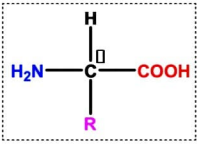
2. Amino acids

Although there are many types of amino acids the ones we will be interested in are those that exist naturally and are found in proteins.
These are known as □-amino acids.
The amino acids are so-called because they contain two functional groups:
The amino group: -NH2
The carboxylic acid group: -COOH
All naturally occurring amino acids have the following overall structure:



2. Amino acids

The ***only difference*** between one amino acid an another is the ***group -R***

You are given a sheet giving the structures of the most common amino acids.

From this sheet state what is the –R group in:

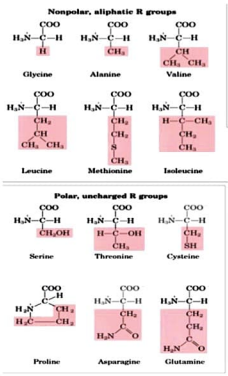
Alanine

leucine

cysteine

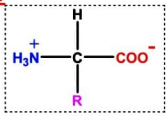
glutamic acid

lysine

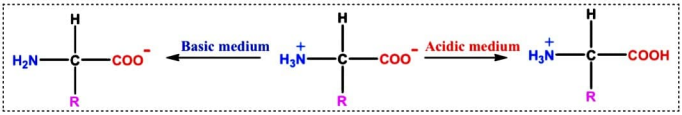


2. Amino acids

Amino acids contain both a **basic group (-NH2)** and an **acidic group (-COOH)**.
In solution the carboxyl group can lose a proton and the amino group can gain one the give a charge known as a **Zwitterion**.

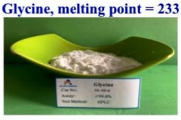






In the solid state, amino acids exist as zwitterions and, because of the electrostatic attraction between them, give them a high melting point.

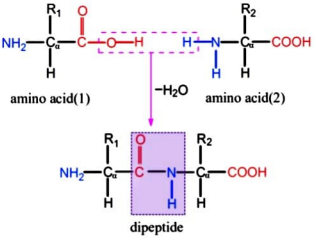
Glycine, melting point = 233 °C



3. Polypeptides & Proteins

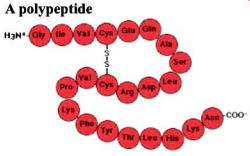
Amino acids are able to link together to form chains.
In this way they can build up large molecules of polypeptides and proteins.
The amino acids link together by a reaction which removes a molecule of water from them
This is known as a **condensation** reaction.
The link between the two amino acids is called a **peptide link** (–CO-NH-)
The dipeptide still has an –NH2 group at one end and a –COOH at the other so that it can undergo further condensation reactions with more amino acid molecules to build up chains of unlimited length (a polypeptide chain)

Formation of a dipeptide



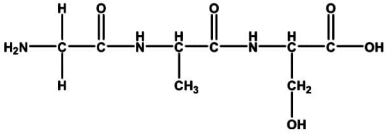
3. Polypeptides & Proteins

A polypeptide



A polypeptide chain undergoes **hydrolysis** when boiled with ***dilute hydrochloric acid*** or ***sodium hydroxide*** solution and produces the individual component amino acids.

Give the formulae and names of the amino acids formed by the hydrolysis of the following tripeptide

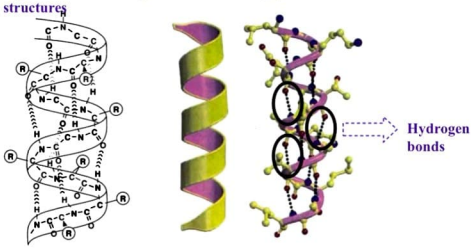


3. Polypeptides & Proteins

A ***polypeptide*** chain consists of a ***long string of amino acid molecules*** but this does not constitute a protein.
In a ***protein*** the polypeptide chain has to be ***arranged into a very specific shape depending on the function of the protein***.

The alpha-helix structure found in many structural proteins such as collagen.
The protein is held in its shape by **hydrogen bonds** between the carbonyl groups and the amino groups

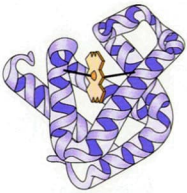
Alpha helices are categorized as secondary protein structures



3. Polypeptides & Proteins

Tertiary protein structure

Many enzymes and metabolic proteins are globular where the polypeptide chain is wound into a complex, but very specific, shape.
The configuration of the molecule is maintained by a network of hydrogen bonds



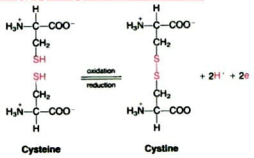
Myoglobin, a globular protein



3D protein structure

3. Polypeptides &

The polypeptide chain can also be held in its configuration by **disulphide bridges** between cysteine molecules.
A disulphide bridge is a much stronger linkage than a hydrogen bond.



Example: Insulin: Two polypeptide chains with three disulphide bridges

