I. Immunology

1. GOALS:

Objectives - at the end of laboratory #7 you should be able to:

1.) state the major functions of immune system
2.) list the functions of each part of the immune system - thymus, white blood cells, antibodies, epidermis, cilia, mucus, and saliva.
3.) describe the interaction between antibodies and antigens
4.) compare and contrast the innate (nonspecific) responses with adaptive (specific) immunity responses of the human body
5.) compare and contrast humoral immunity (initiated by B cells) with cell-mediated immunity (initiated by T cells) within the adaptive (specific) immune response
6.) describe the actions of helper T cells and cytotoxic T cells
7.) explain how bodies develop immunity against disease
8.) briefly define HIV (an RNA virus), AIDS, and how HIV is transmitted
9.) know the function of AZT and "protease inhibitors" in fighting AIDS

Key terms - you should be able to define:

- pathogen
- nonspecific defenses
- macrophages
- phagocytosis vs. cell lysis
- complement proteins
- inflammatory response
- histamine
- lymphocytes
- antigen vs. antigen presenting cells
- antibody
- antigen receptors
- lymphatic system
- immunity
- humoral immunity
- cell-mediated immunity
- memory cells
- effector cells
- cytotoxic T cells
- helper T cells
- B cells
- self/ non-self recognition complex
- vaccination

I. Immunology - Introduction to Major Concepts

1. Immunology Manual Handout:

1.) Read: pp. 1-7, 9, 10-11, 12, and 13 (section numbers correspond to number of question)

2. Immunology Worksheet:

1.) Answer: questions 1 - 4, 7, 9, 11, and 13 (one half point each)
2.) Read review pages and hand in the worksheet, at the end of class


II. HIV/ AIDS - Epidemic and Impacts

1. Immunology Manual Handout:

1.) Read: pp. 17-21, and 23-24 (section numbers correspond to number of question)

2. HIV/AIDS Worksheet:

1.) Answer: questions 1,2, 5, and 6 (one half point each)
2.) Read review pages and hand in the worksheet, at the end of class

3. Review: Read pp. 27-30
ANSWER assigned questions only and HAND IN at the end of this lab, please.

NAME (PRINT, clearly): ______________________________________________________

Day of your lab: ____________________ Time of your lab: ______________________

Using the information provided in the handout, please, answer the following questions (one half point each):

1. A pathogen is a type of antigen?

   Check one: _____ A. True _____ B. False

2. Expectant parents now have the option to save their baby's "cord blood" (blood from the umbilical cord) immediately following birth. This cord blood can be transplanted into individuals whose blood has been damaged by diseases such as leukemia, Hodgkin's lymphoma, and sickle cell anemia. Saved cord blood is a perfect match for the baby it came from, and can also be useful in treating relatives of the baby. What cells should be harvested from the cord blood to best treat patients with blood diseases?

   Check one:
   _____ A. Erythrocytes (red blood cells)
   _____ B. Leukocytes (granulocytes, monocytes, and lymphocytes)
   _____ C. Stem cells

3. Immediately following a break in the skin, phagocytes engulf bacteria within the wound. This is an example of an ________ immune response which is ________ against a pathogen.

   Check one:
   _____ A. adaptive, specific _____ B. innate, specific
   _____ C. innate, nonspecific _____ D. adaptive, nonspecific

4. ________ are responsible for the production of antibody against free pathogens and soluble products from pathogens while ________ destroy pathogens, virally infected cells, and abnormal cells.

   Check one:
   _____ A. Cytotoxic T cells, B cells _____ B. Macrophages, T cells
   _____ C. B cells, helper T cells _____ D. B cells, cytotoxic T cells

5. The ability to produce billions of different antibodies in humans results from:

   Check one:
   _____ A. The presence of billions of complete antibody genes in B cells.
   _____ B. The fact that both T cells and B cells contain antibody genes.
   _____ C. The production of variable regions of light and heavy antibody genes by DNA rearrangement.
D. The fact that a single antibody gene produces an antibody capable of billions of different three-dimensional structures and the ability to combine with any antigen.

6. If a B cell clone began to produce antibody with altered binding strength and specificity for antigen, you would expect the mutation of the antibody gene to involve:

   Check one:
   _____ A. The variable region of the heavy chain or the constant region of the light chain
   _____ B. The variable region of the light chain or the constant region of the heavy chain
   _____ C. The variable regions of the light or heavy chains
   _____ D. The constant regions of the light or heavy chains

7. Allergies result from the production of ________ directed against an antigen.

   Check one:
   _____ A. IgG        _____ B. IgA        _____ C. IgM        _____ D. IgE

8. Epstein Barr virus (EBV) infects endothelial cells and B cells. About half of us are infected by the virus while very young, and do not suffer disease. Around half of individuals who avoid the virus while young are infected in the teenage years and develop a disease called mononucleosis. In this disease, lymph nodes swell painfully as our immune system produces large numbers of lymphocytes to eliminate virus-producing cells. These lymphocytes are probably:

   Check one:
   _____ A. B cells which produce antibody eliminating virus-infected cells
   _____ B. Cytotoxic T cells to destroy virus-containing cells
   _____ C. Helper T cells which stimulate B cell clonal selection
   _____ D. Granulocytes which invade areas of virus production

9. The clonal selection theory of antibody diversity says:

   Check one:
   _____ A. B cell precursors randomly rearrange variable coding parts of antibody genes. Afterwards, antigen binds to a clone with specific membrane antibody, resulting in differentiation to antibody secreting plasma cells
   _____ B. The antigen causes a nonspecific clone of B lymphocytes to proliferate and secrete antibody molecules capable of binding to any foreign antigen
   _____ C. Antigen causes the growth of a clone of lymphocytes which then rearrange DNA, creating a gene coding for a specific antibody
   _____ D. A clone of macrophages with specific receptor for antigen phagocytoses antigen, then rearranges DNA to generate specific antibody-coding genes

10. The significance of the major histocompatibility complex (MHC) in the immune response:

    Check one:
    _____ A. Serves to minimize autoimmunity or "self-reactivity" of the immune system
    _____ B. Serves to present fragments of antigens to T-cells.
11. The lack of an immune response to self is called:

   Check one:  _____  A. Autoimmunity  _____ B. Tolerance

12. Human HLA genes (equivalent to MHC genes in mice) have many alleles, and no two individuals have identical alleles at all gene loci. Which of the following are consequences of this genetic diversity?

   Check one:
   _____ A. Maximizes the kinds of pathogens that can be recognized and eliminated by an immune response within a population
   _____ B. Transplanted organs can be rejected
   _____ C. Females mice prefer to mate with males having different alleles at MHC gene loci
   _____ D. All of the above.

13. Monoclonal antibodies come from clones of B cells that produce a single antibody of known specificity. B cells will nor normally divide in the absence of antibody. The special trick that allowed monoclonal antibody-producing cells to be grown in culture was:

   Check one:
   _____ A. Mice were immunized with antigen and T cells removed and grown in culture to produce antibody
   _____ B. Mice were injected with antigen and B cells were fused with cancer cells, producing a hybrid cell line that can grow in culture yet still produce antibody against the antigen
   _____ C. Antibodies were produced by isolating mRNA from immunized mice and translating the message for antibody in the laboratory
   _____ D. Macrophages were isolated from immunized mice that would stimulate naive B cells to continue to divide in culture, allowing the production of monoclonal antibodies
Using the information provided in the handout, please, answer the following questions (one half point each):

1. Which HIV+ patient is most likely to have AIDS? (Circle one answer)
   - A. A person who engaged in high-risk sexual behavior three months ago
   - B. A person who engaged in high-risk sexual behavior ten years ago
   - C. A recently infected person whose drug therapies include reverse transcription inhibitors and protease inhibitors
   - D. A person who has an almost normal number of helper T cells detected in her blood sample

2. Which activity has a high risk of HIV transmission? (Circle one answer)
   - A. Living with someone who is HIV+
   - B. Receiving a blood transfusion today, with blood that has been screened for HIV
   - C. Sexual intercourse without a condom
   - D. Working as a paramedic

3. Which immune response is specific against one antigen? (Circle one answer)
   - A. Skin blocks entry of antigen into body
   - B. Phagocytic cell engulfs antigen
   - C. Antibody binds antigen and prevents it from infecting cells
   - D. Cilia sweep antigens away from lungs

4. What type of specialized white blood cell interacts with other cells, regulating the production of antibodies and destruction of infected cells? (Circle one answer)
   - A. B cells
   - B. Helper T cells
   - C. Cytotoxic T cells
   - D. Phagocytes

5. AZT, a reverse transcription inhibitor, stops HIV reproduction at what stage? (Circle one answer)
   - A. Producing viral DNA from RNA
   - B. Translating RNA into protein
   - C. Producing viral and host DNA from RNA
   - D. Integrating viral DNA into host DNA

6. Protease inhibitors prevent: (Circle one answer)
   - A. HIV attachment to helper T cells
   - B. Reverse transcription of viral RNA
   - C. Integration of viral DNA into host DNA
   - D. Cutting of a large protein (polypeptide) into multiple smaller proteins essential for viral reproduction