Student-written practice questions: Final

1. Mouse strains A and B are derived from different genetic backgrounds. Strain A mice have a RAG1-deficient phenotype. For the first experiment, the spleens of mice strain A are transplanted into two types of Strain B mice—one is deficient for MHC class I, and the other is deficient for MHC class II.

a) Based on a study that we mentioned when discussing transplantation in class, which strain B mouse do you think will reject the spleens of mice strain A faster, or there is no difference? Explain your reasoning.

For the second experiment, another set of strain B mice (deficient for either class I or class II MHC) is injected with purified MHC class I from strain A mice. Three weeks later, these mice are injected with the same purified protein. One day later, the strain A spleens are transplanted into the two types of strain B mice.

b) Do you expect graft survival results to be different from the first experiment? If so, how? Propose the mechanism of how strain B mice deficient for MHC class I reject the spleens of mice strain A in the second experiment.

2. Johnny's little brother Tommy is born with severe anemia, while Johnny was a healthy baby.

a) Name one disease that involves the immune system that could cause the anemia in Johnny and describe the molecular and cellular interactions that result in anemia.

b) What test could be done to determine if this condition is in fact what is causing the anemia? Describe such an immunological experiment and the results that would support this diagnosis.

c) What steps could have been taken to prevent Tommy's anemia? Describe why these steps might have helped prevent his anemia.

3. You notice that your beloved bunny (H-$2^{k/k}$) has not been looking like itself for the past few days. Some of the illness symptoms that your bunny seems to display are swelling of feet, puffiness of eyes, frequent urination, and passage of blood in the urine. You automatically diagnosed it with kidney disease and decided to perform kidney transplantation since you're an avid immunologist. You know that you've recently extracted a rabbit kidney of the same MHC type, so you went back to your lab to get it. To your dismay, you found another container holding another rabbit kidney next to yours and apparently, your co-worker spilled chemicals on the labels.

a) Why do you have to worry about matching MHCs? What is another substance that is responsible for graft rejection?

b) Your co-worker tells you that one of the containers holds a rabbit kidney with MHC type, H-$2^{b/b}$. Describe a test that you could perform to distinguish the differences between the two kidneys. What would be the expected results?

c) You want your bunny to be able to accept the donor graft; therefore, you administered an immunosuppressant drug. What drug would you give? What are the advantages and disadvantages of it?

4. Your friend is allergic to peanuts. Because you want to help her, you decide to do some research on peanut allergies. After consulting your immunology textbook, you try to explain the allergy to your friend.

a) Explain to her why people do not experience an anaphylactic reaction upon their first exposure to peanuts.

b) What cell types are involved in type I hypersensitivity?

In order to try to alleviate the strains of peanut allergy (first tested in a mouse model), you decide it would be a good idea to delete the genes that encode particular subunits of FCεRI. In one experiment, you delete the gene for the alpha subunit. In a different experiment, you delete the gene for both the beta and gamma subunits.

c) Explain how deletion of these genes could increase resistance to anaphylaxis.

5. An outbreak of a rare bacterial disease is discovered in many individuals who live in the town of Brunswick. The symptoms of the disease are similar to a new influenza virus strain. Having this information, Dudley Coe Health Center, being on the cutting edge of medicine research and wanting to serve its students, decides to create and administer a vaccine for the disease to many students. However, all the students that receive the vaccine have similar symptoms to those individuals in the town of Brunswick.

Having learned many things in Immunology you decide to take the vaccine and administer the vaccine into guinea pigs. Through direct ELISAs and Proliferation tests you observe a full-blown immune response with high amounts of cytotoxic T-cell proliferation and as you predicted the guinea pigs have flu like symptoms.

a) What type of new vaccine do you think was administered? Explain how you think it was created and why the students had symptoms instead of being protected.

b) Propose an alternative strategy to produce a more efficacious vaccine. Describe how this strategy differs from the initial vaccine design, including the specific immune responses elicited by the two types of vaccine.

c) Describe how you would test your vaccine prior to administering it to students.

6. Your uncle had a successful kidney allotransplant 8 years ago, and only recently has he begun to develop serious kidney malfunction problems. The doctors speculated that his kidney is beginning to be rejected by his body's immune system and that his only hope of survival is another kidney transplant.

a) What type of allograft rejection is your uncle currently experiencing?

The doctor's said he has two options for transplant, another allograft or a xenograft. They also explained that both types would likely be rejected.

b) Explain two detrimental problems that might arise with a kidney xenograft.

c) Why would another kidney allograft be detrimental and probably rejected? What type of rejection would occur? Describe two physiological processes involved in the rejection of this new allograft.

d) Is there any way that another allograft would NOT be rejected? What structural similarities must exist between the donor and recipient such that the recipient accepts the kidney allograft? Is it possible for these similarities to exist?

Final project question that will appear on the final

What result did you find interesting or surprising on another group's poster?

a) Describe the question or hypothesis that the experiment addressed, the experimental design and the interesting/surprising result. (1 non-rambling paragraph--i.e. 3-4 sentences)

b) Explain why you found this result interesting or surprising by relating it either to ideas we discussed in class or to ideas from your project (or both). (1 non-rambling paragraph)

Everyone should come up with her/his own interesting/surprising point (I should *NOT* read answers on different exams that look like people worked together to formulate an answer--in which case I may need to give each person partial credit), but you are welcome to talk to folk more about their posters.