

## The Immune System

### **A. Features of the Immune System**

1. Specificity (antibody-antigen)
2. Diversity (variety of lymphocyte populations - each for different antigen)
3. Memory (acquired immunity)
4. Self/Non-self Recognition (otherwise: autoimmune disease)

### **B. Challenge & Response, Clonal Selection, Memory Cells - HUMORAL RESPONSE (in blood or fluid)**

1. Macrophages (a phagocyte)
  - a. the first to encounter an invader (not specific)
  - b. will engulf the pathogen
  - c. becomes antigen presenting cell (displays part outside its cell membrane)
  - d. goes to lymph node
  - e. stimulates helper-T: matches up with helper T-cell that has complementary antigen-receptor
2. T-cells
  - a. because of this exposure, helper T-cells will divide, forming a clone
  - b. the clone of T<sub>H</sub> cells will activate B-cells (that have surface receptors complementary to the antigen)
3. B-cells
  - a. activated B-cells will form clone
  - b. They will differentiate into plasma cells and memory cells.
4. Plasma & Memory cells
  - a. Plasma cells now make lots of antibodies (2,000 Ab/sec. for 4-5 days)
  - b. This primary response takes 5 - 10 days until maximum protection
  - c. Memory cells are long-lived, but are inactive.
  - d. When activated, secondary response takes 3 - 5 days, and more effective

### **C. Challenge & Response, Clonal Selection, Memory Cells - CELL-MEDIATED RESPONSE**

1. Helper-T secretes substance to stimulate Cytotoxic T-cells
2. These will differentiate into active T<sub>C</sub> cells and Memory cells.
3. Active Cytotoxic T-cells now will kill large pathogens and cells invaded by viruses, as well as cancer cells.
4. Invaded cells display certain proteins on their surface so can be identified by T<sub>C</sub>
5. LATER, (on 2nd exposure) the memory cells can be activated by helper T-cells

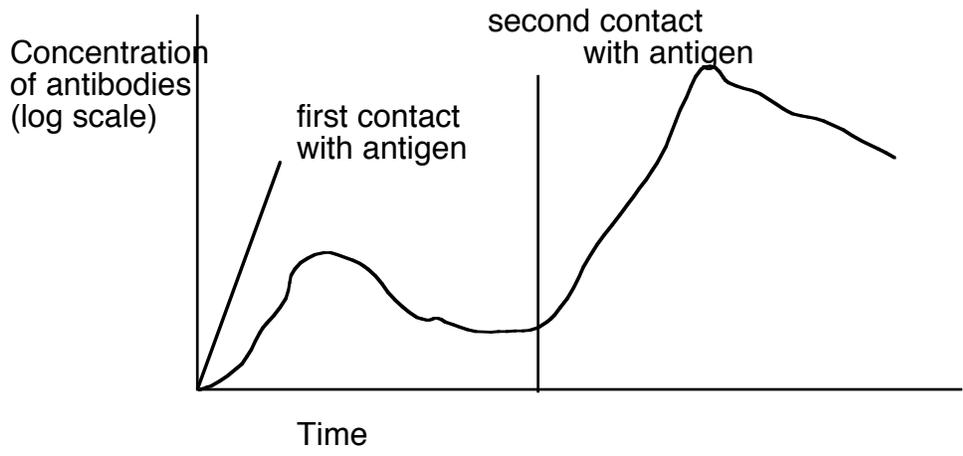
### **D. Definitions**

1. clonal selection: the macrophage (antigen presenting cell) selecting which T-cells and B-cells have the required surface receptors.
2. clonal expansion: the T-cells and B-cells forming clones by mitosis to produce the large number of cells required to deal with infection.

### **E. Antibody production**

1. **MHC** (major histocompatibility complex) proteins are membrane proteins found on macrophages. T-cells only respond to antigens IF associated with MHC proteins.
2. Then the antigen is presented to helper T, the helper T will excrete a substance which activates nearby B-cells
3. B-cells divide, form a clone and differentiate into plasma cells and memory cells.
4. Antibodies work by neutralization, agglutination, precipitation, etc.

**F.**



**G.**

<u>Class of Antibody</u>	<u>Site of Action</u>	<u>Functions</u>
Ig A (4)	saliva, tears, mucous, milk membranes	stops bacteria sticking to cells, stops colonies on mucous
Ig D (2)	surface of B-cells	role in B-cell activation
Ig E (2)	tissue, tissue fluid	release histamines, allergies
Ig G (2)	blood, tissue fluid, can cross placenta	macrophages, antitoxins, agglutinates
Ig M (10)	blood, cannot cross placenta (# binding sites)	agglutinates, macrophages

**H. Four Kinds of Immunity**

	Natural	Artificial (a shot)
Active Immunity (your body makes the antibodies)	Infection by pathogen Ex. Get strep throat	Vaccination Ex. MMR (slow, but lasts long)
Passive Immunity (you get antibodies from elsewhere)	Only as a baby / fetus: 1. colostrum from mom 2. through placenta	Gamma Globulin shot Ex. for travel (quick, but temporary)