

Biology 320 Parasitology
Immunity

I. Nonspecific Immunity

A. First Line of Defense

1. skin
 - a) dry
 - b) low pH
 2. mucous membranes and secretions
 - a) lysozyme
 - b) mucus
- (1) traps, swallow, or expel

B. Second Line of Defense

1. phagocytic white blood cells
 - a) neutrophils (70% of WBC)
 - (1) amoeboid (leave bloodstream)
 - (2) short-lived
 - (3) figure
 - b) monocytes (5% of WBC)
 - (1) mature into macrophages
 - (a) permanent
 - (b) fixed
 - c) eosinophils
 - d) natural killer cells
2. antimicrobial proteins
 - a) complement system (20 + plasma proteins)
 - (1) lyse microorganisms
 - (2) enhance phagocytosis by opsonization (coating "to make tasty")
 - (3) intensify immune response
 - b) interferons
 - (1) mobilize immune system
3. inflammatory response
 - a) cardinal signs
 - (1) redness
 - (2) heat
 - (3) swelling
 - (4) pain
 - b) mechanism & function
 - (1) histamines in mast cells and basophils (WBC's)
 - (2) prevents spread of damaging agents
 - (3) disposes of cell debris & pathogens
 - (4) sets stage for repair

II. Specific Immunity

A. Concepts

1. specificity
2. diversity
3. memory
4. self/nonself recognition
5. antigen is contraction of "antibody generator", usually from non-self
6. immunocompetence- ability to respond to an antigen by binding to it
7. types of immunity
 - a) active vs. passive
 - (1) active
 - (a) infection
 - (b) vaccination
 - (c) results in memory cell production
 - (2) passive
 - (a) conferred from antibodies of donor or mother
 - (b) does not result in memory
 - b) natural vs. artificial
 - (1) naturally acquired
 - (a) active- from infection
 - (b) passive- from maternal antibodies
 - i) placental
 - ii) lactation
 - (2) artificially acquired
 - (a) active
 - i) vaccines
 - (1) dead
 - (2) attenuated
 - (b) passive
 - i) immune serum (gamma globulin)
 - c) figure

B. Third Line of Defense

1. cellular or cell-mediated immunity
 - a) involves T-lymphocytes (T-cells), which oversee process
 - b) effective against:
 - (1) intracellular parasites
 - (2) fungi, protozoans, & worms
 - (3) transplanted tissue

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- (4) cancer
- 2. humoral or antibody-mediated immunity
 - a) involves B- lymphocytes (B-cells), which generate antibodies
 - b) effective against:
 - (1) toxins
 - (2) free bacteria
 - (3) viruses in body fluids
- 3. The Players
 - a) lymphocytes
 - (1) B-cells- mature in bone marrow
 - (2) T-cells- mature in thymus
 - (a) those that respond to self are destroyed
 - (b) those that respond to non-self survive
 - i) each T-cell reacts with only one antigen
 - ii) the array of T-cells is determined genetically
 - b) macrophages ("big eaters")
 - (1) develop from monocytes in bone marrow
 - (2) engulf and present antigens
 - (3) are stimulated to become killers by T-cells
- 4. Figures:
- C. antigen receptors- when bound, stimulate proliferation of that cell
- D. clonal selection
 - 1. plasma cells
 - 2. memory cells
- E. primary immune response 10 - 17 days
- F. secondary immune response 2 - 7 days
 - 1. immunological memory
 - 2. documented 2400 years ago by Thucydides of Athens!
- G. Self vs. Nonself
 - 1. pluripotent stem cells in marrow
 - a) T cells develop in thymus
 - b) B cells develop in bursa/bone
 - 2. programmed cell death (apoptosis)
- H. MHC (Major Histocompatibility Complex)
 - 1. Class I
 - a) generalized: found on all nucleated cells
 - 2. Class II
 - a) specialized: found on immune system cells
 - (1) macrophages
 - (2) B-cells
 - (3) activate T-cells
 - (4) thymus cells
 - 3. lots of variation, hundreds of alleles per gene in a species!
 - a) acts as fingerprint
 - b) first discovered when skin grafts tried and rejected
 - 4. Function? Antigen binding & presentation
 - (1) Cytotoxic T (T_c) cells bind to MHC class I (on all cells)
 - (a) blast holes in infected cells with perforins
 - (2) Helper T (T_h) cells bind to MHC class II (on other immune cells)

III. Summary

- 1. antigen exposure
- 2. macrophage engulfs
- 3. become antigen presenting cell
- 4. stimulates helper T-cell
 - a) which stimulates
 - (1) B-cells
 - (a) become plasma cells
 - (b) produce antibodies = Immunoglobulins (IgM, IgA, IgD, IgG, IgE) = "madge"
 - (c) also produce memory B cells
 - (2) cytotoxic T-cells
 - (a) generate active cytotoxic T-cells
 - (b) generate memory T-cells
 - b) generates memory helper T-cells