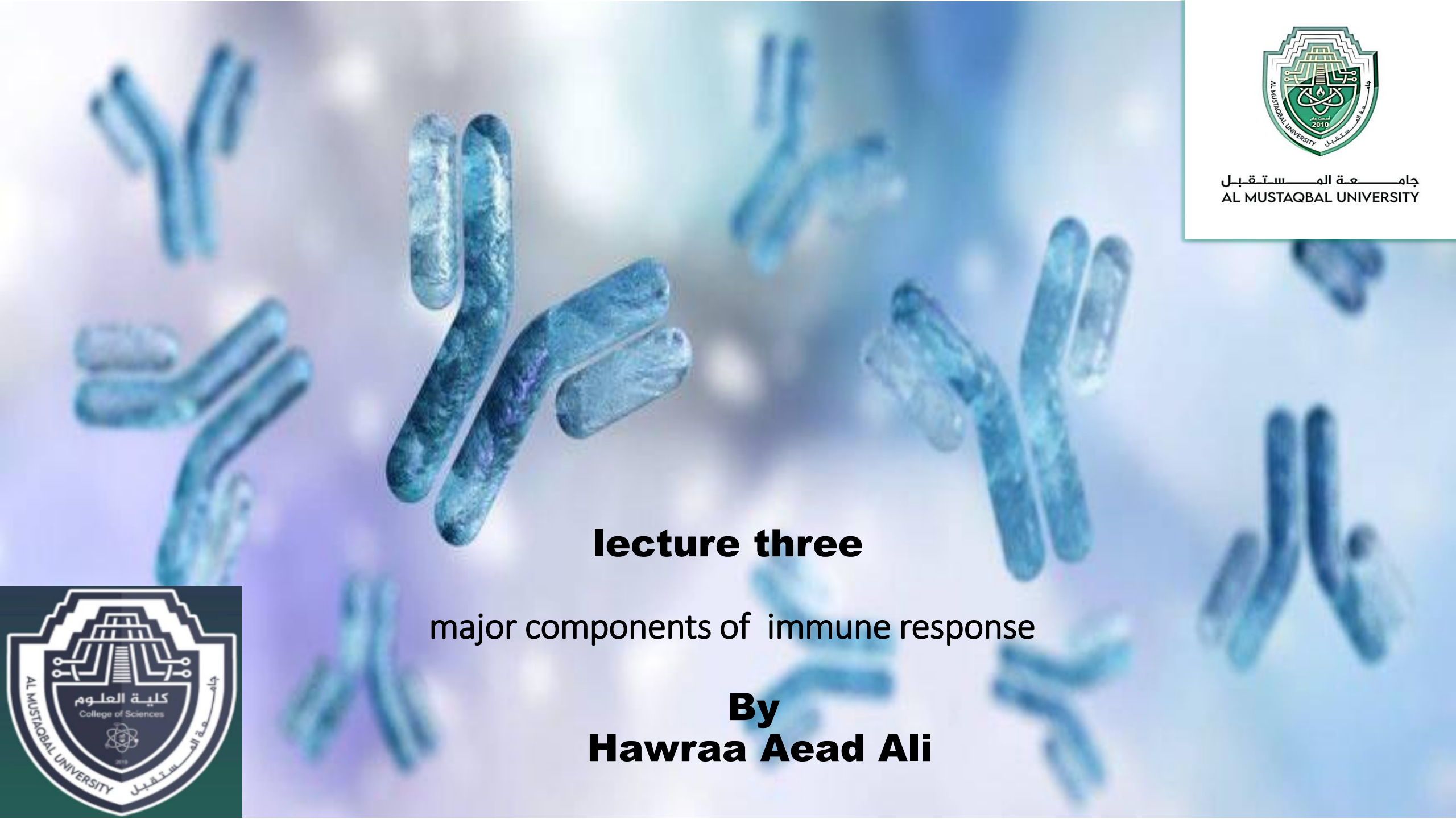

جامعة المستقبل
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# lecture three

major components of immune response


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# major components of  immune response

- The Immune Response Involves Several Key Components That Work Together To Defend The Body Against Harmful Pathogens. Here Are The Major Components:

**1.White Blood Cells (Leukocytes)**

These Are The Primary Cells Involved In The Immune Response, Including:

1. **Phagocytes**: These Cells, Such As Neutrophils And Macrophages, Engulf And Digest Pathogens.
2. **Lymphocytes:** These Include T Cells And B Cells, Which Have Specific Roles In Identifying And Responding To Pathogens.
    1. T Cells: They Help Regulate The Immune Response And Destroy Infected Cells.
    2. B Cells: They Produce Antibodies To Neutralize Pathogens.

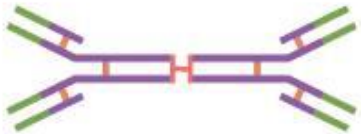
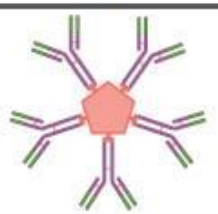
## 2. Antibodies (Immunoglobulins)

An Antibody (Ab) Or Immunoglobulin (Ig) Is A Large, Y-shaped Protein Belonging To The Immunoglobulin Superfamily Which Is Used By The Immune System To Identify And Neutralize Antigens Such As Bacteria And Viruses, Including Those That Cause Disease. Antibodies Can Recognize Virtually Any Size Antigen, Able To Perceive Diverse Chemical Compositions . Each Antibody Recognizes One Or More Specific Antigens.[2][3] Antigen Literally Means "Antibody Generator", As It Is The Presence Of An Antigen That Drives The Formation Of An Antigen-specific Antibody. Each Tip Of The "Y" Of An Antibody Contains A Paratope That Specifically Binds To One Particular Epitope On An Antigen, Allowing The Two Molecules To Bind Together With Precision. Using This Mechanism, Antibodies Can Effectively "Tag" A Microbe Or An Infected Cell For Attack By Other Parts Of The Immune System, Or Can Neutralize It Directly.

# Functions of antibodies

| | |
|---|---|
| Opsonization | They bind to the surface of immunogens and the Fc region interacts with the phagocytes ("calls" them to the site of infection) |
| Neutralization | They stick to antigens and block their attachment sites<br>Stops pathogens from entering the host cells |
| Agglutination | They clump particles together so phagocytosis can occur more efficiently |
| Antibody mediated cytotoxicity | The Fc region of the antibody interacts with eosinophils which release enzymes and reactive oxygen species to attack parasites |
| Complement activation | When antibodies activate a protein that assists in membrane perforation (membrane attack complex) |

# The main classes of antibodies include:

| Name | Properties | Structure |
|---|---|---|
| IgA | Found in mucous, saliva, tears, and breast milk. Protects against pathogens. |  |
| IgD | Part of the B cell receptor. Activates basophils and mast cells. |  |
| IgE | Protects against parasitic worms. Responsible for allergic reactions. |  |
| IgG | Secreted by plasma cells in the blood. Able to cross the placenta into the fetus. |  |
| IgM | May be attached to the surface of a B cell or secreted into the blood. Responsible for early stages of immunity. |  |

## 3. Complement System

The Complement System Is A Group Of Proteins Found In Blood Plasma That Work In Concert With Antibodies To Clear Pathogens And Damaged Cells. It Helps In:

**Pathogen Elimination**: Complement Proteins Can Bind To Pathogens, Making Them More Susceptible To Phagocytosis (This Is Known As Opsonization).

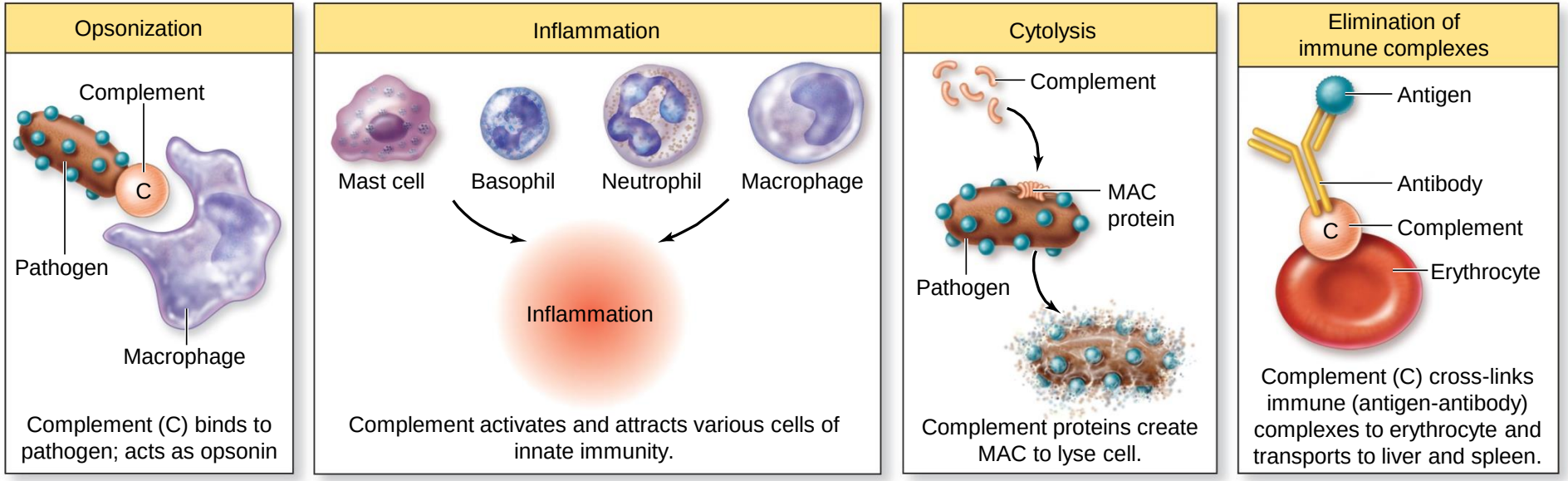
**Membrane Attack Complex (Mac)**: A Cascade Of Complement Proteins Forms The Mac, Which Creates Pores In The Membranes Of Pathogens, Leading To Their Destruction.

**Inflammation**: Complement Proteins Can Trigger Inflammatory Responses, Helping Recruit Other Immune Cells To The Site Of Infection.

# Complement Functions

antimicrobial proteins in plasma – '*complements*' functions of antibodies
They have a number of functions (below) to defend against pathogens






Opsonin – coats pathogen to make appear different and thus recognizable by macrophages
Inflammation - Activates mast cells, basophils, neutrophils, and macrophages to increase inflammatory response -
Cytolysis – causes cell lysis (Big MAC attack)
Eliminates Antigen-Antibody complexes on RBCs killed in spleen

## 4-Cytokines

Cytokines Are Small Signaling Proteins Released By Immune Cells To Communicate And Coordinate The Immune Response. They Include:

**Interleukins (Ils)**: These Are Crucial For Communication Between Leukocytes. They Regulate The Growth, Differentiation, And Activity Of Various Immune Cells.

**Interferons (Ifns)**: These Are Produced In Response To Viral Infections And Help To Prevent Viral Replication In Nearby Cells. They Also Activate Immune Cells, Such As Macrophages And Cytotoxic T Cells.

**Tumor Necrosis Factor (Tnf)**: This Cytokine Is Involved In Inflammation And Can Help Destroy Tumor Cells. It Plays A Role In Both Immune Response And The Development Of Autoimmune Diseases.

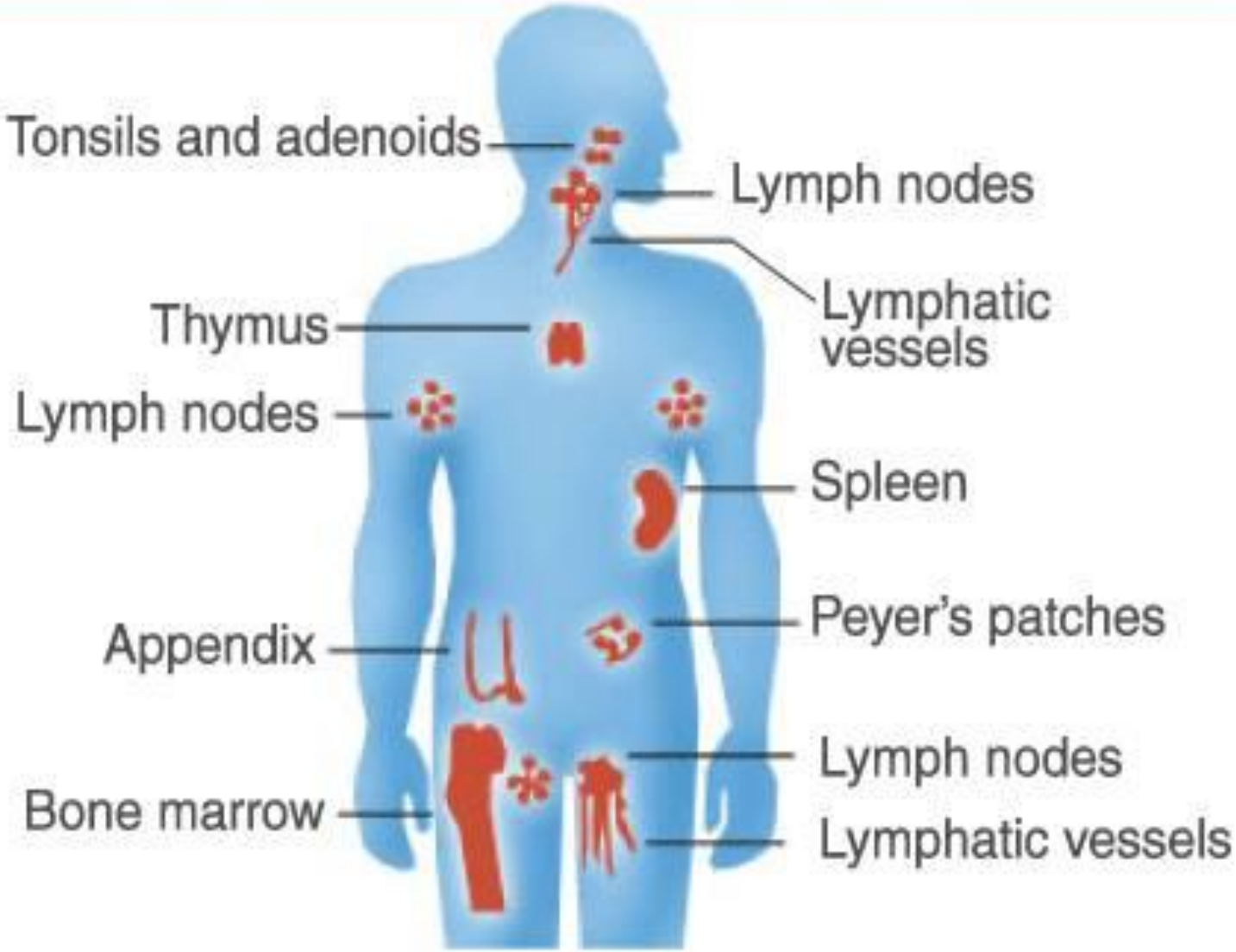
**Chemokines**: These Are A Subset Of Cytokines That Act As Chemical Signals To Attract Immune Cells To The Site Of Infection (Chemotaxis).

# 5. Lymphatic System

The Lymphatic System Is A Network Of Vessels And Organs That Helps Transport Immune Cells And Fluids. It Is Also Responsible For Filtering Pathogens From The Body.

- **Lymph Nodes**: These Act As Hubs Where Immune Cells Can Encounter Antigens. They Also Filter The Lymph (Fluid) That Circulates Through The Body.
- **Spleen**: The Spleen Filters Blood, Removing Damaged Cells, And Helps Coordinate Immune Responses Against Bloodborne Pathogens.
- **Lymphatic Vessels**: These Vessels Carry Lymph (Which Contains Immune Cells) Throughout The Body. They Also Transport Antigen-presenting Cells To Lymph Nodes For T Cell Activation.
- **Bone Marrow**: It Is The Site Of Origin For All Blood Cells, Including Immune Cells Like B Cells And T Cells.

# THE IMMUNE SYSTEM - LYMPHOID ORGANS



## 6. Mucosal Immunity

Mucosal Immunity Protects The Body’s Mucous Membranes (E.G., In The Gastrointestinal, Respiratory, And Urogenital Tracts) From Pathogens.

- **Mucosal-associated Lymphoid Tissue (Malt)**: This Includes Structures Like The Tonsils And Peyer's Patches In The Intestines, Where Immune Cells Are Located To Respond Quickly To Pathogens.
- **Secretory Iga**: This Antibody Is Present In Mucosal Areas And Plays A Critical Role In Neutralizing Pathogens Before They Can Enter The Body.
- **Epithelial Cells**: These Cells Act As A Barrier To Infection In Mucosal Tissues And Can Also Produce Antimicrobial Peptides.

## 7. The Major Histocompatibility Complex (MHC)

- **MHC Class I**: Found On All Nucleated Cells, These Molecules Present Intracellular Antigens (E.G., From Viruses) To Cytotoxic T Cells.
- **Mhc Class Ii**: Found On Specialized Antigen-presenting Cells, These Molecules Present Extracellular Antigens (E.G., From Bacteria) To Helper T Cells.


THANK YOU