

20.106J – Systems Microbiology

Lecture 19

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- Adaptive Immunity, Immunization, and Immune Disorders
 - One of the big things we'll be talking about interactions between dendritic cells and T-cells/lymphocytes

- Immune response
 - Innate immunity – interaction with pathogens
 - Dendritic cells are monophages
 - They create a more specific immune response
 - This is adaptive immunity
 - There are two arms
 - Antigens
 - Molecules that are recognized by antibodies or T-cell receptors
 - TCRs
 - Antigenic determinant or epitope
 - Immunoglobulin Superfamily
 - Class I MHC
 - Class II MHC
 - T-cell receptor
 - Immunoglobulin
 - Major Histocompatibility Complex
 - Human leukocyte antigen complex
 - MHC Proteins
 - Class I proteins are expressed on all nucleated cells
 - Class I proteins are recognized by T cells
 - Class II proteins are expressed only on antigen-presenting cells
 - MHC-antigen Processing and Presentation
 - TCR Genes and Diversity
 - TCRs bind much more specifically
 - Alpha chain genes and beta chain genes
 - T cell Selection and Tolerance
 - T cell Anergy
 - T cell Activation
 - Cytotoxic T cells (T_c)
 - T_H1 T cells (helper cells)
 - T_H2 T cells
 - Also helper cells
 - Typically interact with antigens presented via MHC-II on B cells
 - Antibodies are just used to mark the antigens
 - They can thus encumber the infected cell so it can't do anything
 - Other can also cells recognize the antibodies and phagocytose the infected cell
 - Classes of antibodies

- IgM-mu heavy chain
 - IgD-delta heavy chain (the actual function is not well understood)
 - IgG-gamma heavy chain
 - IgE-epsilon heavy chain (mainly associated with allergies)
 - IgA/sIgA-alpha heavy chain (a monomer in the blood, but transported as a dimer)
 - Antibody diversity
 - Antibody production and B cell clonal selection
 - Roles of antibodies during infection
 - Opsonization
 - Neutralization
 - Activate complement cascade – read this section in the textbook
 - Prevent breach of epithelial barrier
- Categories of immunity
 - Natural active immunity
 - Passive immunity (in infants)
 - Artificial active immunity (from immunizations)
 - Artificial passive immunity (being given antibodies from another person)
- Immunization
 - History of different vaccines
 - Goal
 - Types of immunizing agents
 - Live, attenuated vaccines are better
 - Attenuated/related organisms
 - Related organisms involves infecting you with an organism similar enough that you won't get sick but you'll develop the same immune response
 - Using cowpox to vaccinate for smallpox is an example
 - Cold-adapted influenza virus – it's genetically modified so it can't reproduce at body temperature, and thus it can replicate in your nose where you develop immunity to it, but it can't invade your lungs
 - Viral and bacterial vectors
 - Subunit vaccines
 - Conjugate vaccines
 - Nucleic acid (DNA) Vaccines
 - Edible vaccines (transgenic plants)
 - Mucosal vaccines
- Immune-related Disorders
 - Hypersensitivity
 - Types I, II, III, and IV
 - Allergies, asthma are varieties of Type III

- Poison ivy and the raised rash from a TB test are varieties of Type IV
- Autoimmunity
 - Autoantibodies
 - Type I diabetes, Multiple Sclerosis