

Report on Molecular Motors

The report on the molecular motors consists of answers to the following questions. The answers should be complete and written in such a way that the Chemist (who doesn't know anything about the project other than the structure of the molecules) can understand them. Keep it short but clear. The structure of the report should follow the questions below.

The report is due November 6.

I) (10) Describe the problem the chemist presented to us. In particular, describe the shape of the molecular motor and the main questions we were asked to answer.

II) (10) Describe the model, a Markov process, for the flipper motion of a single molecule.

III) (10) Explain how the model can be used to predict the concentrations of molecules in the different states. Explain how this can be used to validate the model.

IV) (10) Explain the dynamical situation at equilibrium.

V) (10) Describe a simulation of the flipper motion of a single molecule. Explain how the output of a simulation, given by the second program, of a single molecule relates to the actual motion of the flipper. Use examples.

VI) (10) What is the problem with the simulations and how can we solve it? Explain why we have to use statistical methods. Explain with data/examples: Present the results of the simulations. Explain what is the time scale to get reasonable results. (The results are tables with estimated rotational speed for different values of T).

VII) (10) Give the final table of rotational speeds dependent on the light intensity. Use groups of molecules and simulations of long enough time. Explain that the size of the groups and the time you use are sufficiently large. What is the influence of the simulation time?

VIII) (10) Give a formula for the speed in terms of the probability matrix and the equilibrium concentrations. Compare with the results of the table of question VII).

IX) (10) Discuss the qualitative behavior of the rotation speed in terms of the light intensity. When is the speed optimal? Hint: give two differences between light of color $k=0$ and light of color $k=10$.

X) (10) Give a summary for the chemist of the results.

The numbers between parenthesis are the points you can get for the question. Grade=total number of points/ 10, something between 0 and 10.

Often math majors use these reports to satisfy their writing requirements. At the end of the semester let me know whether you want to use your reports for this purpose.