



Module 9

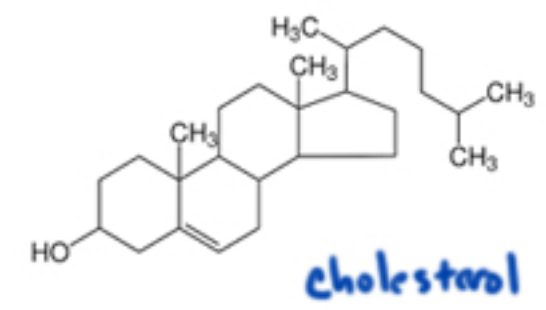
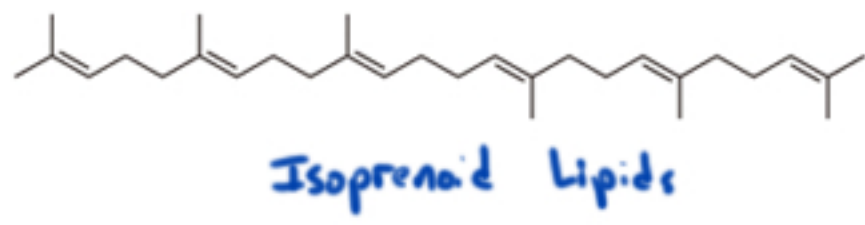
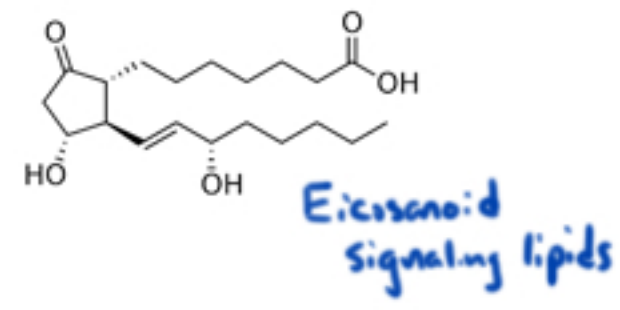
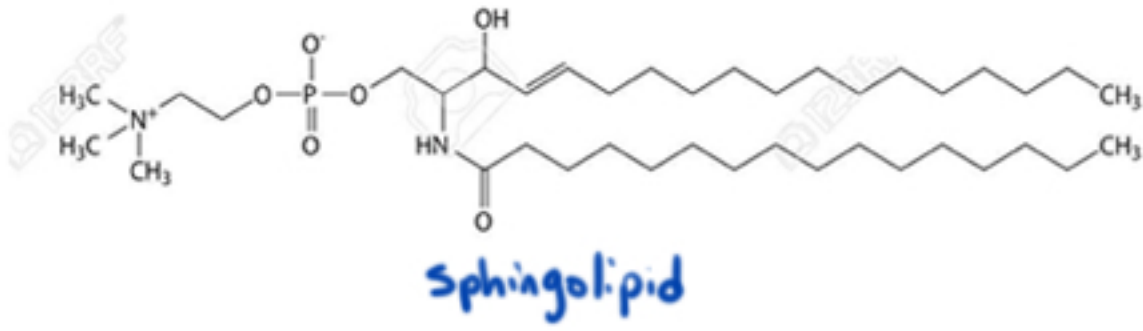
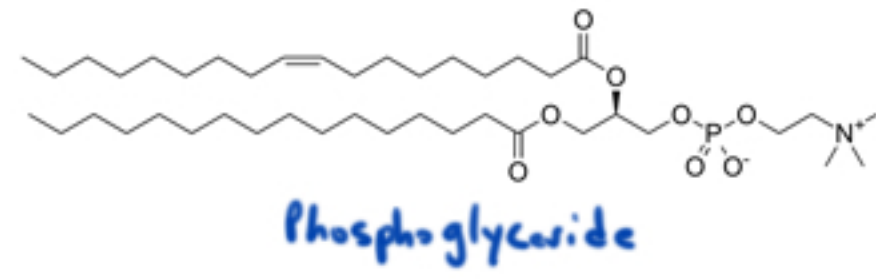
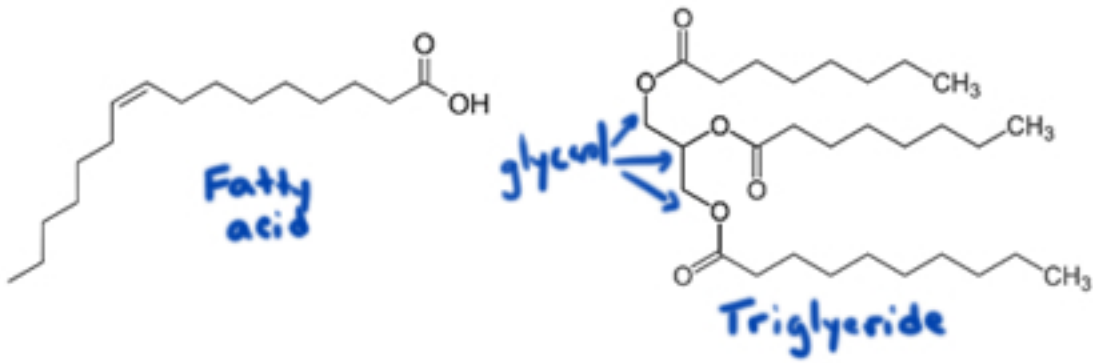
Lipids

Session Slides with Notes

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Lipids



saturated



arachidic



stearic



palmitic

monounsaturated

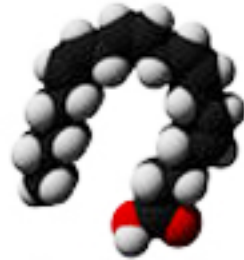


erucic



oleic

polyunsaturated



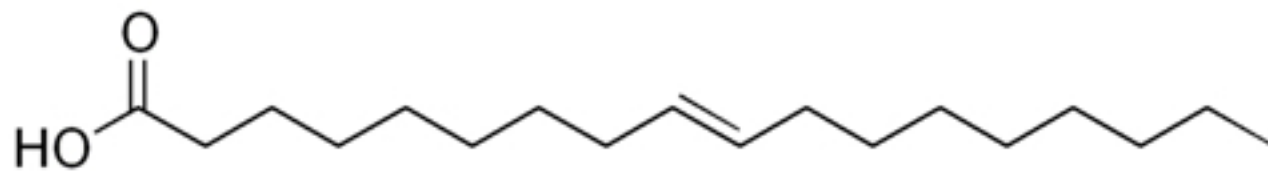
arachidonic



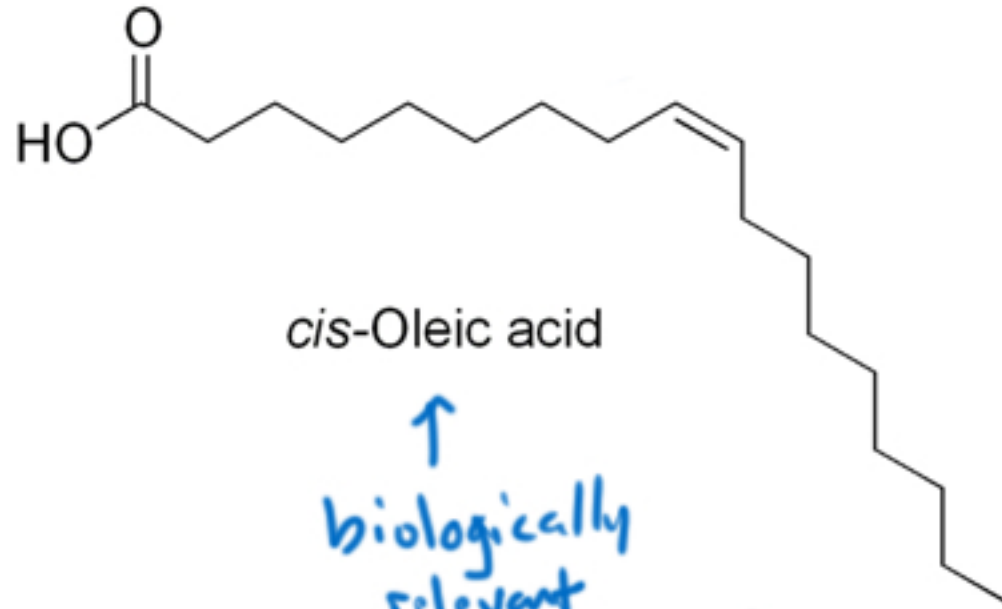
linoleic



linolenic



trans-Oleic acid



cis-Oleic acid

↑
biologically
relevant
(for the most part)

Saturated

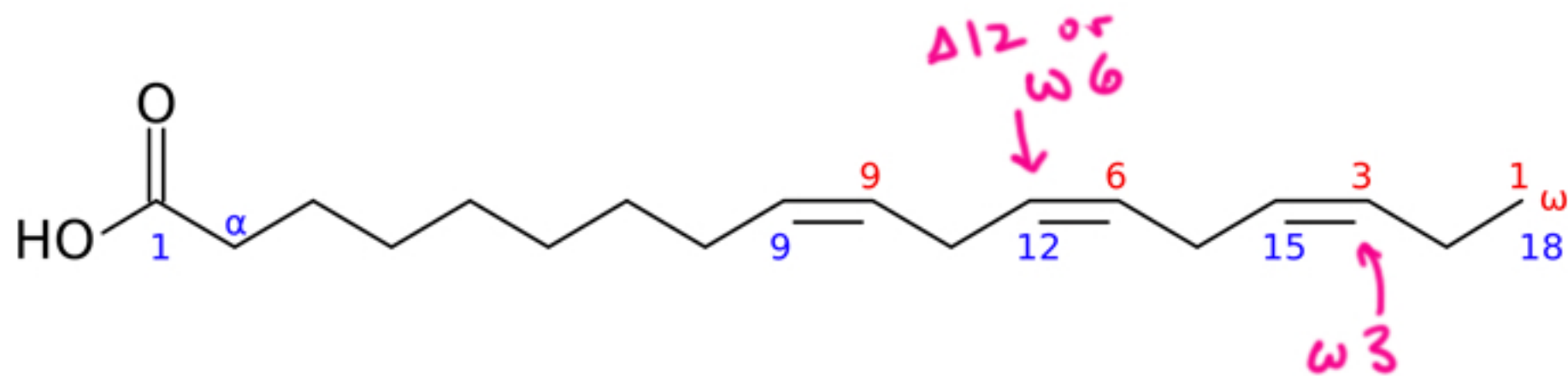


higher
melting
point

unsaturated



α -linolenic acid ← an essential fatty acid

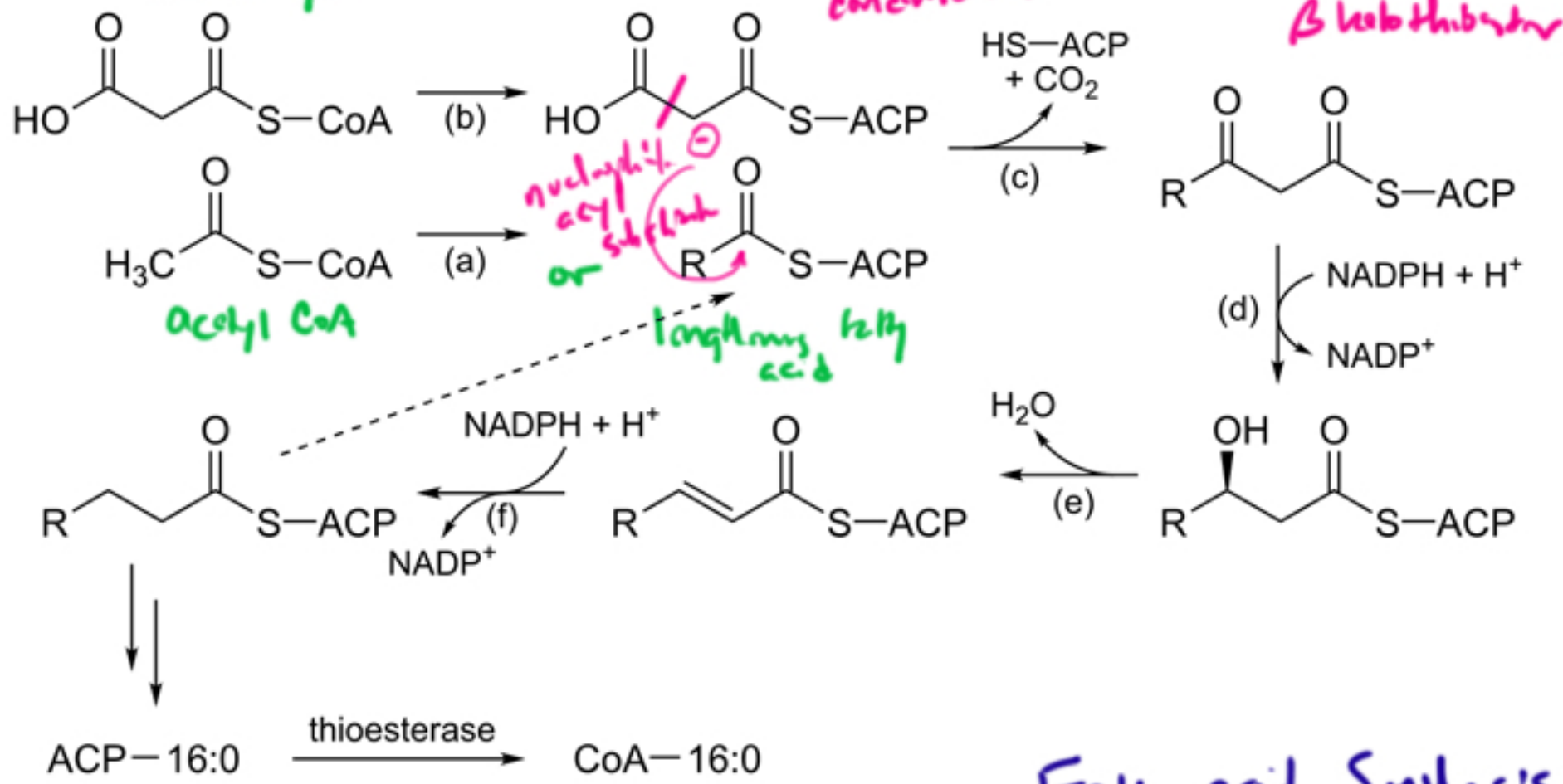


Lipid Number 18:3 (n3)

↑
3 double bonds

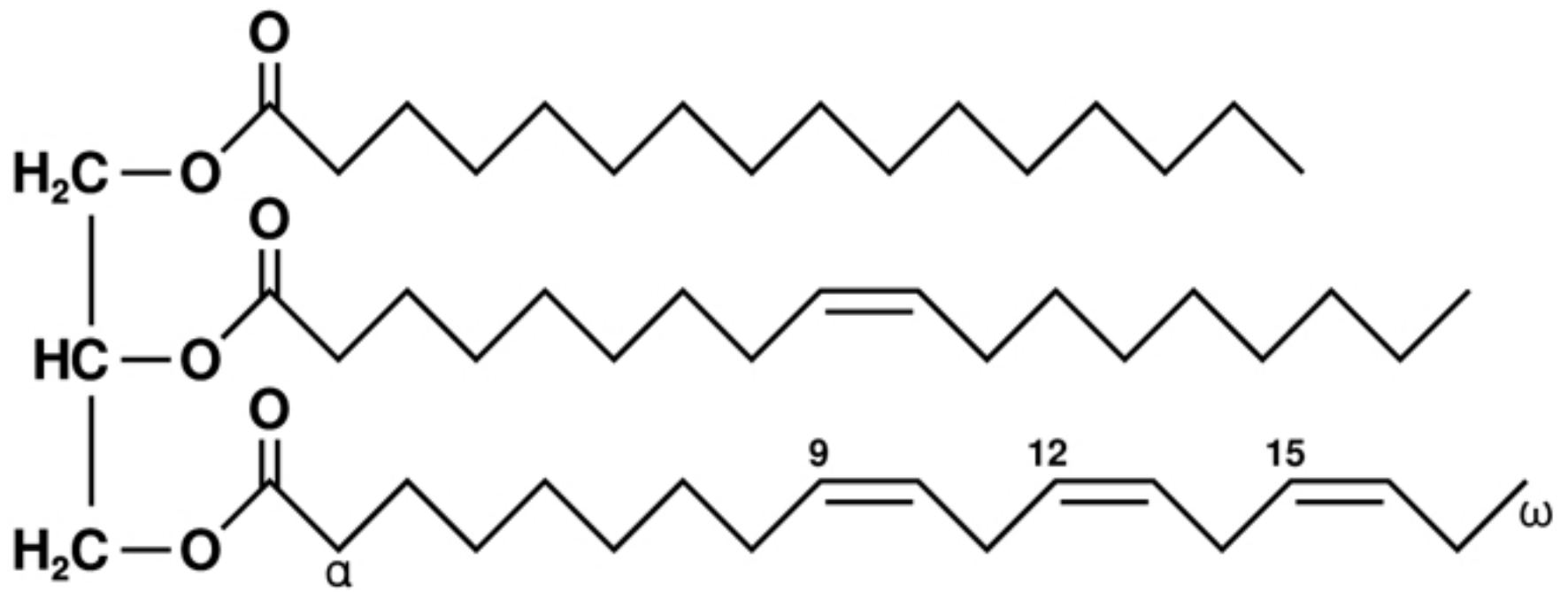
↑ starting at $\omega 3$

acetyl CoA + CO₂
 → malonyl CoA



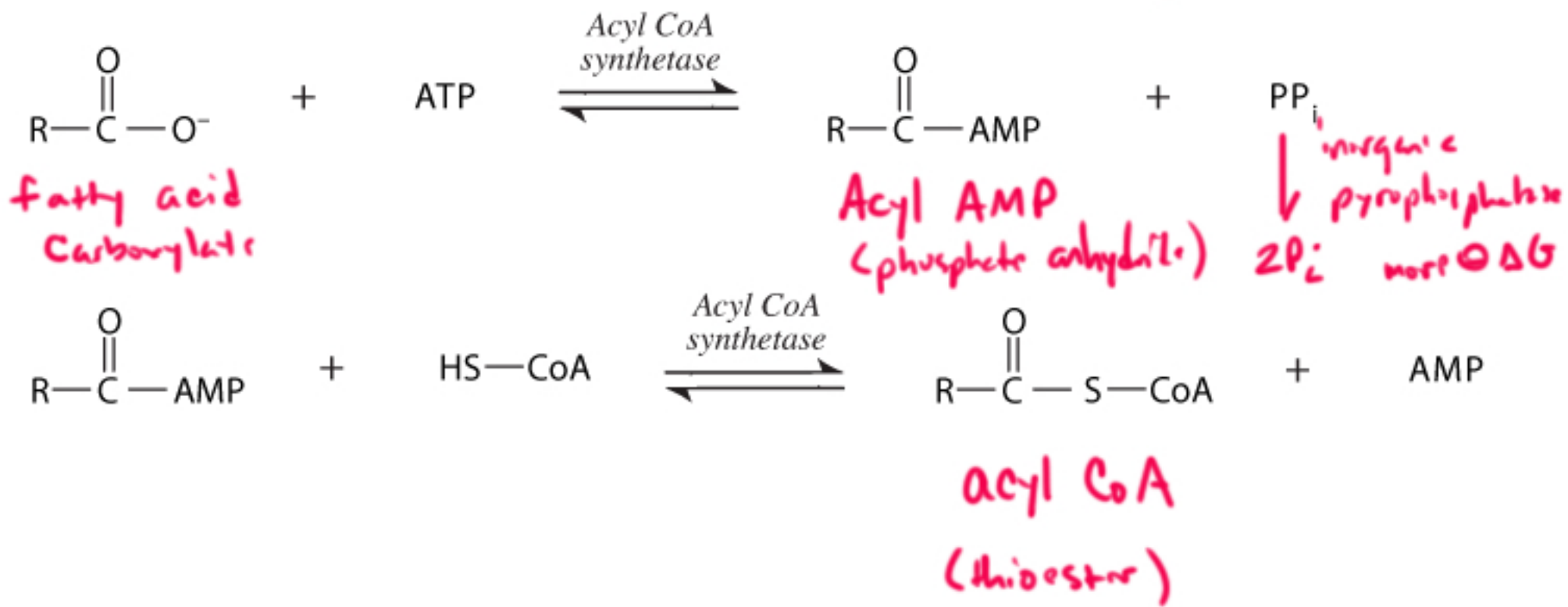
Fatty acid Synthesis
 (supplemental)

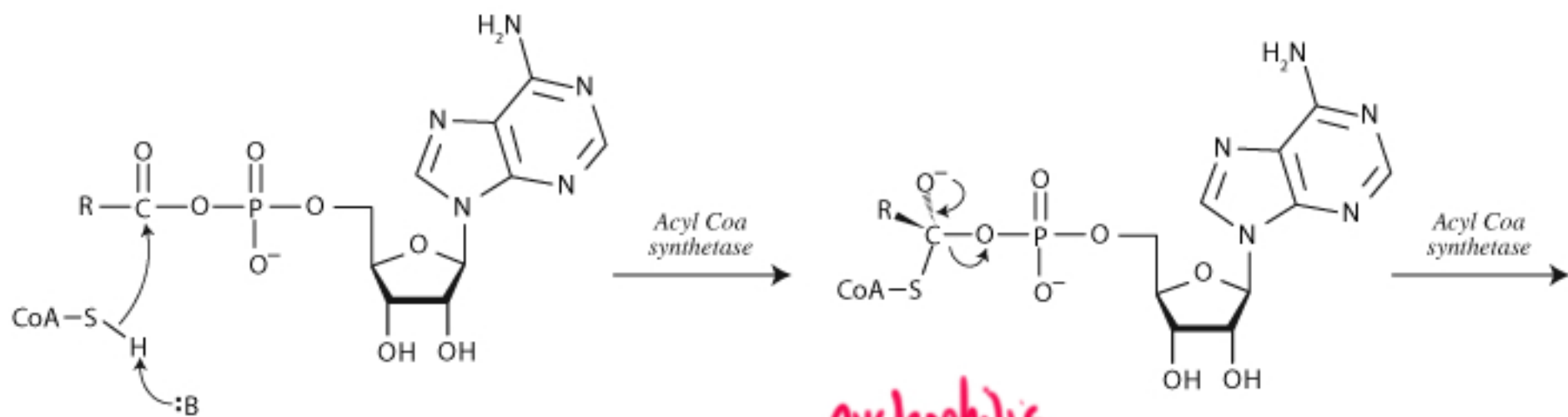
Triglyceridus



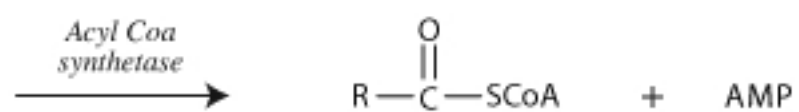
Fatty Acid Activation

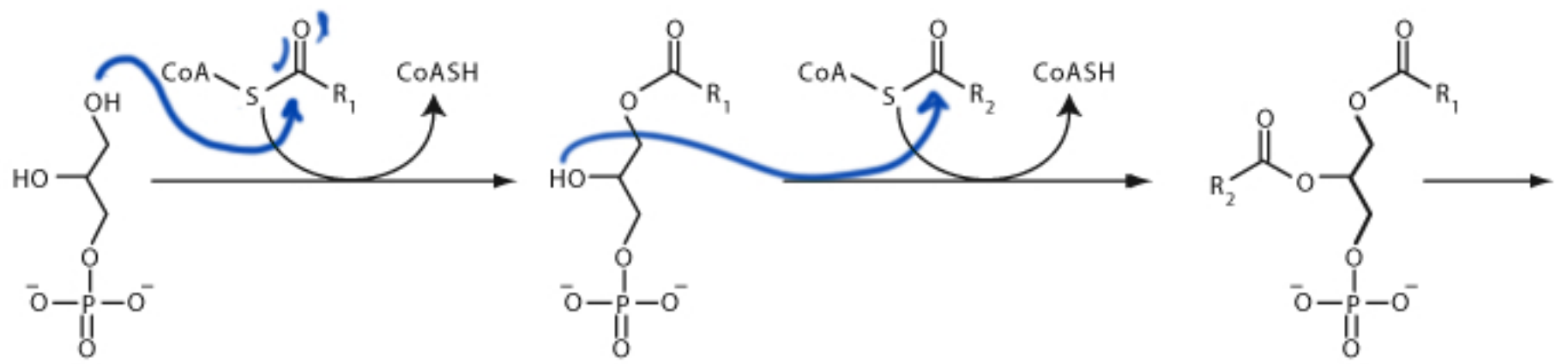
Triglyceride Synthesis



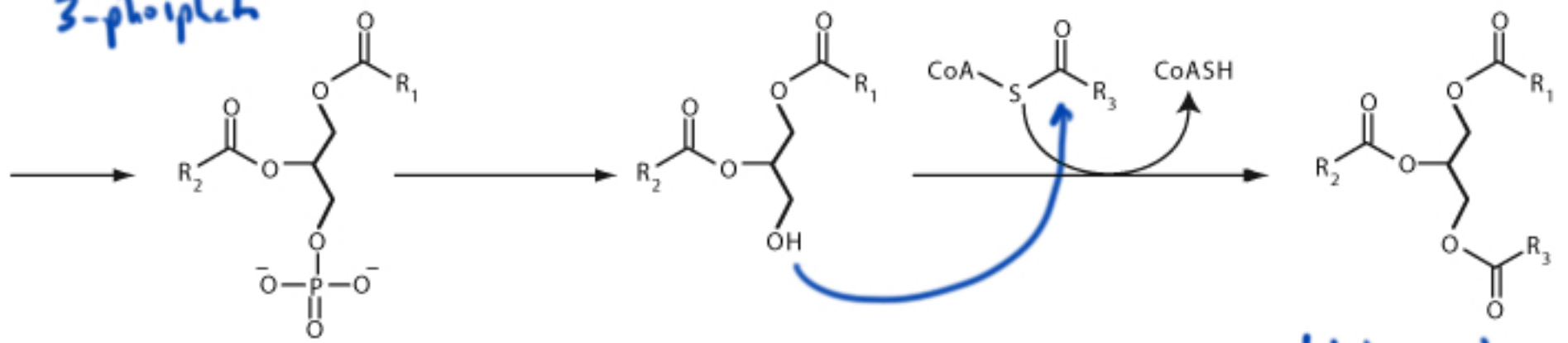


Nucleophilic
acyl
substitution

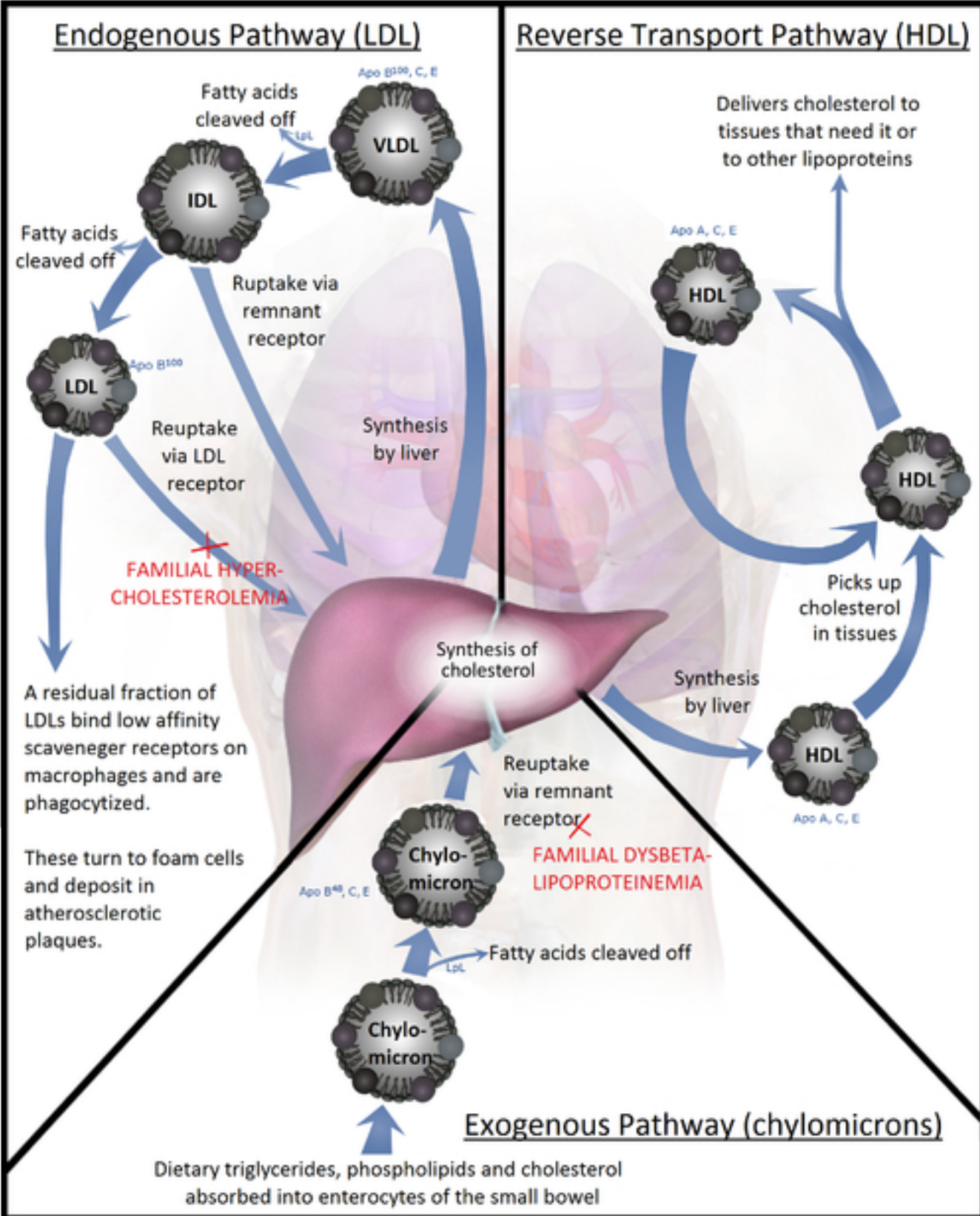




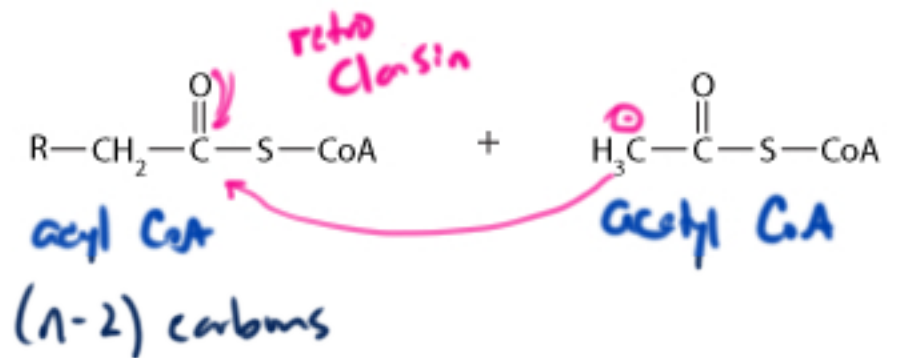
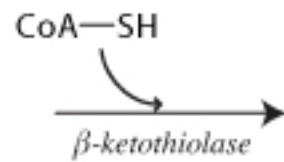
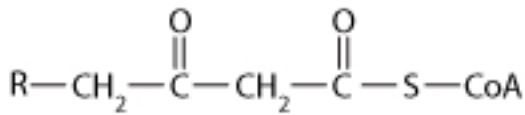
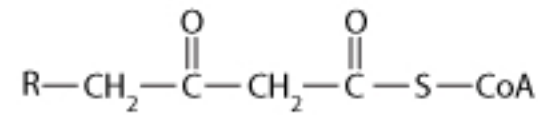
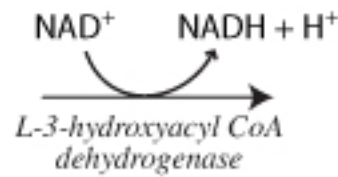
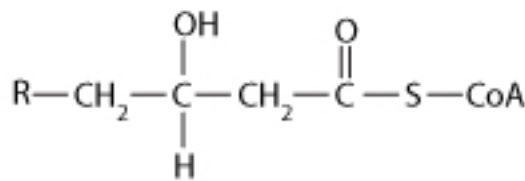
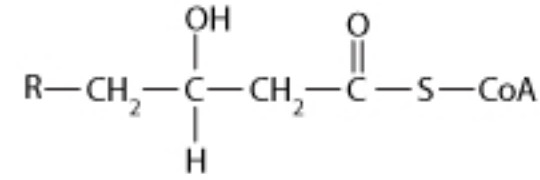
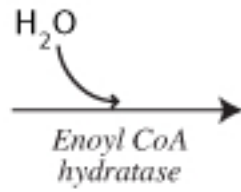
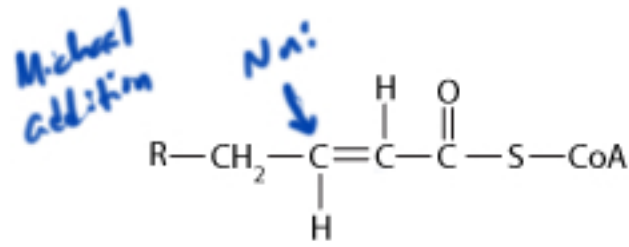
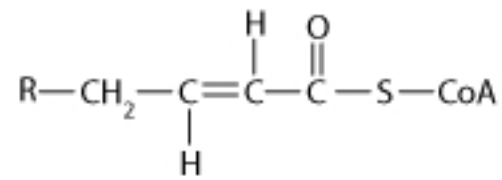
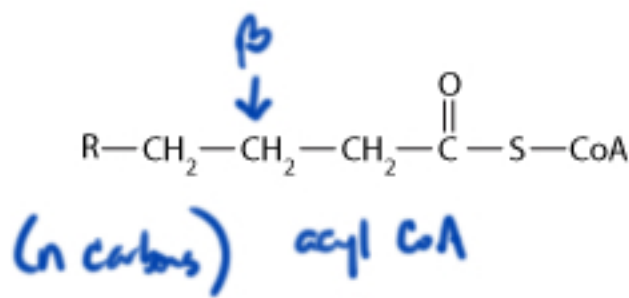
glycerol
3-phosphate



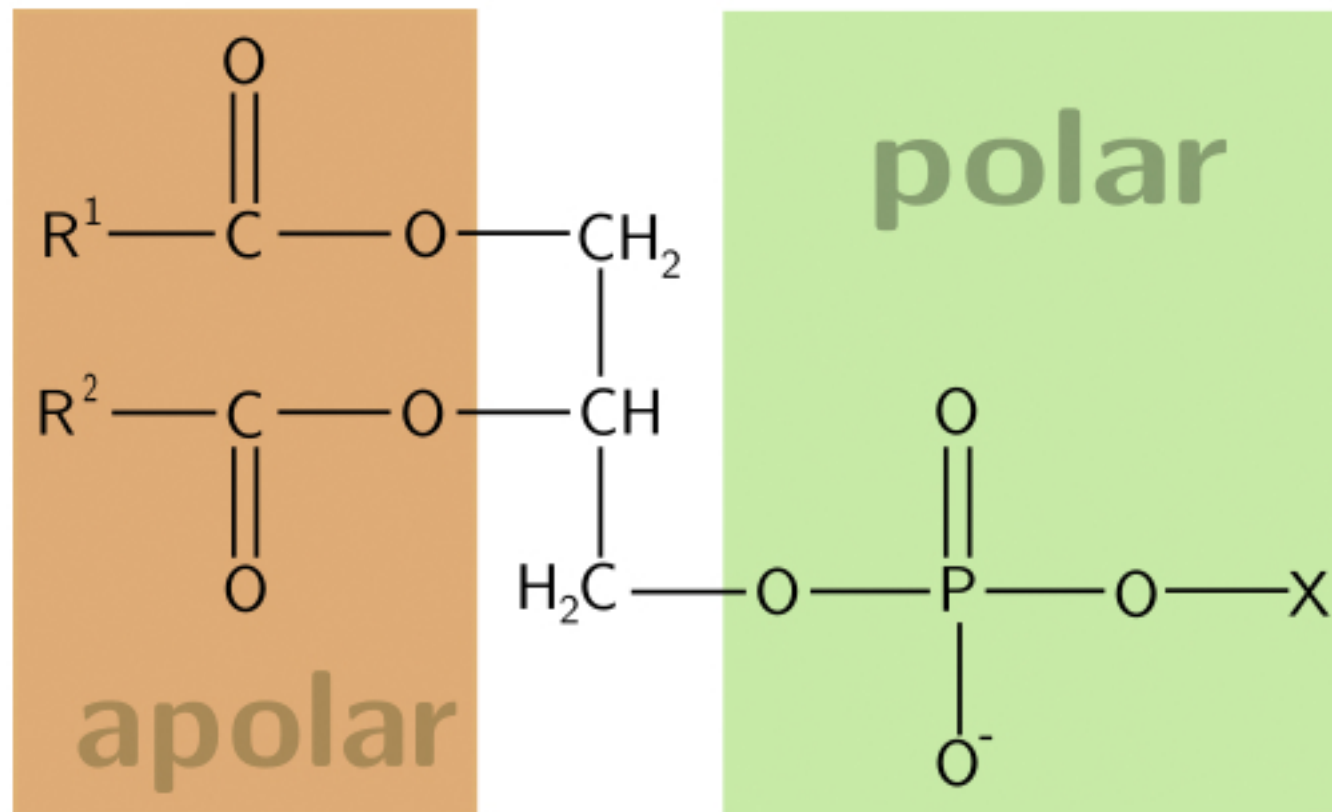
triglyceride

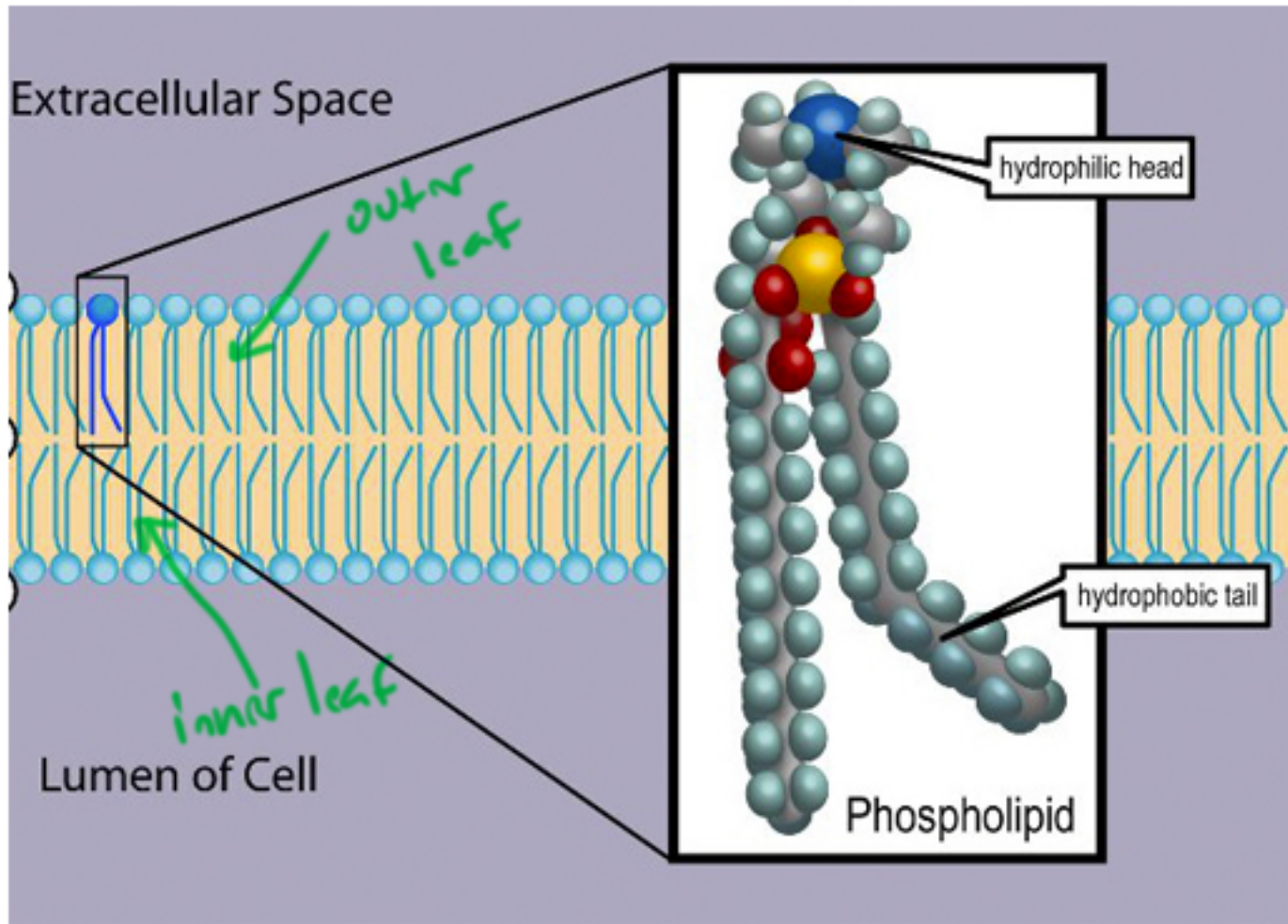


β Oxidation



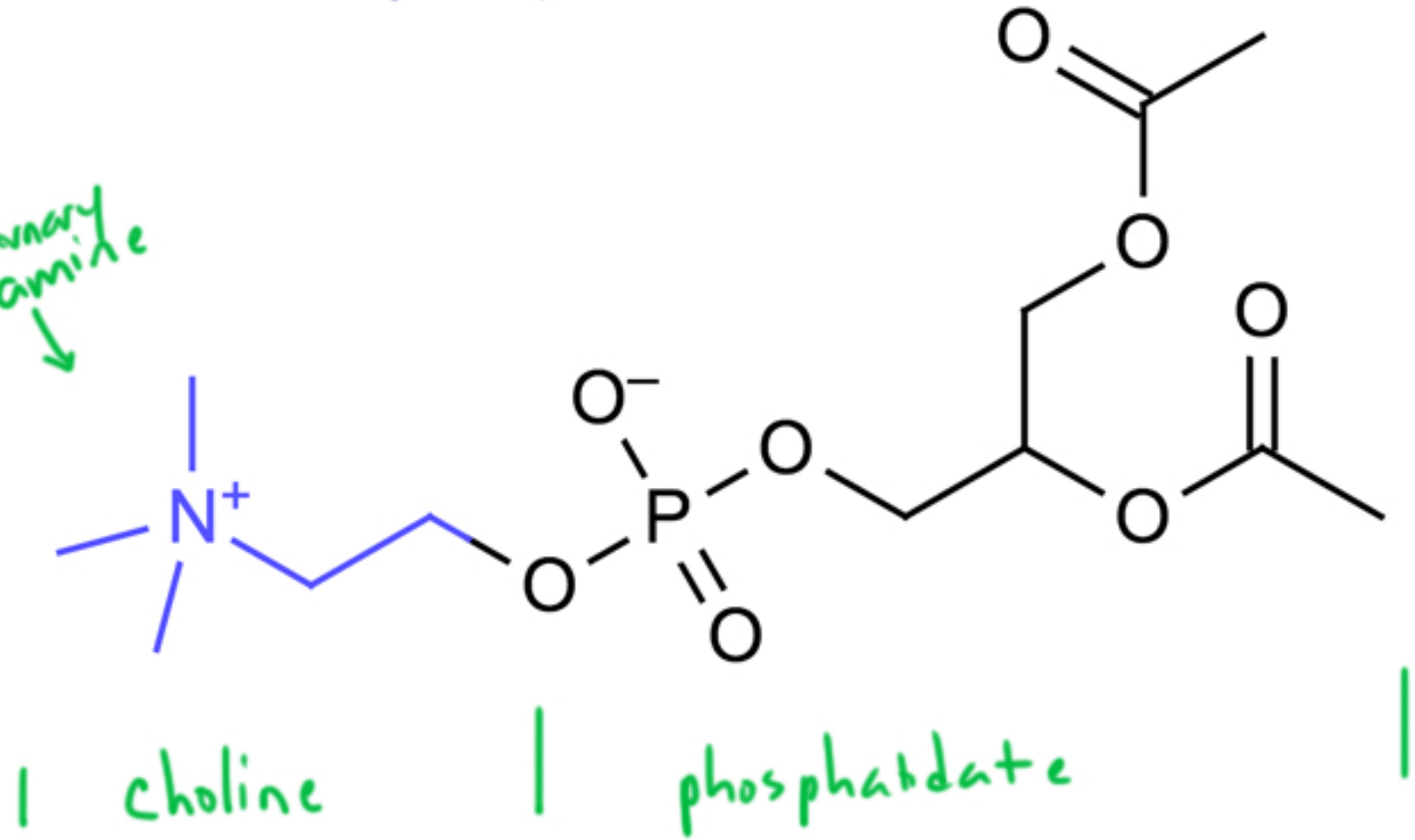
Glycophospholipids





Phosphatidyl Choline

Quaternary
ammonium
↓



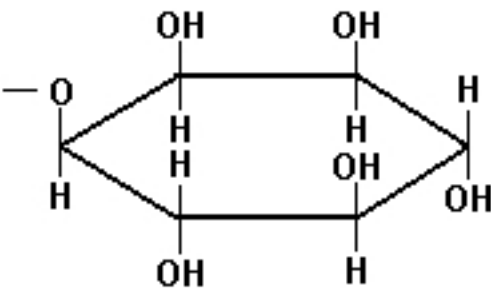
Glycerophospholipids

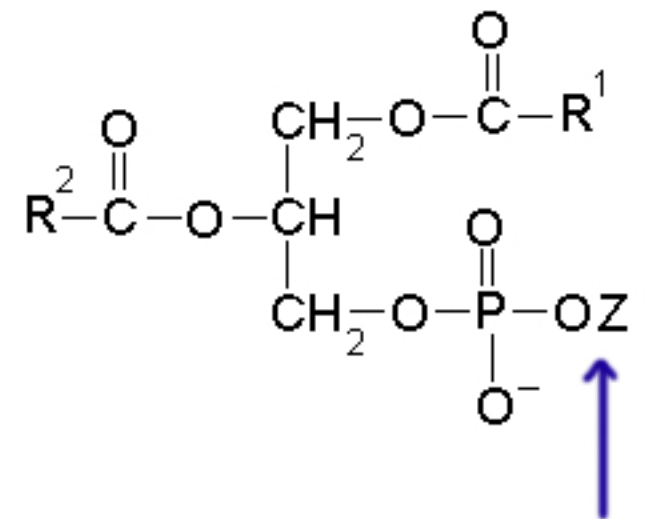
$Z = -H$ Phosphatidic acid

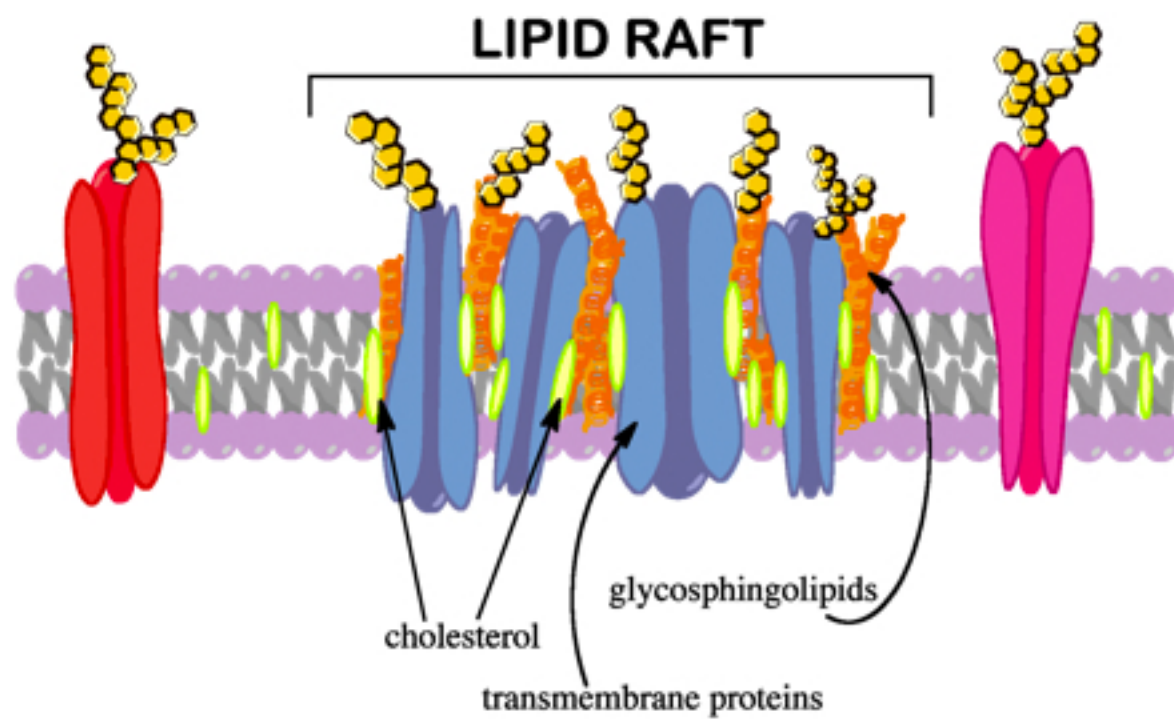
$Z = -CH_2-\underset{\substack{| \\ NH_2}}{CH}-COOH$ Phosphatidylserine

$Z = -CH_2-CH_2-\overset{+}{NH_3}$ Phosphatidylethanolamine

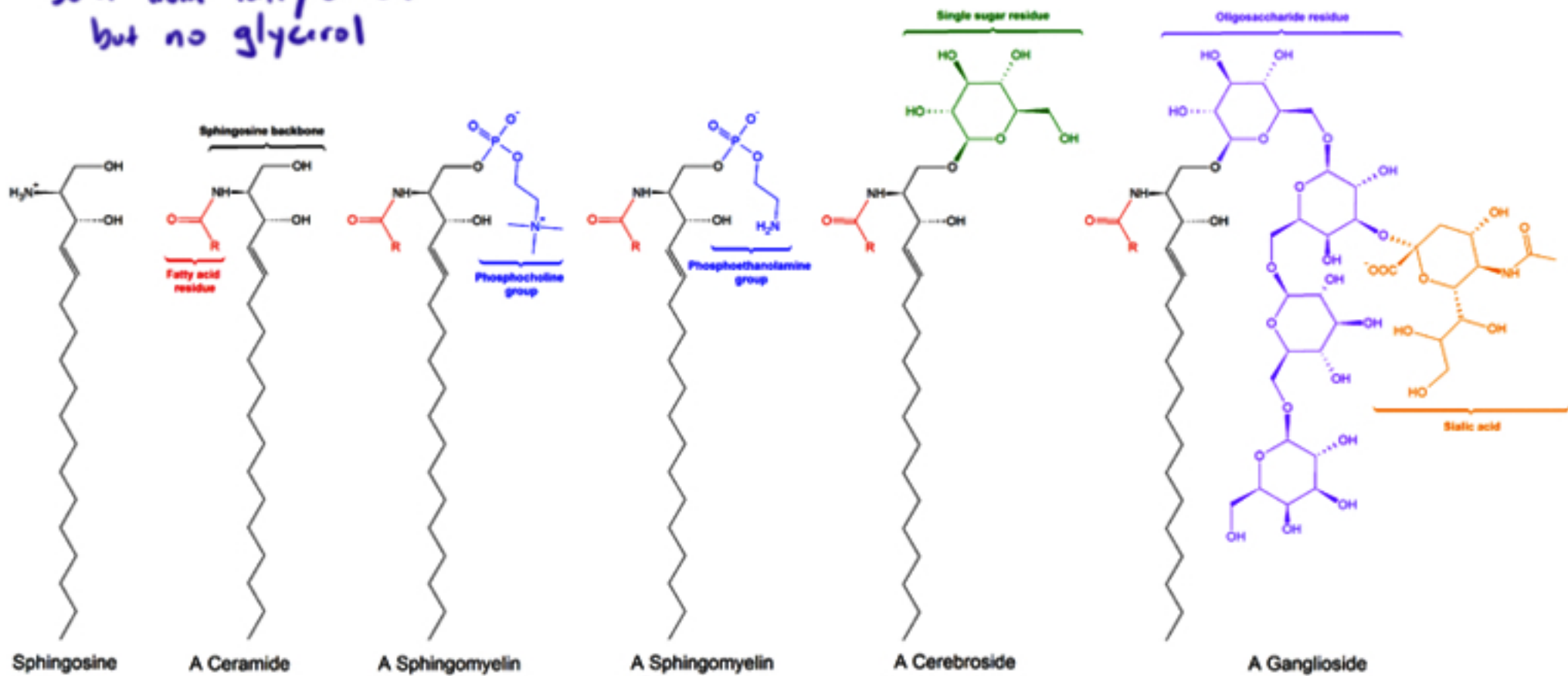
$Z = -CH_2-CH_2-\overset{+}{N}(CH_3)_3$ Phosphatidylcholine

$Z =$  Phosphatidylinositol





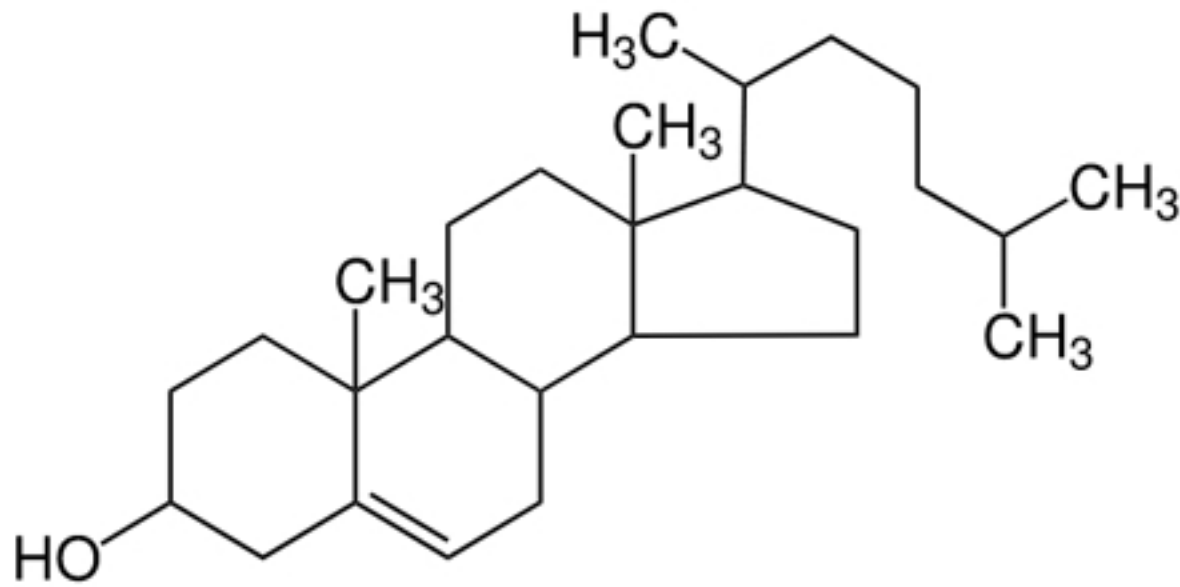
built from fatty acids
but no glycerol



↑
palmitoyl CoA
+ serine → $CO_2 + NADPH + FAD$

← common membrane lipids

Cholesterol

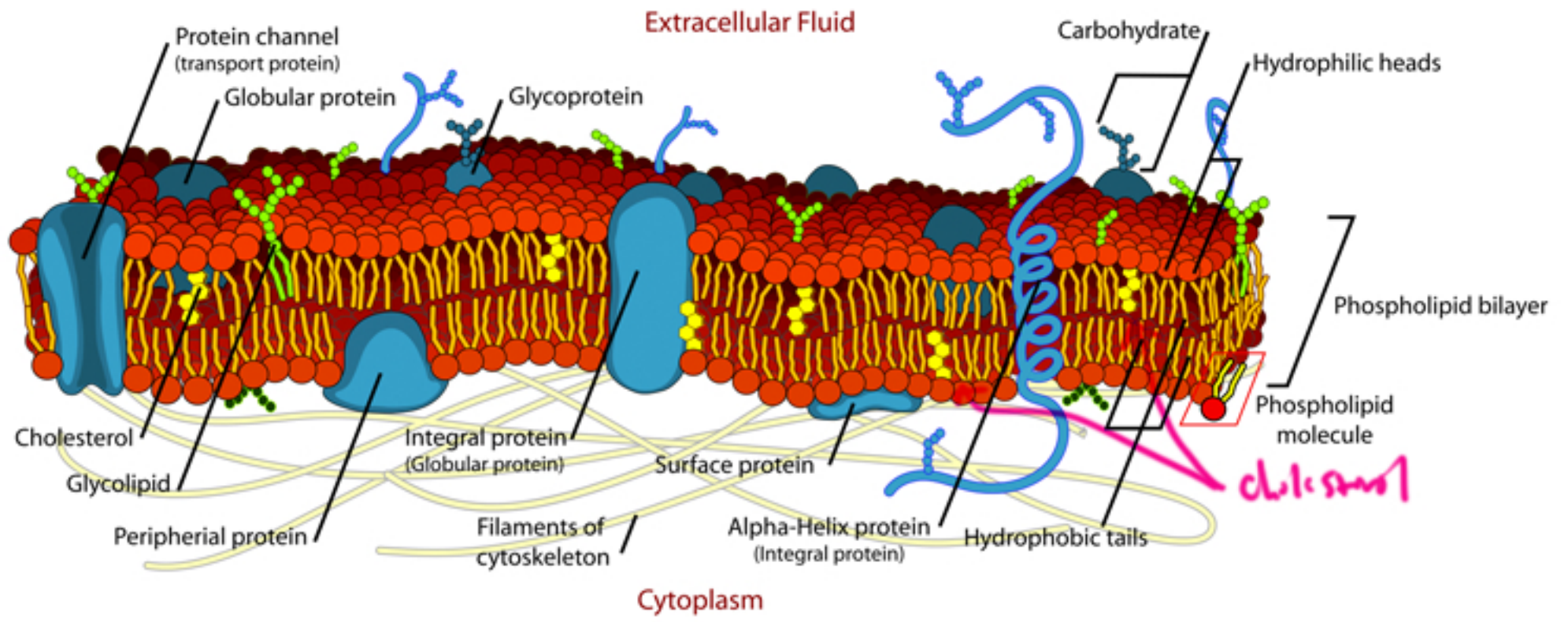


- lipid raft

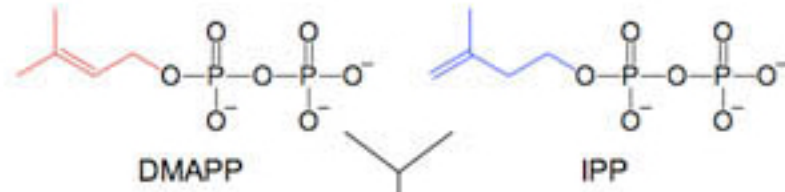
- serves as a fluidity buffer

- low T - prevents crystallization

- high T - increases viscosity

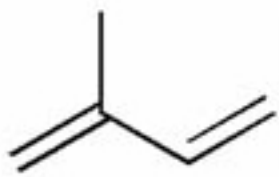
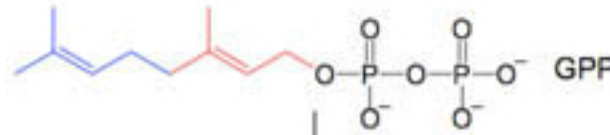


dimethylallyl pyrophosphate



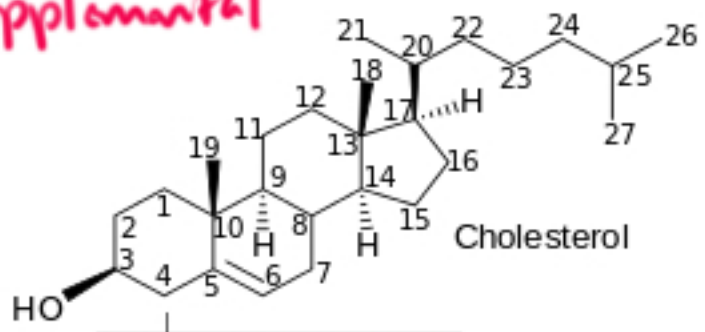
isopentenyl pyrophosphate

↑
mevalonate
↑
HMG-CoA
↑
3 acetyl CoA

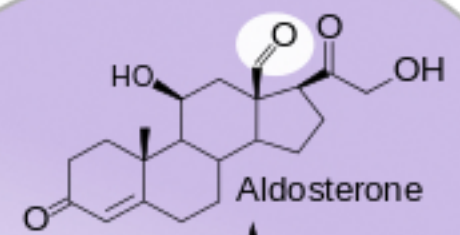


↓ 19 steps (NADPH, O₂, NADH)
cholesterol

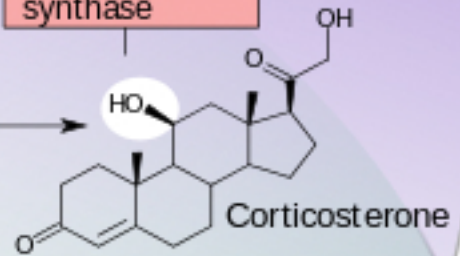
Supplemental



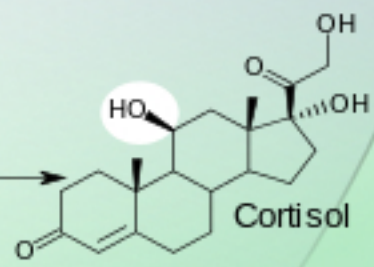
Mineralocorticoids
(21 carbons)



Aldosterone synthase

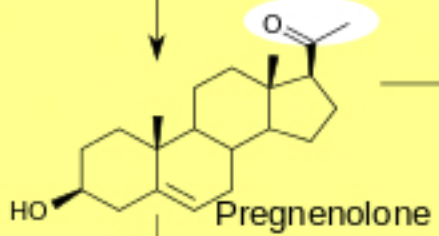


11 β -hydroxylase

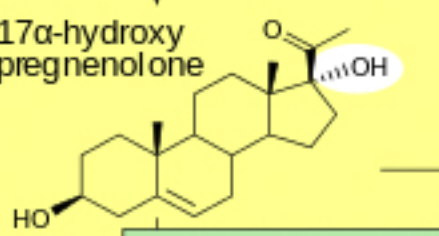


Glucocorticoids
(21 carbons)

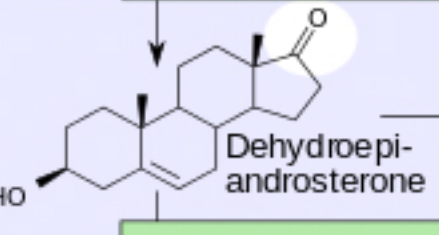
Progestagens (21 carbons)



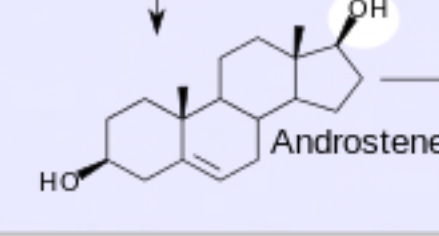
17 α -hydroxylase



17,20 lyase



3- β -hydroxysteroid dehydrogenase (3 β -HSD)



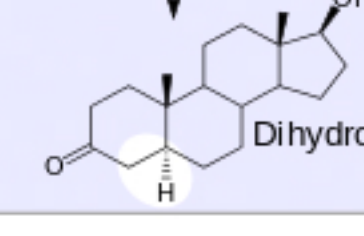
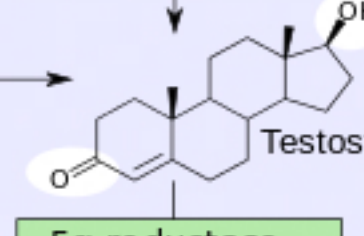
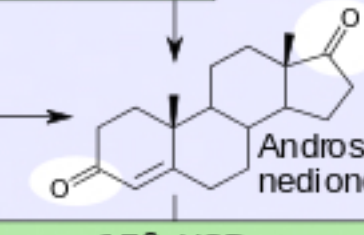
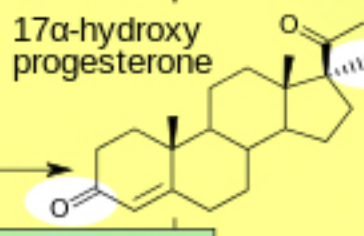
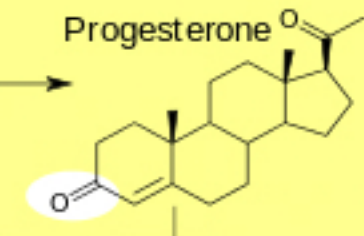
17 β -HSD



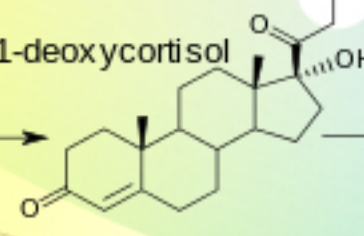
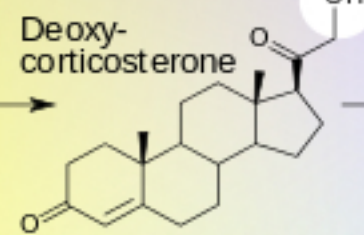
5 α -reductase



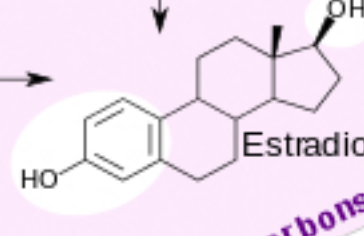
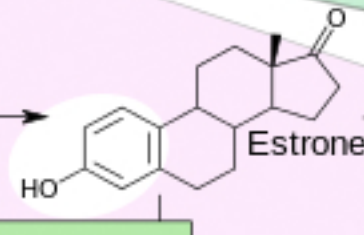
Androgens (19 carbons)



21-hydroxylase

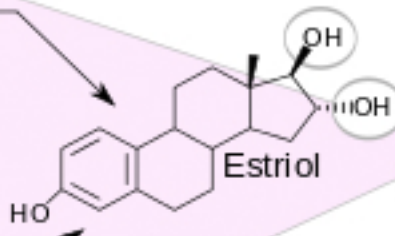


Aromatase



Estrogens (18 carbons)

(liver and placenta)

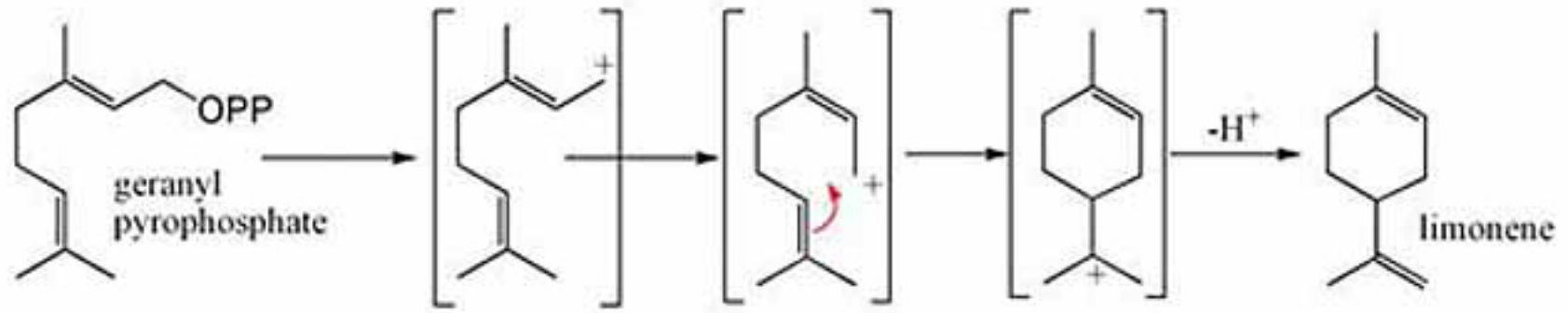


Cellular location of enzymes

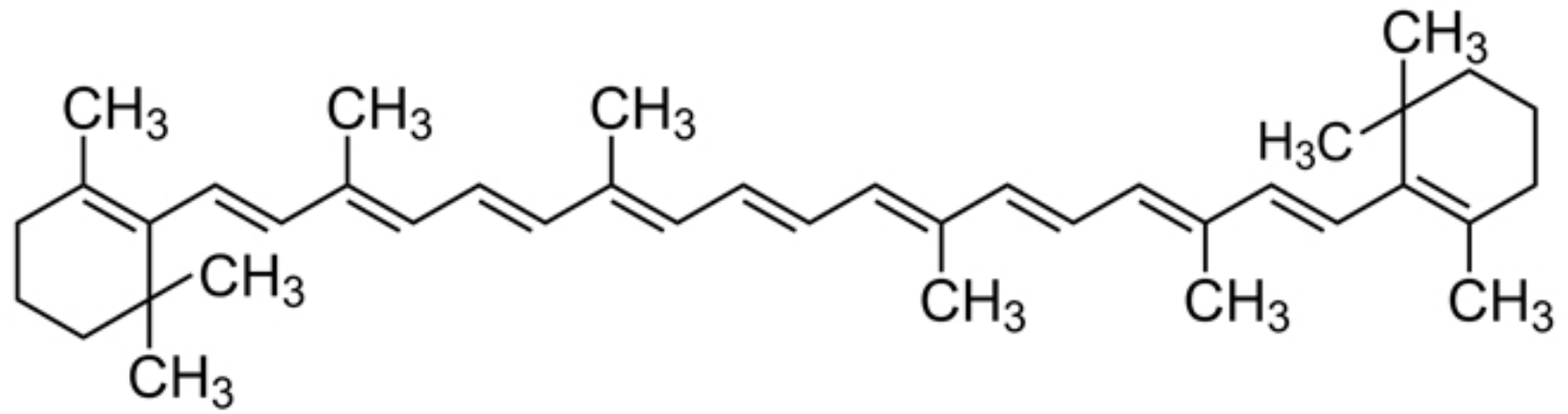
Mitochondria

Smooth endoplasmic reticulum

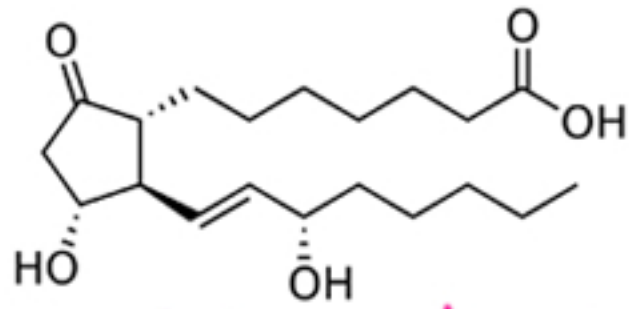
terpenes (plant essential oils)



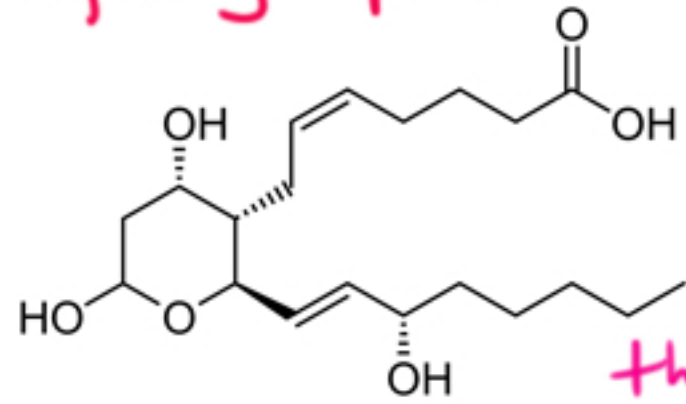
β carotene - precursor of retinal



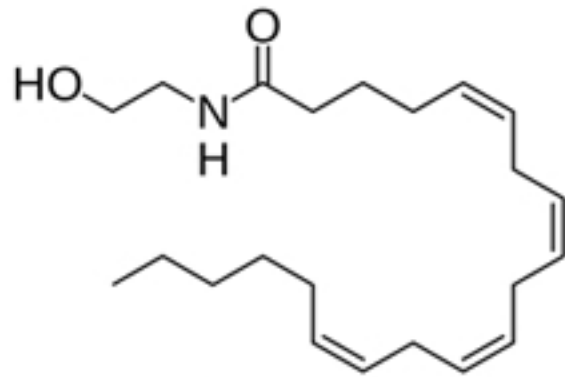
eicosanoid signaling lipids



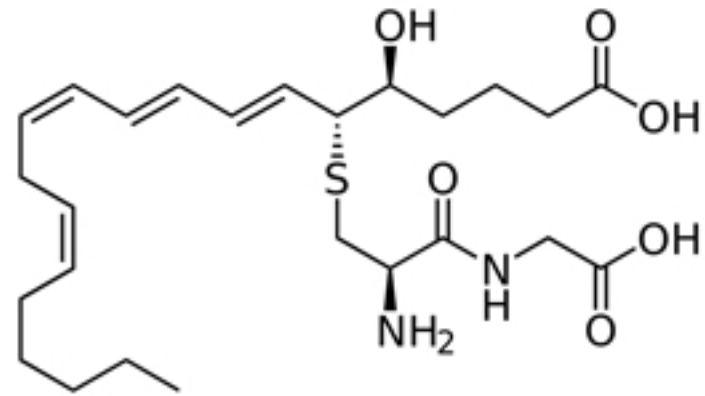
prostaglandin - alprostadil
(vasodilator, inflammation)



thromboxane
(vasoconstrictor)



anandamide
(neurotransmitter)



a cysteinyl
leukotriene