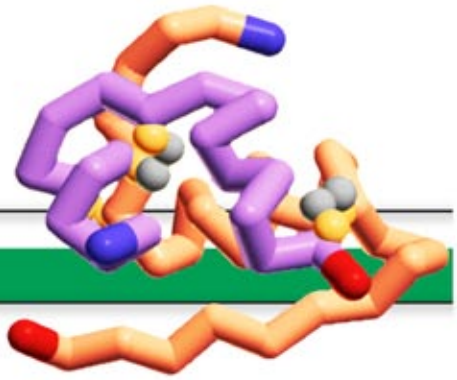


Folding the Physical Model of Insulin

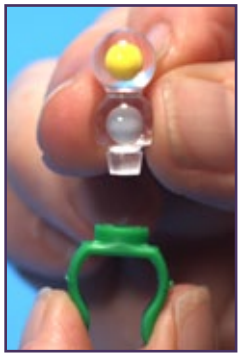
Like all proteins, insulin folds into a specific 3-D shape, following basic principles of chemistry. It is this 3-D shape that allows it to bind to the insulin receptor protein on the surface of liver, muscle, and fat cells to trigger the uptake of glucose from the bloodstream.

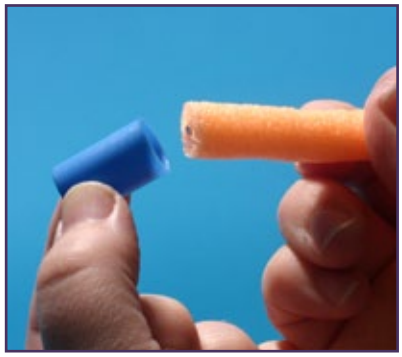
In this final activity, you will shape two mini-toobers into the 3-D shape of the insulin protein.

1. Gather all of the parts you need (see contents photo on page 2).
   - Insulin mini-toober folding map
   - Orange and purple mini toobers
   - Bag with parts for mini toobers
     - Cysteine sidechains and plastic clips
     - Support posts
     - White dots
     - Plastic markers
     - Endcaps

As you proceed with the directions (2) through (6) below you can work with the two chains at the same time or you can complete the B-chain (orange mini toober) and then repeat with the A-chain (purple mini toober).

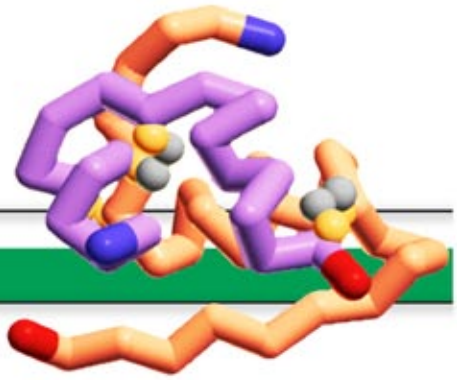
2. Insert each cysteine into a green plastic clip





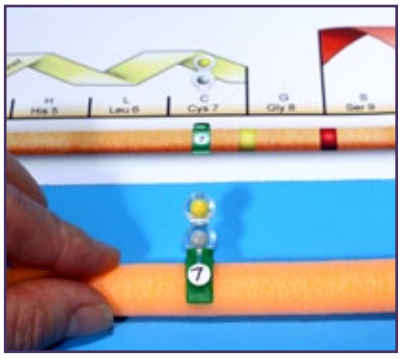
3. Unroll your Insulin Mini Toober Folding Map and identify the **N-terminus (blue)** and the **C-terminus (red)** of each protein chain by putting one red and one blue end cap onto the ends of each mini toober.

4. Using the map, locate the cysteine amino acids on each protein chain. Write the number of each of the six cysteines on the white dots and add these numbered dots to six plastic clips.

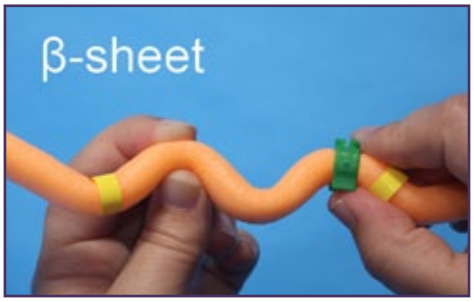


Folding the Physical Model Of Insulin (continued)

5. Carefully align each mini toober with the corresponding chain on the Insulin Mini Toober Folding Map matching the end caps to the images of the end caps on the map. Add the appropriately numbered plastic clips to the mini toober. The plastic clips represent the alpha-carbon of each cysteine amino acid.

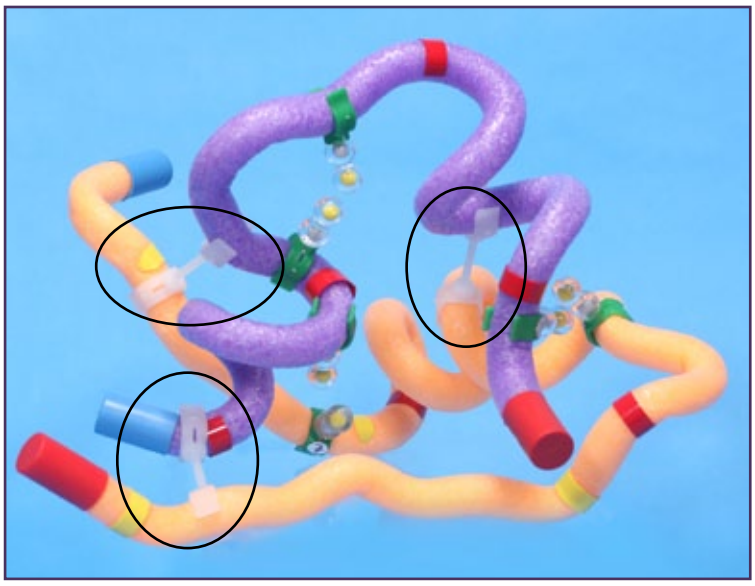


6. Indicate where the α-helicies are on each protein chain by placing the red plastic markers at the beginning and the end of each α-helix. Indicate where the β-sheets are on each protein chain – by placing the yellow plastic markers on the mini-toober at the beginning and the end of each β-sheet shown on the map.



7. Fold the mini toobers to create the α-helicies (right-handed) and the β-sheet strands (extended zig-zag) in each protein chain. See photos above.

   To fold the overall 3-D shape of each protein chain, use the online Jmol visualization tool at 3dmoleculardesigns/Teacher-Resources.htm and/or the images at the end of the map to fold your insulin.



8. Assemble the two chains into the final insulin model by positioning the chains as shown in the photo using the images on the map and/or the Jmol visualization tool.

Hint: The three pairs of cysteine amino acids that form covalent disulfide bonds should be close to each other in the final model. Use the three plastic support posts to stabilize the protein, as shown in the photo.