

**Spring 2011 Genomics Exam #3**  
**Proteomics, Synthetic and Systems Biology**

There is no time limit on this test, though I don't want you to spend too much time on it. I have tried to design an exam that will take about the same amount of time as the first one. You are not allowed to read any papers to help with this exam. There are 4 pages, including this cover sheet, for this test. There are no Discovery Questions on this exam. You are not allowed to discuss the test with anyone until all exams are turned in no later than noon on Monday May 9. **ELECTRONIC COPIES OF YOUR EXAM ANSWERS ARE DUE NO LATER THAN NOON ON MONDAY MAY 9.** You may use a calculator, a ruler, your notes, the book, and the internet except you cannot read any papers except those available from the reading schedule for this course. You may take this exam in as many blocks of time as you want. Submit your electronic version by noon (eastern time zone).

The **answers to the questions must be typed in a Word file and emailed to me as an attachment.** Be sure to backup your test answers just in case (I suggest a thumb drive or other removable medium). You will 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. 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.*

*DO NOT READ or DOWNLOAD ANY NEW PAPERS FOR THIS EXAM. RELY ON YOUR EXPERIENCE, AND YOUR SKILLS.*

**-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 type):

Write out the full pledge and sign (electronic signature is ideal):

How long did this exam take you to complete?

**12 points**

- 1) View this structure in FirstGlance (2KEI) and answer these questions.
- What is holding these proteins together? (2 sentence maximum)
  - View the molecule in “all models” and submit a screen shot in this exam.
  - What is happening at the ends of the protein? (2 sentence maximum)
  - In contrast to c, what is happening at the portions of the protein bound to its ligand, compared to the ends? Explain why this difference makes sense. (3 sentence maximum)

**18 points**

2) In addition to this Word file, I have sent you a PDF file. Look at that figure and answer these questions. Do NOT look up any papers or abstracts to answer this question

- a) Above the gray horizontal line is a green box. “Mat” refers to maternal source. Inside that green box are 5 colors of edges. Explain what happens for each colored line in one sentence per color. Do NOT look up any external resources to answer this question – it is self-contained.

Light blue:

Dark blue:

Thin black:

Thin beige:

Rust red:

- b) Look below the gray line. Explain how *Endo16* is induced. For your answer trace *Endo16*'s induction back as far as you can follow it.

- c) Use the circuit to identify the best candidate for what we called “Bmer” in the textbook. In two sentences or less, explain why you selected this protein to be the functional equivalent of “Bmer”.

**18 points**

3)

- a) In the figure to the right, investigators measured yeast mRNA and protein levels for thousands of genes when cells were grown in either SD or YEPD media. Don't bother finding out the difference between the two media. Tell me what is happening for the expression patterns the genes grouped by the four colors (1 sentence for each color).

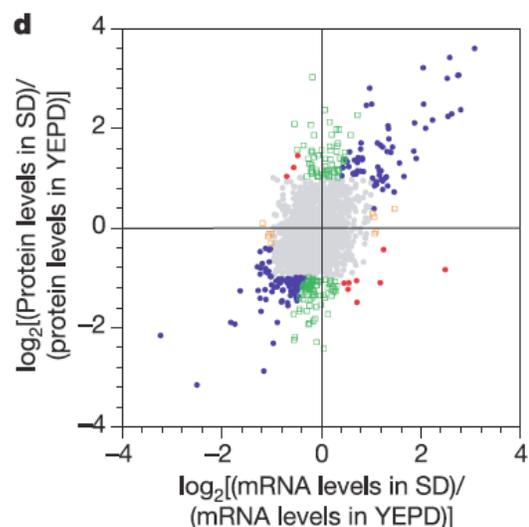
Green:

Red:

Yellow/gold:

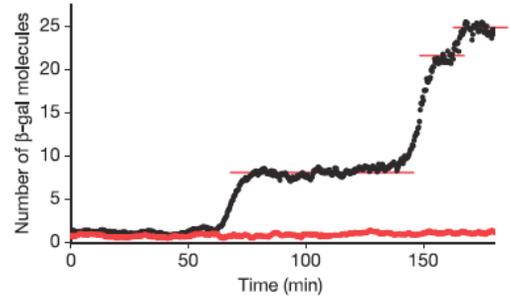
blue:

- b) What is the overall lesson from these data? (2 sentence maximum)



**10 points**

4) In the figure to the right, investigators engineered the  $\beta$ -galactose gene downstream of the pLac promoter. All cells contained LacI. The black line shows the number of  $\beta$ -galactosidase molecules produced over time inside one cell. The red line shows the number of  $\beta$ -galactosidase molecules produced in a different cell during the same experiment.



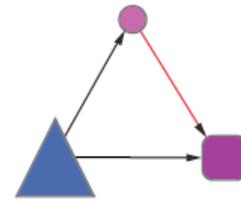
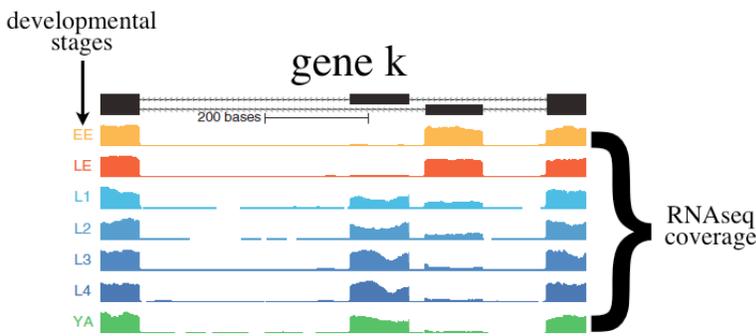
a) Summarize the results you see in this figure. (3 sentences or less)

**11 points**

5) For the figures below, answer these questions:

a) Summarize the *gene k* figure below. (3 sentences or less)

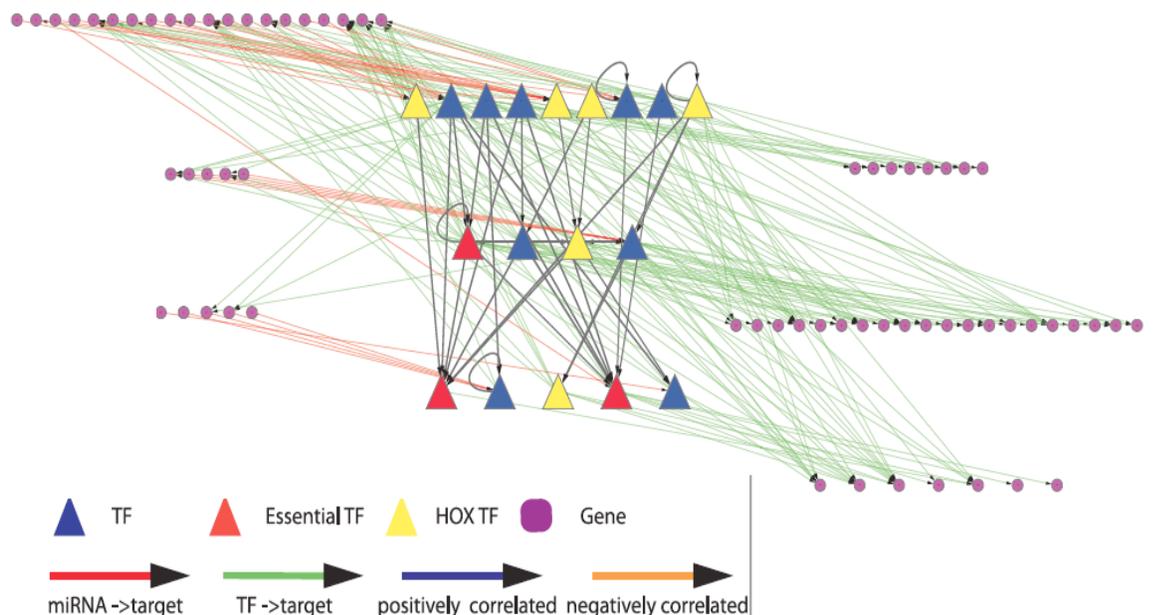
b) Name and describe the circuit motif in the three-point network. (2 sentences or less; the symbols for this figure are the same as in question 6 below)



**16 points**

6) The purple circles in rows are miRNAs. The other symbols are defined within the figure.

a) Explain why the three red triangles are called “essential”



based on the circuit diagram here. (3 sentences or less)

b) Describe 4 general patterns of relationships (you can choose any 4 that strike you) between miRNAs and the transcription factors in this figure. (1 sentence per pattern)

pattern 1:

pattern 2:

pattern 3:

pattern 4:

**15 points**

7)

a) Explain the overall purpose of the figure below. (2 sentences or less)

b) Draw a picture (similar to the other numbered boxes) for point 17 in the figure below. You do NOT have to provide any gene names.

I recommend you do this by hand and scan it into your test. Use colors appropriately.

circles) are numbered 1 through 19. The colored insets show the expression level of each individual gene going through the split and ranked regulators from the physical (black) or functional (blue) regulatory network associated with the higher (H), lower (L), or middle (M) path. The uncolored inset shows

c) Read the highlighted figure legend for the figure and then describe the su(HW) data. We discussed this in class but did not reach clarity at that time. See if you can make sense of the data on your own now. (4 sentences or less)

