

ACTIVITY 1: Handout



In this activity you will be exploring how a protein shape is related to (1) the charge and (2) the sequence of the amino acids in its chain.

Our model represents a short fragment of a protein in a vacuum. Each bead represents an amino acid. In this model you begin with 20 amino acids; they are all Alanine. You can change the amino acid sequence simply by substituting one amino acid for another.

Procedure:

1. Locate your model in one of these two ways:

A. From your browser. Click the link below.

Molecular Workbench: "Protein Folding: Alanine Only " model <http://xeon.concord.org:8080/modeler/webstart/protein/ala20.jnlp>

B. By going through the Molecular Workbench application on your computer (workbench.jar). Then you should click the following links: Student Pages, Protein Folding, A Polymer with 20 Alanines.

(It may take a short while to launch the Molecular Workbench the first time.)

2. Make sure the Select a Solvent Type is set to "Vacuum" and not "Water" or "Oil".

3. To substitute an amino acid, with your cursor on an amino acid, control-apple click if you have a Mac, or control- right click if you have Windows. You will see a pull-down menu with a choice of amino acids.

4. Roll the cursor to the amino acid you want to use as the replacement, and then click (Mac) or left-click (Windows) on the computer mouse. The substitution will be made.

5. Try a few.

6. Click "Run" to see what happens.



Challenge 1: Not all amino acids have a charge capable of

affecting the shape of a protein. Find those five amino acids, three + and two -, which have the biggest impact on the shape of the protein by interacting with each other. (The remaining fifteen have little or no impact on each other because of their charge.) You can locate the charged amino acids in the Molecular Workbench pull-down menu.

The five amino acids that have the biggest impact on the shape of the protein are:

- 1.
- 2.
- 3.
- 4.
- 5.

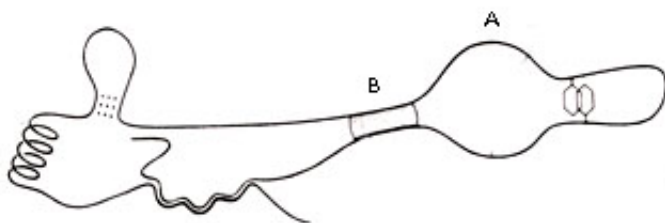
Challenge 2: What happens to the protein chain when half of the amino acids have a positive charge and half of the amino acids have a negative charge? Try variations of sequences of pluses and minuses. (Remember that when you look at the menu of amino acids, those amino acids that carry negative charge will be colored green and those that carry positive charge will be colored red.)

A. Draw the shape that resulted from the changes you made. Be sure to label the charges in your drawing.

B. Draw another shape that resulted from the changes you made. Be sure to label the charges in your drawing.

Challenge 3: Here is a picture of a protein strand. Would you find amino acids with side chains of similar charges at location A or B?

Location _____



Challenge 4: Explain how changing the charge in the model of Sickle Cell hemoglobin might help you understand what is going on in the Sickle Cell Story.

[Return to Student Index](#)