This page looks briefly at the hydrolysis of proteins into their constituent amino acids using hydrochloric acid.

**The chemistry of the reaction**

If you have already studied the hydrolysis of amides under acidic conditions, you will find that this is basically the same reaction. That's not surprising because what biologists and biochemists call a peptide link (in proteins, for example) is what chemists call an amide link. With an amide like ethanamide, the carbon-nitrogen bond in the amide group is broken and you get a carboxylic acid formed:

$$\text{CH}_3\text{CONH}_2 + \text{H}_2\text{O} + \text{H}^+ \rightarrow \text{CH}_3\text{COOH} + \text{NH}_4^+$$

Now imagine doing the same thing with a simple dipeptide made of any two amino acids.

\[\text{NH}_2\text{CH-C-N-CH-COOH + H}_2\text{O + 2H}^+ \rightarrow \text{R} - \text{NH}_3\text{-COOH} + \text{R'} - \text{NH}_3\text{-COOH}\]

Notice the positive ions formed from the amino acids.

Instead of ammonium ions, you get positive ions made from the -NH\textsubscript{2} groups reacting with hydrogen ions.

You need the extra hydrogen ion in the equation (compared with the amide equation) to react with the -NH\textsubscript{2} group on the left-hand end of the dipeptide - the one not involved in the peptide link.

If you scale this up to a polypeptide (a protein chain), each of the peptide links will be broken in exactly the same way. That means that you will end up with a mixture of the amino acids that made up the protein - although in the form of their positive ions because of the presence of the hydrogen ions from the hydrochloric acid.

**Doing the reaction**

There are two ways of carrying out this reaction - an old, slow method, and a new, fast one.

**The old slow way**

The protein is heated with 6 M hydrochloric acid for about 24 hours at 110°C. (6M hydrochloric acid is slightly more than semi-concentrated.)

**The new fast way**
Protein samples are placed in tubes in a sealed container containing 6 M hydrochloric acid in an atmosphere of nitrogen. The whole container is then placed in a microwave oven for about 5 - 30 minutes (depending on the protein) with temperatures up to 200°C. The hydrochloric acid vaporizes, comes into contact with the protein samples and hydrolyses them. This method is used to hydrolyse small samples of protein during protein analysis.