

Protein & amino acid

Proteins play key roles in a living system

- Three examples of protein functions

- Catalysis:

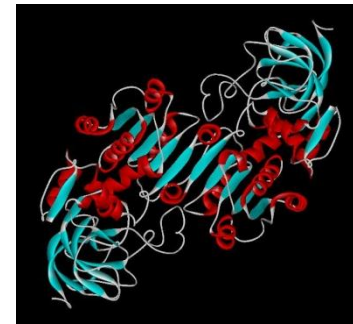
Almost all chemical reactions in a living cell are catalyzed by protein enzymes.

- Transport:

Some proteins transports various substances, such as oxygen, ions, and so on.

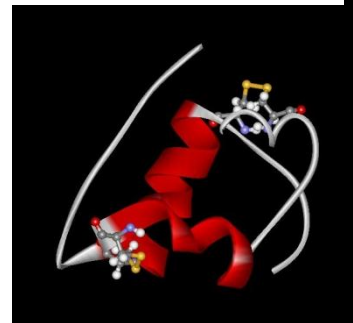
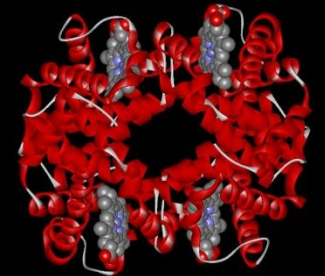
- Information transfer:

For example, hormones.



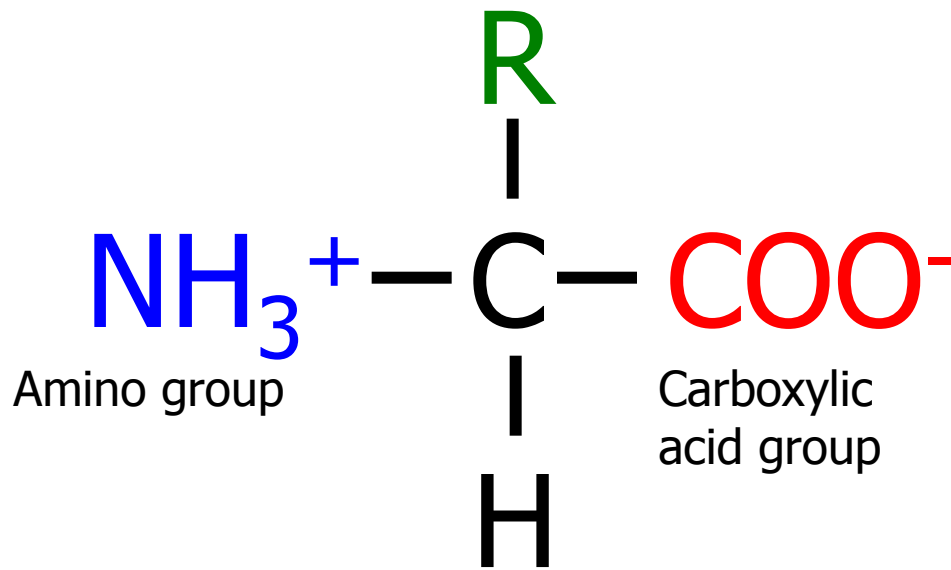
Alcohol dehydrogenase oxidizes alcohols to aldehydes or ketones

Haemoglobin carries oxygen



Insulin controls the amount of sugar in the blood

Amino acid: Basic unit of protein



Different side chains, **R**, determine the properties of 20 amino acids.

An amino acid

20 Amino acids

Glycine (G)



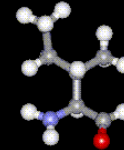
Alanine (A)



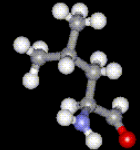
Valine (V)



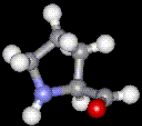
Isoleucine (I)



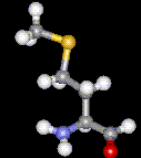
Leucine (L)



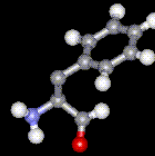
Proline (P)



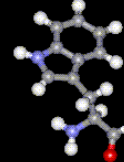
Methionine (M)



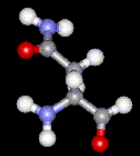
Phenylalanine (F)



Tryptophan (W)



Asparagine (N)



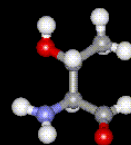
Glutamine (Q)



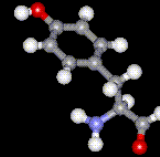
Serine (S)



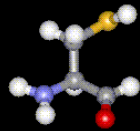
Threonine (T)



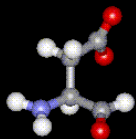
Tyrosine (Y)



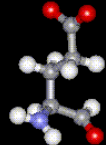
Cysteine (C)



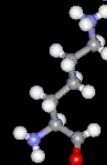
Aspartic acid (D)



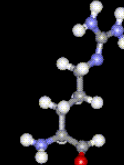
Glutamic acid (E)



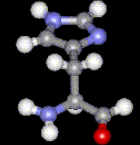
Lysine (K)



Arginine (R)

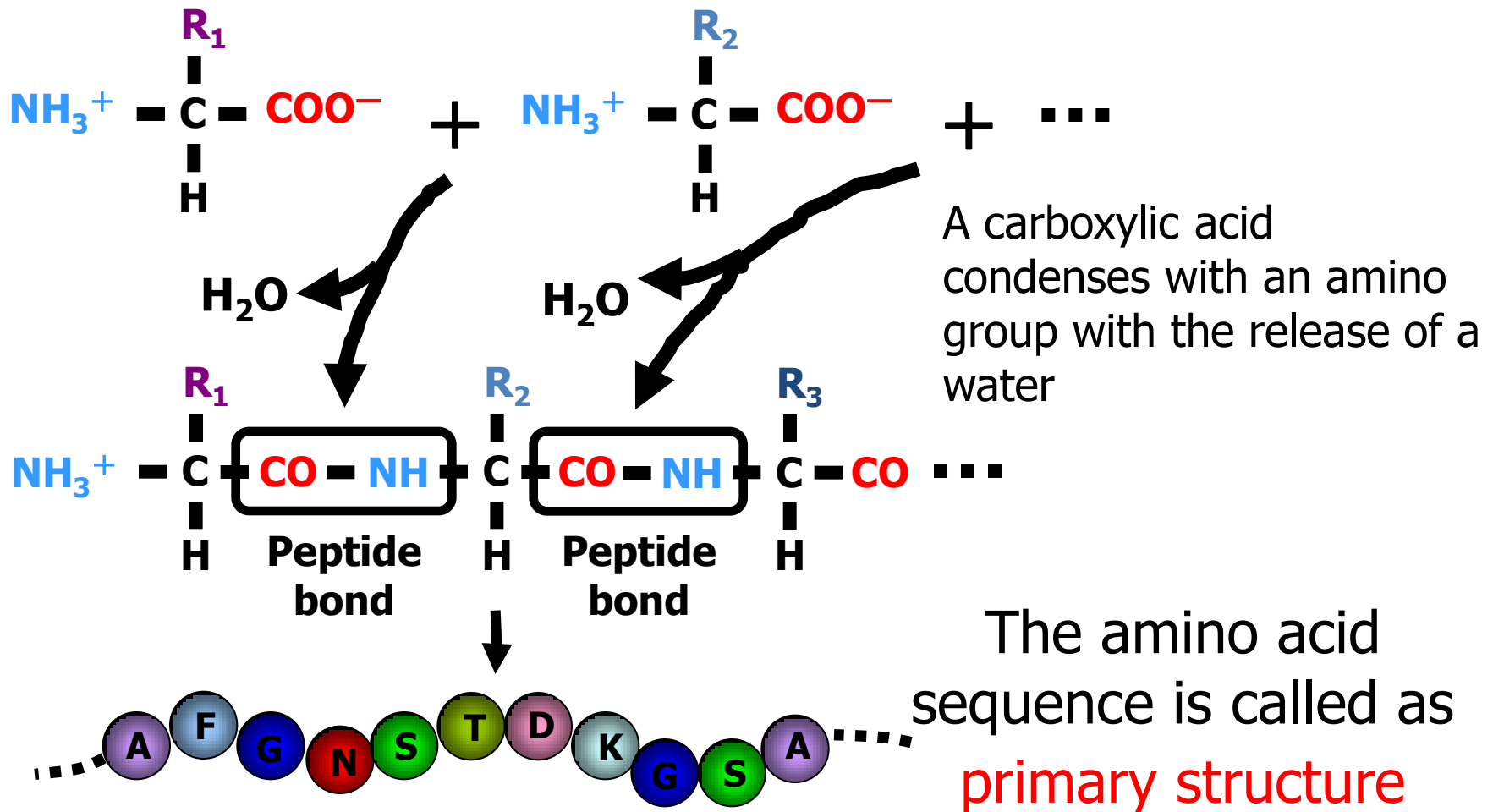


Histidine (H)



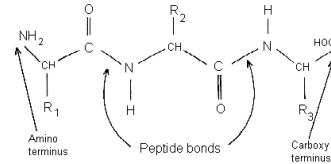
White: Hydrophobic, Green: Hydrophilic, Red: Acidic, Blue: Basic

Proteins are linear polymers of amino acids



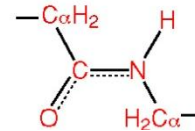
Peptide bond

- Joins amino acids



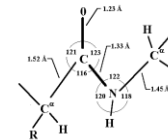
- 40% double bond character

- Caused by resonance



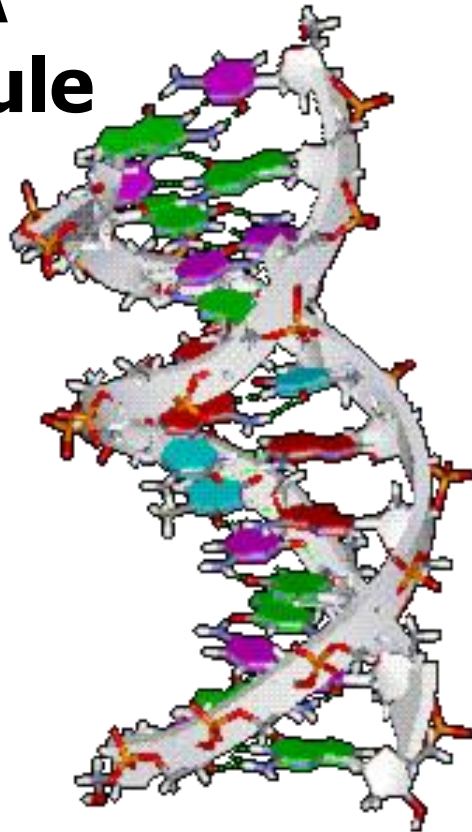
- Results in shorter bond length

- Double bond disallows rotation

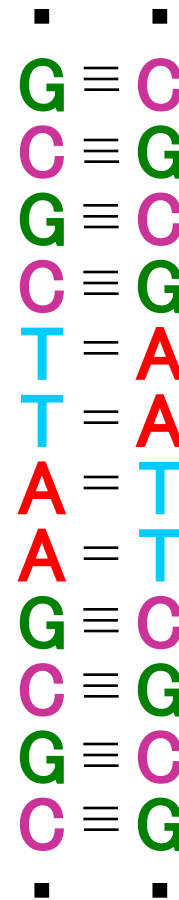


Amino acid sequence is encoded by DNA base sequence in a gene

**DNA
molecule**



=



**DNA base
sequence**

Amino acid sequence is encoded by DNA base sequence in a gene

		Second letter									
		T		C		A		G			
First letter	T	TTT	Phe	TCT	Ser	TAT	Tyr	TGT	Cys	T	Third letter
		TTC		TCC		TAC		TGC		C	
		TTA	Leu	TCA		Stop	TAA	TGA	Stop	A	
		TTG		TCG			TAG	TGG	Trp	G	
	C	CTT	Leu	CCT	Pro	CAT	His	CGT	Arg	T	
		CTC		CCC		CAC		CGC		C	
		CTA		CCA		CAA	CGA	A			
		CTG		CCG		CAG	CGG	G			
	A	ATT	Ile	ACT	Thr	AAT	Asn	AGT	Ser	T	
		ATC		ACC		AAC		AGC		C	
		ATA		ACA		AAA	AGA	A			
		ATG	Met	ACG		AAG	Lys	AGG	Arg	G	
	G	GTT	Val	GCT	Ala	GAT	Asp	GGT	Gly	T	
		GTC		GCC		GAC		GGC		C	
		GTA		GCA		GAA	GGA	A			
		GTG		GCG		GAG	GGG	G			