Bi1x, Spring 2010

Week 6 Assignment

Due May 17, 2010 in class. Turn all three parts as separate paper copies.

Part I. Growth Curves of *E. coli* under the Microscope

A. Answer the questions in the protocol marked in *italics* related to the autofocus and the time resolution.
B. Show the initial and final frames of all the positions you took data from. Did all cells divide?
C. Show a couple of frames of one or two of your favorite movies. You might want to look into the Matlab command *montage* in order to plot many frames right next to each other.
D. Estimate the cell doubling time by looking at your movies. An easy and fast way to look at the movies is with ImageJ by using the command "File → Import → Image Sequence".
E. Make sure to explain your reasoning carefully by showing a couple of division events with their respective time stamps. Time stamps are easy to add using "Plugins → Stacks → Time Stamper". Also add a scale bar by doing "Analyze → Tools → Scale Bar". How do you decide that a cell has divided already? Do all cells divide at the same rate? Do you get the same division rate in all positions on the pad?
F. Look at the movies corresponding to one or two positions and manually track the different cell division times. Draw a histogram of the division times you found and find the mean division time and the standard deviation. How does the division time compare to the bulk results you got last week? Is there are any difference, why do you think this could be?

Part II. Environmental Virus Analysis

A. Based on the images of all four conditions (positive control, negative control, pre-filtered pond water and unfiltered pond water)– are you convinced you are seeing viral particles? Explain. What other experiments would you suggest doing to further convince yourself?
B. Based on your positive control, back calculate the initial concentration of lambda viruses. Average several fields of view. Does it match the number written on the tube? The number written on the tube is not the actual number of particles but the number of infectious units. How does that alter your answer? Please show your calculation.
C. Based on your pre-filtered results, back calculate the concentration of viruses in the pond. Average several fields of view. Does your figure agree with the estimates given in the Suttle Nature review? Please show your calculation.

Part III. Final Project Research

Each group should turn in one references summary report with all the reports of the group. Each person should read three papers and write a 200-word summary of each. It can be helpful to start with a review paper to learn the background in the field and read some of the papers that it cites. In general, the references section of one paper is a great place to start looking for other papers on the topic. Be sure to cite the paper you are summarizing with the pertinent information: title, author(s), year, journal, etc… The formatting of the citation is up to you.

Here's what it could look like:

> Phillips, R., Bi1x, A. Sequencing the Caltech Ponds: a 16s story. Nature, 2010.
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> In this fascinating work, Prof. Phillips and his brilliant team of Caltech students undertakes the intellectual journey of a lifetime ……
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Helpful resources:

- http://library.caltech.edu/ See the quick links bar on the right-hand side.
  - ISI web of Knowledge
  - PubMed
- http://authors.library.caltech.edu/ A repository of Caltech authors' papers, by name.
- Google Scholar
  - On campus, you'll have a "Caltech Connect" button that can see if it's available through Caltech.
  - Sometimes, you're lucky and it'll be free!
  - If you find a document you absolutely need, but it's not available for free, we can buy it through DocuServe (formerly Ibid), just let Helen or your TA know.
- Your TAs! They can help you start the research process and help you find papers in the field.