*Immunity

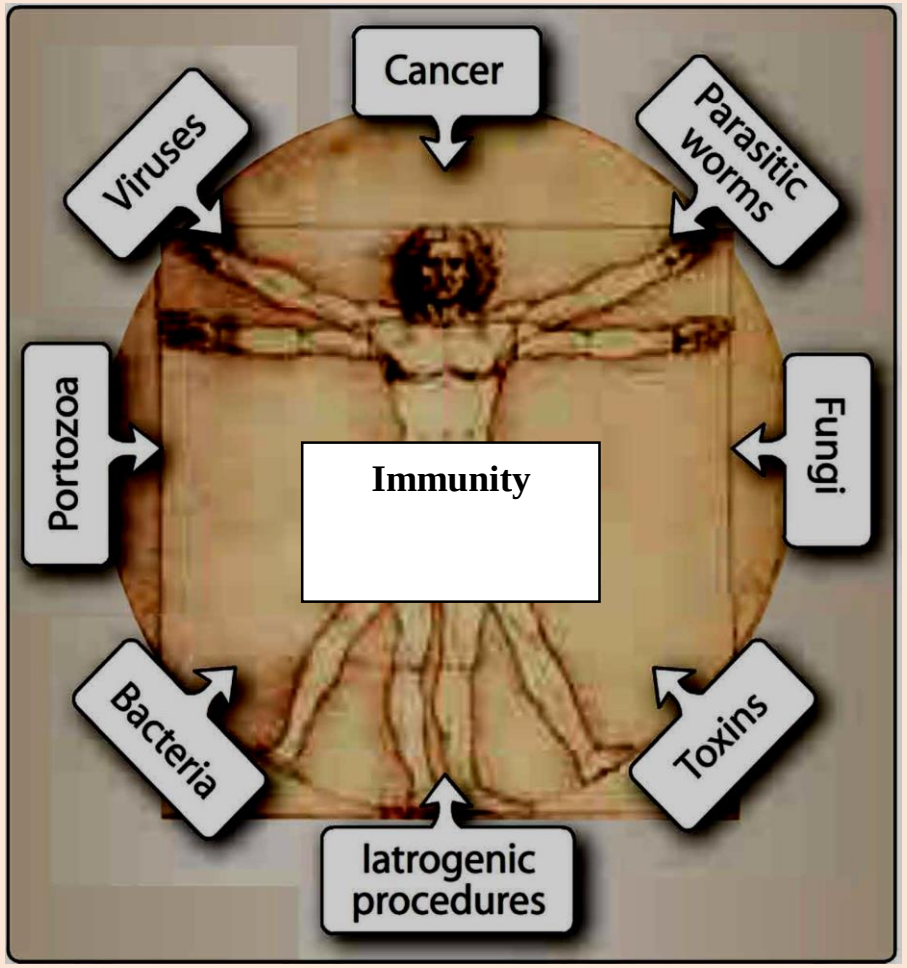
***Definition (In General)**

*Refers to all mechanisms used by the body as protection against environmental agents that are foreign to the body (recognition and disposal). These agents m ay be microorganisms or their products, foods, chemicals, drugs, pollen, or animal hair and dander. Such immunity may be innate (natural) or acquired (adaptive).

-Also the capacity of immune system to recognize and tolerate the self cells and reject foreign non-self cells.

The study of immune system or immunity the study of all aspects of host defense against infection and of adverse consequences of immune responses.

The study of the physiological mechanisms which enable the body to recognize materials as foreign and to neutralize, metabolize or eliminate them without injury to the host tissue.



Types of Immunity

1. **Innate immunity** or **“nonspecific”**

   - Defenses against **any pathogen**.
   - Refers to defenses that are **present at birth**.
   - **Rapid** response.
   - **Unspecific.**
   - **No memory.**

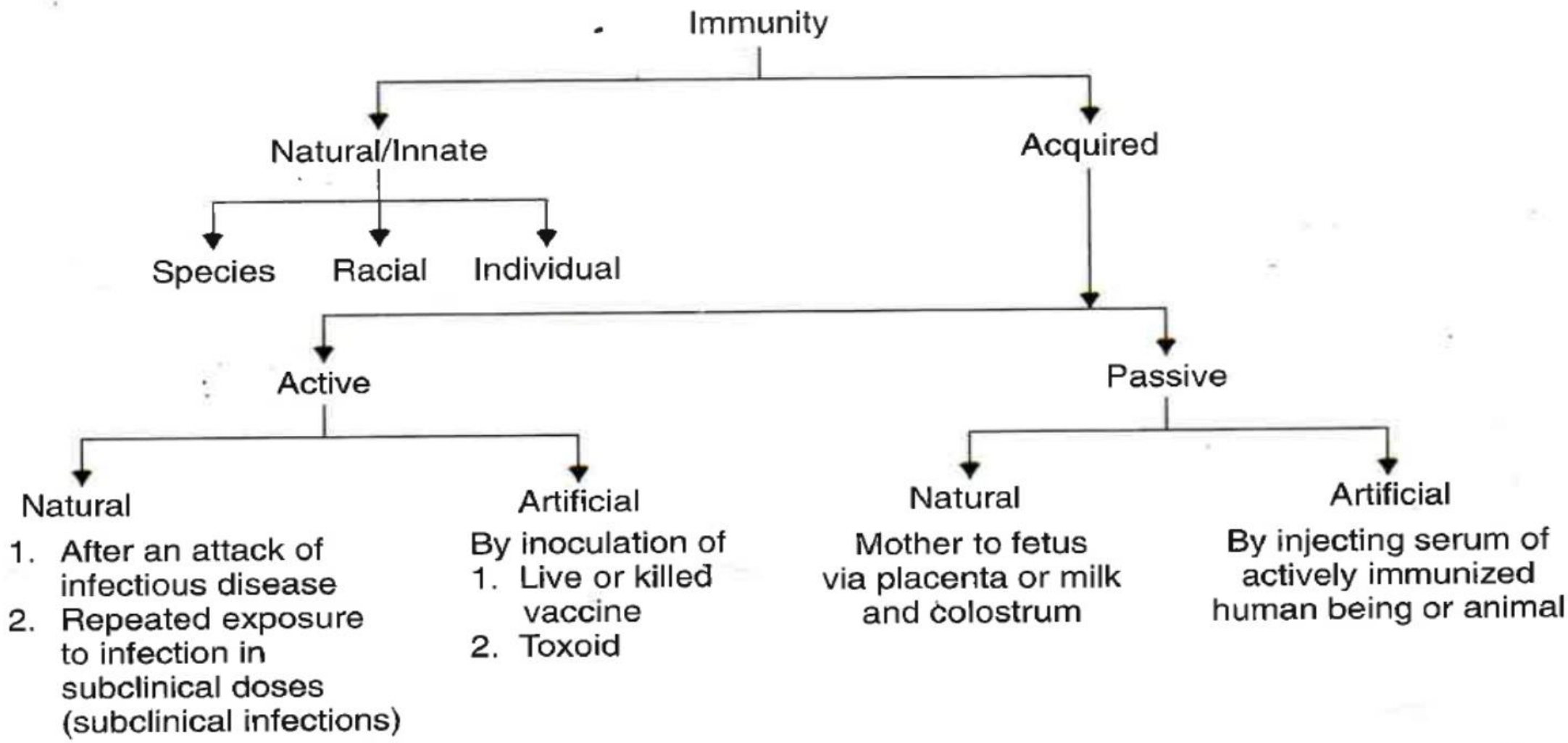
2. **Adaptive immunity** or **“specific ”**

   - Defenses to **a specific pathogen**.
   - **Acquired** during the lifetime of an organism.
   - **Slower** in response.
   - **Has memory** components.

Table 1. Innate and Adaptive Immunity[3]

Innate	Adaptive
Nonspecific	Specific
Present at all times	Develops in response to infection
Immediate but general protection	Protection against specific pathogens
Activates adaptive immune response	Leverages components of the innate response
Does not improve with repeated exposure to a pathogen	Memory develops, which may provide lifelong immunity to reinfection with the same pathogen

*Immune response



Innate Immunity

It is natural immunity present inborn.It is quick unspecific response.

It consists of the following components:

1.The cellular component.

2. The humoral component.

3 The anatomical barrier….

4.The cell receptors. ……

Anatomical component:

- 1. The anatomical barriers:
- They consist of:
- - Skin.
- -Mucous membranes and epithelial tissues linings.
- -Cilia present in the respiratory system.

ommensals

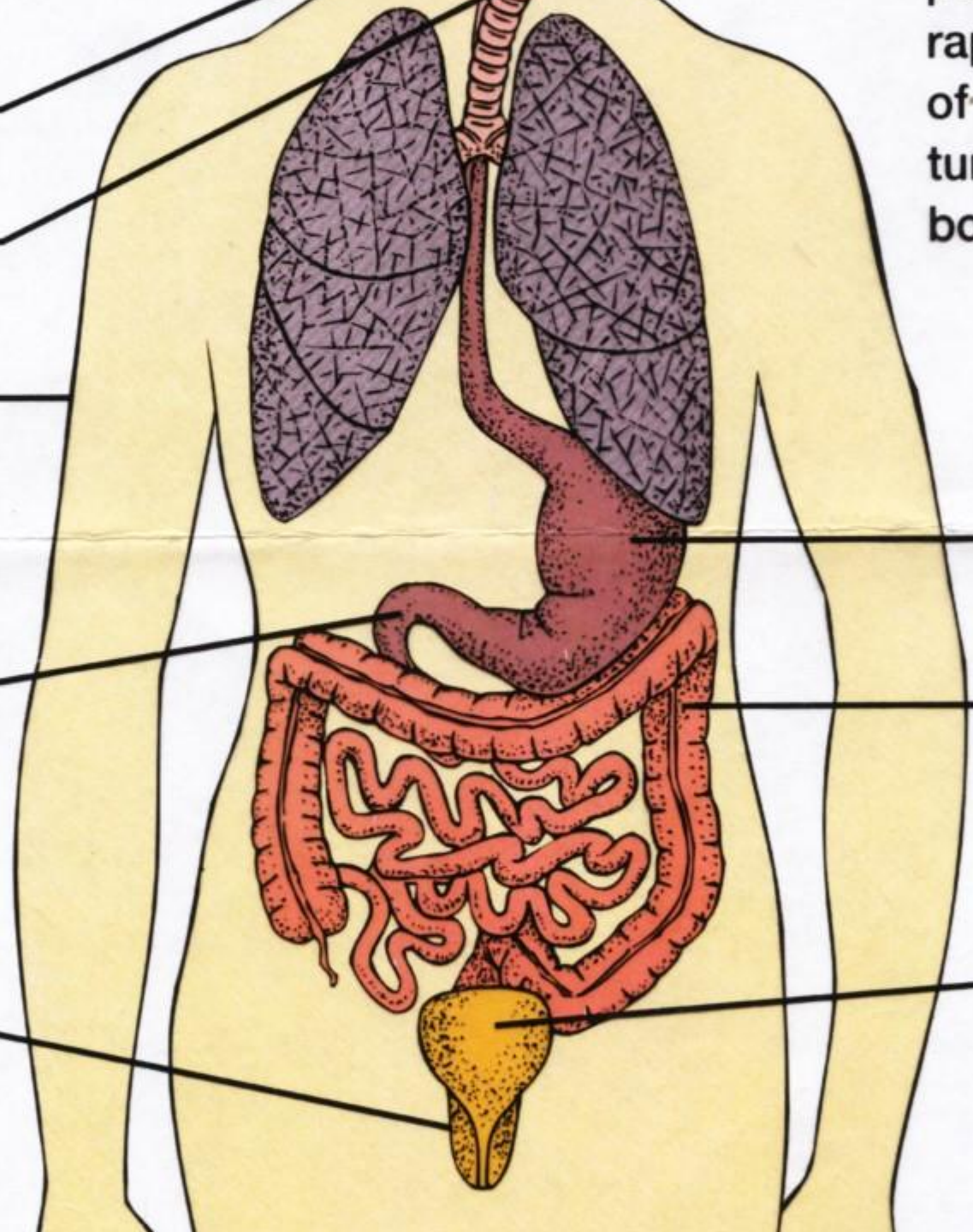
ucus, cilia

kin
hysical barrier
atty acids
ommensals

apid pH
hange

H and
ommensals
f vagina

rapid passage
of air over
turbinate
bones, hairs



Acid

Commensals,
Paneth's cells

Flushing of
urinary tract

2. Humoral component:

- It consists of the following:
- -Salivary glands secretions. Which contain proteolytic enzymes.
- - Sebaceous glands secretion in the skin. which is bactericidal.
- - Mucous secretions in the respiratory ,urogenital tract, and digestive tract. The mucous secretions contain lipolytic and proteolytic enzymes.
- Also the high acidity in the stomach and vagina is toxic for most microorganisms.
- - Acute phase proteins, alpha fetoprotein ,tumor necrosis factor, and interferons.
- Acute phase proteins cause opsonization of the infected cells and facilitates phagocytosis.
- Tumor necrosis factor causes chemotaxis of the phagocytic cells.
- - Interferon. Causes activation of the natural killer cells and

  also Protects uninfected cells from infection by virus.

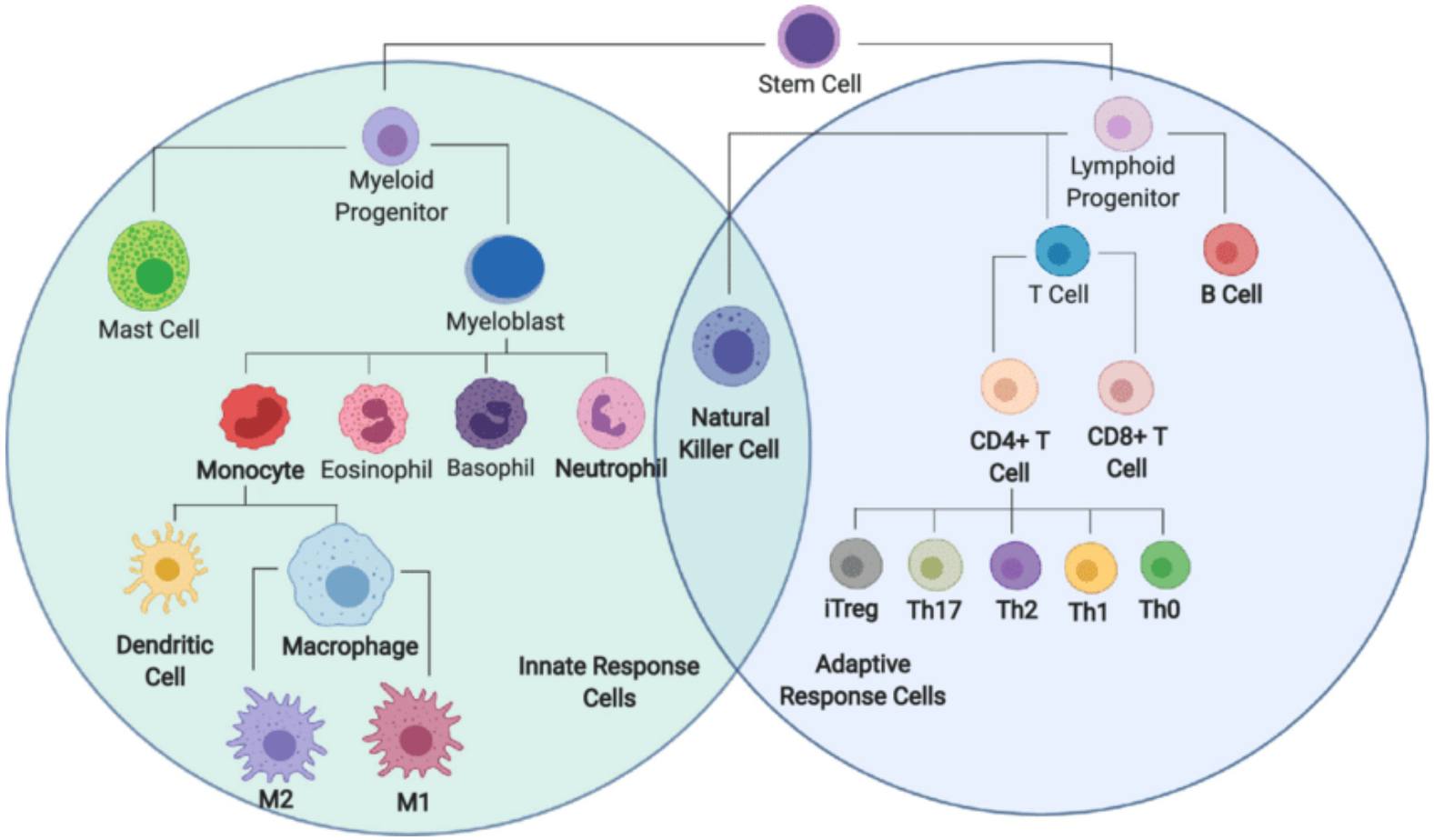
-Complement proteins of the alternative activation pathway.

- Sweat and sebum skin secretions.
- -Tears contain lysozyme which kills the microorganisms.

3. Cellular component:

- Many types of cells participate in the innate defense mechanism. Unspecificly:
- The types of cells are:.
- **A.-Monocytes and its derivatives which are:**
- 1. Monocytes in blood.
- 2. Dendritic cells in skin and lymph nodes.
- 3. Kupfer cells in the liver.
- 4. Alveolar cells in the lung.
- 5 Microglial cells in the brain.
- 6. Osteoclast in bones
- Synovial A cells in joints.
- Mesengial phagocytes in kidneys.
- Langerhan’s cells in skin.
- 7. Macrophages in the peripheral tissues.
- B.- Natural killers in blood which are types of lymphocytes reacts against virally infected or tumor cells.
- -C. Granulocytes like neutrophils which reacts mainly against bacterial infection.

Cells of the immune system:



Immune system 12

- Immunological cells:
- **B: The granulocytes:**
- There are three types of granulocytes which are:
  - Neutrophils.(neutrally stained granules)
  - Eosinophils.(acidic orange granules)
  - Basophils. (basic violet color stained granules).
    (Mast cells)

They have lobulated nucleous with two to five lobules.

They have granulated cytoplasm. The granules are colored according to the type of cells.

Cellular components of the immune system:

- Immunological cells;
- **C: Lymphocytes:**
- There are three types of lymphocytes which are:

1. B-cells : its final maturation stage is plasms cells . They are the main effector cells in the humoral immunity. They are responsible of production of the antibodies.

Also they can present antigens to the T-lymphocytes.

2. T-lymphocytes : which are the active cells in both humoral and cell mediated immunity. It consists of different types which are:

- T- helper cells.
- T- suppressor cells.
- T- cytotoxic cells.
- T- regulatory cells.

The main functions of T-cells are cytotoxic and regulatory

3. Natural killers: which are active against cancer and virally infected cells. They are mainly cytotoxic.

Innate immune system receptors:

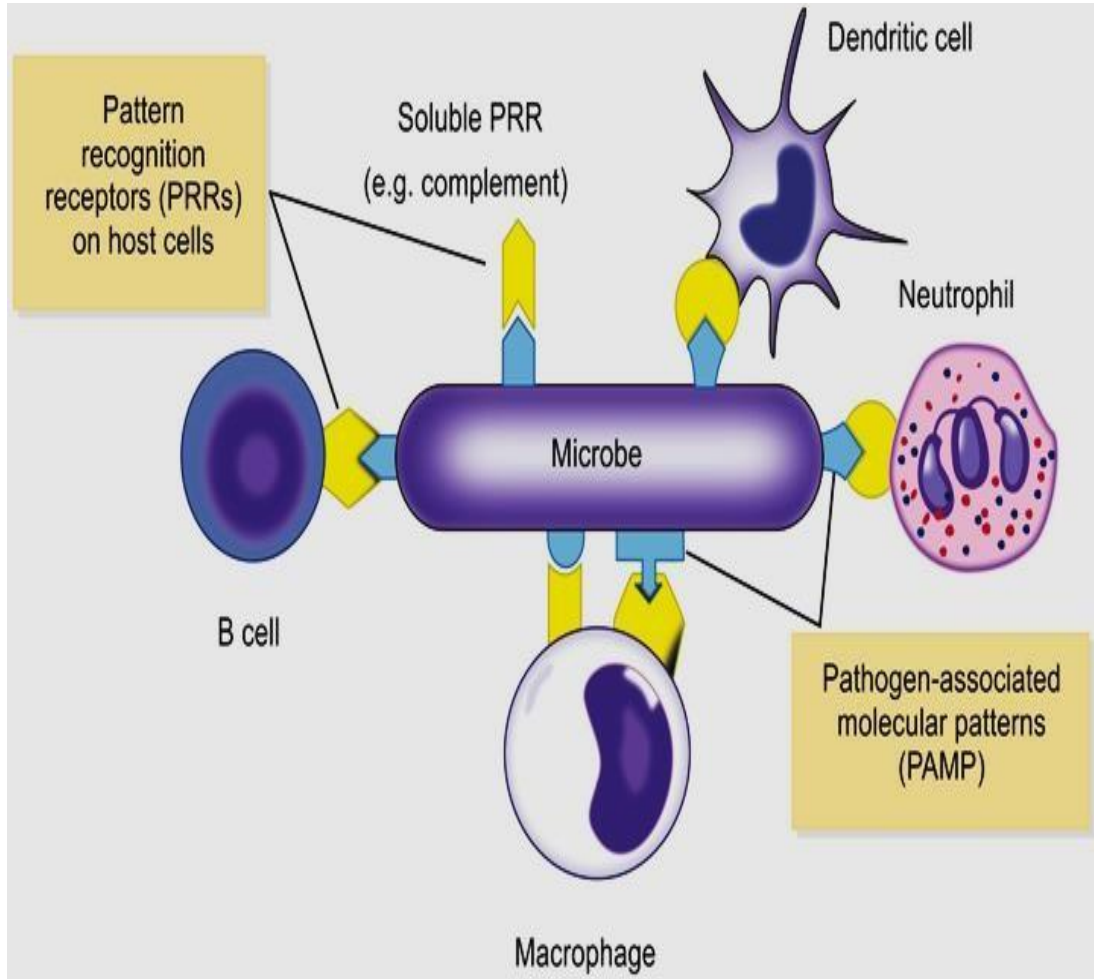
- The phagocytic cells have **Pattern Recognition Receptors(PRR).**
- These receptors recognize the **Pathogen Associated Molecular Patterns(PAMPs)** present on the surface of the pathogens which facilitate phagocytosis of the pathogens

The PRR includes the following receptors:

1. **Toll like receptors(TLRs)**: It causes the synthesis and secretion of cytokines to cause inflammation.
2. **Scavenger receptors:** it involved in the internalization of bacteria and phagocytosis of dead host cells.
3. **Opsonin** :which are C3a and IgM which bind to the microbes and facilitate phagocytosis.

PAMPs:

1. **Flagellin and Fibrin:** as bacterial antigens.
2. **Zymosan:** antigen present on the surfaces of the fungi.
3. **LPS lipopolysaccharide** present on the surface of G- negative bacteria.


Dendritic cell
Pattern recognition receptors (PRRs) on host cells
Soluble PRR
(e.g. complement)
Neutrophil
Microbe
B cell
Pathogen-associated molecular patterns (PAMP)
Macrophage