

## Biology

### Immunity 09.4

"Even the righteousness of God which is by faith of Jesus Christ unto all and upon all them that believe: for there is no difference." Romans 3:22

#### Immunity

1. Defense to respond to infection, eliminate pathogens, and prevent disease.
2. Three lines of defense: surface, non-specific, and specific responses.
3. Can also be the cause of diseases resulting from allergies and autoimmune responses.
4. Infectious disease "formula":  $(V \times N)/R = I$ 
  - a. Virulence times the number of pathogens divided by resistance determines whether an infection will occur.
  - b. Theoretically, 100% immunity to infectious diseases is not possible.
5. Long term immunity and short-term immunity depends on the person and the disease.
6. **Inborn** immunity is genetic immunity to disease that affects other animals and plants.
7. **Acquired** Immunity can be Active and Passive
  - a. **Active** immunity is your body's immune response acquired **Naturally** from exposure to the infectious agent or acquired **Artificially** from exposure to a vaccine containing particles from an infectious agent.
  - b. **Passive** immunity is acquired Naturally from mother's milk, or artificially from serum containing immunoglobulins.

#### First line of defense

1. Surface barriers- first line of defense prevents entry of pathogens.
2. Skin
3. Sebaceous glands secrete fatty acids and enzymes
4. Tear glands: lysozyme
5. Mucous membranes
6. Cilia
7. Gastric juices
8. Natural microflora of nonpathogenic bacteria
9. Bleeding and clotting

#### Second line of defense

1. Non-specific response: Same general response to any pathogen or injury.
2. Cellular defense
  - a. Phagocytic cells clean the body by removing foreign, diseased, and dead materials.
  - b. Fixed: lymph nodes, spleen, liver
  - c. Free: blood and lymph system
  - d. Pus: dead cells and bacteria (casualties of war)
3. Inflammation
  - a. Induced by phagocytic cells
  - b. Fluid and swelling
  - c. Free phagocytes
  - d. Lymph system
  - e. Fixed phagocytes in nodes
  - f. Wheal and Flare

4. Fever
  - a. Increase in temperature
  - b. Induced by cells to increase metabolism and response to infection
  - c. Can be local or systemic

#### Third line of defense

1. Specific response
2. Coordinated by lymphocytes: B lymphocytes, and T lymphocytes
3. Lymphocytes respond to **antigens** and attempt to eliminate them.
4. **Antigens** are substances identified by lymphocytes as being foreign to the body.
5. **B lymphocytes** produce **antibodies** to neutralize and help remove antigens such as bacteria, viruses, toxins, and foreign proteins.
  - a. **Antibodies** are proteins produced by B lymphocytes specific to each antigen.
  - b. Antibodies are also called **Immunoglobulins**.
  - c. Once a B lymphocyte reacts to an antigen, it remains committed to producing one antibody for that antigen.
  - d. It is thought that there can be over a thousand trillion antibody producing B lymphocytes in the body.
6. T lymphocytes complete their maturity in the thymus before entering the blood to provide cellular immunity.
  - a. Killer T cells identify and destroy infected and cancerous cells.
  - b. Helper T cells coordinate an immune response to pathogens.
7. B and T lymphocytes
  - a. Every encounter with an antigen stimulates a lymphocyte to clone itself to respond to more antigens of the same kind.
  - b. A few lymphocyte clones already committed to responding to a specific remain in the body ready to respond again if an antigen reappears. This repeat response is quicker and more abundant than the first response. This is called an **anamnestic** immune response.
  - c. An anamnestic immune response can result from natural or intentional (artificial, **vaccination**) exposure to an antigen.
    - i. A live vaccine contains attenuated pathogens (living but reduced virulence)
    - ii. A dead vaccine contains particles (antigens) of pathogens.

#### Allergies

1. An allergy reaction is an inflammatory response resulting from an immune response to an antigen (allergen) such as pollen, bee venom, pet dander, medicine, etc.
2. Inflammatory response causes swelling and itching at sites where your body encounters **allergens** such as sinuses, respiratory tract, digestive system, and skin.
3. Allergic responses range from mild to serious (**anaphylaxis**).
4. Symptoms include rash, swollen throat, wheezing, difficulty breathing, vomiting, diarrhea, stomach cramping, etc.

#### Autoimmune diseases

1. Autoimmune disease is a self destruct disease.
2. Your immune system responds to your own cells as being foreign and attacks your own body.
3. Autoimmune disease can affect one type of tissue in your body or many different types.

4. Eighty types of autoimmune diseases have been identified including rheumatoid arthritis, systemic lupus erythematosus, Hashimoto's disease, and Graves' disease.
5. Seventy-five percent of those affected are women.

#### Medical treatment of disease

1. Chemotherapy: Rx with chemicals
  - a. Trypan red: African sleeping sickness
  - b. Salvarsan 606: syphilis (the invisible bullet)
  - c. Sulphanilamide: sulfa drugs
2. Antibiotics
  - a. Produced by microbes as a form of chemical warfare between competing microorganisms.
  - b. Alexander Fleming: Accidental discovery in 1929. Mold (*Penicillium*) killed bacteria. Named the substance penicillin. First used on an English bobby with staph infection.
  - c. Streptomycin (produced by *Streptomyces griseus*). Side effects are possible.
  - d. Important to follow prescription to avoid producing resistant strains such as MRSA (Multiple-Resistant Staphylococcus Aureus)
3. Bacteriostatic drugs prevent growth of pathogens.
4. Bactericidal drugs kill pathogens.

#### Cancer treatment

1. Surgical removal of tumors.
2. Radiation uses high energy waves or particles to penetrate through skin to kill cancer cells. There are side effects such as causing cancer and damaging normal tissues.
3. Chemotherapy uses chemicals to kill cancer cells before killing normal cells.
4. Targeted therapy uses drugs and/or photodynamic therapy to identify and attack cancer cells while avoiding normal cells.
5. Immunotherapy enhances your immune system to attack cancer cells.
6. Reducing risk is best.
  - a. Avoid smoking, breathing fiber glass and asbestos, too much exposure to sun and radiation, and exposure to carcinogens in oils and solvents.
  - b. Maintain a healthy diet and weight.
  - c. Exercise.