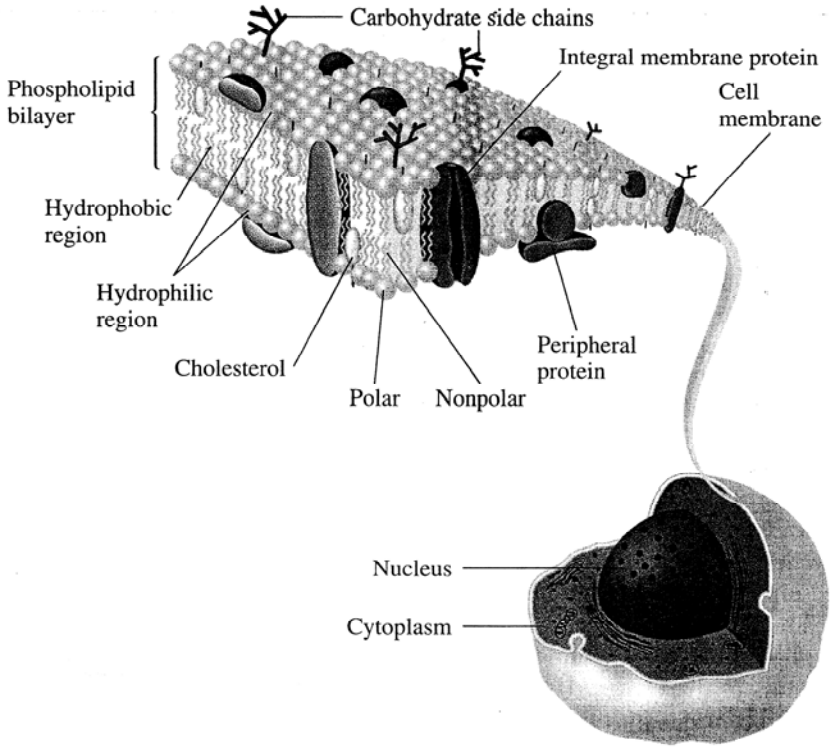
Cholesterol adds structural support to our lipid bilayers.

Circle the structural feature that indicates cholesterol is a steroid.

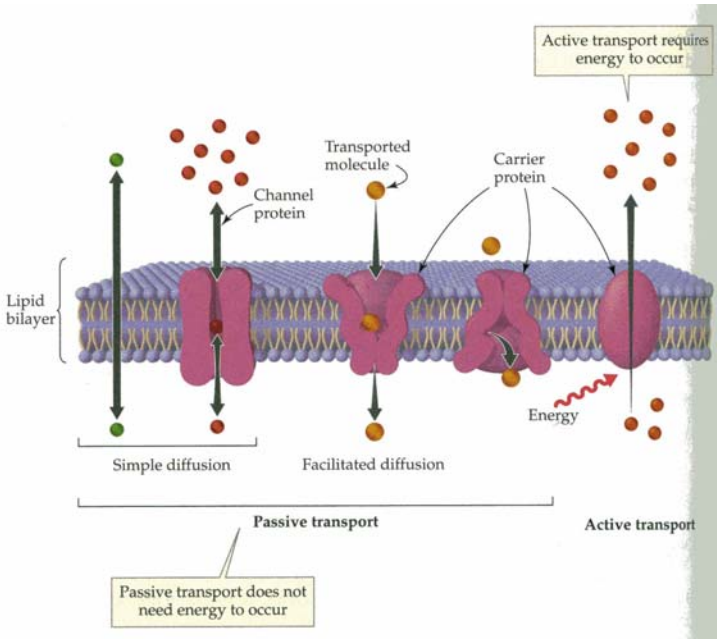
Box the structural feature the gives cholesterol its suffix.



The Structure of Cell Membranes



Lipids Part 3: Transport across Cell Membranes



Passive Transport: diffusion of substance from high concentration to low concentration

Simple Diffusion
hydrophobic substances

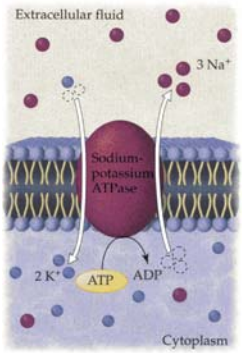
Facilitated Diffusion
hydrophilic substances

Molecule binds to membrane protein which changes its shape to allow the molecule to be released on the other side of the membrane

Active Transport: energy must be supplied because substances move against diffusion

Example: Continuous movement of Na^+ and K^+ ions across cell membranes

Energy from ATP is used to change the shape of an integral protein to bring 2 K+ ions into a cell while moving 3 Na+ ions out of the cell.

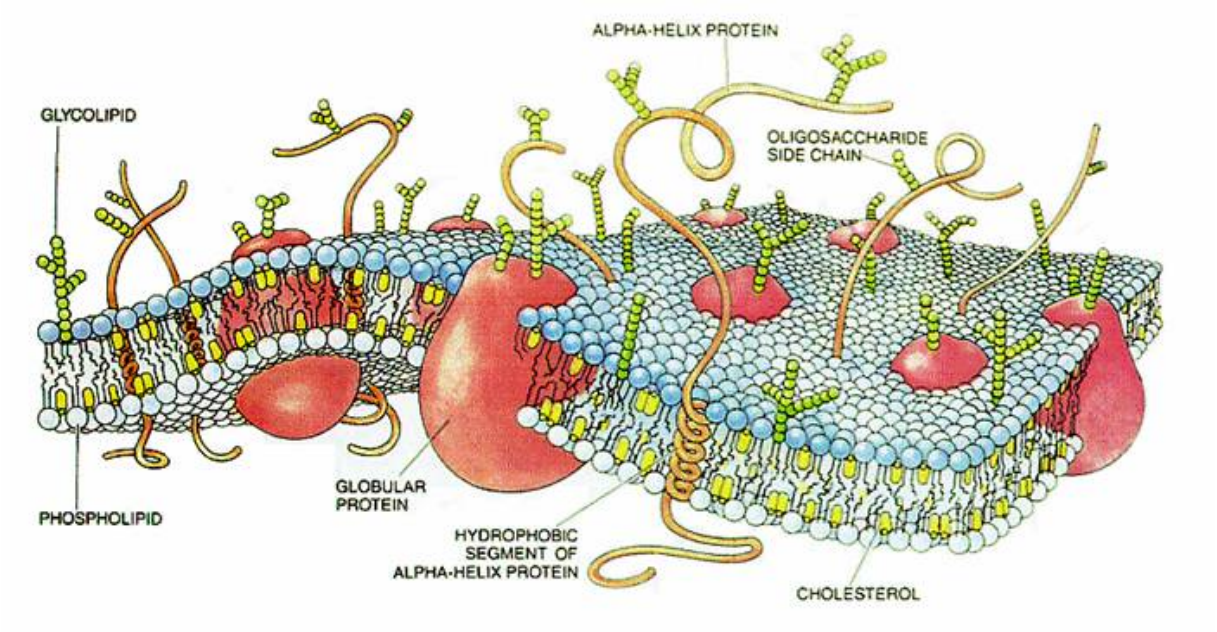


Lipids Part 4: Cholesterol

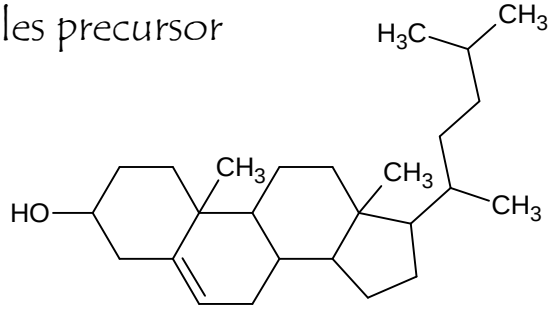
Cholesterol and Other Steroid Hormones

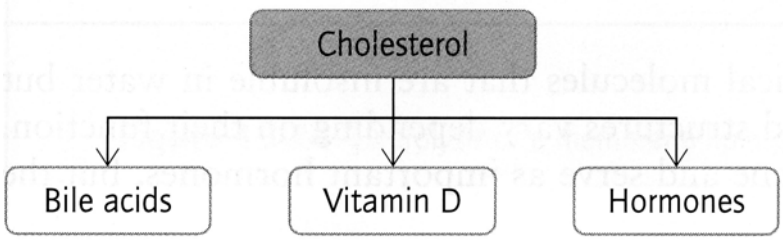
Cholesterol – 2 roles

1) Cholesterol is distributed among the hydrophobic tails of the phospholipids and helps to maintain the structure of the membrane.

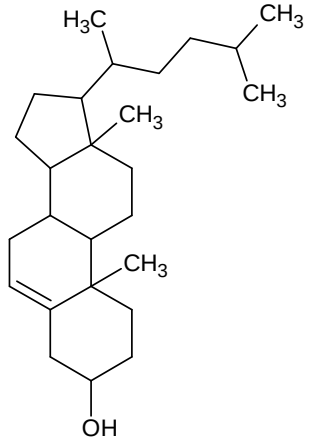


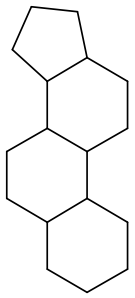
2) Cholesterol is the starting material for important biological molecules precursor

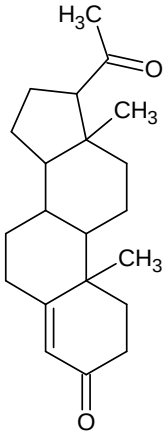


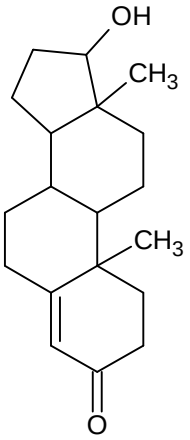


Cholesterol – the precursor to five classes of steroid hormones

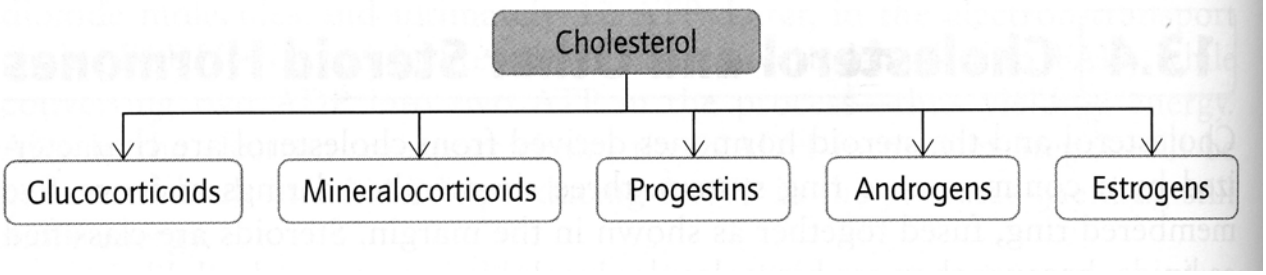








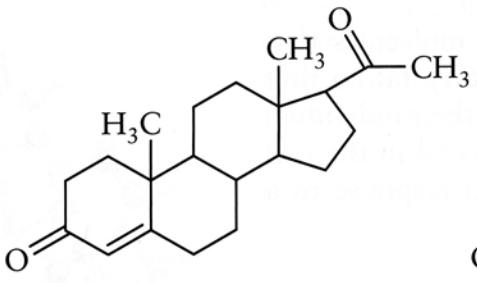
Cholesterol steroid fused rings cortisone testosterone



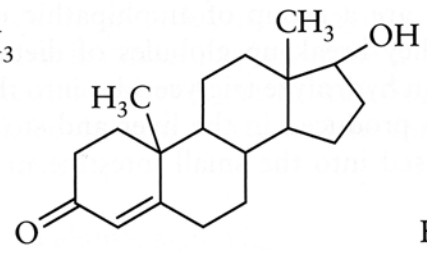
Glucocorticoids: regulate carbohydrate, protein, and lipid metabolism
powerful anti-inflammatory & immunosuppresent activity

Mineralcorticoids: produced in the adrenal gland
regulate Na^+, K^+ and Cl^- balance in tissues

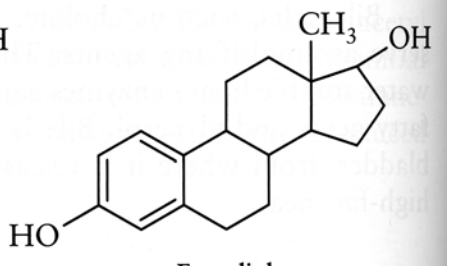
Progestins, Androgens, & Estrogens represent the sex hormones



Progesterone
(progestin)



Testosterone
(androgen)

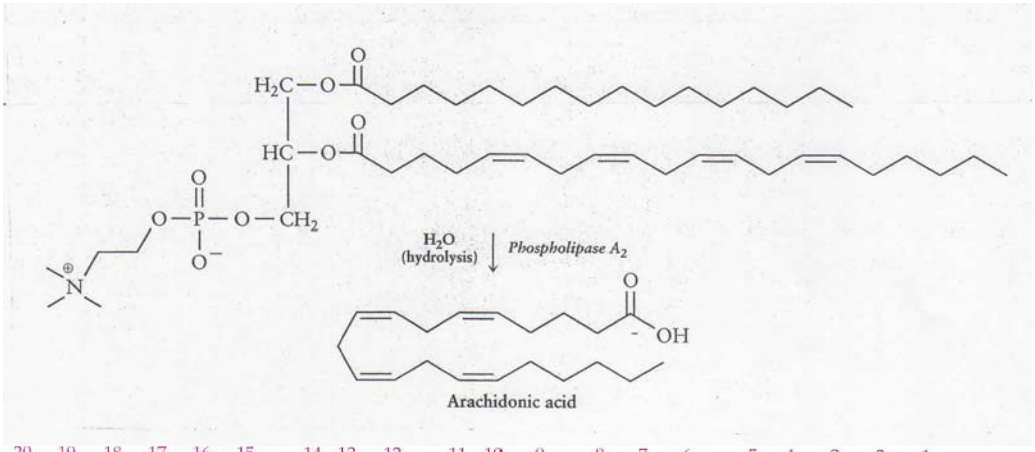


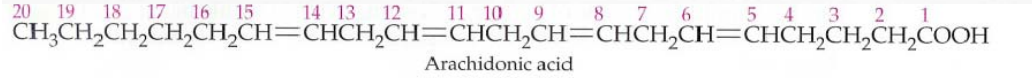
Estradiol
(estrogen)

Eicosanoids are the chemical initiators of inflammation. Two major classifications are the prostaglandins and leukotrienes.

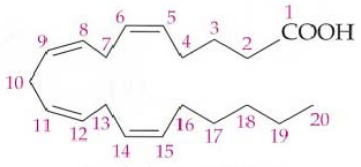
Eicosanoids are derived from 20-carbon unsaturated fatty acids (eicosanoic acids) and are synthesized throughout the body. Prostaglandins and leukotrienes are synthesized in the body from arachidonic acid.

Arachidonic acid is synthesized from the hydrolysis of glycerophospholipids in our cell membranes.





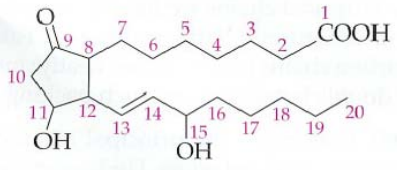
Arachidonic acid



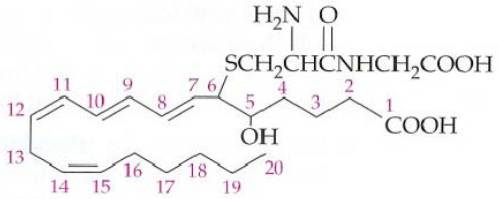
Arachidonic acid (bent)

Multistep enzyme-catalyzed synthesis

Multistep enzyme-catalyzed synthesis



PGE_1, a prostaglandin



Leukotriene D_4

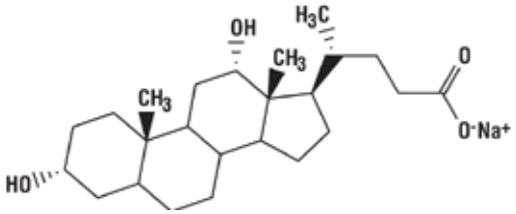
Lipids Part 6: Bile Salts, Lipoproteins, and Fat Digestion

The hydrophobic nature of fats and oils requires special emulsifiers and transport molecules for our aqueous body fluids.

Bile Salts

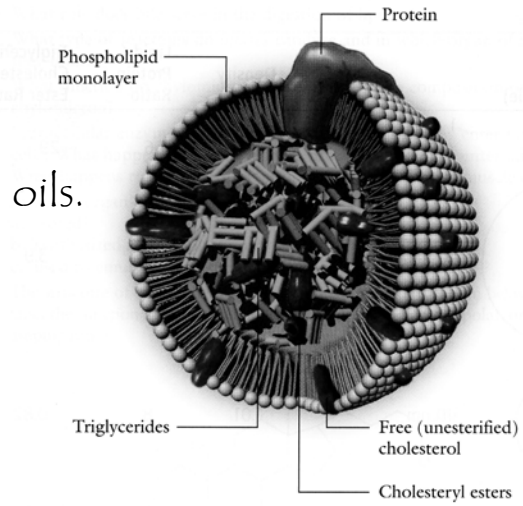
The bile acids (salts) and phospholipids help emulsify the fatty acids so that the enzymes can breakdown the lipids.

Look at the bile salt below and explain why it is a good emulsifier.



Lipoprotiens

Lipoproteins transport hydrophobic fats and oils.



Lipoprotein Structure and Function

Lipoprotein	Size (drawn to scale)		Density (g/mL)	Lipid/ Protein Ratio	Triglyceride/ Cholesterol Ester Ratio
Chylomicrons	(10× larger than VLDL)	1 μm (1000 nm) = 1 micron	0.95	66	29
VLDL (very-low-density)		70 nm	0.98	11	3.9
IDL (intermediate-density)		40 nm	1.01	8	0.82
LDL (low-density)		20 nm	1.04	3.8	0.18
HDL (high-density)		10 nm	1.13	1.2	0.16