

MCB 199/Physics 199: Statistical Thermodynamics and Quantitative Biology,  
Spring 2023

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OH: Monday 4:30-5:30 in Jefferson 453

Lectures: MW 12-1:15, Biological Labs - 1080 (Main Lecture Hall)

Weekly sections: Thursday 6-7 in Biolabs 1058, Friday 10:30-11:30 in Jefferson 453

**Section Meetings:** One each week to go over background and additional lecture materials, work problems and answer questions.

**Prerequisites:** Two semesters of college calculus, a calculus-based physics course and some exposure to molecular and cellular biology. Experience with statistics and differential equations is not essential, but helpful.

**Text:** required: *Molecular Driving Forces* (by K. A. Dill & S. Bromberg; 2nd Edition, based on a course developed at the UCSF Medical School). Also useful is *Random Walks in Biology* (by Howard Berg). These texts can be purchased from the Harvard Coop using the following link: <https://tinyurl.com/Order-Spring-23-materials-here>

**Problem Sets:** Due weekly during the Wednesday class period. Collaboration encouraged, but final work should be your own. Good news — We will drop your lowest score among the problem sets in calculating the final grade. Less good news — late problem sets will count  $\epsilon$ , where  $\epsilon \ll 10^{-4}!!$  (Problem set solutions will be made available on the due date.)

**Final Exam:** Regularly scheduled three hour final exam in May. Open class notes and pocket calculators only.

**Midterm Exam:** On Wednesday, March 22, during the regular class time.

**Grading:** 50% problem set scores, 15% hourly exam, 35% final exam.

**Syllabus:** Time permitting, Chapters from *Molecular Driving Forces* (MDF) covering the topics below, as well as polymer solution theory and a brief introduction to statistical methods in population genetics.

Random Walks and Entropy  
Thermodynamic Driving Forces  
Free Energies  
Boltzmann Distribution Law  
Chemical Equilibrium  
Solutions and Mixtures

Transfers of Molecules between Phases  
Physical Kinetics, including Diffusion  
Chemical Kinetics and Transition States