BE/APh 161: Physical Biology of the Cell, Winter 2018
Homework #8
Due at the start of lecture, 2:30 PM, February 28, 2018.

Problem 8.1 (Tensile strength of the $\phi 29$ capsid, 20 pts)**.**
In lecture and in the last homework, we discussed the packaging of the $\phi 29$ viral capsid. Specifically, we used Fig. 1 to estimate packaging forces. Here, we will estimate a lower bound for the tensile strength of the capsid. Tensile strength, measured in units of force per area, is the maximum stretching stress a material can bear before rupturing. Based on that curve and our discussion in lecture, estimate the minimum that the tensile strength of the $\phi 29$ virus must be to contain the genome. How does this compare to the tensile strength of bone? *Hint*: It might be useful to read about the Young-Laplace Law, described in section 11.3.1 of *PBoC2*.

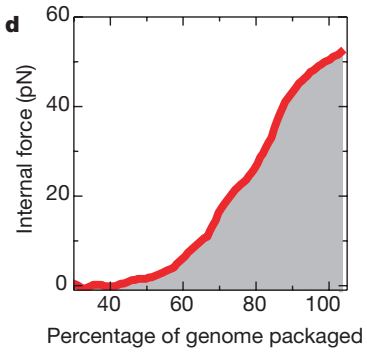

Figure 1: Force/fractional packaging curve for a $\phi 29$ virus. Figure taken from Smith, et al., *Nature*, **413**, 748, 2001.

Problem 8.2 (Antenna model for microtubule length control, 50 pts)**.**
Do problem 15.7 of *PBoC2*.

Problem 8.3 (Kinesin as an ATP-hydrolyzing enzyme, 30 pts)**.**
Do problem 16.3 of *PBoC2*. When you do your nonlinear regression, fit the approximate Michaelis-Menten expression to obtain the parameters $v_{\max}$ and K_m. The data from the Schnitzer and Block paper are given below.

ATP concentration (μM)	motor speed (nm/s)
0.75	9
1	13
2	19
4	50
10	95
40	260
100	410
400	650
1000	650