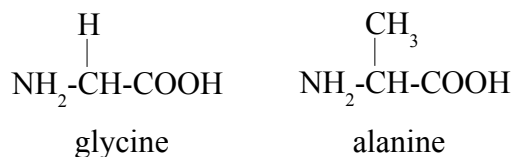


Chemguide – questions

PROTEINS: STRUCTURE

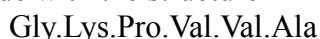
1. For biochemistry purposes, amino acids are invariably drawn in this way: $\text{NH}_2\text{-}\overset{\text{R}}{\underset{|}{\text{CH}}}\text{-COOH}$
The parts of the amino acid which are constant are all written horizontally, with the variable side groups drawn above.

a) The simplest amino acids, glycine and alanine are:



Draw the structures of the two dipeptides which can be formed from glycine and alanine. You should draw the structure of the peptide link fully displayed in both cases.

b) Suppose you had a short polypeptide with the structure



where the abbreviations show the amino acid residues – for example, Gly comes from glycine, and Ala from alanine. The two ends are referred to as the *C-terminal* and the *N-terminal*. Explain what this means, and how you know which is which from a given structure such as



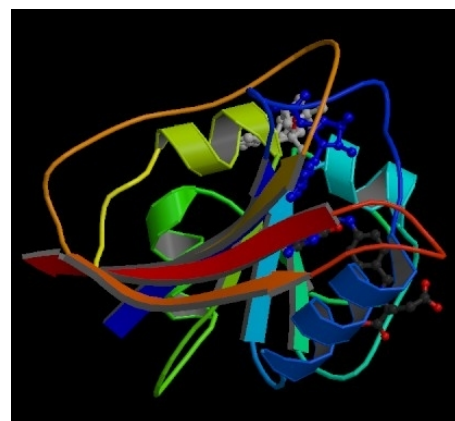
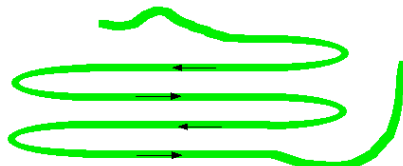
c) In chemistry, if you draw the structure of a molecule and then flip it over, it is still same molecule. Is that also true if you flipped the polypeptide above over to give Ala.Val.Val.Pro.Lys.Gly? Explain your answer.

2. This model (taken from the Chemguide page) shows a protein molecule acting as an enzyme. The smaller molecules that are processed by the enzyme are just visible as ball-and-stick models.

The protein structure contains three different sorts of symbol: string-like parts, broad ribbons, and spirals.

a) What name is given to the broad ribbons?

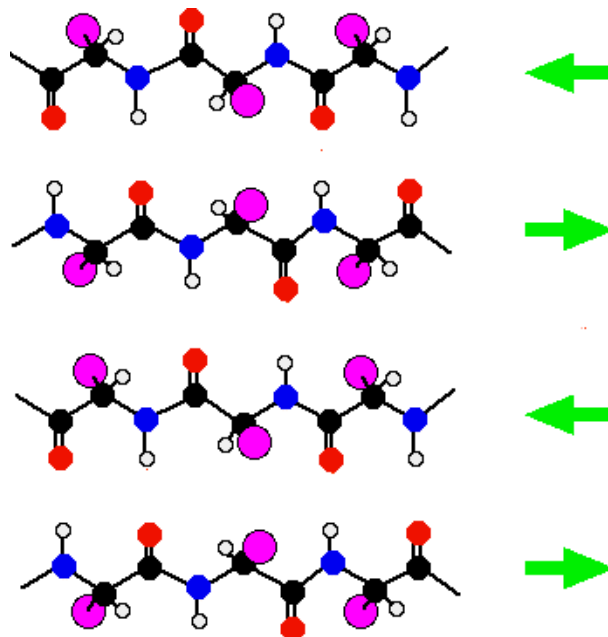
b) The broad ribbons happen because the protein chains get folded like this:



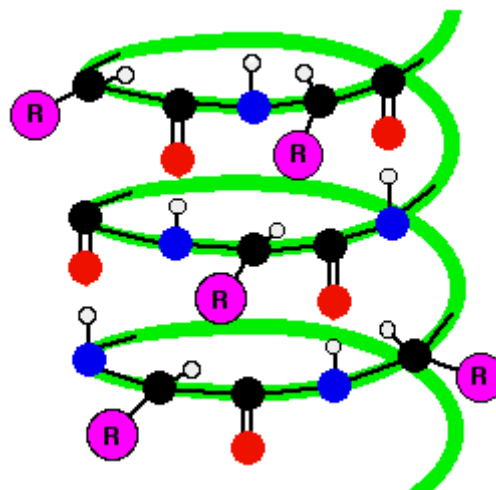
What intermolecular forces hold the folds together in this regular way?

Chemguide – questions

c) The diagram (modified from the Chemguide page) shows a close-up view of one of these ribbons. Mark the intermolecular forces on the diagram.



This diagram (also modified from the Chemguide page) shows some of the bits of the protein chain in the spirals.



d) What name is given to the spirals?

e) Name the intermolecular forces holding the spiral together and mark them on the diagram.

f) What is represented by the string-like sections of the protein?

g) Proteins are described in terms of their primary, secondary and tertiary structures (and quaternary, but we aren't concerned with that at this level). What level of structure are we talking about in the diagrams above?

3. The overall shape of a protein, the tertiary structure (if you said that in the last question, you were wrong!), is controlled by ionic interactions, hydrogen bonds, van der Waals dispersion forces and sulphur-sulphur bridges between the chains. Explain how each of these arises. (Be as precise as you can, but you are *not* expected to be able to name specific amino acids, or know the structures of specific side-groups.)