

## Proteins: Chemistry and Identification

Living things are made up of many different chemical molecules. One important group of chemical molecules is proteins. Proteins make up the bulk of all solid material within your body and the bodies of other animals. Your muscle, skin, hair, and inside organs are largely protein. Proteins are essential for body growth and repair. They also make up some hormones which function in chemical control in the body.

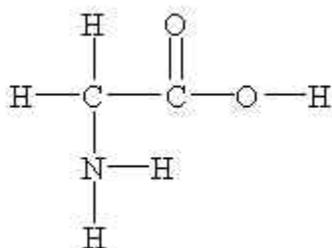
In this investigation, you will

- learn how to recognize molecular formulas for small molecules called amino acids
- use models of different amino acids to construct a protein molecule

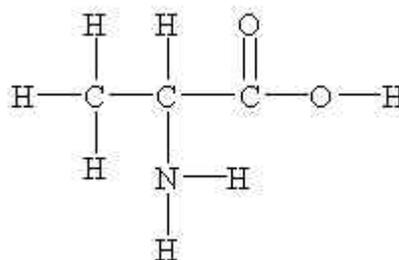
### I. Amino acids, building blocks of proteins

Proteins are complex molecules made up of smaller molecules called amino acids. There are about 20 different amino acids found in nature. The element nitrogen (N) is present in all amino acids.

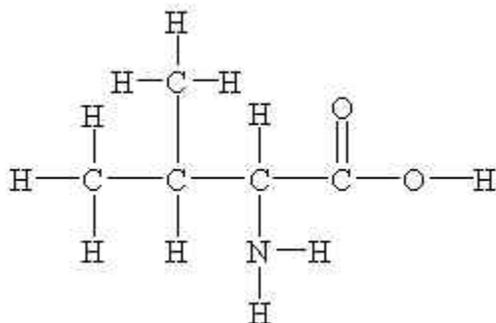
Examine the structural formulas of the four representative amino acids shown in Fig. 7-1.



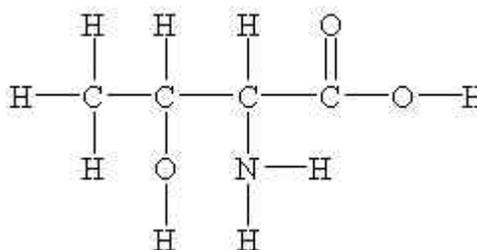
**GLYCINE**



**ALANINE**



**VALINE**



**THREONINE**

Name the four elements present in these amino acids.

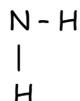
- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
- d. \_\_\_\_\_

2. What is the molecular formula for the amino acid

- a. Glycine? C H O N
- b. Alanine? C H O N
- c. Valine? C H O N
- d. Threonine? C H O N

3. How do the molecular formulas for all the amino acids differ? \_\_\_\_\_

4. Note the lower right corner of each amino acid. These ends have a special arrangement of nitrogen and hydrogen atoms. The end arrangement is called an **amino group** and looks like this:



5. Use dashed lines to circle the amino groups on the structural formulas in Fig. 7-1.

6. In the previous lab, you studied carbohydrates. Do carbohydrates have amino groups? \_\_\_\_

7. How does the number of hydrogen atoms compare to the number of oxygen atoms in each amino acid? \_\_\_\_\_

## II. Combining amino acids to form proteins

Amino acids are not protein molecules. They are only the building blocks of protein. Several amino acids must be chemically joined in a chain to form a protein molecule. We can show how amino acids join by using models.

Use the paper models given to you by your teacher to complete this section.

Cut out the four amino acids. **SEE CRITICAL CAUTION IN CARBOHYDRATES LAB!!**

8. Can the amino acid models easily join to form a protein molecule? \_\_\_\_\_

Join the molecules by removing as many -OH groups and -H groups as needed from the amino acids. All four amino acid molecules can be joined in this manner to form a protein. Join them in this order: valine - threonine - alanine - glycine

Join the leftover -OH and -H ends.

9. What chemical substance is formed when the -OH's and the -H's are joined? \_\_\_\_\_
10. How many molecules of water are formed when four amino acids join? \_\_\_\_\_
11. What chemical compound is formed when the four amino acids are joined? \_\_\_\_\_
12. Describe the difference between an amino acid molecule and a protein molecule. \_\_\_\_\_  
\_\_\_\_\_

There are thousands of different proteins in living organisms. What makes each protein different is the order, number, kind, and arrangement in space of amino acids joined. You only assembled four amino acids into a protein using a specific order.

13. Construct two proteins different from the one you made above. List the order of amino acids here:
  - a. \_\_\_\_\_
  - b. \_\_\_\_\_