BIO 401. IMMUNOBIOLOGY. FALL 2012.
REVIEW SHEET FOR SECOND (This is only a study aid to help you prepare for the exam!!!)

CHAPTER 8. MHC complex:

1. Know what a haplotype is in term of the MHC complex. Be familiar with MHC molecules in both the mouse and human.
2. Why are the MHC proteins referred to as "histocompatibility" proteins?
3. Why are the two MHC genes (alleles) that you inherited very important to you?
4. What is meant by the statement that the MHC genes are highly polymorphic. How can you explain this phenomenon?
5. What functions are represented by the three types of MHC genes?
6. What is meant by the term, "congenic mouse", syngenic mouse?
7. What is the structure of the type I and type II MHC complexes? What is the role of the β2-microglobulin in these structures?
8. In MHC type I and II MHC complexes. Is the antigens bound the same for both? What are the differences in the way that these two structures bind antigen? (Table 8.2).
9. Be familiar with the distribution of MHC molecules in the F1 progeny when you cross mice with different haplotypes (MHC).
10. Considering all of the polymorphisms of the MHC I structure that have been studied, what is the significance of the differences in structure between one polymorphism and another?
11. Be able to present an argument as to the relative advantages of both the up regulation of MHC complexes as a result of viral infection as well as the down regulation as a result of infection with other viruses.
11. What is the selective advantage of the up regulation of MHC I complexes by cytokines such as IFN-γ as well as IFN-α and IFN-β and by tumor necrosis factor-α?
12. Be able to make a general hypothesis relative to the polymorphisms of MHC complexes present and the relative susceptibility (risk) of the population to some diseases.

MHC Class I and MHC Class II Antigen Processing and Presentation

1. Know what the term "restriction" means as it applies to MHC molecules. Be familiar with the experimental evidence (Fig 8.15) that led to this finding.
2. What is the role of antigen presenting cells? Know the experiment that demonstrated the need for antigen processing by APC for activation of T cells (Fig. 8.3).
3. Know the difference between a professional APC and a non-professional APC. Why are DC better APC than macrophages? (see Table 8.3).
4. You must know the pathway for endogenous (cytosolic) antigen processing and presentation by MHC-I. Be able to draw and describe the role(s) played by the different chaperones/molecules. It is easier if you use different section/compartments to illustrate this pathway: from the initial antigen until it is displayed on the surface.
5. You must know the pathway for exogenous (endocytic) antigen processing and presentation by MHC II. Be able to draw and describe the role(s) played by the different molecules.
6. Understand the alternative presentation of non-peptide antigens by CD1 molecules. Why presentation by CD1 molecules is important?

Chapter 9. T cell receptor gene organization

1. Compare the structure and function of TCRs versus antibody molecules.
2. How is each chain in the TCR similar to those of an antibody molecule? What are the regions interacting with the antigenic peptide?
4. Be familiar with the major differences between alpha/beta and gamma/delta T cells (Table 9.1).
5. How are TCRs genes organized? What is it about alpha and delta T cells that is interesting? What are some features unique to this T cell population?

6. Why are TCRs genes MHC restricted?
7. What are the differences in the function of the CDR regions of the TCRs versus antibodies? What CDRs are more important for diversity?
8. When one examines the potential diversity of the TCRs produced by rearrangement of TCR genes, it is not as impressive as is the case for antibody genes. However, the total diversity is actually much larger than that of antibody genes. Why is this so?
9. What is the T cell receptor complex? What is the function of the CD3 accessory proteins that are associated with a T-cell receptor complex? What is the function of the CD4 and CD8 co-receptors? What is the general function of the other accessory proteins? (CD2, LFA-1, CD28, CD45R)
10. What are ITAMs? What is the role of CTLA-4? (see Chapter 10)

Chapter 10. T cell Maturation, Activation and Differentiation.

1. Be able to describe the sequence of events that leads to the maturation of T-cell in the thymus. I am interested in the main differences for each stage, what are unique markers for each stage…...if you want to tell me where these events take place within in the thymus is a plus. What is the role of the pre TCR (Pre-T alpha chain) in this process? How this developmental check point ensures that T cells end up with a correct TCR?
2. In the thymus, mature T- cells are put through a dual process of positive and negative selection. Why is this process critically important to the overall function of the immune system?
3. What is the process and outcomes of negative selection and positive selection that occur in the thymus? Be familiar and pick one model in the SP outcome, instructive vs stochastic model.
4. You must know the process of maturation within the thymus: from Pro-T cell to single positive/negative CD4/CD8 (see question 1).
5. What is T cell activation? What are the signaling pathways? (those covered in class) You must know the molecules involved in these pathways.
6. You have to be familiar with the pathways that lead to the production of the following transcription factors: NF-kB and NF-AT, and AP-1. It is easy if you divide it into two sections: initial interaction to formation of central kinase, and from central kinase to translocation to the nucleus of transcription factors.
7. What are positive and negative co-stimulatory signals for T cell activation?
8. What are the co-stimulatory signals? Why we said that CD28 is a positive regulator and CTLA-4 a negative regulator of T helper activation? What is anergy?
9. What are superantigens? How are they able to activate T cells? Be able to provide at least one example of either endogenous or exogenous superantigen.
10. What are suppressive T cells (Ts) or T regulatory as they are known? Unique markers?
11. What is the role of apoptosis in T cell populations? How can apoptosis be triggered?

Chapter 11. B-cell generation, activation and differentiation

1. Be able to describe the sequence of events that leads to the maturation of B-cells in the bone marrow. What are the different events that characterize each developmental stage? (See Figure 11.3). Remember, we will only focus on unique surface markers or features that appear at each stage of development.
2. What is the role of bone marrow stromal cells in the maturation and differentiation of B cells?
3. What is the Pre-B cell receptor? What is its role? What is its homolog in T cells?
4. What is the process of negative selection in B cell development?
5. What is the difference between B-1 and B-2 B cells? (Figure 11.5)
6. What are thymus-dependent (TD) and thymus-independent (TI) antigens? How TI type 1 are different from TI type 2? (Table 11.2)

7. What is B cell activation? What are the signaling pathways? (Those covered in class) What are the molecules involved in these pathways to generate: NF-kB, NF-AT nuclear transcription factors? Make sure to remember the central kinase as well as the adaptor proteins.
8. What is the B cell-co-receptor complex? What is its function? What is the relevance of having a combination of specific (antibody) and non-specific (C3d, iC3b) immunities to the overall immune response?
9. How can B cells and T cells (Th) collaborate during activation by a thymus-dependent antigen? (Figure 11.12). Step by step.
10. Compare primary vs secondary responses. What are the main differences? (Table 11.4)
11. What cytokines are involved in antibody class switching? Why class switching is important? What does somatic hypermutation accomplish? (Figure 11-22)
12. Make sure that you know at least two differences between naïve and memory B cells (Table 11.6).