

StarCellBio Introduction in 7.06 Recitations - Spring 2013

Introduction

I am [insert relevant information here!] in biology education within Professor Graham Walker's Education Group in the Biology Department. I help to design, develop and implement biology educational software tools that are used in the classroom at MIT and at other colleges and universities around the world.

We are currently developing a new cell and molecular biology experiment simulator, called StarCellBio, which will be used for the first time in 7.06 this spring. StarCellBio will enable you to design, perform and analyze your own experiments in a simulated environment. In StarCellBio, you will be able to design and setup your own cell biology experiments and analyze the resulting samples by 1) western blotting to detect changes in the amount of or modifications to proteins or 2) flow cytometry to analyze the properties of individual cells within a population of cells.

The extra credit assignment

1. Assignment Details & Goal

StarCellBio will be implemented for the first time this spring. We have developed a prototype version of StarCellBio that you will have the opportunity to use if you choose to complete the extra-credit assignment. The extra credit assignment is relevant to material on Exam 3 and the assignment is worth up to 5 points on your Exam III score. To receive the extra credit points, you will also need to complete a feedback survey on the extra credit assignment and StarCellBio user experience. A link to the survey will be provided in the assignment and the feedback survey should be completed after you complete the assignment. The extra credit assignment and feedback survey must be completed by the beginning of lecture on Thursday, April 25th.

The goal of this assignment is to enhance learning of experimental design and analysis by providing you with the opportunity to design, perform and analyze your own cell and molecular biology experiments which complements the material you have learned in 7.06.

Tour of StarCellBio

1. Administrative Details

Website for the tour of StarCellBio: <https://edison.mit.edu> (Note: this is NOT the website that the students will use - we don't want them to look at the assignment before April 11th, when the assignment will be posted.)

Username: starcellbio

Password: STARald32laleman

The program works in Firefox, Safari and Chrome web browsers, but is not currently supported in Internet Explorer.

2. Tour

A. When on the homepage: StarCellBio has several resources that are available to you on

every page:

- Contact - use this icon to send us feedback or report technical bugs
- Reference Library - contains information about the biology content and experimental techniques that are contained within the program
- User Guide - contains information about using the program itself

Please note that since this is StarCellBio's first implementation in the classroom and this is a beta version of StarCellBio, some features are not available yet, such as the 'See more' link on the homepage and the 'In the Lab' features within the program.

B. To get started, click on 'Sign In' in the upper right corner or 'Try an Experiment' on the homepage.

- User accounts will not be available for this first implementation. The program will save all of their work in the browser in which they complete their experiments. We recommend that the students use the same browser for their experiments.

C. The assignment overview will be displayed on the 'Assignments' page. To view the complete assignment, click 'Complete Assignment'. The condensed version of the complete assignment will be displayed. At the bottom of the page, you will find reference information that you may need to reference while designing and completing the experiments in StarCellBio. The assignment will also be posted on the Stellar website for your review.

- The students should complete the version of the assignment that is posted on Stellar.

D. Navigation Tool Bar - The navigation tool bar is the green bar at the top of the page. The tool bar can be used to navigate around the program as students complete experiments in the program.

E. Design page -

- Use the design page to think about the question their experiment is addressing, the hypothesis they are proposing, and the experimental technique that would be best suited to analyze their samples. The design page is for their own experimental design process and planning.
- Fill in the question that you would like to answer, hypothesis and select a technique(s) that you think is(are) best suited for the experiment.

F. Progress Bar -

- Displays progress through the experiment including the 5 steps of an experiment: design, setup, run, select technique and perform technique.
- The progress bar is not clickable.

G. Set up page -

- Specify that each row in the table corresponds to one treatment protocol that is being applied to one sample of cells.
- Use the 'Add Multiple rows' button to select the treatments that you would like to set up.
- Although there are a lot of options here, for the purpose of this demo we will select the following treatments: 1) Wild type, growth media, 30 C, no PP1, and 2) Nocodazole, 30 C, no PP1

H. Techniques page - Select the experimental technique that would like to perform to analyze your samples.

Western blotting:

- Western blotting is a technique that detects changes in the concentration or modification of a protein of interest.
- Navigate to an already started western blotting experiment where you have blotted for PGK1 (loading control) already.
- Point out the sub-steps of the progress bar that indicates all of the steps of the western blotting experimental technique.
- Show them how to 're-probe' your blot with another protein of interest by clicking on 'Re-probe' and selecting the new blotting conditions for Cyclin E. Show them the blot for Cyclin E.

Flow Cytometry:

- Flow cytometry is a technique to analyze the size, shape, and properties of individual cells within a population of cells. In this extra credit assignment, you will analyze the DNA content of your samples.
- Already set up flow cytometry technique in which you have prepared and run your samples. Have the window open with the 'Analyze Data' tool already selected and 'Hide' the instructions for the Control sample.
- Show the control sample and describe the axes on the histogram. X axis is for Fluorescence corresponding to the dye propidium iodide (PI) which is used to analyze DNA content. Y axis shows the number of cells.
- Then select the nocodazole sample and immediately draw the segment for the analysis tool. Describe that the tool will calculate the percentage of cells within a particular segment on the graph, which you can use to determine the percentage of cells that are in different phases of the cell cycle.
- If you would like to apply a particular analysis to all of the histograms within a flow cytometry experiment, then select 'Apply to All' (but do NOT then show them the original sample due to the bug!)

3. Assignment

To provide supporting evidence for your conclusions, you will need to take screenshots of your informative data (and include the list of samples) for the western blotting and flow cytometry analyses. Be sure to only include the results that informed your conclusion.

Help Sessions

We will offer 1-2 help sessions where we can answer questions about the StarCellBio program. We will post the information regarding the dates and times of the help sessions on the Stellar website.

Conclusion

The extra credit assignment and links to the program will be provided on the 7.06 Stellar website. If you have any questions, please contact us: star@mit.edu.

Thank you in advance! Your feedback on StarCellBio is critical for the development of StarCellBio. This is your chance to make a contribution to how future cell biology courses are taught at MIT and other universities worldwide.

