

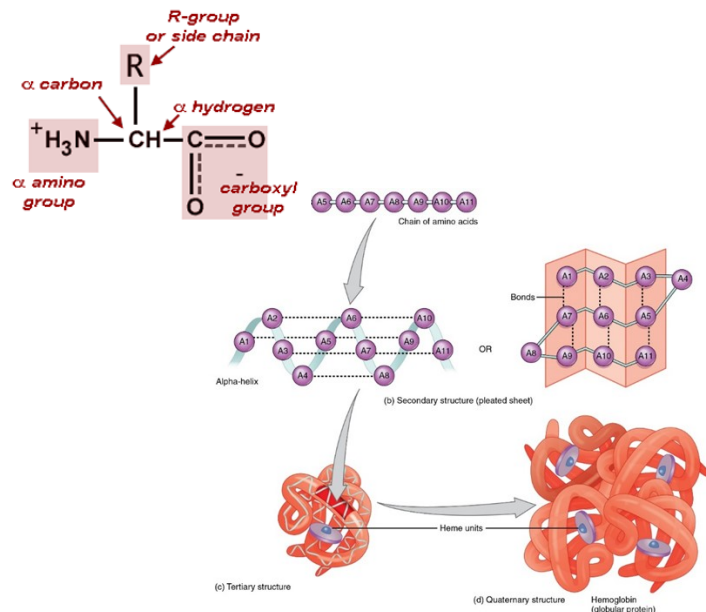
# Amino acids, Proteins and DNA Knowledge organiser

## 1. Keywords

Denaturing	destroy the characteristic properties of a biological macromolecule by heat, acidity, or other effect which disrupts its molecular conformation.
Stereospecific	preferentially interacting a particular stereoisomeric form of the substrate.
Zwitterions	molecule or ion having separate positively and negatively charged groups.

## 2. Denaturation

- The primary structure can be hydrolyzed: by boiling a protein or a peptide in HCl. The structure breaks down into a mixture of all the constituent amino acids. Hydrolysis requires 24 hours and 6 mol dm<sup>-3</sup> HCl since the covalent bond is a strong bond.
- Secondary structure can be disrupted by changes in pH or gentle heating (**denaturing**).



## 3. Amino acids

- There are 20 essential amino acids that make up proteins in the human body. •Amino acids contain both amine (NH<sub>2</sub>) and carboxyl (COOH) functional groups.
- The molecule is chiral (not glycine) because it has a carbon bonded to four different groups. Most naturally occurring amino acids are the (-) enantiomer.
- Amino acids exist as **zwitterions** - ions that have both a permanent positive charge and a permanent negative charge, but are neutral overall.
- They can act both as acids and as bases
- $\alpha$ - amino acids have the amine group on the carbon next to the -COOH group

Proteins are sequences of amino acids joined by peptide links -CONH-. (condensation reaction).

Proteins can have 4 structures:

- Primary structure: the sequence of amino acids along a protein chain. The structure is held together by strong covalent bonds (peptide bonds) and is therefore stable.
- Secondary structure: Either an  $\alpha$ -helix or a  $\beta$ -pleated sheet. Held together by hydrogen bonds which are much weaker than covalent bonds.
- Tertiary structure: The secondary structure scan be folded into a 3-D shape. This is held together by hydrogen bonding, ionic interactions and sulphur-sulphur bonds.
- Quaternary structure: arrangement of two or more folded polypeptide chains that bond together with several types of bonds.

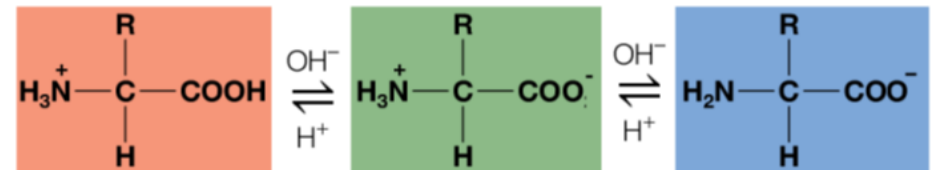
Sulfur-sulfur bonds.

- The amino acid cysteine has a side chain with a -CH<sub>2</sub>SH group.
- When oxidised, two cysteine molecules can form a sulfur-sulfur bond that makes a bridge between the two molecules; this is called a disulfide bridge.
- A double amino acid called cystine is formed.

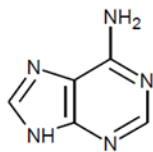
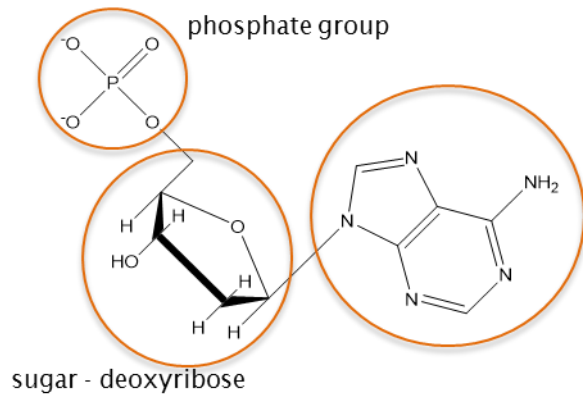
## 4. Enzymes

- Enzymes are biological catalysts
- Stereospecificity:** The active site of an enzyme can be so specific that many enzymes will only catalyse reactions of one enantiomeric form of a substrate.

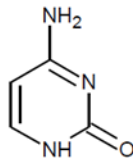
Aminoacids with acids and bases



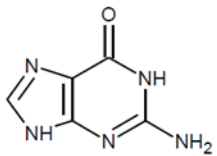
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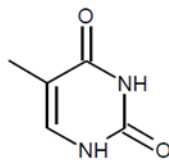
Adenine



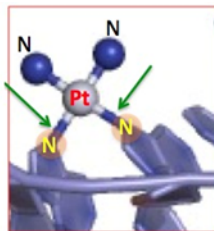
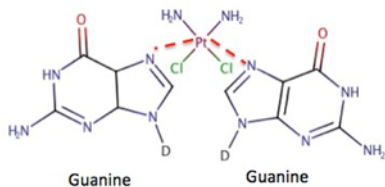
Cytosine



Guanine



Thymine



## 1. DNA

- DNA = Deoxyribonucleic acid
- A single strand of DNA is a polymer made up from four different monomers (nucleotides):
  1. Cytosine (C)
  2. Thymine (T)
  3. Adenine (A)
  4. Guanine (G)
- A nucleotide has three parts - a phosphate, a sugar and a base
- A single strand of DNA is a polymer of nucleotides linked by covalent bonds between the phosphate group of one nucleotide and the sugar of another nucleotide. Formed in a condensation reaction.
- The DNA Double helix is stabilised by hydrogen bonds between bases of complementary chain (A-T, C-G)

## 2. Anticancer drug

- Cisplatin is an anticancer drug
- works by bonding to strands of DNA (Ligand replacement reaction), distorting their shape and preventing the replication of the cells.
- The molecule bonds to the lone pair of nitrogen atoms on two adjacent guanine bases on a strand of DNA forming a dative covalent bonds with the platinum, displacing the Cl<sup>-</sup> ions.

Side effects:

- It will bond to DNA in healthy cells as well as cancerous ones.

