

1. **What is in the PDB file that I am looking at?**
 - Upload/fetch file >> Presets >> Interactive 1 >> (each polymer chain is colored in a different color)
 - Figure out what each chain represents >>
 - Type PDB ID in top search box (www.rcsb.org) >> Open structure summary page >> Read about contents by chain ID
 - Go to Chimera graphical display >> mouse over chains and match chain ID with that on structure summary page
2. **To Select:** See selection (the selected atom, residue, chain etc.) highlighted with a green halo
 - a. **An atom(*)**
 - Left click on atom in graphics display with Control button pressed
 - b. **A specific residue**
 - Left click on any atom of residue (see above*) >> press up arrow OR
 - Select residue from sequence based on chain ID and residue number
 - Favorites >> Sequence >> *See new window with sequence* >>
 - Mouse over amino acid sequence to see chain ID and residue number >> Click-drag on one or more specific amino acid residues in sequence window to select them
 - c. **All residues of a type(#)**
 - Select >> Residue >> Standard (or Non-standard) >> select a specific one (or all) OR
 - Select >> Residue >> Amino acid category
 - d. **A chain**
 - Left click (with Control pressed) on any atom of residue (see above*) >> press up arrow (pressing it once *selects residue*, twice *selects secondary structural element* and thrice *selects chain* etc.; clicking down arrow reverses these selections) OR
 - Select >> Chain >> select Chain ID (A or B or C etc.)
 - e. **A specific type of residues within a or chain or a selected group of residues/chains(\$)**
 - Select chain/group (see above) >>
 - Select >> Selection Mode >> Intersect >> Select specific type of residue (see above #)
 - Reset selection mode >> (Select >> Selection Mode >> Replace) for further selections
 - f. **A zone (%)**
 - Select a residue or chain (as above) around which to explore >> Select >> Zone >>
 - *New window opens* >> input the distance within which all residue should be selected >>
 - Input/select options to select zone (atoms/residues within specified distance)
3. **To See or Hide:**
 - Select residue(s)/chain(s) >> Actions >> Atoms/Bonds or Ribbons or Surface >> Show or Hide
4. **To explore interactions within or between polymer chains:**
 - a. **Find H-bonds**
 - To find all H-Bonds in structure: Tools >> Structure Analysis >> FindHBond >> OK
 - To find ones in a selected set of residues: Tools >> Structure Analysis >> FindHbond >> Check on "Only find H-bonds" options (with at least one end or both ends selected) >> OK
 - b. **Find hydrophobic interactions**
 - Select >> Residue(s) (either in entire structure or within a selected set (see above \$ or %)) >>
 - Amino acid category >> hydrophobic >> Action >> Atoms/Bonds >> Show >>
 - Examine residues >> Mouse over atoms or Left click on them to identify them
 - c. **Find charge-based interactions**
 - Select Amino Acid category# >> Negative >> Actions >> Atoms/Bonds >> Show >> Actions >> Color >> select color 1
 - Select Amino Acid category# >> Positive >> Actions >> Atoms/Bonds >> Show >> Actions >> Color >> select color 2
 - Visually locate pairs of color 1 and color 2 amino acid side chains within (~4-6 Å) of each other >> do closer analysis
 - d. **Find pi-pi interactions**
 - Select Amino Acid category# >> Aromatic >> Actions >> Atoms/Bonds >> Show >>
 - Examine location and orientation of aromatic rings >> Identify sandwiched, edge-to-face, displaced interactions
5. **To compare structures:**
 - Upload/Fetch PDB entry of interest >> Orient/understand all components (polymer chains, ligands) >>
 - For complex structure, click on Presets >> Interactive 1 >> this colors the chains in the polymer >>
 - Upload/Fetch one or more PDB entries to be compared >> Tools >> Structure comparison >>
 - Matchmaker >> *New window opens* >> Click to select pairs of PDB IDs - Reference structure (in one column) and Structure(s) to match (in the other) >> OK >> Review the graphics window to see match
6. **To measure distances:**
 - Select two atoms - press Shift + Control + Left click on the atoms in the graphics window >>
 - Tools >> Structure Analysis >> Distances >> Create - Distance reported in graphics and new window
7. **To label structures:**
 - Tools >> Utilities >> 2D Labels >> *New Window opens* >> Left click on desired label location >> Write text (select font, color etc.)>> Show or hide label and move to suitable location OR
 - Actions >> Label >> select general or Residue options >> Edit label color options from Actions >> Color >> All Options >> select Label options in new window

For a quick overview of key functions of UCSF Chimera check out the following short videos:

1. Basics (<https://www.youtube.com/watch?v=hOxKYSUdiD8>)
 - how to open a file from the PDB in the software, interact with it, save images and close the software.
2. Menus (<https://www.youtube.com/watch?v=ZICQW3LBdpw>)
 - how to select, display, color and label specific residues and chains in different representations
3. Selections (<https://www.youtube.com/watch?v=HRPVmRD5e1U>)
 - how to select specific residues from the graphics window or in a specific polymer chain to visualize and explore
4. Structure analysis (<https://www.youtube.com/watch?v=eLxhKc7Ljjk>)
 - how to explore the interactions of a given residue or ligand with its neighboring atoms, measure distances, angles etc.
5. Structure comparisons (<https://www.youtube.com/watch?v=oThN3LG8LQU>)
 - how to compare and visualize the structures of two related proteins/domains.