Assignment-12

Amino acids and proteins

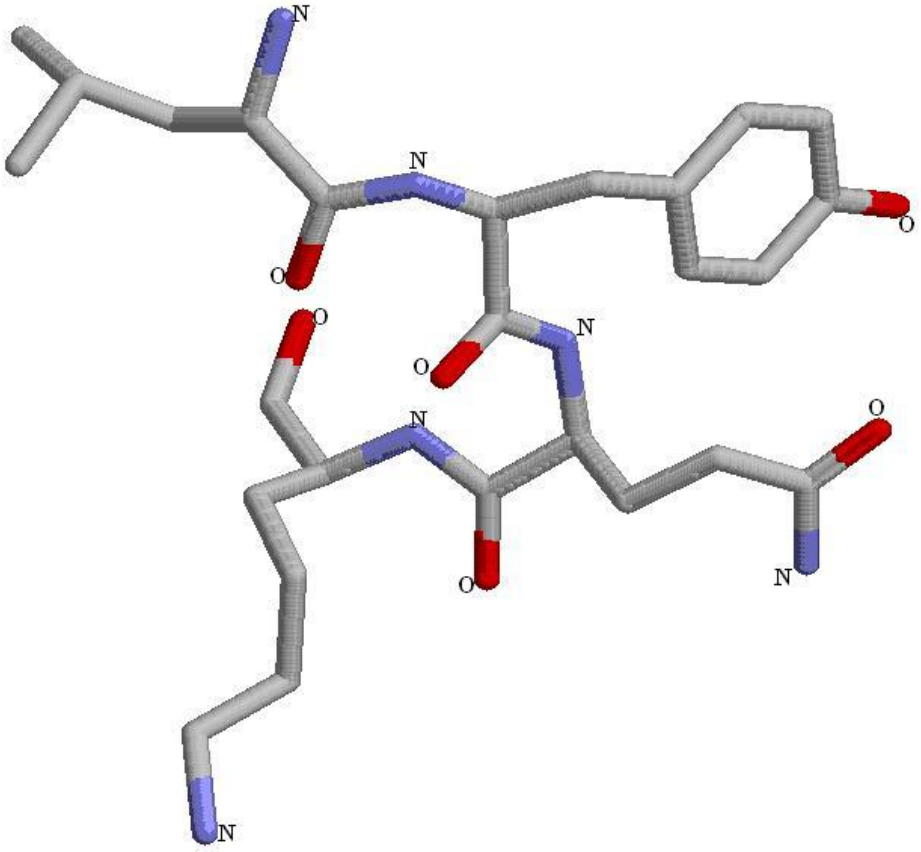
(To be submitted by November 6, 2k17)

Q1. The figure below represents a polypeptide showing only the heavy (non hydrogen atoms). The hetero atoms (that is other than carbon atoms are labeled appropriately).

a. How many residues are there in the polypeptide? Number the Cα atoms starting from the N-terminal residue.

b. Name these residues, give their one and three letter codes and classify them as hydrophobic/polar/positive/negative/uncharged etc.

c. Take any one of the middle residues and label the Φ, Ψ and ω angles for it.



Q2. < SAVE ME I AM TRAPPED IN A GENE>

Convert the above into a string of amino acids with their three letter codes. Then convert the string in to a 'property string' by replacing the amino acid 'three letter codes' with corresponding property codes as follows:

Hydrophobic **L**arge/**M**edium/**S**mall (**HL**/**HM**/**HS**)

And

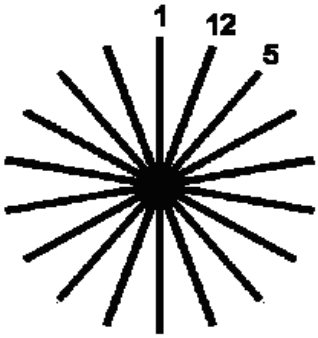
Polar **N**eutral/Positive or **P**lus/Negative or **M**inus (**PN**/**PP**/**PM**)

Resolve to perform what you ought - Perform without fail what you have resolved

Q3. Download and unzip <torsions and ramachandran.rar>

a. Go through the ppt file < rama.ppt> and write a short note on helical parameters for different types of helices. What would be the length of a 20 residue long polypeptide chain, if it were in an alpha helical conformation?

b. Draw a rough sketch of the Ramachandran plot template, and mark different secondary structure regions on the plot. You may first do this by looking at the ppt slides. Then try doing it on your template, without consulting the slides. *(Only for practice)*



c. Shown to your left is a helical wheel diagram which shows a schematic plan projection of 'n' turns of a protein alpha helix. The positions of three of the residues are shown to provide a clue.

i. What is the value of 'n' in the helix?

ii. What is the angle between two 'spokes' corresponding to consecutive residues? Hence fill in the rest of the residue numbers in the given diagram.

iii. Use the helical wheel and/or other methods and state whether the sequences below could correspond to amphipathic helices or strands.

- ✓ Val-Phe-Glu-Arg-Met-Ile-Glu-Thr-Leu-Asn-Arg-Leu-Phe-Ser-Glu-Trp-Ile-Ser
- ✓ Ala-Arg-Val-His-Trp-Ser-Ile-Thr-Met-Gln-Leu-Cys-Phe-Lys-Ser-Tyr-Arg-Val

d. Open the file < Ramachandran revisited.htm>,
or, go to the site <http://xray.bmc.uu.se/gerard/supmat/ramarev.html#S13>
Browse and familiarize yourself with Ramachandran plots for different aminoacids. Also familiarize yourself regarding the applications of the Ramachandran plot. *(Only for practice)*

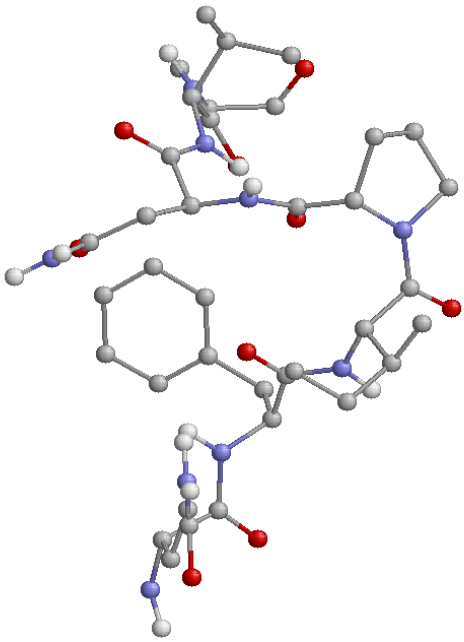
Q4a. There are five proline residues in the four small polypeptides shown below. Classify them as cis proline or trans proline.

Q4b. What do you understand by parallel and antiparallel sheets? Draw schematic diagrams to show intra strand hydrogen bonding in each case. Which of them form stabler hydrogen bonds and why?

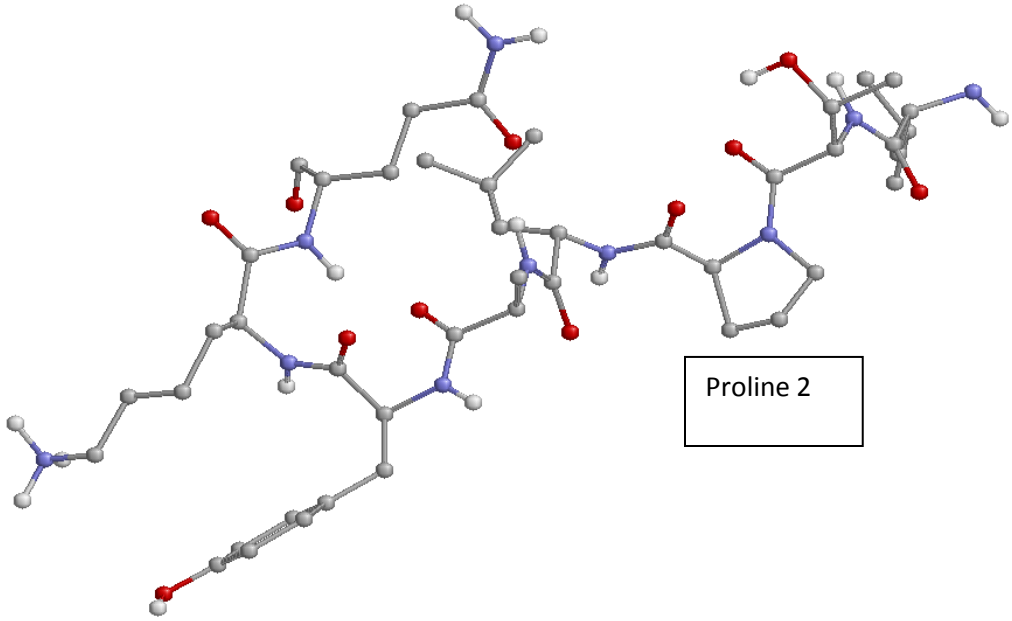
5a.Amino acids can be classified as 'hydrophobic' or 'polar'. In some situations they are also classified as 'surface' or 'buried'. Discuss the correlation between these two types of classifications if any.

5b. Proline is usually classified as a 'surface' amino acid. Is it a polar or a hydrophobic amino acid? Does your answer correspond to the correlation mentioned in the question a above? Explain.

NB. You are free to discuss these questions among yourselves and consult the net or any book of your choice in the library. However, please answer the questions separately by yourselves. Submit your assignments by Monday November 16th night.

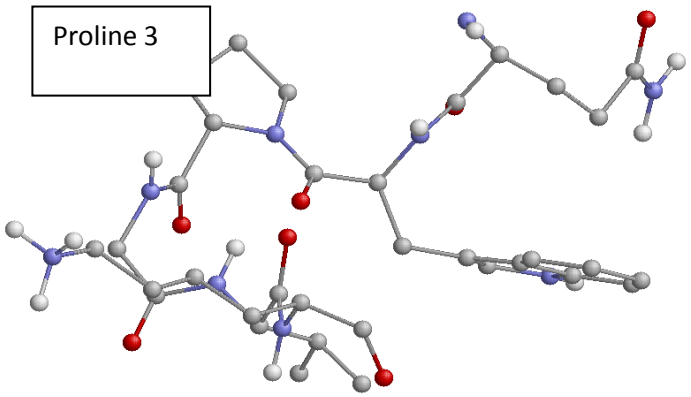


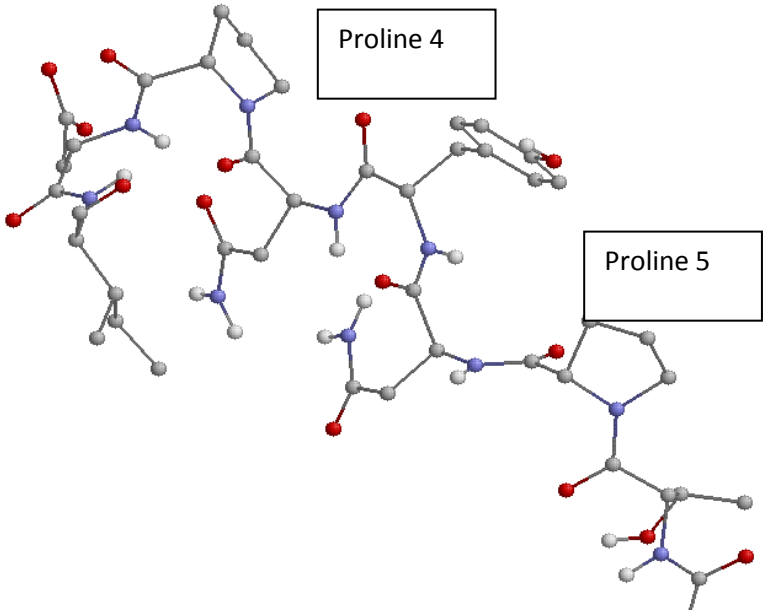
Proline 1



Proline 2

Resolve to perform what you ought - Perform without fail what you have resolved


Proline 3


Proline 4
Proline 5