Amino acid folding basics

How do the chemical properties of amino acids affect the structure of a protein?

Use the following information to complete this activity where you will use the chemical properties of amino acids to determine the shape of a 15 amino acid protein.

- Each protein is made of a specific sequence of **amino acids.** There are **20** amino acids found in proteins.
- Each amino acid consists of two parts: a backbone and a side chain. **The backbone** is the same in all 20 amino acids while **the side chain** is different in each one.
- Each side chain consists of a unique combination of atoms which determines its 3D shape and its chemical properties.
- Based on the atoms in each amino acid side chain, it could be **hydrophobic**, **hydrophilic**, **acidic** (negatively charged), or **basic** (positively charged). When different amino acids join to make a protein, *the unique properties of each amino acid determine how the protein folds* into its final 3D shape. The shape of the protein makes it possible to perform a specific function in our cells.

Materials

- Bendable wire (1m per group)
- Craft pipe cleaners (20 colors)
- Key of colors to match amino acids
- Information sheet for amino acid properties

Procedure

1. Choose 15 “side chains.” *Be sure to include two cysteine side chains!*
2. Attach amino acids to your wire (which represents the “backbone” of the amino acid).
3. Refer to the Amino Acid chart to see properties.
    a. Fold the hydrophobic to the inside of your protein.
    b. Fold the acids and bases so they are towards the outside, and then fold the chains so they are very close together.
    c. Bend the tuber so that the cysteine side chains are close together.
    d. Continue to fold your protein making sure that your hydrophilic (polar) side chains are also on the outside surface of your protein where they can hydrogen bond with water.
    e. Were you able to satisfy all properties? Congratulations! You just made a tertiary protein structure!

Reflection

1. What was the most difficult part of folding the protein?

2. Did your protein make a recognizable shape (i.e., alpha helix or beta sheet)?

3. How does this information help you to better understand protein functions (i.e., in the immune system or regulatory functions in the body)?