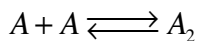


Name:

1. So far about 21000 protein-coding genes have been identified in the human genome. Estimate how many transcription factor genes (= different transcription factors) are needed in the human genome to regulate gene expression.

- a) Write down your strategy and identify other parameters you need to make the estimate.
- b) Calculate the result with your approach.
- c) Look up the number of human transcription factor genes and compare/discuss your result.

2. The reaction for the dimerization of a protein



has a value of  $\Delta G = -8.2$  kcal/mol. How much would you have to change  $\Delta G$  to increase the ratio of dimer to monomer by 10 fold? What would be the corresponding energy difference in terms of  $k_B T$  for the reaction?

3. Calculate the configurational free energy, which destabilizes the folded form of the protein for a polypeptide chain of 200 amino acid residues. Assume that there are three positions of "flexibility" per residue with an average of two conformations of equal energy per flexible point. Which flexible points are present per amino acid in a peptide chain?