

BE/APh161: Physical Biology of the Cell
Homework 7
Due Date: Wednesday, March 6, 2013

“Truth will sooner come out from error than from confusion.” - Francis Bacon

1. Freely-jointed chain.

Do problem 8.9 of PBoC2. The goal of this problem is to amplify on the force-extension calculation that I did in class so that you have a chance to see for yourselves how the entropic spring works.

2. Antenna model of microtubule length control.

(a) Read the paper by V. Varga *et al.* from Nat. Cell Biol., 8:957 (2006). Write a one-paragraph summary of what they did in the paper.

(b) Do problem 15.7 of PBoC2.

(c) Extra credit: Read their second paper, Cell 138: 1174 (2009) and write a one-paragraph summary of what this paper does beyond the 2006 paper.

3. Your Turn to Teach 161

RP: all answers to this problem must be submitted electronically to the TAs and me in pdf form.

(a) Some have argued that only by quantitation will we really be able to come to terms with the complexity of living organisms, with the quantitative approach advocated in this class meant to give you a feel for how such quantitative dissection of biological problems might work. Others have argued that the approach we have taken is a mopping up operation which amounts to dotting the "i"s and crossing the "t"s already worked out by biologists. Write one paragraph defending each of these two points of view. One document you might find interesting to look at is “Bio2010” from the National

Academy of Sciences.

(b) Next, make a syllabus for the course. Start with one brief paragraph on the mission of your course. Issues that you might want to consider include: is it important to do hard calculations, or is that the province of other physics courses and our goal here is to illustrate the *style* of thinking? Are estimates a part of the way you will present the material (if yes, why, if no, why not?). How will you organize the material - note that in typical biology books DNA and actin would never be in the same chapter but for PBoC they are both in chap. 10 as examples of "beam theory". The course is only 10 weeks long. What will you cover, what will you skip and why? How will you balance the desire to cover more topics with the resulting superficiality? This is not a look up something in Wikipedia question, nor is it a request to regurgitate what I did in the course. It is asking you how to organize a new and unfinished topic and to present it to advanced Caltech undergrads and to grad students at the beginning of their grad careers. What are the important points?

(c) What subject did you find most interesting from the course? What subject did you find least interesting from the course? Please answer with several sentences only, but justify your outlook and tastes (to the extent possible).