Physical Biology of the Cell: GIST
Homework 1
Due Date: Wednesday, August 6, 2014

1. A feeling for the numbers in biology

(A) Read the paper by Milo, Flamholtz and Phillips on “The Quantified Cell” and provide a one-paragraph referee report which summarizes what the paper has to say and your opinions about it.

(B) Imitating the concept of the simple calculations in the paper, come up with a calculation of your own that you would like to do over the coming two weeks and tell us what that estimate will be. In this homework, you are not providing the estimate itself, but rather just giving us the concept for what you are going to do.

2. Order-of-Magnitude Cell Biology

In this problem, you are not going to look anything up or refer to any references. Rather, this is practice at doing simple estimates on the basis of educated guesswork and by reducing problems to smaller pieces.

(A) Using your knowledge of the size of \textit{E. coli}, estimate out how many water molecules there are in a bacterium. Then, once you have that figured out, use this to estimate how many waters have to be imported into the cell per second in order to make a new cell over the course of the cell cycle.

(B) If a typical bacterium has on the order of $3 \times 10^6$ proteins, and a typical ribosome translates at roughly 10 aa/s, make an estimate of the number of ribosomes are needed for this bacterium to reproduce once every 40 minutes.

(C) Do problem 3.4 of \textit{Physical Biology of the Cell}. 

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