Lecture 2/3 Summary Sheet - Study Guide:

Clusters of differentiation (CD) are used to identify immune cells. They are often important functional molecules. Signficant ones are:

CD19 = B cells
CD3, CD4, CD8 = T cells
CD56 = NK cells

CD4 and CD8 distinguish two subsets of T cells with distinct functions. CD4+ T cells examine MHCII for extracellular-derived peptides, while CD8+ T cells look at MHCI for intracellular-derived peptides.

Unlike innate cells, who have conserved and germline-encoded receptors, T cells have somatically rearranged receptors that are unique to each T cell. This rearrangement will result in the capacity to recognize any antigen, including self-antigens. T cells that either fail to recognize MHC or recognize self peptides in MHC are removed in the thymus. This protects against autoimmunity, or immune responses directed against self.

In is important that you understand the different roles for CD8 and CD4 T cells in immune responses.

B cells are adaptive cells that use somatically rearranged receptors to recognize extracellular antigens in an MHC-independent fashion. Autoreactive B cells are removed in the bone marrow. Surface expressed forms of antibodies or immunoglobulins (Ig) are secreted by activated B cells (plasma cells), often into the circulation, where they can aid innate cell functions. Repeated antigen exposure and cytokines cause different isotypes, or antibodies with different constant regions of the heavy chain are placed behind the same variable region. This changes the function of the antibodies. For example an anti-flu vaccine will initiate a B cell response via activation of IgD on the surface of a B cell. This activated B cell will shift too secretion of IgM and if the cells is exposed to various cytokines, will begin to secrete IgG, IgE, IgA. All these antibodies will have the same specificity, but function differently. As examples: IgG will circulate and could direct NK cells to infected cells. IgM could clump viral particles or activate complement against infected cells. IgA could protect at the mucous membranes. IgG could provide be passed from mother to fetus and provide protection to a new born.

The process of somatic recombination to generate the TCR and BCR is complex, but know the role that RAG and TdT enzymes play in this process.

Appreciate the steps of how a double negative T cells, becomes a double positive T cells, then CD4 or CD8+ T cells in the thymus. Be able to describe how this process limits the chance for autoimmunity.

Be able to describe the 3 signals needed to activate T cells, where they come from, and what happens to T cells when they have limited exposure to each.

Know how IL-1, -2, -4, -5, -6, -10, -12, -13, -15, IFNγ, TNF, TGF-β contribute to innate and adaptive immune responses.

B cell effector functions involve the activities of secreted antibodies. Understand how this adaptive immune effector activity typically requires the assistance of innate immune cells. For example: IgM mediated agglutination supports macrophage phagocytic removal of bacteria. Fc receptor mediated activities use the specificity of Ab to direct the activities of various innate cells, such as IgE against parasitic worms directing the secretion of granules by basophils or eosinophils.

T cells that recognize self antigens can escape the thymus or situations may arise where anti-pathogen responses generate T cells and B cells that have cross reactivity with self material. What are some ways that the immune system limits its period of reactivity or imposes regulation on itself?