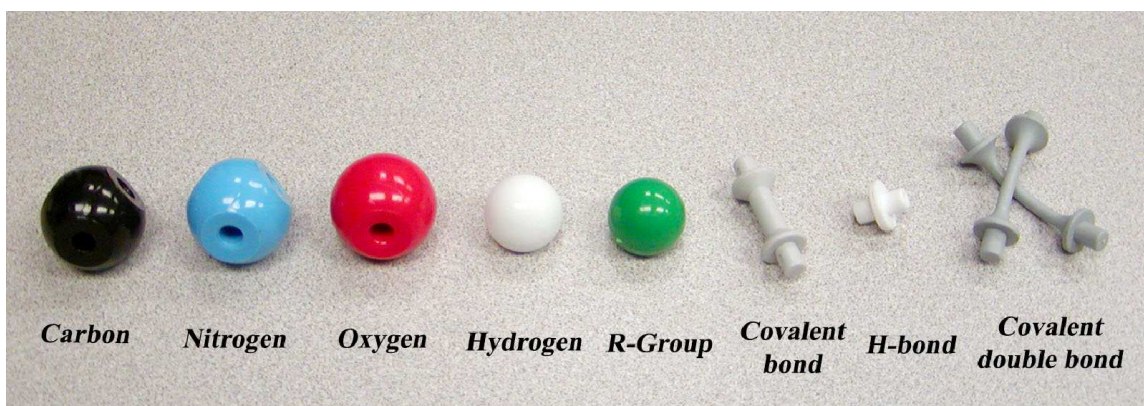


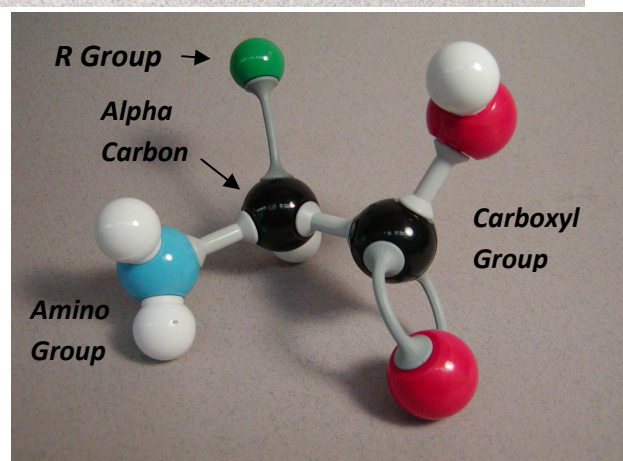
Amino Acids Are the Building Blocks Of Proteins

The purpose of this activity is to introduce students to the structure of an amino acid displayed as a ball and stick model format. Each atom is represented by a colored sphere; covalent bonds and hydrogen bonds are represented by "sticks". Students will build an amino acid and identify the atoms and parts of an amino acid. Students will build a dipeptide and identify components of the dipeptide. After this activity, students should be able to recognize an amino acid and identify the atoms. This knowledge is necessary to master specific commands in RasMol.



Molymod® Kit contents:

- 4 Carbon (black)
- 4 Oxygen (red)
- 2 Nitrogen (blue)
- 2 R-groups (green), representing sidechains
- 8 Hydrogen (white)
- 6 Covalent bonds – single (thick, short, gray)
- 6 Covalent bonds – double (thick, long, gray)
- 8 Hydrogen bonds (short, white)
- 1 Molymod® link remover



Activity:

1. Construct two separate amino acids using the Molymod® atoms, covalent bonds and hydrogen bonds.
 - a. Identify the following components: amino group, carboxyl group, the R group or sidechain, alpha carbon, carboxyl carbon, nitrogen. (See labeled diagram and parts list above.)
 - b. Compare the two amino acids that have been built. Are they similar? How might two amino acids be different? *Amino acids are similar because they share the same "core" structure of NH₂-CHR-COOH. Amino acids are different because the composition of the "R group" is different for each of the 20 amino acids. A second way that amino acid structures may be different is their*

stereochemistry. The arrangement of atoms around the alpha-carbon may be “right-handed” or “left-handed” to form a D-amino acid or an L-amino acid. The L-amino acids are the naturally occurring form used to make proteins. If you hold the hydrogen atom attached to the alpha carbon in your fist, then move from the carboxyl group to the amino group to the R group in a CLOCKWISE direction, you have an L-amino acid. If you trace the path in a COUNTERCLOCKWISE direction, it is a D-amino acid. An L-amino acid is illustrated above.

2. Two amino acids can be chemically linked by a reaction called “condensation” or “dehydration synthesis”: to form a dipeptide bond linking two amino acids. A chain of amino acids linked together by peptide bonds is called a polypeptide. Using the two amino acids built in step 1, create a dipeptide.
 - a. What are the products of the condensation reaction? *The products are a dipeptide and a molecule of water.*
 - b. Identify the following components of the dipeptide: amino groups, amino terminal end, carboxyl groups, carboxyl terminal end, carbonyl group, peptide bond, R-groups or sidechains, alpha carbon, carbonyl carbon.

Teaching Points:

- Amino acids are the building blocks of proteins.
- Amino acids structure
 - Identify atoms: nitrogen, oxygen, carboxyl carbon, alpha carbon, oxygen, hydrogen
 - Identify groups: amino terminal, carboxyl terminal, R-group or sidechain, amino group, carboxyl group
- There are twenty different amino acids
 - Amino acids are similar because they share a core structure.
 - Amino acids are different because they have unique R-groups or sidechains.
- A linear chain of amino acids is a polypeptide.
- The primary sequence of a protein is the linear sequence of amino acids in a polypeptide.