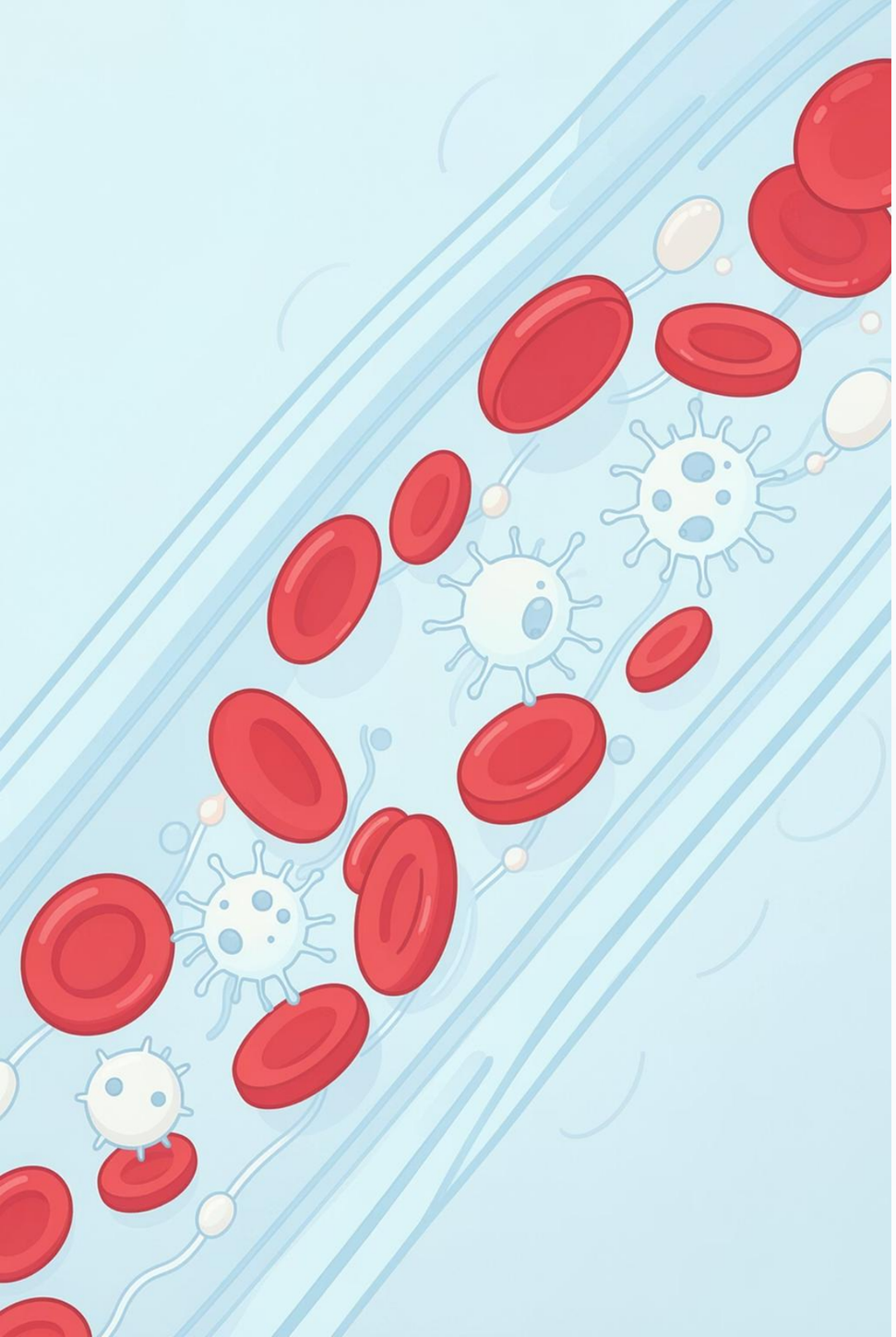
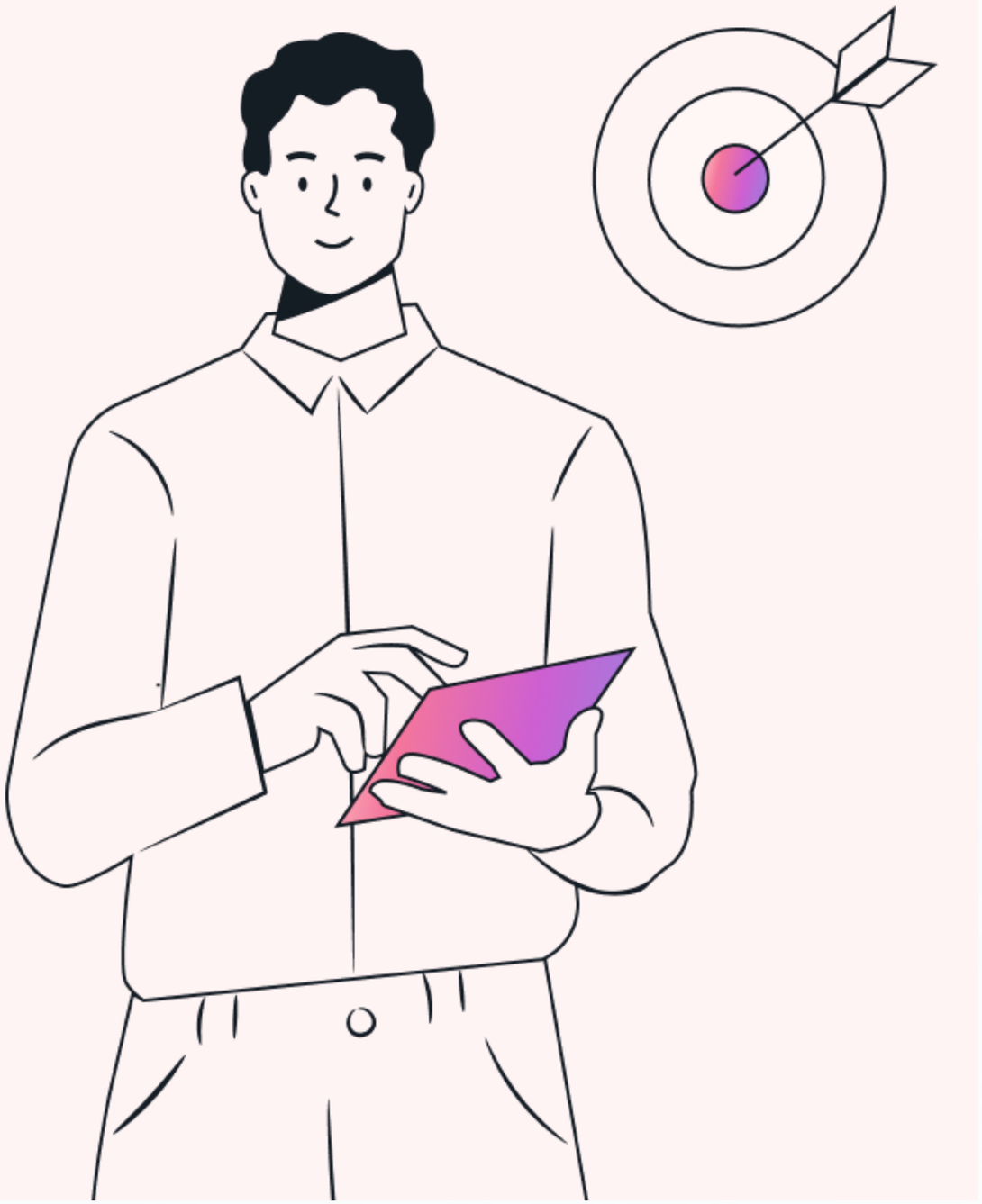


Blood, Lymph & Immune Systems

Assist.Lect. Noor Alaa Abdulrazziq



🎯 Learning Objectives

- By the end of this module, you will be able to:
  - Explain the role of white blood cells (WBCs) in immunity
  - Differentiate between key blood and immune-related disorders
  - Analyze symptoms and link them to underlying conditions
  - Apply knowledge through real-life scenarios and activities

Quick Oral Review Questions

1

Blood Basics

Components & functions?

- Plasma, RBCs, WBCs, Platelets
- Transport of oxygen, nutrients, and waste

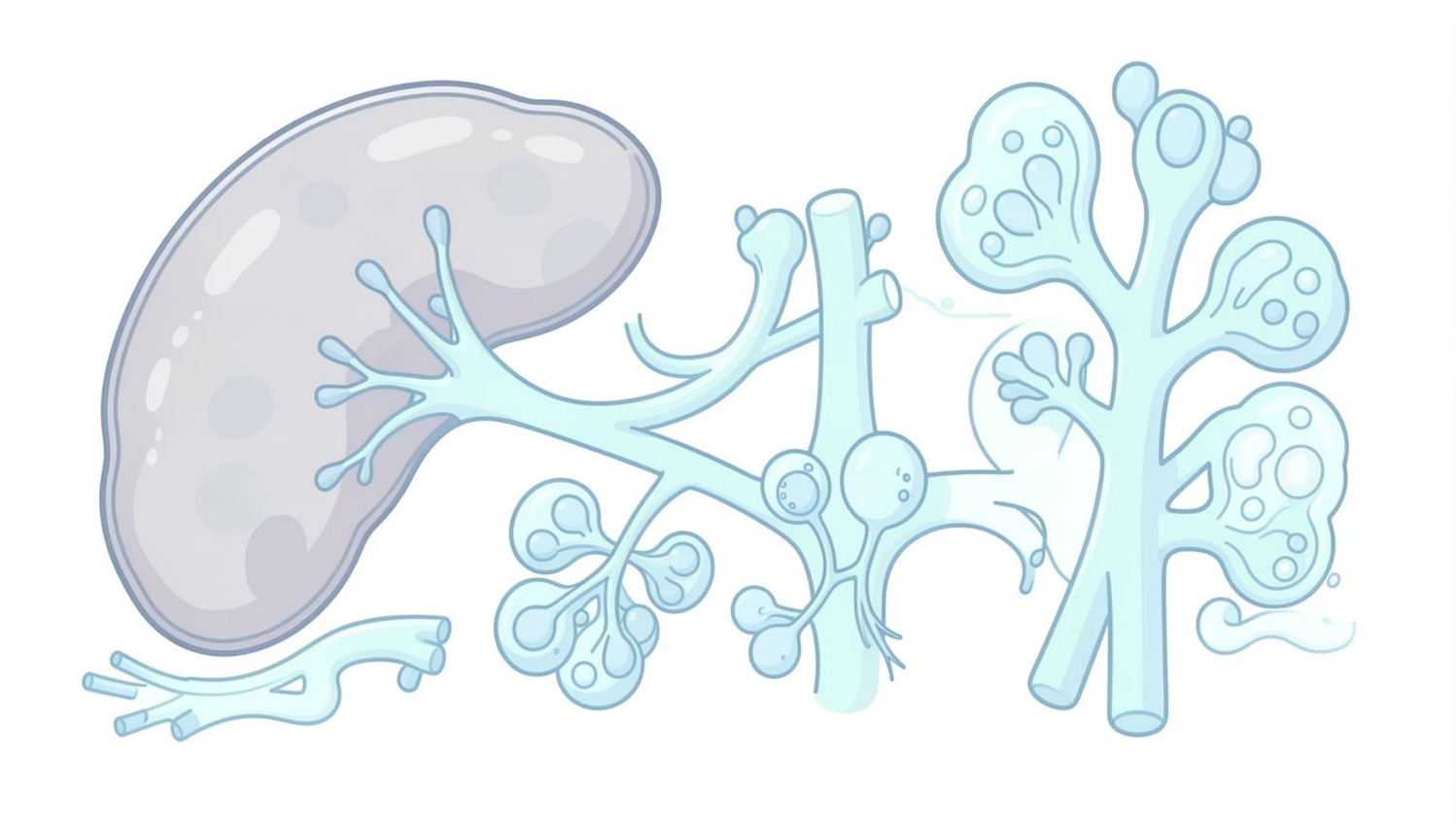
2

Lymphatic System

Formation & function?

- Capillary fluid → lymph
- Returns fluid to blood; lymph nodes filter infection

Immune System Overview



The immune system is the body's primary defense network — identifying, neutralizing, and remembering pathogens to protect against future threats.

Key Organs: Spleen · Lymph Nodes · Bone Marrow

Detects Antigens

Recognizes foreign substances and pathogens

Eliminates Threats

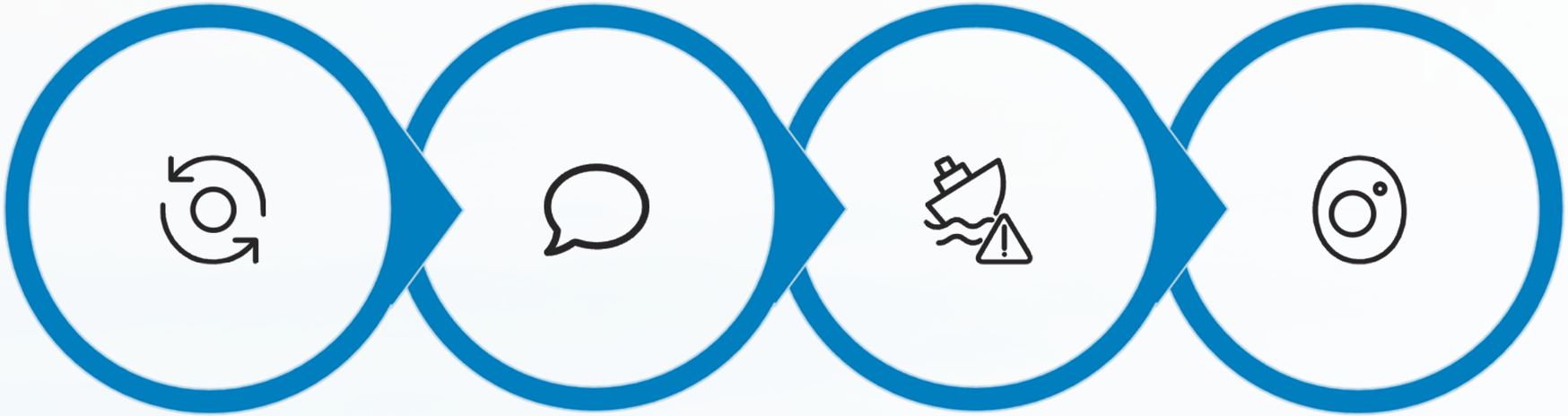
Destroys invaders through coordinated cellular responses

Builds Immune Memory

Retains memory of past infections for faster future response

White Blood Cells: Mechanism of Action

Monocytes circulate in the blood before migrating into tissues, where they mature into **macrophages** — powerful phagocytic cells central to innate immunity.



Monocyte Migration

Phagocytosis

Antigen Processing

Antigen Presentation

As **Antigen-Presenting Cells (APCs)**, macrophages bridge innate and adaptive immunity by displaying antigen fragments to T cells.

Adaptive Immunity

Once APCs activate lymphocytes, the adaptive immune response delivers a **precise, targeted attack** with long-lasting memory.

B Cells

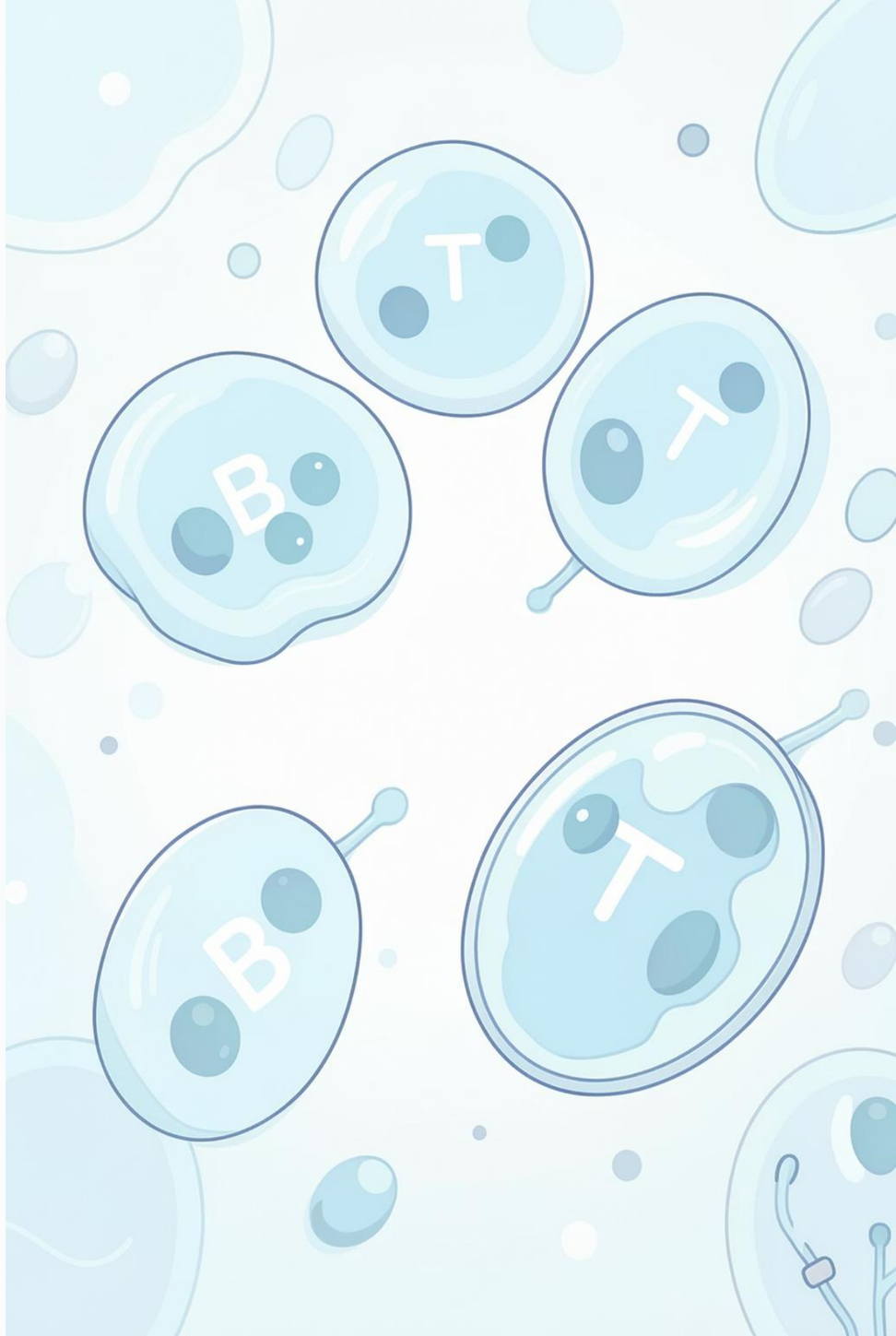
Produce **antibodies** that bind to specific antigens, neutralizing pathogens in the bloodstream

T Cells

Destroy infected cells directly and coordinate the broader immune response

Immune Memory

Memory cells enable a **faster, stronger response** upon re-exposure to the same antigen



Blood Disorders

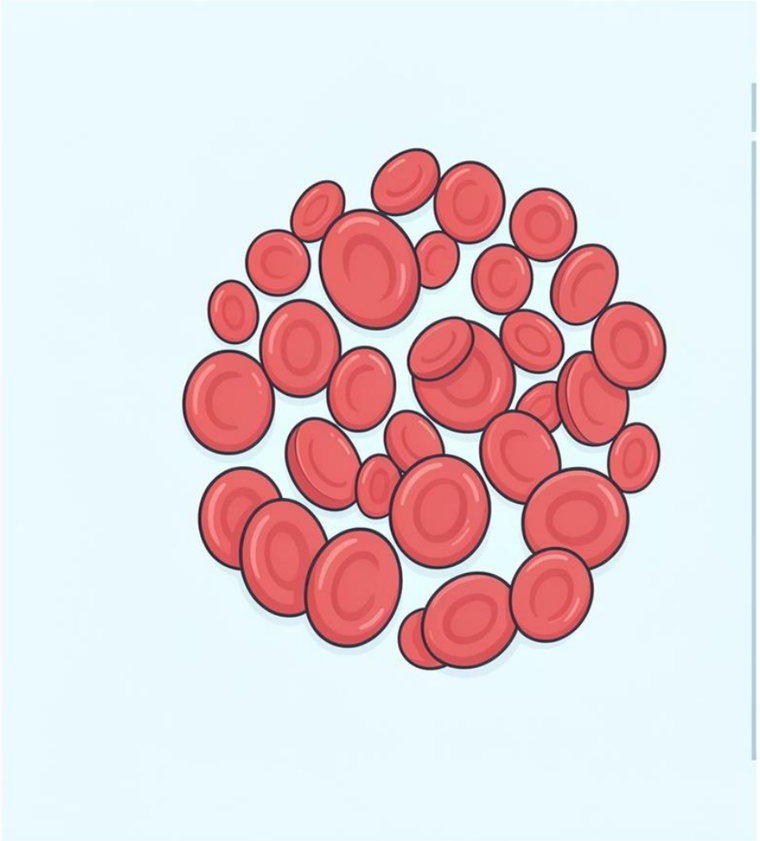
Anemia

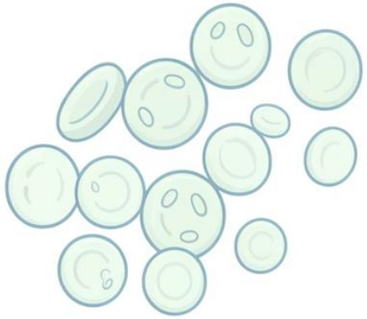
- Reduced RBCs or hemoglobin
- Impaired oxygen delivery to tissues
- Symptoms: fatigue, weakness, pallor

A **symptom**, not a standalone disease

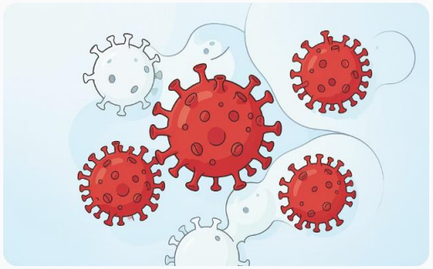
Hemophilia

- Deficiency in clotting factors (VIII or IX)
- Prolonged bleeding after injury
- Can cause spontaneous internal bleeding



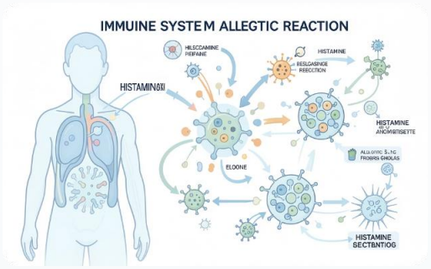


Immune Disorders



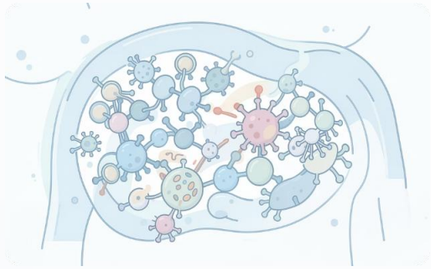
(**Acquired Immunodeficiency Syndrome (AIDS)**

HIV destroys **CD4 T cells**, progressively weakening immune defenses and leading to severe immunosuppression and opportunistic infections.



Allergy

An **overreaction** of the immune system to harmless substances (allergens), triggering histamine release and inflammatory responses.



Autoimmune Disease

The immune system **mistakenly attacks** the body's own tissues, causing chronic inflammation and organ damage (e.g., lupus, rheumatoid arthritis).

Edema: Fluid Accumulation in Tissues

What Is Edema?

Edema occurs when excess fluid accumulates in interstitial spaces, causing visible **swelling and discomfort**. It reflects an imbalance in fluid dynamics.

- **Heart Failure**
  Reduced cardiac output causes fluid backup
- **Kidney Dysfunction**
  Impaired fluid and electrolyte regulation
- **Lymph Obstruction**
  Blocked drainage prevents fluid return
- **Inflammation**
  Increased capillary permeability
- **Low Plasma Proteins**
  Reduced oncotic pressure

Final Integration: Key Takeaways

Immune System Balance

Innate Immunity

Macrophages and neutrophils provide rapid, non-specific first-line defense

Adaptive Immunity

B cells and T cells deliver targeted, antigen-specific responses with lasting memory

Disease Categories at a Glance

Deficiency → AIDS (immune suppression)

Overreaction → Allergy (hypersensitivity)

Dysfunction → Anemia, Hemophilia, Edema

Infection → Mononucleosis (EBV)

Knowledge Check (Quiz)

1

1. What is the main role of macrophages?

- a) Produce hormones
- b) Destroy pathogens
- c) Carry oxygen

2

2. Which condition is NOT a disease but a symptom?

- a) Leukemia
- b) Anemia
- c) AIDS

3

3. Autoimmune disease means:

- a) Weak immunity
- b) Body attacks itself
- c) External infection

🎯 Activity: “True or False – Fix the Mistake”

Ready Statements:

1. Macrophages produce hormones.
2. The immune system protects the body from pathogens.
3. B cells produce antibodies.
4. T cells carry oxygen in the blood.
5. Lymph nodes help filter infections.
6. The immune system has memory.
7. Red blood cells fight infection.
8. The spleen is part of the immune system.


THANK
YOU!