Immunity: The ability of the body to fight infection by producing antibodies or cells that deactivate foreign substances.

Immune System: The system in the body responsible for maintaining homeostasis by recognizing harmful from nonharmful organisms and produces an appropriate response.

Pathogen: Virus, bacteria or other microorganisms that cause disease.

Antigen: Toxin produced by a foreign invader.

Parts of the Immune System:
1. Blood (White blood cells in particular)
2. Lymph nodes
3. Spleen
4. Bone marrow (to produce more WBC’s)

THE BODY’S THREE LINES OF DEFENSE AGAINST INFECTION

First Line of Defense: These are natural chemical and physical barriers that act as the body’s first line of defense against invaders.

Physical Barriers: Skin and Mucous Membranes
Chemical Barriers: Tears, Sweat, urine, stomach acid

Second Line of Defense → Non-specific Immune Response
These are defenses that the body uses no matter what the invader may be. These defenses are:

a. Phagocytosis - done by macrophages
b. Natural Killer Cells - the killer cells kill infected cells
c. Inflammation - cuts off the infected area from rest of body
d. Fever - raising temperature kills invading microorganisms.
Third Line of Defense → Specific Immune Response

These are defenses that the body uses for specific invaders. These defenses include:

a. The production of **Antibodies**.
b. The killing of specifically infected body cells and microbes

**THE MECHANISM OF SPECIFIC IMMUNE RESPONSE**

When you become infected with a pathogen the following series of events occurs.

**Step 1:** The pathogen is attacked by macrophages and they engulf the organism/particle.
**Step 2:** The macrophage displays a form of the antigen on its surface.
**Step 3:** Helper T-cells recognize the antigen on the surface of the macrophage and it begins two forms of response. One is called **cellular immunity** and the other is **Humoral or blood immunity**.

### Cellular Immunity
- Helper T-cell activates a Cytotoxic T cell.
- Cytotoxic T-cell divides into **Active** Cytotoxic T-cells and Memory T-cells.
- Killer T-cells kill infected cells.
- Memory T – cells remain ready for a second invasion.

### Humoral or Blood Immunity
- Helper T – cell activates a B – Cell.
- B-cell divides into Plasma and Memory B – Cells.
- Plasma Cells create **antibodies**.
- Antibodies attach to and deactivate pathogens found in blood.
- Memory B – cells remain ready for a second invasion.

**NOTE:** Suppressor T cells release substances that slow down the immune response and eventually stop it.
Antibody

- Y-shaped protein molecule created by Plasma cells during specific immune response.
  - **Function:** Attach to and deactivate antigens/pathogens present in the bloodstream during a specific immune response.

Primary .vs. Secondary Immune Response

**Primary Immune Response:**

- This is a response to an invader the **FIRST** time the invader infects your body.
- There is no measurable immune response for about the first 5 days. For the next 10 - 15 days the number of antibodies increases and destroys the invader.

**Secondary Immune Response:**

- The next time the same invader invades the body a more rapid response occurs and within 2 days there may be very high levels of antibodies in the blood.
- Memory B – cells easily recognize the antigens and produce mass quantities of antibodies in a very short time.
- Memory T- cells quickly recognize infected cells and kill them quickly.

Passive/Induced .vs. Active Immunity

**Active Immunity:** Immunity where the body produces its own antibodies or Killer T cells to attack an antigen.

**Ex:** You have had a throat infection and you have built up antibodies against the cold virus.

You were given a **vaccination** for polio so your body built up antibodies to the polio antigen.

**Vaccination:** An injection of a weakened strain of an infectious microbe that causes the body to produce antibodies without harming the body.
Passive/Induced Immunity: Immunity where antibodies are given to a person from the blood of another person or animal.

Ex: Maternal immunity: A mother gives antibodies to her child while breast feeding. This protects the baby against infection until the baby is able to produce its own antibodies.

Autoimmune Diseases

• Autoimmune diseases are diseases where the immune system begins to attack itself.
  – Ex:
    • Rheumatoid Arthritis – crippling disease of the joints.
    • Lupus – disease of blood and organs.
    • Multiple Sclerosis – disease of nervous system

• Cause(s): unknown
• Cures/Treatments: No known cures. Usually treated with drugs.

Allergies and Allergic Reaction

Allergy

• An exaggerated response by the immune system to an allergen.

Allergen: A normally harmless substance that causes an allergic reaction.

Ex: dust, pollen, mould, food, insect stings

Types of Allergic reactions

There are two types of allergic reactions.

A. Immediate – occurs within seconds and normally lasts for about 30 mins.
B. Delayed – takes longer to react and can last for a much longer time.
The Mechanism of Allergic Reaction

During an allergic reaction antibodies cause histamines to be released from certain cells.

**Histamines:**
- Chemical released into the blood stream that causes:
  
  a. Swelling/Inflammation of tissues  
  b. Release of fluids (runny noses and eyes)  
  c. muscle spasms (some cases)

**Anaphylaxis or anaphylactic shock:**
This is the sudden and severe allergic reaction to a substance that can cause death.

**Treatments for Allergies**
1. Avoidance of material – especially food.  
2. Epinephrine – “epi – pen”  
   - Contains a hormone called “epinephrine” that helps restore normal blood pressure during anaphylactic shock.  
3. Antihistamines  
   - Drugs such as Benadryl, Sudafed, and Actifed contain chemicals called “Antihistamines” that help reduce the amount of histamine in the blood. This reduces the allergic reaction.