

Immunity

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Immunity = the protection against infectious disease conferred either by the immune response generated by immunization or previous infection or by other non-immunologic factors... a.k.a the body's ability to resist infection

Two types of immunity

1. Non-specific (innate)

- Skin
 - What characteristics of the skin make it an effective mechanical barrier?
 - Acid pH: sweat and sebaceous secretions
 - Lower temp that is suboptimal for some bacteria
- Mucous membranes (mechanical)
 - Cilia in respirator tract
 - Lysozymes, pH
- Iron-binding proteins
 - Some bacteria require iron for growth
 - Transferrin, lactoferrin
- Phagocytosis
 - PMNs, monocytes and macrophages
- Complement

2. Specific (adaptive, acquired)

- Humoral and Cell-mediated (CMI)
- What is the difference between innate immunity and adaptive immunity?
 - Innate: protects against any invader, does not discriminate
 - Adaptive: directed against one type of invader, dependant on past exposure

Where do immune cells come from?

- Bone marrow; lymphoid stem cell

Humoral Immunity

- Circulating antibodies

- Antibody: protein that binds specifically to a substance (its antigen)
 - Igs or immunoglobulins
 - Produced by B-lymphocytes upon stimulation from antigen presenting T-cells
 - Recognize toxins, capsules, some viral proteins
- Antigen: a substance capable of inducing a specific immune response
 - "non-self"
 - Protein; glycoprotein, lipoprotein, polysaccharide
 - What structures could be "antigenic" in a bacteria? Virus?
 - Capsular substance, flagella, cell wall
 - Viruses - polypeptide antigens
- Antibody Binding: how does it occur?

Immunoglobulins (antibodies)

- Ig produced in response to stimulation by an antigen and reacting specifically with it
- Distinguish "non-self" from "self"
- Constant and variable region
 - Variable region is responsible for antigen recognition
- Classes of Igs
 - IgG
 - Host defense
 - Crosses placenta and protects newborn
 - IgD
 - Role is unknown
 - IgA
 - Host defense
 - Found in secretions (tears, saliva, milk, respiratory, GI and genitourinary tract)
 - Dimer
 - IgM
 - Host defence
 - Early immune response
 - Pentamer
 - IgE
 - Hypersensitivity (allergies)
 - Defends against parasites

First and Second Immune Response

- First response
 - Ab production triggered on first antigen introduction
 - Latent period of several days
 - Circulating antibody detectable after 5-10 days
 - Antibody in serum is maximum at ~21 days, then drops to low levels
- Second response
 - Basis for immunizations
 - Occurs when Ab is introduced second, third, forth... time
 - Lag, rapid Ab increase (2-3 days), slow decrease over longer time
 - Booster injections to maximize Ab levels

Antibody Detection

- Serological Reaction
 - Detects presence of antibodies in serum sample
 - Antigen and antibody reaction; agglutination
 - Antibody titration
 - Detect unknown microorganisms using known antisera

Cell-Mediated Immunity (CMI)

- T-cells not antibodies
 - Helper, suppressive cytotoxic (killer) generated from memory cells
- Exposure to antigen induces response from trained T-cells
- Essential for defense against intracellular organisms, parasites tumors and other foreign cells (i.e., transplants, grafts)
- Immune-suppressive medication for transplant recipient

Disorders of Immunity

1. Allergy and Hypersensitivity
 - Over-reaction to antigens in absence of true infection
 - Can be fatal (anaphylaxis)
2. Auto-immune diseases
 - Immune system reacts to its own "self" antigens
 - "auto-antibodies"
 - Type I diabetes, MS, rheumatoid arthritis, lupus
3. Immunodeficiency states
 - Inability to produce antibodies and/or dysfunctional CMI
 - Congenital abnormalities. disease. AIDS

- Congenital abnormalities, disease, etc

4. Graft rejection

- Normal immune reaction to "non-self"
- Control by immune-suppressive medication

Immunization

- Passive Immunization
 - Administration of pre-formed antibody against a specific microbial agent
 - IgG animal origin: short-lived, risk of hypersensitivity reaction
 - IgG human origin: short lived, no risk of reaction
 - Gamma globulin (IgG): pooled from large grouped of blood donors and has antibodies to many common infections
 - Hyper-immune globulins (IgG): specific for a particular microbe
- Active Immunization
 - Stimulates immune system by administration of antigen
 - Longer lasting
 - Live-attenuated vaccine
 - Sub-clinical or mild illness mimicking the disease
 - Local (IgA) and humoral (IgG) immunity
 - Rapid immunity development
 - Serious illness in immuno-compromised individuals
 - Killed vaccines, sub-unit vaccines and toxoids
 - Antigens without infectivity
 - May require boosters
 - Adjuvant with toxoids
 - Polysaccharide vaccines can be conjugated to protein (see conjugate vaccines)
 - Recombinant vaccines
 - DNA recombinant technology
 - Attenuates microorganisms
 - Hep B vaccine
 - Adsorbed vaccines
 - Vaccine mixed with inorganic salt for slower adsorption and longer-lasting immunity
 - Tetanus, diphtheria
 - Conjugate vaccines
 - Designed for poorly antigenic microorganisms
 - Conjugate antigen of interest to immunogenic, non-toxic protein
 - Haemophilus influenzae type b: its polysaccharide capsule becomes

...inert particles of a certain type or, the polyacrylamide capsule becomes immunogenic

- Combined vaccines
 - Several live attenuated or several killed vaccine
 - For ease of administration
- Combined Active-Passive Immunization
 - Immediate protection after possible exposure to microbe
 - Hyper-immune Igs and vaccine injected at different sites
 - Tetanus, Rabies, Hep B