

Fall 2005 Genomics Exam #3
Proteomics and Systems Biology

There is no time limit on this test, though I am hoping it will not take more than 6 hours. There are 4 pages for this exam, including this cover sheet. You are not allowed discuss the test with anyone until all exams are turned in at noon on Thursday December 15. **EXAMS ARE DUE AT NOON ON THURSDAY DECEMBER 15.** Submit your paper and electronic answers before the deadline. You may use a calculator, a computer, but only the web pages that appear in this exam. You are NOT allowed to explore the internet to take this exam. This is a new policy and is required if I am to shorten the length of the exams. You may take this exam in as many blocks of time as you need to. NOTE: I leave town on December 9 and return December 14 after a red-eye back from a meeting in SF,CA. If you have questions, I suggest you ask me before I leave. I will have *very limited* access to email so you can use gmail: <amalcolm.campbell@gmail.com>.

The **answers to the questions must be typed in a Word file and emailed to me as an attachment or handed to me on a thumb drive. I want paper and electronic submissions, please.** Be sure to backup your test answers just in case. You may need to capture screen images as a part of your answers which you may do without seeking permission since your test answers will not be in the public domain. Make sure the screen shots are big enough for me to read easily. Remember to explain your thoughts in your own words and use screen shots to support your answers. **Screen shots without your words are worth very few points.**

THIS IS A CLOSED BOOK EXAM TO HELP SHORTEN THE TEST.

-3 pts if you do not follow this direction.

Please do not write or type your name on any page other than this cover page.

Staple all your pages (INCLUDING THE TEST PAGES) together when finished with the exam.

Name (please print):

Write out the full pledge and sign:

How long did this exam take you to complete (excluding typing)?

20 Points

- 1) Open the file called "Exam1.pdf".
 - a. What was the ultimate goal of this research design?
 - b. Explain what happens in each of the steps A – D.
 - c. How could you experimentally test the results from step D?
 - d. Go to this URL <http://string.embl.de/newstring.cgi/show_input_page.pl> and generate pictures that show:
 - i. which proteins interact with human BRCA1 similar to panel A in Exam1.pdf;
 - ii. how well BRCA1 protein interactions are probably conserved in diverse species.
 - e. Which proteins from your figures above would you use for the process described in Exam1.pdf?

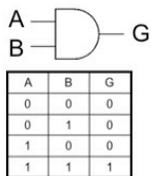
20 Points

- 2) Open the file called "Exam2.pdf".
 - a. Summarize the behavior of circuits simulated in panels C – G.
 - b. Explain why C and D give different outputs.
 - c. Explain why circuits E and F exhibit the outputs they do and contrast your answer to the one you provided for C and D.
 - d. Which of these 5 circuits would you want controlling calcium signaling inside a cell, such as a cardiac cell? Explain your answer.

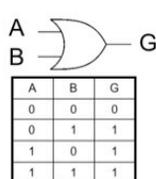
20 Points

- 3) a. In only one paragraph, explain how this multi-colored device works.
 - b. Write a truth table for this device.
 - c. Redraw this device using electrical circuit symbols from the subset provided here.
 - d. Is this a toggle switch, a bistable toggle switch, or neither? Explain your answer.

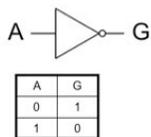
a) AND



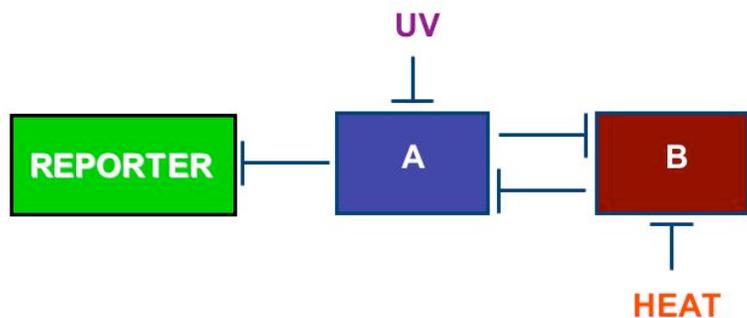
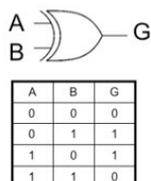
b) OR



c) NOT



d) XOR



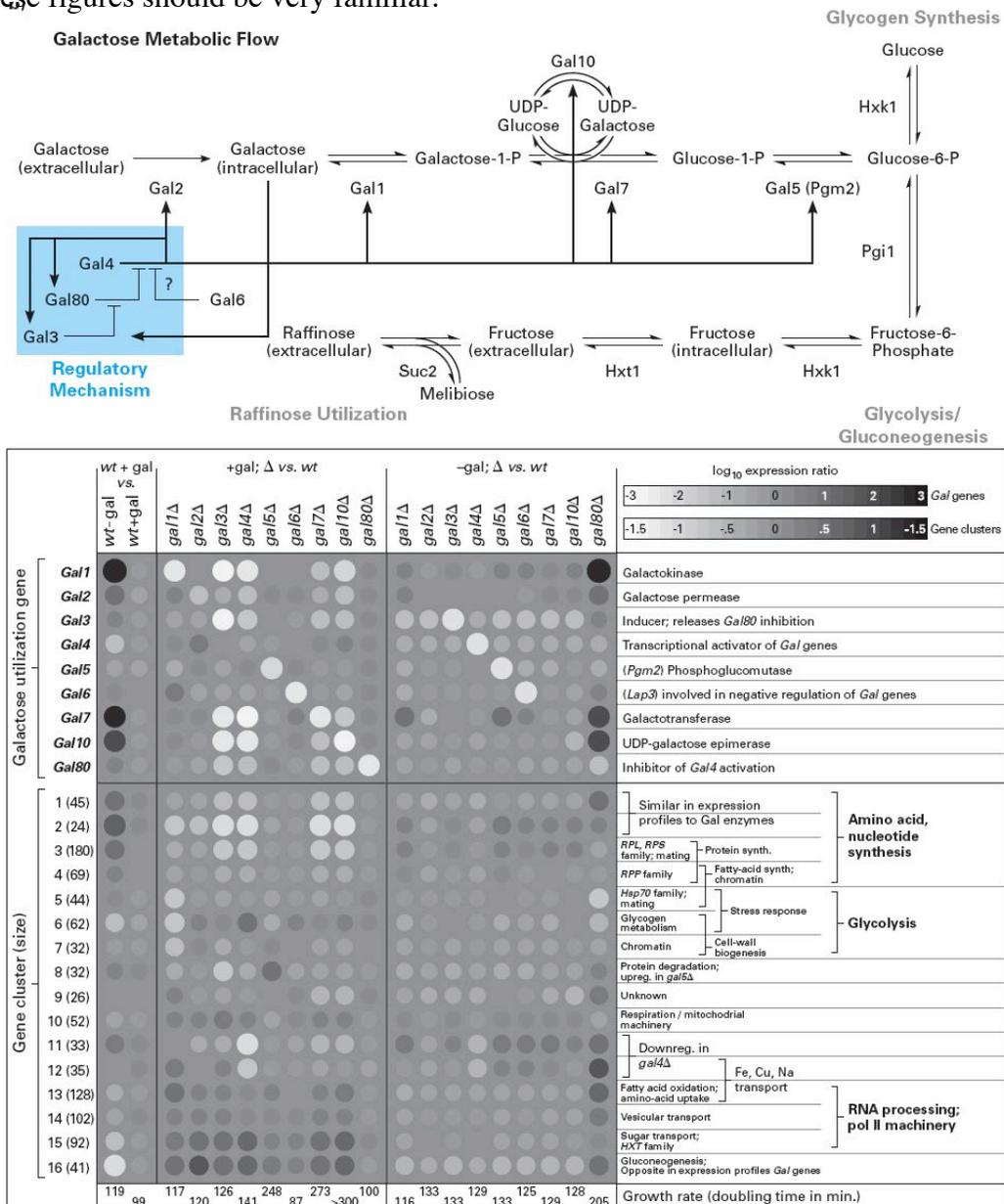
20 Points

4) Open "Exam4.pdf".

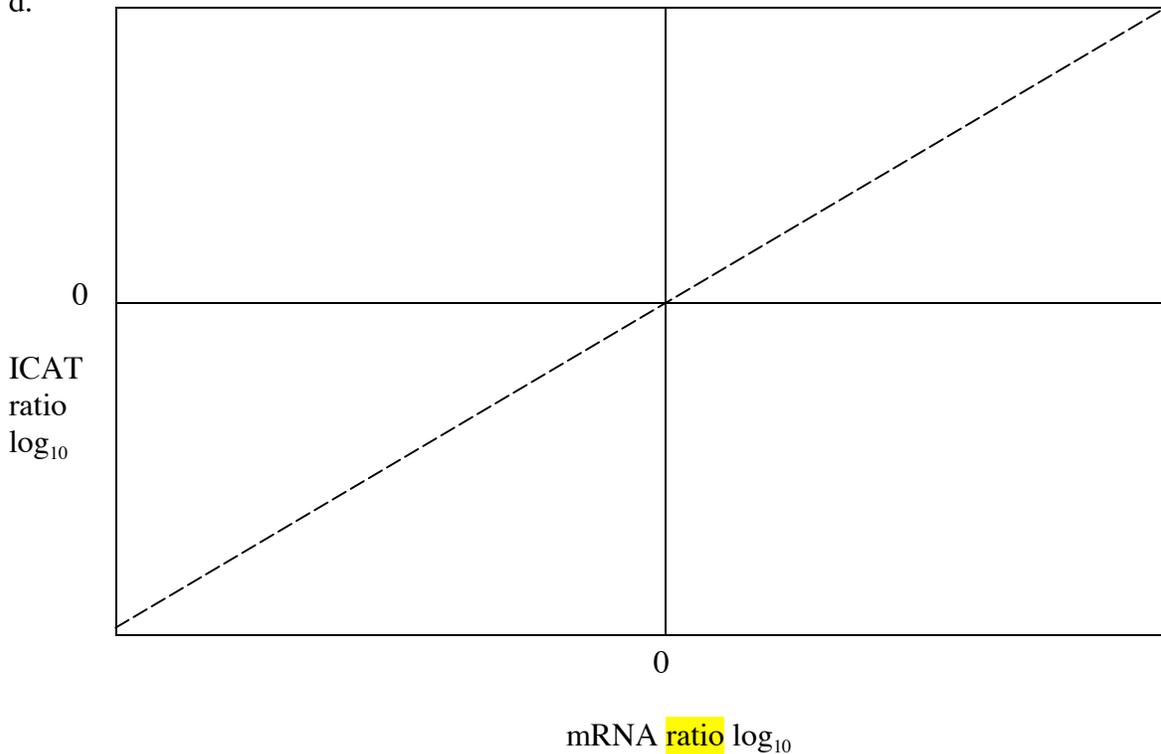
- Summarize briefly in words how a cell can produce different levels of noise for each of the panels A – D.
- Make a generalization about what one process a cell should regulate if it wants to minimize noise. Support your generalization with examples in this figure.
- Give one general rule or common example that we studied in class that would be subject to regulation as shown in panel C.
- What evolutionary implications are inherent in the example you have chosen for question c above?

20 Points

5) These figures should be very familiar.



- Name two emergent properties became evident during this research?
 - Improve the blue regulatory area and redraw it in any format you prefer.
 - Do you think the galactose pathway is a system with high or low intrinsic noise?
Support your claim with data.
- d.



Use the drawing tool in Word to plot where you think *Gal2*, *Gal4*, *Gal3*, *Gal80*, and *Gal5* would be in *wt* cells + gal/ *wt* cells - gal based on the data reproduced in question #5. Be sure to label each gene. If you have trouble doing it in Word, you may do it by hand on your paper copy.

Extra Credit: 3 points

Go to the URL below and take the post-semester survey. You are part of a national effort to measure how well students are learning DNA microarrays. You will be asked for other information as well so we can correlate your scores with those of other students around the country. The URL is:

<<http://www2.davidson.edu/survey/survey.asp?s=01181106106124014>>.