

## The Human Immune System

With all the pathogens around us, it might seem like a miracle that we aren't sick all of the time. The immune system is the body's primary defense against pathogens.

- I. **First Line of Defense:** The job of the body's first line of defense is to keep pathogens out. This role is carried out by the skin, mucus, cilia in the nose, sweat, tears and the digestive acids in the stomach. However, your body's most important initial line of defense is the skin; very few pathogens can penetrate the layers of dead cells at the skin's surface.

- a. What is the job of your immune system's first line of defense? Which part is the most important?

The job of the first line of defense is to keep pathogens (disease causing agents such as bacteria and viruses) out of the body. The skin is the most important component of the first line of defense.

- b. How do cilia and mucus keep pathogens out of the body?

Cilia (hair-like structures in nasal passages) and mucus trap pathogens which are removed from the body during a sneeze or cough.

- II. **Second Line of Defense:** When pathogens do manage to enter the body, they may multiply rapidly and release toxins into your tissues. When this happens, your immune system reacts with a series of responses, referred to as an **immune response**. A substance that triggers this response is called a **foreign antigen (pathogen)**. The body can produce two different immune responses: humoral and cell-mediated.

- a. **Humoral Immunity** involves the **use of B lymphocytes** that produce specialized proteins called **antibodies**. Each antibody has a specific shape that allows it to attach to specific foreign antigens.

- b. **Cell-Mediated Immunity** involves T lymphocytes; T-cells do not produce antibodies but can divide to create T4 helper cells and T8 killer cells.

**\*Both types of immunity begin with the detection and ingestion of a pathogen by a large phagocyte called a macrophage**

### Immune Response:

Step	Description
1	A pathogen enters the body
2	A macrophage takes pathogen in, destroys it and displays the foreign antigens on its surface
3	Helper T cells are activated and divide
4	Helper T cells activate killer T cells (cytotoxic T cells) to divide
5	Helper T cells activate B cells to create plasma cells
6	Plasma cells make antibodies
7	Antibodies attach to foreign antigen and contain them until they can be destroyed by phagocytes
8	Killer T cells destroy infected body cells so that pathogen cannot further

	<b>reproduce and spread</b>
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**III. Types of Immunity**

- a. **Active Immunity**
  - i. **Description-** the immune system is exposed to a pathogen and responds by producing antibodies and memory cells (enable a faster future response) \*permanent
  - ii. **Role of vaccines-** vaccines contain an inactive version of the pathogen causing an immune response including the production of antibodies and memory cells, without the individual actually getting the disease
  
- b. **Passive Immunity-** the body is given antibodies without having an immune response; NO ANTIBODIES or MEMORY CELLS are produced by the immune system itself \*temporary (examples include breast milk and immunoglobulin shots)

**IV. Disorders of the Immune System**

<b>Disorder</b>	<b>Description</b>	<b>Prevention/Treatment</b>
<b>Allergies</b>	- <b>(food/environmental) when immune system responds to a harmless antigen (allergen)</b> -mast cells release histamine which causes the inflammatory response	- <b>avoid allergen</b> - <b>antihistamines</b> * <b>Epi Pen for food allergies</b>
<b>Autoimmune disorders</b>	<b>Immune system attacks its own body cells (nervous system- Multiple Sclerosis, Guillain Barre, joints- rheumatoid arthritis, GI tract- Crohns</b>	<b>No prevention</b> <b>Can suppress the immune system</b>

<p><b>Transplanted organ rejection</b></p>	<p><b>Organs have antigens on surface of cells of their tissues, which may cause the immune system to attack the cells of a transplanted organ (if antigens are considered foreign)</b></p>	<p><b>-no prevention Can suppress the immune system</b></p>
<p><b>HIV (Human Immunodeficiency Virus)</b></p>	<p><b>-Transmitted by bodily fluids s/a semen, vaginal fluid &amp; blood -targets helper T4 cells (infects and then body's own killer T cells destroy infected helper T4s) -immune system rendered virtually helpless (susceptible to more frequent &amp; rare types of infections)</b></p>	<p><b>-prevent through abstinence, safe sex, use sterile needles (including those for tattoos and piercings) -drugs can slow the reproduction of the virus</b></p>