Questions on T-Cell Development:

1. A progenitor is committed to T cell lineage at the stage when it
   a. expresses neither CD4 nor CD8.
   b. expresses CD3.
   c. expresses either CD4 or CD8.
   d. expresses both CD4 and CD8.
   e. is undergoing somatic recombination of the alpha chain.

2. __ are essential for positive selection of thymocytes.
   a. Thymic dendritic cells.
   b. Cortical thymic epithelial cells.
   c. Thymic macrophages.
   d. Double-negative cells.
   e. Epithelial cells

3. T cell development in nude mice can be rescued by transplanting bone marrow stem cells isolated from:
   a. the SCID mice.
   b. the wildtype mice.
   c. the nude mice.
   d. all of the above.
   e. none of the above.

6. Which of the following is NOT associated with negative selection?
   a. Apoptosis of thymocytes.
   b. Bone-marrow derived APC.
   c. Recognition of foreign antigen.
   d. Recognition of self antigen.
   e. Thymic epithelial cells.

8. Double positive T cells express
   a. both gamma chain and delta chain TCR.
   b. both CD3 and CD4.
   c. both CD3 and CD8.
   d. both CD4 and CD8.
   e. TCR of more than one antigen specificity.

9. T cells from an MHC a x b F1 mouse will
   a. recognize antigen presented ONLY on MHCa.
   b. recognize antigen presented ONLY on MHCb.
   c. recognize antigen on either MHCa or MHCb.
   d. fail to recognize antigen on either MHCa or MHCb.
   e. ONLY recognize antigen on MHCa x MHCb (F1 antigen presenting cells).

12. Which of the following claims in negative selection is true:
   a. Negative selection only occurs in the medullary region of the thymus.
   b. Aire regulates the thymic expression of all the tissue restricted antigens.
   c. Negative selection of autoreactive T-cells is solely mediated by medullary thymic epithelial cells (mTECs).
   d. Aire and Fezf2 mediate the expression of different subsets of tissue restricted antigens in the thymus.
   e. Insulin produced in the thymus can regulate blood glucose.

13. Most of the developing thymic cells in the thymus
   a. become self MHC-restricted alpha beta TCR cells.
   b. become self MHC-restricted gamma delta TCR cells.
   c. become monoclonal T cell tumors at various stages of development.
   d. die because they bind self peptide.
   e. die because they cannot make a TCR that can bind to self-MHC.

14. Regarding the mechanisms of negative selection, which of the following claim is true:
   a. Self-antigens are presented by medullary thymic epithelial cells (mTECs).
   b. Self-antigens are presented by thymic dendritic cells (DCs) in the medulla.
   c. Self-antigens are presented by thymic dendritic cells in the cortical region of the thymus.
   d. Self-antigens can be passed from the mTECs to the DCs in the medulla.
   e. All of the above.
   f. None of the above.

18. The following cytokine are important for the differentiation of Th2 cell (select all that are correct):
   a. IL-12
   b. IL-17
   c. TGFb
   d. IL-6
   e. IL-4
   f. IFNg
Short Answer Questions:
1. Three signals are required to induce the activation and differentiation of naïve T-cells into effector T cells. What are these signals?

2. Mice lacking CTLA-4 die at an age of 2–3 weeks due to massive lymphoproliferation, leading to lymphocytic infiltration and destruction of major organs. Why does this occur and how could it be corrected.

3. Briefly describe one mechanism by which T regulatory cells suppress the activation of effector cells.

Questions on Vaccines:
1. What are the benefits/risks between live attenuated pathogens and polysaccharide formulation prepared from the same pathogen as vaccine candidates? Think of the type of immune activation that each elicits, the longevity, the health risk overall, as well as the costs to manufacture.

2. If an alien race comes to our planet, and allows themselves to be examined, as an immunologist interested in how to protect them from human pathogenic micro-organisms, and assuming that they have cells resembling our white blood cells, what would be the first thing that you would want to look for in their blood? Think of the sort of molecules normally neutralizing pathogen-cell interactions. How would you test this in the lab?

3. If you are in the middle of the desert and bitten by a snake whose venom is poisonous to humans, what type of treatment would you most likely receive? How does this treatment work? How would it be manufactured if the manufacturer suddenly was not in business and you had to prepare the treatment yourself (assuming you were close to a farm with all possible livestock)?

4. In females that have just given birth, and that are vaccinated against the most common pathogens that have been the main infectious disease killers, their milk contains molecules that are prophylactic for the baby. Is this protection to the baby permanent? Describe and discuss.

Questions on Transplantation:
1. In the Transplant Unit an organ donor is available. A recipient among potential candidates needs to be selected. What kinds of laboratory tests are useful to determine the best donor-recipient match?

2. Transplants can be performed between different individuals in the same species or, experimentally, between different species. What kind of rejection may occur in the two settings, following transplantation?

3. A patient with an ongoing hemorrhage needs an immediate blood transfusion. There is no time to blood type this patient. What donor blood type is safe to transfuse and why? What are the consequences of an incompatible blood transfusion?

4. Briefly describe the two mechanisms by which recipient T_{H} cells become sensitized to the transplanted tissue.