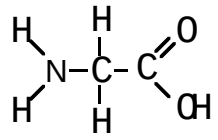
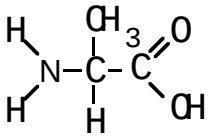
Proteins

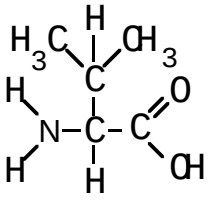
Proteins are condensation polymers of amino acids. There are 26 different amino acids e.g.



Glycine

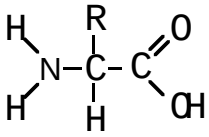


Alanine

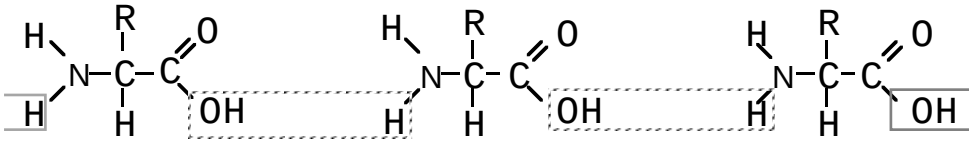


Valine

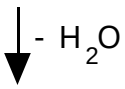
All amino acids can therefore be represented by the general formula :

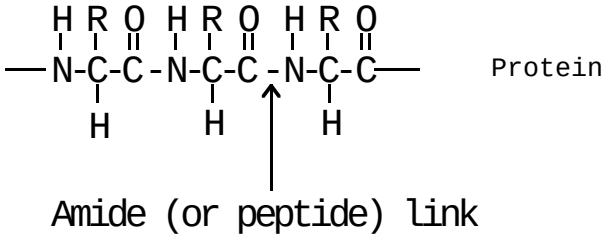


where R = alkyl group ,aromatic group or Hydrogen.
Condensation involves :



Amino acid



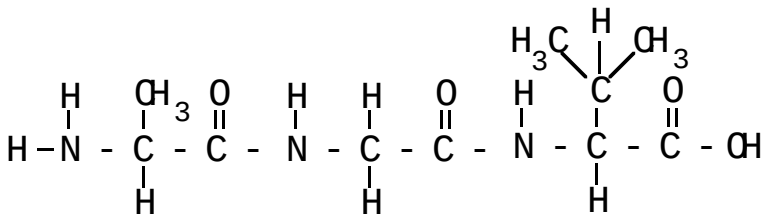


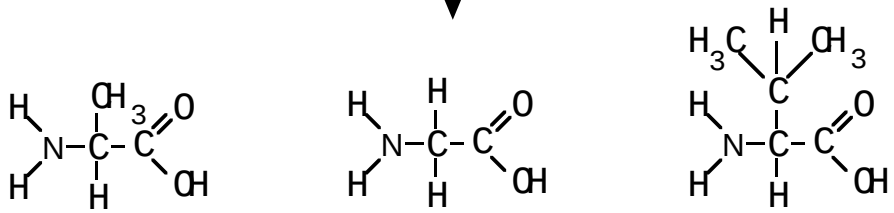
Protein

Amide (or peptide) link

Several thousand amino acid molecules may link up to form one protein molecule ; proteins thus have very high molecular weights (10000 - 1000000). Due to the many possible sequencies of the amino acids in the protein there are a very large number of different proteins e.g. almost all animal tissue (muscles, skin, hair etc) and the growing points of plants and seeds.

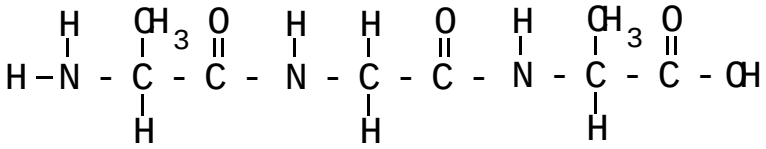
Nitrogen is required to make the original amino acids : plants obtain Nitrogen from nitrates in the soil ; animals from food.
Human beings cannot make all the amino acids required for body proteins. Certain amino acids, known as 'essential amino acids', are made by enzyme catalysed hydrolysis of the proteins we eat (fish, meat, cheese etc) during digestion e.g.





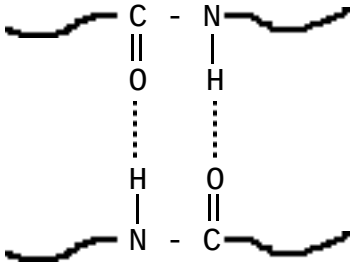
Alanine Glycine Valine

Proteins specific to the body's needs are built up in the body by condensation of amino acids e.g condensation of Alanine, Glycine and Alanine in this sequence will give the tripeptide (mini-protein) :



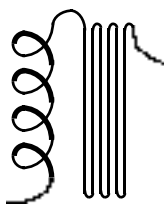
Proteins can be classified as fibrous or globular according to how the chains arrange themselves after formation.

In fibrous proteins the long protein molecules lie side by side held together by Hydrogen bonding:

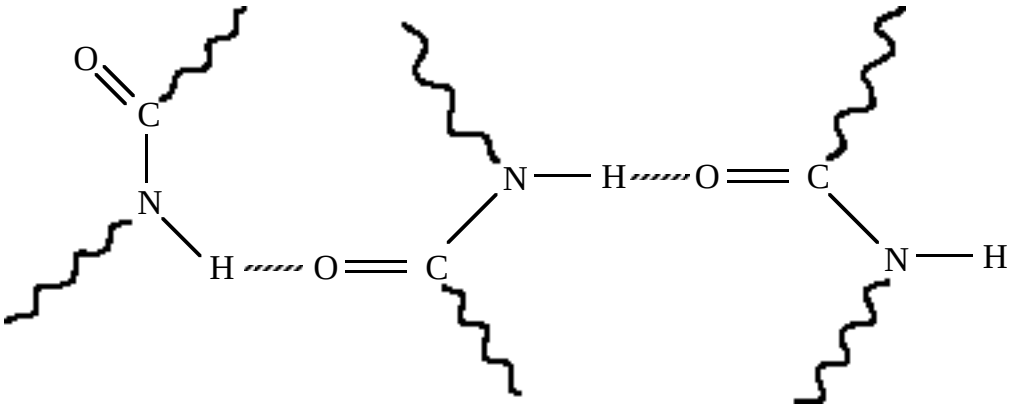


Most animal tissue is composed of fibrous proteins e.g. hair, skin and muscle.

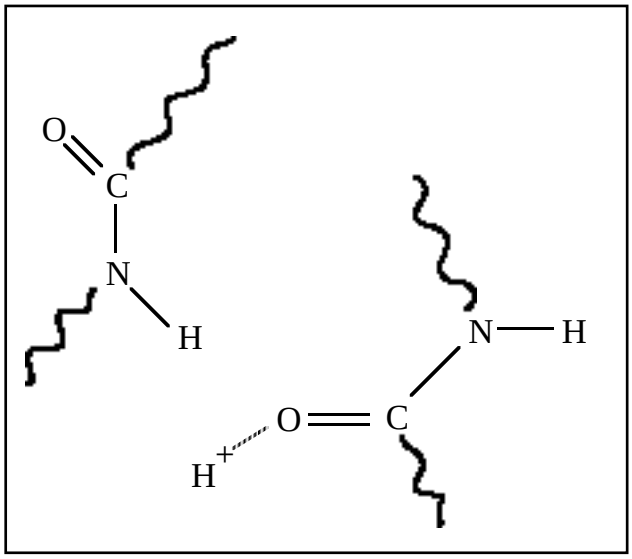
In globular proteins the long protein molecule is folded into a ball-shaped molecule. Within the molecule are chains and coils held together by Hydrogen bonding. Globular proteins are involved in the maintenance and regulation of life processes and include many hormones (e.g. insulin), haemoglobin and enzymes.



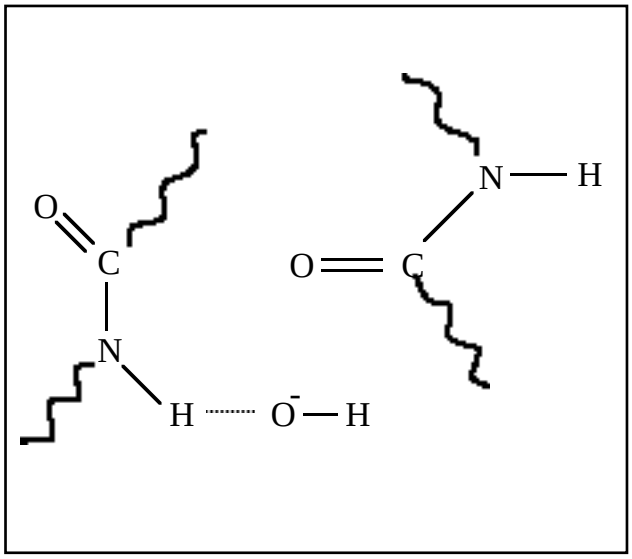
Both fibrous and globular proteins break down under the effect of high temperatures. This is known as **denaturing**. At temperatures above about 50 ^{0}C the Hydrogen bonds, holding the chains and coils together, break. The protein loses its external structure.



Denaturing also occurs in acidic or alkaline solutions due to the protein forming strong hydrogen bonds with the H^+ or OH^- ions instead of the intermolecular hydrogen bonds :



Acidic solution



Alkaline solution

Thus enzymes, which are proteins, have an optimum pH at which they work best - usually around pH 7. Enzymes are denatured at high temperatures - usually around 50-60 ^{0}C.