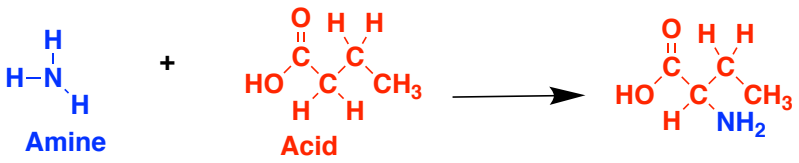
ChemBam

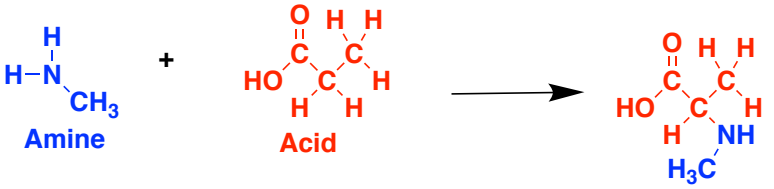
Protein building blocks (teachers guide to exercise and experiments)

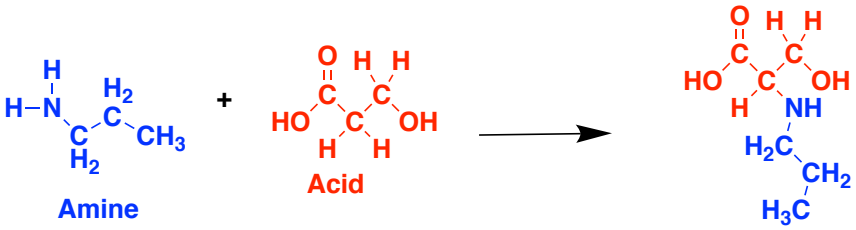
AIM

- ⇒ For students to understand the importance of proteins in living things
- ⇒ For students to gain an understanding of the amino acid building blocks in proteins, with emphasis on how they bond together to form polypeptide chains
- ⇒ For students to be able to differentiate between primary, secondary and tertiary structure
- ⇒ For students to recognise that different molecules dissolve in different solvents and this property can be exploited in chromatography
- ⇒ For students to appreciate how fluorescence and absorption are related and why fluorescence is seen in some proteins
- ⇒ For students to keenly observe and determine the effect of different additives on the denaturing of proteins

EXERCISE 1 – Answer guide for teachers

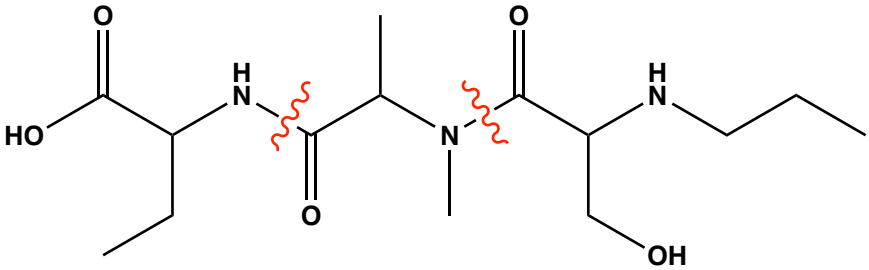
1. 

2. 

3. 

The bond is always formed between the nitrogen and the carbon atom adjacent to the carboxylic acid group. This is because the carboxylic acid is very strongly electron withdrawing which makes the carbon next to it much more reactive, so the reaction is favoured here

Extension task



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This is one example based on the order the questions are asked in. Red lines indicate peptide bond.

EXPERIMENT QUESTIONS – Answer guide for teachers

1. Chlorophyll doesn't dissolve in water. They are said to be immiscible. Chlorophyll does dissolve in methanol however. This theory can be applied to chromatography, which is the separation of different components in a mixture based on their ability to interact with different solvents.
2. The protein fluoresces red because it absorbs yellow light. Could mention the colour wheel/complementary colours.
3. The protein should lose its fluorescence in all cases
4. The protein has become denatured. The primary structure remains intact but the secondary and tertiary structure has been lost due to the breaking of intermolecular bonds between chains.
5. When the sample in test tube 4 cools, the fluorescence returns, suggesting that denaturation with temperature for a short period of time is reversible, as the primary structure remains intact and can reform the secondary and tertiary structure of the protein. However, when you heat test tube 5 for much longer, fluorescence doesn't return, suggesting that denaturation due to heating for an extended period of time is irreversible.
6. The egg white becomes solid as the protein is denatured. Upon cooling, this doesn't change. Denaturation of the egg white is permanent.