CHAPTER NO. 13

IMMUNITY

KEY POINTS

- Immunology = The branch of biology in which we study about immune systems.
- Immune system = The defensive system of the body against pathogens or parasite.
- Defensive system of the body consists of 3-lines.
- First line of defense, Second line of defense and Third line of defense.
- First and second lines of defense are non-specific in nature.
- Third line of defense is specific in nature.
- First line of defense consists of skin, eyes, nose, ear, mouth and stomach.

FIRST LINE OF DEFENSE

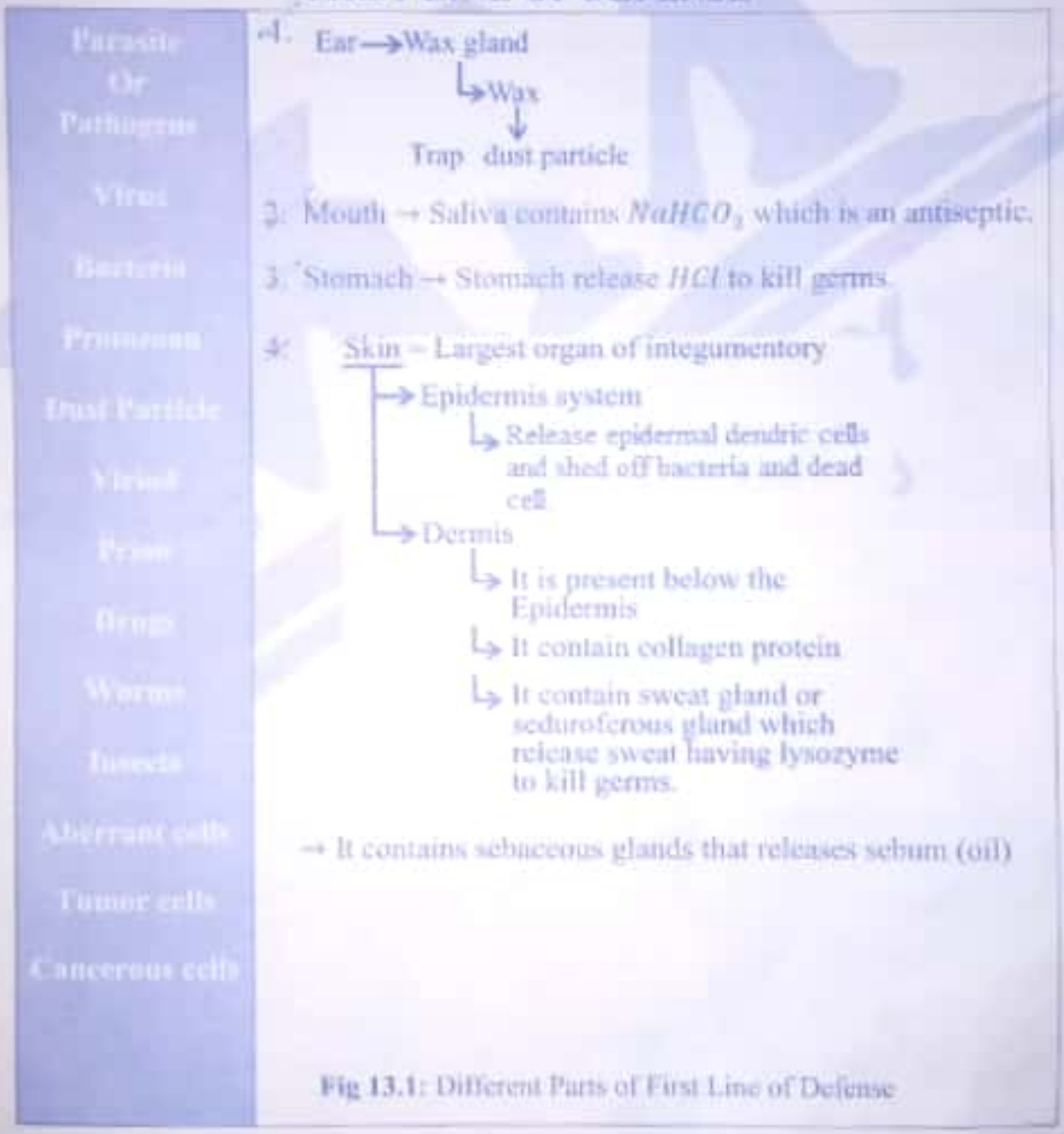

Fig 13.1: Different Parts of First Line of Defense

SECOND LINE OF DEFENSE

1. Basophil → Basophil release enzyme to digest bacterial cell wall.
2. Eosinophil → Eosinophil digest the bacterial cell by releasing lysozyme enzyme.
3. Monocyte → Bone Marrow [Stem cells]

↓

Pro monocyte

↓

[Monocyte]

↓

[Macrophage]

- Largest type of W.B.C is Macrophage
- Macrophage removes pus e.g. Alveolar macrophage, lungs organ/tissue, Kupffer cells of liver

4. Neutrophils = Dead neutrophils is called pus.

- Neutrophils release H_2O_2 to destroy cell of parasite.
- Common type of W.B.C
  Natural killer cells = Natural killer cell release granzymes.
- Granzymes consist of protease and perforin to digest bacterial cell wall.
- Natural killer cell is a type of lymphocyte and is component of innate immune system.
- The cells in blood that detect pathogenic bacteria and signal the component system to get work are macrophages.

5. Pyrexia or Fever

Bacteria → Release Toxic material

↓

Pyrogens → Disturb set point of hypothalamus

↓

Temperature Increase

↓

Germs or toxic material are destroyed

6. Antibody = (Complementary System)

- Antibody consists of four polypeptide chains which capture bacteria and destroys them. Antibody is produced by B-cells.
- Interferon = It is specific for the virus. Interferon
  - Alpha, Beta] Produced by W.B.C and
  - Gamma] Produced by T-cell

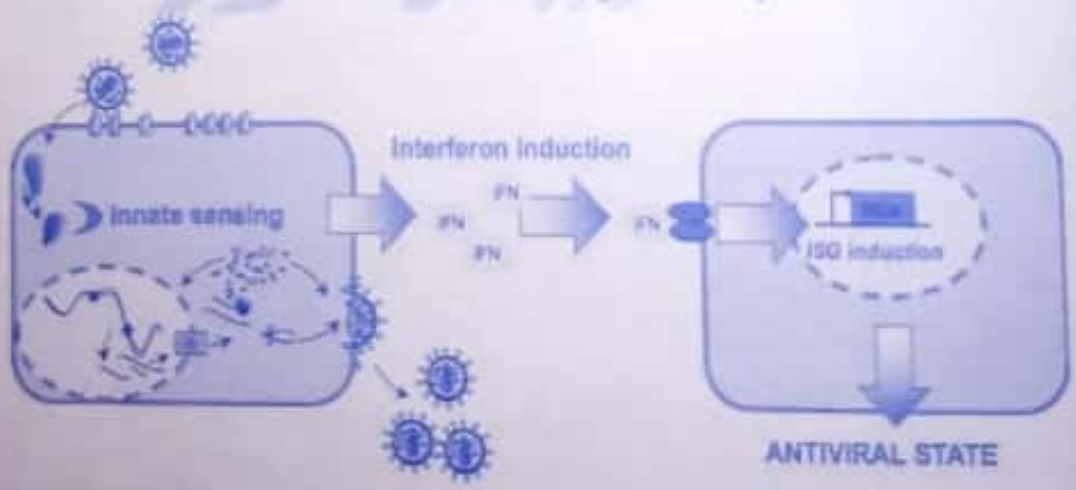

Fig 13.2: Mechanism of interferon

- Inflammatory response = Tissue damage through accidental release of serotonin, bradykinin and histamine which causes inflammation by producing heat so and attracting WBC's so that parasite can't enter further into the body.

THIRD LINE OF DEFENSE

- Cell mediated response: Cells are involved to destroy the parasite.
- Helper T-cells (CD_4 cells) scan the body and capture parasites and is presented in front of B-cells to destroy them and memory B-cells are formed.
- Killer T-cells directly kill the parasite and memory killer T- cells are produced.
- Cytotoxic T-cells directly kill the parasite.
- Suppressor T-cells suppress the activity of B-cells to prevent from over sensitivity.
- Antibody mediated response or Humoral response:
  Antibodies are produced by B-cells. Such antibodies are attached on the surface of B-cells to identify the parasite
- B-cells are produced and mature in Lymph Nodes (B-cells are called B-cell due to "Born of fabrics")
- T-cells are produced in Bone Marrow while mature in thymus gland (Backside of sternum).
- Programme cell death e.g. RBC is called Apoptosis while accidental cell death is called Necrosis.
- The cell death due to parasite or pathogen is called cell lysis.
- Ig G activate complementary systems. First line of defense: skin is the largest organ of the integumentary system
- Skin provide insulation, temperature sensation and temperature regulation
- Skin contains epidermis which is composed of multiple layers of tightly packed cells in which few pathogens can penetrate on their own.
- Epidermal dendritic cells actively patrol the skin to phagocytize pathogens.

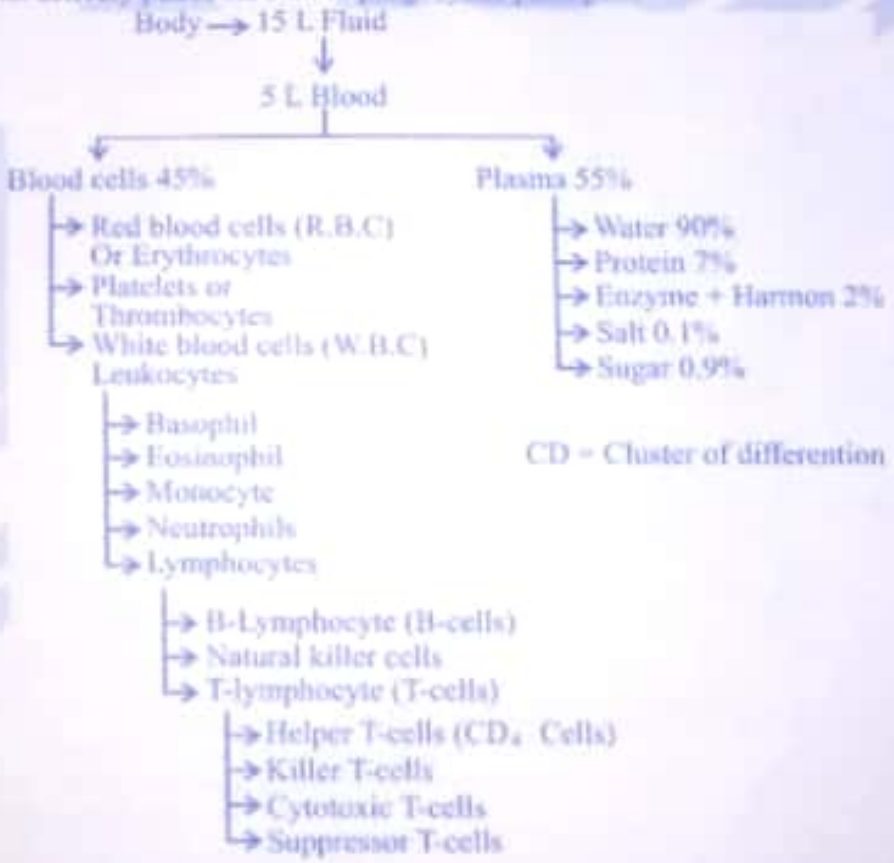

Fig 13.3: Composition of Blood

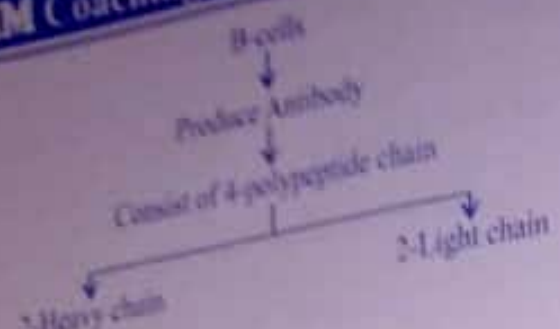

Fig 13.4: B-Cells

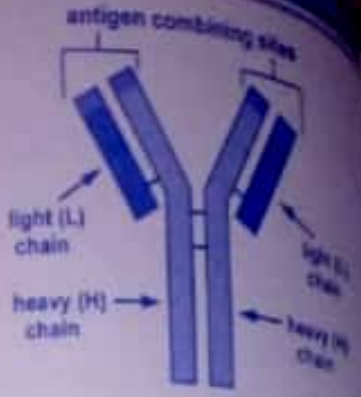

Fig 13.5: Structure of antibodies

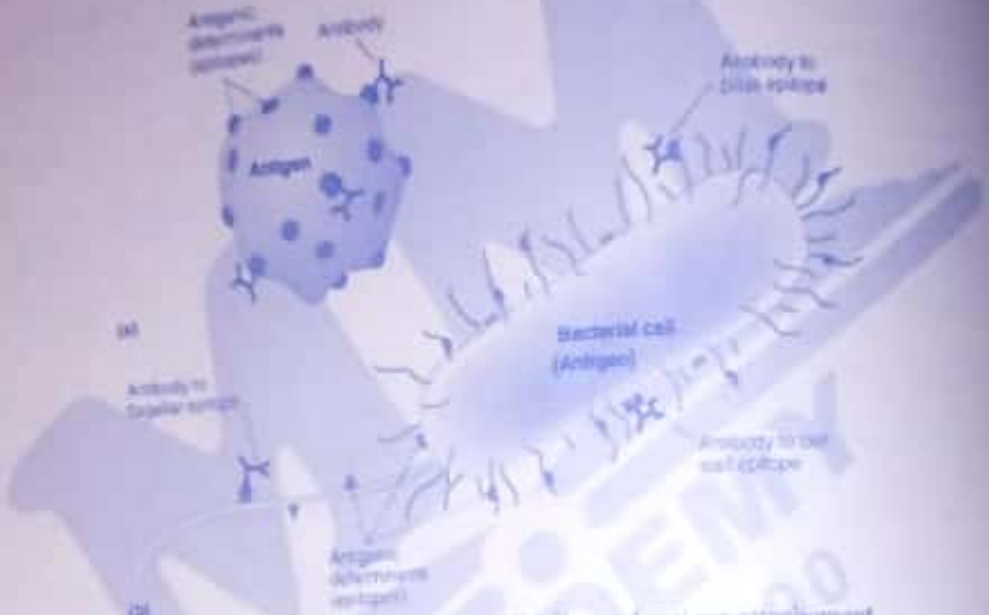

Fig 13.6: Mechanism of antibodies and antigen attachment

- Epitope Antibody or immunoglobulin (GAMLD)

Ig A
Ig D
Ig M
Ig G
Ig E

Types of Antibody

Fig 13.7: Types of Immunity

VACCINATION:

- The process of administering vaccine is called vaccination.

VACCINE:

- The word vaccine is derived from Latin word *Vacca* which means "Small pox"
- First vaccine was produced by Edward Jenner by performing experiment on his 8-year-old son James Philips.
- First vaccine was produced from Cow pox.
- First vaccine was produced for Small pox.
- The word vaccine was used by Louis Pasteur.
- Vaccine is an immunobiological substance which activate the immune system of the body.
- Sabin is live vaccine and salk is killed vaccine.

ALLERGY:

- Over production of Ig E or over sensitivity of a body is called Allergy.
- If neither of the parents are allergic so the chances of allergy in their offsprings will be 15%.
- If one of the parents is allergic, the chances of occurrence of allergy in their offsprings will be 30%.
- If both the parents are allergic, the chances of occurrence of allergy in their offsprings will be 60%.
- Allergy is caused by Allergens.
- The risk of developing allergies is genetic.
- The most common allergic conditions include hay fever (allergic rhinitis), asthma, allergic eyes (allergic conjunctivitis) and allergic shock (also called Anaphylaxis and Anaphylactic shock).

AUTOIMMUNE DISORDERS:

- When abnormal antibody attack on our body tissue and is considered as a foreign particle is called. Autoimmune disorders e.g. Lupus, Juvenile rheumatoid Arthritis, scleroderma, Ankylosing spondylitis and Juvenile dermatomyositis.
- Lupus: Kidney is considered as a foreign part.
- Juvenile rheumatoid arthritis: Abnormal antibody attack on ligament (type of cartilage which is present between two bone) and is considered as a foreign particle.
- Scleroderma: When antibody attack on skin and consider it as a foreign particle.
- Ankylosing spondylitis: When abnormal antibody attack on vertebral disc and consider it as a foreign particle.
- Juvenile dermatomyositis: When abnormal antibody attack on muscle and considers called Juvenile dermatomyositis.

ROLE OF T-CELLS AND B-CELLS IN TRANSPLANT REJECTION:

- Identical twins (Maternal twin) and cloned tissues are MHC matched and are therefore not subject to T-cell mediated rejection.
- MHC is involved in the organ rejection or acceptance.
- MHC gene is present on chromosome number 6.
- Rheumatoid arthritis is an autoimmune disease where the body perceives tissue in the joint as being foreign object and fights them through immune response.
- Pyrogens cause the set point to increase.
- While antipyretic drugs such as aspirin and paracetamol lower the "set point"
- Examples of pyrogens are:
  many proteins, break down product of protein and lipopolysaccharide toxin.
- These pyrogens are extremely potent since little as few nanograms = 1billion of a gram.
- Attachment of antigen to phagocytes is called opsonization.
- All components pathways carry out 6 beneficial innate response.
- T-cell occur both in blood and lymph.
- Antigen are present on the blood cells.
- Antigen are present both in plasma and lymph.
- Rh-factor and Anti-A-Antibody and Anti-B anti body in blood are Igm.
- Igm normally protect body from pathogens only.