The Immune System

You make me SICK!

When germ relationships go bad
Basic Vocab.

- **Disease** - any change that disrupts the normal functions of the body.
- **Pathogen** - Disease-causing agents; such as; viruses, bacteria, protists, worms, fungi
- **Infectious Diseases** - diseases caused by pathogens
- **Antigen** – triggers immune response (bad guys)
- **Antibody** – protein; destroys pathogens (good guys)
How Diseases are Spread

- **Physical Contact** - transmitted when a healthy person touches a person with a disease.

- **Sexual Contact** - transmitted through bodily fluids

- **Indirect contact** - through the air or by touching objects that have been infected and then touching your nose or mouth.
How Diseases are Spread

- Some behaviors can help to control transmission of diseases. Such as covering your mouth with a tissue when you cough, & wash your hands
How Diseases are Spread

- **Contaminated Food and Water** – caused by eating food containing pathogens or drinking un-sanitized water.

- **Infected Animals** - Vectors carry diseases like Lyme disease, West Nile virus, & rabies
Immune System

- The Immune system is the body’s primary defense against pathogens.

4 Nonspecific Defenses:
- Not directed against any one pathogen, guards against all infections.
  1. Skin
  2. Mouth & Respiratory Passages
  3. Inflammation
  4. Fever
1. Skin

- Most important nonspecific defense
- Few pathogens can penetrate that tough layer of **keratin** protein (dead skin) at the skin's outer surface
2. **Mouth & Respiratory Passages**

- Millions of microorganisms enter each day
- Passages leading to lungs are coated with **mucus**
- Mucus traps airborne pathogens
- Swept into the **digestive system** to be destroyed
3. Inflammation

- Occurs when **pathogens** do enter the body (usually through skin)
- Blood vessels near wound expand
- WBC leak from the vessels to invade the infected tissues
- **Phagocytes** (wbc) engulf and destroy them
- Infected tissue may become swollen and painful
a Bacteria invade.
b Substances accumulate.
c The substances make plasma and proteins escape.
d Plasma proteins attack bacteria, phagocytes, or repair damage.
e Phagocytes engulf bacteria.
When a wound breaks human skin, it creates a gateway for harmful pathogens to invade human cells.

Neutrophils, which are a type of white blood cell, live in human blood vessels.

When pathogens invade a human cell, neutrophils travel to the infection site to destroy the invading pathogen. The first step in this process is engulfing the pathogen.

Once the neutrophil has completely surrounded the pathogen, it produces an oxidant, hypochlorous acid. Hypochlorous acid is a biocide, meaning it kills organic material. Once produced by the neutrophil, it kills the bacteria almost instantly.
4. Fever

- **Pathogen** has spread
- Immune System releases chemicals that increase the body’s temp
- Pathogens can only survive within a narrow temperature range
Specific Defenses

- Attacks the particular disease causing agents
- 2 types
  - Antibody & T cells
Antibody Immunity

- Antigens stimulate production of **antibodies**.
- Antibody has two binding sites which are specific in a particular antigen.
An antibody matches an antigen much as a key matches a lock. Whenever antigen and antibody interlock, the antibody marks the antigen for destruction.
Antibodies surround the virus and bind to it. This prevents the virus from reproducing or being transported throughout the body.
Lymphocytes

- White blood cells
- One group called B cells
- Another group called T cells
B cells

- Mature in bone marrow
- Produce antibodies
- As B cells develop, antibody genes in each rearrange themselves in different ways.
- When complete, immune system contains millions of B cells each capable of producing a slightly different antibody.
- Vaccine-shot of weakened or killed pathogens to stimulate production of antibodies.
1. The B cell finds an antigen which matches its receptors.
2. It waits until it is activated by a helper T cell.
3. Then the B cell divides to produce plasma and memory cells.

4. Plasma cells produce antibodies that attach to the current type of invader.
5. "Eater cells," prefer intruders marked with antibodies, and "eat" loads of them.
6. If the same intruder invades again, memory cells help the immune system to activate much faster.
T-Cells

Three types:

**Killer T** - track down and **destroy** pathogens & foreign tissue

**Helper T** - **identify** pathogen & send message to Killer T

**Suppressor T** – turns **off** the immune response
- **HIV/AIDS** - infects, weakens, and gradually destroys the helper T cells.

- **Killer T** - cells are responsible for the rejection of tissue transplants.
Immune Disorders

1. **Allergies** - overreaction of the immune system to an antigen in the environment

2. **Autoimmune Diseases** - immune system makes mistakes and attacks its own cells
   - Multiple sclerosis - attacks the myelin sheath that surrounds nerve fibers
   - Rheumatoid Arthritis - antibodies attack connective tissues around the joints
   - Type 1 Diabetes - antibodies attack the insulin producing cells of the pancreas
Diagram of immune system components:

- Bacteria trigger an immune response.
- Antigen is recognized by the macrophage and processed.
- The processed antigen fragment binds to the antigen receptor on the B cell.
- Activated B cell produces antibodies.
- Activated B cell also produces memory B cells.
- Helper T cell assists in activating the B cell.
- Cytotoxic T cell (killer T cell) attacks infected cells.

Types of immunity:

- **Cell-mediated immunity:** Involves T cells.
- **Humoral immunity:** Involves B cells and antibodies.