

Course Title – Immunology

Course Code: L.Sc. – 204

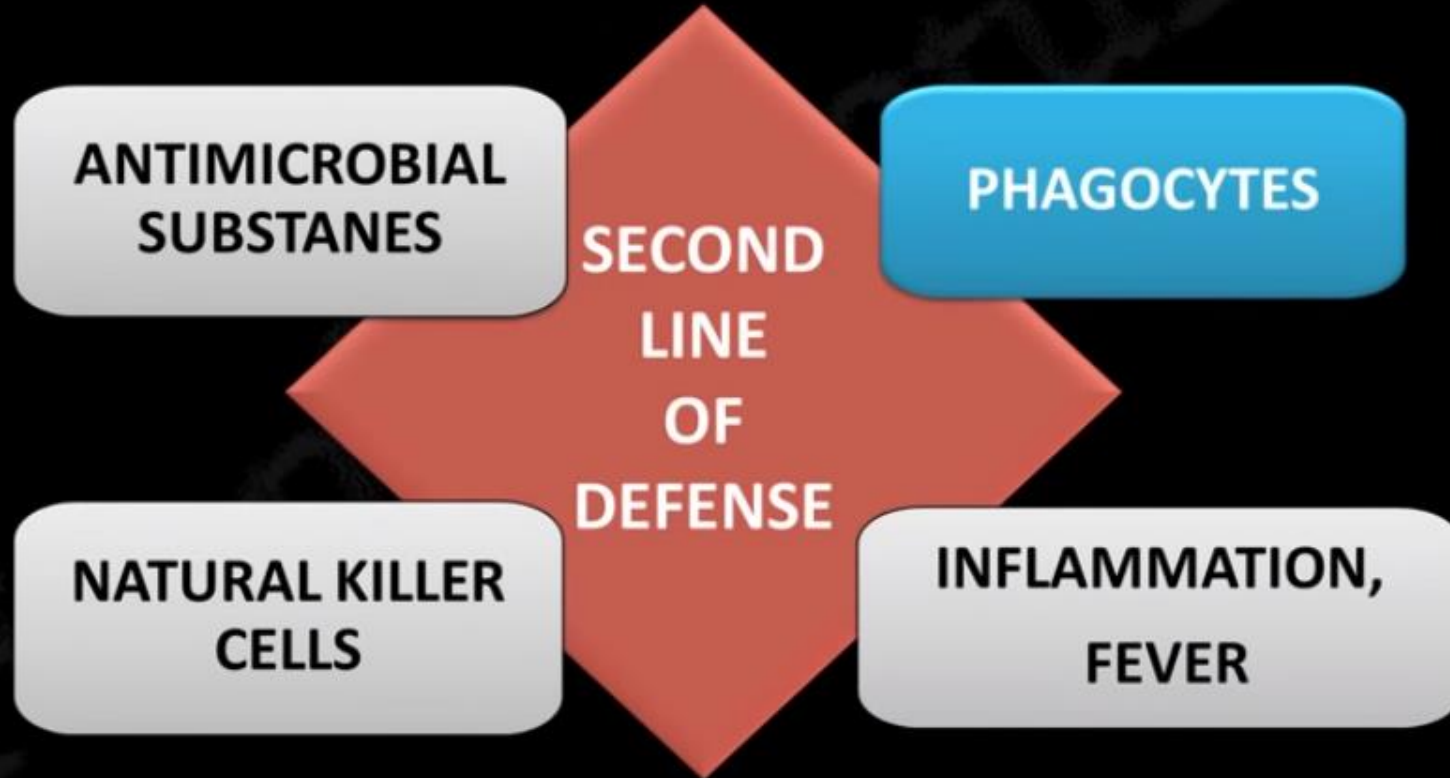
Marks: 50

S.No.	Topic
1.	Introduction to Immune System, organs, cells and molecules involved in innate and adaptive immunity. Mechanisms of barrier to entry of microbes/pathogens
2.	Hematopoiesis and its regulation: Differentiation of stem cells to different cellular elements in blood, role of cytokines.
3.	Introduction to inflammatory reaction chemokines, adhesion molecules, migration of leukocytes to the site of infection, phagocytosis and microbicidal mechanisms Immediate hypersensitivity role of eosinophils, and mast cells. Asthma. IgE receptor, prostaglandins and leukotrienes
4.	Receptors of innate immunity Toll-like receptors and sensing of PAMPs, signal transduction, opsonization, Fc receptors
5.	Antigens, antigenicity, and immunogenicity B and T cell epitopes
6.	Antibody structure and function (classification of immunoglobulins, immunoglobulin domains, concept of variability, isotypes, allotypes and idiotypic markers). Antigen-antibody interactions
7.	Immunoglobulin genes, VJ/VDJ rearrangements and genetic mechanisms responsible for antibody diversity, affinity maturation, allelic exclusion Class switching, receptor and soluble forms of immunoglobulin
8.	Hybridoma, monoclonal antibodies, and antibody engineering
9.	Immunological Techniques (antibody generation, detection of molecules using ELISA, RIA, Western blot, immunoprecipitation, flow cytometry, immunofluorescence microscopy etc.)
10.	The complement system: classical and alternative pathways

Phagocytosis

- Source: Youtube

Phagocytosis



Phagocytosis

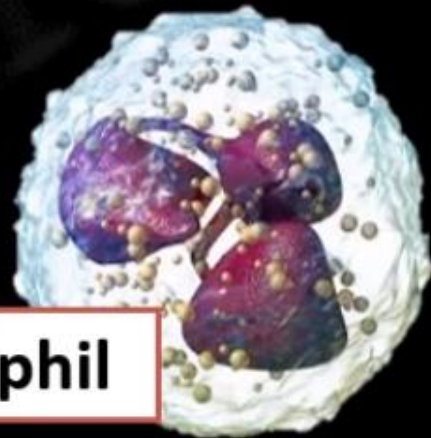
- In Greek “phagein” means to eat; “cyte” means cell and “osis” means a process.
- Phagocytosis is used by phagocytic cells to get rid of pathogens which have breached first line of defense.

PHAGOCYTES

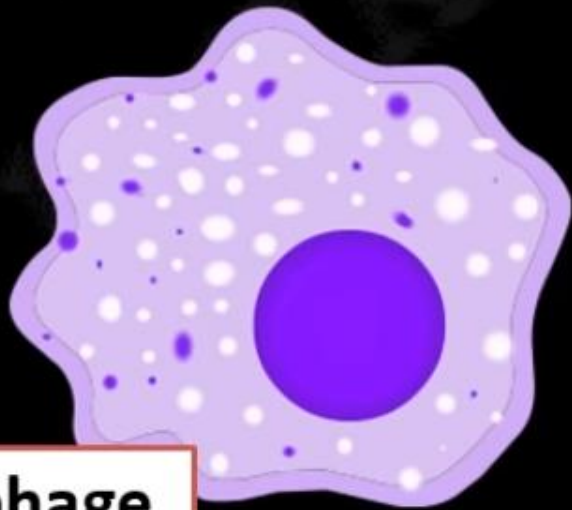
Monocyte



Neutrophil



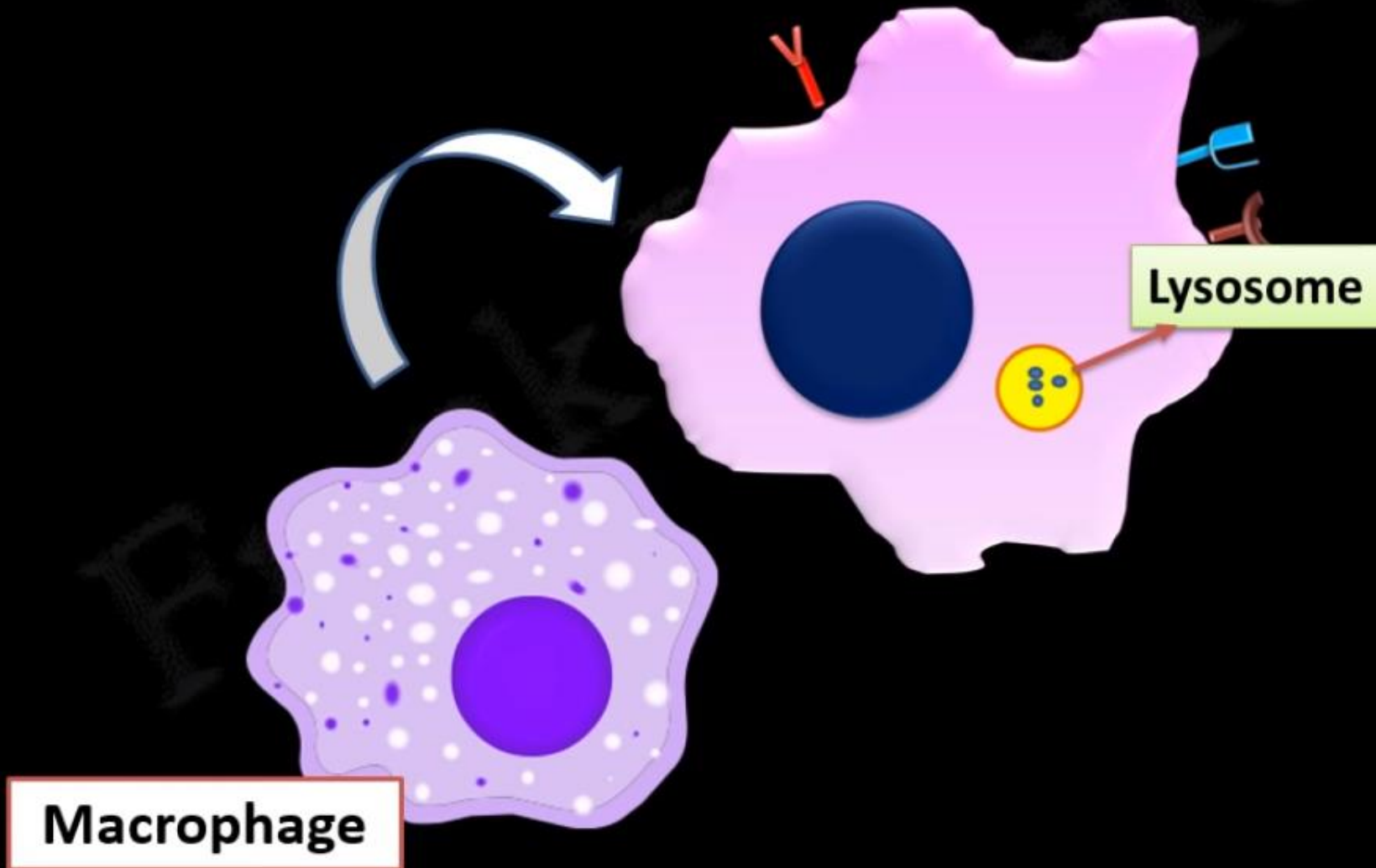
Macrophage



Dendritic Cell



PHAGOCYTES



Microbicidal substances:

- Lysozyme
- Nucleases
- Proteases
- Lipases
- Hydrogen peroxide

PHAGOCYTES

- Special group of phagocytic cells
- Perform **Antigen Processing and Presentation** in Adaptive Immune System



Dendritic Cell

MECHANISM OF PHAGOCYTOSIS

1

Recognition of invading microbe

2

Ingestion and formation of phagosome

3

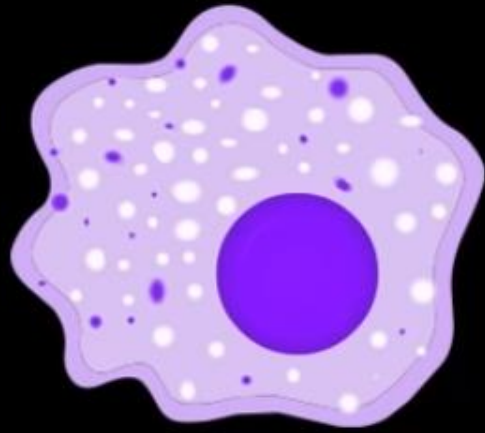
Formation of Phagolysosome

4

Microbial Killing and formation of residual body

5

Elimination or Exocytosis



PRRs

**Pattern Recognition
Receptors**

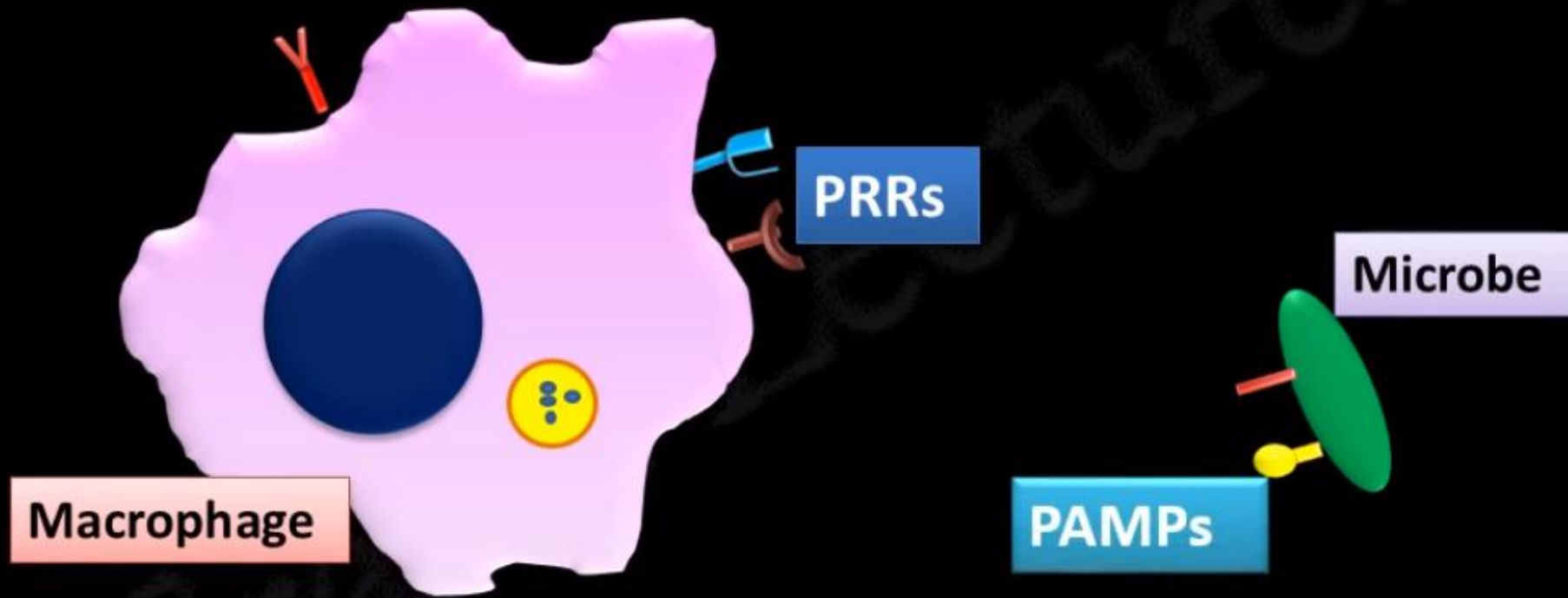


Recognize

PAMPs

**Pathogen-Associated
Molecular Patterns**

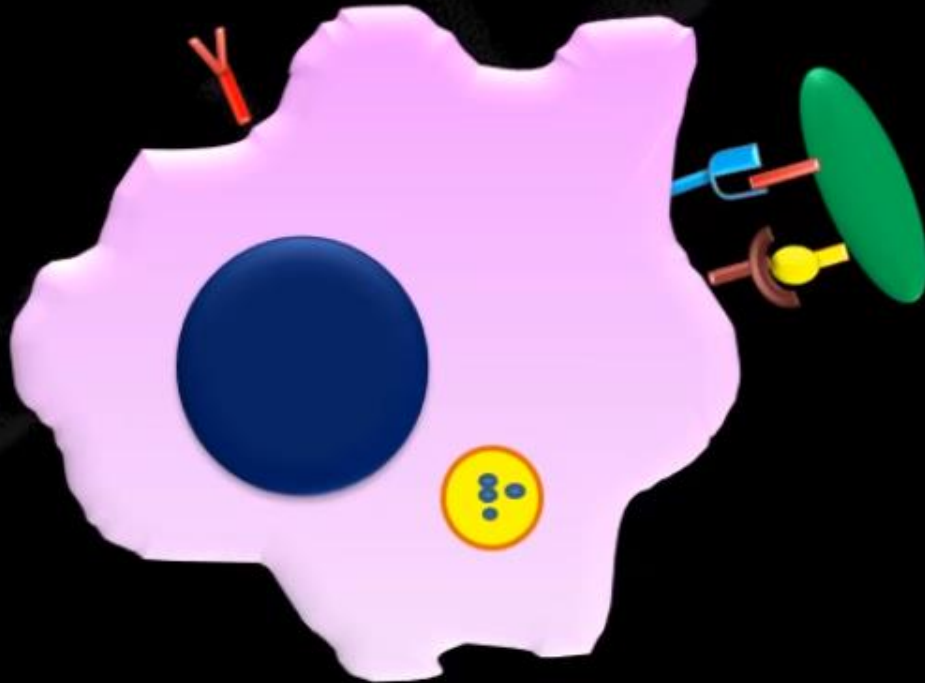




PROCESS OF PHAGOCYTOSIS

1

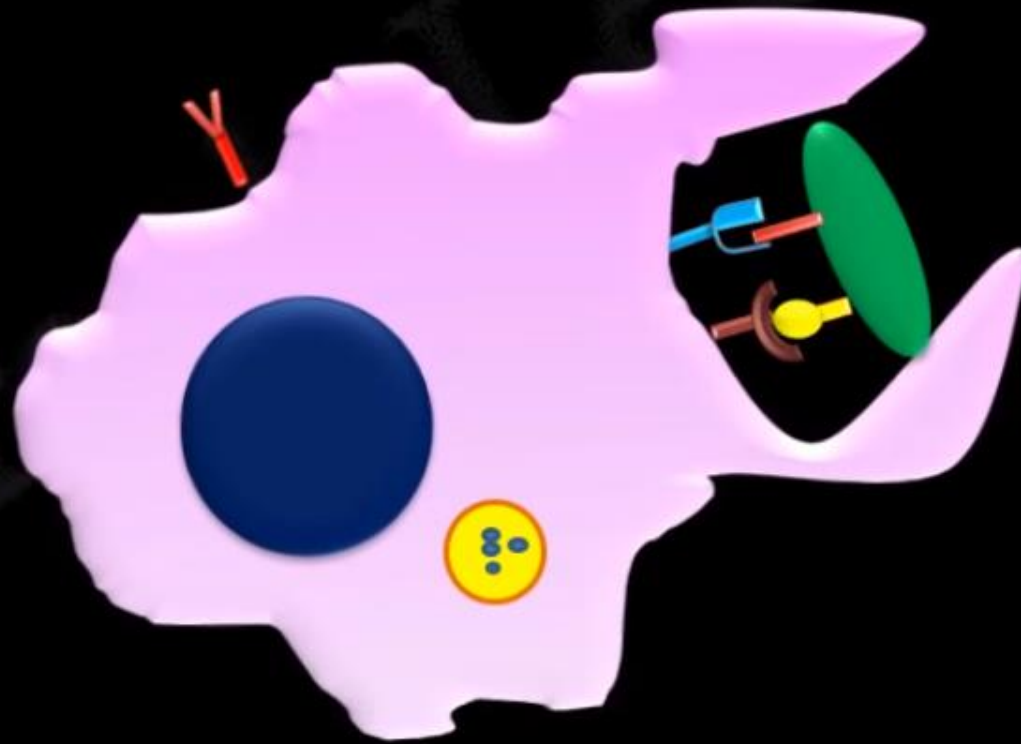
Recognition of invading microbe



PROCESS OF PHAGOCYTOSIS

2

Ingestion and formation of phagosome

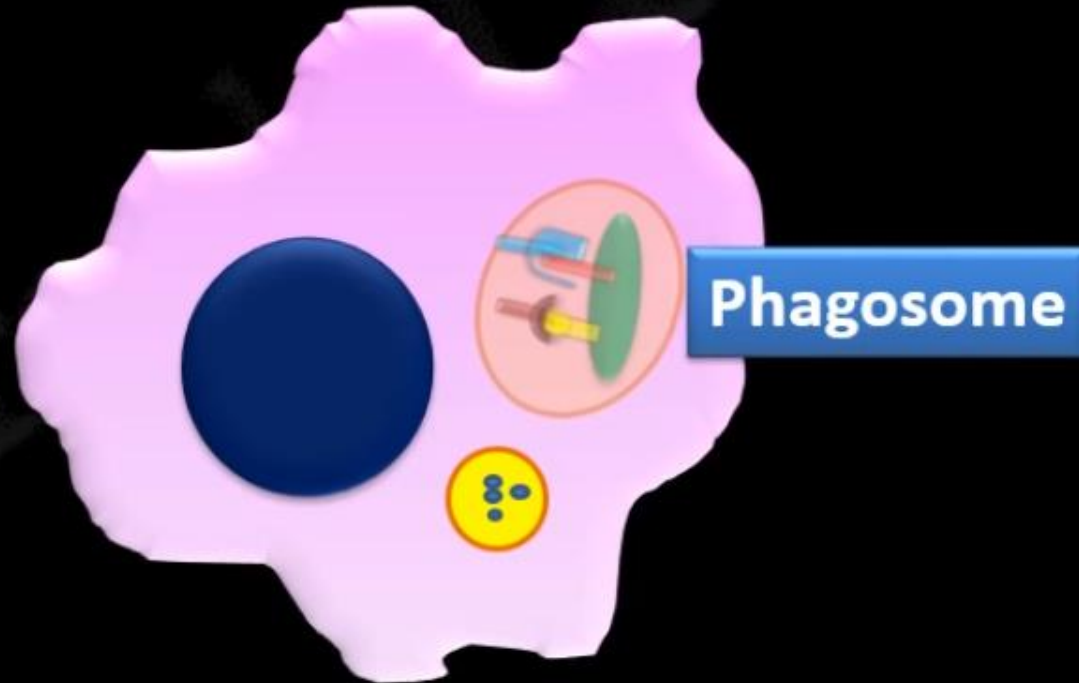


*Plasma membrane
of the phagocyte
surrounds the
bound pathogen*

PROCESS OF PHAGOCYTOSIS

2

Ingestion and formation of phagosome



PROCESS OF PHAGOCYTOSIS

3

Formation of Phagolysosome



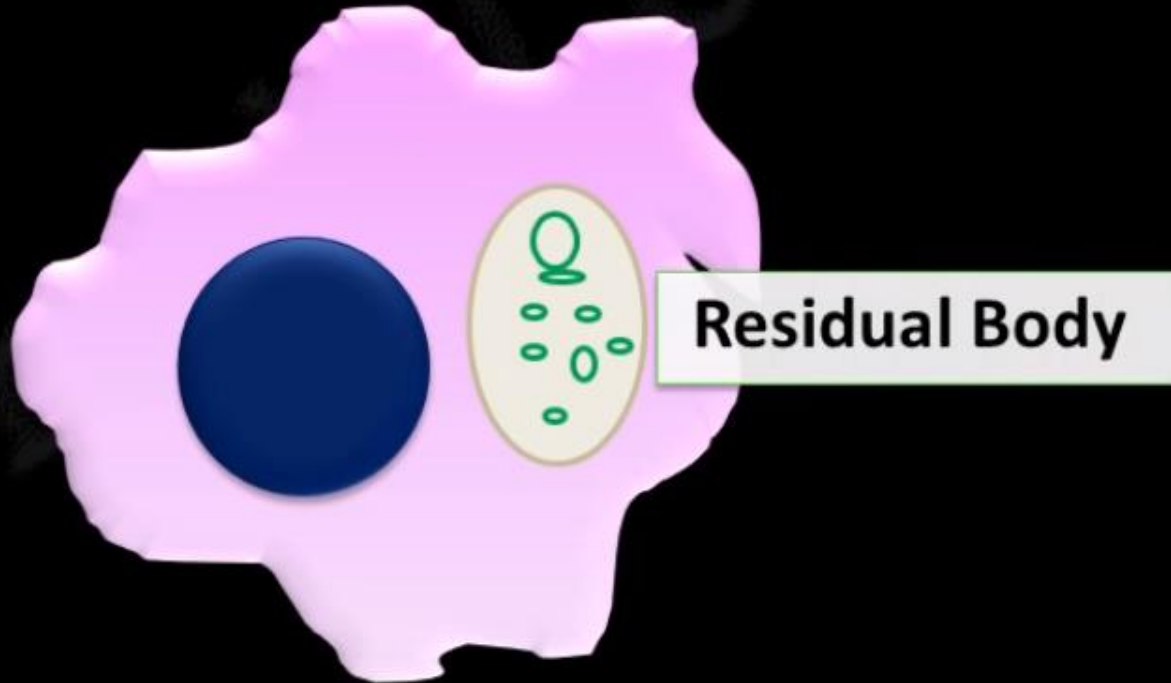
Fusion of lysosome and phagosome

Phagolysosome

PROCESS OF PHAGOCYTOSIS

4

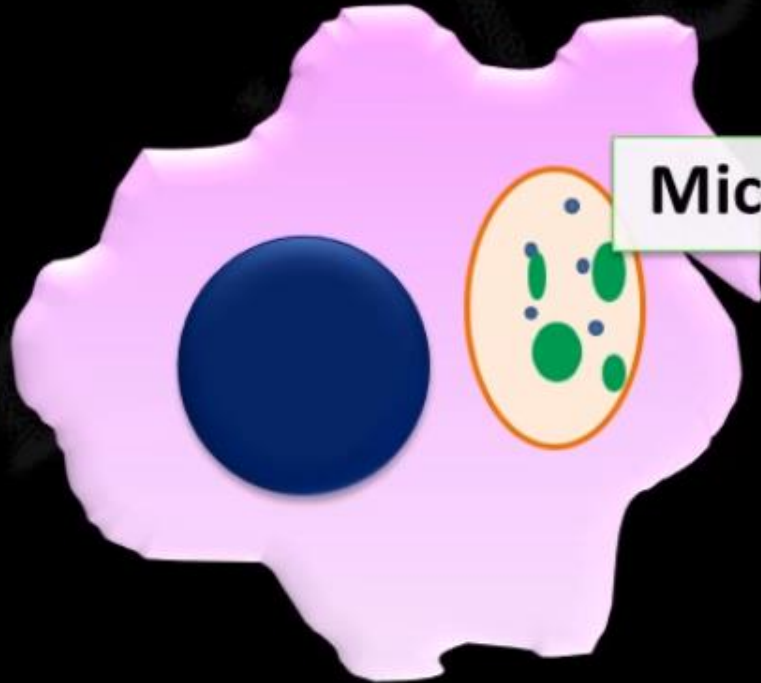
Microbial Killing and formation of residual body



PROCESS OF PHAGOCYTOSIS

4

Microbial Killing and formation of residual body

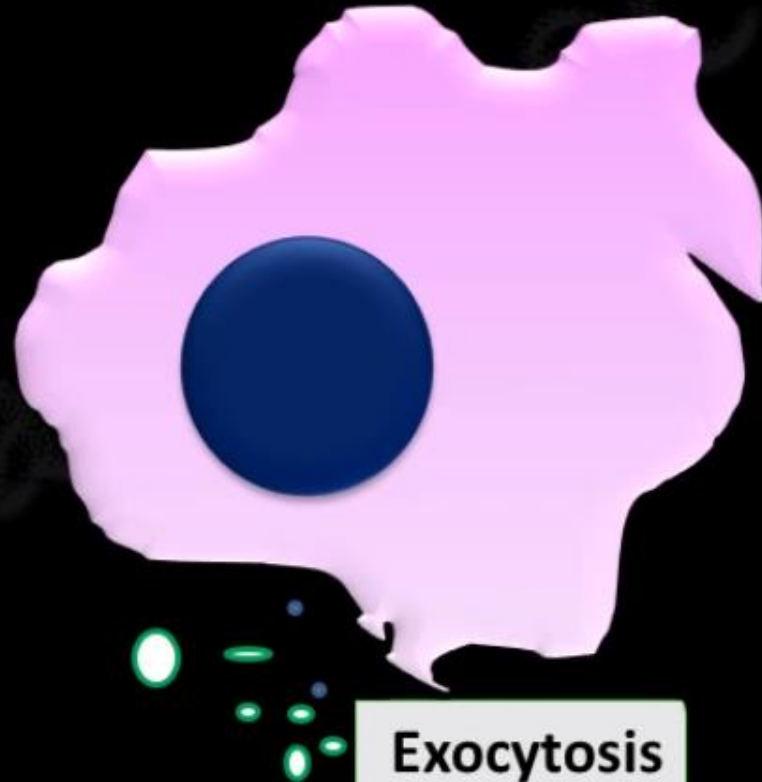


Microbial killing

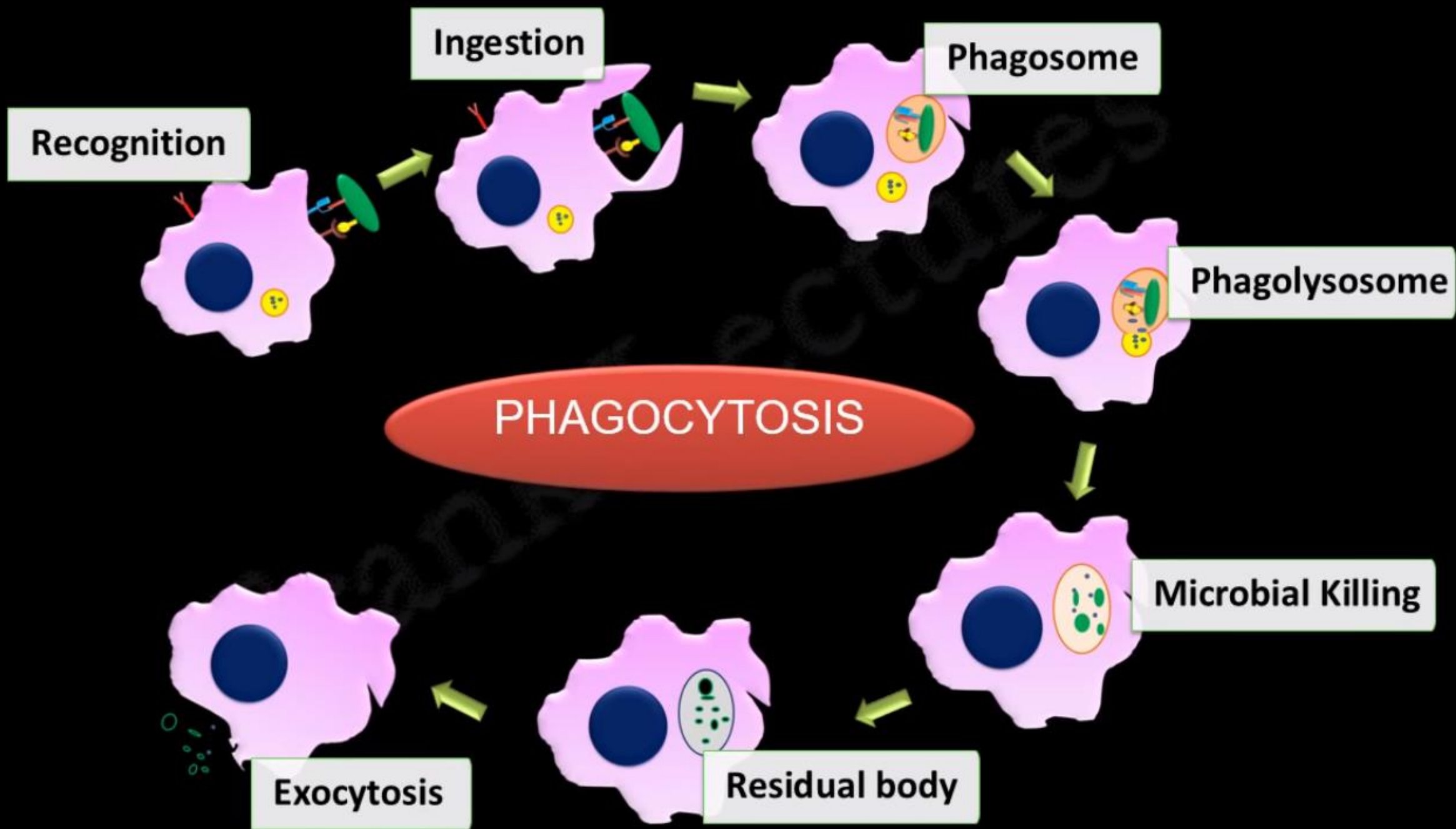
PROCESS OF PHAGOCYTOSIS

5

Elimination or Exocytosis

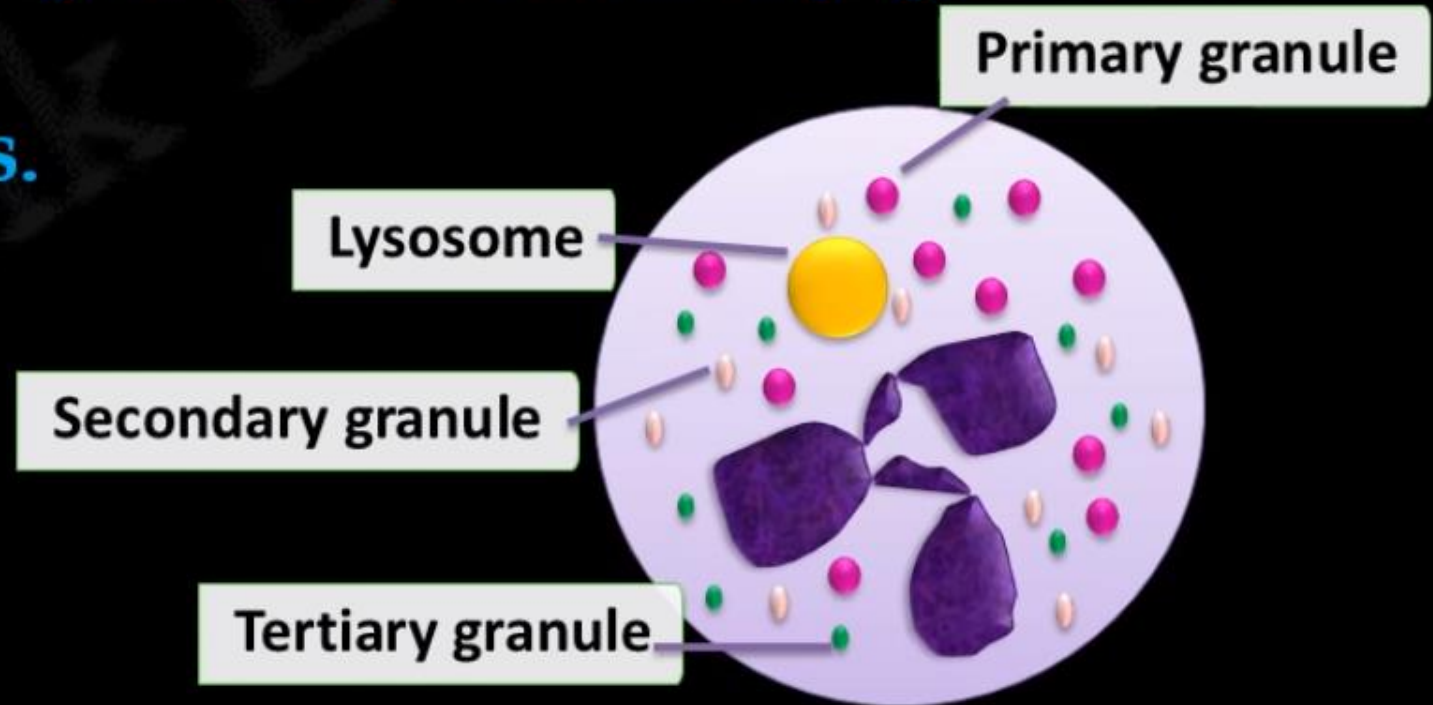


Exocytosis



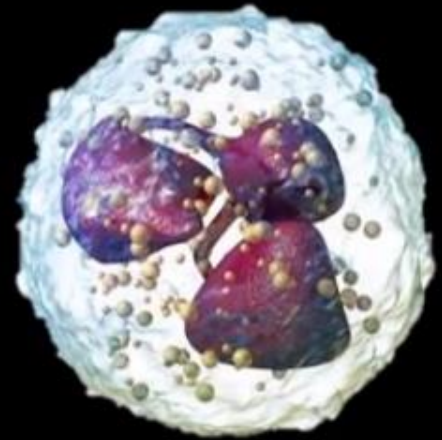
Phagocytosis By Neutrophils

- They contain **three types of cytoplasmic granules** i.e. the **primary granules, secondary granules and tertiary granules.**



Phagocytosis By Neutrophils

- **Most numerous and lethal among phagocytes**
- **Neutrophils are highly specialized phagocytes**



Phagocytosis By Neutrophils

- Neutrophils undergo apoptosis after ingestion and killing of microbes. They are short-lived.
- Dead neutrophils are phagocytized by Macrophages.



TREATMENT of Atopic reactions

- **Avoidance** of known allergen
- Localized atopic reactions are treated by **Antihistamines**
- Systemic atopic reactions are treated by **Epinephrine**

TREATMENT of Atopic reactions

- **Avoidance** of known allergen
- Localized atopic reactions are treated by **Antihistamines**
- Systemic atopic reactions are treated by **Epinephrine**

Components of immune system involved.....



IgE antibodies

Atopic person

- Respond to allergen
- Produce **IgE** antibodies
- Show clinical symptoms

Normal person

- Do not respond to allergen
- Or eliminate allergen with the help of **IgM, IgG** or **IgA** antibodies
- No clinical symptoms

Immune System

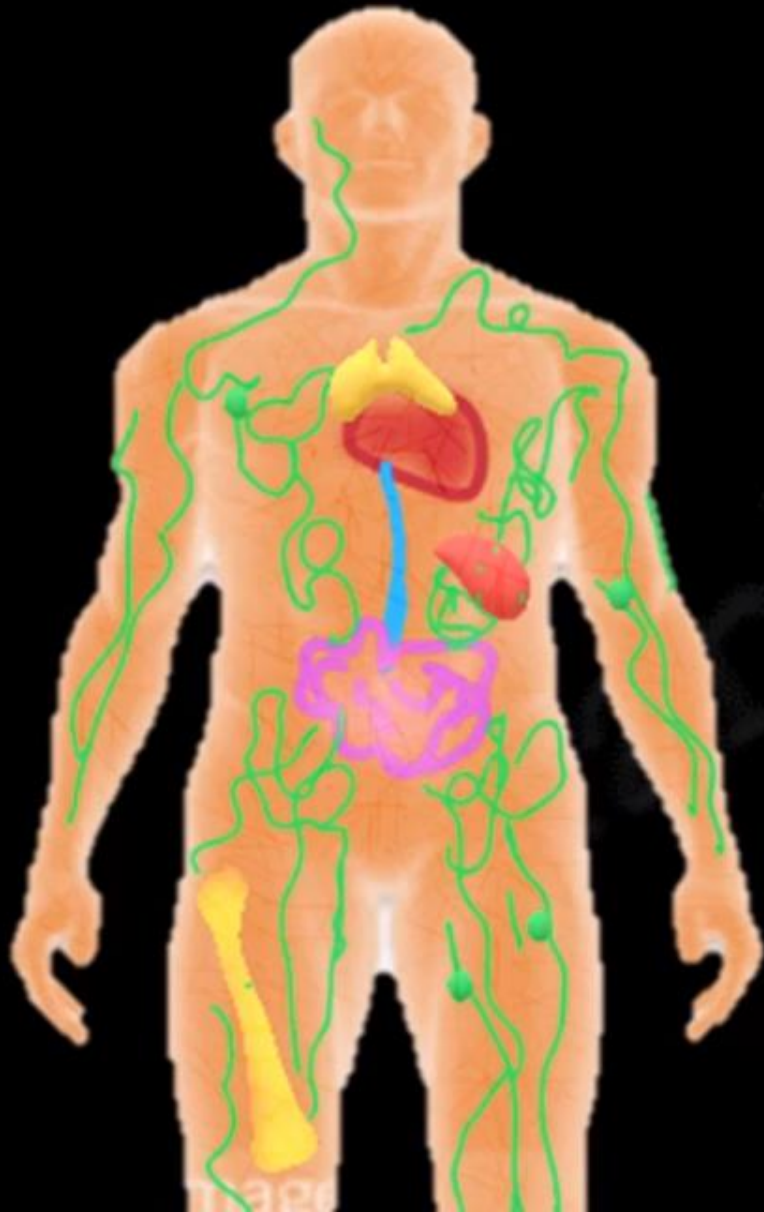
- Provides **PROTECTION** against pathogens

But when...

Immune system mechanisms cause **DAMAGE** instead of providing protection



Hypersensitivity Reactions



Allergy

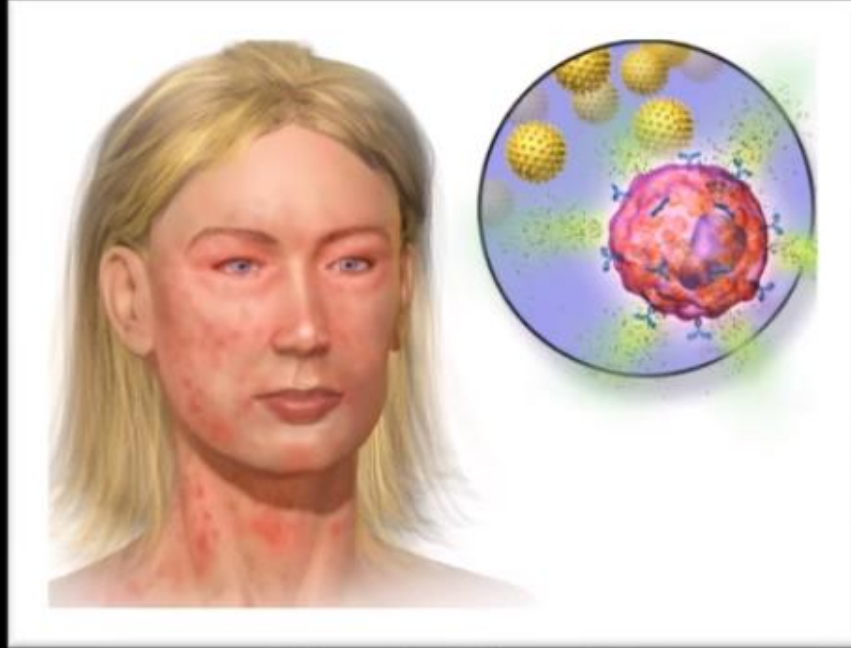
Drug Allergy

Food Allergy

Animal Allergy

Skin Allergy

Dust Allergy



Type I Hypersensitivity Reactions

Antigens that **stimulate allergies** are known as **ALLERGENS**

- Common **non-microbial** environmental antigens



Dust Mite Allergies



Pollen

Dust

Food (Milk, nuts, eggs, fruits)

Drugs

Development of allergy depends on...



Genetic background

*Relatives of allergic individuals
are more likely to have allergies
than unrelated people.*

Environment

Hygiene Hypothesis

*Increased hygiene and
underexposure to pathogens*

Development of allergy depends on...



Genetic background

*Relatives of allergic individuals
are more likely to have allergies
than unrelated people.*

Environment

Hygiene Hypothesis

*Increased hygiene and
underexposure to pathogens*

Atopy (Atopic reactions)

IgE mediated hypersensitivity

Localized

- Confined to an organ system, affect a **specific target tissue**

Allergic asthma (**airway**)

Eczema (**Skin**)

Hay Fever (**Nose**)

Systemic

- Affects **whole body**

ANAPHYLAXIS

Life-threatening reactions

Venom (bee, wasp, insect stings)

Drugs (penicillin)

Food (seafood, nuts)

★ Electrophoresis -

→ Electrophoresis is the study of movement of charged particles in an electric field.

→ Biomolecules, like- DNA, RNA, Amino acid and Proteins etc carry positive or negative charge with them.

→ When these biomolecules placed in an electric field then charged molecules move towards the electrode of opposite charge due to the phenomenon of electrostatic attraction.