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

**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
4. Compare structures – superpose 2 (or more) structures

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 powerpoint where you can add labels and include additional text to describe the images.

**Immunoglobulin**

Review the MOM feature on Antibodies for background information.

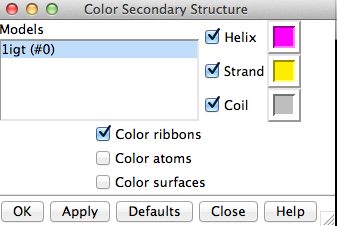
(<http://pdb101.rcsb.org/motm/21>)

Launch the Chimera program and load PDB entry 1igt. Assuming your machine is connected to the internet, from the “File” menu choose **File… Fetch by ID** and type **1IGT** in the box, make sure that the radio button next to “PDB” is selected, then click “Fetch.” You should see a ribbons view of the structure as follows:

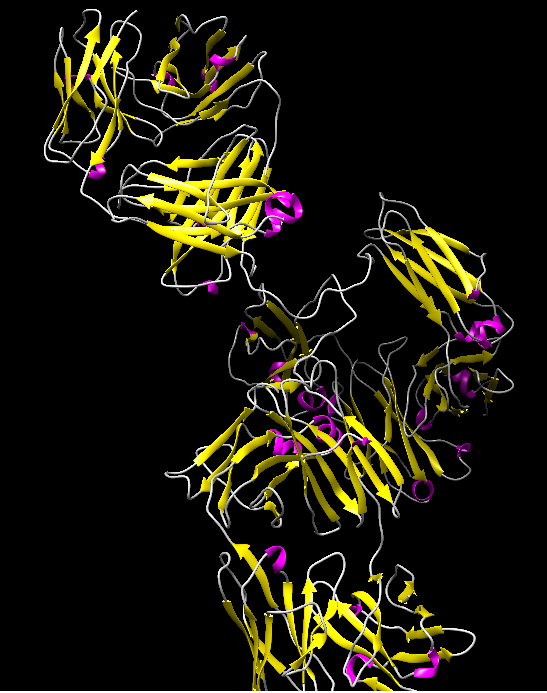


Color the ribbons as follows:

Choose **Tools… Depiction… Color Secondary Structure** from the menu. This should launch a new window with the color code for the helices and sheets (such as shown below):

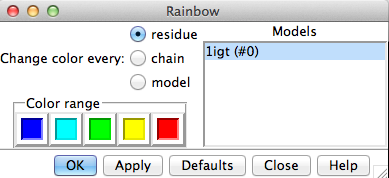


Note that the specific colors may be different in your installation. You can click on the colored box to change it to another color. When you click on **Apply** you should see the following in your structure display window.



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

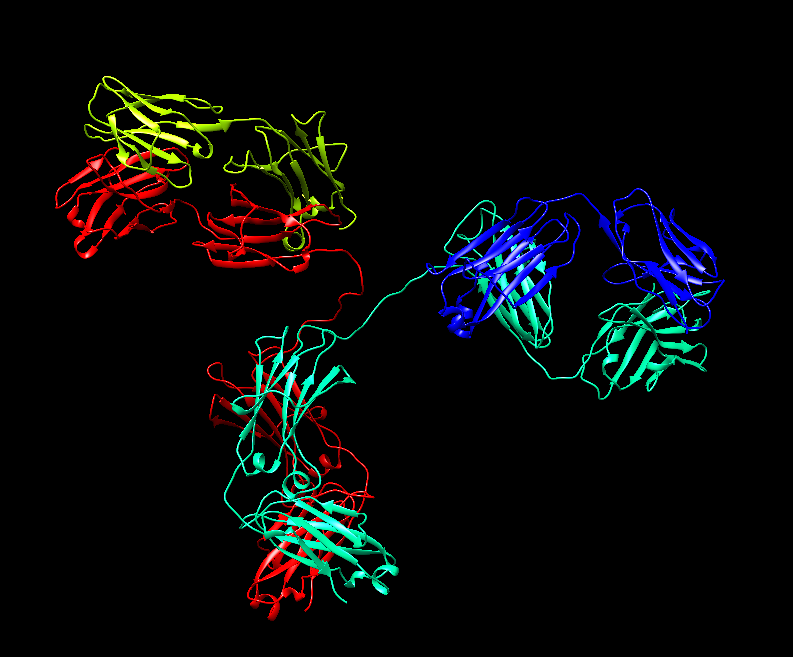
Color all chains in the structure in a different color. Choose **Tools… Depiction… Rainbow** from the menu. This should launch a new window with various rainbow coloring options as shown here.

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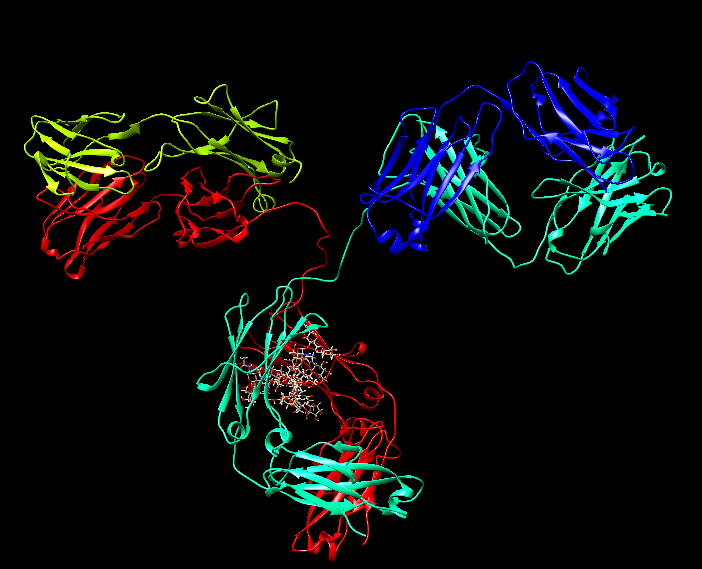
Select the Rainbow color scheme by **chain.** Click on the **Apply** button. You should see something like the following:



Move the molecule in the display to see the characteristic Y-shape of this molecule as shown below:



Select all the non-standard residues – using Menu **Select … Residue … all non-standard**. They show all the selected atoms using Menu **Action …** **Atoms/Bonds … Show**.



*Q2. What do you think these residues are? What is their function?*

*Q3. Draw a picture of the immunoglobulin molecule and label the heavy and light chains. Save a suitable image and label it. Also label the antigen binding sites.*

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 antibody structure?*

Compare this antibody structure to that in PDB entry 1igy.

Upload the second antibody structure by choosing **File… Fetch by ID…** and type **1igy** in the box

Superpose the 2 structures by clicking on Menu **Tools… Structure Comparison… Matchmaker** This brings up the structure alignment window: On the left side of the new window, under **Reference Structure**, highlight 1igt by clicking it once, then select structure 1igy in the right hand section (structure to match). Now press **OK**

After a few moments, the second antibody structure moves to and is aligned on the first structure. *Save this image.*

*Q5. How well do the 2 structures match? Do they align? in which parts?*

*Q6. What can you say about Antibody structures based on this comparison? (Hint: Are they rigid or flexible).*

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>.