**Exploring a Protein Structure in the RCSB PDB: Insulin**

**Learning Goals:**

1. Visualize the structure of a given molecule using RCSB PDB resources.
2. Explore the structure to understand its structure function relationships

**Exercise:**

The molecular visualization software, UCSF Chimera, is freely available to academic users from <http://www.cgl.ucsf.edu/chimera/>. Instructions for downloading/installing the software and documentation for using it are also available from this site.

This worksheet provides instructions for visualization of a PDB entry, where you will learn to do the following:

1. Fetch/load a PDB coordinate file
2. Select specific regions of the coordinates
3. Display the atomic coordinates in various formats

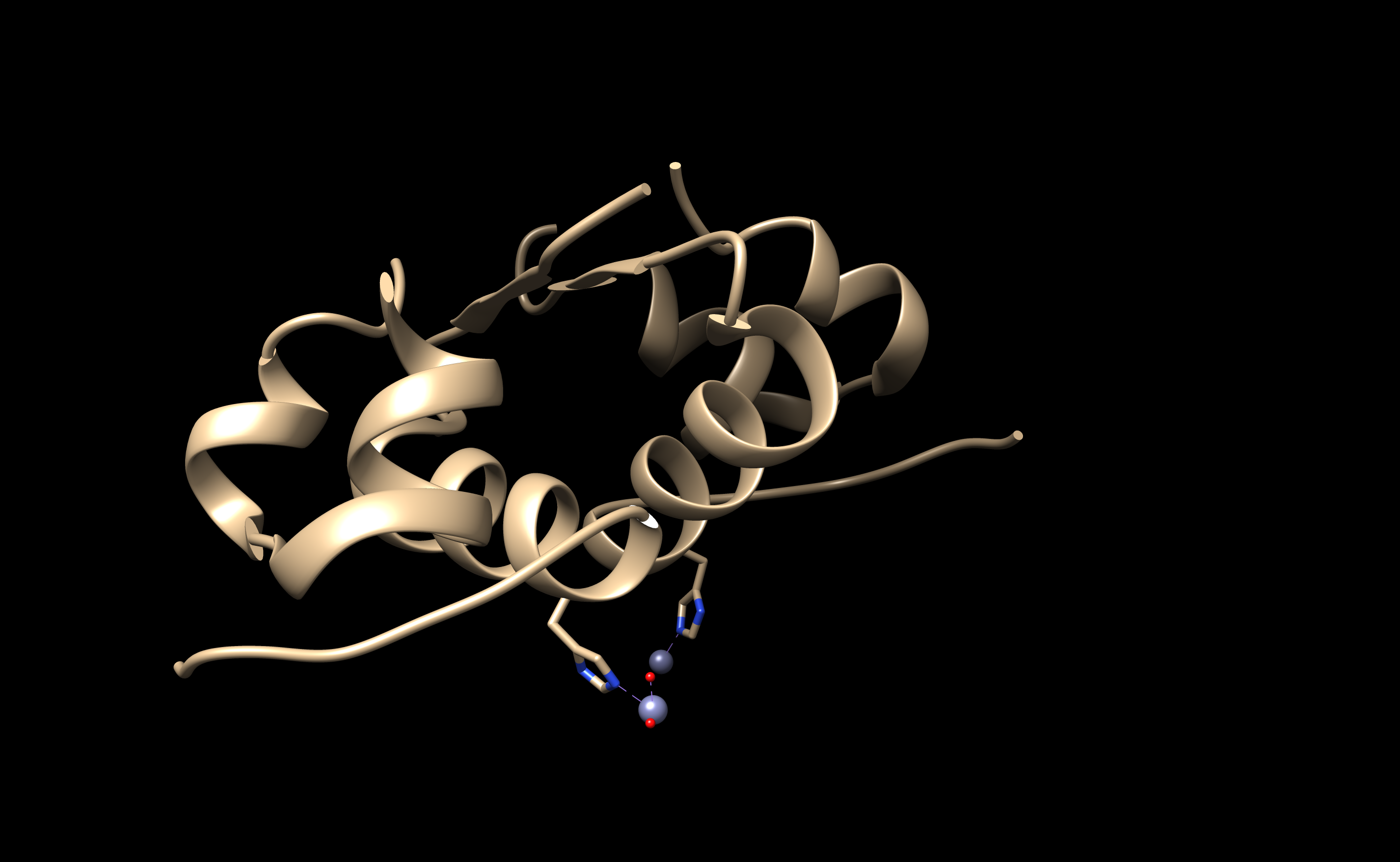
To save images that you make, select **File… Save Image …,** provide a file name. While you can label atoms and residues in Chimera, it may be easier to import the saved image to a document or power point where you can add labels and include additional text to describe the images.

**Insulin**

Review the Molecule of the Month feature on Insulin for background information.

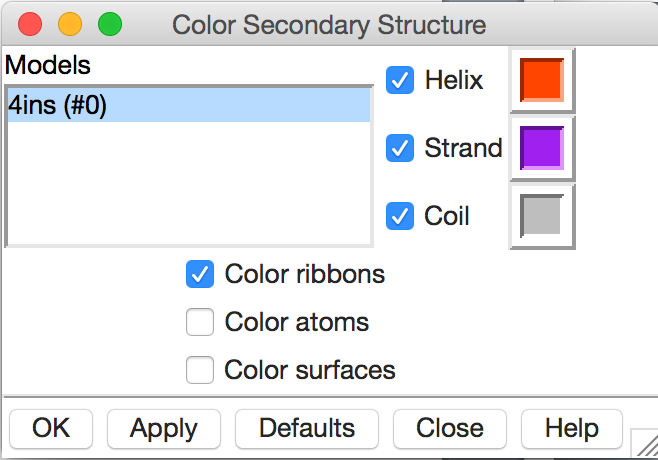
(<http://pdb101.rcsb.org/motm/14>)

Launch the Chimera program and load PDB entry 4ins. Assuming your machine is connected to the internet, choose from the “File” menu **File… Fetch by ID,** type **4INS** in the box, (make sure that the radio button next to “PDB” is selected), and then click “Fetch.” You should see a ribbons view of the structure as follows:

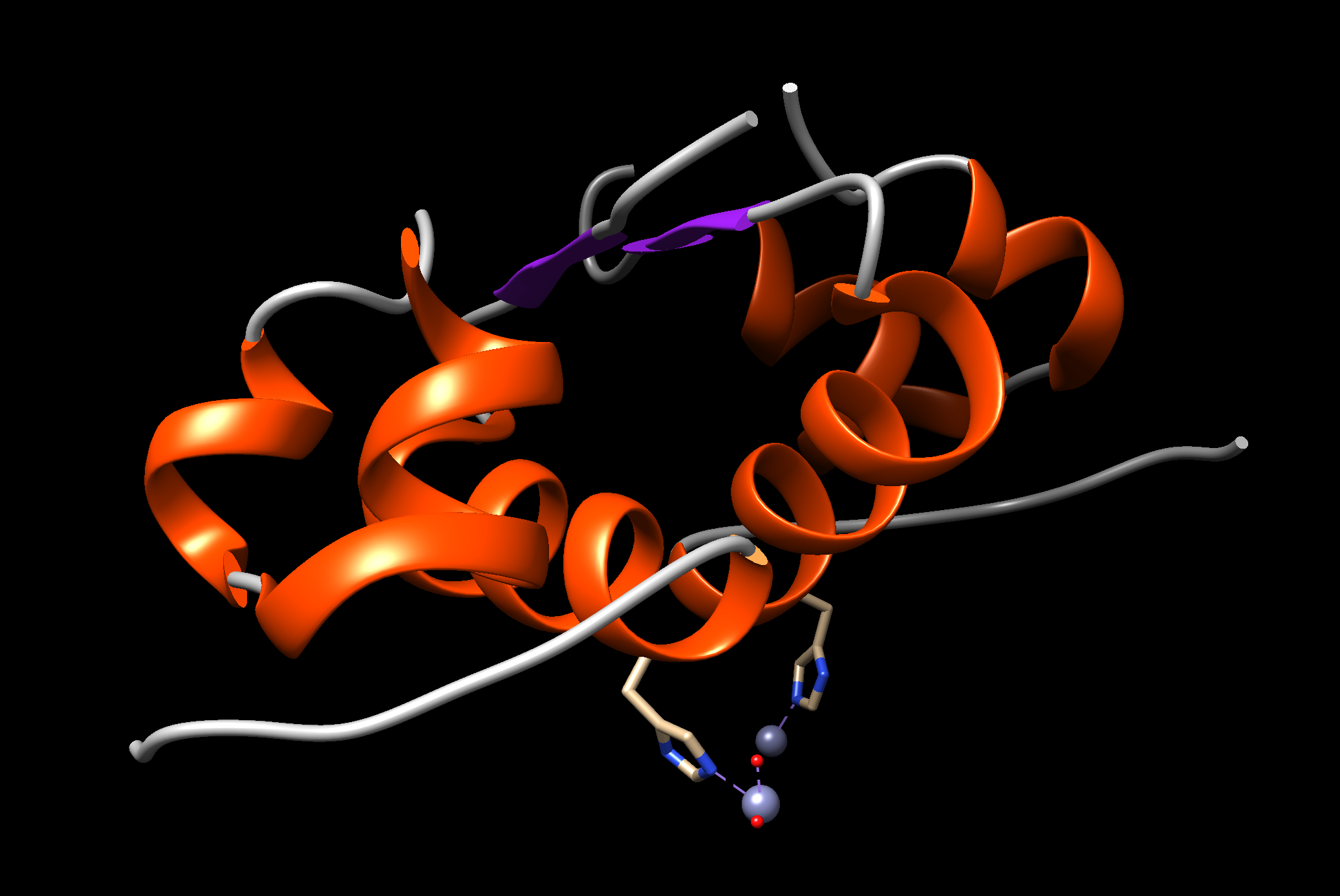


Color the ribbons as follows:

Choose **Tools… Depiction… Color Secondary Structure** from the menu. This should launch a new window with the helix and sheet color code (shown below):

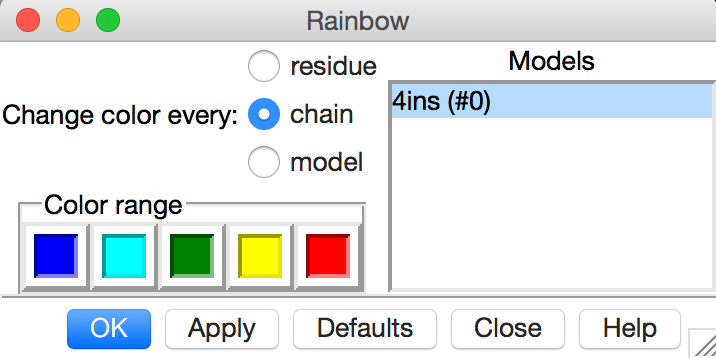


Note that the specific colors may be different in your installation, you can click on the colored box to change it to another color. When you click on **Apply** you should see the following in your structure display window.

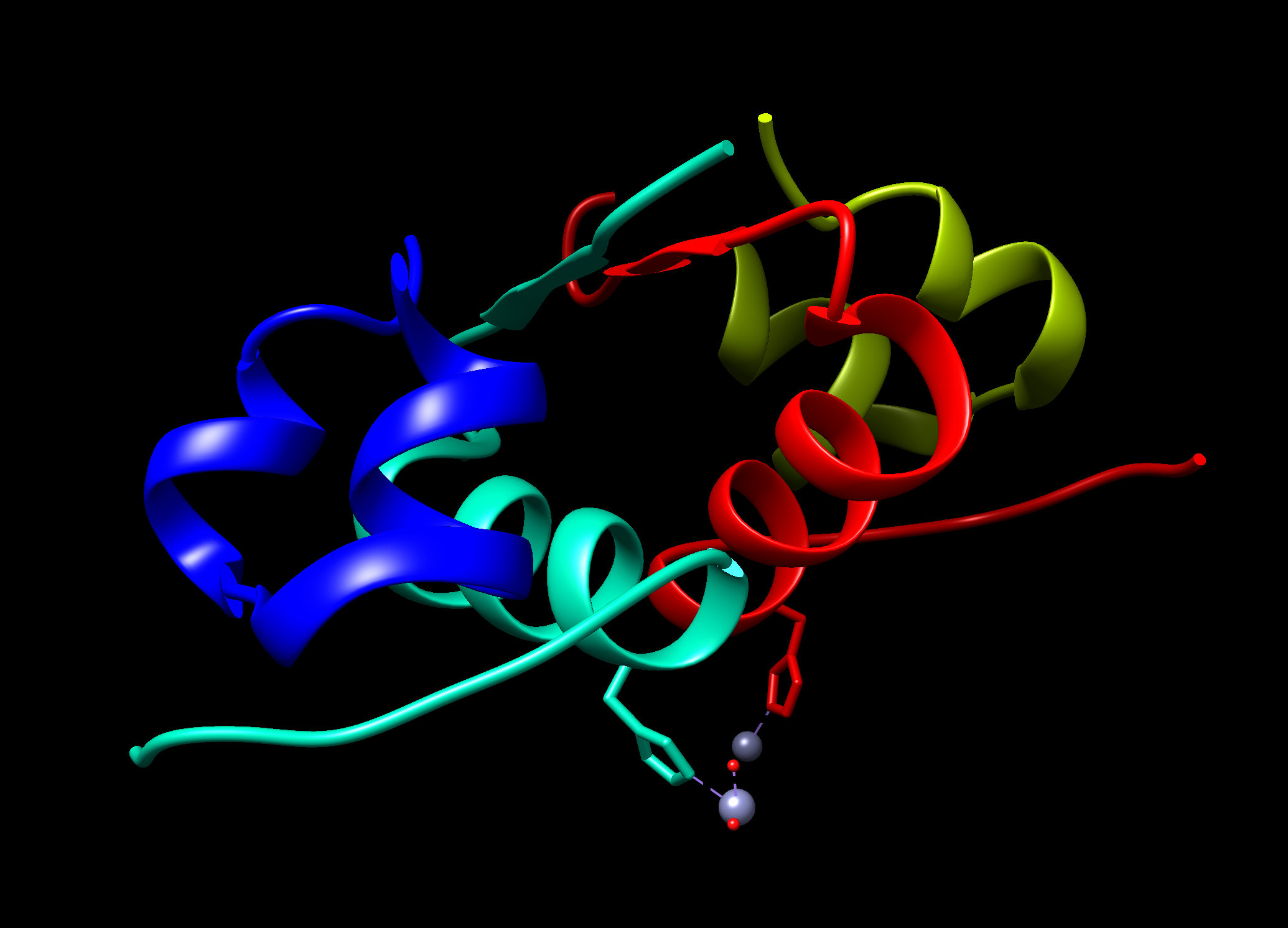


*Q1. What is the predominant secondary structural element seen in the insulin structure?*

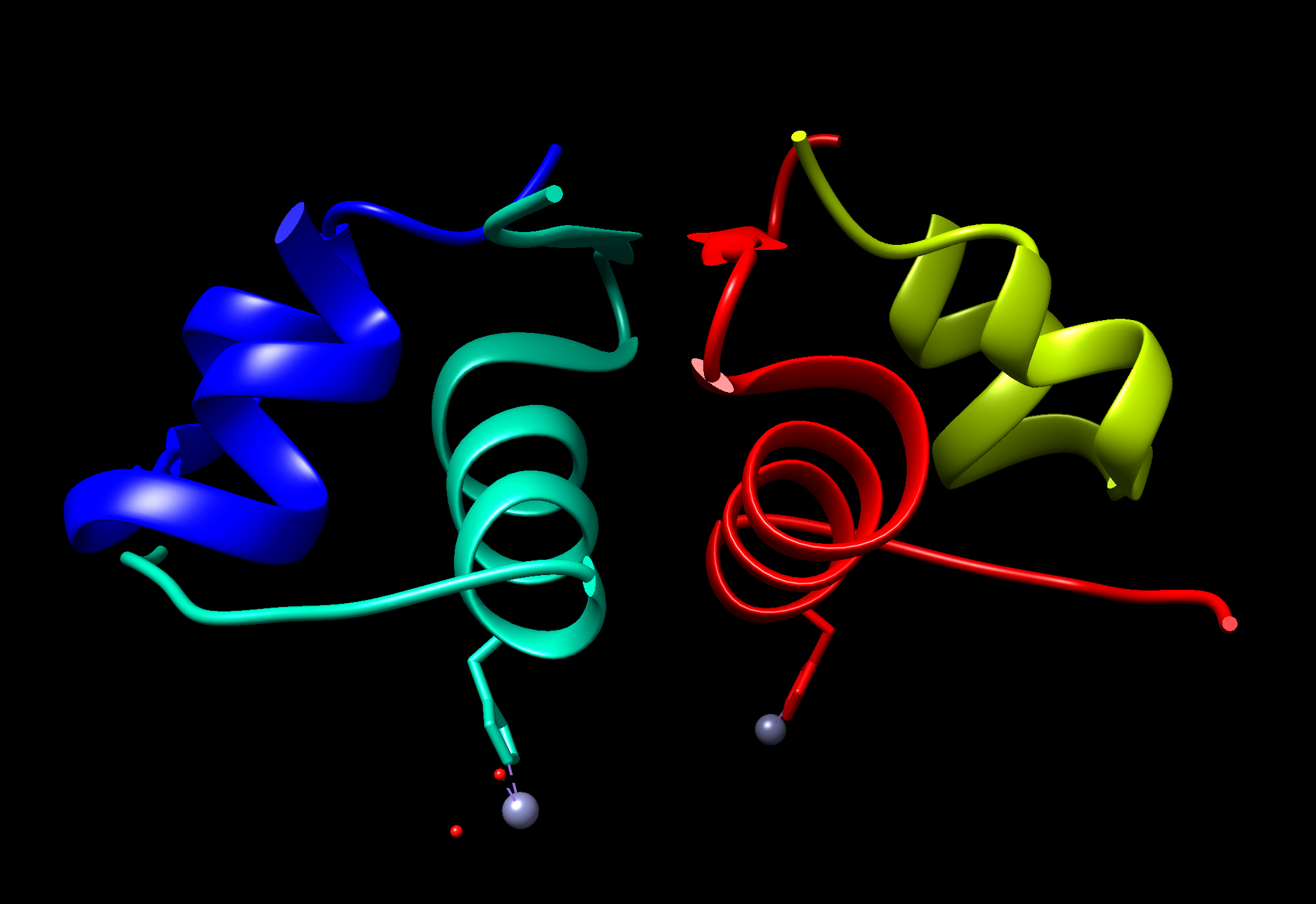
Color all chains in the structure in a different color. Choose **Tools… Depiction… Rainbow** from the menu. This should launch a new window with various rainbow coloring options as shown here.

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Select the Rainbow color scheme by **chain**. Click on the **Apply** button. You should see something like the following:



Move the molecule in the display to see the structure of this molecule as shown below:



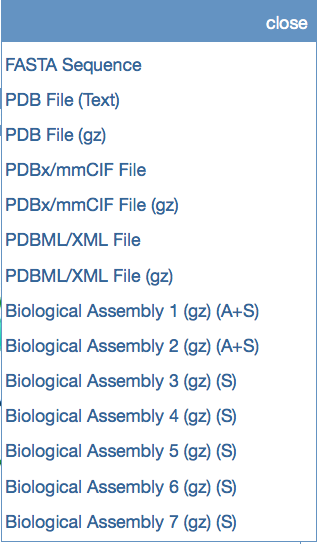
*Q2. What do you think the grey spheres shown in the above images are? What is their function? (Hint: Read the title of the PDB entry and the abstract for clues).*

*Q3. How are these grey atoms interacting with the insulin protein? (Hint: Look at the side chains of amino acids from Insulin interacting with these atoms)*

Select the Cys residues in the molecule – Menu **Select … Residue … CYS**. Display the side chains atoms by Menu **Action … Atoms/Bonds … Show**.

*Q4. Where are these residues located? Can you explain the role that these residues play in the stability of the insulin structure?*

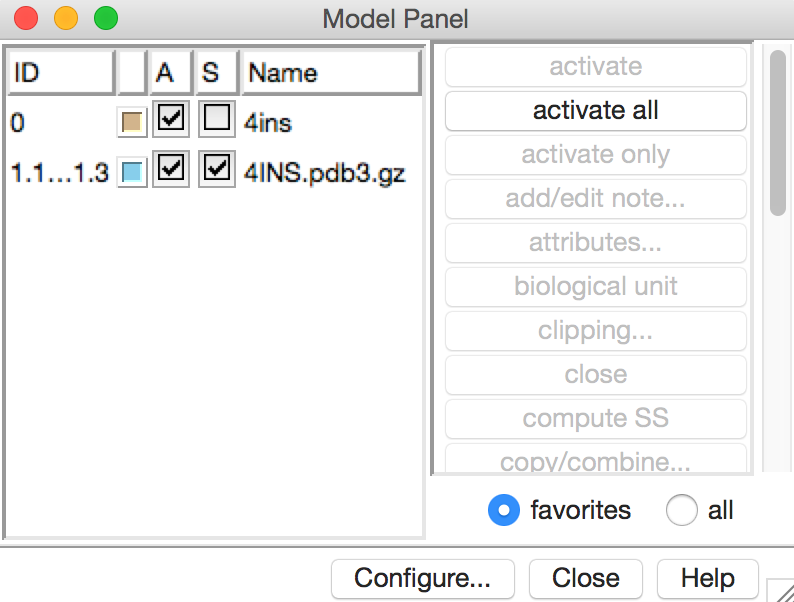
Download the coordinates of biological assembly 3 of the PDB entry 4ins.



Upload this file (4INS.pdb3) in Chimera Menu **File … Open …** path to 4INS.pdb3. You should see something like the following:



Now hide the multi-colored structure seen above to view the biological assembly image that you downloaded. Menu Favorites … Model Panel … check on the seen option of the molecules seen as below:



The Biological Assembly appears as follows:



*Q5. How many insulin molecules are shown in the biological assembly shown above? What does this structure tell you about a functional assembly of insulin?*

*Q6. Based on the structure seen here, what do you think the role of Zinc is? (Hint: the active form of insulin is monomeric, composed of a single copy of disulfide linked A and B chains).*

To learn more about manipulating, selecting and analyzing the structures loaded in Chimera explore the UCSF Chimera documentation at <http://www.cgl.ucsf.edu/chimera/docindex.html>.