Biology I Exam June 2011: Essay Bank

Directions: *Part I- Collaborative Essay of your final exam will consist of two of the following questions from the bank below. You are highly encouraged to prepare thoroughly for each question prior to the exam. Remember you **will not** be able to take in any form of outline or review sheet for this portion of the exam but you will have a ten minute collaboration period before you begin writing to discuss your ideas with your group. The writing period will be 30 minutes for both essays.*

1. Please review the following movies prior to answering the question.

http://www.dnatube.com/video/104/ATP-synthase-structure-and-mechanism
http://www.youtube.com/watch?v=vA0hw29Q26g&feature=related

The protein ATP synthase can be used to power a variety of cellular functions.
   a. What drives the movement and activation of the ATP synthase motor?
   b. List and describe three mechanisms of cellular function that are dependent on the movement of the ATP Synthase motor.
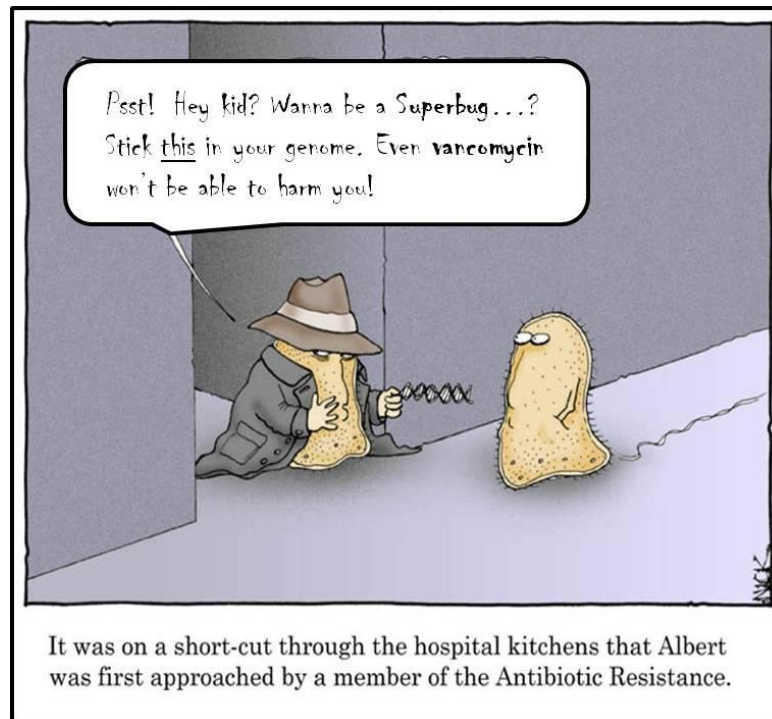
2. Creating concept maps is a very effective method to conceptually and visually organize the relationships between multiple concepts and ideas. Concepts maps connect individual ideas with each other, highlighting their relationships and connections. See the example below:
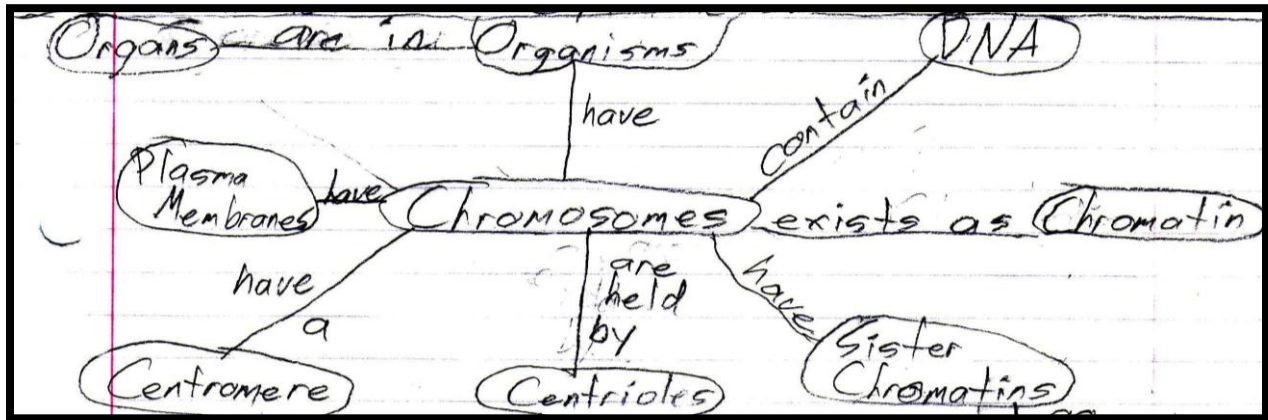
Create a concept map using the following set of key concepts (see below) describing the expression of GFP (Green Fluorescent Protein) in a prokaryotic cell but each key concept must be linked with descriptive phrases. You must include a short phrase with a verb connecting each concept. There can be multiple arrows pointing to each concept, but ALL listed concepts should be tied together into a single map. Pictures are not appropriate answers for this question. The terms below are NOT listed in any particular order and can be arranged in any order for your answer.

**DNA, nucleus, mRNA, tRNA, rRNA, transcription, ribosome,
promoter, codon, translation, RNA Polymerase, terminator, anticodon
start codon, peptide bond, GFP gene, GFP protein, rough ER**

3. Read the following cartoon carefully and reflect on how ideas presented in the cartoon are connected to concepts presented in class. Please utilize the information in the cartoon as you build your answer.

Psst! Hey kid? Wanna be a Superbug...? Stick this in your genome. Even vancomycin won't be able to harm you!

It was on a short-cut through the hospital kitchens that Albert was first approached by a member of the Antibiotic Resistance.

The above cartoon represents several concepts discussed in our Biology I course this semester. A member of the notorious "Antibiotic Resistance" mafia has approached Albert to become a Superbug by encouraging Albert to uptake a novel piece of DNA.
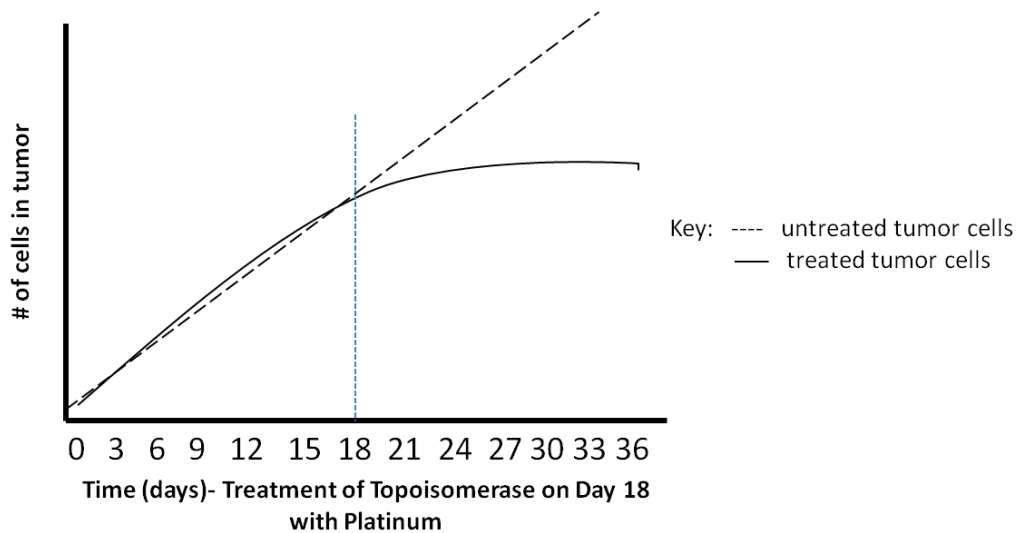
a. What is a superbug?

b. What does the piece of DNA being handed to Albert represent? How would it allow Albert to become a Superbug? Describe the biological concept that would allow Albert to become a Superbug.

c. Albert is later picked up by the "police" and is suspected of being a Superbug. Design a simple experiment to see if Albert has picked up the novel piece of DNA. Explain your design in a systematic format and state the possible outcomes that will help the police determine if Albert is guilty of being a superbug.

4. The following data evaluates the effectiveness of Platinum as an anticancer drug (otherwise known as a chemotherapy agent). Because of its widespread role in the cell, Topoismerase can be a target in cancer therapies. The role of Topoisomerase in normal cell processes is to "snip" one of the strands in the DNA double helix, allowing the strands to unwind and release tension. Topoisomerase will then ligate the backbone it has cut. Cancer drugs can target this process and cause Topoisomerase to become permanently and covalently bonded to both DNA strands.

Cancer cells require the synthesis of many proteins very quickly in order to meet the functional demands of a cell that is growing and dividing out of control.

      a. Evaluating the data presented below, explain the different ways the drug is affecting the cancer cells. Identify and explain the pathways that are affected and decide if the drug has a greater effect on either pathway or does the drug equally targets BOTH pathways.

Graph A:

Key: ---- untreated tumor cells
       —— treated tumor cells

y-axis: # of cells in tumor
x-axis: 0 3 6 9 12 15 18 21 24 27 30 33 36
Time (days)- Treatment of Topoisomerase on Day 18 with Platinum

Graph B:

Key: ---- untreated tumor cells
       —— treated tumor cells

y-axis: Amount of mRNA produced
x-axis: 0 3 6 9 12 15 18 21 24 27 30 33 36
Time (days)- Treatment of Topoisomerase with Platinum on Day 9