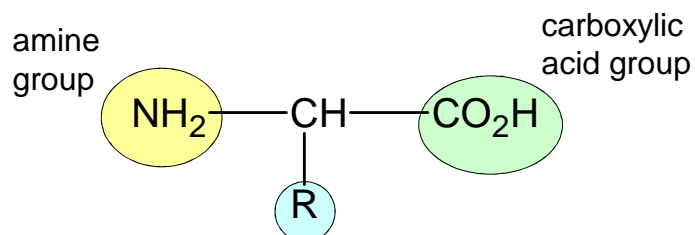


Amino Acids and Proteins

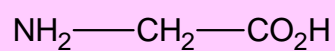
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Amino Acids



R group can be a variety of different things depending on what amino acid it is.

The simplest amino acid is glycine, where the R is an H

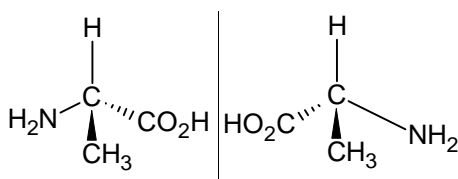
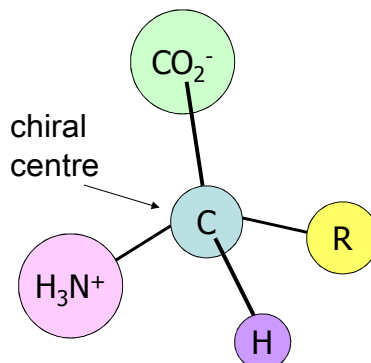


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Chirality

All amino acids, except glycine, are chiral because there are four different groups around the C

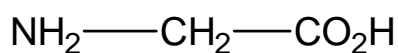
They rotate plane polarised light.



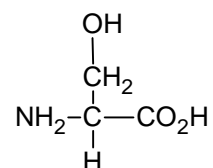
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Some amino acids

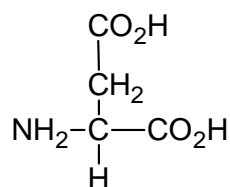
You do not need to know any common names for the 20 essential amino acids. We should, however, be able to name given amino acids using IUPAC organic naming



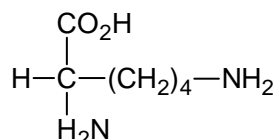
(2-)aminoethanoic acid



2-amino-3-hydroxypropanoic acid

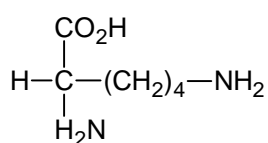
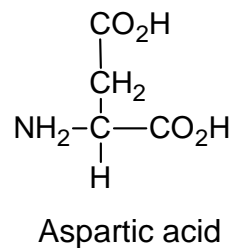


2-aminobutandioic acid



Lysine (basic)
2,6-diaminohexanoic acid

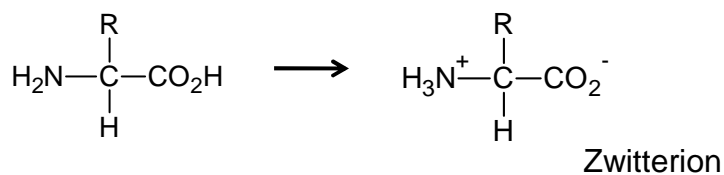
Some amino acids have an extra carboxylic acid or an amine group on the R group. These are classed as acidic or basic (respectively) amino acids



Lysine (basic)
2,6-diaminohexanoic acid

Zwitterions

The no charge form of an amino acid never occurs. The amino acid exists as a dipolar zwitterion.



Amino acids are often solids

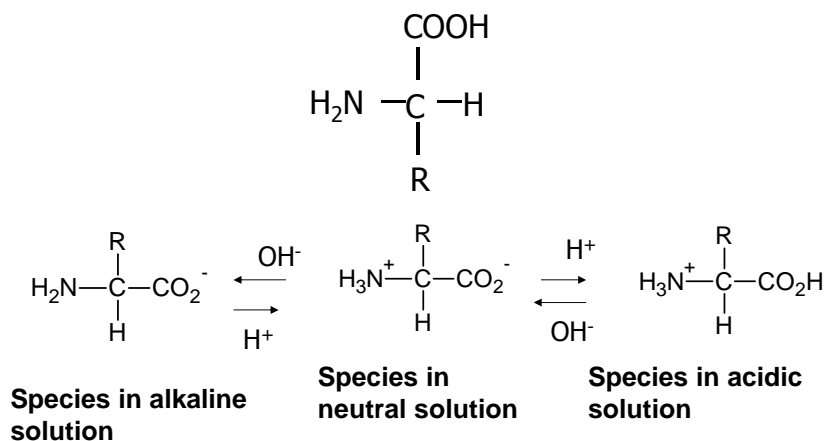
The ionic interaction between zwitterions explains the relatively high melting points of amino acids as opposed to the weaker hydrogen bonding that would occur in the no charge form

Reaction of amino acids

1 acidity and basicity

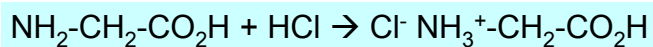
The amine group is basic and the carboxylic acid group is acidic.

Amino acids act as weak buffers and will only gradually change pH if small amounts of acid or alkali are added to the amino acids.



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Acid base reactions of amino acids

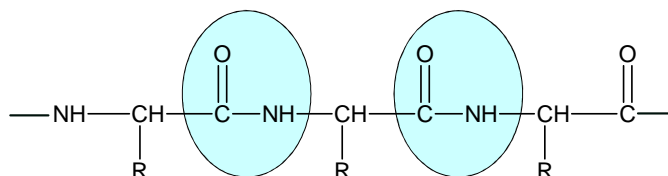


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Proteins

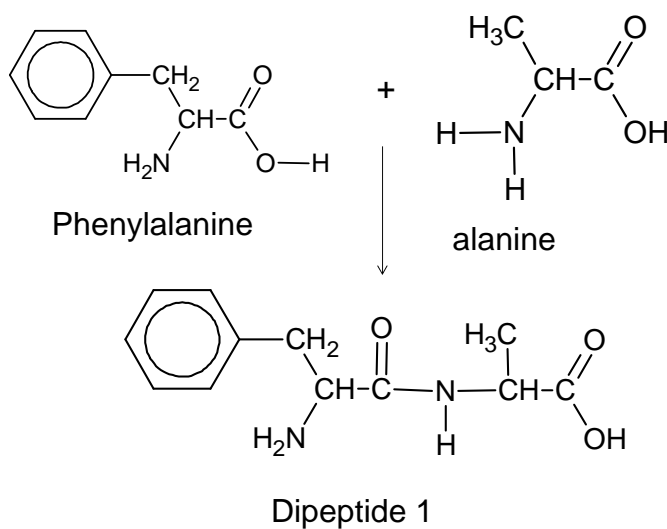
Proteins are polymers made from combinations of amino acids.

The amino acids are linked by peptide links, which are amide functional group.

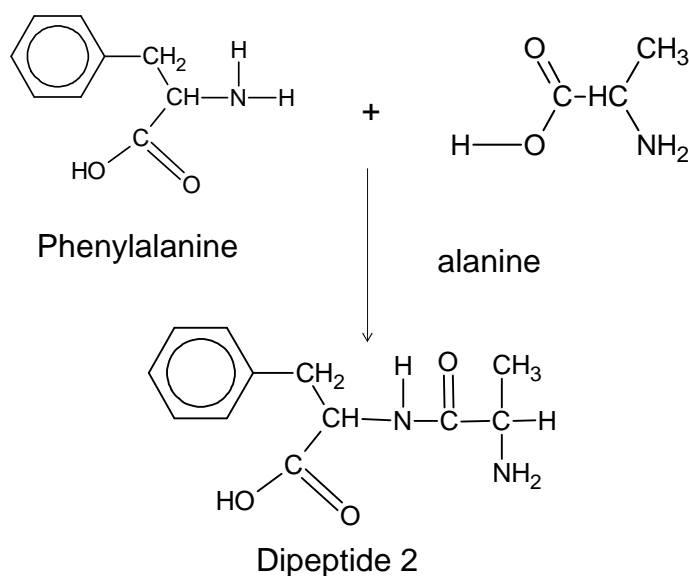


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The dipeptide phe-ala



The dipeptide phe-ala: second possibility



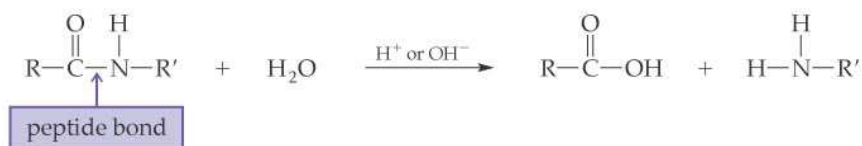
Hydrolysis of di-peptides/proteins

If proteins are heated with dilute acid or alkali they can be hydrolysed and split back in to their constituent amino acids.

Breaks the peptide linkages in a protein molecule

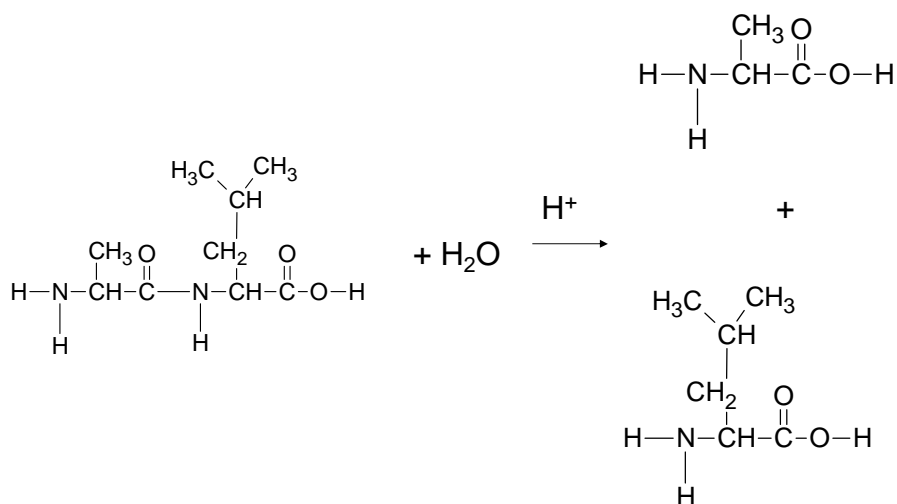
Similar to digestion of proteins using enzymes

The composition of the protein molecule may be deduced by using paper chromatography



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Hydrolysis of a Dipeptide



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Ninhydrin

If ninhydrin is sprayed on an amino acid and then heated for 10 minutes then red to blue spots appear.

This is done because amino acids are transparent and cannot be seen.

Chromatography of amino acids

A mixture of amino acids can be separated by chromatography and identified from the amount they have moved.

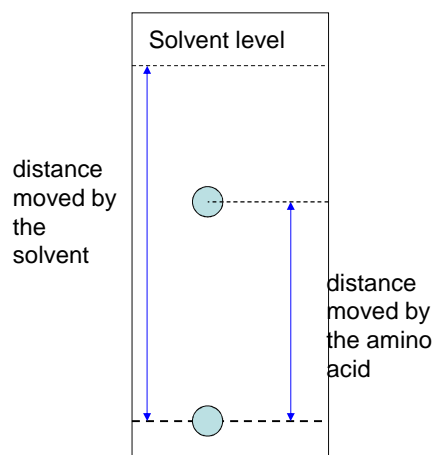
R_f value = $\frac{\text{distance moved by amino acid}}{\text{distance moved by the solvent}}$

Each amino acid has its own R_f value

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Method chromatography

- Take chromatography paper and draw a pencil line 1.5cm from bottom.
- With a capillary tube put a small drop of amino acid on pencil line
- Roll up paper and stand it in a large beaker.
- The solvent in the beaker should be below the pencil line.
- Allow to stand for 20 mins and mark final solvent level
- Spray paper with ninhydrin and put in oven



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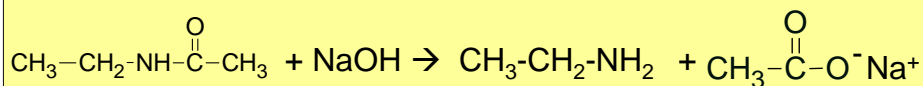
Hydrolysis of amides

Amides can be hydrolysed by aqueous acids or alkalis.

With HCl an amide will be hydrolysed and split up into the original carboxylic acid and amine salt

With NaOH an amide will be hydrolysed and split up into the amine and carboxylic acid salt.

If a compound contains an ester and amide group then both functional groups can be hydrolysed by the action of acid or alkali.



extra