

## Protein Folding Instructions

**Background:** Proteins are the molecules that carry out most of the cell's day-to-day functions. While the DNA in the nucleus is "the boss" and controls the activities of the cell, it is the proteins that "do the work." In this activity you will examine the structure of proteins and how their structure is related to their function.

Proteins are made from a chain of amino acids and are folded into a variety of shapes. A chain of amino acids is called a polypeptide chain. A protein may consist of one or more polypeptide chains. The shape of the protein will determine its function.

**Procedure:** To help you understand how a protein is constructed and how its structure is related to its function, you and your lab partner(s) will build a model of a protein. A protein's shape, and ultimately its function, is determined by four levels of structure.

1. Take a pipe cleaner and some <sup>10</sup>~~50~~ beads and string the beads onto the pipe cleaner. (Leave a little of the pipe cleaner at each end free so that you can fold it back to prevent the beads from falling off.) The beads represent the amino acid sequence in a polypeptide that was specified by the DNA. Find the chart of amino acids in your text. Look at the R group on each of the following amino acids, and **Label** each as nonpolar, polar, negatively charged, or positively charged on your data sheet. **Write down** the amino acids that you placed in your primary structure.
2. The **secondary structure** of a protein results when parts of the polypeptide coil or fold. Take your string of beads and either fold the strand back and forth accordion style, or coil it around your pencil to form a spiral, or do a little of both. You have now made the secondary structure.
3. The third level of organization is called the **tertiary structure** and this is created when the folded, twisted chain of amino acids folds back on itself to form the overall shape of the polypeptide. Take your polypeptide chain and fold it so that the free ends meet.
4. Many proteins are made of more than one polypeptide chain. Take your polypeptide chain and join it with the polypeptide chain of your lab partner and two or three other students. You now have a protein model that is demonstrating **quaternary (4<sup>th</sup> level) structure**. The shape of your molecule will determine its function.
5. Straighten out your pipe-cleaner, remove the beads and put them back in the dish.

Each color of bead represents one of the 20 possible amino acids:

Red = methionine (met)

Orange = leucine (leu)

Yellow = cysteine (cys)

Green = threonine (thr)

Blue = glutamic acid (glu)