

BIOL 1002-Final Exam Learning Objectives- 5/1/14  
Chapter 36-Defenses Against Diseases

- Understand the three major lines of defense against disease that vertebrates have, and be able to give examples of each
  - o 1. Nonspecific external barriers
    - Prevent most pathogens from entering the body
    - An example is
      - Skin and cilia, tears, saliva, and mucus
    - Not letting them into your body
    - Tears have antibodies
    - Saliva has enzymes that dissolve things in your mouth
    - Mucus found in body cavities like your nose and ears
    - Bodies 1<sup>st</sup> line of defense- meant to trap pathogens before they enter your body
  - o 2. Nonspecific internal barriers
    - If the external barriers are breached, a variety of nonspecific internal defenses swing into action
      - White blood cells, which engulf foreign particles or destroy infected cells
      - Chemicals released by damaged cells and proteins released by white blood cells that trigger inflammation and fever
      - These operate regardless of the nature of the invader, neutralizing the threat
      - 2<sup>nd</sup> line of defense
      - Cells trigger an immune response- signal immune system to come to its rescue
      - Anything that can cause you harm gets fought by these nonspecific internal defenses
  - o 3. Specific (immune) internal defenses
    - The final line of defense is the adaptive immune response
    - Immune cells selectively destroy specific invading microbes and toxins and then remember the invader
    - Only selective line of defense we have\*\*
    - Shortens the amount of time needed to neutralize the threat
    - Takes 2 weeks for your immune cells to divide and overcome the threat but in the meantime you are already sick
    - Immune system has tons of memory cells and when you are exposed to the real flu virus you already have enough cells to destroy it before you get sick or see symptoms
      - Process only takes a few hours because the memory cells have already been exposed to that pathogen
- Understand Table 36-2, and be able to explain the role of each of these cell types in immunity

- Dendritic cells
  - Engulf invading microbes and present antigens to lymphocytes
- Macrophages
  - White blood cells that engulf invading microbes and present antigens to lymphocytes
  - Any cell that performs phagocytosis
  - Has to be large
- Natural killer cells- think cancer
  - Destroy infected or cancerous cells
  - Can attack without having been exposed to it before
- Mast cells
  - Connective tissue cells that release histamine; important in the inflammatory response
- B cells
  - White blood cells that produce antibodies
  - Memory B cells
    - Offspring of B cells that provide future immunity against invasion by the same antigen
    - Stick around to fight pathogens in the blood
  - Plasma cells
    - Offspring of B cells that secrete antibodies into the bloodstream
- T cells
  - White blood cells that regulate the immune response or kill infected cells or cancerous cells
  - Cytotoxic T cells
    - T cells that destroy infected body cells or cancerous cells
  - Helper T cells
    - T cells that stimulate immune responses by both B cells and cytotoxic T cells
    - They recognize cells that have engulfed pathogens (macrophages) and bind to them and then activate T cells and B cells
    - Announce the threat and tell them to activate
    - A lot of B and T cells wouldn't know about the threat otherwise
    - Then gets the immune system involved
  - Memory T cells
    - Offspring of cytotoxic or helper T cells that provide future immunity against invasion by the same antigen
    - Fight infected cells that already have an infection- they destroy already infected cells
    - Had to have been exposed to it before

- Regulatory T cells
      - T cells that suppress immune attack against the body's own cells and molecules; important in preventing autoimmune diseases
    - B and T both considered lymphocytes
- Understand how the mucous membranes are able to protect your body against microbes
  - Nonspecific external barriers- the ideal defenses are barriers that prevent invaders from entering the body in the first place
  - The first line of defense consists of two surfaces with direct exposure to the environment
    - The skin
    - The mucous membranes of the digestive, respiratory, and urogenital tracts
    - It is like buying a lock instead of a gun
    - Designed to keep pathogens out of your body
    - Hairs serve as a mesh or screen to trap dust, pathogens, etc. and the mucus is there to neutralize it
    - The outer surface of the skin consists of dry, **dead cells** filled with tough **proteins** that do not allow the microbes to obtain the water and nutrients they need to survive
    - Sweat and sebaceous glands secrete natural antibiotics, such as lactic acid, **that inhibit the growth of many bacteria and fungi**
    - Hardly any water in dead skin cells
    - Sweat and the oil that comes out of your body inhibits pathogens
    - Trains your immune system to recognize its own cells
    - If you don't develop these your immune system doesn't properly recognize a pathogen
    - Antimicrobial secretions, mucus, and ciliary action defend the mucous membranes against microbes
      - Mucous membrane secretions trap microbes entering the nose or mouth
      - They contain antibacterial proteins, including **lysozyme**, which kills bacteria by digesting their cell walls, and defensins, which makes holes in bacterial plasma membranes
      - **Cilia** on the membranes sweep up the mucus, so it is swallowed, coughed or sneezed out of the body
      - Mucus membranes line body cavities and they physically trap microbes
      - Lysozyme punches holes in the bacteria
      - Cilia sweep up mucus and you cough or sneeze it out
      - Mucus membranes trap pathogens before they get inside of you; **a layer of thick liquid that acts like a fly trap**