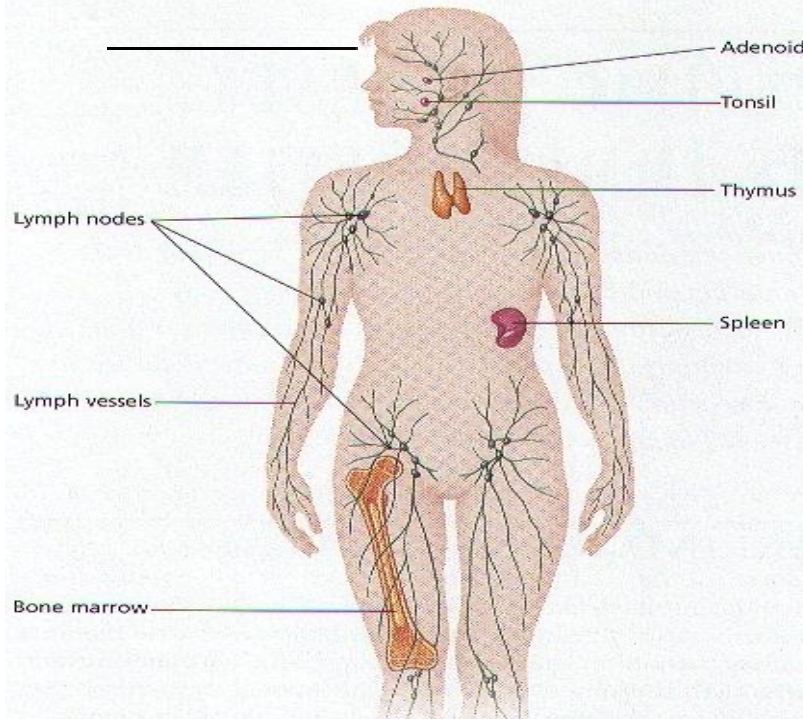


Introduction to Immunity

- **Immunology** is an emerging branch of medical science that deals with the studies of **immune system** like the organs, cells, structure, function, response against antigens, and disorders.
- **Immunology:** Is also the study of the physiological mechanisms which enable the body to recognize materials as foreign agents and to neutralize, metabolize or eliminate them without injury to the host tissue

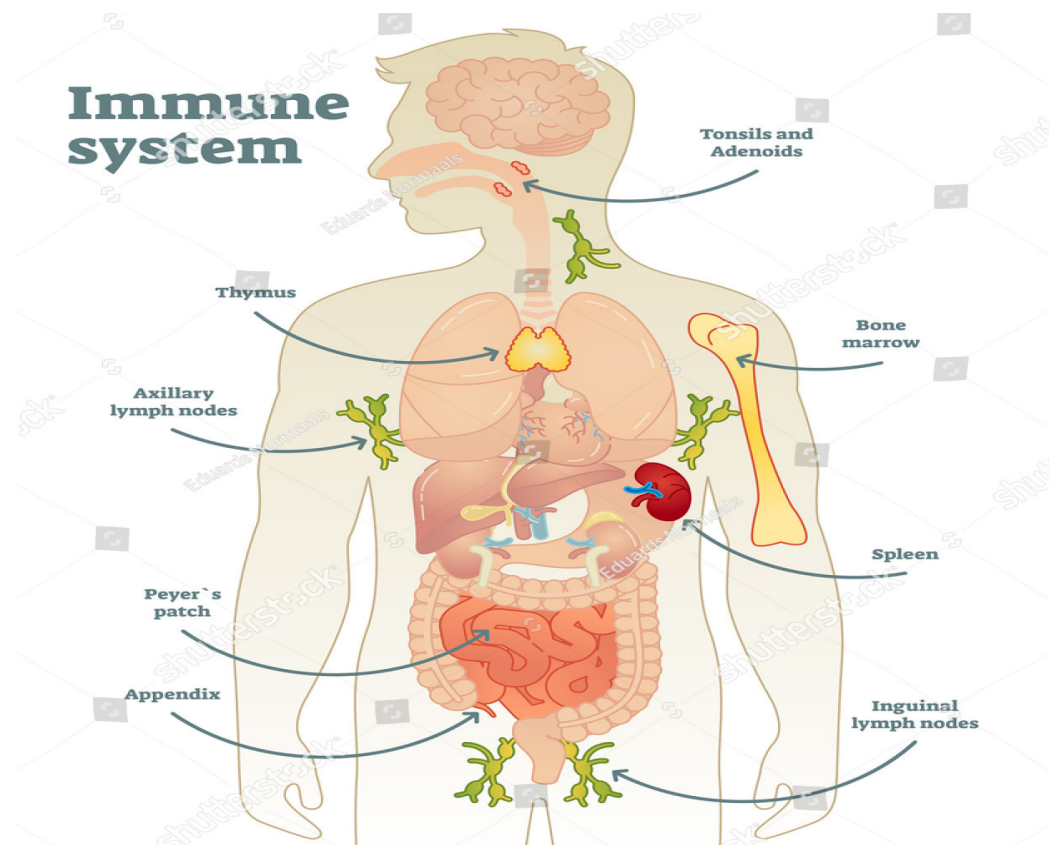
The Immune System

- **The Immune System** - includes all parts of the body that help in the recognition and destruction of foreign materials. **White blood cells, phagocytes and lymphocytes, bone marrow, lymph nodes, tonsils, thymus, and the spleen** are all part of the immune system.



The immune system

- **The immune system** is a collection of organs, cells, chemicals, processes, and mechanisms that function to protect the body (give **immunity**) from foreign antigens, such as microbes, cancer cells, and toxins.



- **Immunity** refers to protection against infection. The immune system is the collection of cells, tissues and molecules that functions to defend us against infectious microbes.
- **Immunity** [Latin immunis] refers to the resistance exhibited by the host towards injury caused by microorganisms and their products.
- **Immune response:** **The** coordinated reaction of the immune system against infections (and other foreign substances) is known as the **Immune response.**

The main tasks of the body's immune system are:

1. Classifying ability to distinguish between the body's own cells (self) and foreign cells (non-self).
2. It provides defenses against pathogens like bacteria, viruses, parasites or fungi.
3. Identifying-ability to distinguish one pathogen from another.
4. It removes (Scavenges) dead or worn out cells like RBCs.
5. It identifies and destroys abnormal cancer cells.
6. It protects against autoimmune diseases.
7. It rejects tissue cells with foreign antigens.
8. Remembering: The ability to remember previously encountered pathogens.
9. Switch on: The ability to respond when a pathogen invades.
10. Switch off: The ability to stop when danger passes.



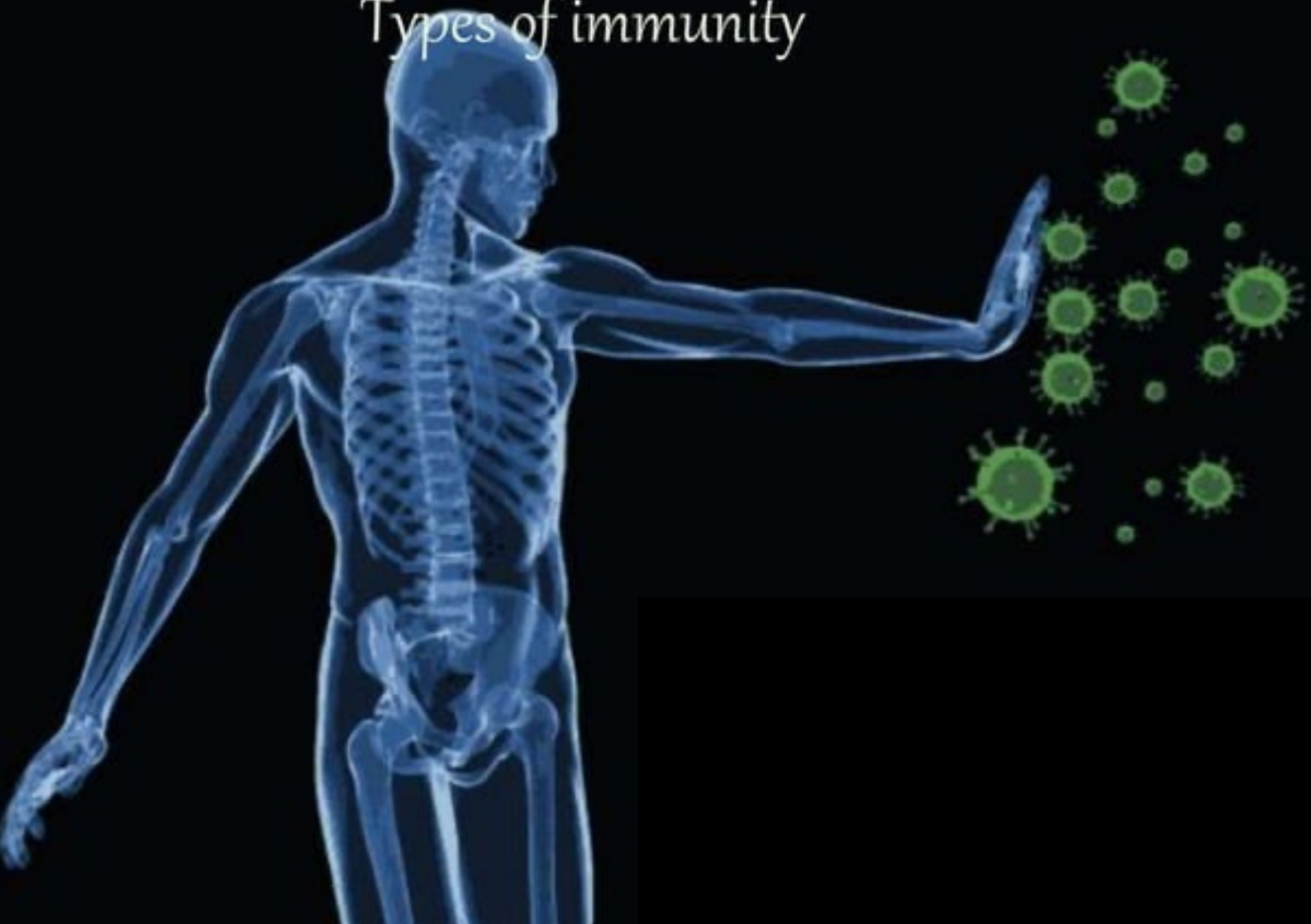
Traditional concept:

Immunity refers to protection against infectious diseases.

Modern concept:

Immunity is a function of which an individual recognizes and excludes antigenic foreign substances. It is normally beneficial, but sometimes, it is injurious.

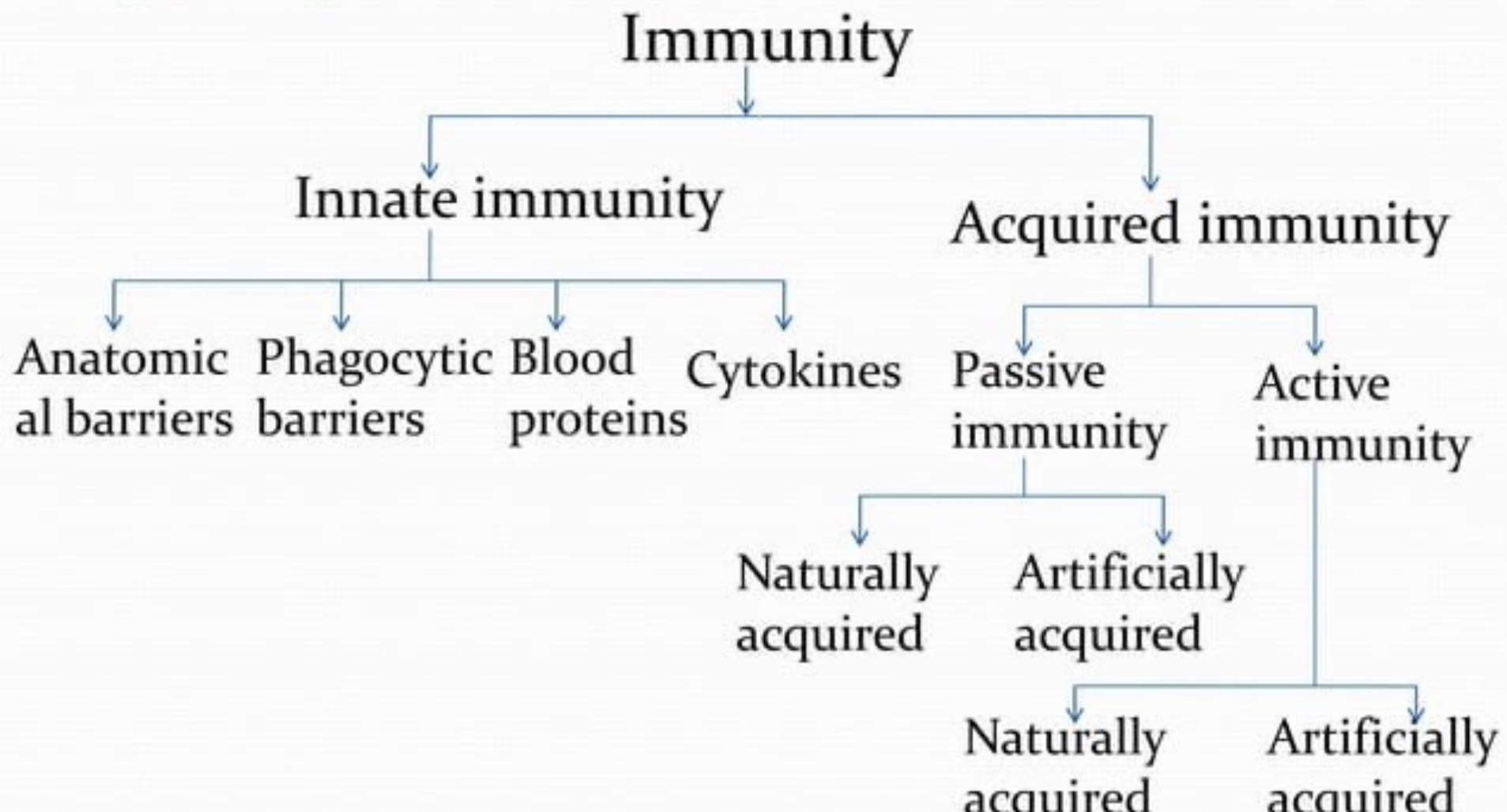
Types of immunity

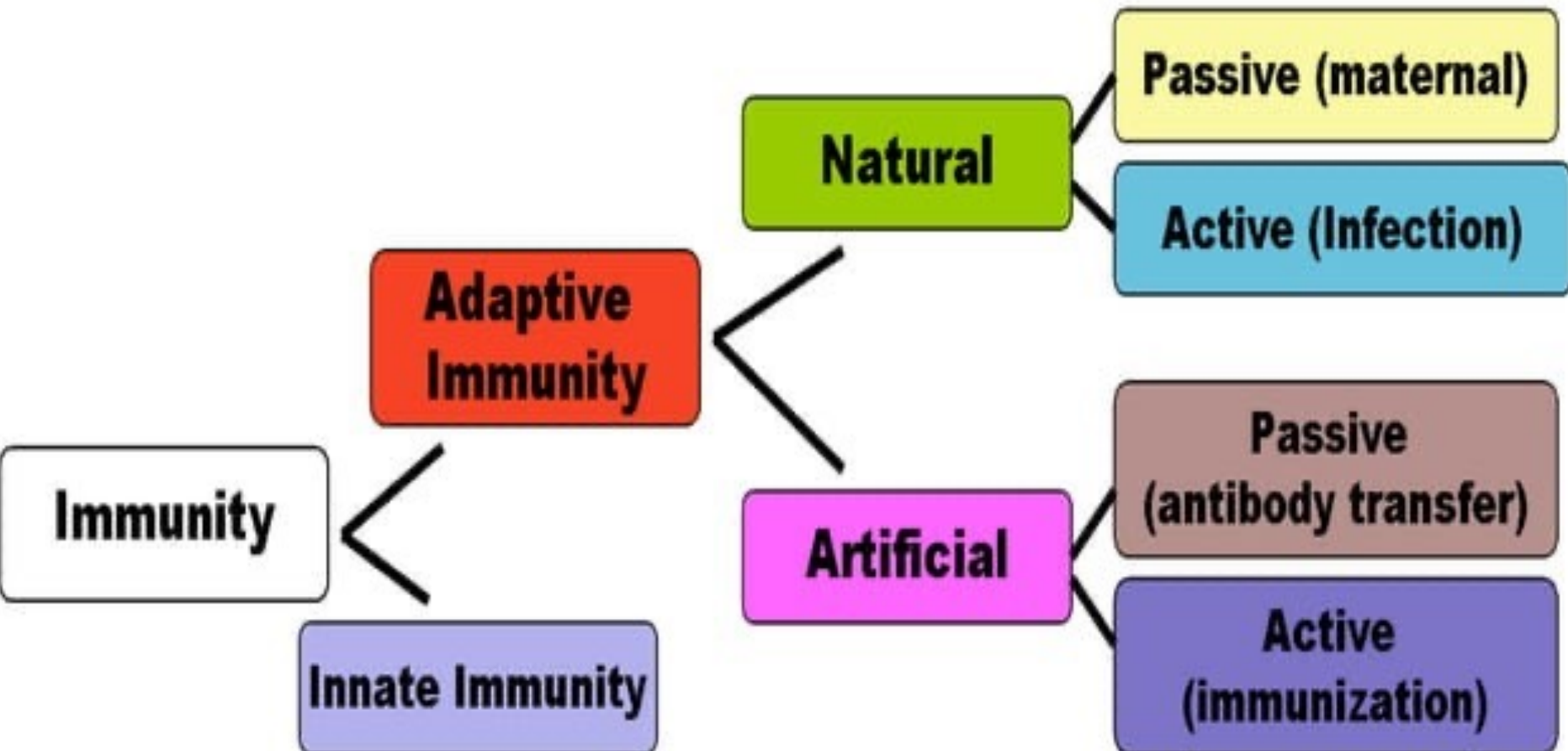


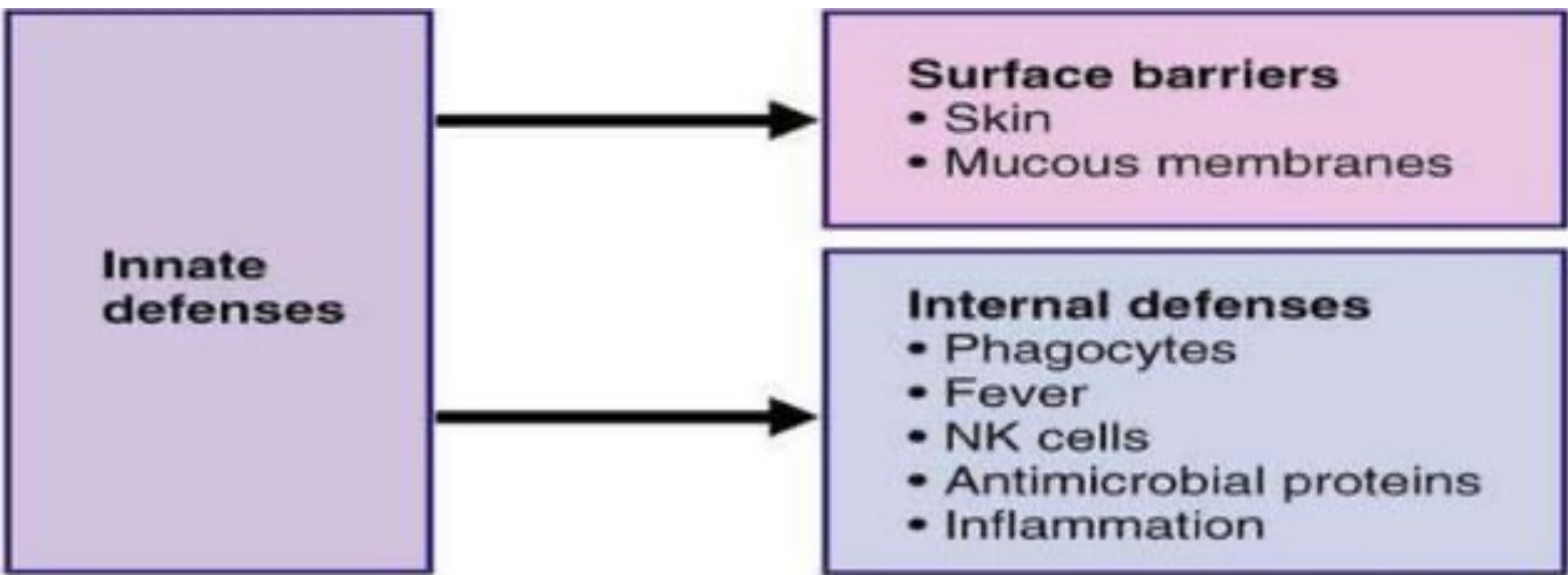
Types of Immunity

- In basic terms, the immune system has two lines of defense
- **Innate immunity**
- **Adaptive immunity.**
- Innate immunity is the first immunological, non-specific (antigen-independent) mechanism for fighting against an intruding pathogen. It is a rapid immune response, occurring within minutes or hours after aggression, that has no immunologic memory.

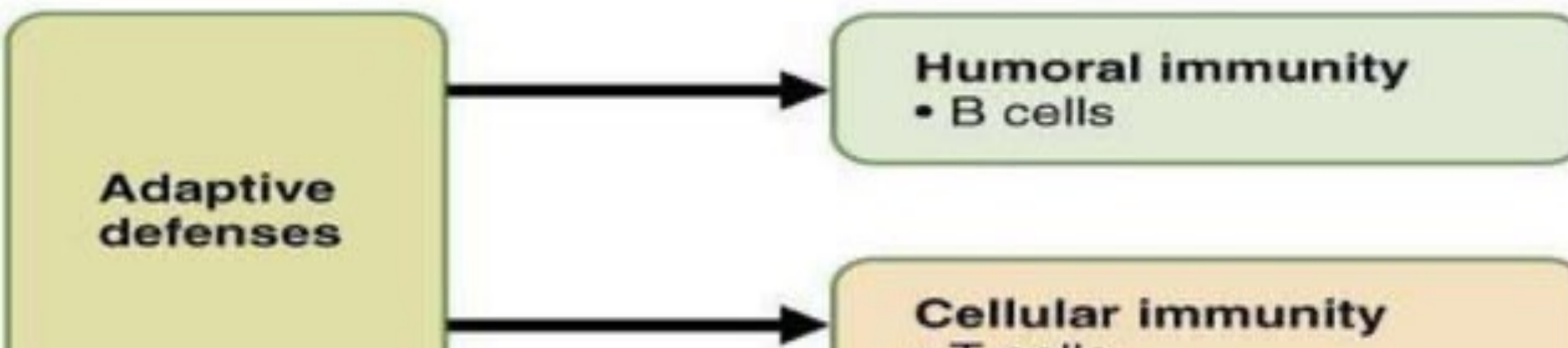
Types of immunity







(a)



Innate Immunity

- It is also called **natural** or **native** immunity, consist of mechanisms that exist before infection and are capable of rapid responses to microbes.
- It is comprises four types of defense barriers–
 - 1) Anatomical barriers
 - 2) Phagocytic barriers
 - 3) Blood proteins and
 - 4) Cytokines.

Type

Mechanism

1) Anatomical barriers

➤ Skin

Mechanical barriers retards entry of microbes.

Acidic environment (pH 3-5) retards growth of microbes.

➤ Mucous membrane

Mucous entraps foreign microorganism.

2) Physiologic barriers

➤ Temperature

Body temperature and fever response inhibits growth of some pathogens.

➤ Low pH

Acidic pH of stomach (pH 2) kills most ingested microorganism.

3) Phagocytic barriers

(Neutrophils, Macrophages and NK cells)

Ingest and destroys microbes by endocytosis and phagocytosis)

Tissue damage and infection induce

4) Inflammatory barriers

leakage of vascular fluid, containing serum protein with antibacterial activity.

Innate immunity (non specific immunity)

- Innate Immune System / First-Line Defenses - The body's **first line of defense** against pathogens uses mostly physical and chemical barriers such as
 - **Skin** – acts as a barrier to invasion
 - **Sweat** – has chemicals which can kill different pathogens.
 - **Tears** - have lysozyme which has powerful digestive abilities that render antigens harmless.
 - Saliva – also has lysozyme.
 - **Mucus** - can trap pathogens, which are then sneezed, coughed, washed away, or destroyed by chemicals.
 - **Stomach Acid** – destroys pathogens

FIRST LINE OF DEFENSE

Components are:

Skin, Mucous membranes and their secretions

Prevent access of microbes into the body



Second-Line Defenses

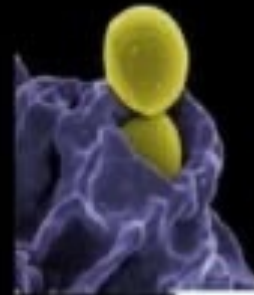
- **Second-Line Defenses** - If a pathogen is able to get past the body's first line of defense, and an infection starts, the body can rely on its second line of defense. This will result in what is called an Inflammatory response causes
 - Redness - due to capillary dilation resulting in increased blood flow
 - Heat - due to capillary dilation resulting in increased blood flow
 - Swelling – due to passage of plasma from the blood stream into the damaged tissue
 - Pain – due mainly to tissue destruction and, to a lesser extent, swelling.

SECOND LINE OF DEFENSE

Components are:

Phagocytes, Antimicrobial substances, Natural Killer cells, Inflammation, Fever

Destruction or elimination of microbes which penetrate the body



PHAGOCYTE



INFLAMMATION



FEVER

Types of innate immunity

- It is of three types-
 - 1) Species Immunity
 - 2) Racial Immunity
 - 3) Individual Immunity
- **Species immunity** is the total immunity shown by all members of a species against pathogen; e.g. birds immune to **tetanus**.
- **Racial immunity** is that in which various races show marked difference in their resistance to certain infectious disease.
- **Individual immunity** is very specific for each and every individual despite having same racial background and opportunity for exposure.

INNATE IMMUNITY

```
graph TD; A[INNATE IMMUNITY] --- B[Natural/Native immunity]; A --- C[Non-Specific Immunity]; A --- D[Immunological Memory is Absent]; A --- E[Respond quickly i.e. within minutes or hours]; A --- F[Major Components are: 1. Skin and Mucous membrane 2. Phagocytes, Antimicrobial substances, Natural Killer cells, Inflammation, Fever];
```

**Natural/Native
immunity**

**Non-Specific
Immunity**

**Immunological
Memory is Absent**

**Respond quickly i.e. within
minutes or hours**

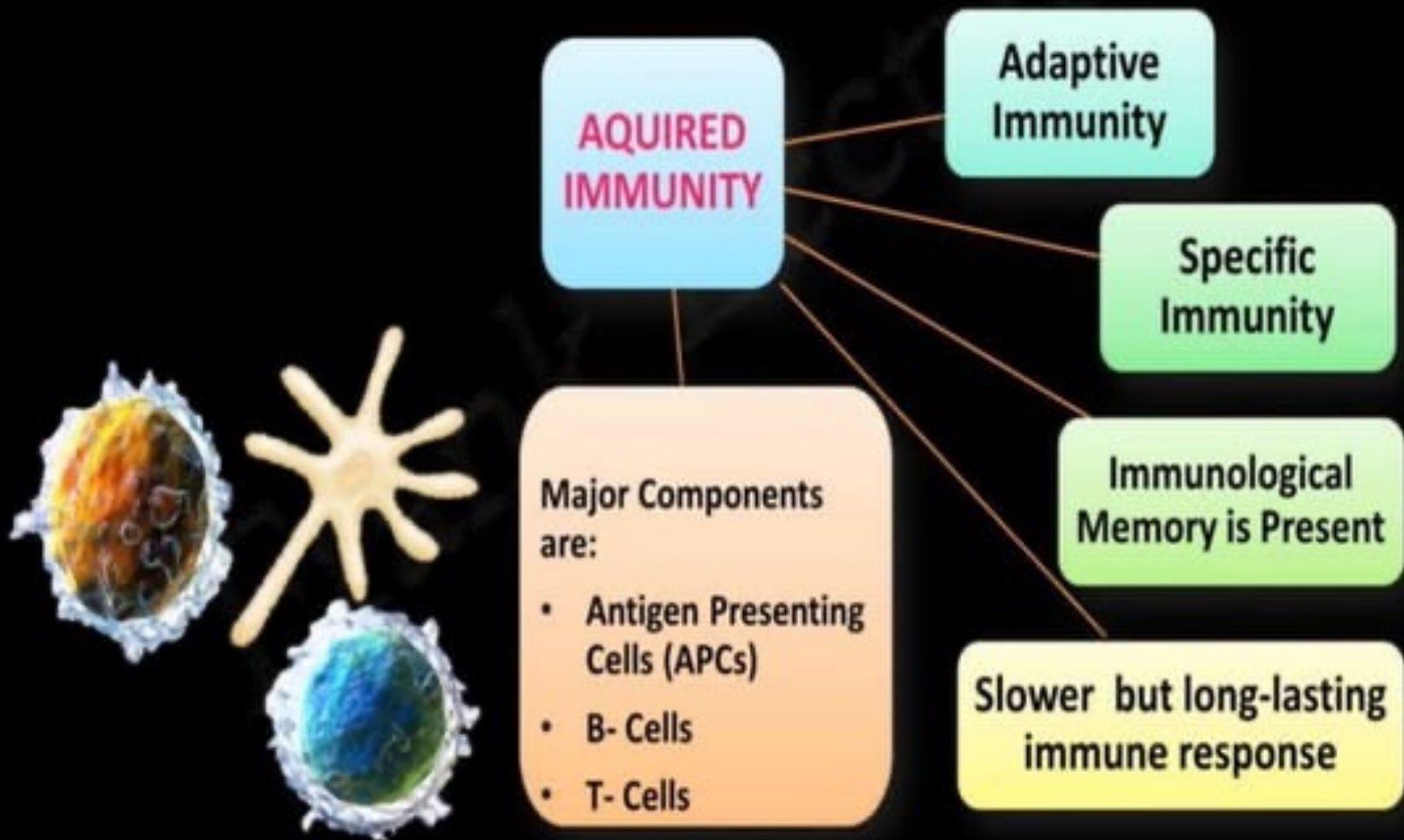
Major Components are:

- 1. Skin and Mucous
membrane**
- 2. Phagocytes,
Antimicrobial
substances, Natural Killer
cells, Inflammation,
Fever**

Adaptive (Acquired) immunity (Specific Mechanisms of Defense)

- Adaptive immunity refers to antigen-specific immune response. The adaptive immune response is more complex than the innate.
- **Third-Line Defenses** - Sometimes the second line of defense is still not enough and the pathogen is then heading for the body's last line of defense, the immune system.
- The immune system recognizes, attacks, destroys, and remembers each pathogen that enters the body. It does this by making specialized cells and antibodies that render the pathogens harmless.
- **Unlike the first line and second line defense** the immune system differentiates among pathogens.
- For each type of pathogen, the immune system produces cells that are specific for that particular pathogen.

Adaptive Immunity



Acquired immunity

Acquired or **adaptive** immunity is the immunity that is developed by the host in its body after exposure to suitable antigen or after transfer of antibodies or lymphocyte from an immune donor.

Characteristics of Acquired Immunity

1. Antigenic Specificity
2. Diversity
3. Immunologic memory
4. Self/non-self recognition

Acquired immunity

Acquired or **adaptive** immunity is the immunity that is developed by the host in its body after exposure to suitable antigen or after transfer of antibodies or lymphocyte from an immune donor.

Characteristics of Acquired Immunity

1. Antigenic Specificity
2. Diversity
3. Immunologic memory
4. Self/non-self recognition

Fig 2. **Haematopoiesis**

