

## Spring 2008 Biology 111 Take-Home Exam #1 - Cellular Communications

There is no time limit on the take-home portion of this exam, though I have tried to design one that you should be able to complete within 2 hours. There are 2 pages for this exam, including this cover sheet. You are not allowed to use your notes, old tests, the internet, or any books, nor are you allowed to discuss the test with anyone until the in-class exam is completed at 1:30 pm on Monday February 11. **TYPED EXAM ANSWERS ARE DUE AT 12:30 PM ON MONDAY FEBRUARY 11.** You may use a calculator and/or ruler for both portions of the exam. The **answers to the take-home exam must be typed on separate sheets of paper** unless the question specifically says to write the answer in the space provided. If you do not write your answers in the appropriate location, I may not find them.

**-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): **ANSWER KEY**

Write out the pledge and sign:

**"On my honor I have neither given nor received unauthorized information regarding this work, I have followed and will continue to observe all regulations regarding it, and I am unaware of any violation of the Honor Code by others."**

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

Lab Question:

**7 pts.**

1) Download this file

([www.bio.davidson.edu/people/macampbell/111/oldexams/Spring08\\_111/Lab1\\_Exam.xls](http://www.bio.davidson.edu/people/macampbell/111/oldexams/Spring08_111/Lab1_Exam.xls)), generate graphs for each sample, and tell me:

a) Which sample has the highest activity? Support your answer with data. **3, greatest slope.**

b) Offer two testable hypotheses why all the samples start at different places on the Y axis.

You must include a copy of your graph in your printed test answers to receive credit. Answers without a graph will receive zero points. **File has graph in it now.**

**Samples mixed at different times.**

**Different depths of liquids in wells.**

Lecture Questions:

**8 pts.**

2) *List* 4 general phenomena that describe how cells communicate. Write only one sentence for each general phenomena.

**Second messengers**

**Specificity of binding/enzymes**

**Change of shape, change of function**

**Signal transduction**

**Amplification of signal**

**Deactivation pathway**

**8 pts.**

3) a) Explain why covalent modulation causes a change in protein function. Use an example in your answer.

**Covalent modulation with a phosphate adds a negative charge which pushes around the neighboring R groups and thus changes shape and function of the phosphorylated enzyme. An example is the myosin heads which cycle faster when phosphorylated.**

b) Explain why a covalent modulation does not wiggle free but an allosteric modulator does.

**Covalent bond is strong enough to withstand the kinetic energy of a living system but an allosteric modulator is bound to its target by MUCH weaker bonds and thus can wiggle free due to kinetic energy in the system.**

**8 pts.**

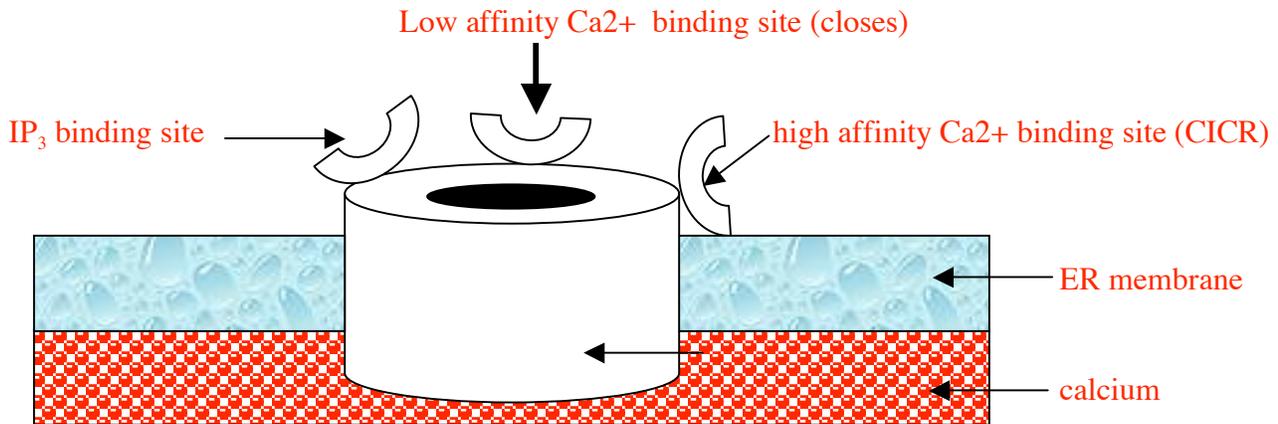
4) List all the roles played by calcium when you make your skeletal muscles move starting with the *thought* of moving your muscle. For each of these roles, tell me from where the calcium comes, and how it returns to its resting location.

**Nerve ending to start exocytosis of neurotransmitter / outside the cell / calcium pumps in PM**

**Cytoplasm of muscle cell for contraction / SR / calcium pumps in ER**

**8 pts.**

5) Draw a stylized picture of the ligand-gated ion channel in the endoplasmic reticulum that is responsible for initiating exocytosis. Be sure to label all its functional parts. Don't worry about "being a good drawer", just draw a figure that conveys the major parts and functions. Write neatly.



**6 pts.**

6) List all the ways that an egg makes sure that only one sperm is able to deliver its pronucleus to the egg's cytoplasm.

1. Depolarization = fast block
2. slow block and exocytosis story

**10 pts.**

7) Hypothesize what would happen if someone took a drug that prevented epinephrine from binding to your  $\beta$ -adrenergic receptors. Describe this medicated person at the macro level (what behaviors would you observe) and also at the molecular level.

Main points: macro = no increased contraction rate or force in heart. regular heart beat at all times. Not able to beat faster when scared so tire easier.

Micro = no binding and no cascade of epi in heart cells

**6 pts.**

8) Design an experiment that would allow you to know where G proteins are located. Which cells and where within the cell? You don't need to describe individual steps, but you do need to provide major steps and appropriate controls.

Key steps:

Need antibody that binds to G protein

Immunofluorescence method

Controls: + = known cells such as liver

- = only secondary antibody or cells known not to have G protein (if any exist)

**8 pts.**

9) Explain the functional consequences of a membrane's structure. To get full credit for this answer, you MUST list a structure (and number it), then explain its functional consequences. Each explanation should be one sentence.

1. Phosphate/head group = hydrophilic and interacts with water
2. Fatty acids = hydrophobic and creates a barrier that establishes compartments and gradients
3. Fluid = proteins and lipids can diffuse in the plane of the membrane
4. Mosaic = proteins with functions