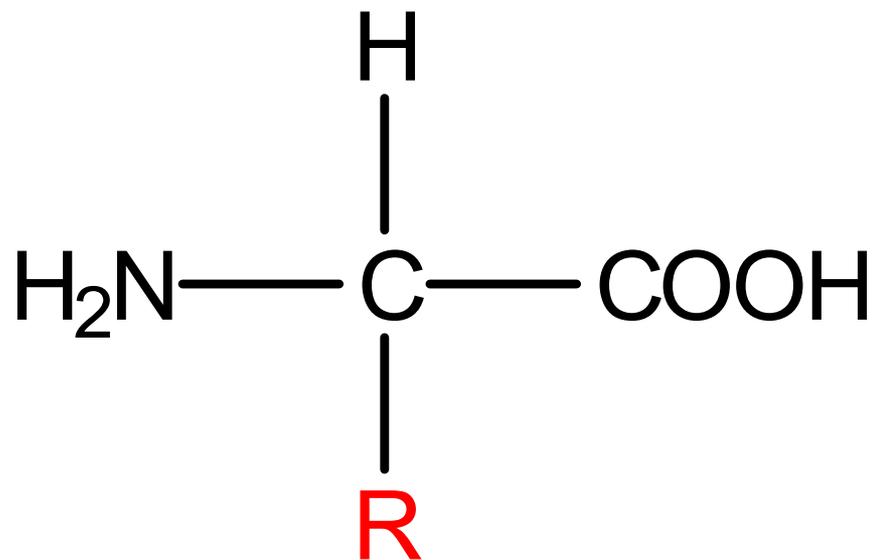




[WWW.CHEMSHEETS.CO.UK](http://www.chemsheets.co.uk)

# BIOCHEMISTRY

# AMINO ACIDS

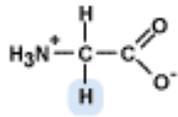


**amine  
group**

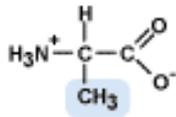
**carboxylic  
acid group**

# AMINO ACIDS

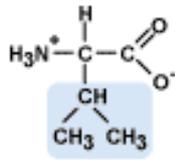
NONPOLAR



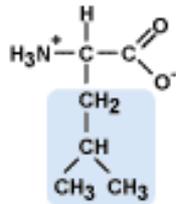
Glycine (Gly)



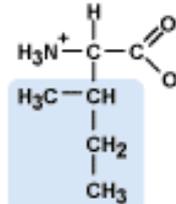
Alanine (Ala)



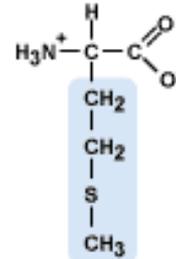
Valine (Val)



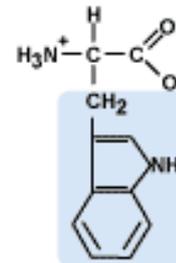
Leucine (Leu)



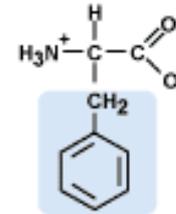
Isoleucine (Ile)



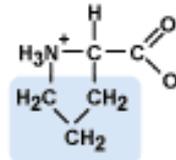
Methionine (Met)



Tryptophan (Trp)

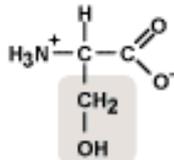


Phenylalanine (Phe)

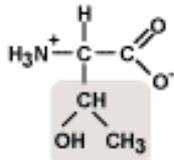


Proline (Pro)

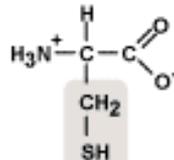
POLAR



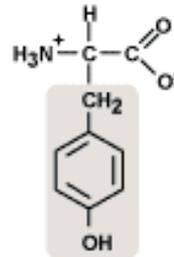
Serine (Ser)



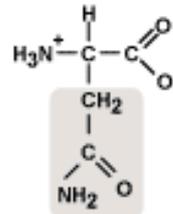
Threonine (Thr)



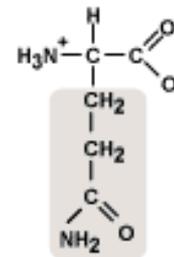
Cysteine (Cys)



Tyrosine (Tyr)

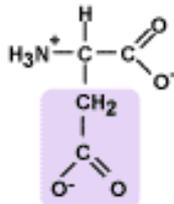


Asparagine (Asn)

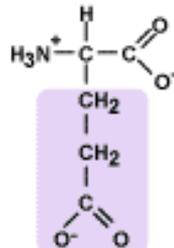


Glutamine (Gln)

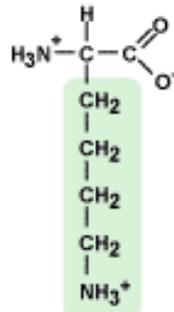
Electrically Charged



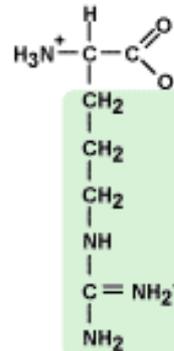
**Acidic**  
Aspartic Acid (Asp)



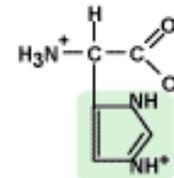
Glutamic Acid (Glu)



Lysine (Lys)

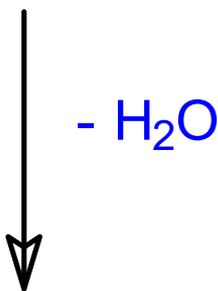
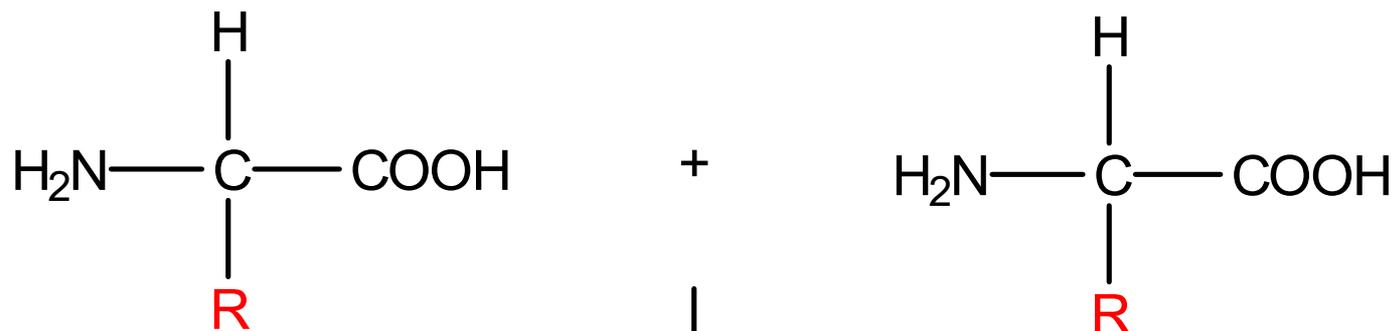


**Basic**  
Arginine (Arg)

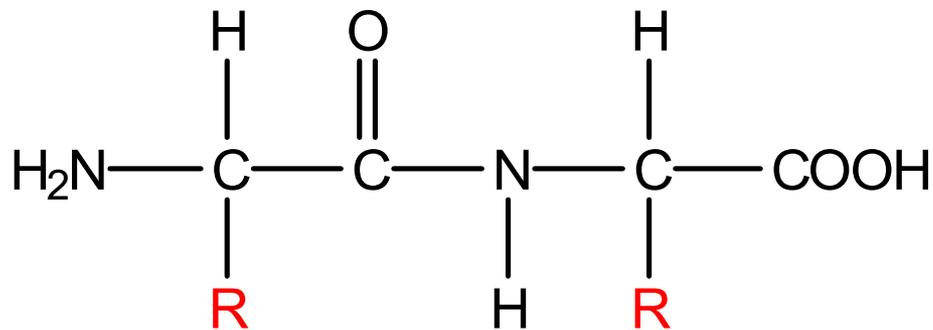


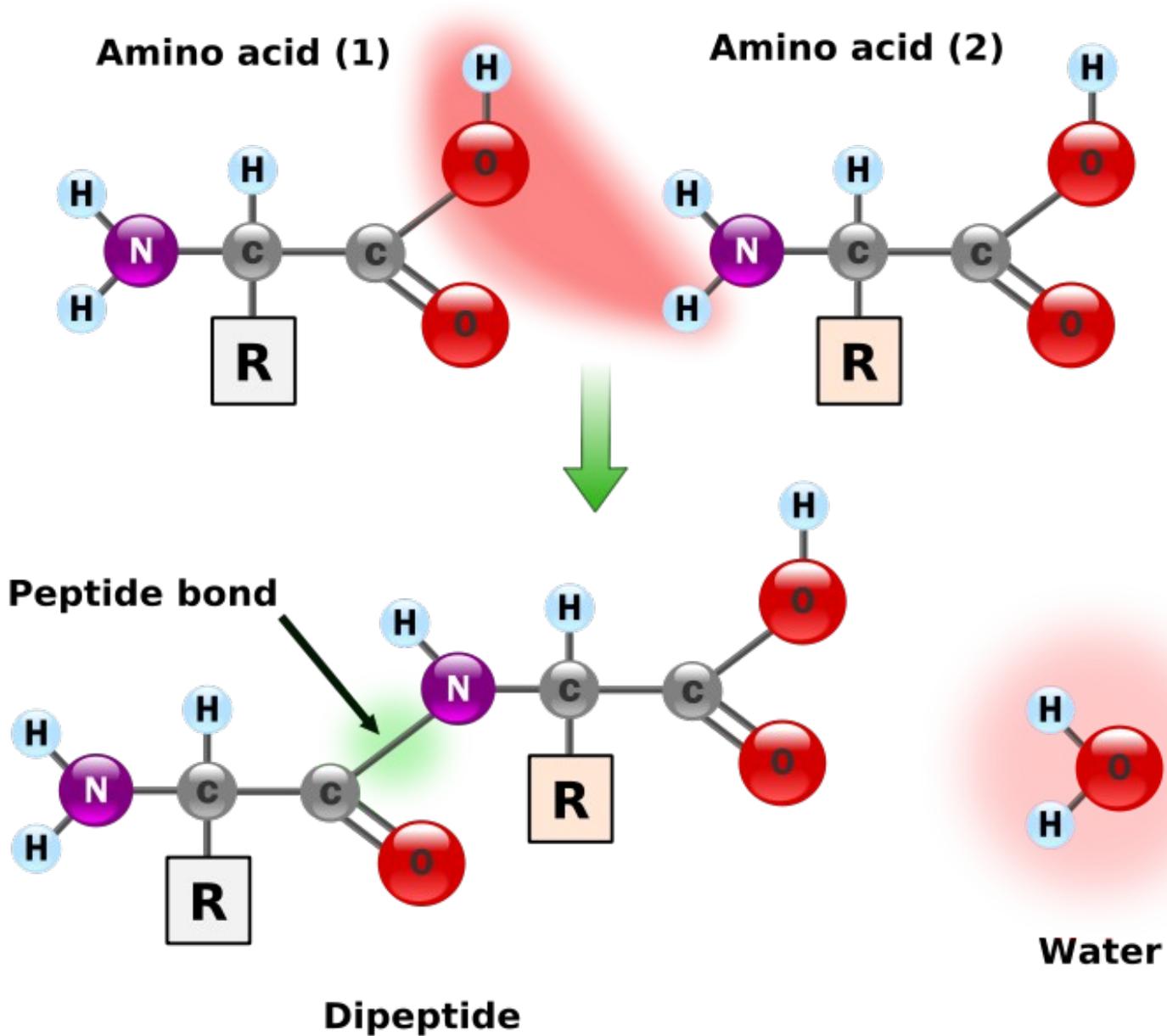
Histidine (His)

Joining amino acids together to make polypeptides and proteins:

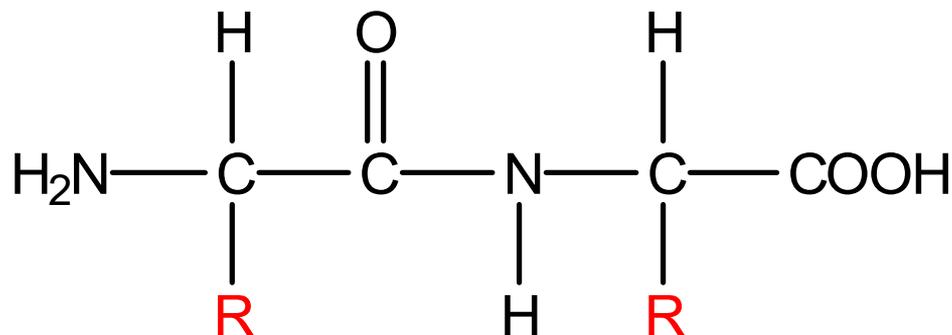


Condensation reaction:  
molecules join and  
water is eliminated





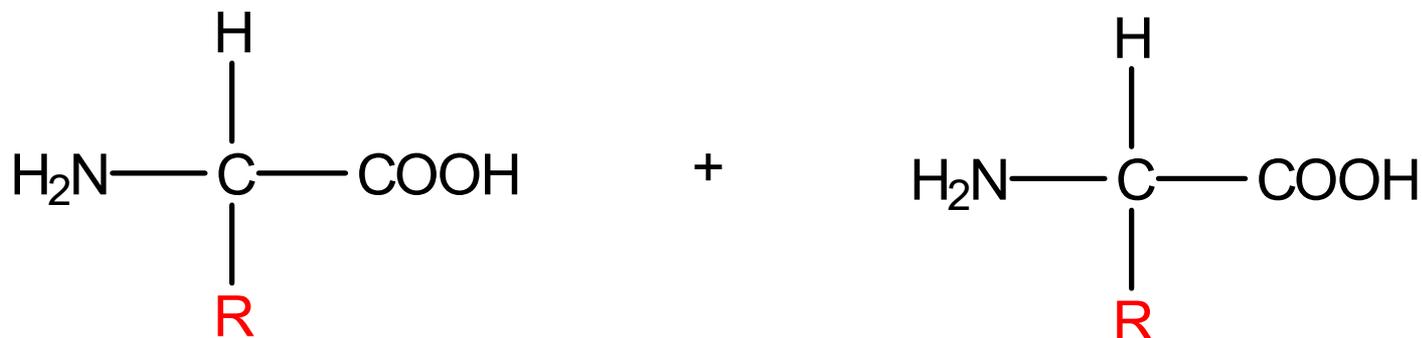
# Breaking down polypeptides and proteins into amino acids:

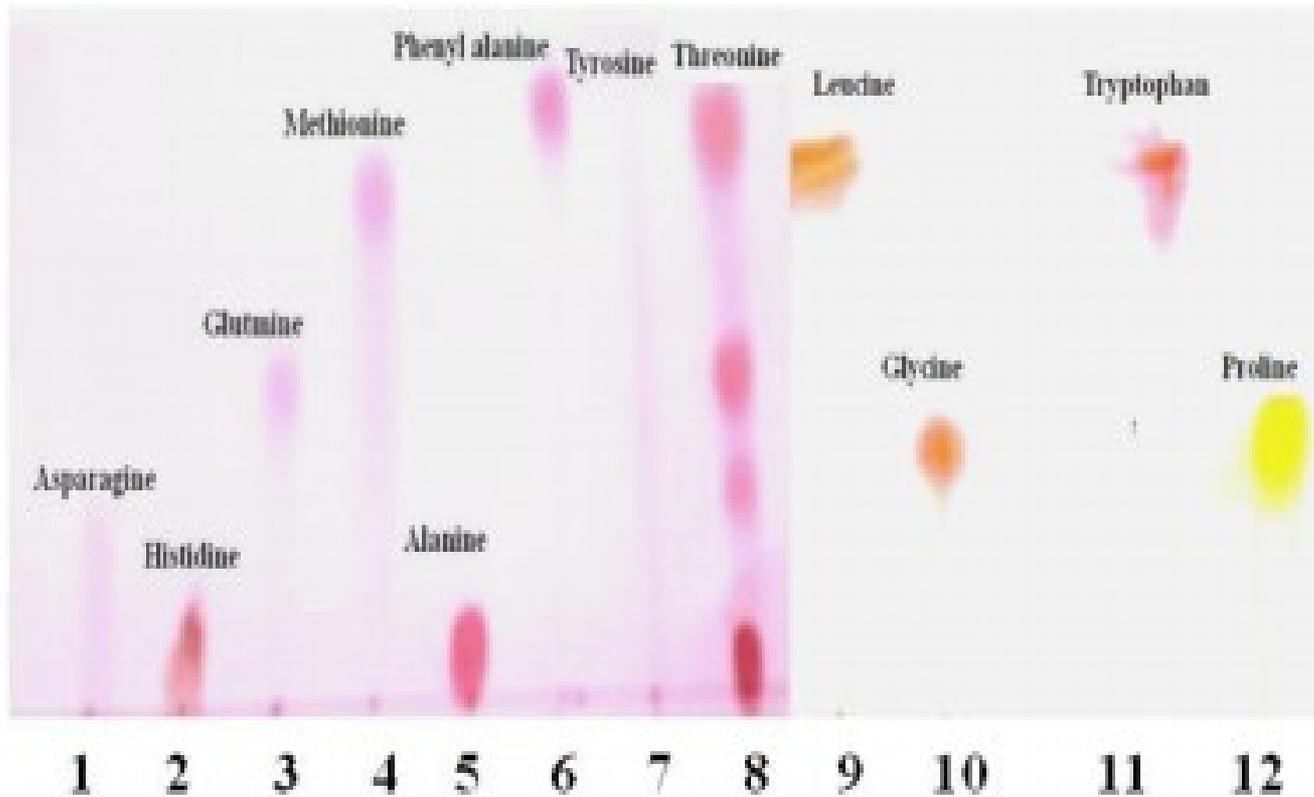


Needs:  
acid or enzyme



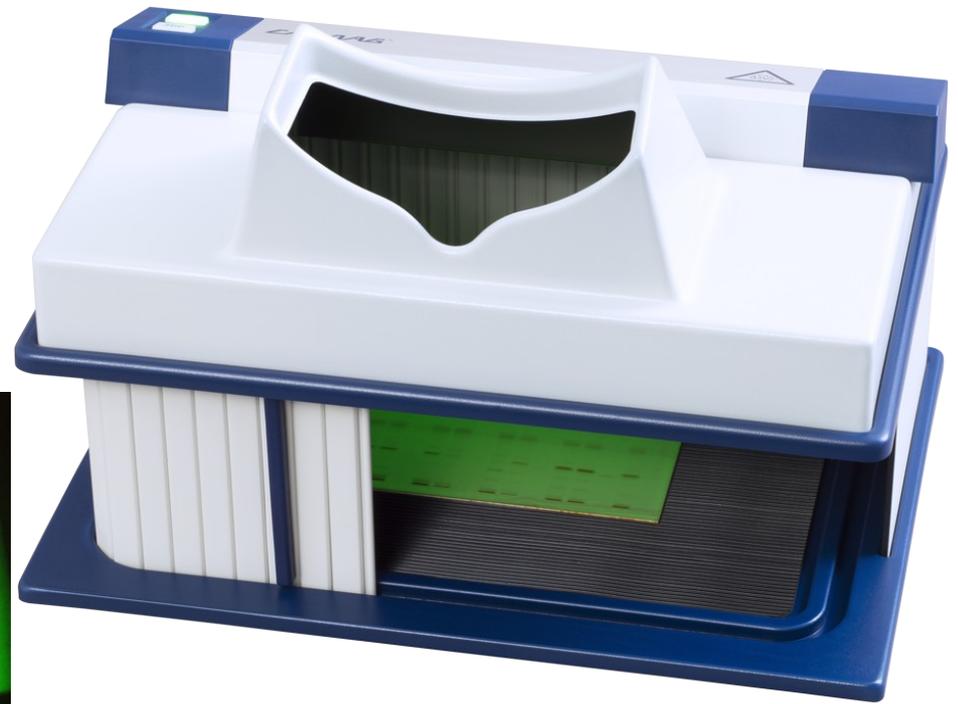
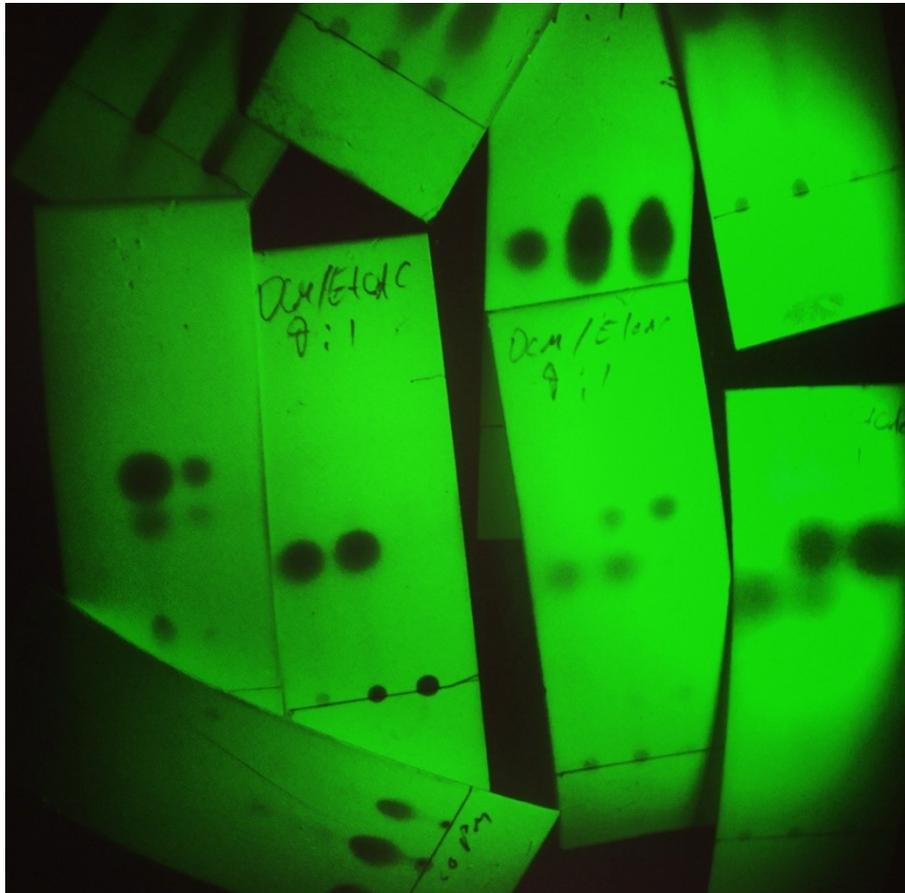
Hydrolysis reaction:  
reaction with water in  
which O-H bond breaks

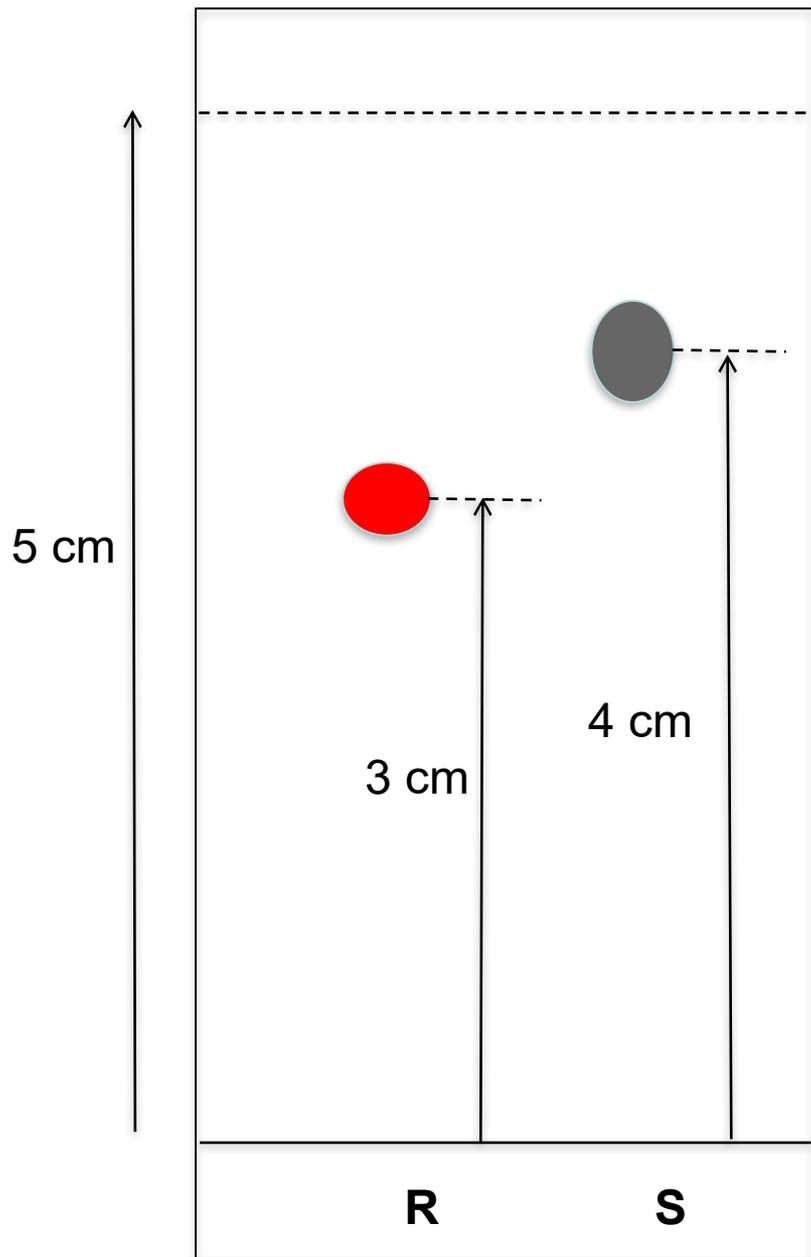




**Amino acids be analysed by TLC  
(can be stained using ninhydrin)**

or view results under UV light





solvent front

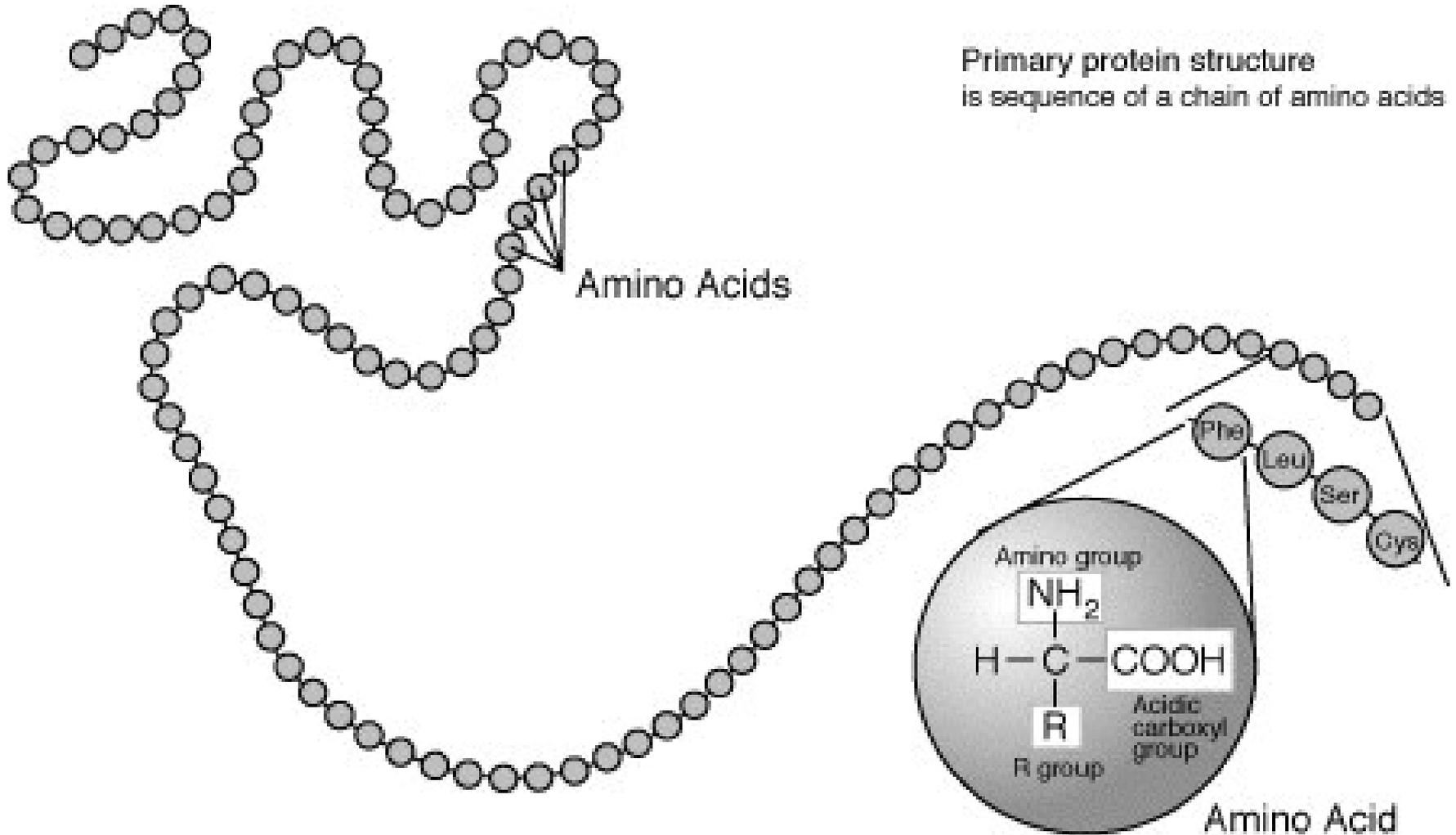
**$R_f$  values can identify amino acids**

For substance **R**       $R_f = \frac{3}{5} = 0.6$

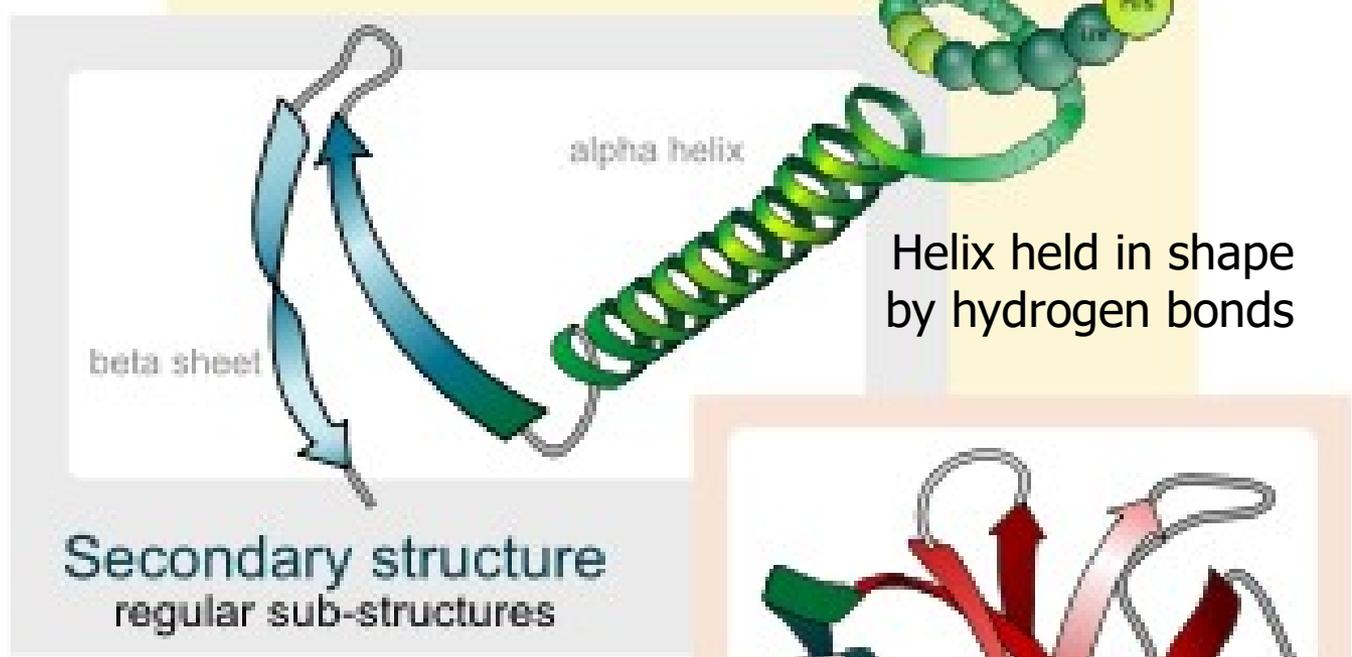
For substance **S**       $R_f = \frac{4}{5} = 0.8$

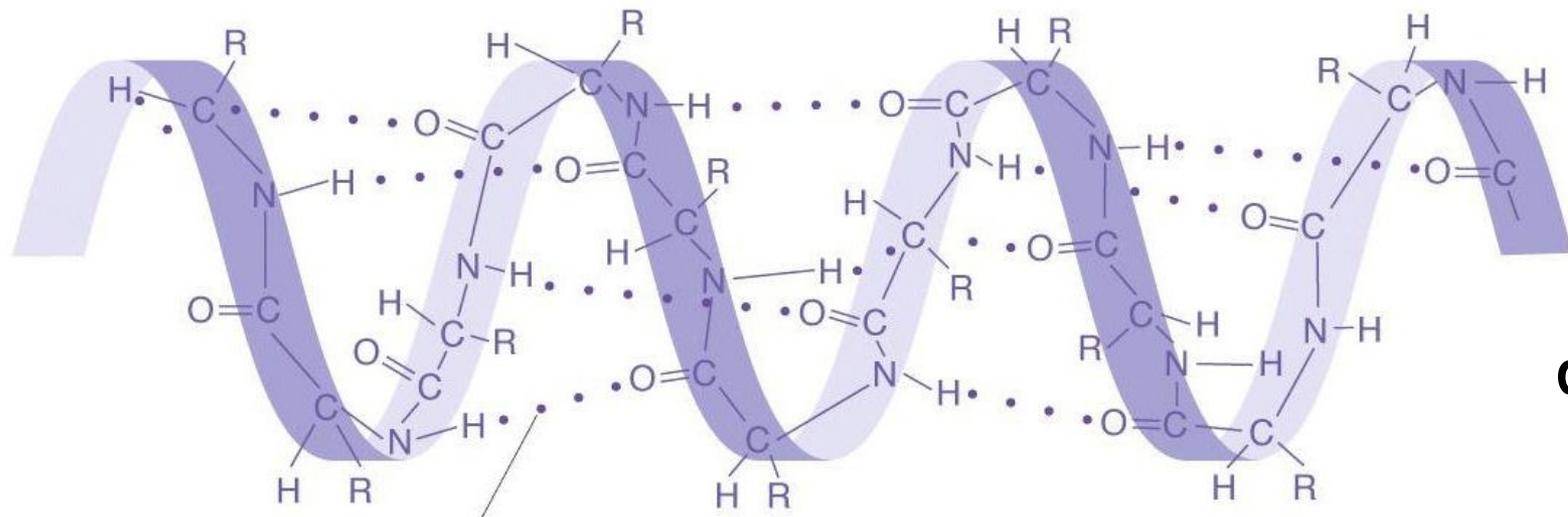
starting line

# PROTEINS



# Primary structure amino acid sequence

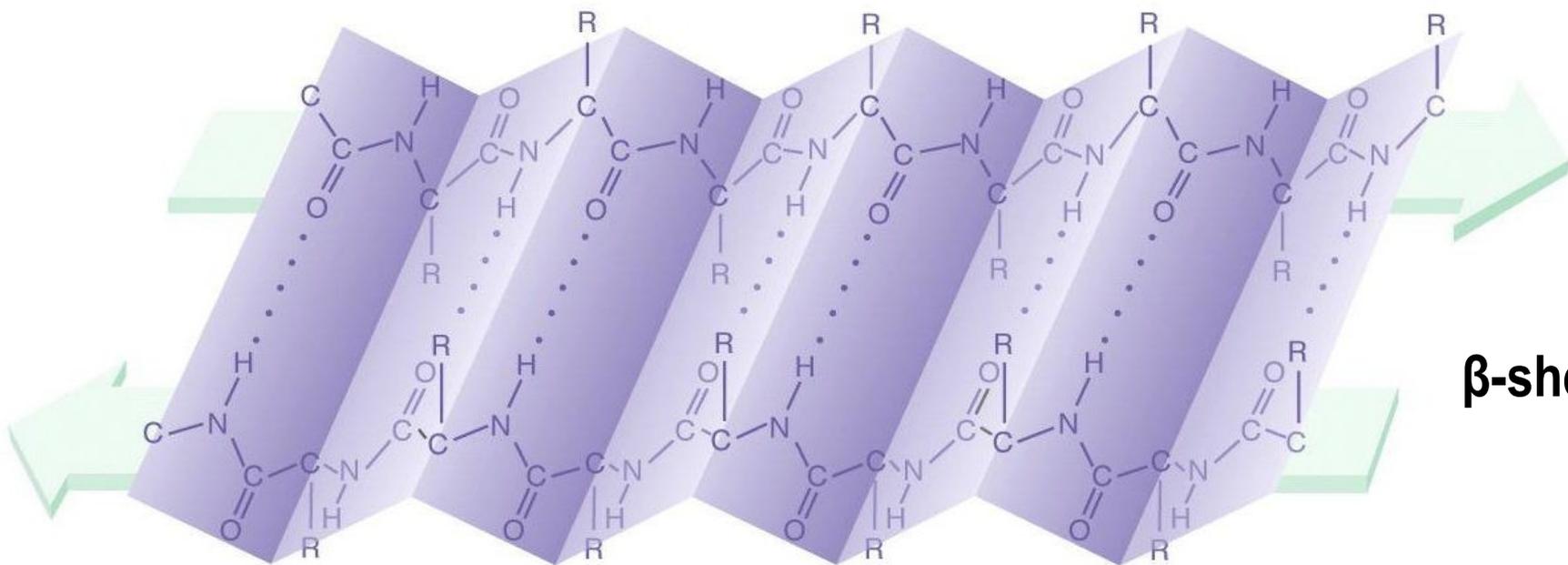




**$\alpha$ -helix**

$\alpha$  helix

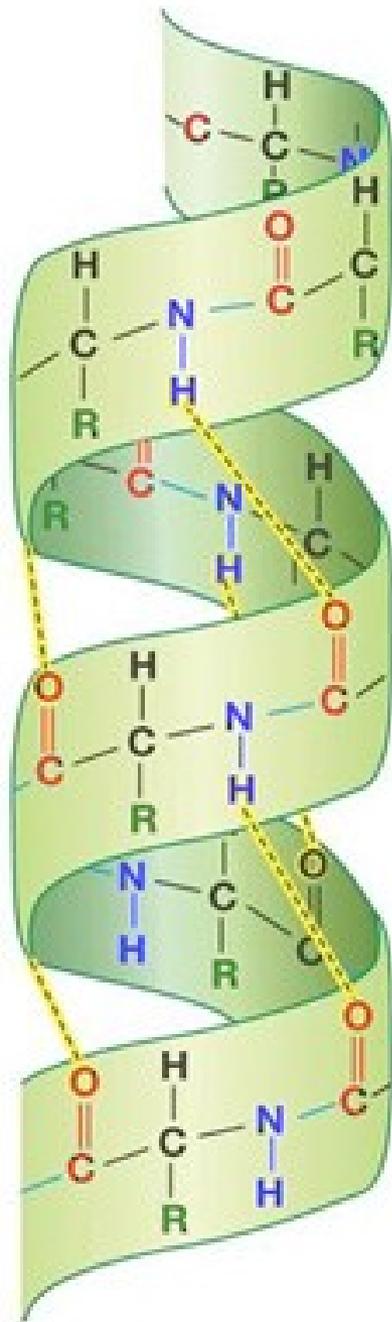
Hydrogen bonds between amino acids at different locations in polypeptide chain



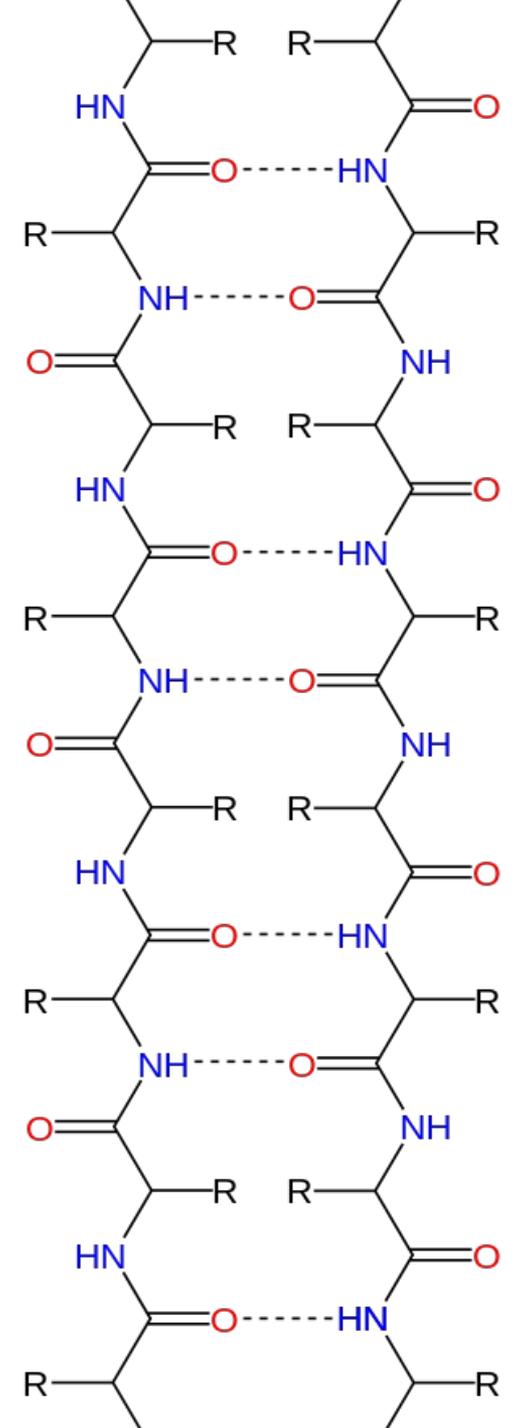
**$\beta$ -sheet**

Pleated sheet

$\alpha$ -helix



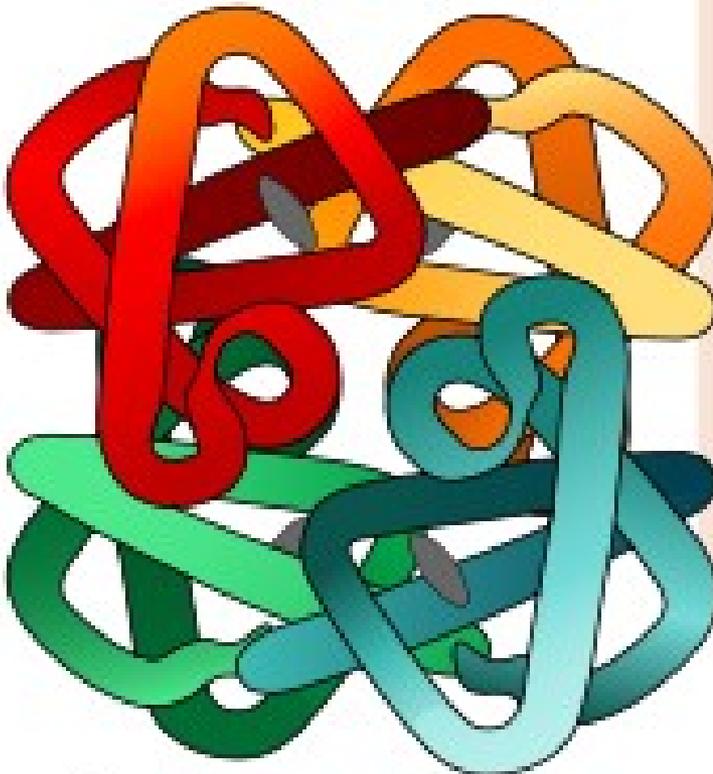
$\beta$ -sheet



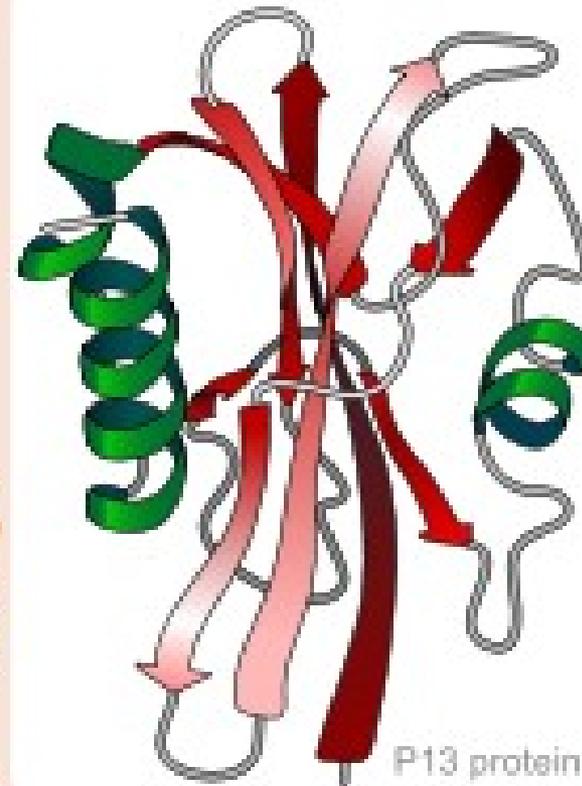
beta sheet

Secondary structure  
regular sub-structures

hemoglobin



Quaternary structure  
complex of protein molecules



Tertiary structure  
three-dimensional structure

Primary structure  
amino acid sequence

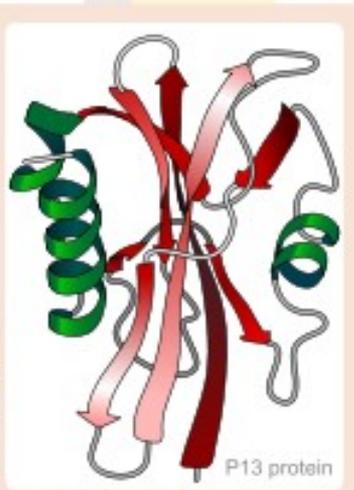
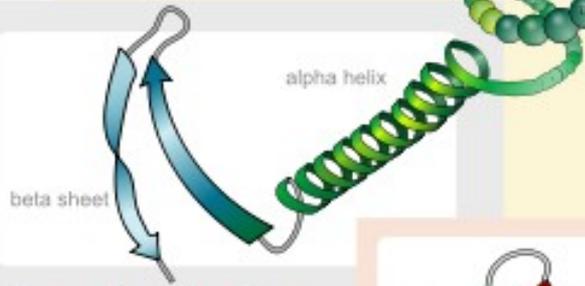


1<sup>y</sup> structure held by:  
covalent bonds between amino acids

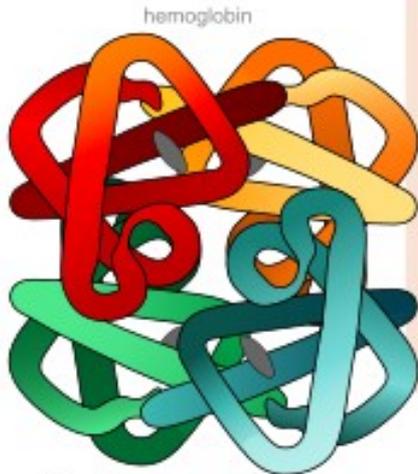
2<sup>y</sup> structure held by:  
hydrogen bonds

3<sup>y</sup> structure held by:  
hydrogen bonds  
disulfide bonds  
ionic attractions (e.g.  $\text{COO}^-$  and  $\text{NH}_3^+$ )  
etc

Secondary structure  
regular sub-structures

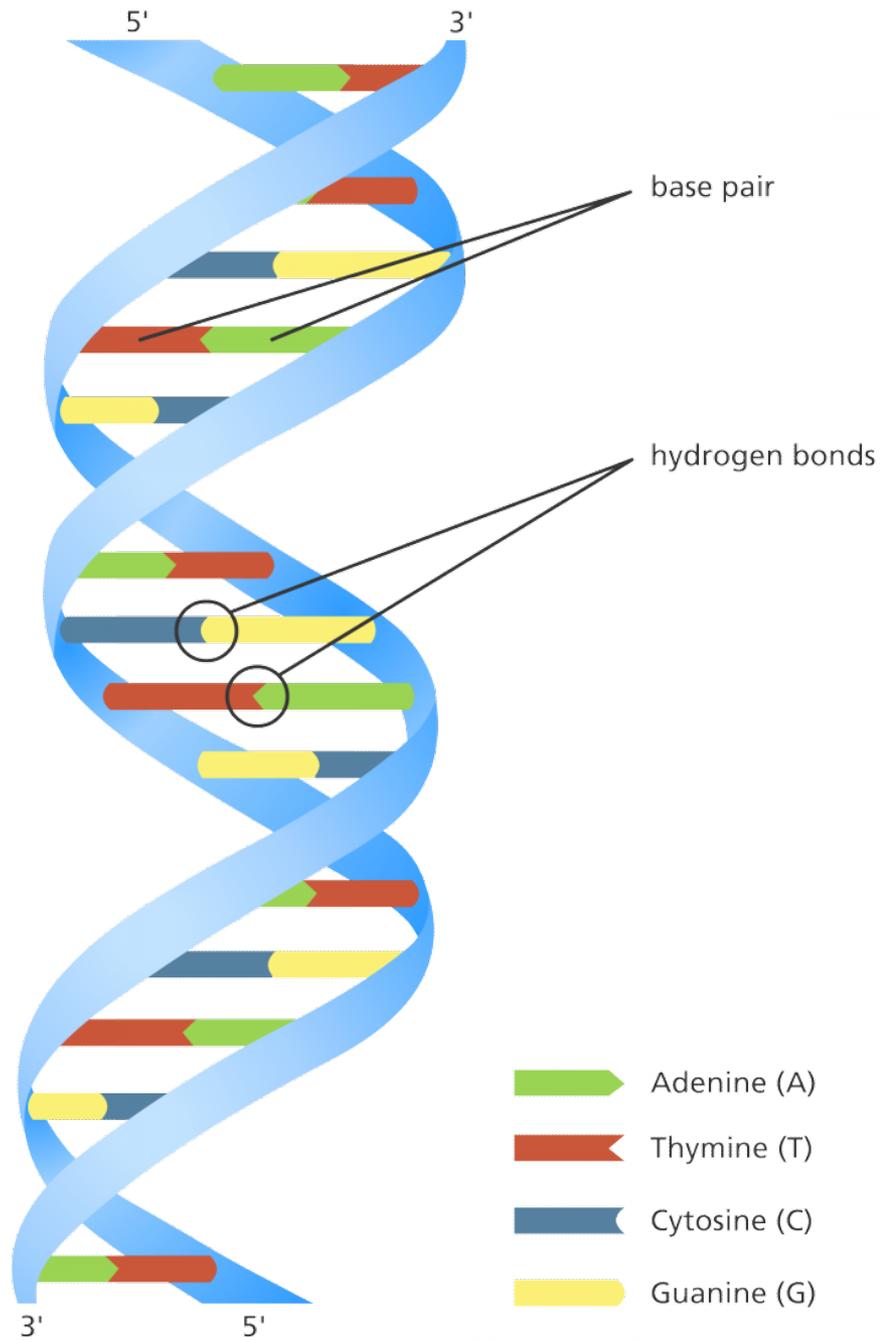


Tertiary structure  
three-dimensional structure



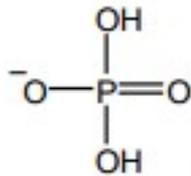
Quaternary structure  
complex of protein molecules

# DNA

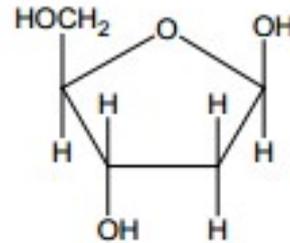


# DNA

## Phosphate and sugars

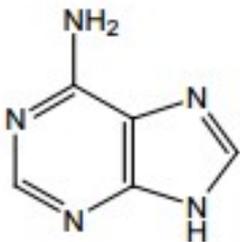


phosphate

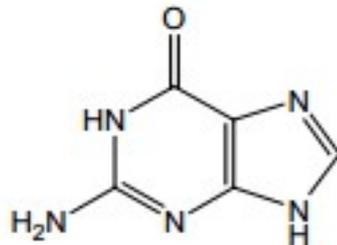


2-deoxyribose

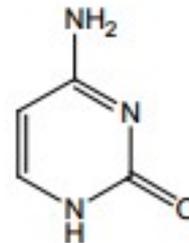
## Bases



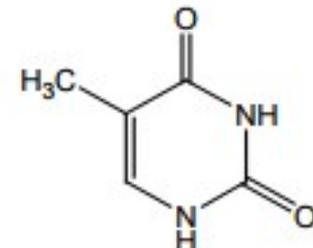
adenine



guanine

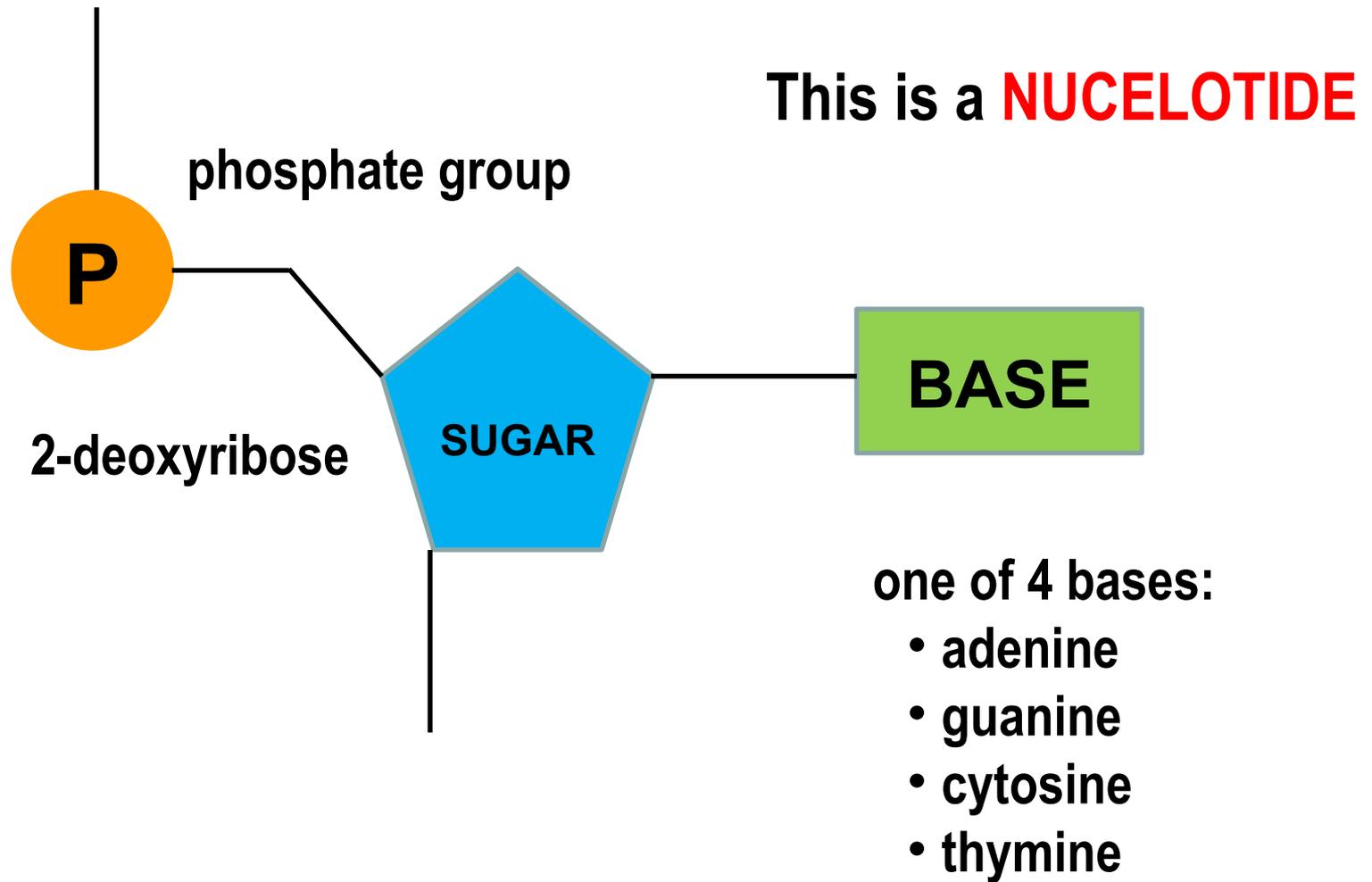


cytosine

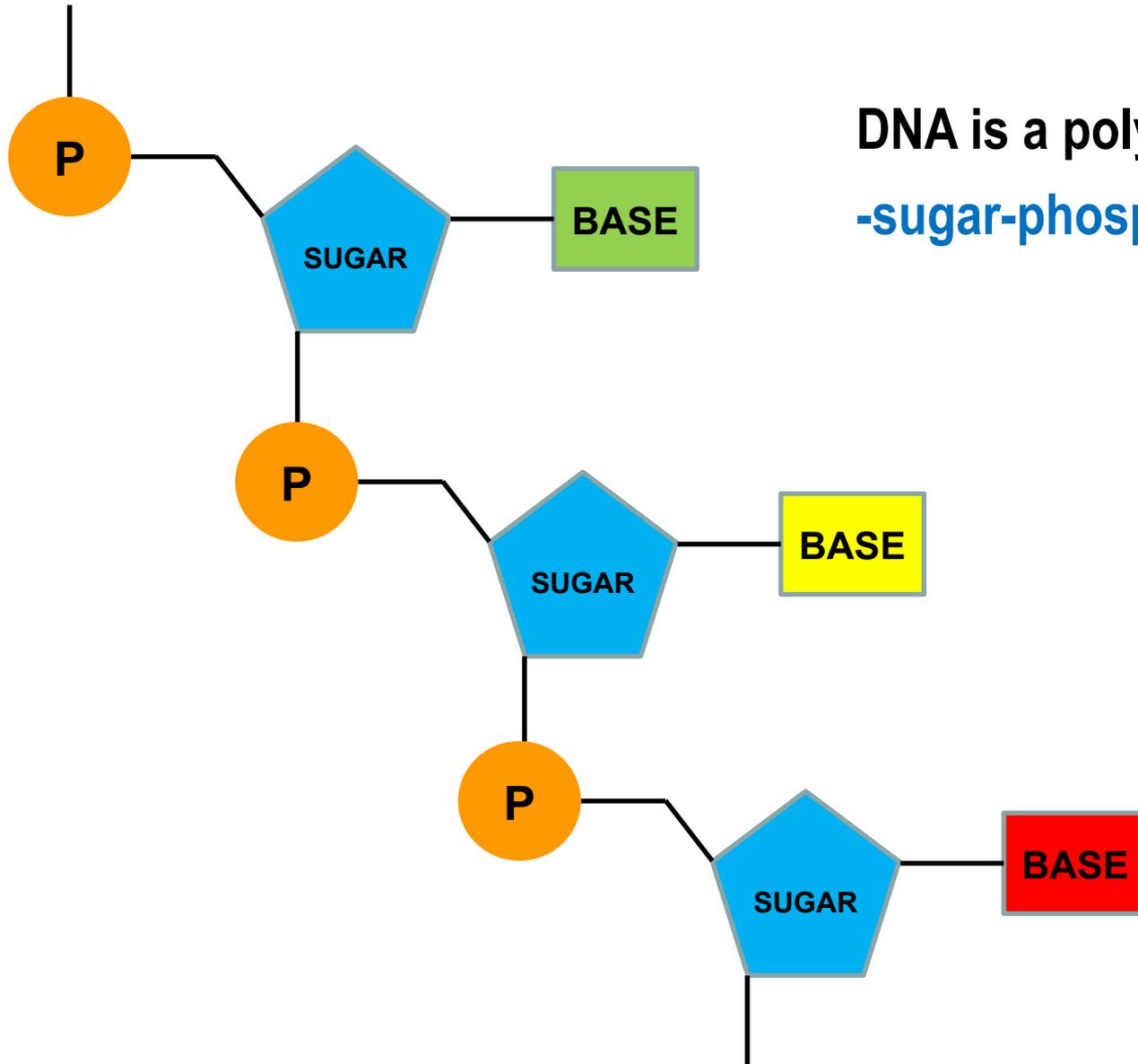


thymine

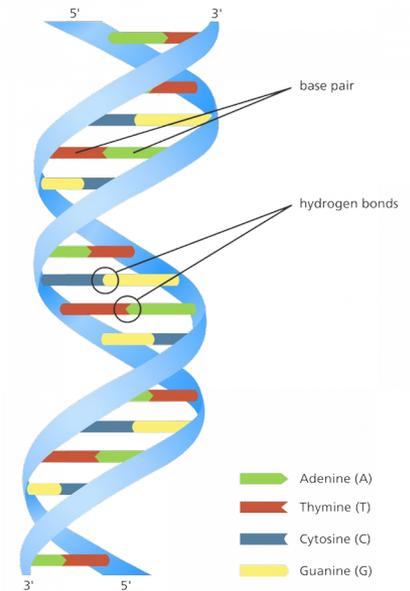
# DNA



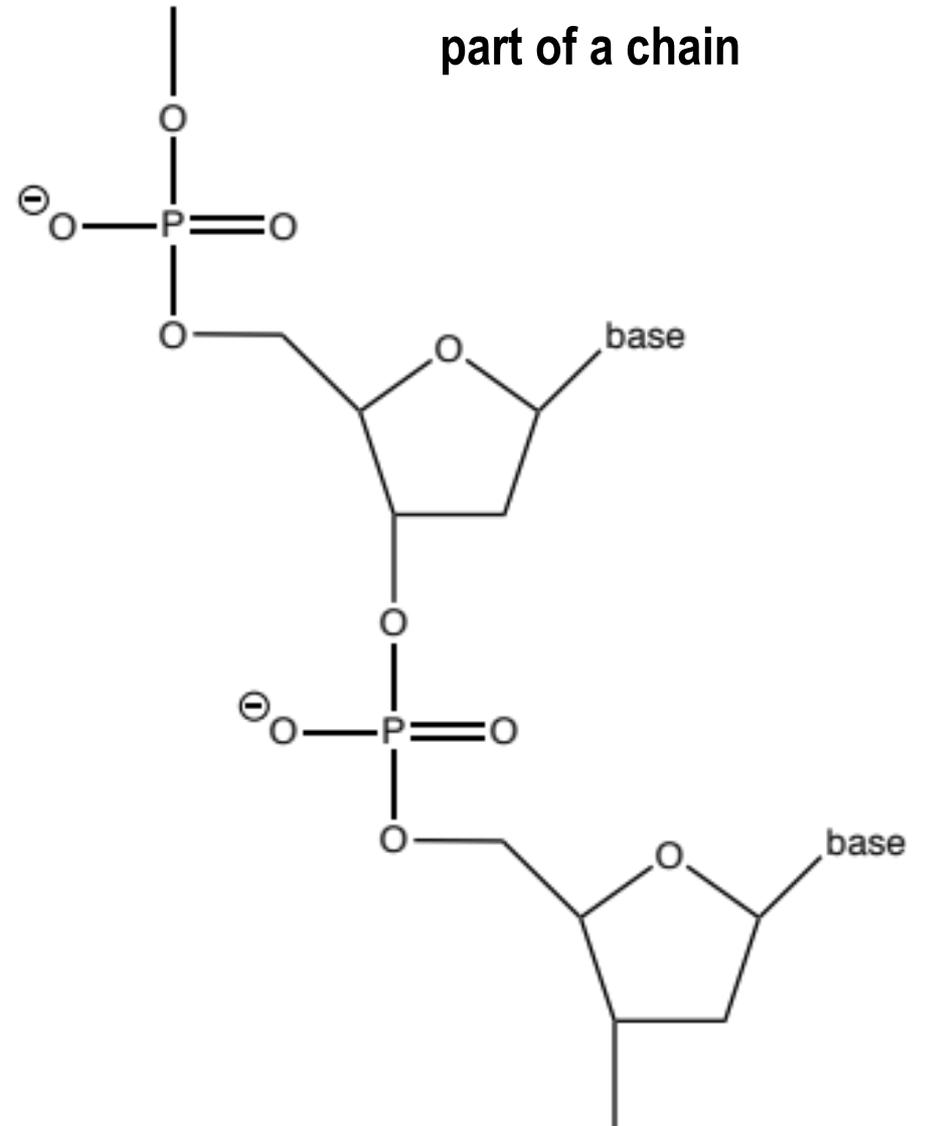
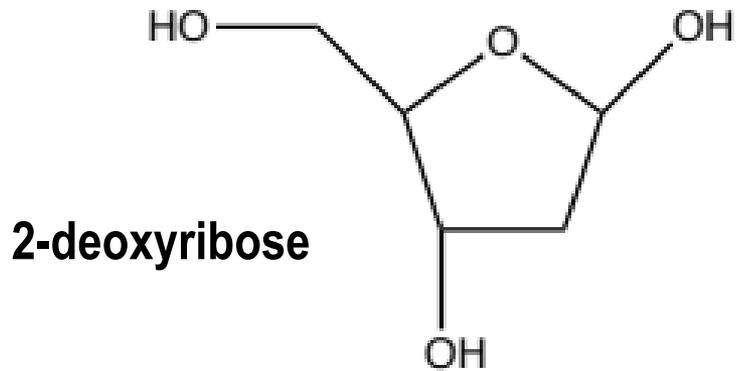
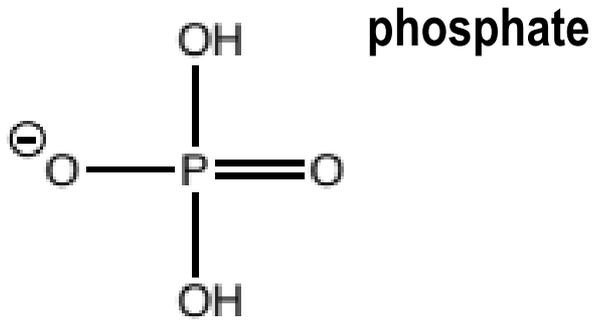
# DNA



DNA is a polymer made of:  
**-sugar-phosphate-sugar-phosphate-**

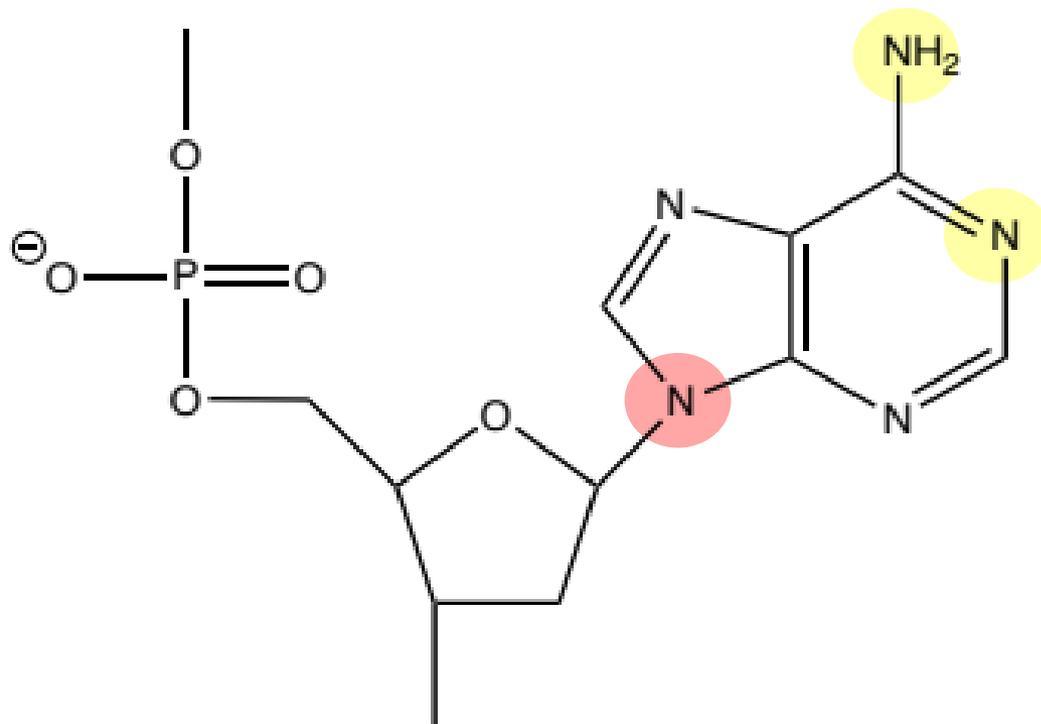
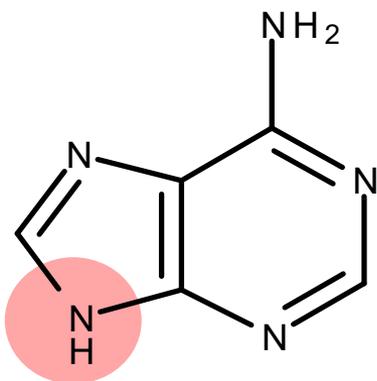


# DNA



# DNA

## adenine

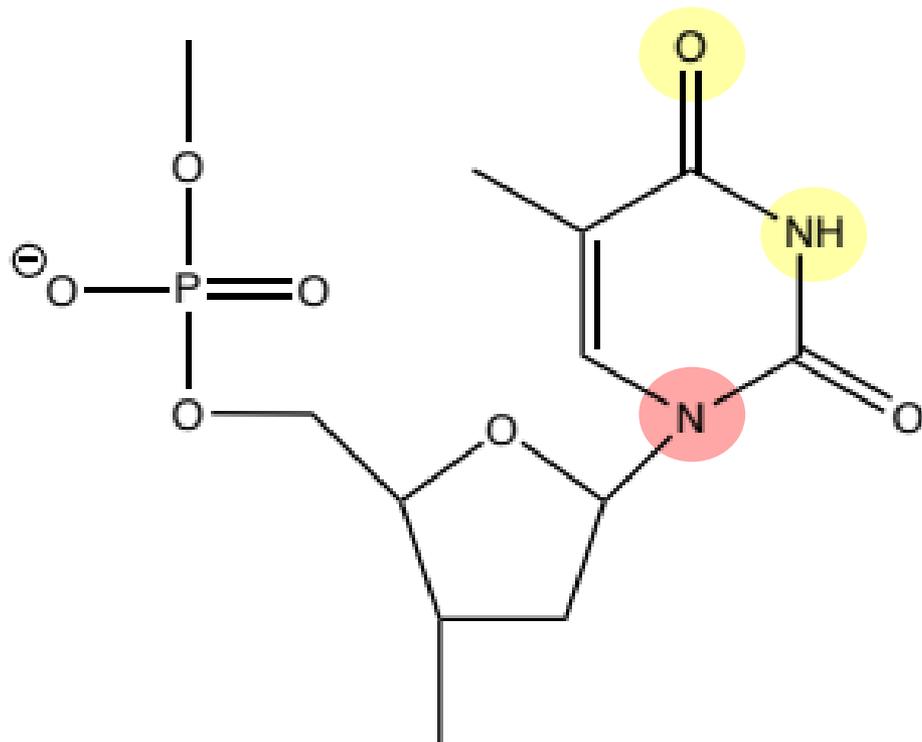
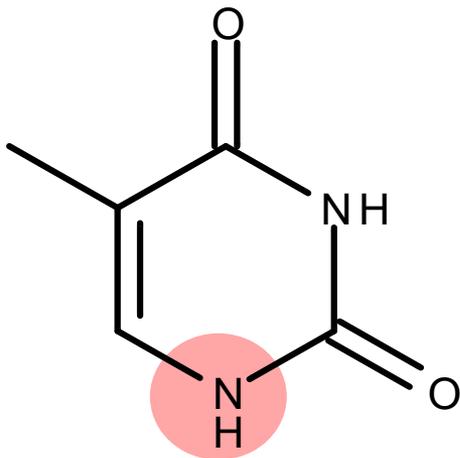


 bonding site to deoxyribose

 H bonding site to base partner

# DNA

thymine

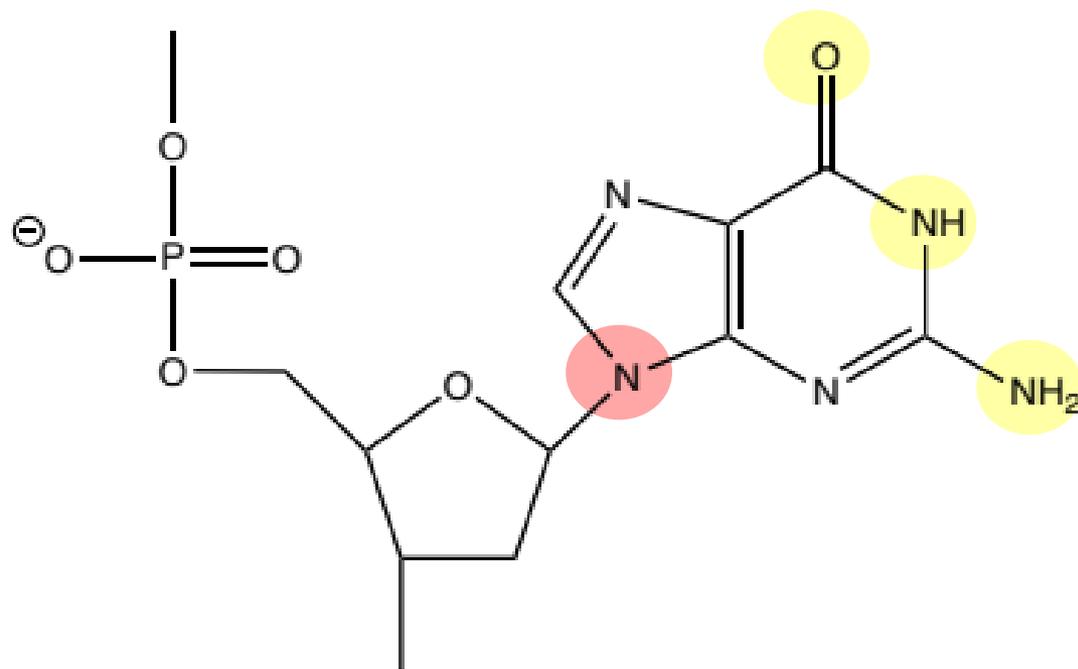
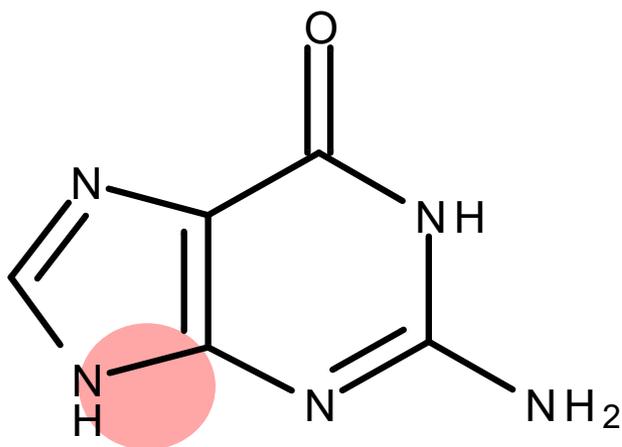


 bonding site to deoxyribose

 H bonding site to base partner

# DNA

guanine

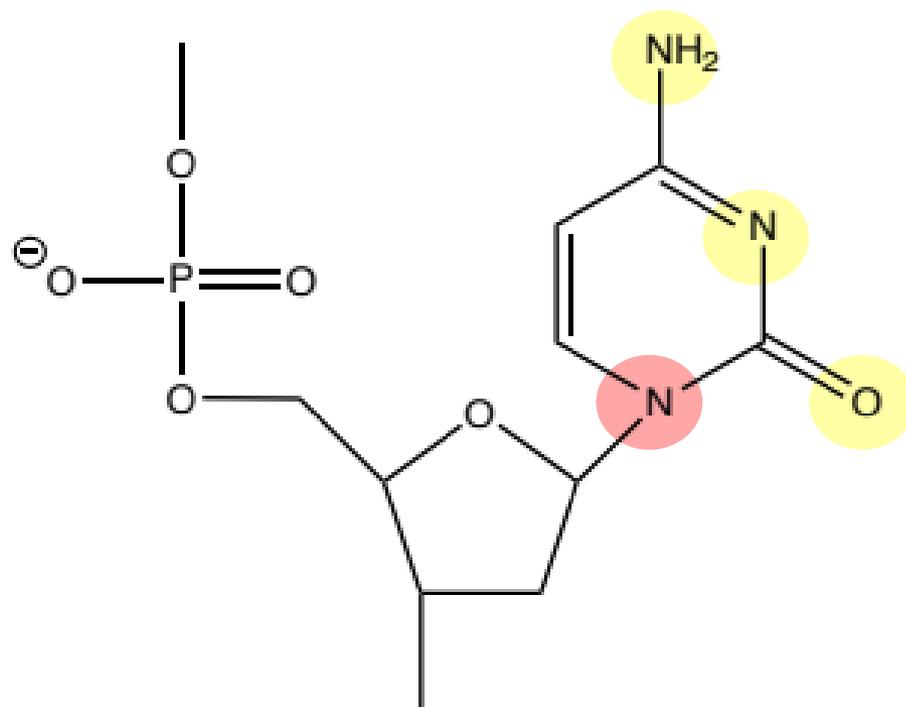
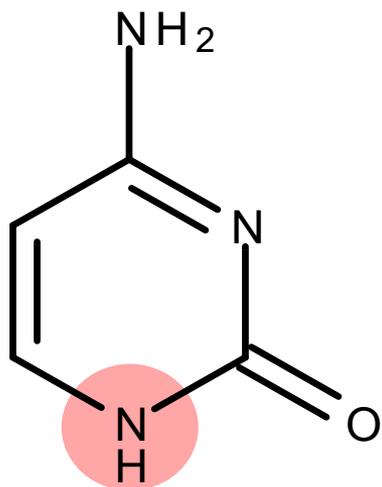


 bonding site to deoxyribose

 H bonding site to base partner

# DNA

## cytosine

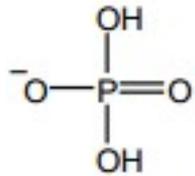


 bonding site to deoxyribose

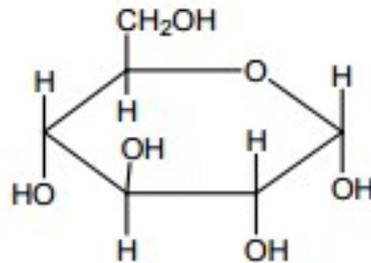
 H bonding site to base partner

# DNA

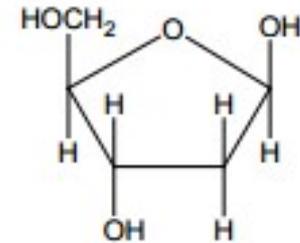
## Phosphate and sugars



phosphate

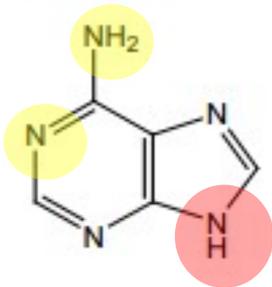


glucose

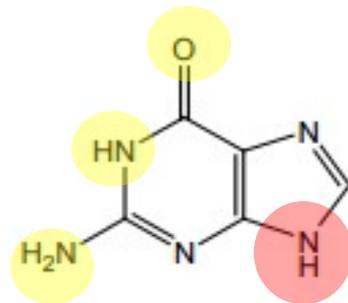


2-deoxyribose

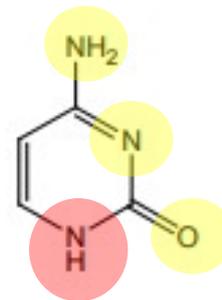
## Bases



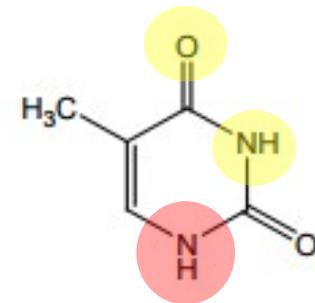
adenine



guanine

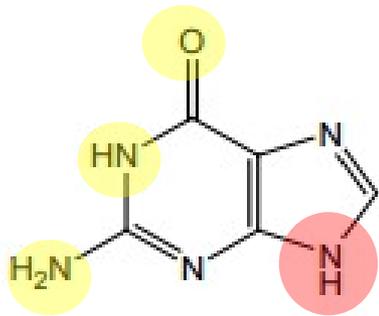


cytosine

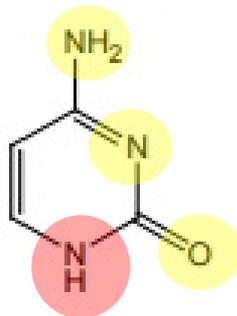


thymine

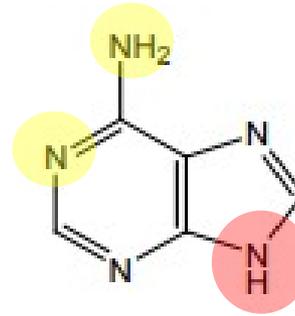
# BASE PAIRS IN DNA



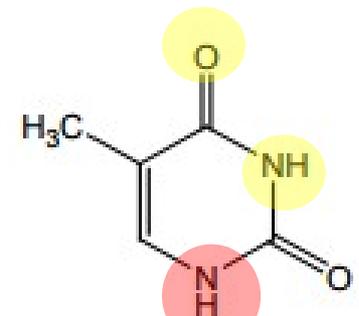
guanine



cytosine

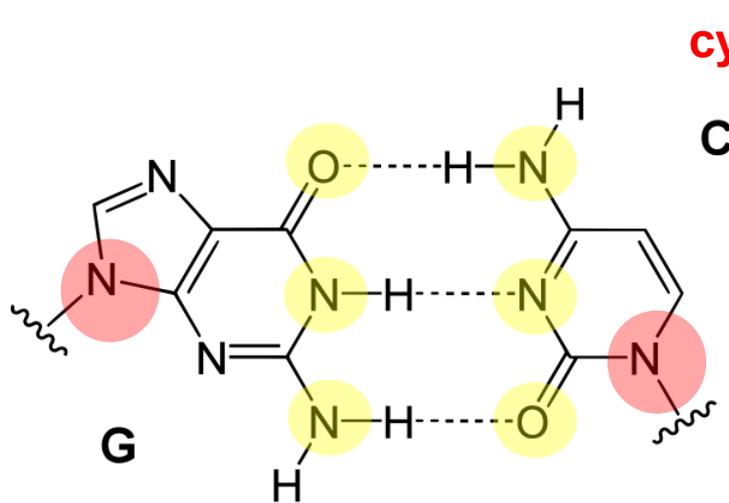


adenine

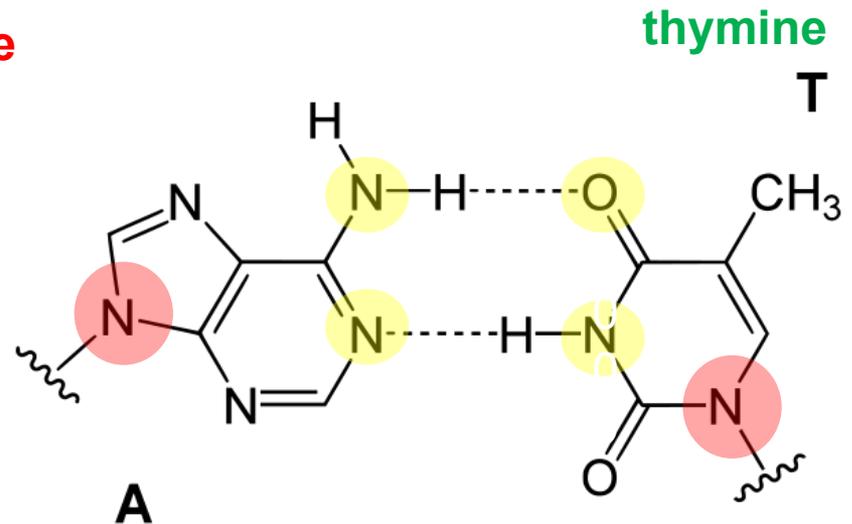


thymine

hydrogen bonding between base pairs holds DNA strands together



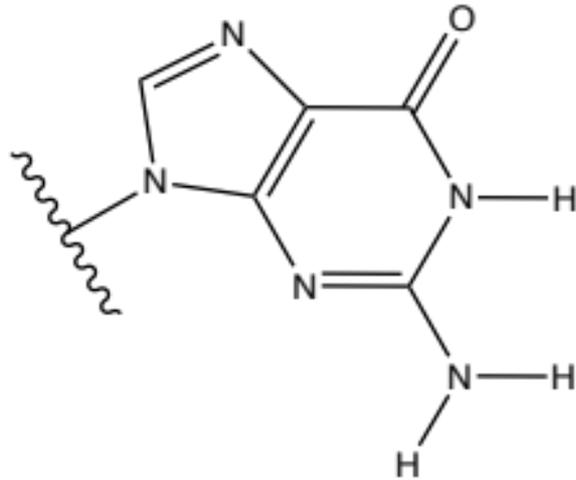
guanine



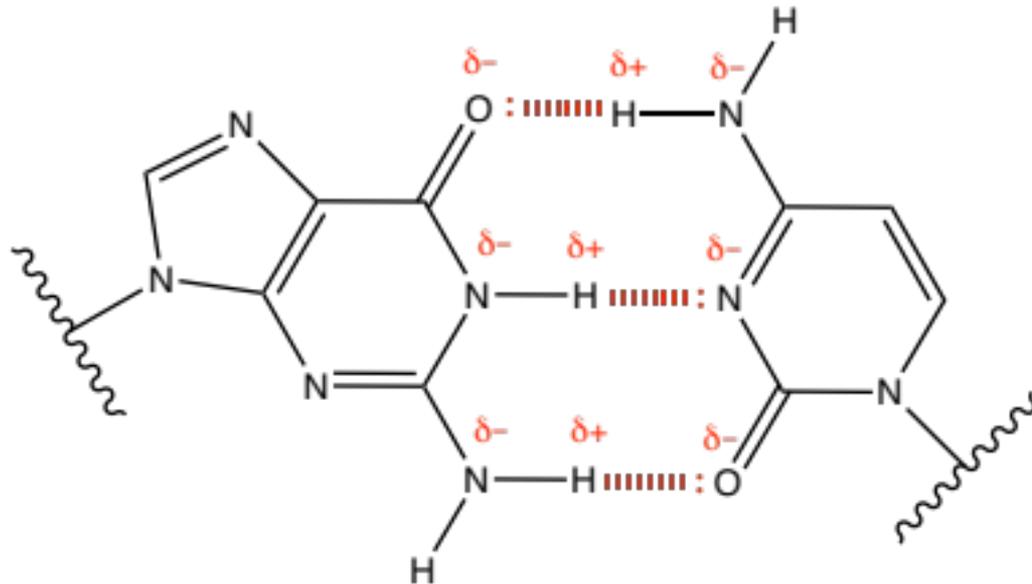
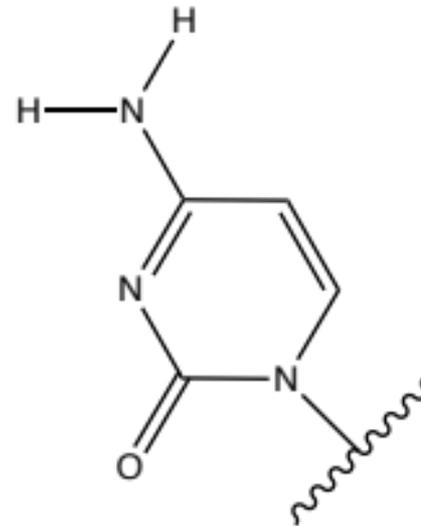
adenine

# BASE PAIRS IN DNA

guanine

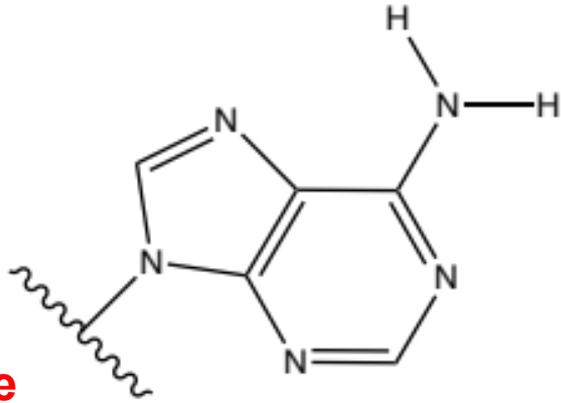


cytosine

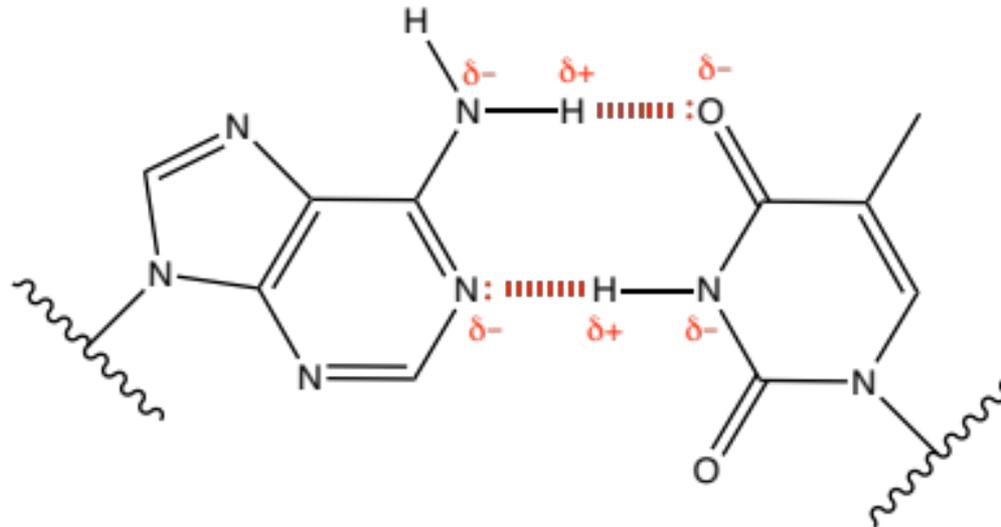
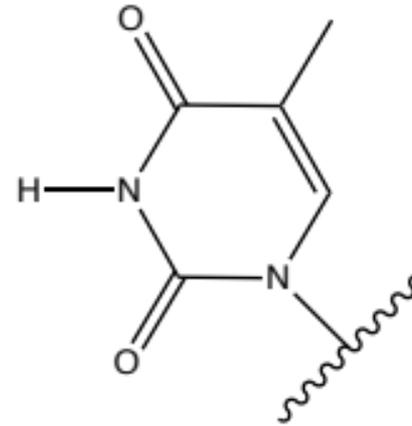


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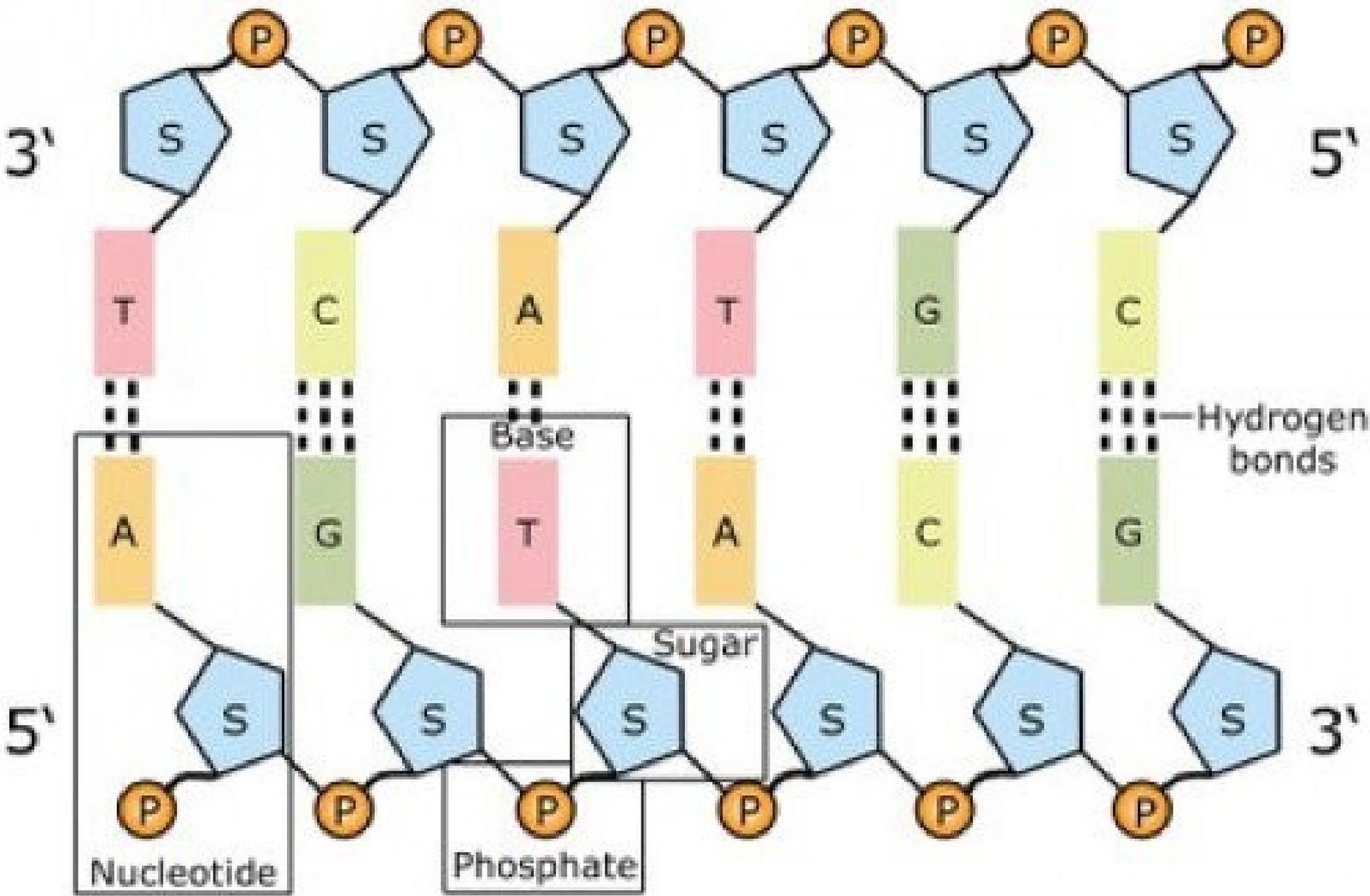
adenine

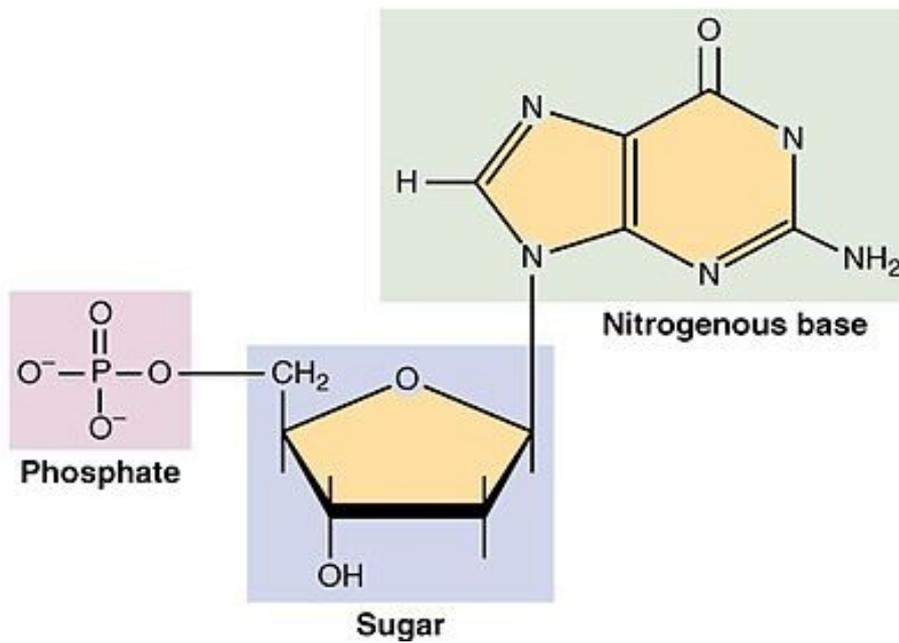
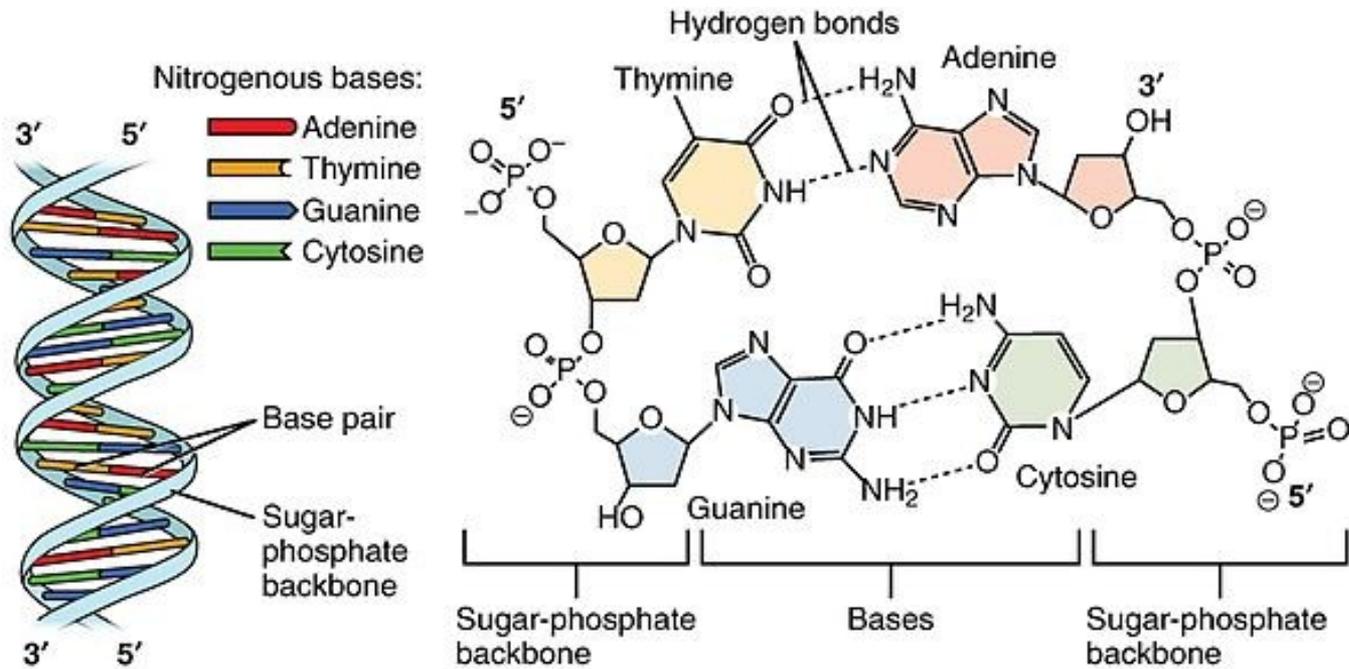


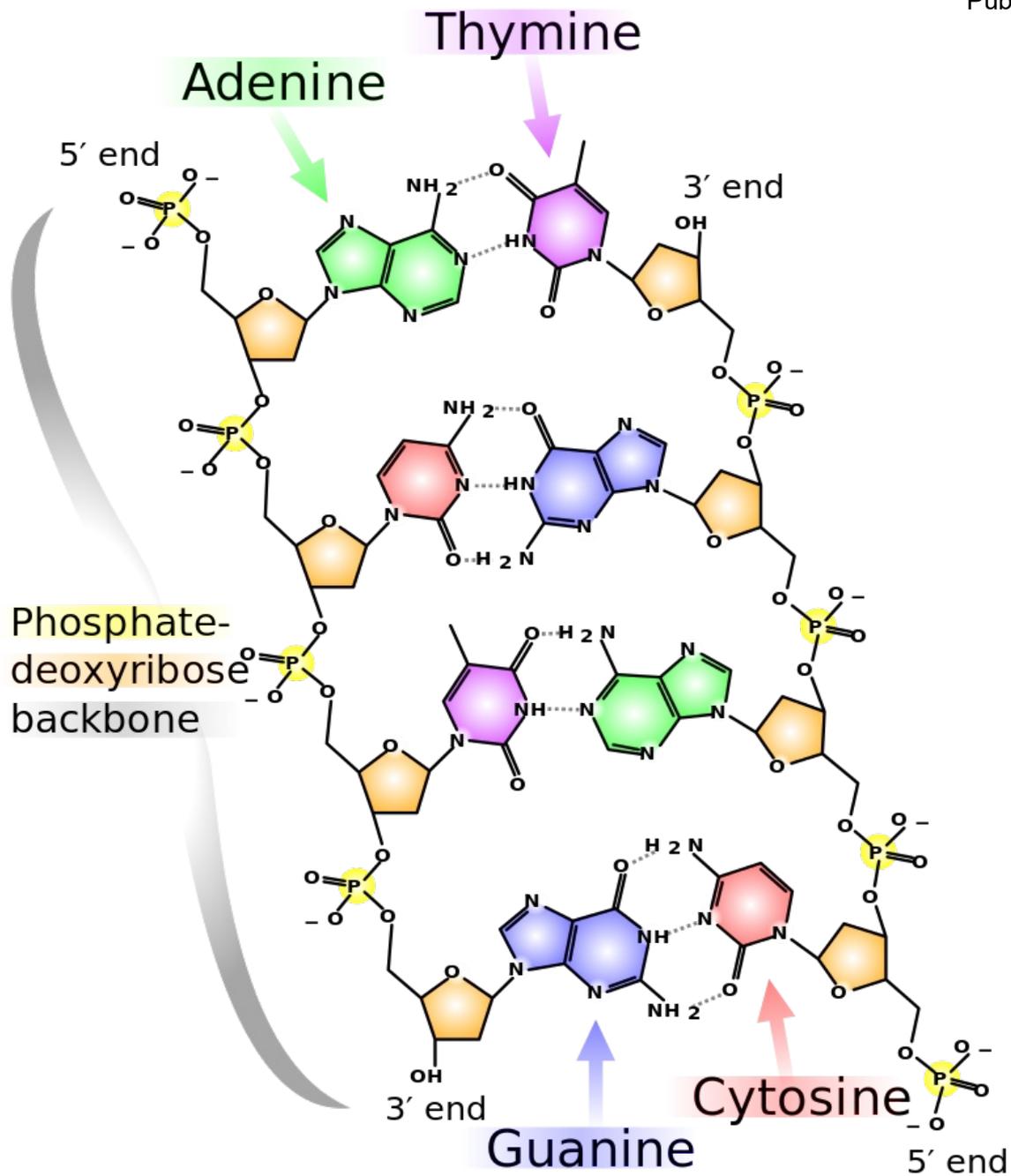
thymine



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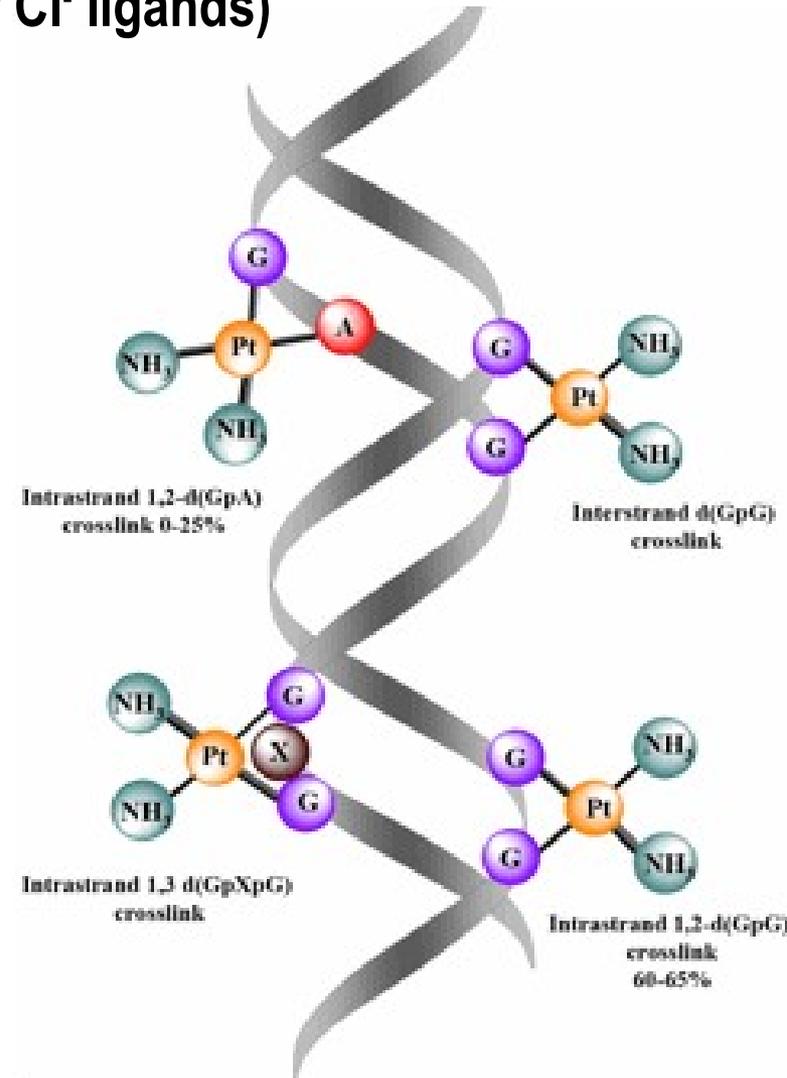
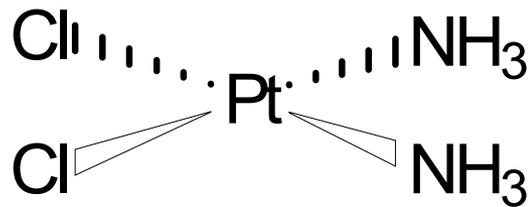


# CIS-PLATIN

Very effective drug to fight cancer (e.g. testicular)

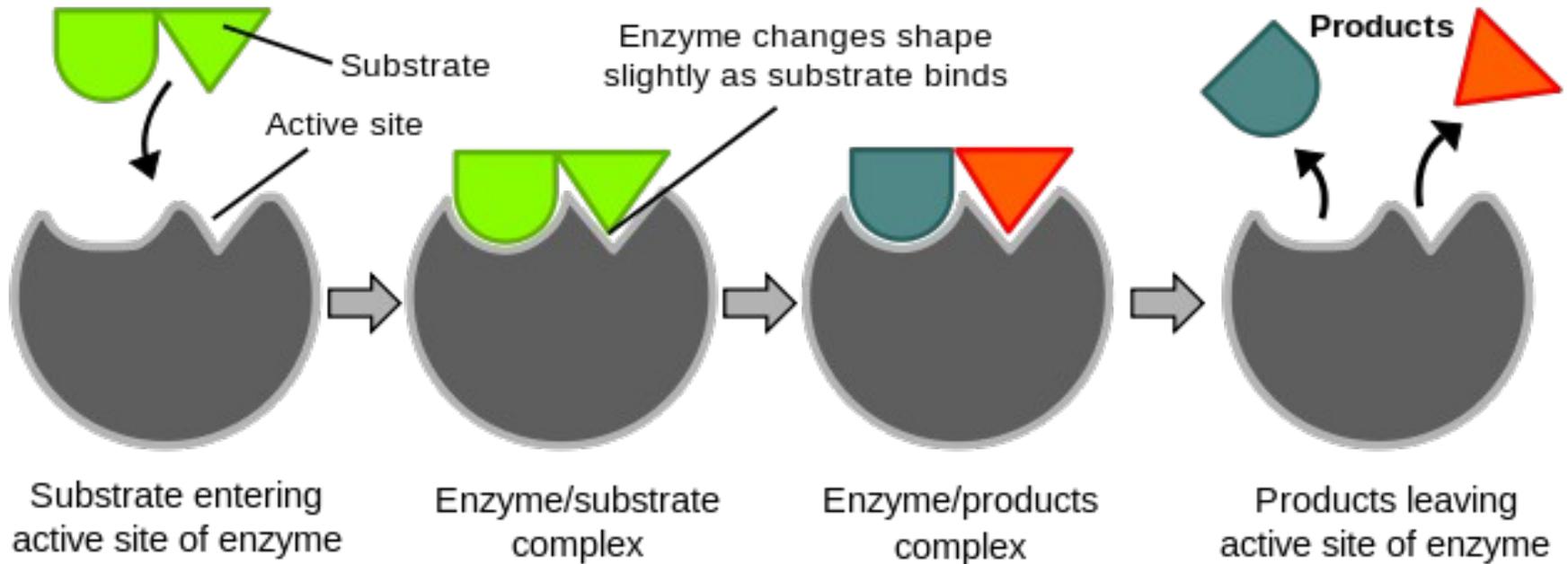
Pt binds to N in guanine in DNA (substitutes for Cl<sup>-</sup> ligands)

Stops DNA replication



# ENZYMES

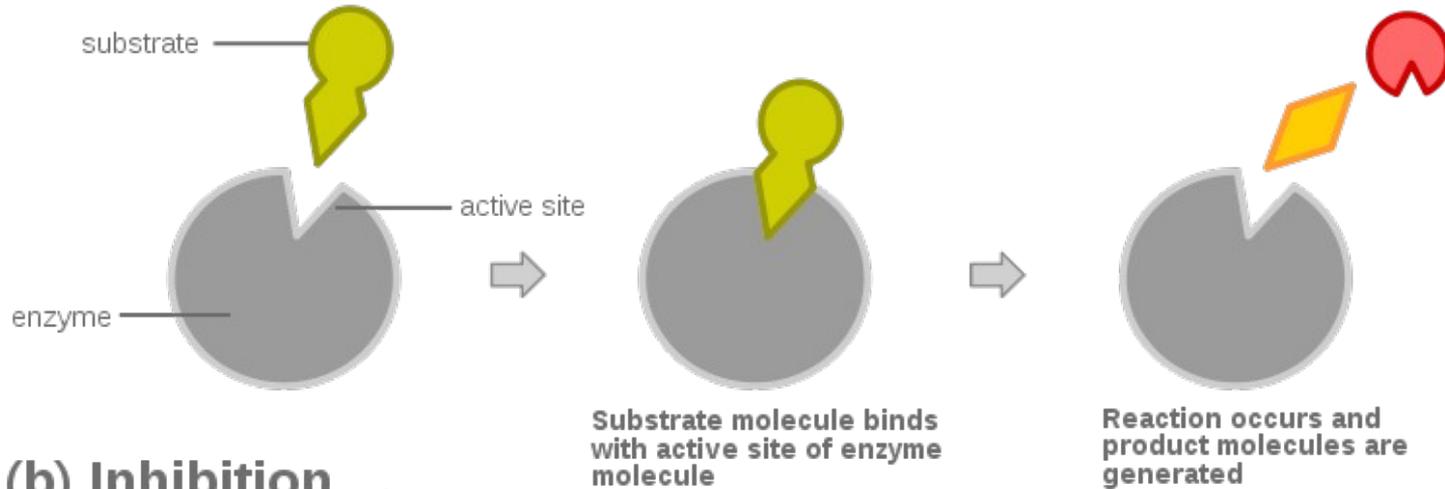
- are proteins that act as catalysts in biological systems
- they bind to a substrate but are very stereospecific



# ENZYMES

- **Drug action – blocks active sites to inhibit enzymes**

## (a) Reaction



## (b) Inhibition

