Today

Loose Ends

Reactions

Polymers

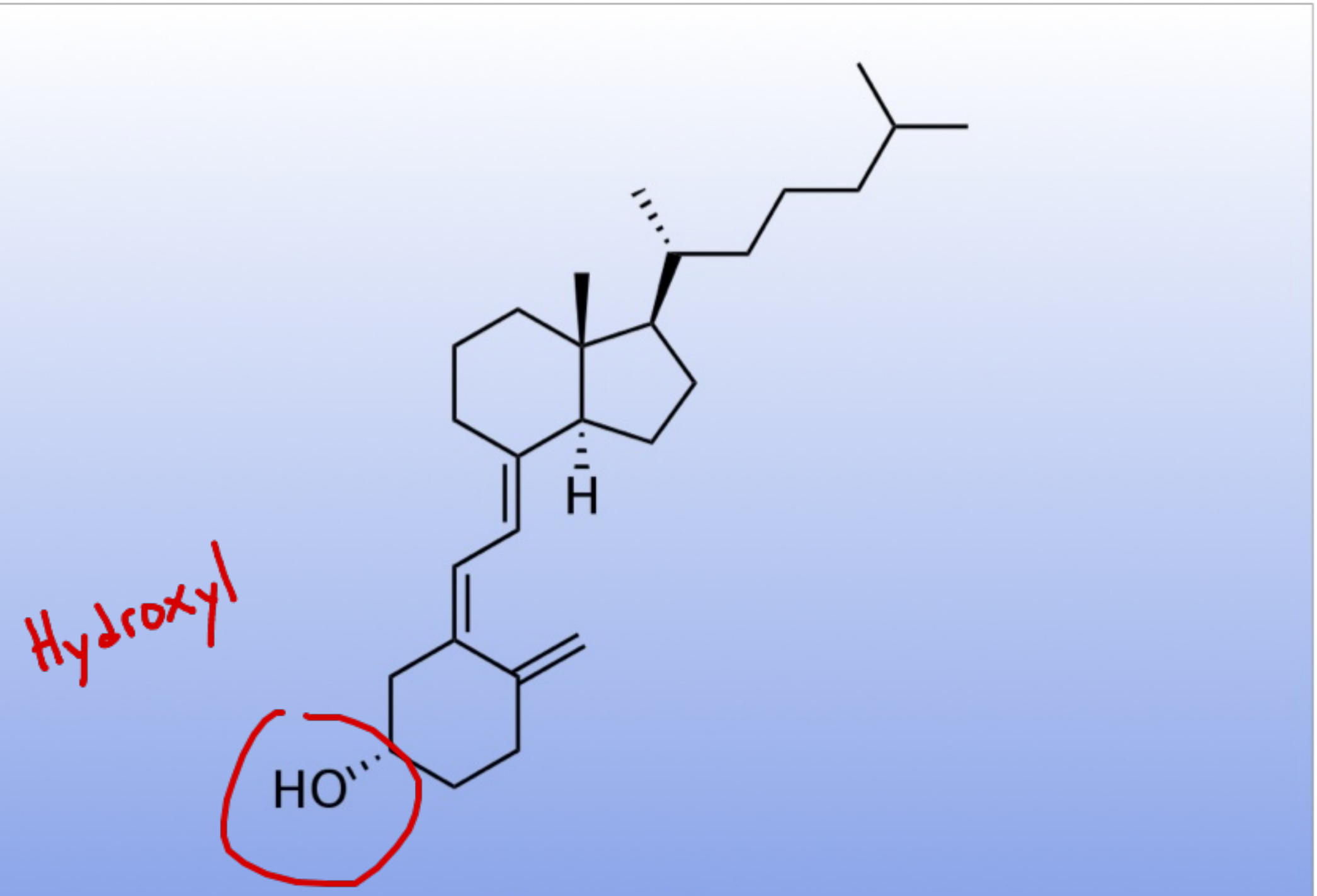
Names for isolated "groups"

-OH Hydroxyl

-NH_2 Amino

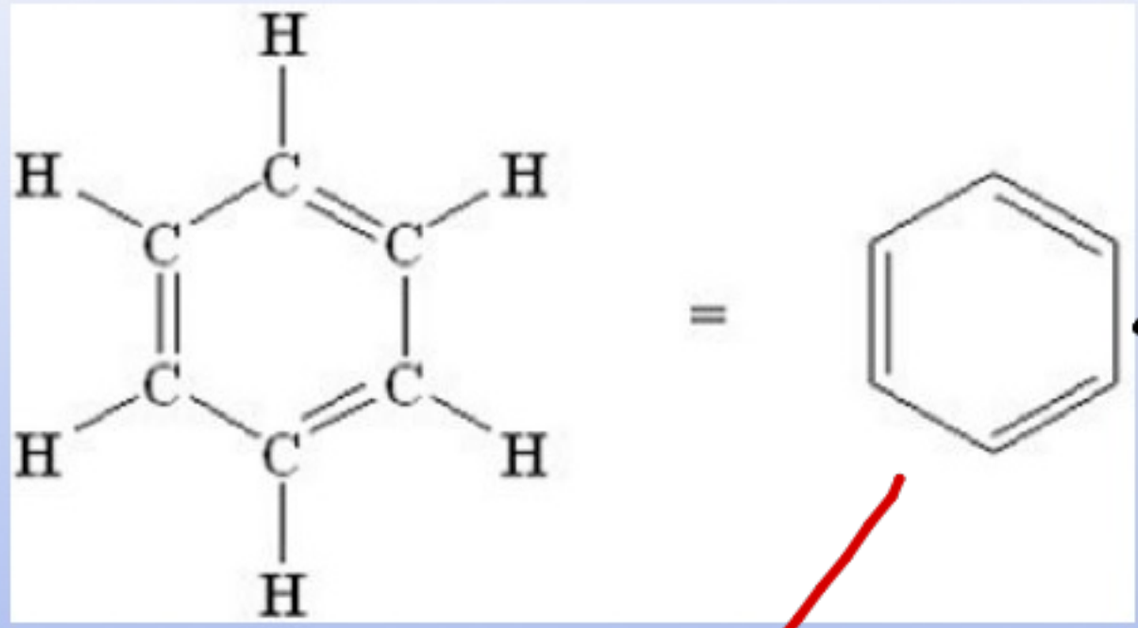
Carbonyl

Carboxyl



Vitamin D_4

Our friend the benzene ring



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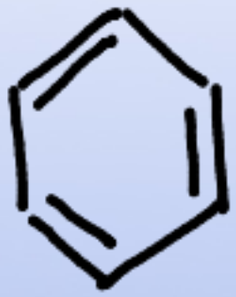
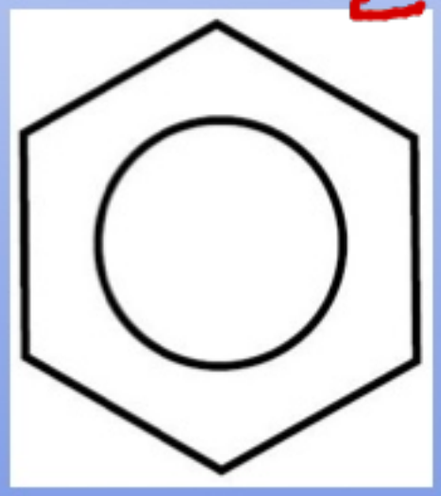
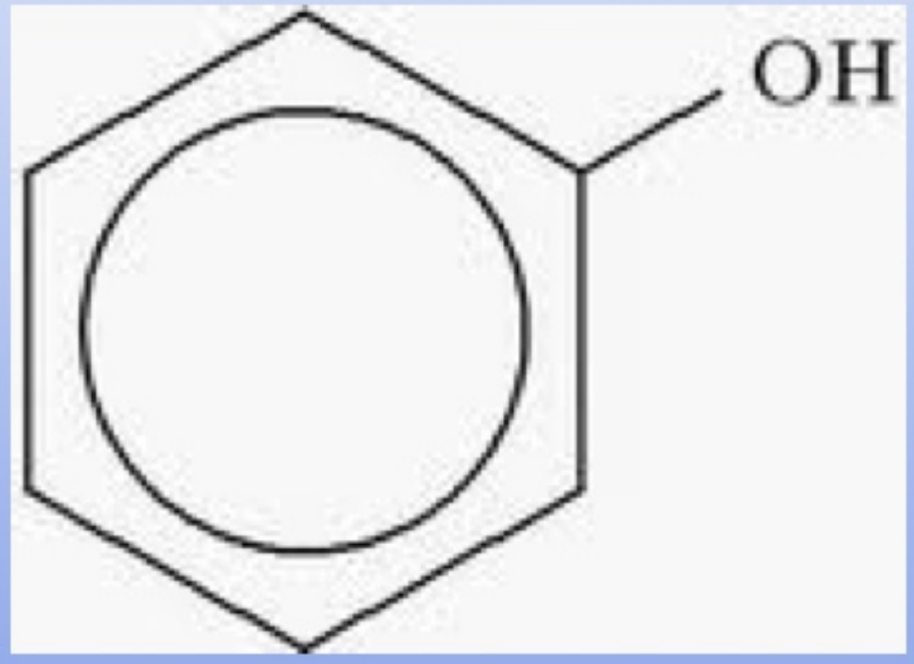


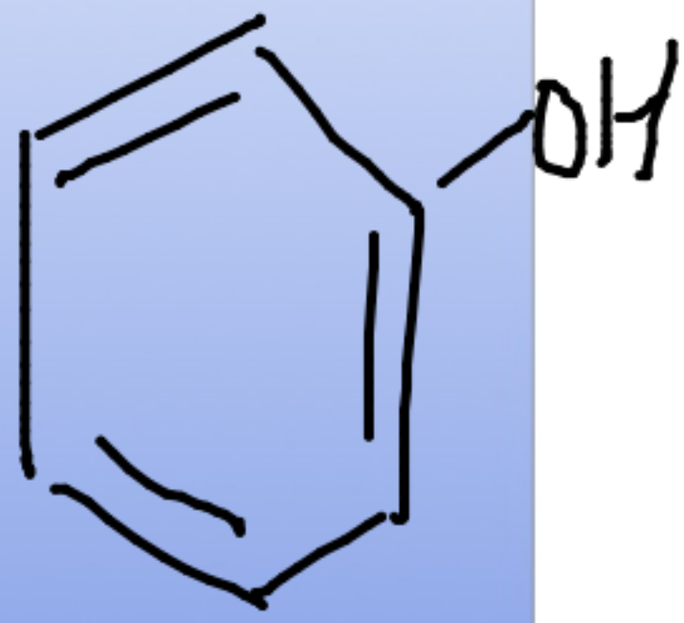


phenyl
aromatic
group

Another important Functional Group

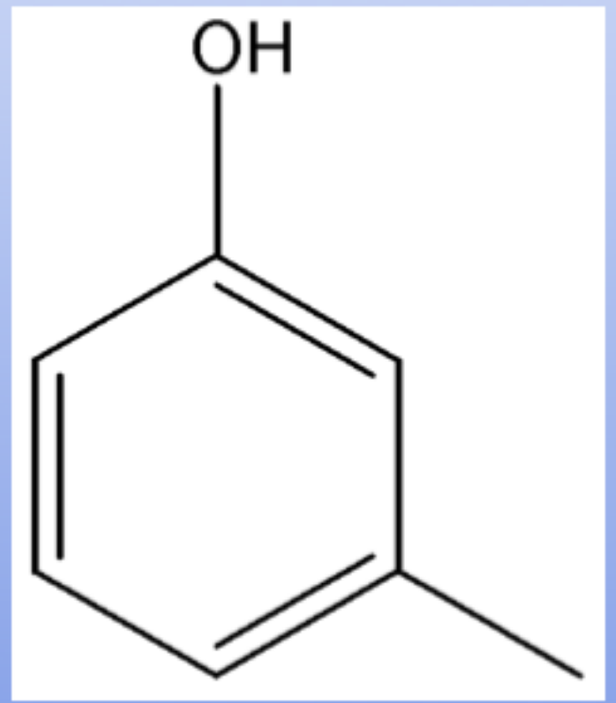
Phenol





Nomenclature

Number carbons clockwise with
#1 starting at the functional group



3 methyl phenol

The chemistry of phenols is

A. essentially the same as that of primary alcohols

B. essentially the same as that of secondary alcohols

C. essentially the same as that of tertiary alcohols

D. differs substantially from alcohols

That is why it is its own functional group

2H

1H

ϕH

Primary

Secondary

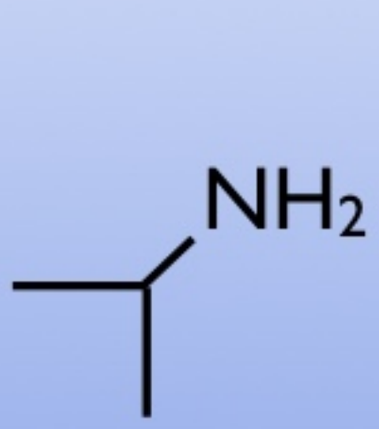
Tertiary

Amine

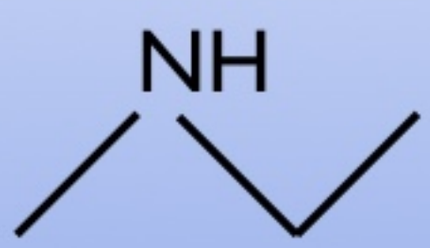
R-NH_2

R,R'-NH

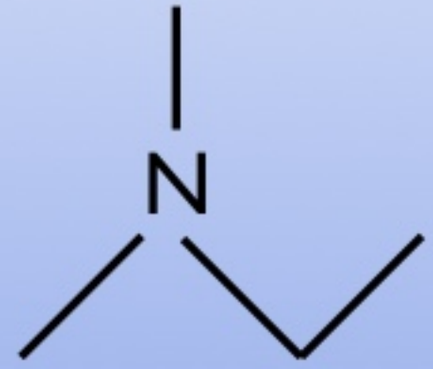
R,R',R''-N



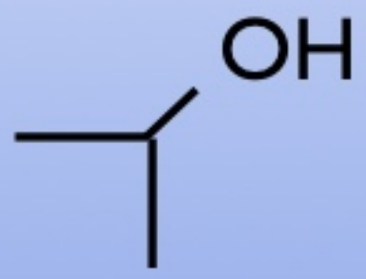
l-methyl ethyl amine



methyl ethyl amine



dimethyl ethyl amine

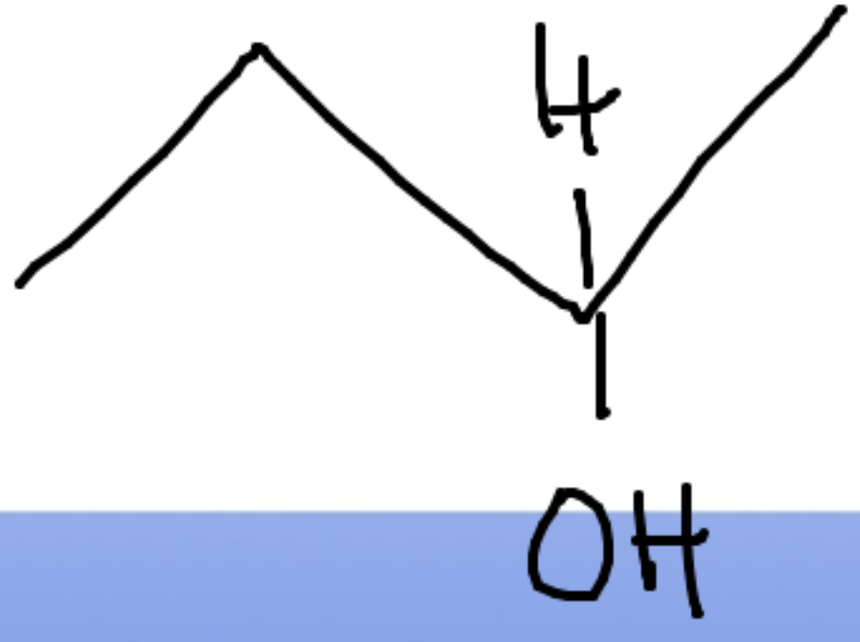
	Primary	Secondary	Tertiary
Alcohol	RCH_2OH	RCHOH	RCOH
			
	1 propanol	2 propanol	2-methyl 2-butanol

2 butanol is a

A. primary alcohol

B. secondary alcohol

C. tertiary alcohol

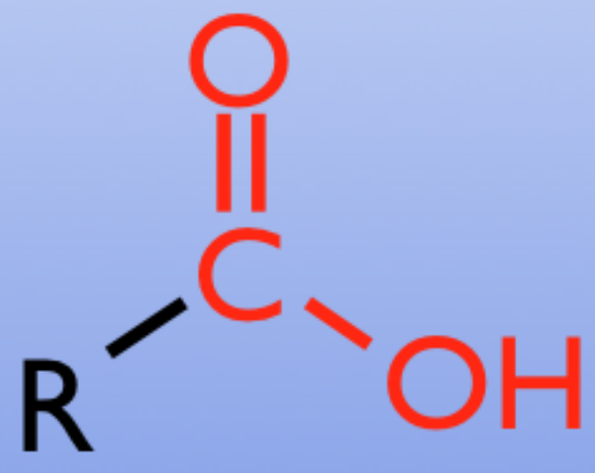


Important Reaction for Biochemistry

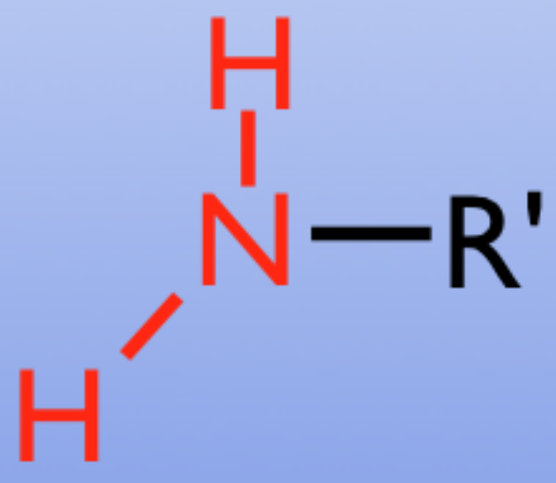
Formation of an Amide

They don't call them functional groups for nothing

Carboxylic Acid

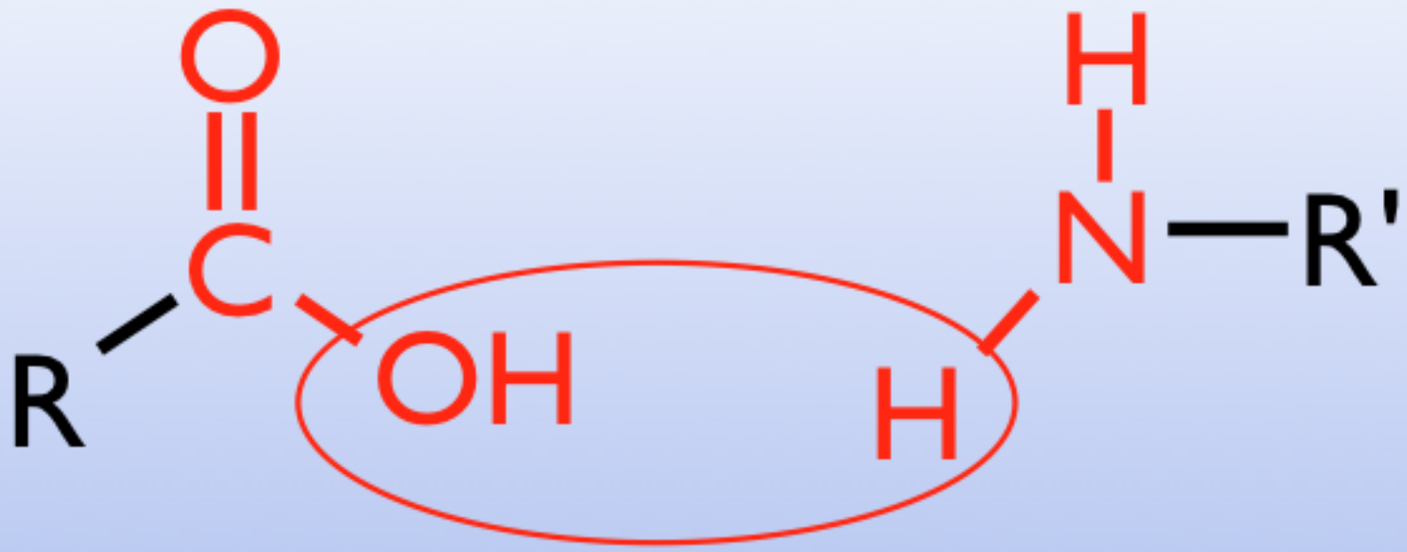


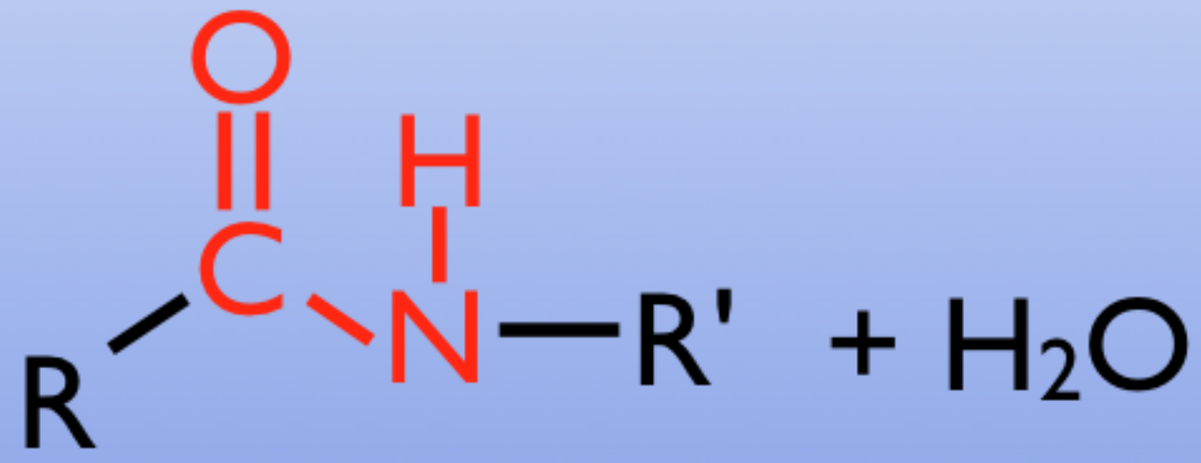
Primary Amine



Carboxylic Acid

Primary Amine

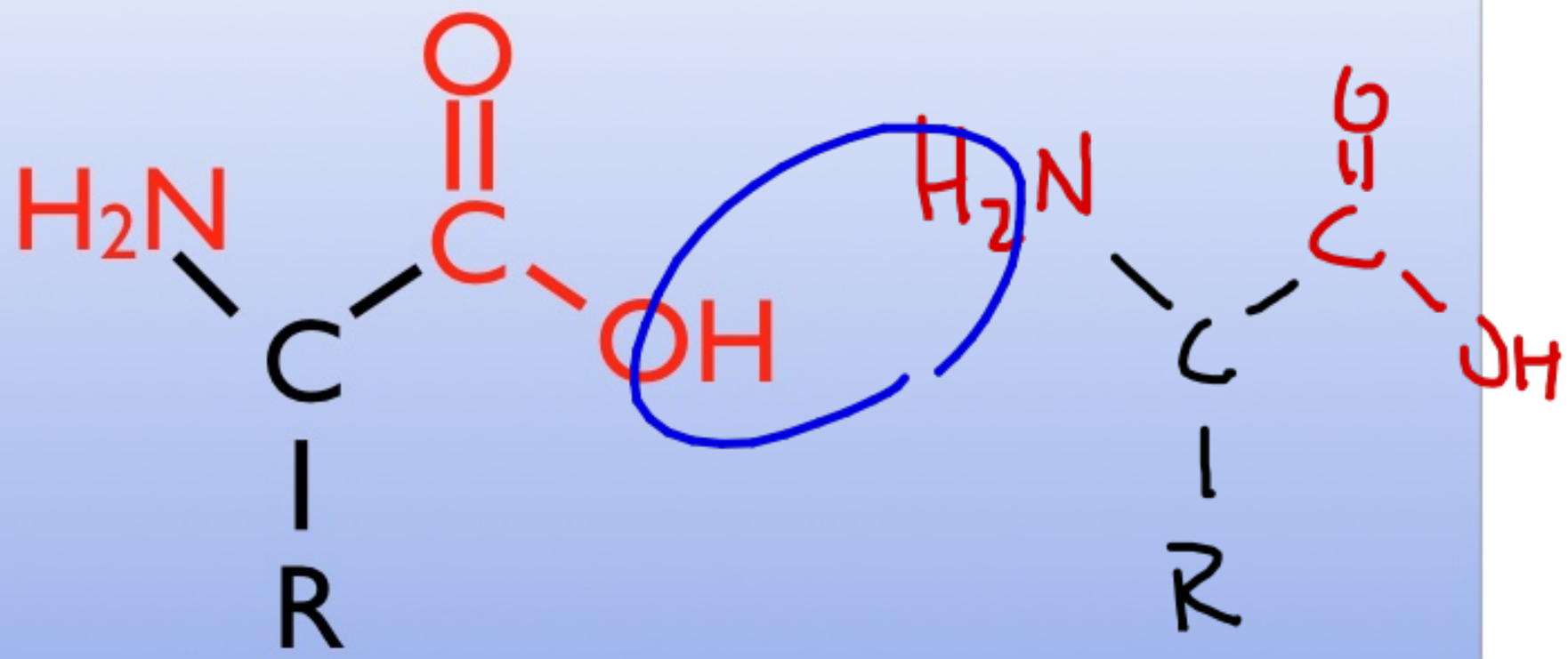




Amide + Water

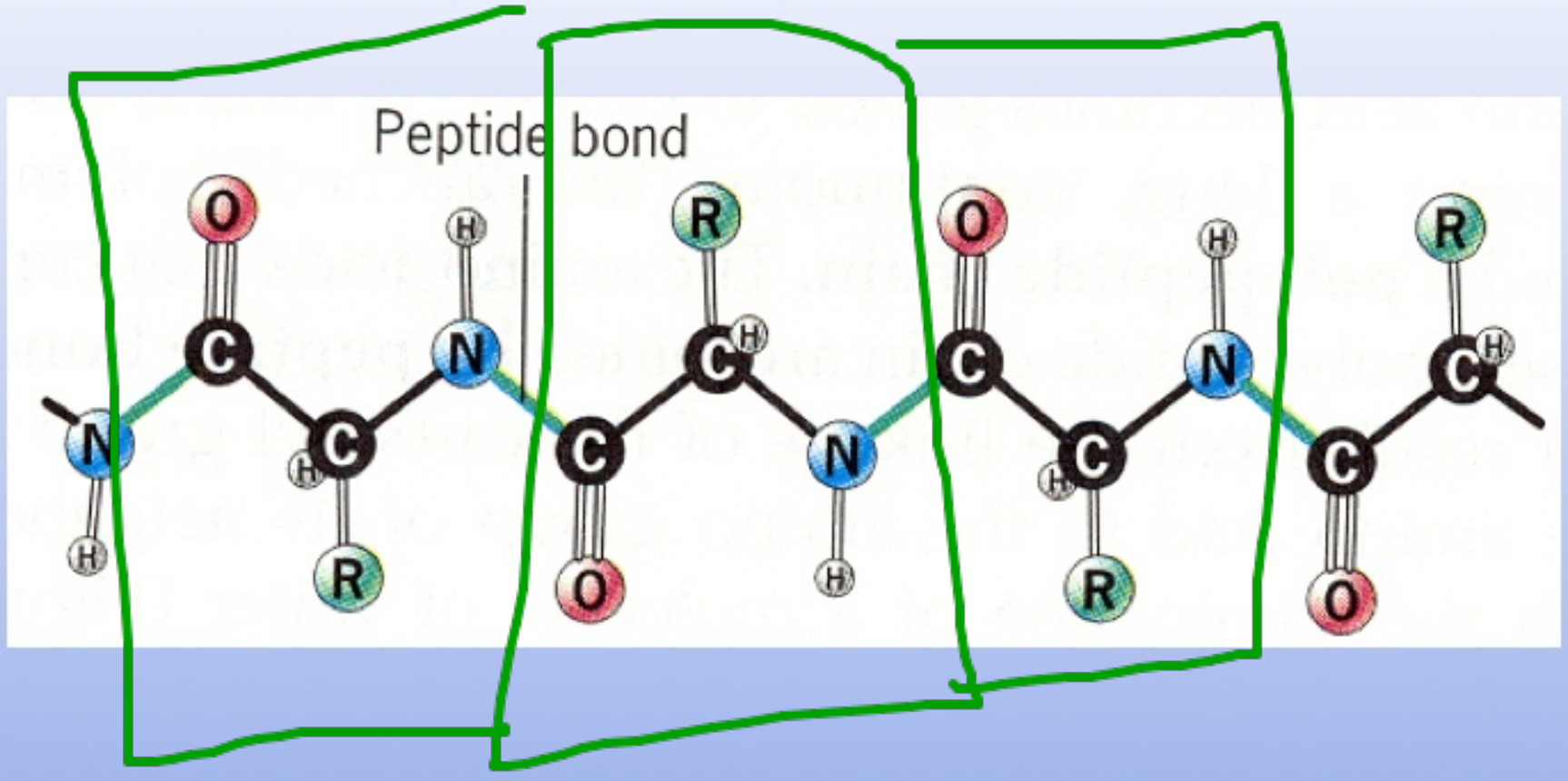
CONDENSATION REACTION

Amino Acid



Carboxylic End and Amine End
Can react with itself
(or similar molecules) in a chain

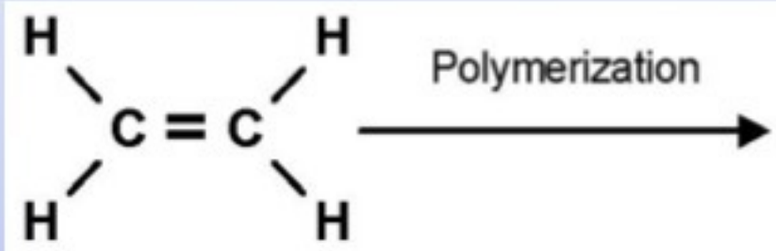
Polypeptide



Two distinct ends
N-terminus is an amine
C-terminus is a carboxylic acid

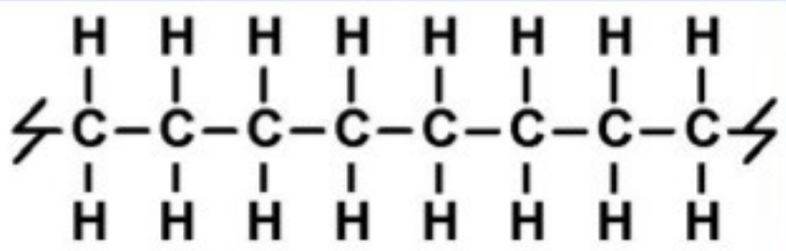
Such a compound is called a polymer

monomer



Polymerization

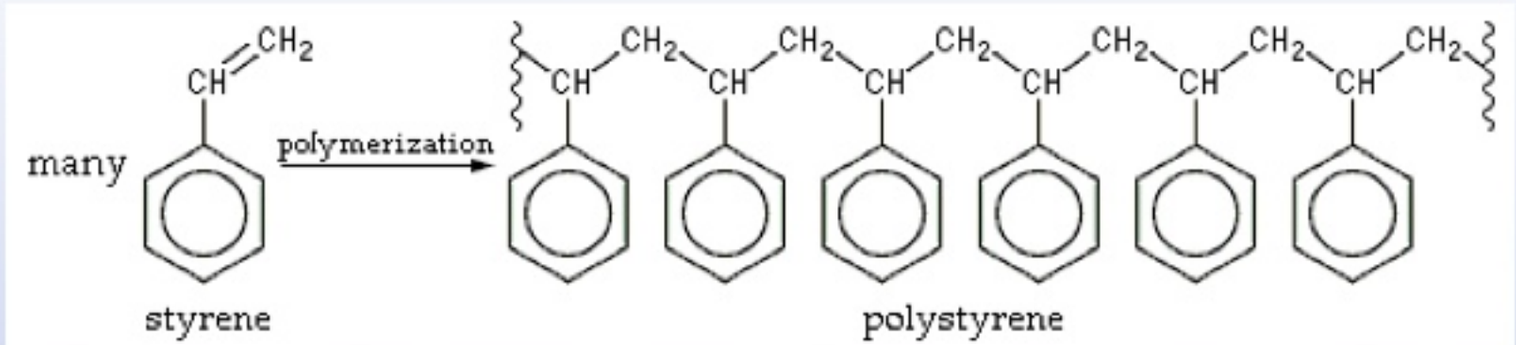
polymer



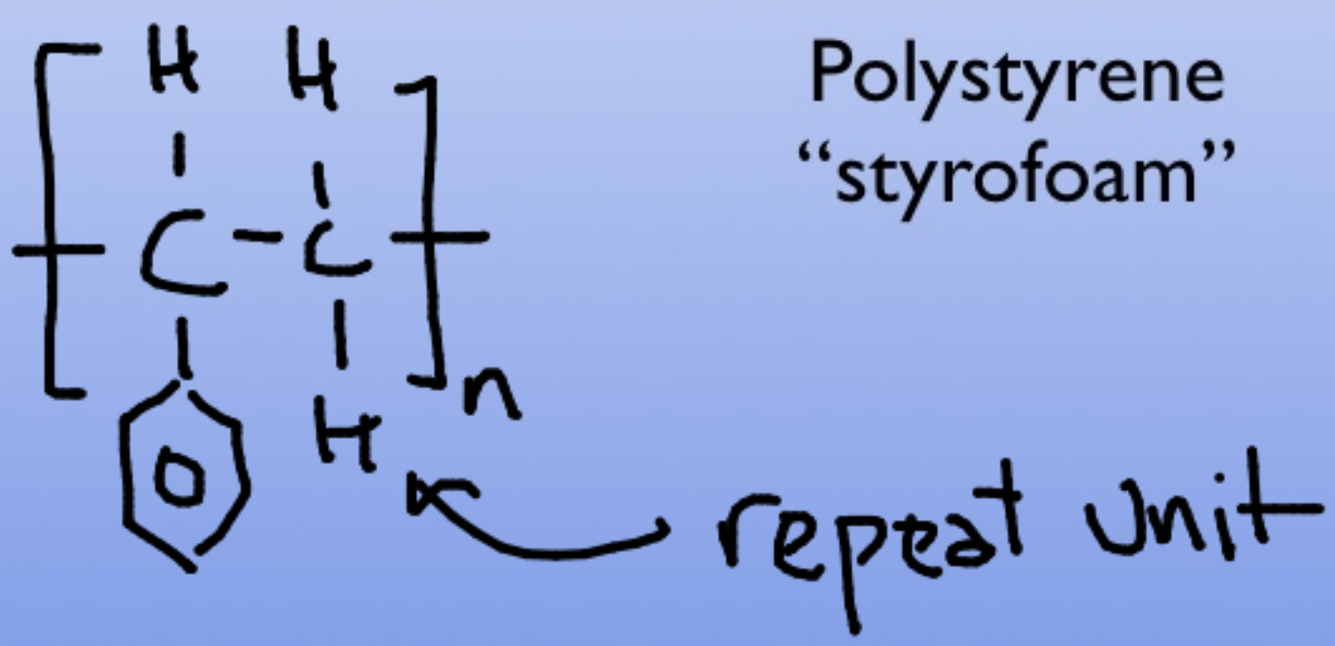
really really big molecule
macromolecule

polyethylene = plastic shopping bag

Addition Reaction
(combined no other molecule "lost")



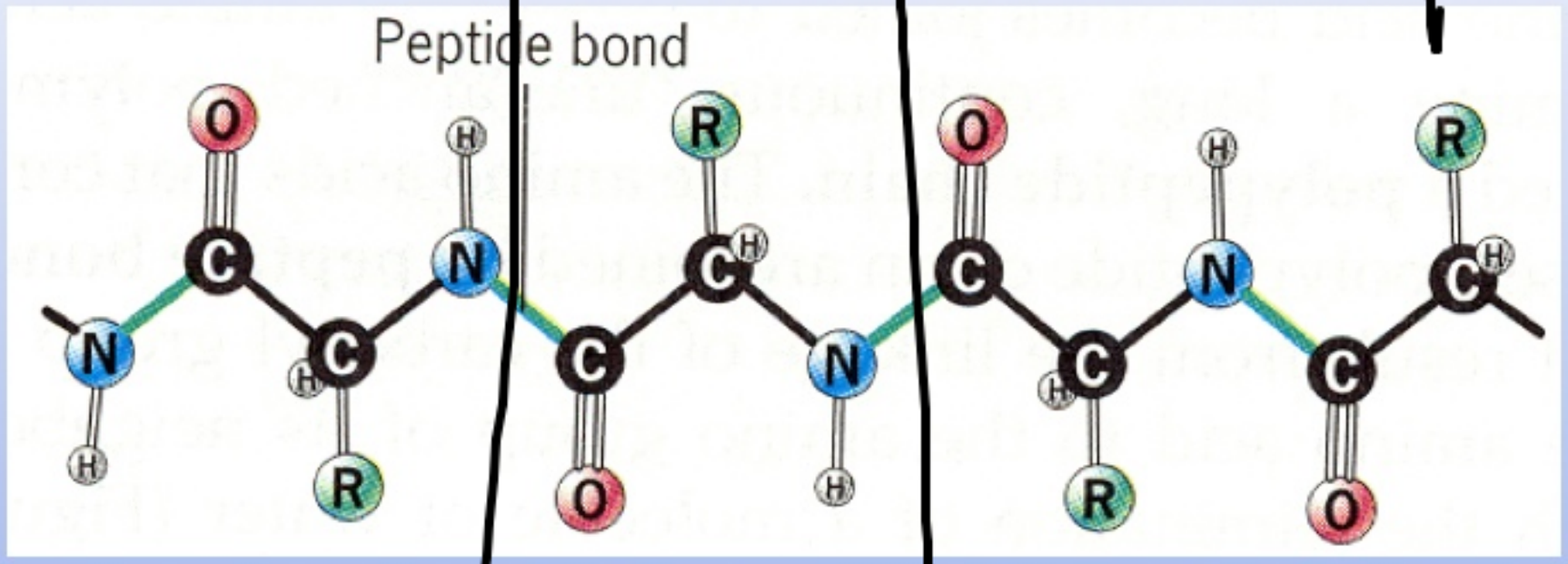
Another addition polymerization



Polystyrene
"styrofoam"

Biopolymer (polymer that is biologically relevant)

repeat

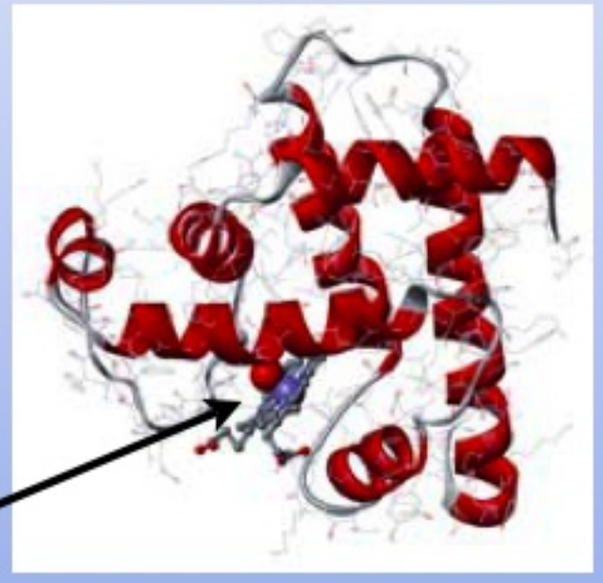


monomer = amino acid

But here R can be different

Condensation Polymerization

Polypeptides have unique structures that give them function (proteins)

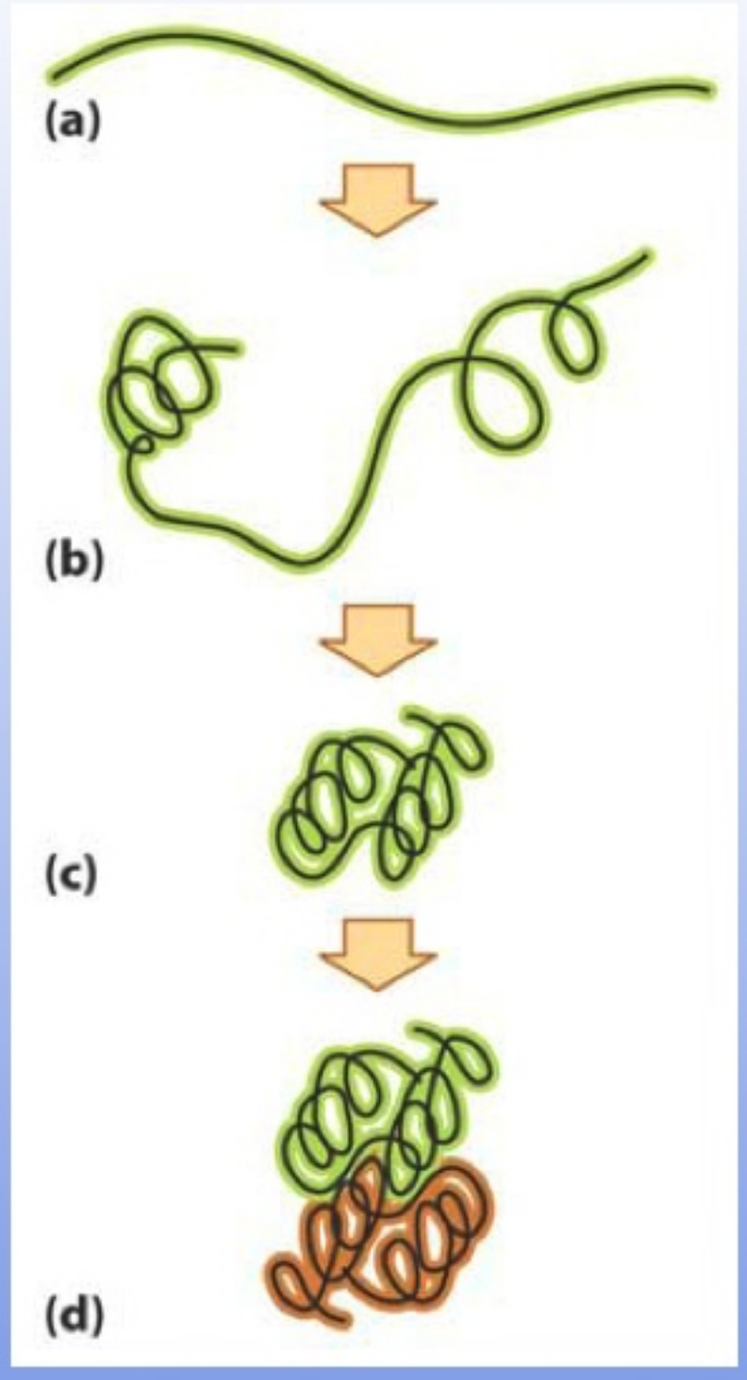


binding site
might be an enzyme
(catalyst)

STRUCTURE

↓

FUNCTION



STRUCTUR

primary structure = sequence

(ORDER OF 'R' Groups)

secondary structure = folds

tertiary structure = 3-D arrangment

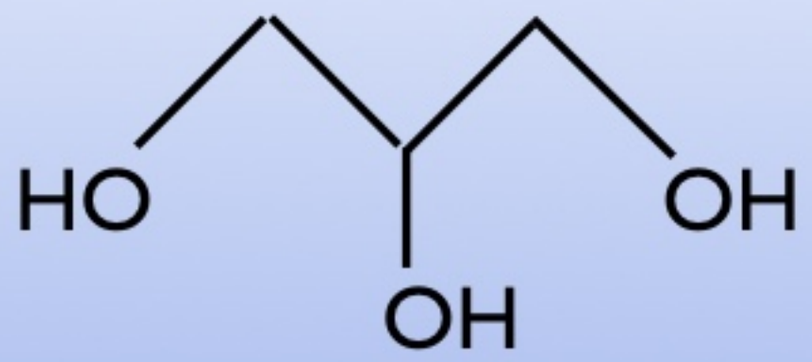
quaternary structure = interactions with other proteins

FUNCTION

similar Triglycerides

(~~same~~ condensation reaction)

Gylcerol

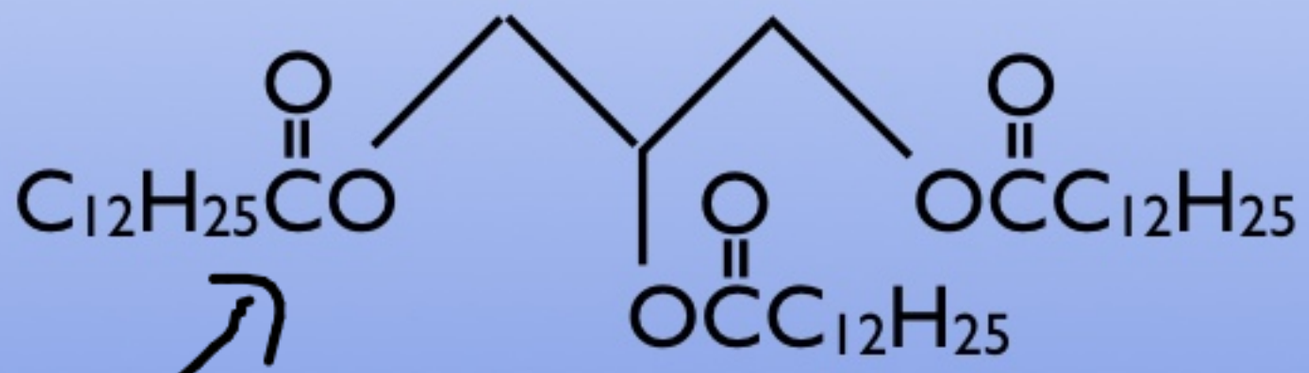


← alcohol

Fatty Acid

(carboxylic acid with long chain)

$C_{12}H_{25}COOH$



ester

Makes Trigylceride

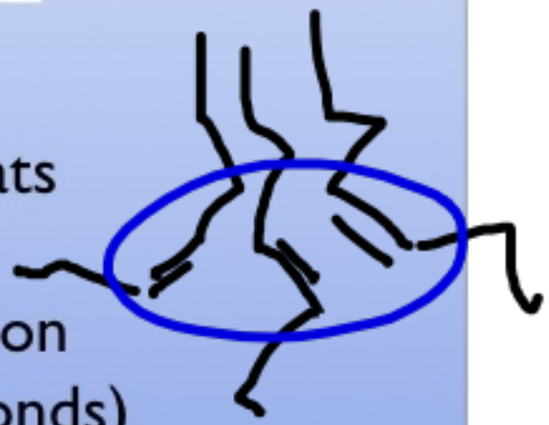
The three fatty acids can
all be the same or different

High levels of triglycerides is linked to
build up of plaque in the arteries
= heart disease

saturated fats

all sp^3 carbon
(no double bonds)
strong intermolecular forces
solid
(lard, crisco, ...)

unsaturated fats



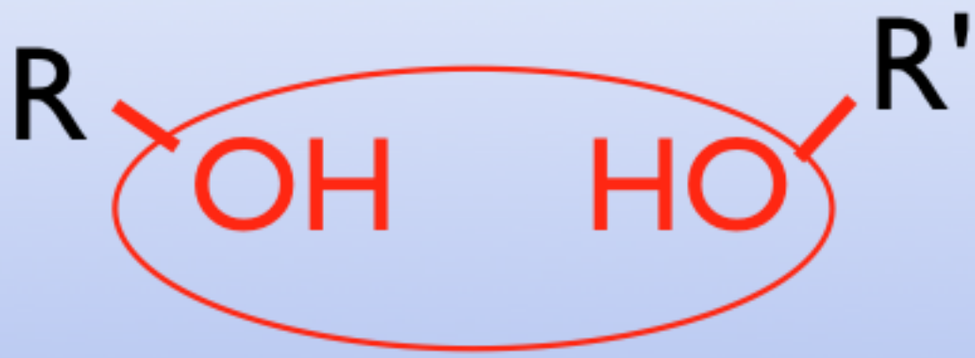
some sp^2 carbon
(some double bonds)
weaker intermolecular forces
liquid
(canola oil, olive oil, ...)

Double Bonds Disrupt IMF

Condensation reaction for two alcohols

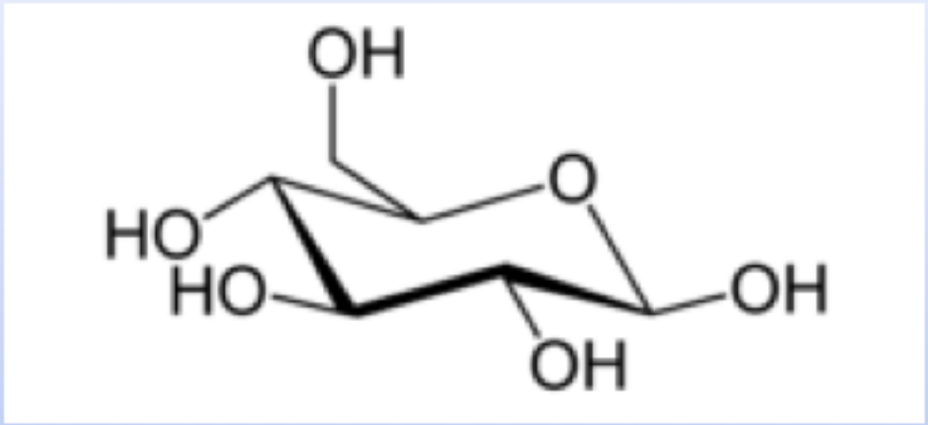
Alcohol

Alcohol



Ether + Water

Sugars



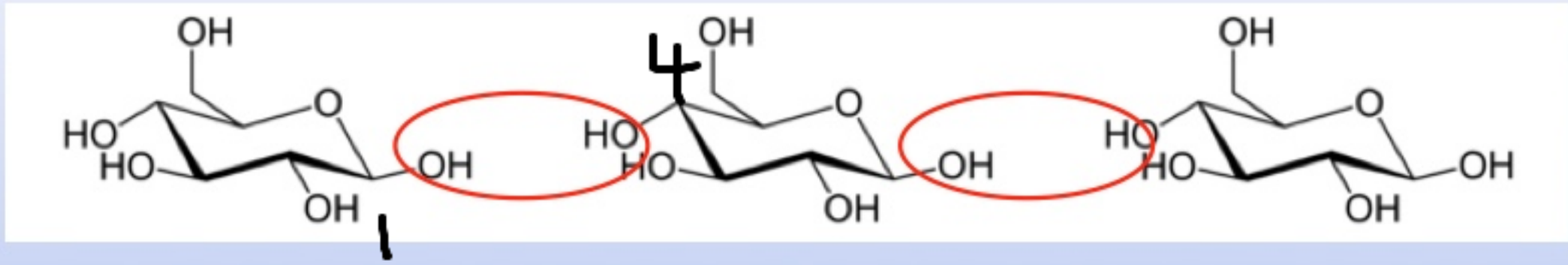
Glucose

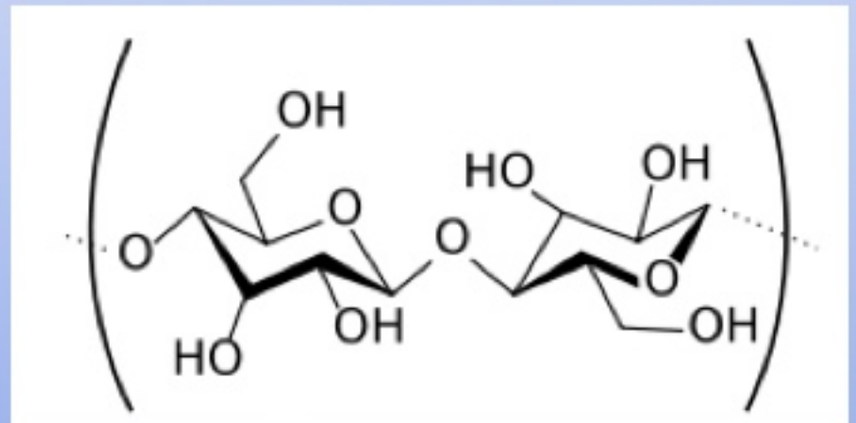
(key factor for sugars lots of hydroxyls)

They can react to form chains of sugars

polysaccharide

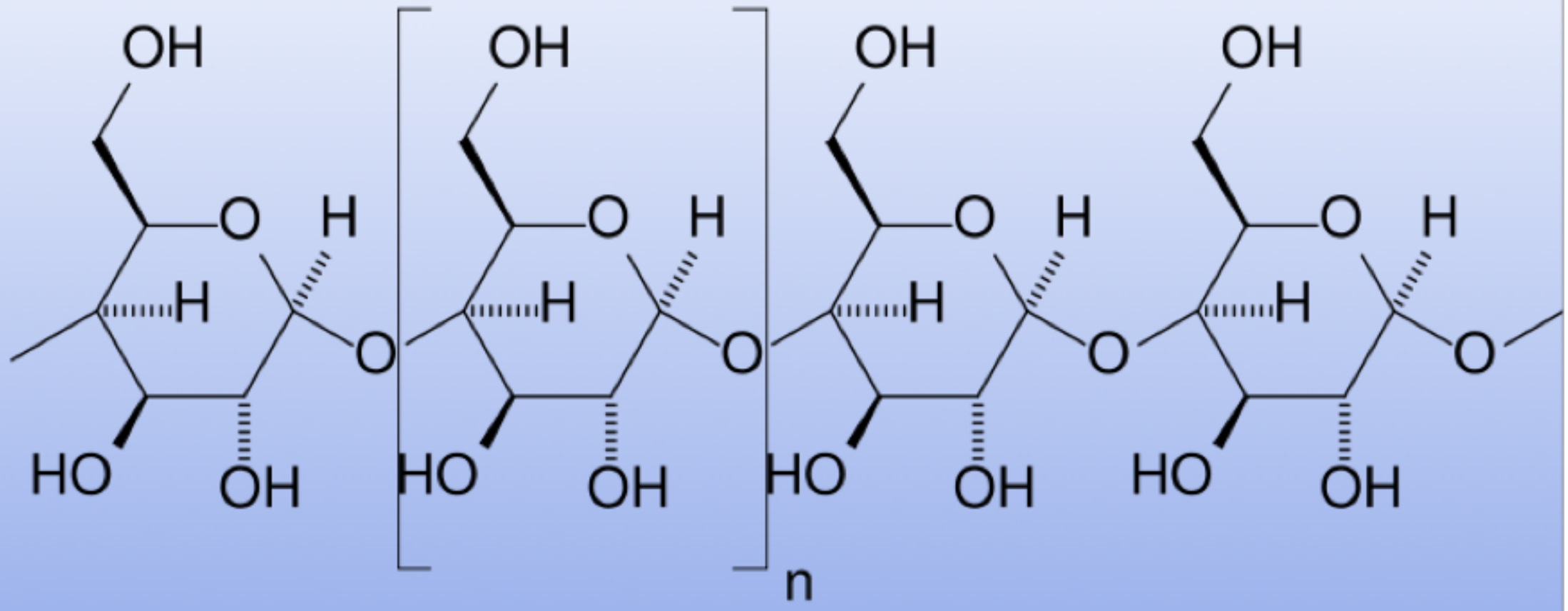
Celluose



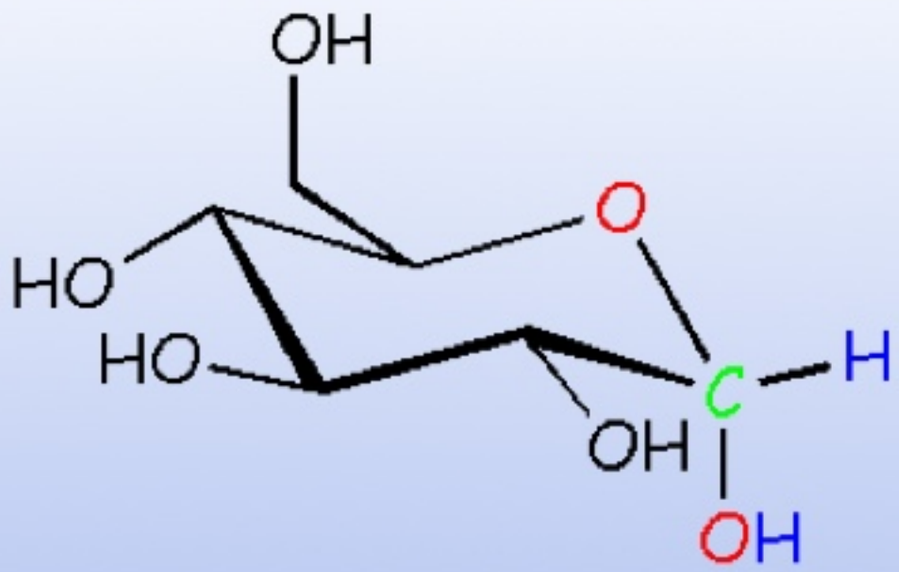


Very long ether chain
(pretty much all plant material)

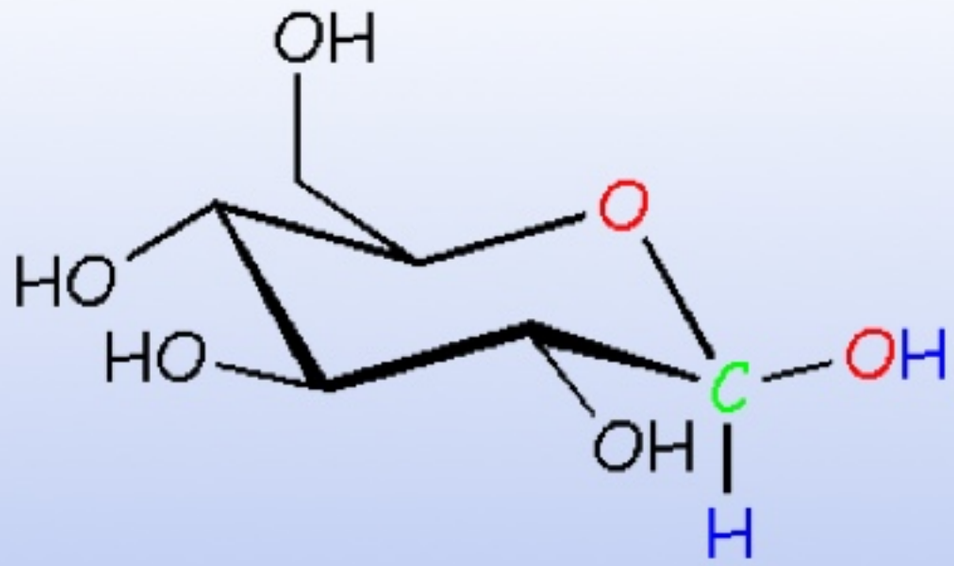
Polysaccharide (Starch)



Sugars, Carbohydrates
monosaccharides (one)
disaccharides (two)
polysaccharides (many)

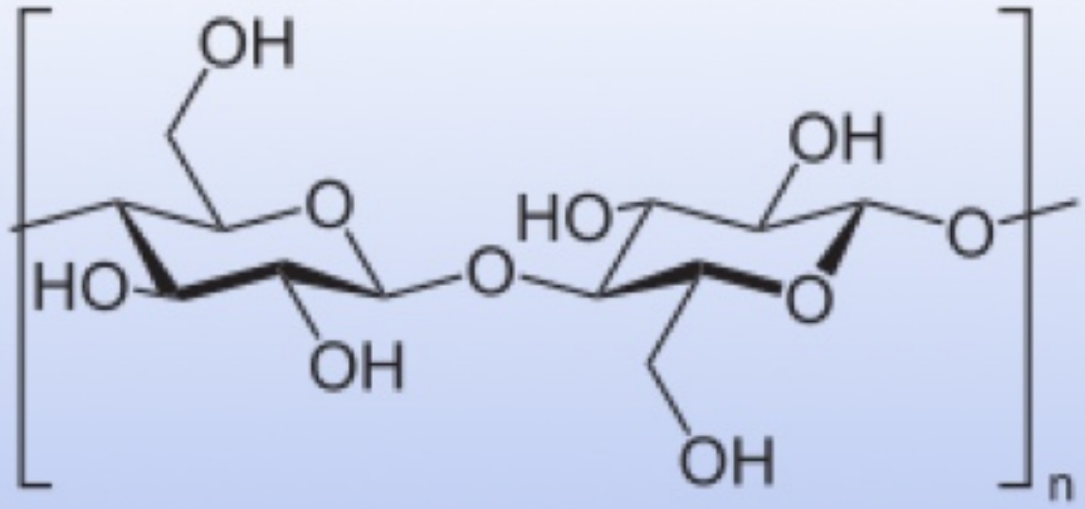


α Glucose



β Glucose

Subtle differences in 3D structure



β 1,4 linkage polysaccharide
Cellulose

WOOD

α 1,4 linkage polysaccharide
Starch/Carbohydrate

FOOD

Condensation Reactions
(two molecules make one + water)

Carboxylic Acid + Amine = Amide + water

Carboxylic Acid + Alcohol = Ester + water

Alcohol + Alcohol = Ether + water

Rember these 3

Structurally what is different between RNA and DNA

A. the phosphate

B. the sugar

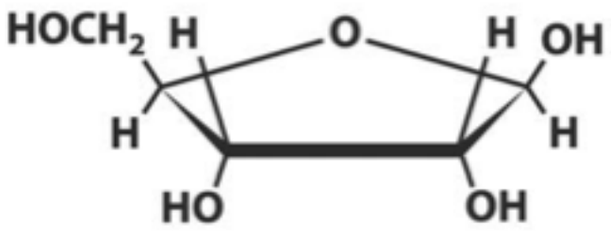
C. the base

Structurally what is different between RNA and DNA

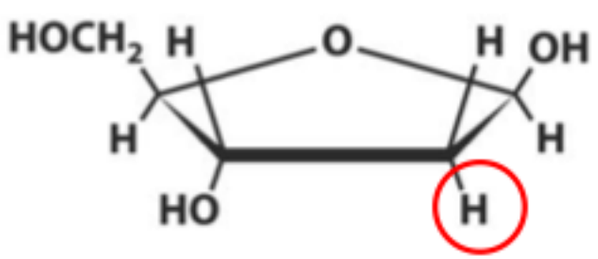
A. the phosphate

B. the sugar ←

C. the base



20 Ribose, $C_5H_{10}O_5$

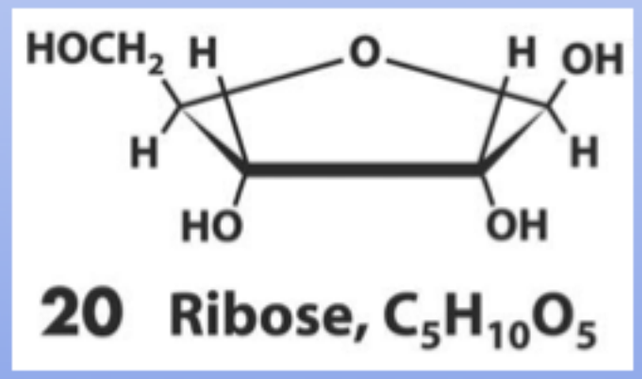


21 Deoxyribose, $C_5H_{10}O_4$

Other important biopolymers

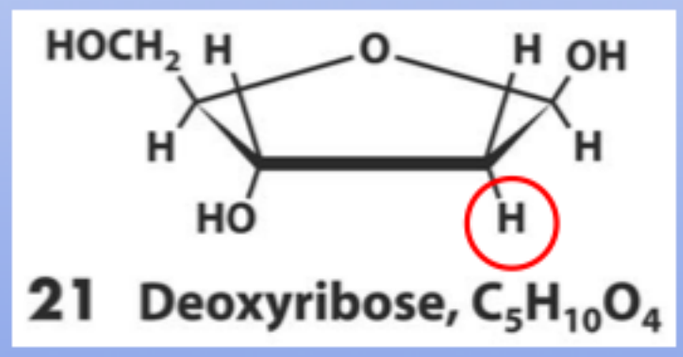
(RNA and DNA)

Three pieces Base, Sugar, Phosphate



20 Ribose, $C_5H_{10}O_5$

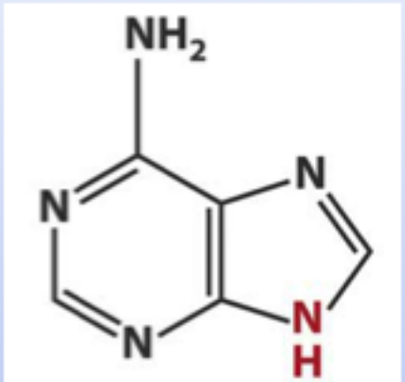
RNA sugar



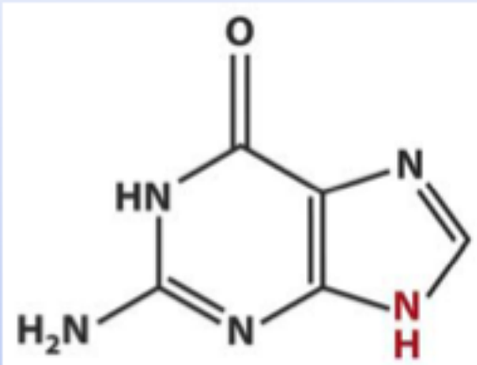
21 Deoxyribose, $C_5H_{10}O_4$

DNA sugar

Base units (4 DNA base units)

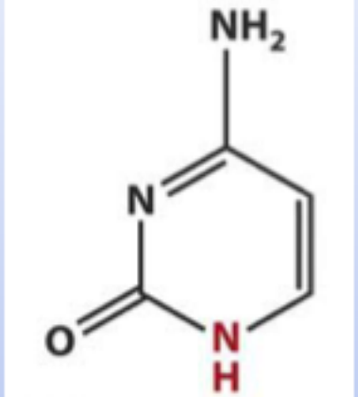


22 Adenine

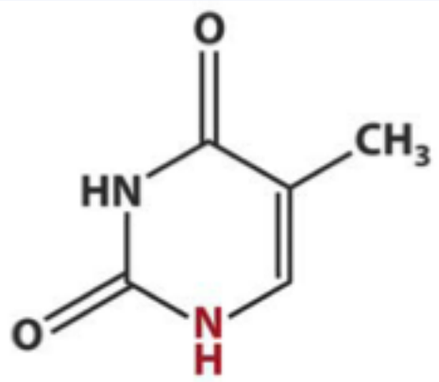


23 Guanine

guanidine

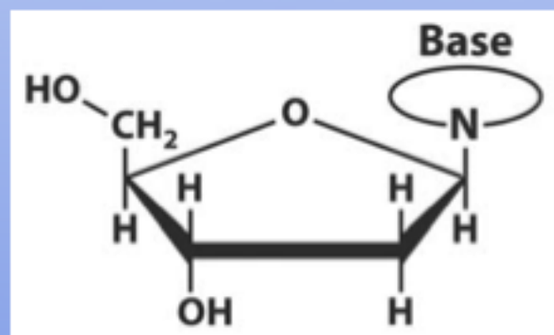


24 Cytosine

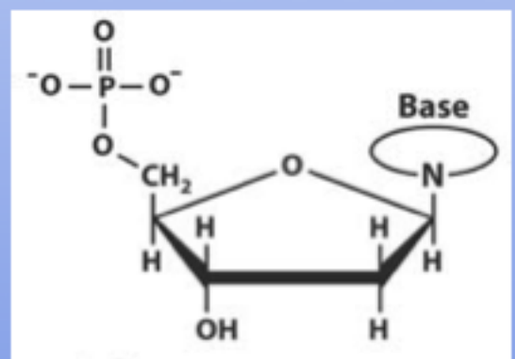


25 Thymine

pyrimidine

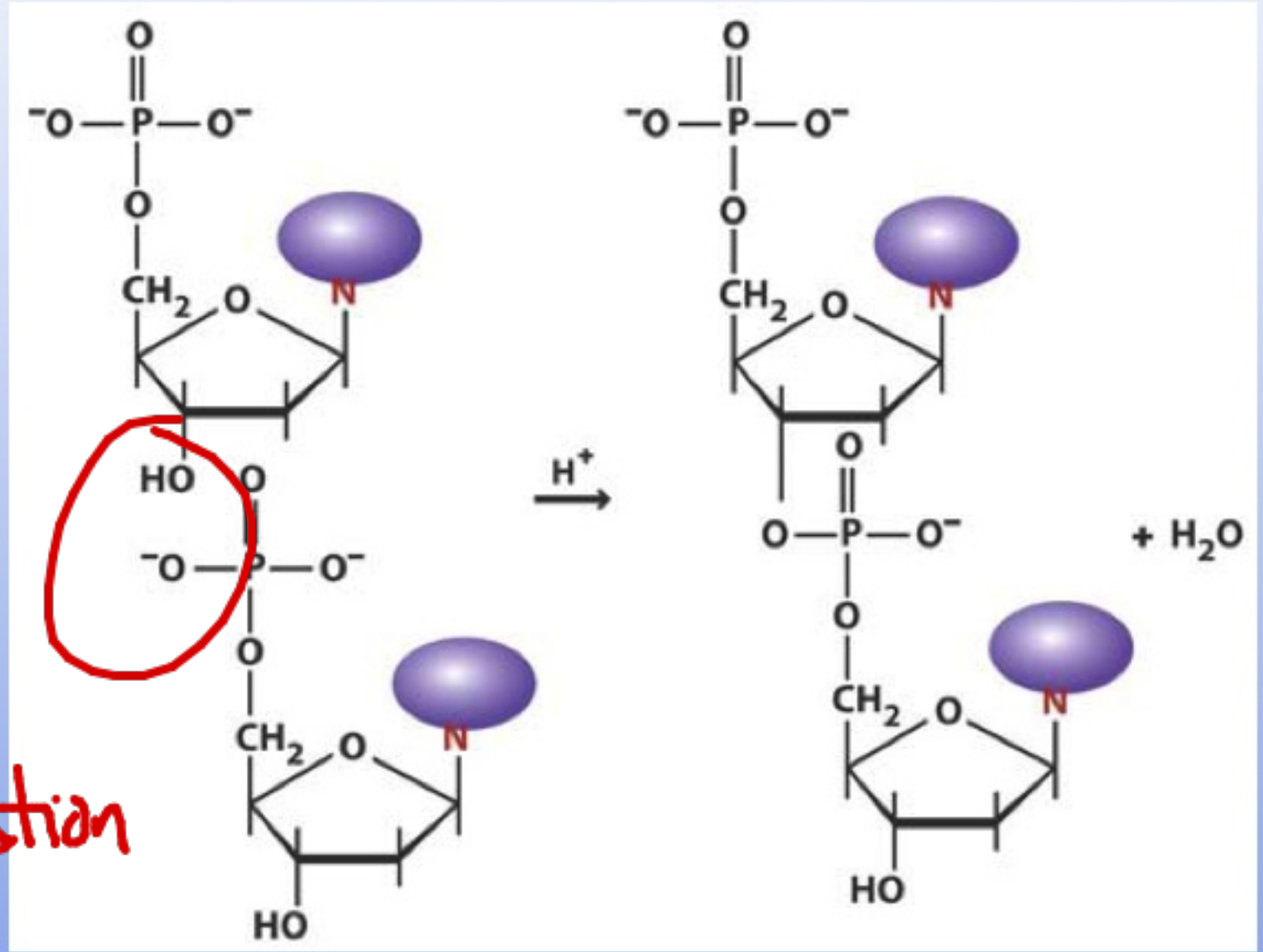


27 A nucleoside



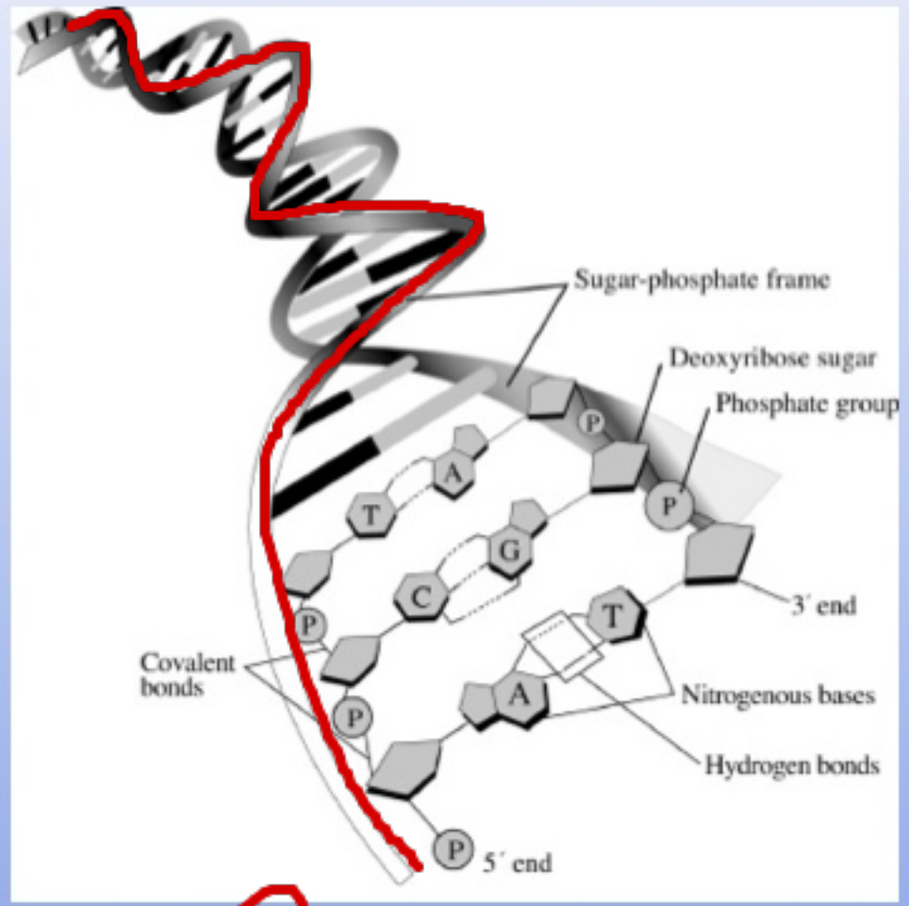
28 A nucleotide

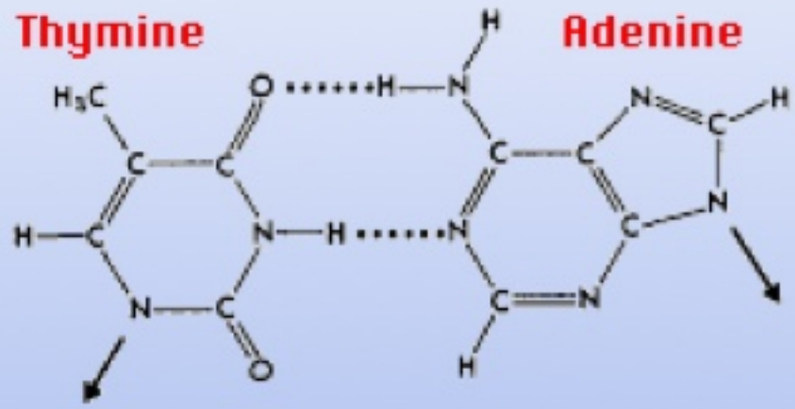
Put it all together and you get a polymer

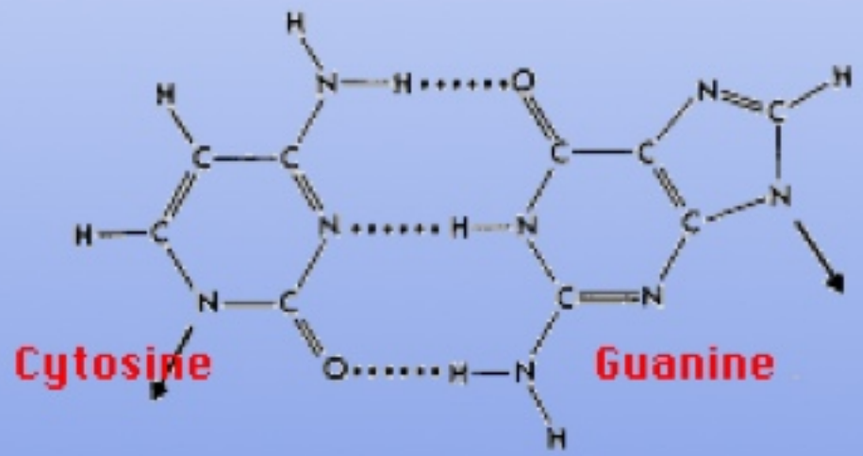


opposite of this reaction is hydrolysis

what about tertiary structure?
double helix due to hydrogenbonds







polymer phosphate/sugar BACKBONE