BIO 111 - Laboratory #7: Immunology

- **Assigned pages**: "Biology Project Immunology" Handout (in numbered manila folder)
  - ✓Please, RETURN THE FOLDER, at the end of class, when you are finished
  - ✓Additional information is available in your lecture text (C. Starr and R. Taggert. 2008. Biology - The Unity and Diversity of Life, SUNY Cortland edition, 11th edition. Mason, OH: Thompson Custom Solutions) on pages 678-699.
  - ✓ **Website used as a source for this lab**: Introduction to Immunology - Great site with live video clips: **http://www.biology.arizona.edu/immunology/tutorials/immunology/main.html**
  - ✓ **HAND IN BOTH worksheets - Answer the assigned, 12 multiple choice questions (max., 6 points)**

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
3. **Review** : **Read** pp. 25 - 26.

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

BIO 111 - Laboratory #7: Immunology Introduction -WORKSHEET -

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.

_____ **C.** Used by helper T-cells to regulate the expansion of antibody producing B-cells.

_____ **D.** All of the above.

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

BIO 111 - Laboratory #7: HIV/ AIDS -WORKSHEET -

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. 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