Explore the 3D Structure of Insulin

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The Insulin hormone controls blood glucose levels. To learn more about the function of insulin, visit pdb101.rcsb.org and read the Molecule of the Month on Insulin.

To learn more about the primary, secondary, tertiary and quaternary levels of protein structure, watch the What is a Protein? video at bit.ly/1JkBKgZ.

1. Preparation:
Cut out the five strips on the dotted line. Make sure to separate the conjoined strips. The green, orange, and yellow tabs have to remain attached to their respective strips.

2. Protein Chains:
Proteins are polymer CHAINS of amino acid residues. Each number on the model represents one amino acid residue.

Insulin has 2 chains. Chain A is green; chain B is blue.

3. Alpha Helices:
Some sections of amino acid chains curl and form ALPHA HELICES due to HYDROGEN BONDS between N-H and C-O groups.
The helix regions on the model are marked on the chains with darker shades of green and blue.

3.1. Chain A:
Starting with residues 1 and 5 form a hydrogen bond between C-O and N-H, and tape together.

3.2. Keep creating the hydrogen bonds until you reach the end of the darker colored area. When you reach residue 6, make sure the green tab is on the outside of the helix.

3.3. Create another alpha helix starting with residues 17 and 21. Keep creating hydrogen bonds until you reach the end of the darker colored area.

3.4. Chain B:
Starting with residues 7 and 11, form a hydrogen bond. Keep creating the alpha helix until you reach the end of the darker colored area.

4. Turns:
Some amino acids give a TURN to the chain. The turns are marked on chain B of the paper model with the white dashed lines.

4.1. Fold outwards on the white dashed lines to create the turns. You can secure the folds with tape.

5. Disulfide Bridges:
The structure of Insulin is stabilized by 3 DISULFIDE BRIDGES. A disulfide bridge is formed when a sulfur atom from the residue cysteine forms a single covalent bond with a sulfur atom from a second cysteine.

5.1. The first disulfide bridge connects 2 cysteines in chain A. To form the bridge, connect the green tabs as seen on the photo.

5.2. Connect the yellow tabs, matching their shape while making sure the colored sides are facing the same way.

5.3. Connect the orange tabs matching their shape while making sure the colored sides are facing the same way.

Complete model:
PDB ID 1trz

Go to pdb101.rcsb.org (Learn > Paper models) to DOWNLOAD additional copies of this model, to watch a VIDEO DEMONSTRATION of how to build it, and to access a DIGITAL ACTIVITY PAGE allowing for further exploration of the 3D model.

Note: Chain B also includes a beta strand marked with a blue arrow.
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The template for this paper model is based on the human insulin structure (PDB entry 1trz, chains A and B).