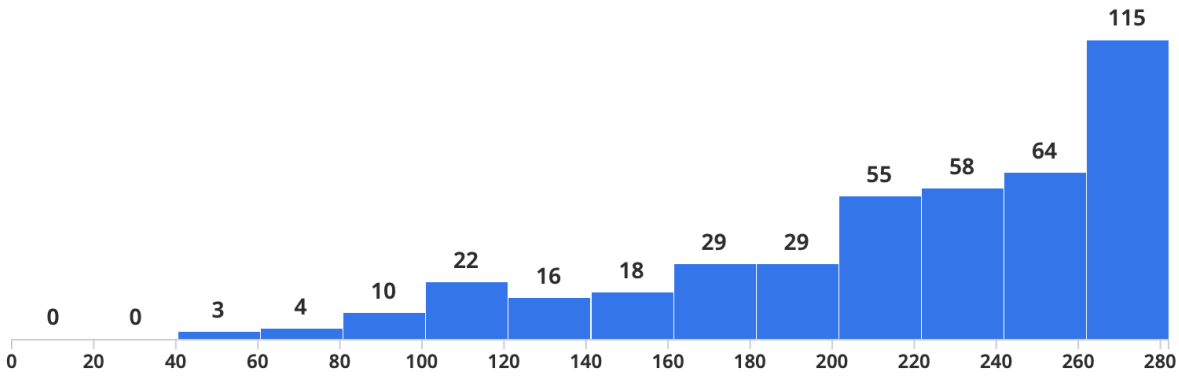
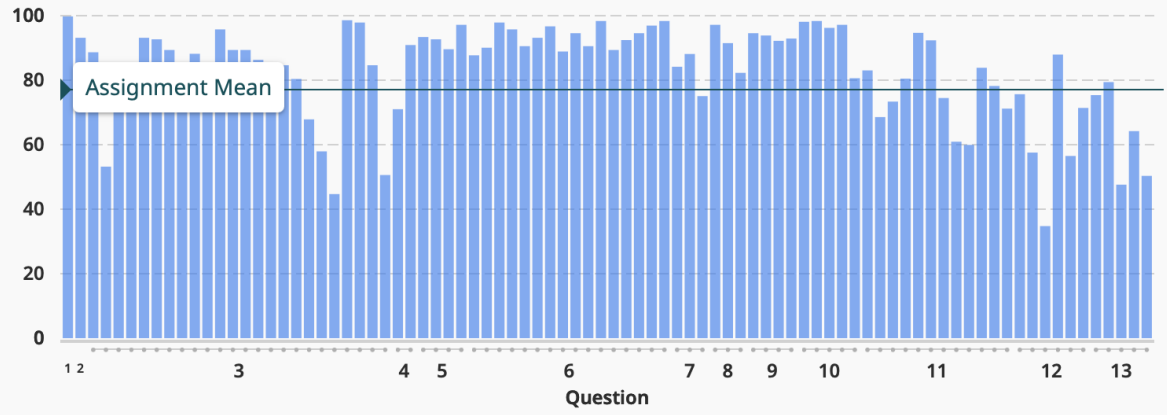
Review Grades for Midterm 3

● Regrade Requests Open ● Grades Not Published



Minimum	Median	Maximum	Mean	Std Dev
41.0	230.5	282.0	216.72	55.75



Midterm 3 282.0 points

Minimum	Median	Maximum	Mean	Std Dev
14.54%	81.74%	100.0%	76.85%	19.77%

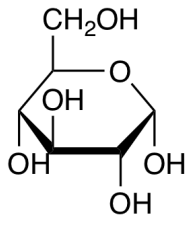
Corn starch → cheap polymer of α-D-Glucose

→ Converted to α-D-Glucose monomers using 2 enzymes:

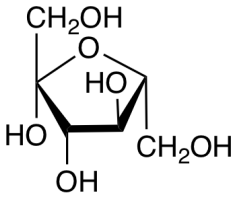
1) α-Amylase → takes starch polymer and makes smaller chains

2) Glucoamylase → converts the shorter chains to D-glucose monomers.

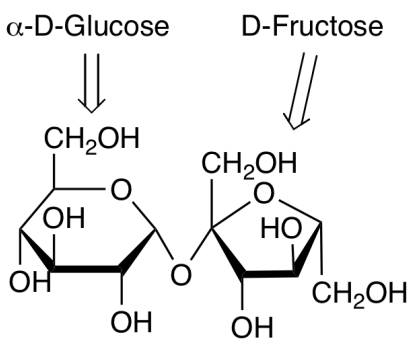
3) Some of the D-Glucose is converted to D-Fructose using xylose isomerase



α-D-Glucose



D-Fructose



Sucrose (Table Sugar)

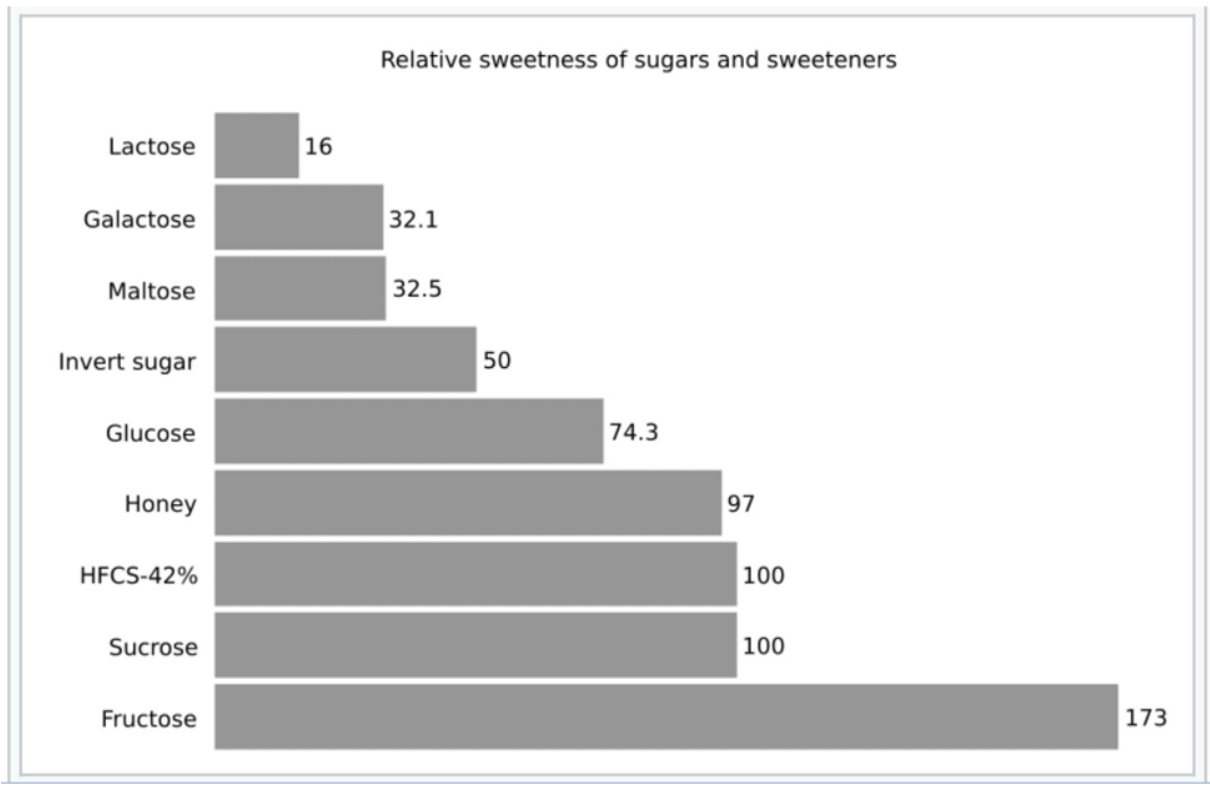
Final high fructose corn syrup:

55% D-Fructose 45% D-Glucose

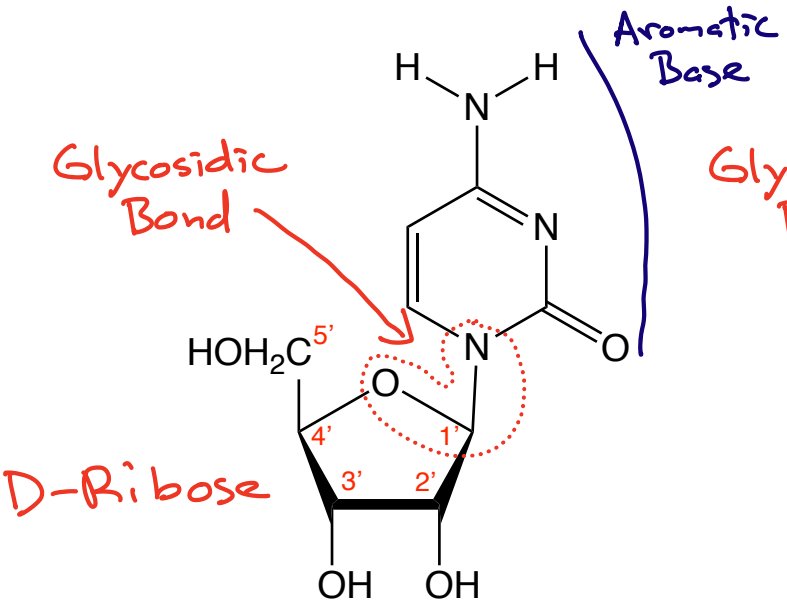
This is intended to mimic bee honey

38 ± 6% D-Fructose 30 ± 8% D-Glucose

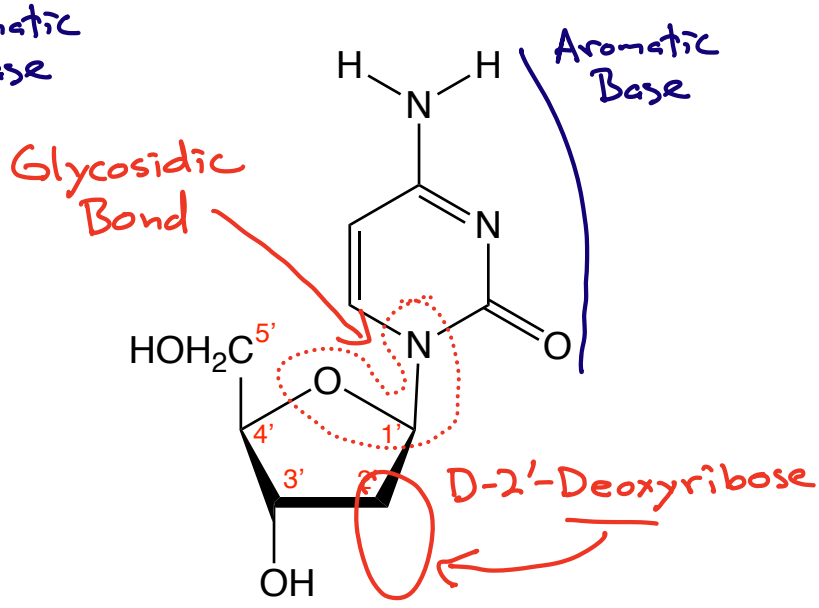
5 ± 4% Sucrose



RNA



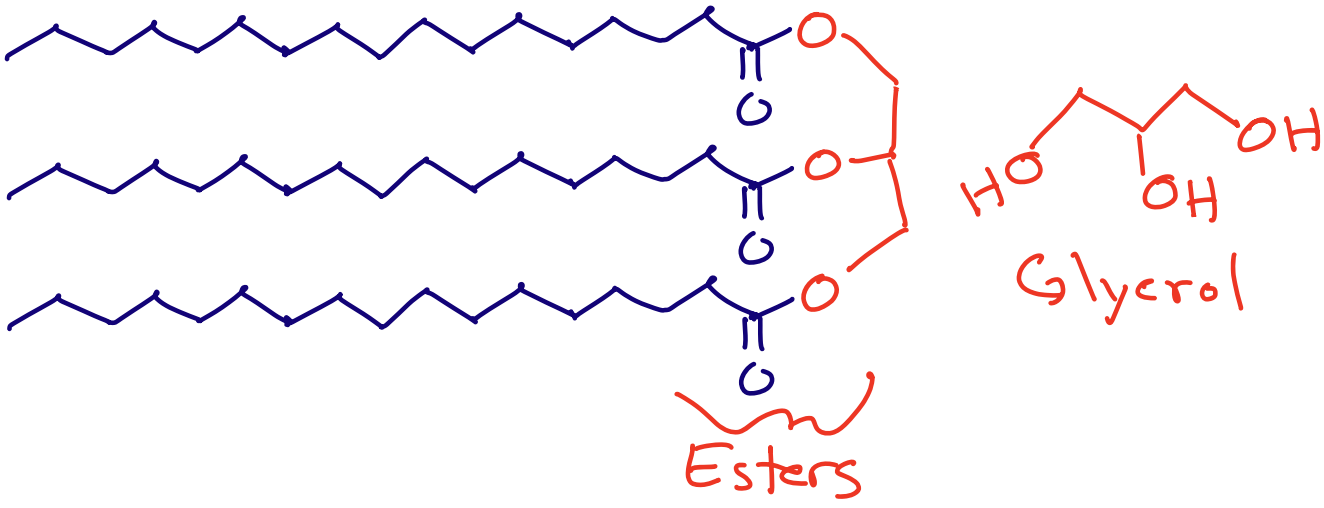
DNA

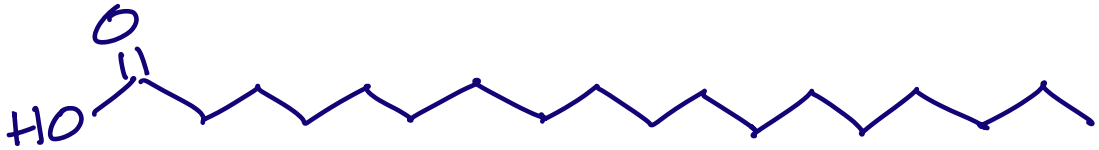


In RNA and DNA → The aromatic base is linked to the D-ribose or D-2'-deoxyribose through a glycosidic bond!

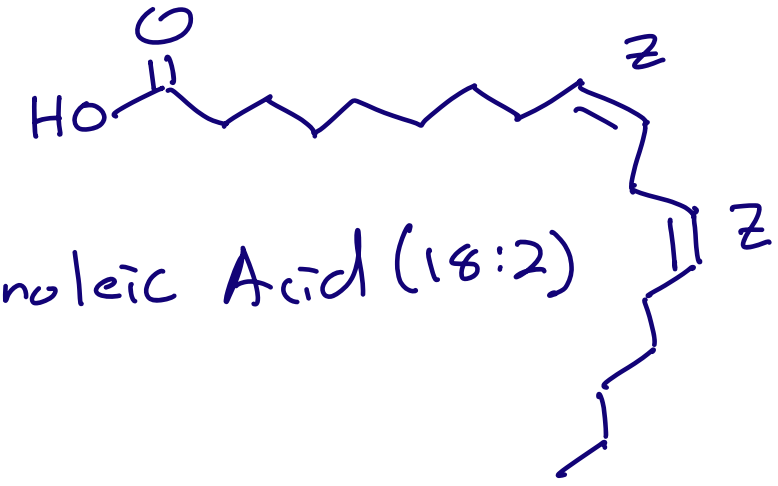
Lipids → Biological molecules that are not soluble in water

Triglycerides → Fats and oils





Stearic Acid (18:0)



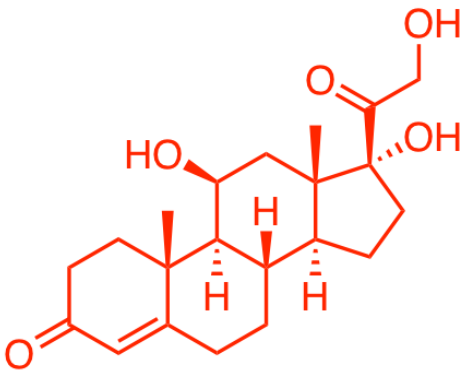
Linoleic Acid (18:2)

$Fa H_x$ Acids

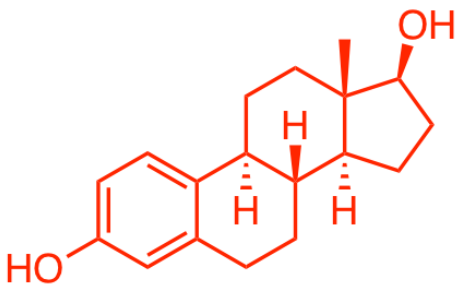
Steroids → Rigid multiring structures that are important signals

→ Bind to specific receptors that cause many genes to be turned on or off

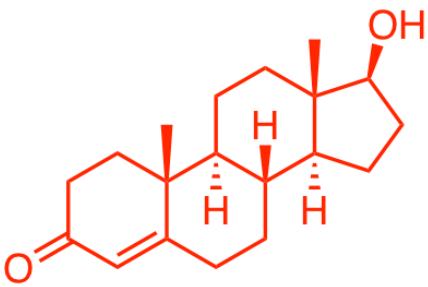
→ Rigid structure ensures high degree of specificity for these critical functions



Cortisol

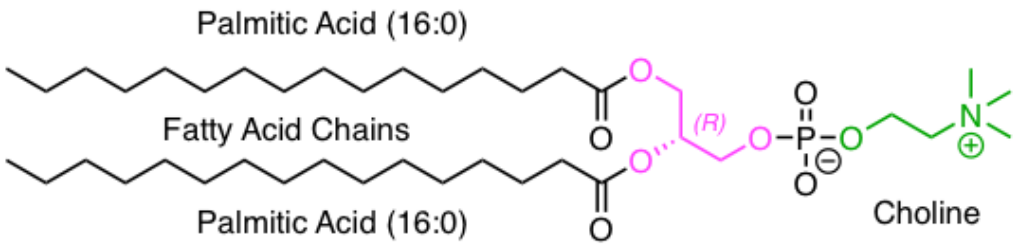


Estradiol

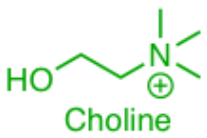


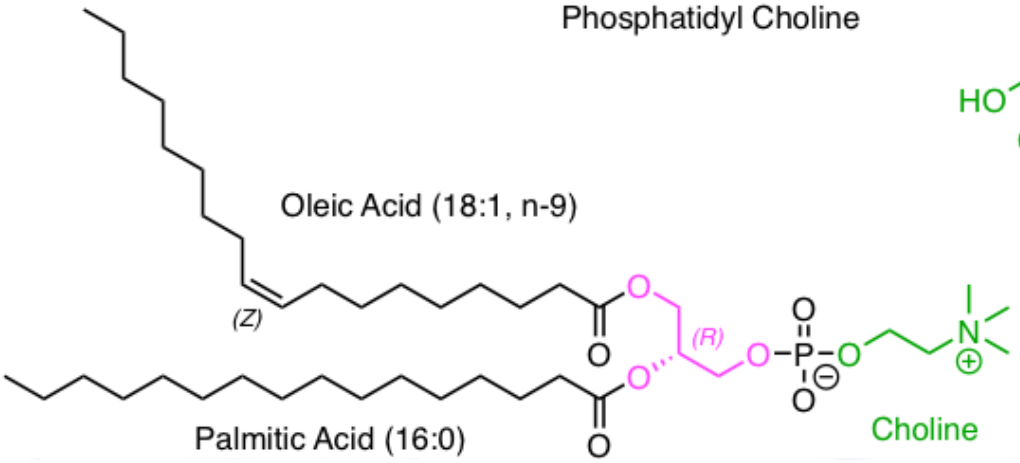
Testosterone

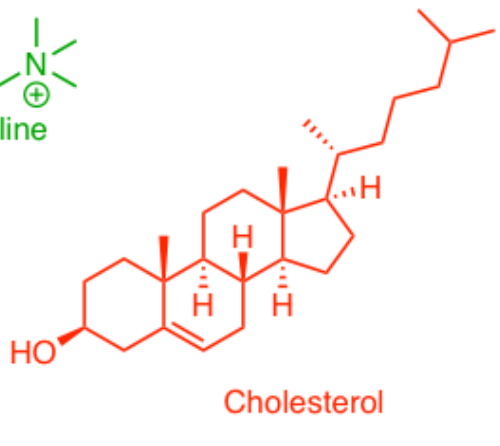
Phospholipids → Make up cellular membranes



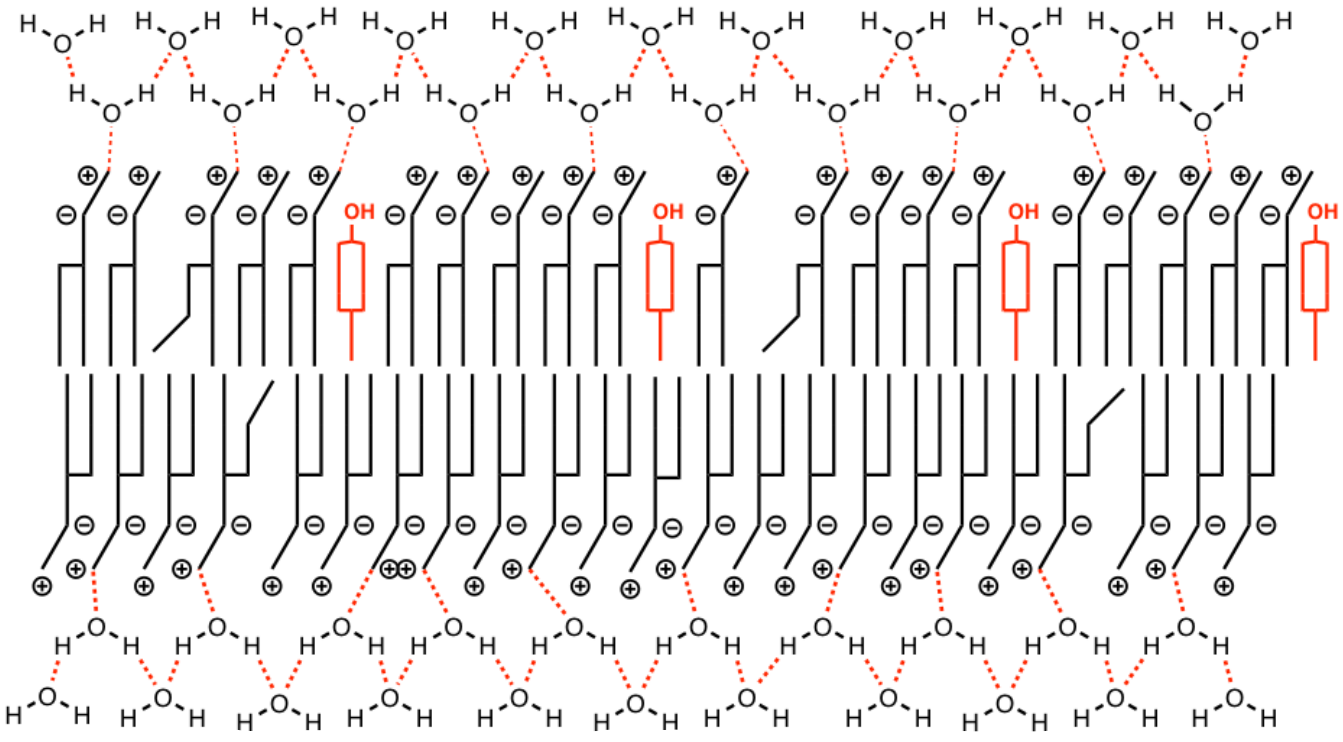
Phosphatidyl Choline







Phospholipid membrane bilayers → The Z double bonds and cholesterol combine to make the membranes fluid enough to operate effectively



Lipid Bilayer Membrane

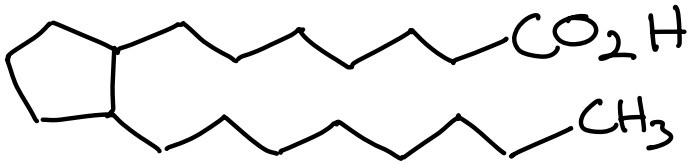
So what holds membranes together?

The fatty acid chains are not soluble in water → The strong hydrogen bonds in water prevent the alkyl chains from "dissolving" into the water → Only things that can interact strongly with polar water molecules dissolve in water. → To break up water-water hydrogen bonds a molecule must be charged and/or be capable of strong hydrogen bonds

"Like likes like" → Key rule of solvents

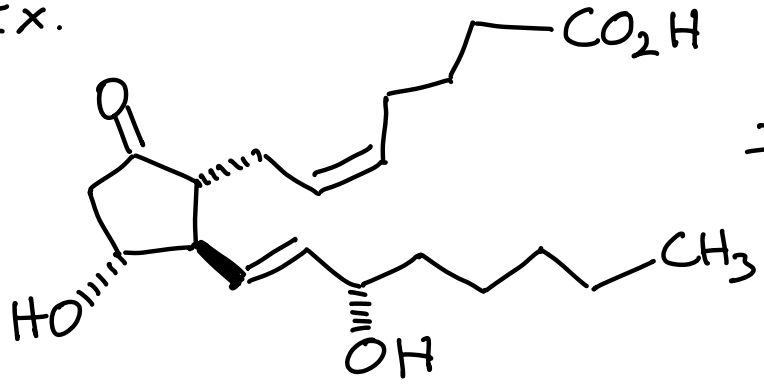
!!! ⟹ The alkyl chains cannot interact with water so they must therefore associate together providing the driving force to hold membranes together

Prostaglandins → another important lipid



Prostaglandin general formula – 20 carbons

Ex.



PGE_2

⇒ Key mediator of inflammation and immunity
- swelling
- vasodilation
- suppresses T-Cell response

Speeds healing of bone

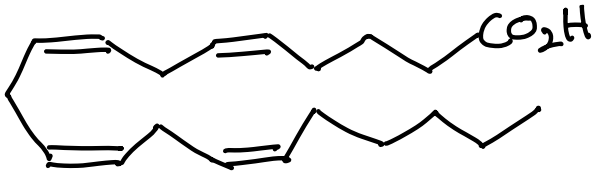
Induces uterine contractions

Enhances pain and causes fever

All of these are <u>local</u> effects → as opposed to steroids that have more systemic effects

Prostaglandins are synthesized when needed → not stored.

Important medication involving prostaglandins — Aspirin



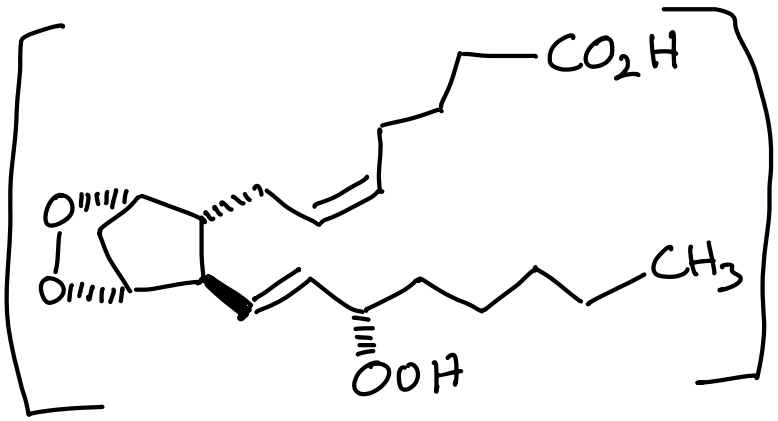
Arachidonic Acid

An enzyme called cyclooxygenase (COX)

⇐ Aspirin inhibits this

⇐ So do other non-steroidal anti-inflammatory drugs (NSAIDS)

Aleve
Advil
Motrin
Celebrex

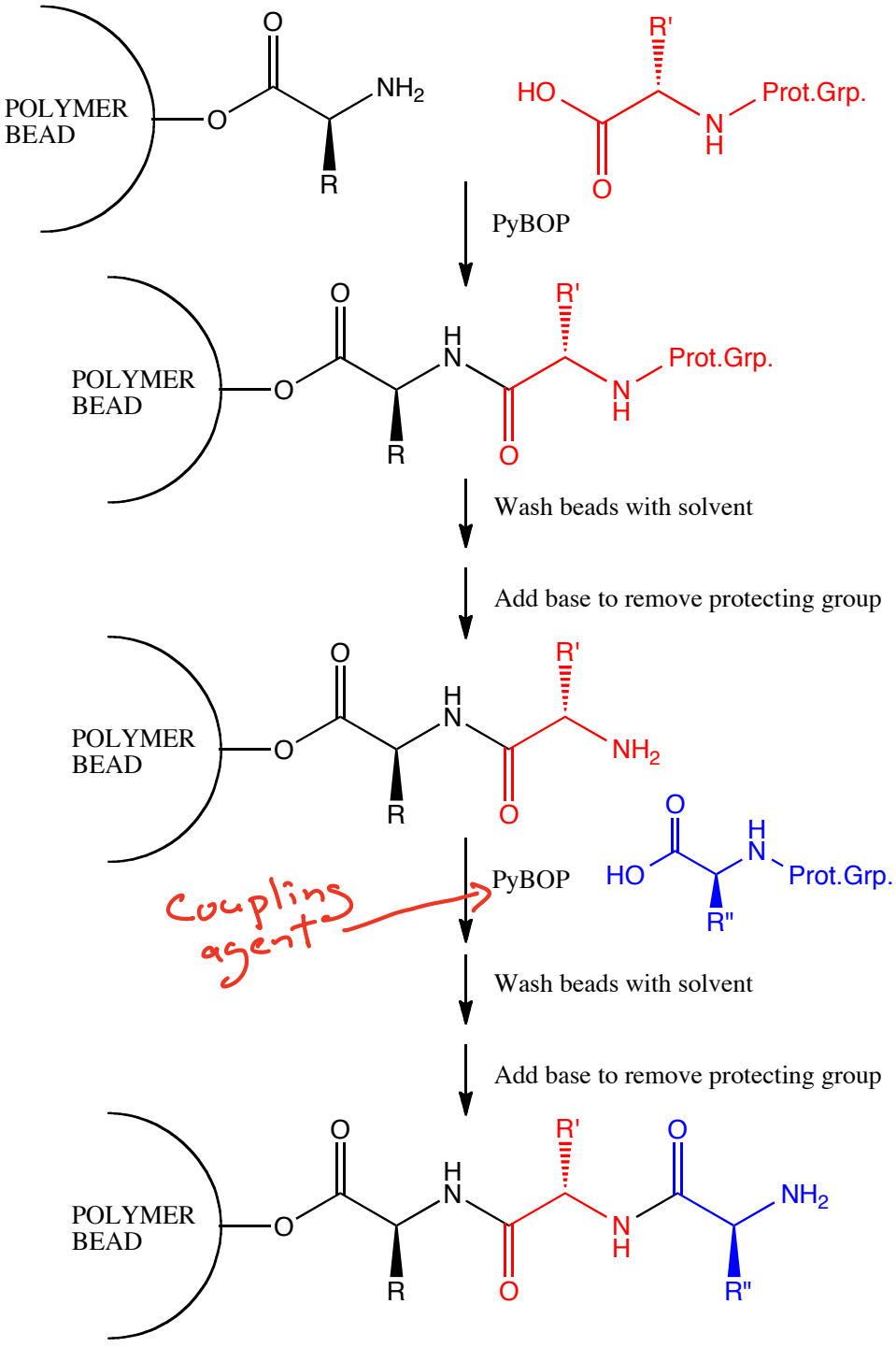


Unstable intermediate

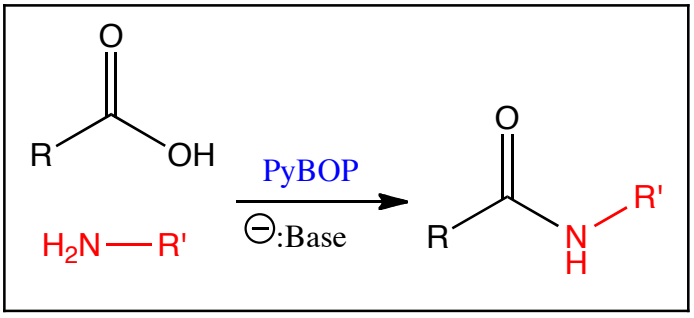
↓

Immediately converted to other prostaglandins that control various important functions involved with inflammation, pain, fever

Solid Phase Peptide Synthesis



Repeat as necessary then remove from resin. Can add up to 100 amino acids this way.



Good Leaving Group

PyBOP

overall an electrophile

:Base

REALLY Good Leaving Group

Good Nucleophile

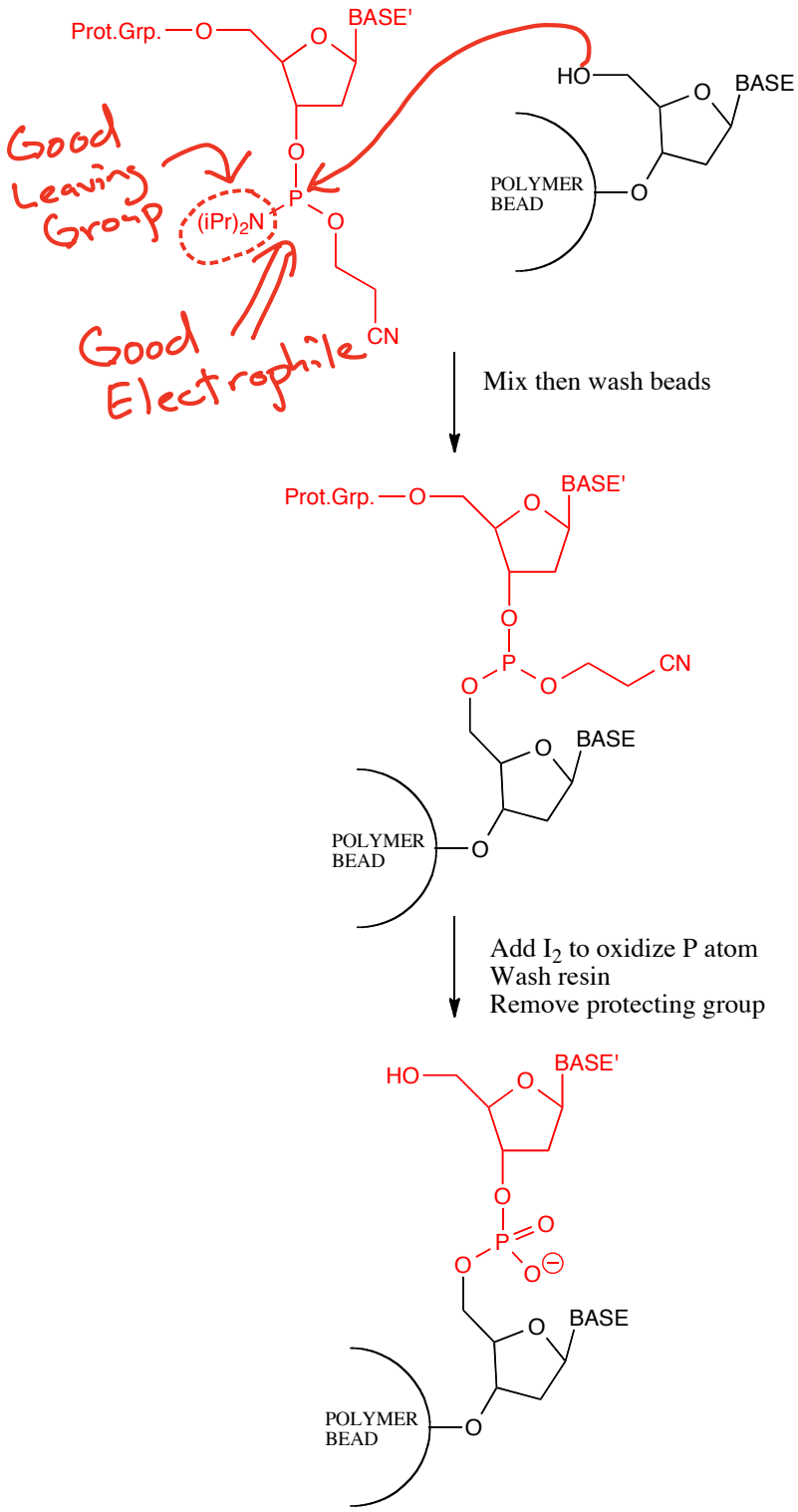
Good Leaving Group

Formation of this strong bond drives reaction

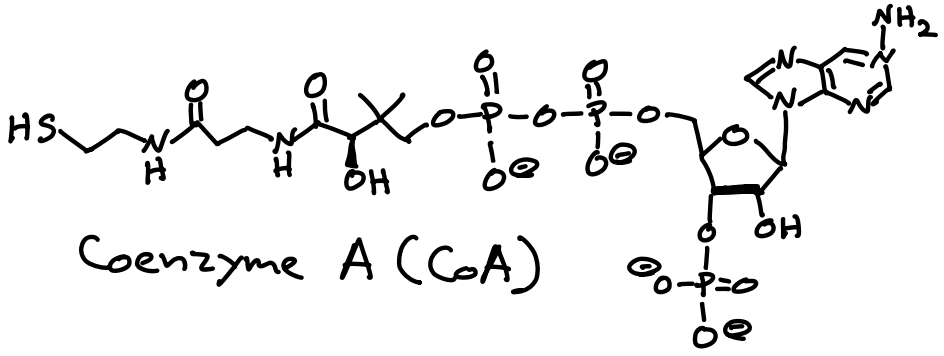
Provides "Motive"

Just like the Wittig reaction!

Solid Phase Synthesis of DNA

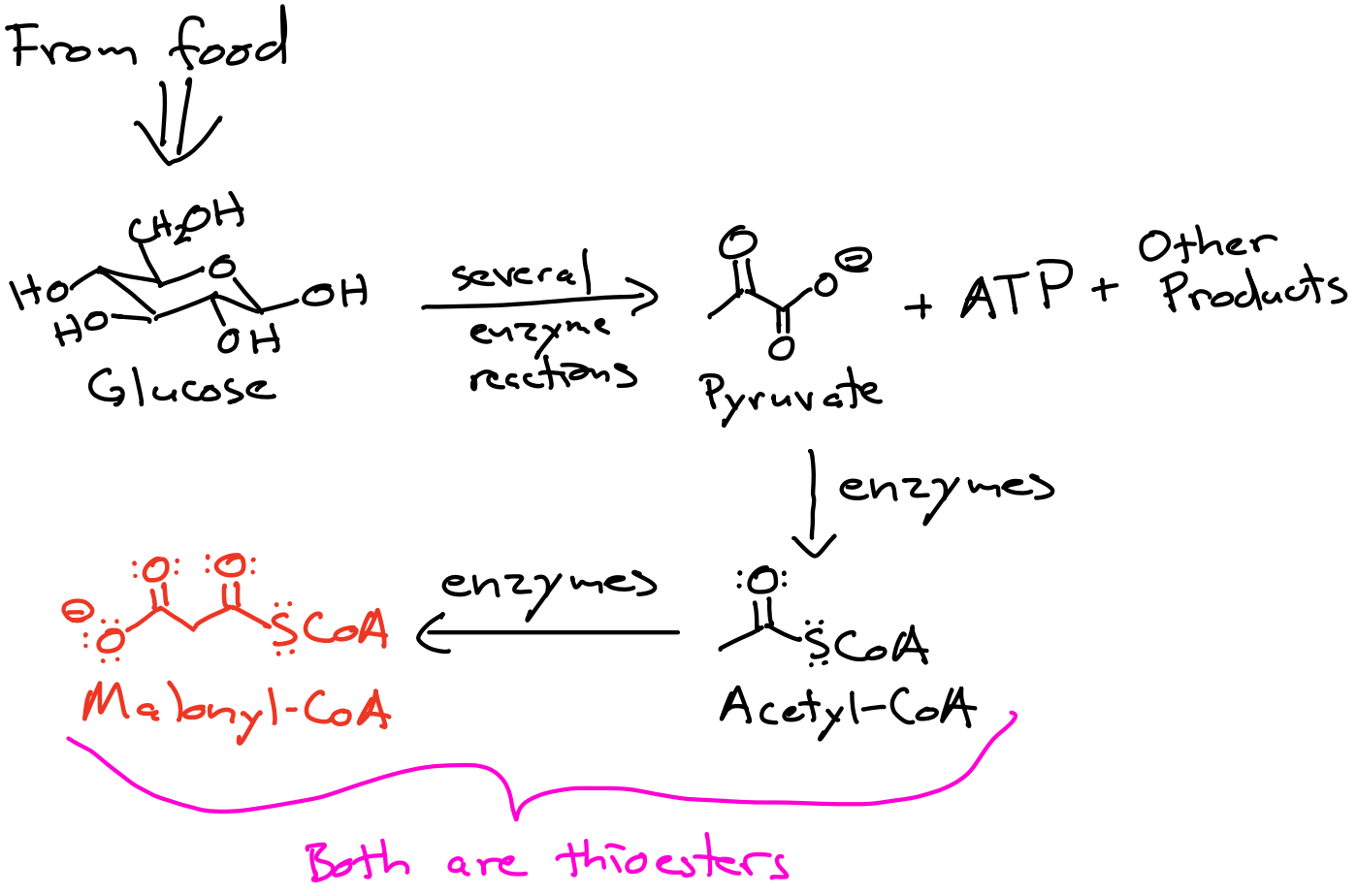


How does mother nature make C-C bonds? → ENOLATES!

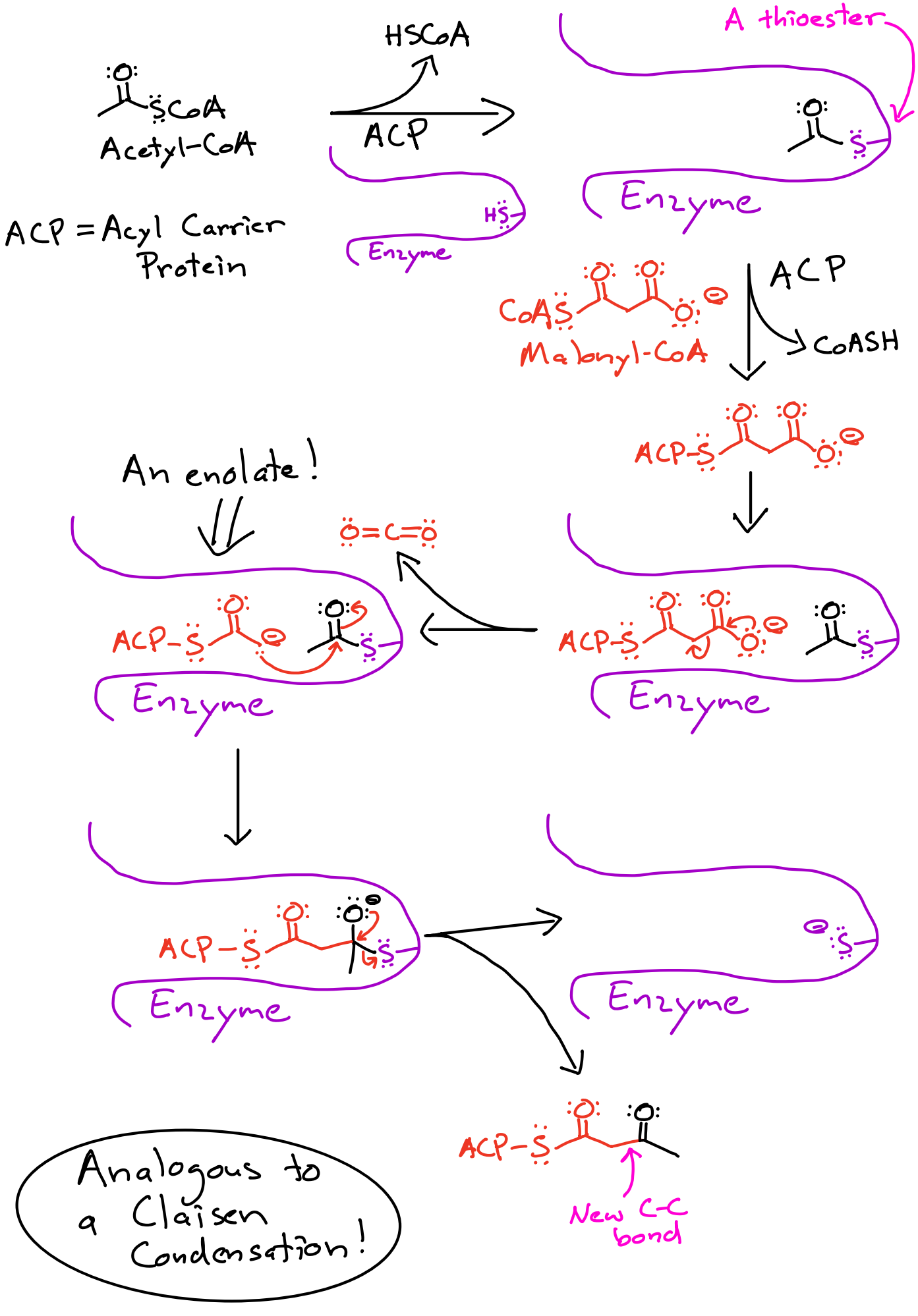


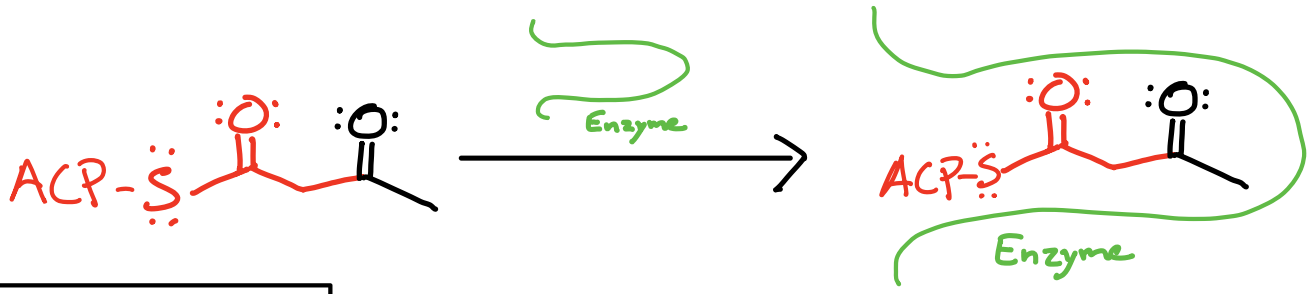
Coenzyme A (CoA)

Thioesters → more reactive than esters → $^{\ominus}$S-R is a better leaving group (more stable anion) than $^{\ominus}$O-R.



These are used to make C-C bonds in a reaction catalyzed by an enzyme that resembles a Claisen!

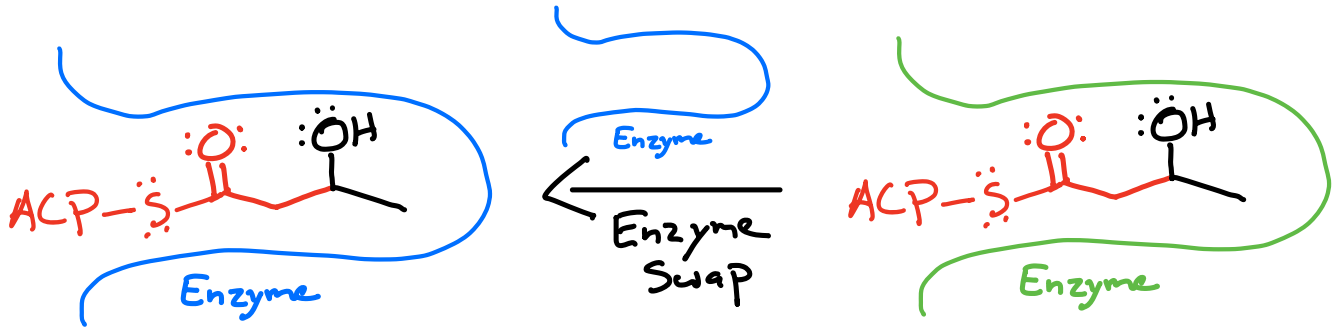

HSCoA
ACP
Acetyl-CoA
ACP = Acyl Carrier Protein
A thioester
Enzyme
HS
Enzyme
CoAS
Malonyl-CoA
ACP
CoASH
ACP-S
An enolate!
O=C=O
ACP-S
Enzyme
ACP-S
Enzyme
ACP-S
Enzyme
Enzyme
ACP-S
New C-C bond
Analogous to a Claisen Condensation!



The substrate is handed off from one enzyme to another

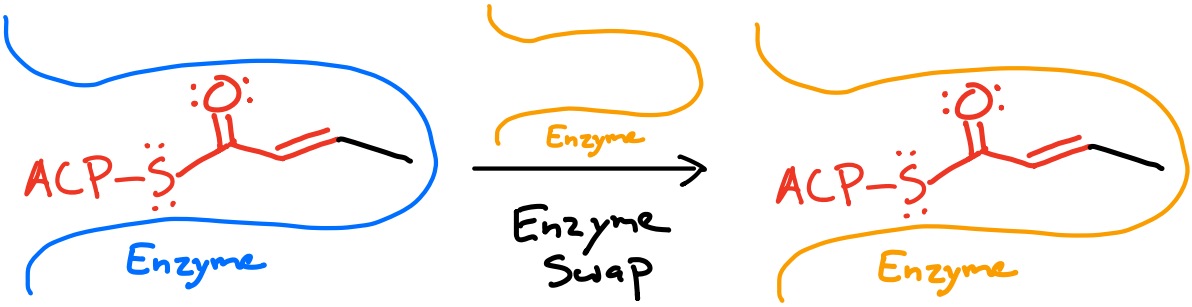
NADPH
(biological reducing agent)

Analogous to 1) $NaBH_4$ 2) H_2O or H_2/Pd°



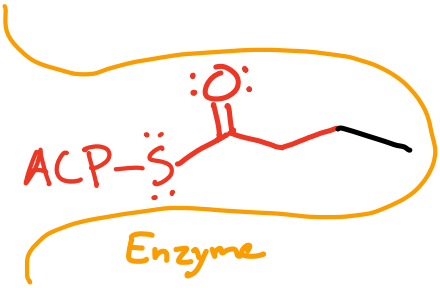
Analogous to $H^\oplus$/heat

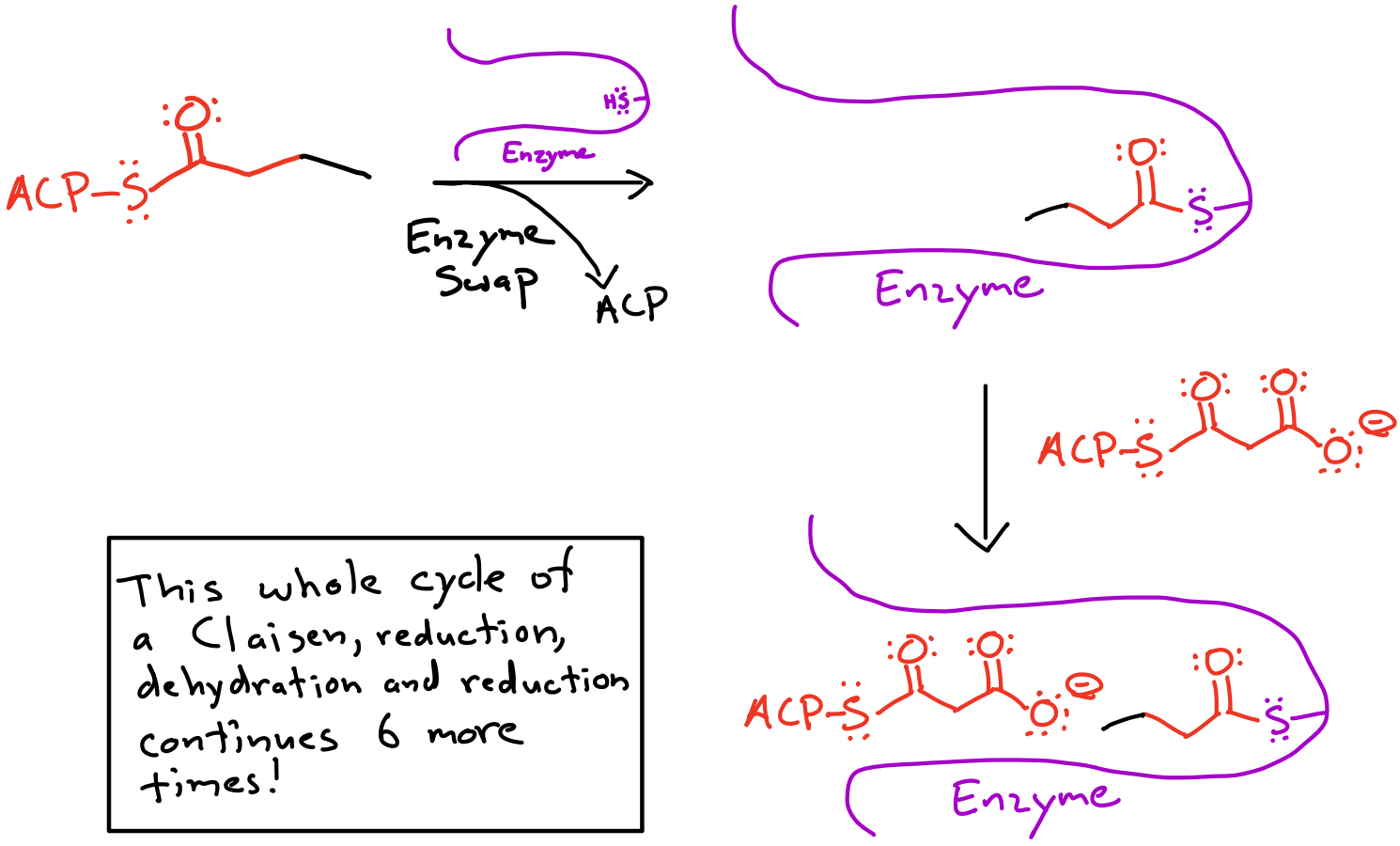
Dehydration



NADPH
(biological reducing agent)

Analogous to H_2/Pd°

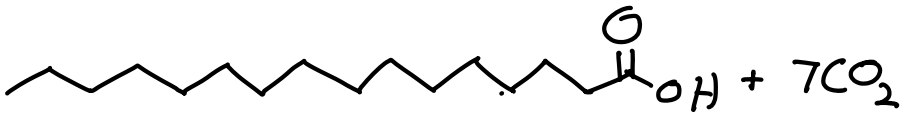




This whole cycle of a Claisen, reduction, dehydration and reduction continues 6 more times!

Overall Process:

Acetyl-CoA
+
7-Malonyl-CoA
+
14 NADPH



Palmitic acid
(a C_{16} fatty acid)

Major Take Home Lesson

The chemistry of biological systems resembles the chemistry we have learned!

You are now well-prepared to crush biochemistry!