




IMMUNOLOGY

INTRODUCTION


Immunology is the branch of biomedical science which covers the study of all the aspects of the immune system in all organism.

- ▶ It deals with the physiological functioning of the immune system in states of both health and disease.
 - ▶ What does IMMUNE mean ?
 - ▶ It is derived from Latin Immunis = exempt.
- 


- ▶ The immune system is made up of a complex network of :
 - ▶ lymphoid organs
 - ▶ Cells
 - ▶ Humoral factors &
 - ▶ Soluble cellular messengers or cytokines
- 


- ▶ These enables us to recognize ‘self ‘from ‘non self’ or altered self and thereby provides the protection against the disease.
 - ▶ The most common clinical problems are :
 - ▶ Over activity of immune response leading to allergic and autoimmune disease.
 - ▶ Under activity resulting in immunodeficiency.
- 

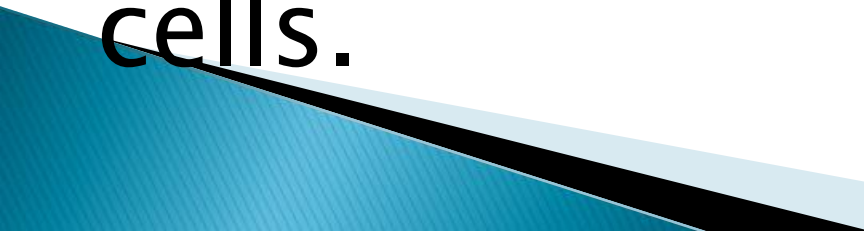
THE LYMPHOID ORGANS OF IMMUNE SYSTEM


- ▶ PRIMARY LYMPHOID ORGANS :
 - ▶ 1. THYMUS.
 - ▶ 2. BONE MARROW.
 - ▶ SECONDARY LYMPHATIC TISSUE:
 - ▶ SPLEEN, TONSIL, LYMPH VESSEL, LYMPH NODES, ADENOIDS, SKIN & LIVER.
- 

LYMPHATIC SYSTEM

- ▶ It is the part of circulatory system.
 - ▶ Consists of a network of lymphatic vessels which carry a clear fluid called lymph directionally towards heart..
 - ▶ Lymph word is derived from Latin lymph meaning water.
- 

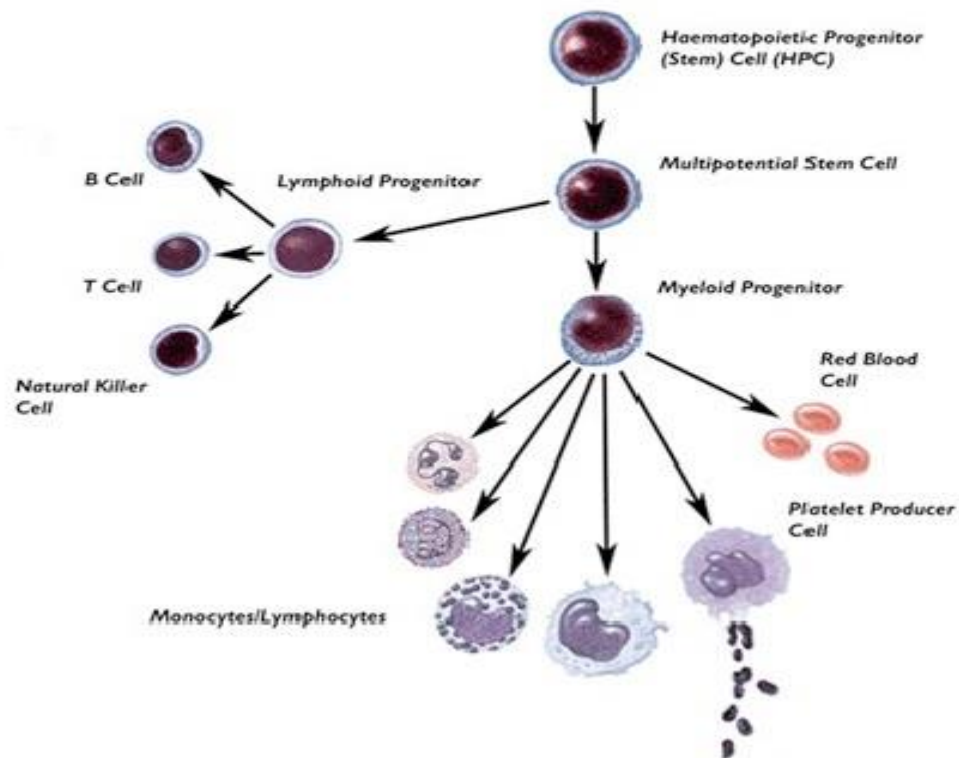
- ▶ Lymphatic system was first described by Olaus Rudbeck and Thomas Bartholin.
 - ▶ Functions of lymph system is to provide an accessory rout to return the 3 liters of blood lodged in the interstitial fluid.
 - ▶ Note: around 20 liters of blood is processed through capillaries filtration which separates plasma leaving blood cells. 17 liters of filtered plasma get reabsorbed in the blood vessels.
- 

- ▶ The other main function of lymphatic is defense in the immune system.
 - ▶ Thymus and bone marrow constitute the primary lymphoid organs of our body.
 - ▶ Bone marrow is responsible for the creation of both T- cells and production & maturation of B- cells.
- 

- ▶ From bone marrow the B- cells immediately joins the blood system and travel to secondary lymphoide organs in search of pathogens.
 - ▶ T-cells on the other hand travel from bone marrow to thymus for further maturation.
 - ▶ The matured T-cells joins B-cells in search of pathogens.
- 


TERMINOLOGY USED IN IMMUNOLOGY

Immune System layout




- ▶ **Plasma:** yellow liquid component of blood in which blood cells are suspended.
- ▶ **Hematocrite:** proportion of blood volume that is occupied by RBC'S.
- ▶ **WBC'S:** monocytes, granulocytes and leukocytes → T-cells which are time memory . B-cells which are Antibodies & Natural killer cells which are non specific.

T-CELL RECEPTOR (TCR)

- ▶ T-lymphocytes are different from B & N K cells
 - ▶ They have special receptor on their surface called T-cell receptor(TCR)
 - ▶ When TCR comes in contact with an antigen the T-cell matures and changes into one of the five things:
- 


- ▶ **1. A Helper T-cell:** which divides rapidly and secretes tiny proteins(cytokines), that helps in immune response.
- ▶ **2. A cytotoxic T-cell:** which destroys virally infected cells & tumor cells.
- ▶ **3. A memory T-cells:** which remains active after immune response , and helps body remember the specific antigen that attacked it.

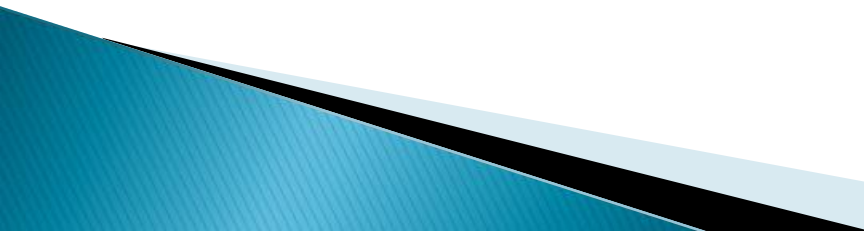
- ▶ **4. A regulatory T–cells:** They are responsible for shutting down the T–cell reaction after an immune response is over.

 - ▶ **5. A Natural killer T–cell:** which are responsible for recognizing different types of antigens.
- 

B-LYMPHOCYTES


- ▶ Their primary role is to make antibodies to attack the antigens.

 - ▶ Once a B-cell has come in contact with an antigen it becomes a memory B-cell; meaning it will remember that specific antigen if the body is ever attacked by it again.
- 

- ▶ **Flow cytometry:** it is the process of counting and measuring cells. The hospital & clinics use flow cytometry to test their patients for HIV, AIDS etc.
 - ▶ **Compliment:** A series of serum protein involved in mediation of immune reaction. The cascade is triggered classically by the interaction of antibody with specific antigen.
- 

Complement components

An enzymatic system of serum proteins triggered by the classical & alternative pathway and resulting in target cell lysis, phagocytosis, opsinization & chemotaxis.





Complement Receptor(CR)

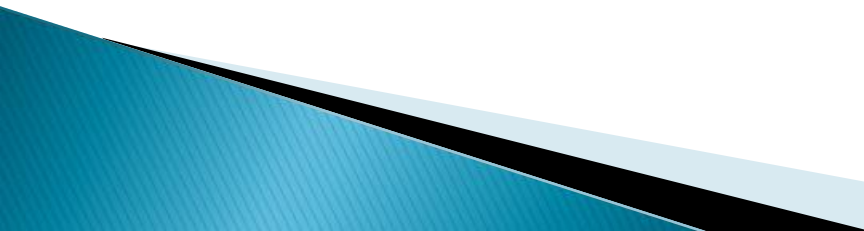
- ▶ A structure found on erythrocytes, neutrophils, monocytes and macrophages that binds C3 fragments.
- ▶ **Determinant:** Part of antigen molecule which binds to an antibody combining site or to a receptor of T-cell.

▶ Hapten:

- ▶ A compound of low molecular weight which is not immunogenic but after conjugation to a carrier protein of cell, becomes immunogenic & induces antibody.

- ▶ **Heavy chain:** The larger parts of the two types of chains that comprises of a normal immunoglobulin or antibody molecules.
 - ▶ **Humoral immunity:** An immune reaction that can be transferred with immune serum is termed Humoral immunity.
 - ▶ **In contrast**
- 

- ▶ **Cell mediated immunity:** It is the delayed immunity reaction leading to phagocytosis which takes 24–48 hours to set.
 - ▶ **Hybridoma:** A hybrid cell that results from the fusion of an antibody– secreting cells with malignant cell.
- 

- ▶ **Hypersensitivity:** It is the state of reactivity of individual's immune system to antigen that is greater than normal for the antigenic cell.
 - ▶ **Immunoglobulin (Ig):** A general term for all antibody molecules. Each Ig unit is made up of 2 heavy chains & 2 light chains & has 2 antigen binding sites.
- 

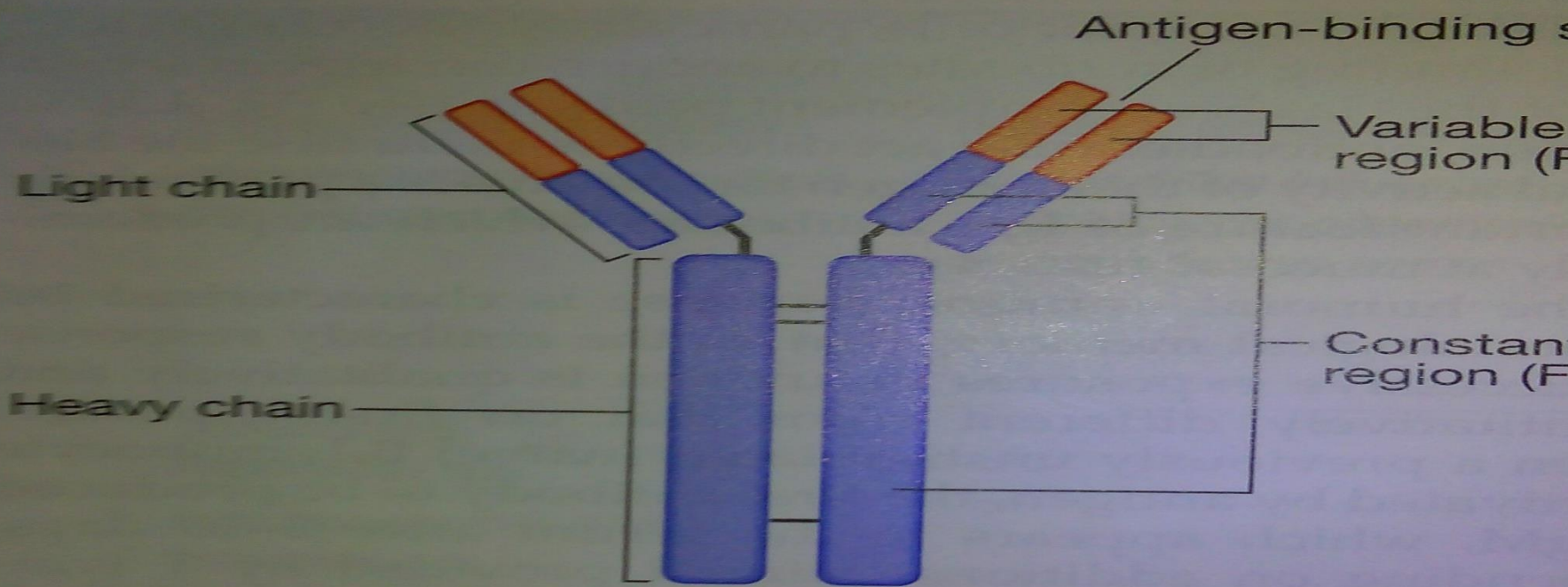





Fig. 4.5 The structure of an immunoglobulin (antibody) molecule

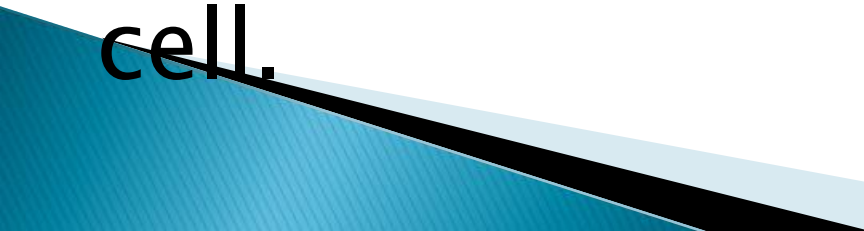
cytes, stimulated antigen-specific B cells respond by rapidly proliferating in a process known as clonal expansion. This is accompanied by a highly complex series of gene rearrangements which generates B-cell populations that express receptors with greater affinity for antigen than the original. These cells differentiate into either plasma cells


- ▶ **Major Histocompatibility complex(MHC):** A cluster of genes on chromosome 6 in humans they are 2 MHC-I & MHC-II. In humans they are known as **Human Leukocyte antigen(HLA)**.
- ▶ **Mast cells:** Tissue located cells derived from Basophils. It possesses receptors for Fc of IgE. It participates in immediate hypersensitivity reaction.

- ▶ **Monoclonal: single clone.**
 - ▶ a clone is the progeny of a single cell.
 - ▶ In immunology monoclonal generally describes a preparation of antibody that is monogenous or cells of a single specificity.
- 

- ▶ **Monocytes:** A large circulating white blood cell 2–10% of total white cells.
 - ▶ They are phagocytic.
 - ▶ It migrates to tissues where it is k/a macrophage.
- 

- ▶ **Myeloma:** A tumor of plasma cells.
 - ▶ **Opsonin:** A substance usually an antibody/complement which coats the bacterium and enhances phagocytosis by phagocytic cells.
 - ▶ **Opsonization:** literally means “preparation to eat”.
- 

- ▶ **Passive immunization:** Immunization by the administration of preformed antibody into a non-immune individual.
 - ▶ **Phenotype:** The physical expression of the an individual genotype.
 - ▶ **Pinocytosis:** Ingestion of liquid or very small particle by vesicle formation in a cell.
- 

- ▶ **Plasma cell:** End-stage differentiation of B-cell to an antibody-producing cells.
 - ▶ **Polymorphysim:** Means having many shapes but in genetics it means occurring in more than one form in same species.
- 

▶ **Polymorphoneuclear leukocytes (PMNL):** They are white cells e.g.

▶ Granular Neutrophils

▶ Phagocytic Basophils

▶ Eosinophils



- ▶ **Prophylaxis:** protection.
 - ▶ **Radioimmunoassay(RIA):** A widely used technique for measurement of primary antigen–antibody interactions.
 - ▶ **ELISA(Enzyme linked immunosorbent assay):** An assay in which an enzyme is linked to an antibody and a colored substance is used to measure the activity of antibody.
- 