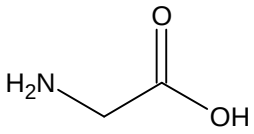
2.4 Proteins – Natural Polyamides

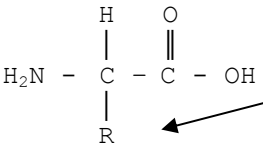
- Macromolecules are large molecules composed of several subunits.
- Biological macromolecules are also known as proteins, carbohydrates, nucleic acids, and lipids (fats).

Amino Acids

- Proteins are made up of amino acids. As the name suggest an amino group and a carboxylic acid group is attached to the same carbon atom.
- E.g. Gylcine



- There are 20 naturally occurring amino acids each with different properties.
- E.g. Basic Amino Acid



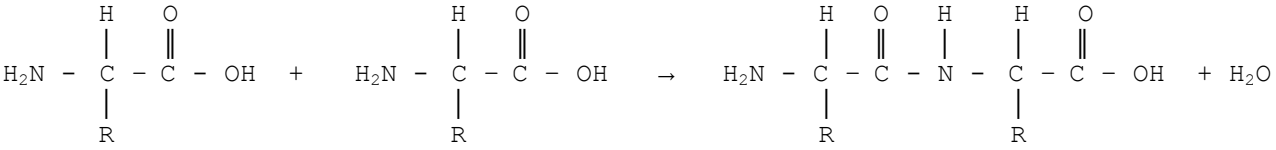
The R group gives each of the amino acids distinct properties.
(acid, base, polar, non-polar)
see page 119 for all the amino acids

Chiral Molecules

- Isomers that are mirror images of each other.
- Since amino acids have a carboxyl group, an amino group and a R coming off a central atom, they can be chiral molecules
- When naming use the prefix L for left (*laevus*) and D for right (*dexter*). All naturally occurring amino acids are L.
- E.g. Chiral molecules of alanine

Polypeptides of Amino Acids

- Peptide bond: the bond formed when the amine group of one amino acid reacts with the acid group of the next.
- Polypeptide: a polymer made up of amino acids joined together with peptide bonds.
- Dipeptide: two amino acids joined together with a peptide bond.
- E.g. Peptide bond
  amino acid + amino acid → dipeptide



Artificial Sweeteners

- Aspartame = aspartic acid, phenylalanine and methanol
- Health risks?: phenylalanine → phenylketonuria (rare genetic disease)
  methanol → toxic

Protein Structure

- Protein is a polypeptide (chain of amino acids)
- Primary structure: the sequence of the monomers in a polymer chain; in polypeptides and proteins, it is the sequence of amino acid subunits.

- Secondary structure: the three dimensional organization of segments of a polymer chain, such as alpha helices and pleated sheet structures.
    - Alpha helix: a right handed spiraling structure held by intramolecular hydrogen bonding between groups along a polymer chain.
    - Pleated sheet conformation: a folded sheet like structure held by intramolecular or intermolecular hydrogen bonding between polymer chains.
    - See page 122 for diagrams.
- Tertiary Structure: a description of the three-dimensional folding of the alpha helices and pleated sheet structures of polypeptide chains.
- Quaternary Structure: a description of the arrangement of several protein subunits joined together (e.g. Hemoglobin)

Homework

Practice 1,2,4,5,6 Questions 1,2,3,4,5,6