EN.580.441/641 Cellular Engineering, Fall 2018 **HW #1**
Assigned: Sept 4 **Due: By midnight on Sept 18**

Instructions:
All parts to this assignment are turned in directly to Blackboard.

(1) A PDF of a brief report answering Question 1 containing a brief introduction, the equations used, the MATLAB functions used, and your results. This report should include your assumptions, plots (with labels and units), and a discussion of your results.
(2) Your executable MATLAB file named "YourlastnameFirstname_HW1.m"
(3) A PDF containing your answers to Question 2.

Question 1:
You performed an experiment in lab to study the protein/ligand interaction of your favorite protein. You tested both wild-type and mutant versions of the protein using the same ligand concentration which ranged from 1 nM – 10,000 nM and recorded the signals you read from a multi-well plate reader as indicated below. You think that there is some noise in the data and also think that the mutant protein's readings are different from what you were expecting. You can assume that ligand concentration is not depleted during the experiment and stays constant. Use "nlinfit" in MATLAB to calculate K_d and a "signal coefficient" for each protein. Plot an overlay of your fit to the experimental data using "plot" and "semilogx." Plot the residuals (the second output of "nlinfit") using "semilogx" as well.

What are your findings? Which protein binds to the ligand more strongly?

Ligand (nM)	Wild-Type Signal	Mutant Signal
1	0.0178	0.0312
2	0.0441	0.0786
4	0.0826	0.1454
8	0.2060	0.2432
10	0.2222	0.2727
20	0.3336	0.3208
40	0.5533	0.4602
80	0.6457	0.4346
100	0.7207	0.6288
200	0.8811	0.5175
400	0.9395	0.5519
800	0.9181	0.5978
1600	0.9686	0.5548
3200	0.9892	0.7384
6400	0.9846	0.7198
10000	0.9965	0.6828

Question 2:

This question is intended to:

(1) Intended to provide background / review / independent study on basic "building blocks" of cells and how even small changes to their properties can exert significant control over biological activity

(2) Provide an opportunity for you to do a "mini" independent project that will allow you to demonstrate skills (proper citation of literature, proper use of figures, proper citation of references) that will be critical for your course term project
(*yes, it's never too early to be thinking about that!*)

Limit your answer to one page in length. Your response should include at least three (3) references from peer-reviewed journals that are properly cited in the text and referenced in a standard format at the end of the article. Hint: scientific articles generally have section headings (i.e., they are not a continuous story-like narrative) and include illustrative figures (which for the purpose of this assignment can be "cut and pasted" as long as their source is clearly referenced).

As in Question 1 that you modeled, a mutation to single amino acid of a protein can dramatically (or at least measurably) change the health, phenotype, or even behavior of higher organisms (e.g., mammals [including but not limited to people], birds, reptiles, or fish) compared to wild-type. Perhaps the most well-known example of this phenomenon – which you CANNOT use to answer this question – is the single amino acid mutation in haemoglobin that causes sickle cell disease. Select another example and provide an introduction, describe the biochemical/molecular basis of the mutation, and briefly discuss larger ramifications (e.g., how to treat the disease [if applicable] or how the behavior/lifestyle [if applicable] of the animal involved is affected).