

Immunology :

Types of Immunity



Dr. Abhishek Vashishtha
Department of Microbiology,
Maharaja Ganga Singh University, Bikaner.
e.mail: abhiv24@gmail.com,

The Specific Immune System is the Third Line of Defense Against Infection

NONSPECIFIC DEFENSE MECHANISMS		SPECIFIC DEFENSE MECHANISMS (IMMUNE SYSTEM)
First line of defense	Second line of defense	Third line of defense
<ul style="list-style-type: none">• Skin• Mucous membranes• Secretions of skin and mucous membranes	<ul style="list-style-type: none">• Phagocytic white blood cells• Antimicrobial proteins• The inflammatory response	<ul style="list-style-type: none">• Lymphocytes• Antibodies

Immunity

```
graph TD; A[Immunity] --> B["Non specific \ Innate\ Non adaptive \ natural immunity"]; A --> C["Acquired\ Adaptive \ Specific Immunity"];
```

Non specific \ Innate\ Non adaptive \ natural immunity

1. First and some times second line of defense.
2. Immunity an organism is born with.
3. Genetically determined.
4. No enhancement by repetition

Acquired\ Adaptive \ Specific Immunity

1. Third and some times second line of defense.
2. Immunity that an organism develops during lifetime.
3. Not genetically determined.
4. May be acquired naturally or artificially
5. Get enhanced by repetition

Acquired Immunity

```
graph TD; A[Acquired Immunity] --> B[Humoral Immunity]; A --> C[Cell Mediated Immunity]; B --> D[Active Immunity]; B --> E[Passive Immunity]; C --> D; C --> E; D --> F[Naturally Acquired]; D --> G[Artificially Acquired]; E --> H[Naturally Acquired]; E --> I[Artificially Acquired];
```

The diagram is a hierarchical flowchart. At the top is a yellow oval containing the text 'Acquired Immunity'. A vertical line descends from this oval to a horizontal line. From this horizontal line, two vertical lines with downward-pointing arrowheads lead to 'Humoral Immunity' (left) and 'Cell Mediated Immunity' (right). From 'Humoral Immunity', a vertical line descends to another horizontal line. From this horizontal line, two vertical lines with downward-pointing arrowheads lead to 'Active Immunity' (left) and 'Passive Immunity' (right). From 'Cell Mediated Immunity', a vertical line descends to the same horizontal line as 'Humoral Immunity'. From 'Active Immunity', a vertical line descends to another horizontal line. From this horizontal line, two vertical lines with downward-pointing arrowheads lead to 'Naturally Acquired' (left) and 'Artificially Acquired' (right). From 'Passive Immunity', a vertical line descends to another horizontal line. From this horizontal line, two vertical lines with downward-pointing arrowheads lead to 'Naturally Acquired' (left) and 'Artificially Acquired' (right). The text 'Acquired Immunity' is in blue, while 'Humoral Immunity' and 'Cell Mediated Immunity' are in red. 'Active Immunity' and 'Passive Immunity' are in black. 'Naturally Acquired' and 'Artificially Acquired' are in blue.

Humoral Immunity

Cell Mediated Immunity

Active Immunity

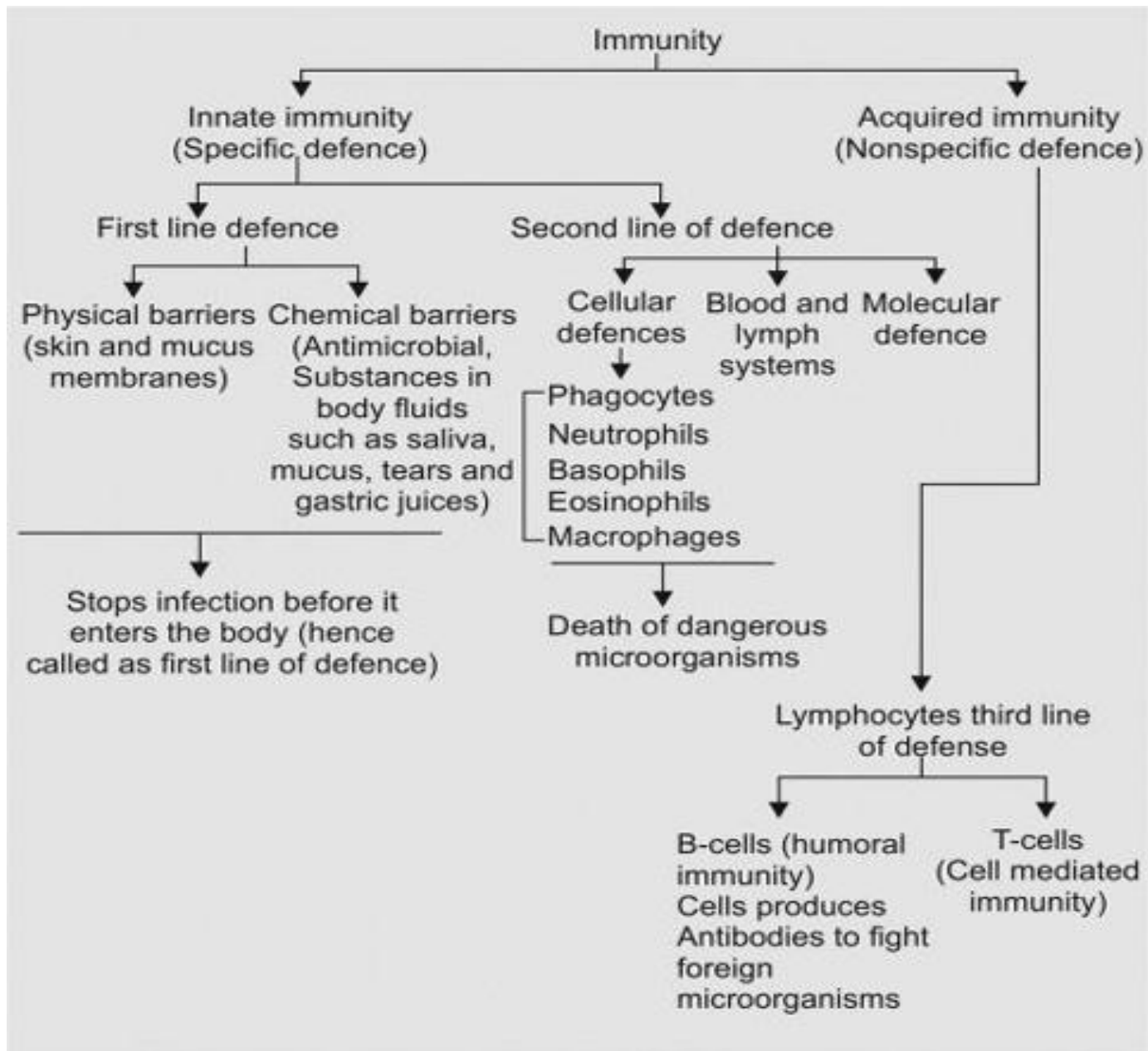
Passive Immunity

Naturally
Acquired

Artificially
Acquired

Naturally
Acquired

Artificially
Acquired



Acquired Immunity

Immunity you develop during your life

Active Immunity

Immunity you develop after being exposed to an infection or from getting a vaccine

Natural

Antibodies made after exposure to an infection

Artificial

Antibodies made after getting a vaccination

Passive Immunity

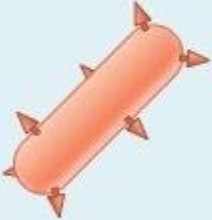


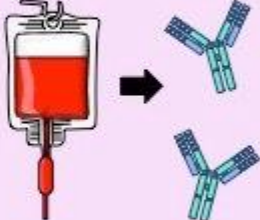
Immunity you acquire from someone or something else

Natural

Antibodies transmitted from mother to baby (e.g., via mother's milk)

Artificial

Antibodies acquired from an immune serum medicine

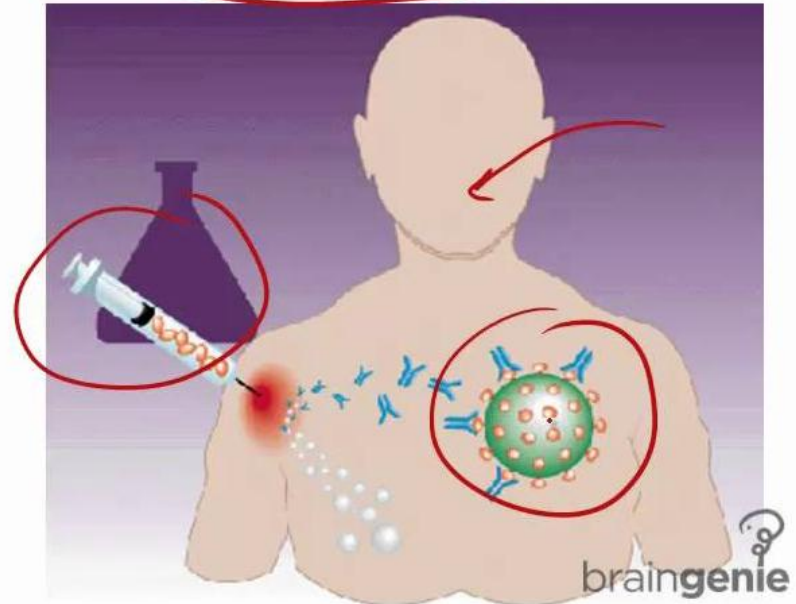
ACTIVE IMMUNITY		PASSIVE IMMUNITY	
Natural	Artificial	Natural	Artificial
 <p>Infection</p>	 <p>Vaccination</p>	 <p>Maternal antibodies</p>	 <p>Monoclonal antibodies</p>

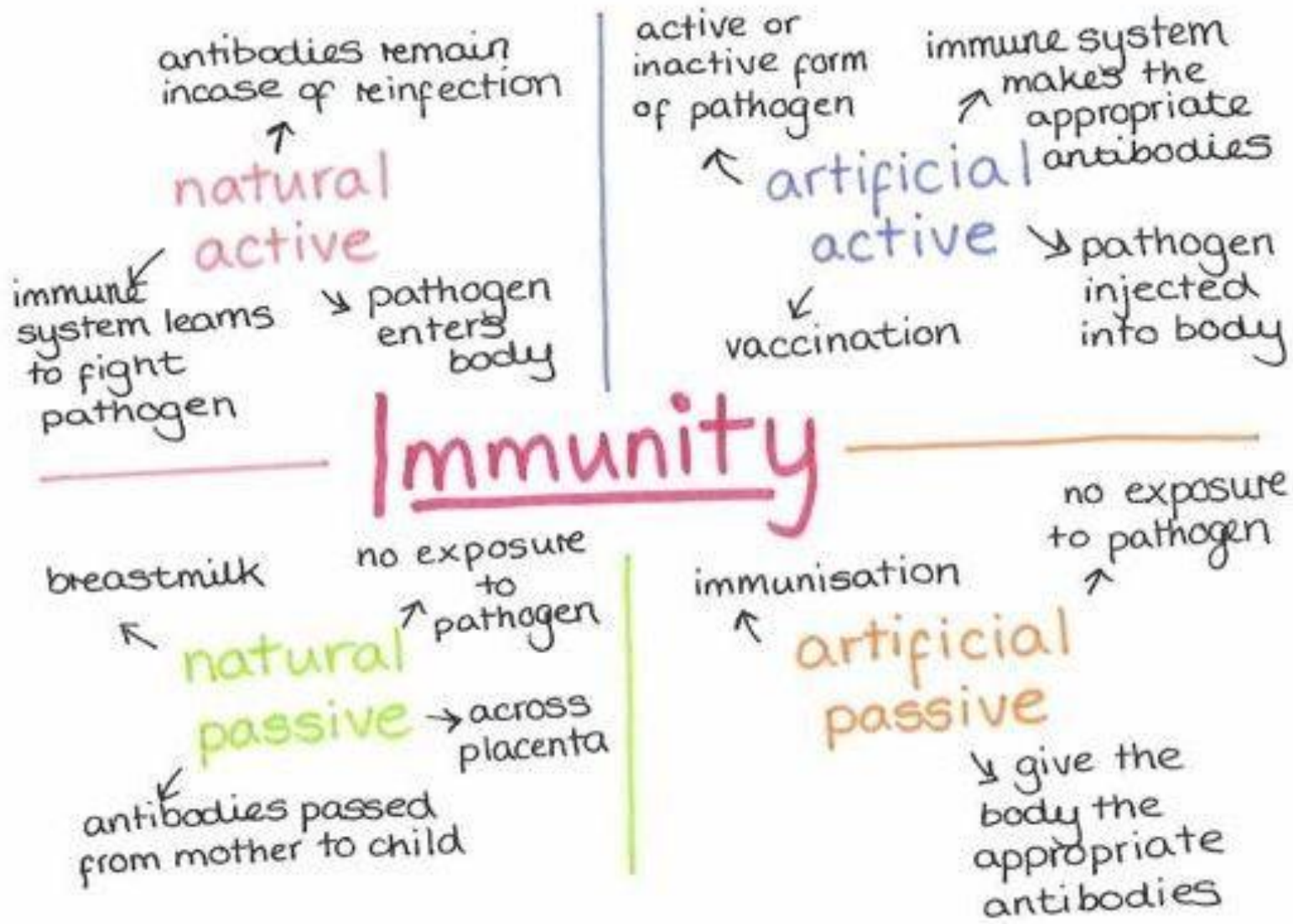
Passive Immunity

Short-term Immunity



Active Immunity





Types of Humoral Acquired Immunity

I. **Naturally Acquired Immunity**: Obtained in the course of daily life.

A. **Naturally Acquired Active Immunity**:

- ◆ *Antigens* or pathogens enter body naturally.
- ◆ Body generates an immune response to antigens.
- ◆ Immunity may be lifelong (chickenpox or mumps) or temporary (influenza or intestinal infections).

NATURAL ACTIVE IMMUNITY

- May be as a result of clinical or inapparent infection
- Measles infection gives the patient life long immunity
- Adults in developing countries have natural active immunity against polio because of inapparent infections in childhood
- Duration of immunity depends on the pathogen
 - Short term – Eg. Influenza
 - Long term - Eg. Measeles , chicken pox



GERMS MAKE
ME SICK

B. Naturally Acquired Passive Immunity:

- ◆ *Antibodies* pass from mother to fetus via placenta or breast feeding (**colostrum**).
- ◆ No immune response to antigens.
- ◆ Immunity is usually **short-lived** (weeks to months).
- ◆ Protection until child's immune system develops.

Types of Humoral Acquired Immunity(Contd.)

II. **Artificially Acquired Immunity:** Obtained by receiving a vaccine or immune serum.

1. **Artificially Acquired Active Immunity:**

◆ *Antigens* are introduced in vaccines (**immunization**).

◆ Body generates an immune response to antigens.

◆ Immunity can be lifelong (oral polio vaccine) or temporary (tetanus toxoid).

2. Artificially Acquired Passive Immunity:

- ◆ Preformed *antibodies* (*antiserum*) are introduced into body by injection.
 - ☞ Snake antivenom injection from horses or rabbits.
- ◆ Immunity is short lived (half life three weeks).
- ◆ Host immune system does not respond to antigens.

Natural

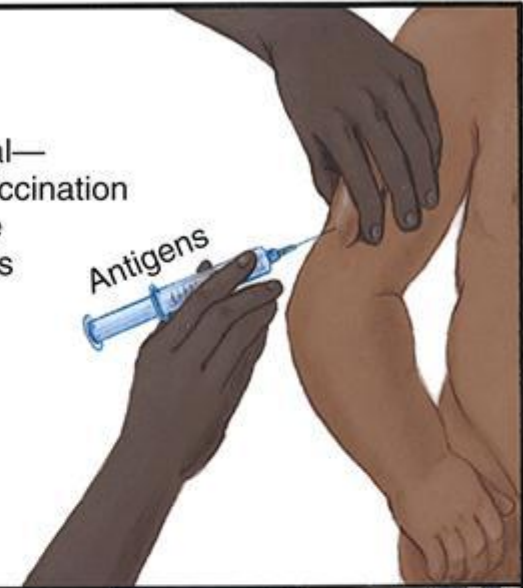
Artificial

Active

Active natural—
contract disease
and produce
memory cells



Active artificial—
receive a vaccination
and produce
memory cells



Passive

Passive natural—
receive maternal
antibodies through
placenta or breast
milk

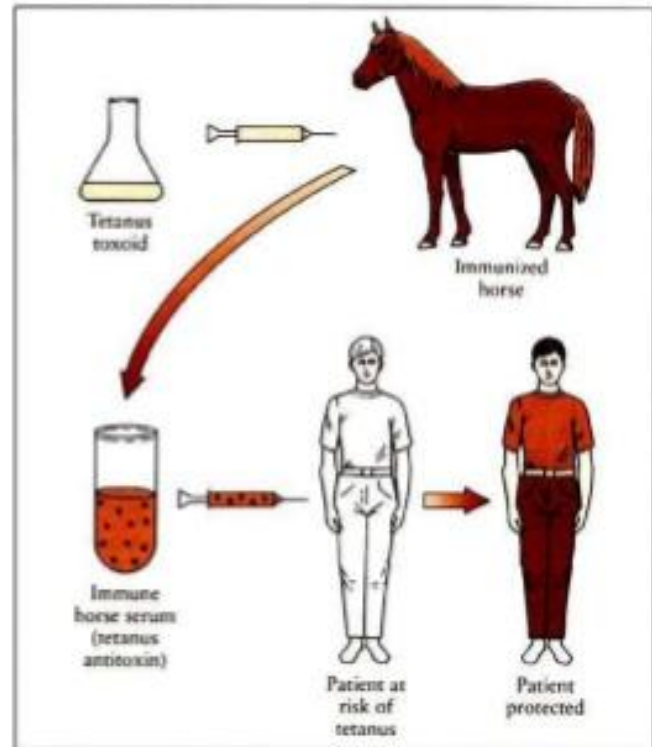


Passive artificial—
receive antiserum
with antibodies
from another host



PASSIVE IMMUNITY

- No infection
- Readymade antibodies are administered
- No latent period
- No negative phase
- Immediate protection



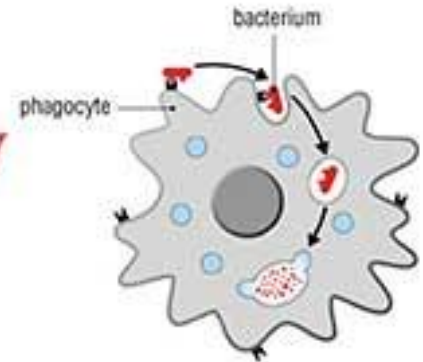
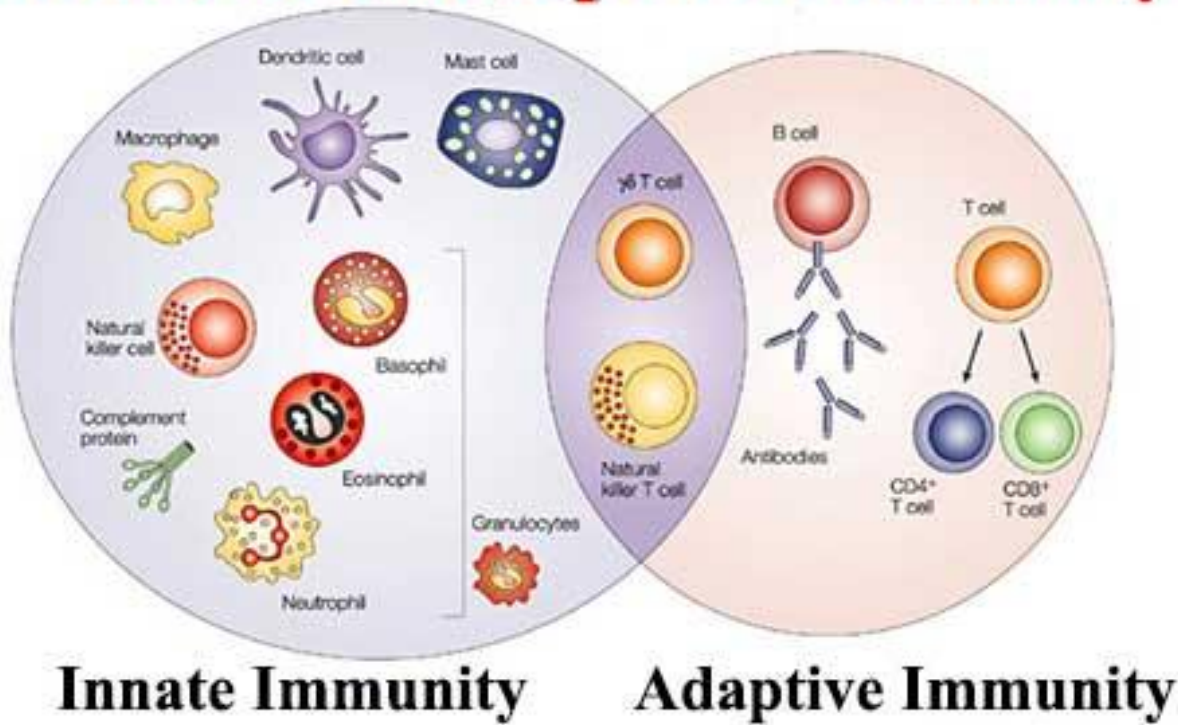
Acquired immunity

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.

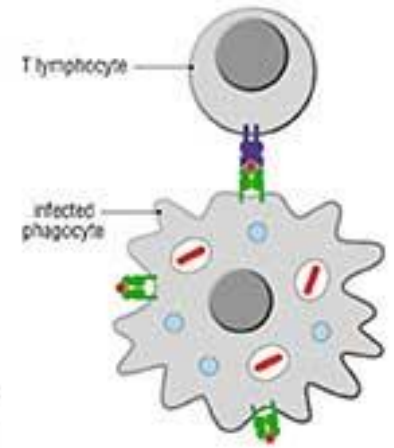
Characteristics of Acquired Immunity

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

Difference between Innate and Adaptive Immunity



VS



	Innate memory	Adaptive memory
Effector molecules	Cytokines	Antibodies
Mechanisms	Epigenetic changes (e.g., DNA methylation, histone acetylation)	Gene rearrangement (somatic recombination of gene segments)
Type of response	Rapid (same as primary response), either enhanced (“trained memory”) or reduced (“tolerance”)	Rapid (much more than primary response), enhanced/more potent
Specificity	Triggered by any molecule or stressful event (e.g., molecules shared by groups of related microbes or produced by damaged host cells, metabolic compounds, pollutants, etc.), upon a second exposure to the same or different agent/event	For a specific antigen, upon a second exposure to the same

TABLE 11-1

Differences between innate and acquired immunity

Feature	Innate immunity	Acquired immunity
Definition	The resistance to infection that an individual possesses by virtue of genetic and constitutional makeup	The resistance that an individual acquires during life
Types	Nonspecific and specific	Active and passive
Time taken to develop	Hours	Days
Specificity	For structures shared by groups of related microbes	For antigens of microbes and for nonmicrobial antigens
Memory	None; repeated exposure brings response like primary response	Yes; secondary response much faster than primary response
Components		
Physical and chemical barriers	Skin, mucosal epithelia, and antimicrobial chemicals	Lymphocytes in epithelia and antibodies secreted at epithelial surfaces
Blood and tissue antimicrobial substances	Complement; leukins from leukocytes, plakins from platelets, lactic acid found in muscle tissue, lactoperoxidase in milk, and interferons (antiviral)	Antibodies
Cells	Phagocytes (macrophages and neutrophils) and natural killer cells	Lymphocytes