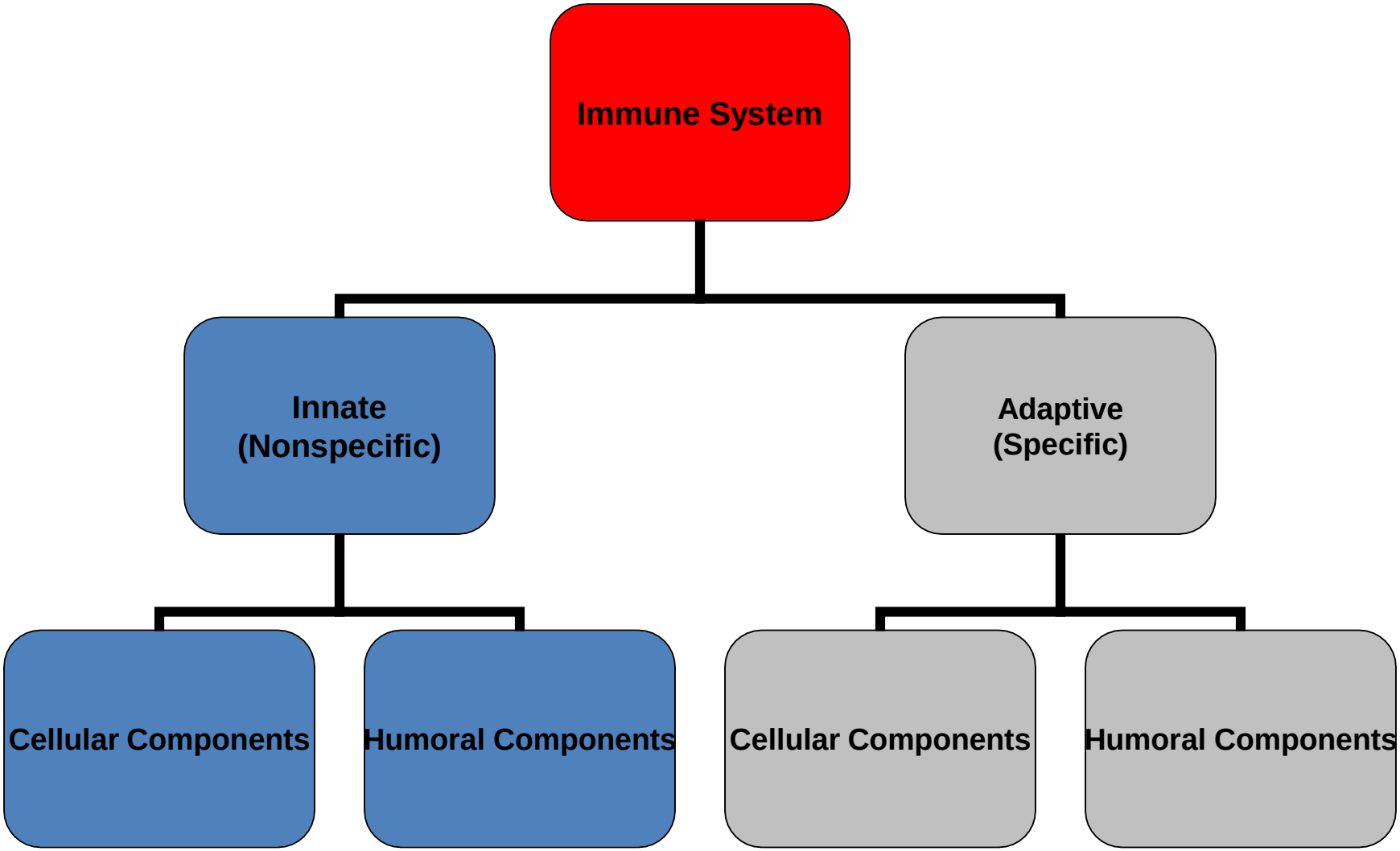
TYPES OF IMMUNITY

RAKESH SHARDA

Overview of the Immune System



INNATE *versus* ADAPTIVE IMMUNITY

Innate immunity refers to an immediate or early antigen-nonspecific defense mechanisms that are present in a host since birth without being induced and are designed to react and/or eliminate any antigen. This is the immunity one is born with

Adaptive (acquired) immunity refers to antigen-specific induced defense mechanisms that take several days to develop and are designed to react and/or eliminate a specific antigen. This is the immunity one acquires during life.

(Adaptive immunity is found exclusively in vertebrates)

Innate Immunity

The innate immune responses involve:

- **physical barriers**
- **chemicals - lysozyme, bile salts, sebum, HCl acid, etc**
- **cells that release inflammatory mediators**
- **phagocytic cells**
- **natural killer cells**
- **humoral factors - complement proteins, acute phase proteins, and cytokines.**

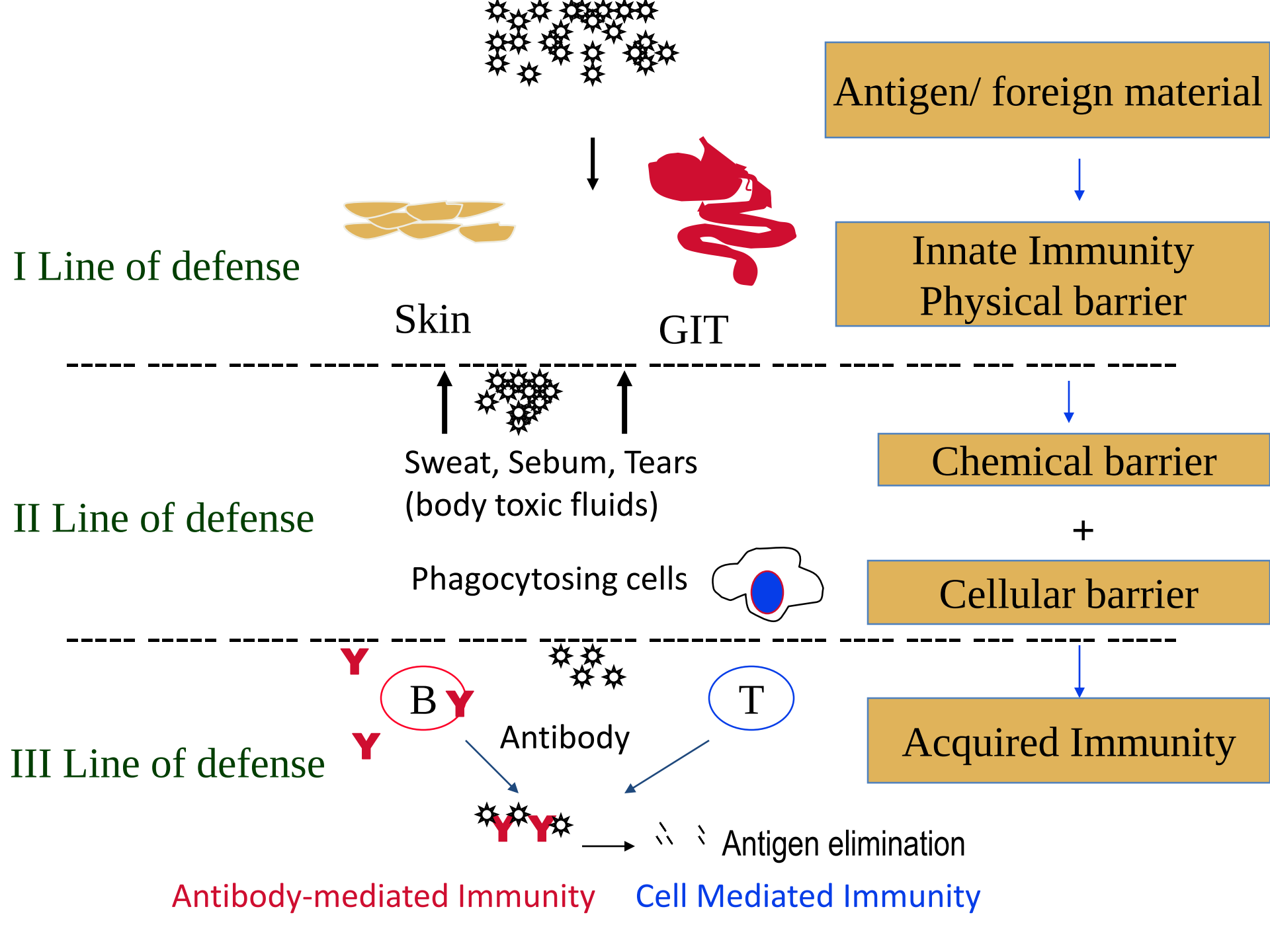
Adaptive Immunity

The Adaptive immune responses involves:

- **antigen-presenting cells (APCs)** such as macrophages and dendritic cells;
- the activation and proliferation of **antigen-specific B-lymphocytes;**
- the activation and proliferation of **antigen-specific T-lymphocytes;**
- the production of **antibody molecules, cytotoxic T-lymphocytes (CTLs), and cytokines.**

Components of Innate and Adaptive Immunity

Innate Immunity	Adaptive Immunity
physical barriers	
skin, gut Villi, lung cilia,etc	none
soluble factors	
many protein and non-protein secretions	Immunoglobulins (antibody)
cells	
phagocytes, NK cell eosinophils, K cells	T and B lymphocytes APCs


Antigen/ foreign material
I Line of defense
Skin
GIT
Innate Immunity
Physical barrier
Sweat, Sebum, Tears
(body toxic fluids)
II Line of defense
Chemical barrier
+
Phagocytosing cells
Cellular barrier
B
T
Antibody
III Line of defense
Acquired Immunity
Antigen elimination
Antibody-mediated Immunity
Cell Mediated Immunity

CARDINAL FEATURES OF ADAPTIVE IMMUNE SYSTEM

1. **Tolerance to self antigens -** under normal conditions, an immune response to "self" antigens (called an autoimmune response) does not occur.
2. **Specificity** – components of adaptive immunity react specifically with the antigen that induced their formation.
3. **Memory -** the adaptive immunological response remembers the antigen for invariable period of time and upon subsequent exposure to homologous antigen there is an anamnestic immune response, i.e. **strengthens upon repeated exposure**

Characteristics/Differences of Innate and Adaptive Immunity

Innate Immunity	Adaptive Immunity
Antigen independent	Antigen dependent
No time lag	A lag period
Not antigen specific	Antigen specific
No Immunologic memory	Development of memory

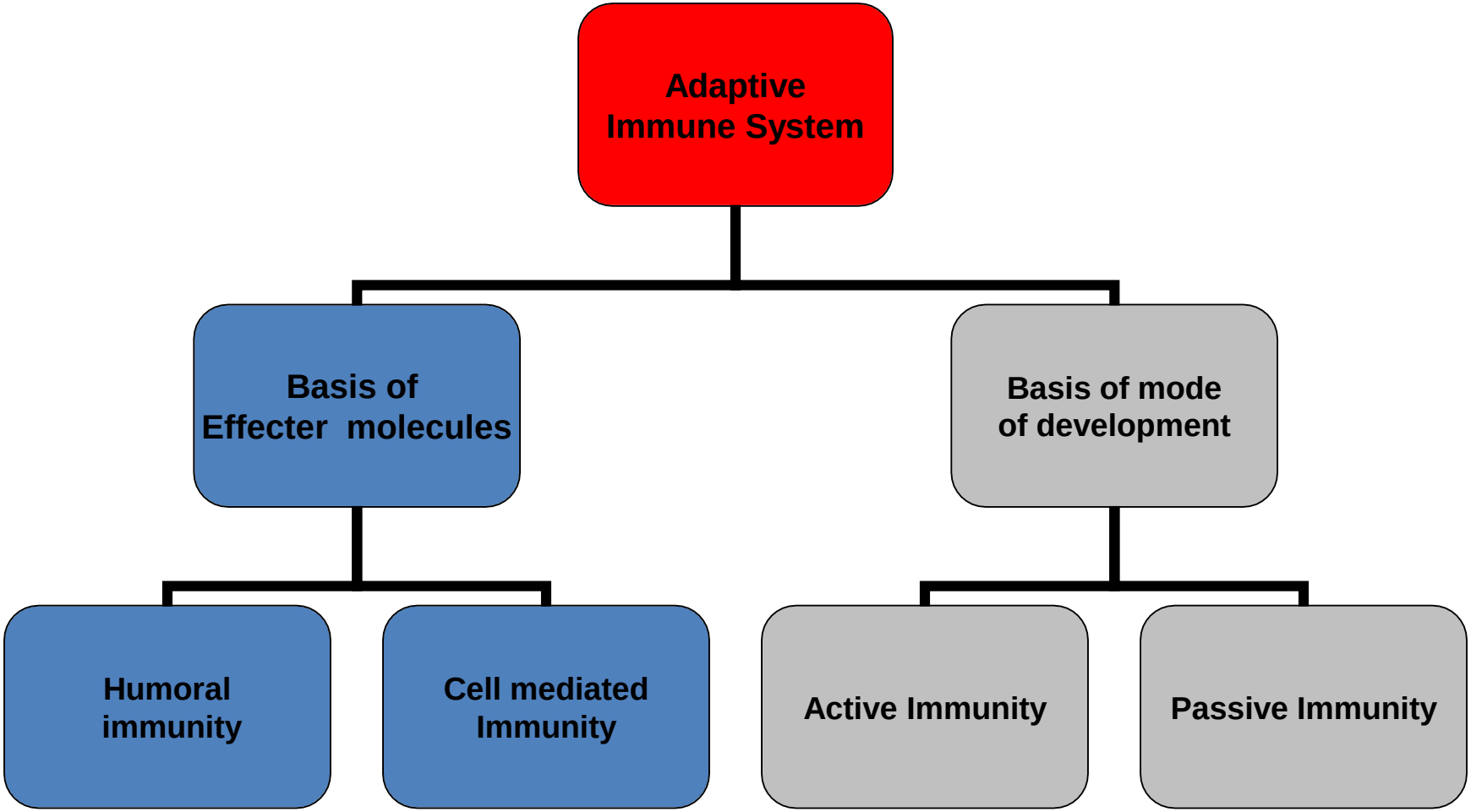
Innate and Adaptive immunity

Innate immune system generates signals that

- identify nature of the antigen
- type of effector response to be induced
- whether an adaptive response will be induced

The antigen presenting cell – *APC* – is
the bridge between innate and adaptive immunity

Classification of Adaptive Immunity



Types of Acquired Immunity
(On the basis of effector molecules)

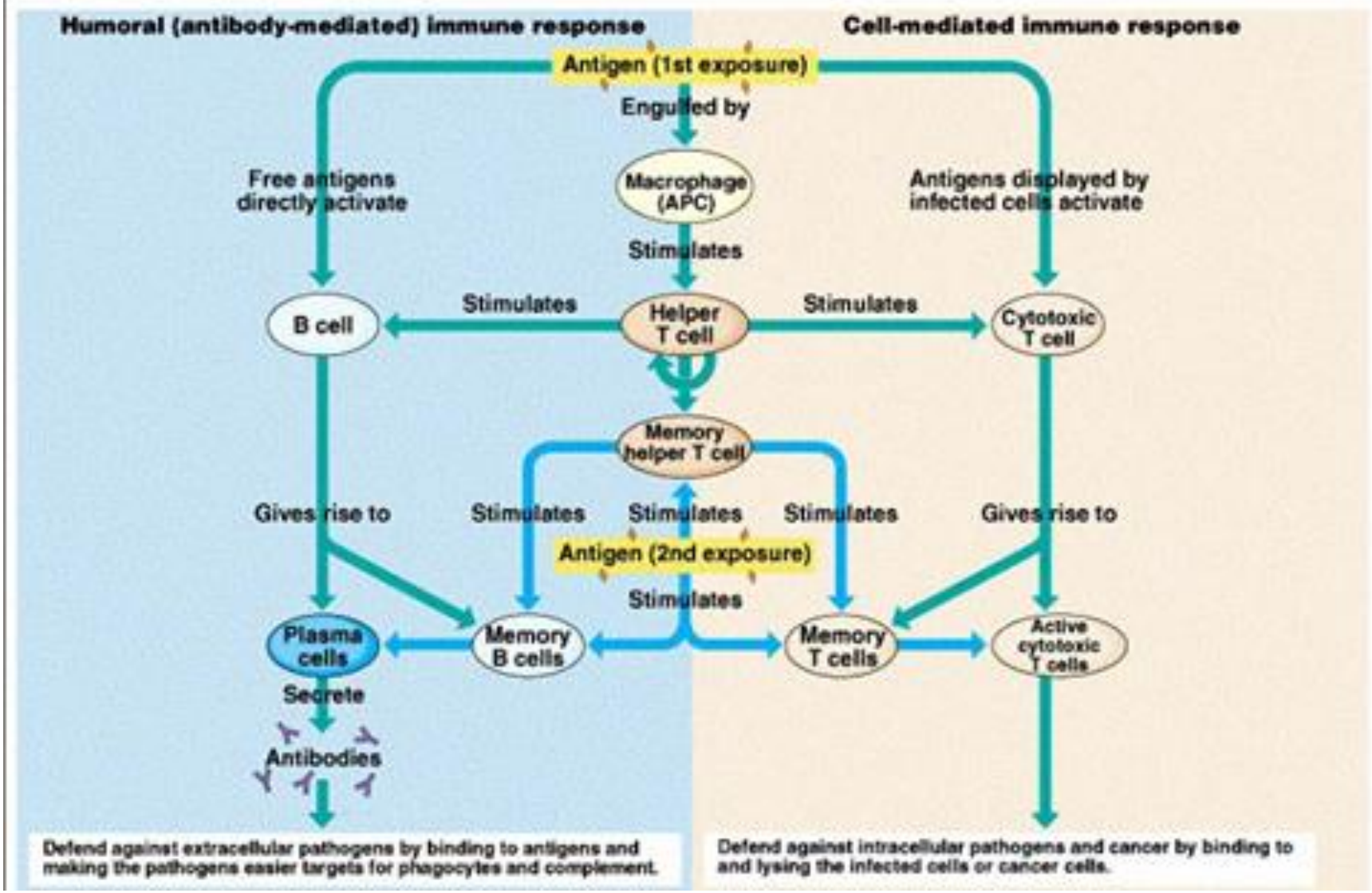
- **Humoral immunity:** Humoral or antibody mediated immunity (AMI) is characterized by the production of antigen-specific immunoglobulin molecules, called as 'antibodies', induced in response to an antigen and is mediated by B-lymphocytes. Antibodies primarily defend against extracellular pathogens and toxins. Humoral immunity is so named because it involves substances found in the humors, or body fluids.

- **Cell-mediated immunity:** Cell-mediated immunity (CMI) involves the activation of antigen-specific cells, such as CTLs and macrophages, which destroys the cells harboring antigen. Cellular immunity primarily defend against intracellular pathogens, multicellular parasites, transplanted tissue, and cancer cells.

Characteristics/Differences of Humoral and Cell mediated Immunity

Humoral Immunity	Cell mediated Immunity
B-cell dependent	T-cell dependent
Effecter molecule - antibodies	Effecter – CTL, NK, macrophages
Effective against extracellular parasites	Effective against intracellular parasites, tumor cells, tissue grafts
MHC restriction: +/-	MHC restriction:+

Overview of Adaptive Immune Response



The Interrelation of AMI and CMI

1. **Th cells activate B cells** to produce antibodies against **T-dependent antigens** (usually **protein** in composition).

2. In **antibody-dependent cell-mediated cytotoxicity** (**ADCC**), NK cells, macrophages, and other leukocytes lyse antibody-coated cells that are too large to be phagocytosed.

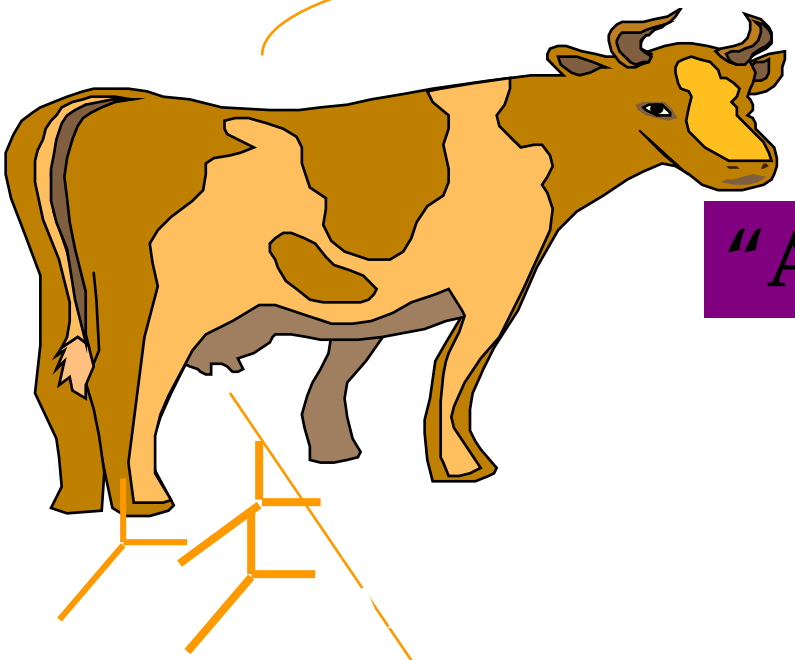
Types of Acquired Immunity

(On the basis of mode of development)

Active immunity, in which the host develops an adaptive immunological response and produces the cells and factors responsible for the immunity. Active immunity can persist for a long time in the host.

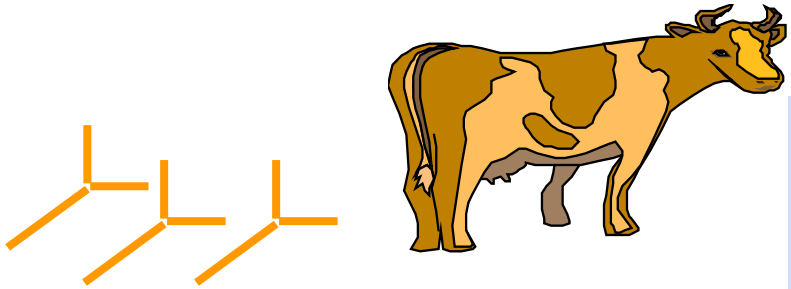
Passive immunity is acquisition by a host of immune factors which were produced in another animal, i.e., the host receives pre-formed antibodies and/or immuno-reactive lymphocytes. Passive immunity is typically short-lived and usually persists only a few weeks or months.

INFECTION OF " X"



" ACTIVE IMMUNITY "

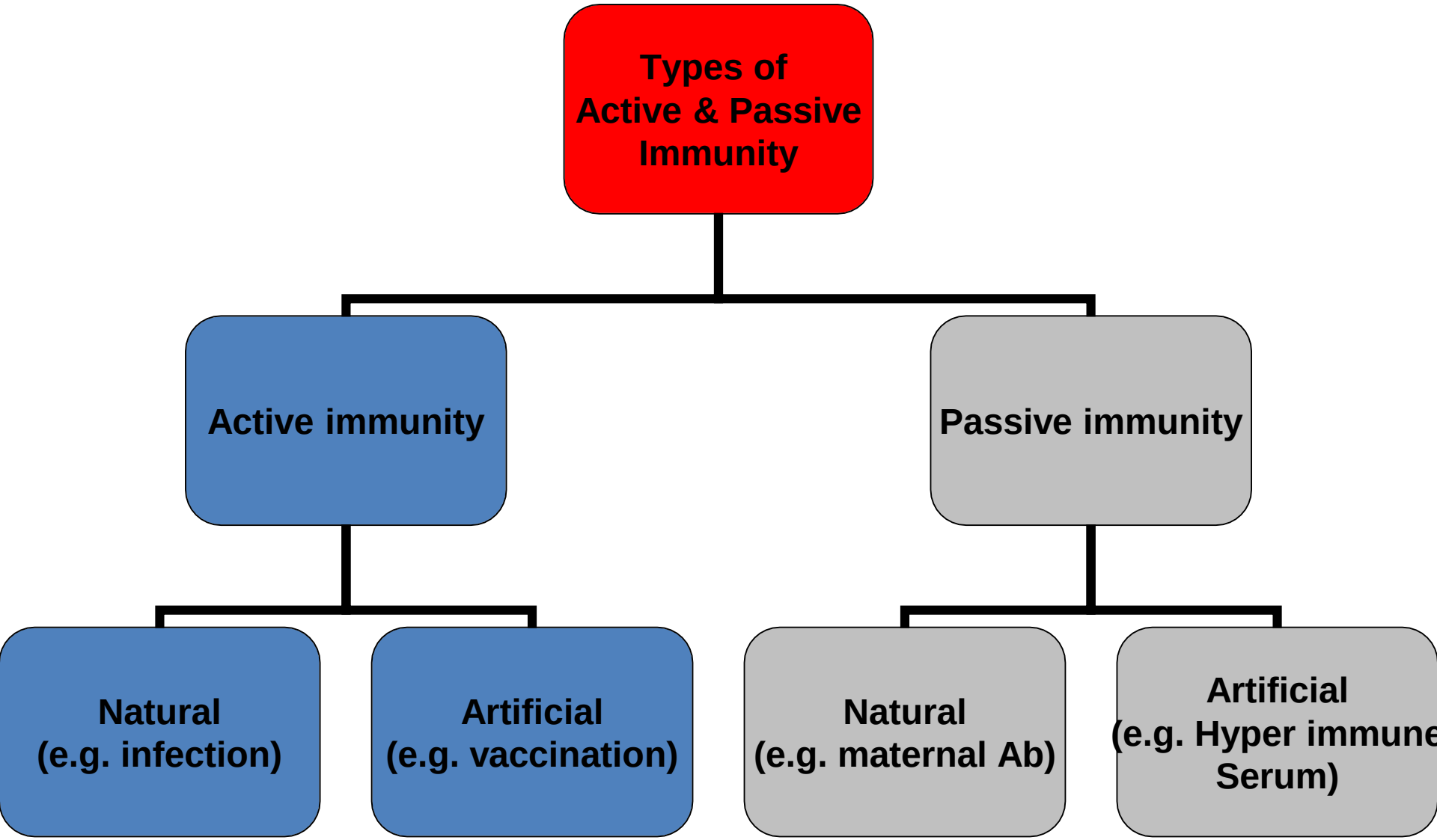
Resistance



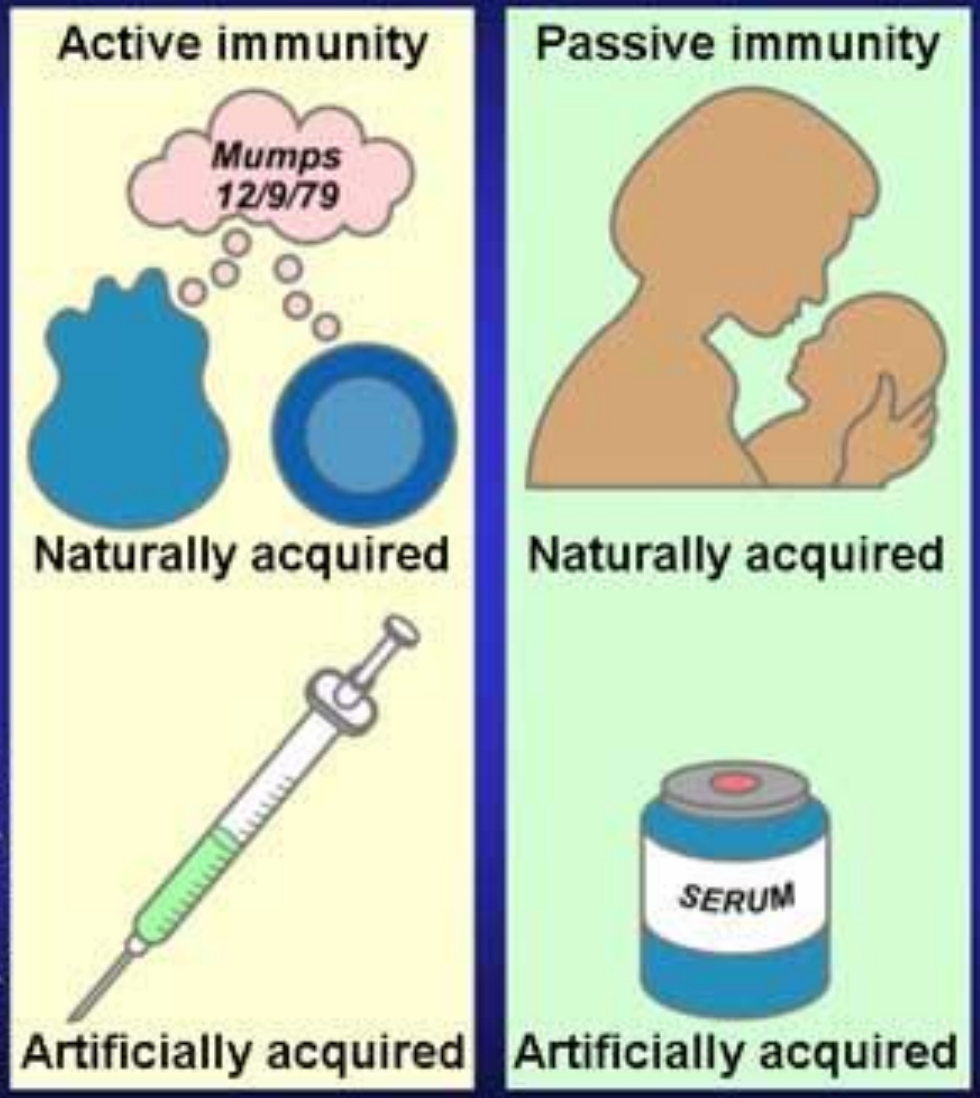
" PASSIVE IMMUNITY "

Characteristics/Differences of Active and Passive Immunity

Active Immunity	Passive Immunity
Participation of hosts' immune system	No participation
Long lived	Short lived
Memory	No memory
Lag period	No lag period
Titer is time dependent	Immediately high titer


Types of
Active & Passive
Immunity
Active immunity
Passive immunity
Natural
(e.g. infection)
Artificial
(e.g. vaccination)
Natural
(e.g. maternal Ab)
Artificial
(e.g. Hyper immune
Serum)

Immunity: Active and Passive



Advantages and Disadvantages of Passive Immunization

Advantages	Disadvantages
immediate protection	no long term protection serum sickness risk of hepatitis and Aids graft vs. host disease (**cell graft only**)