INTRODUCTION TO IMMUNITY

By

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Learning Objectives

- Define immunity
- Classify immunity
- Mechanism of activation of each type of immunity
- Factors responsible for maintenance of an active immunity
- Clinical significances of immunity

Definition

- The ability of the body to counter any type of foreign invasion (organism or toxin)

  is called immunity

The DEFENSIVE mechanism of the body

Types of the Immunity

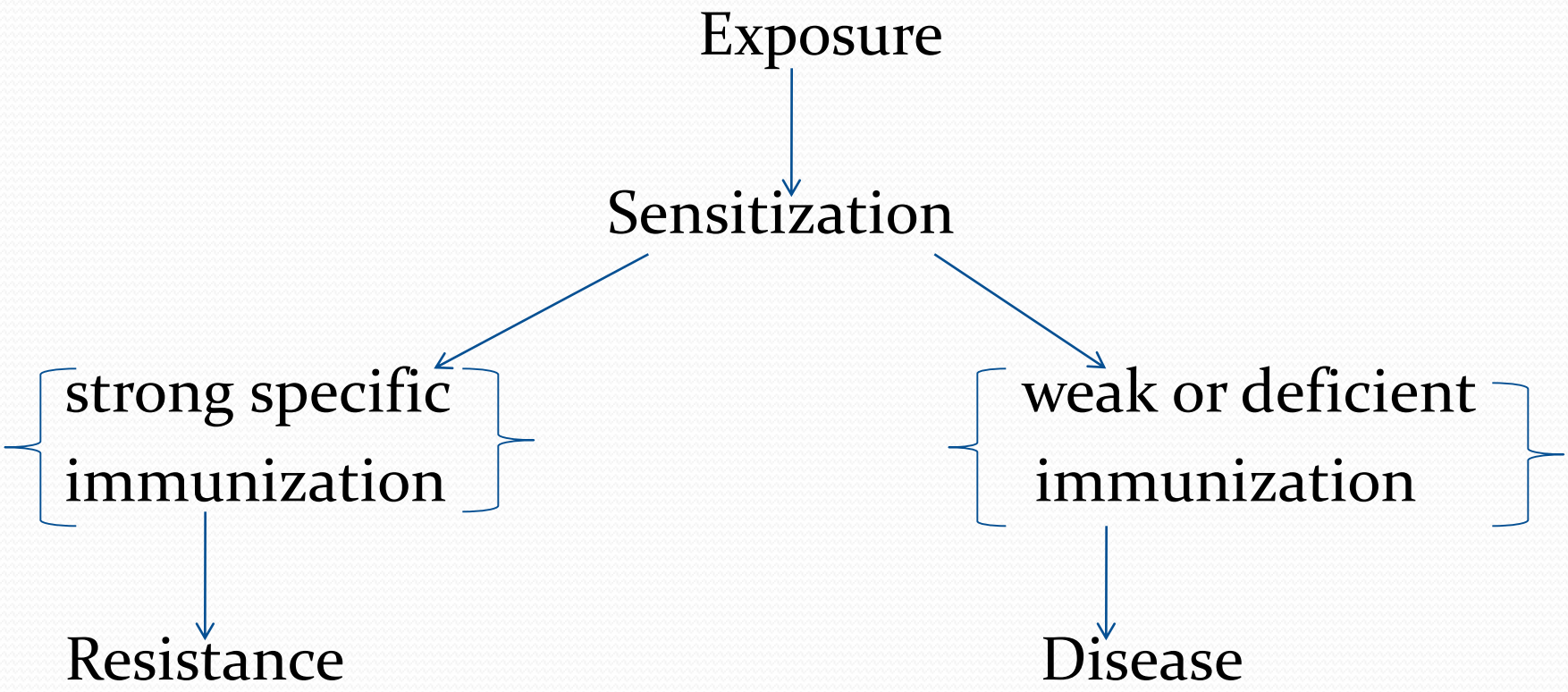
- Innate Immunity
- Acquired immunity

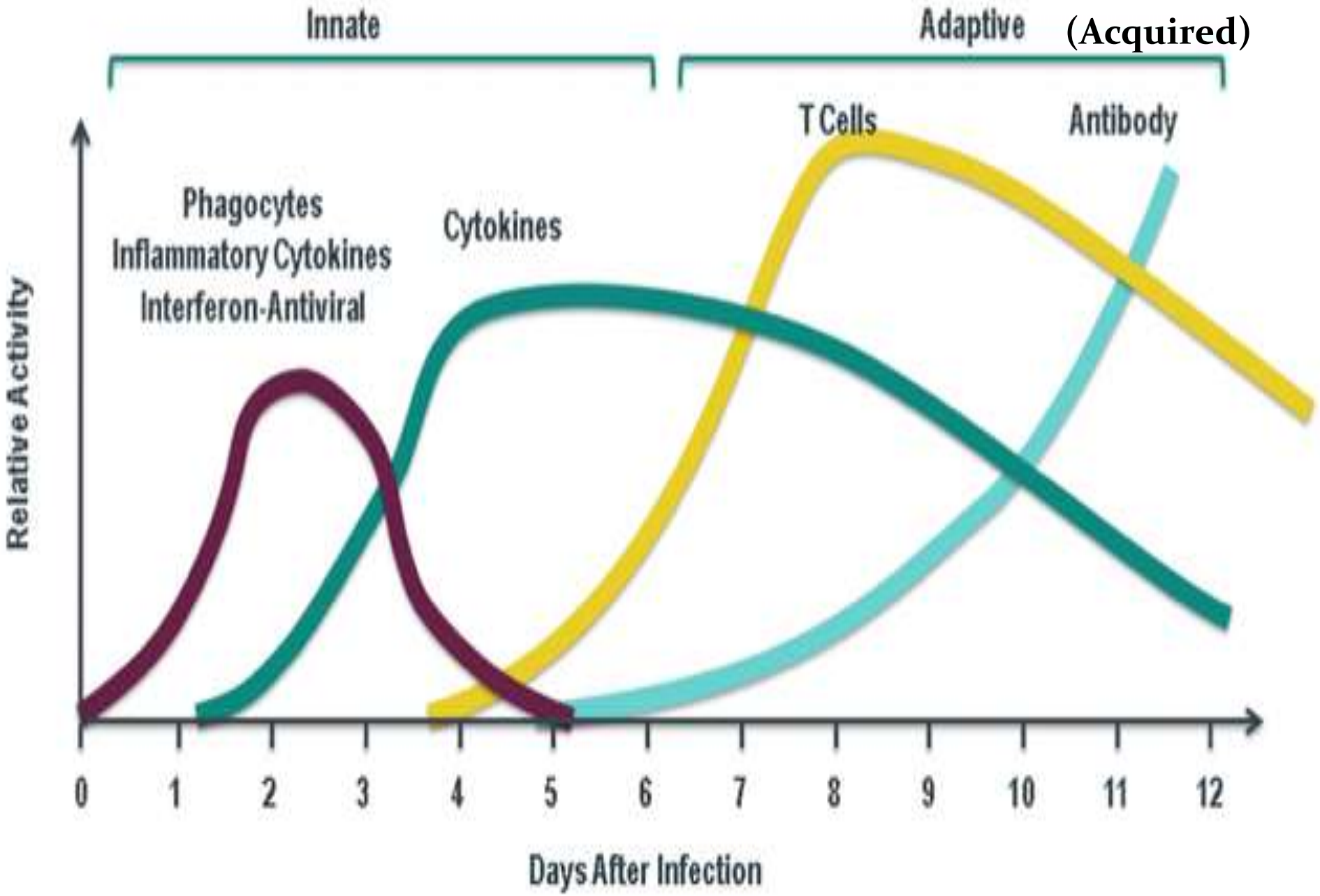
Innate Immunity

Naturally and already existing defensive mechanism of our body against every type of infection or injury is called Innate Immunity.

a. Protection by skin, mucous membrane, gastric acids etc
b. Phagocytosis
c. Destruction of organisms by any means in the body
d. Destruction by lysozymes, polypeptides , compliments complex activation and by Natural Killer cell activation

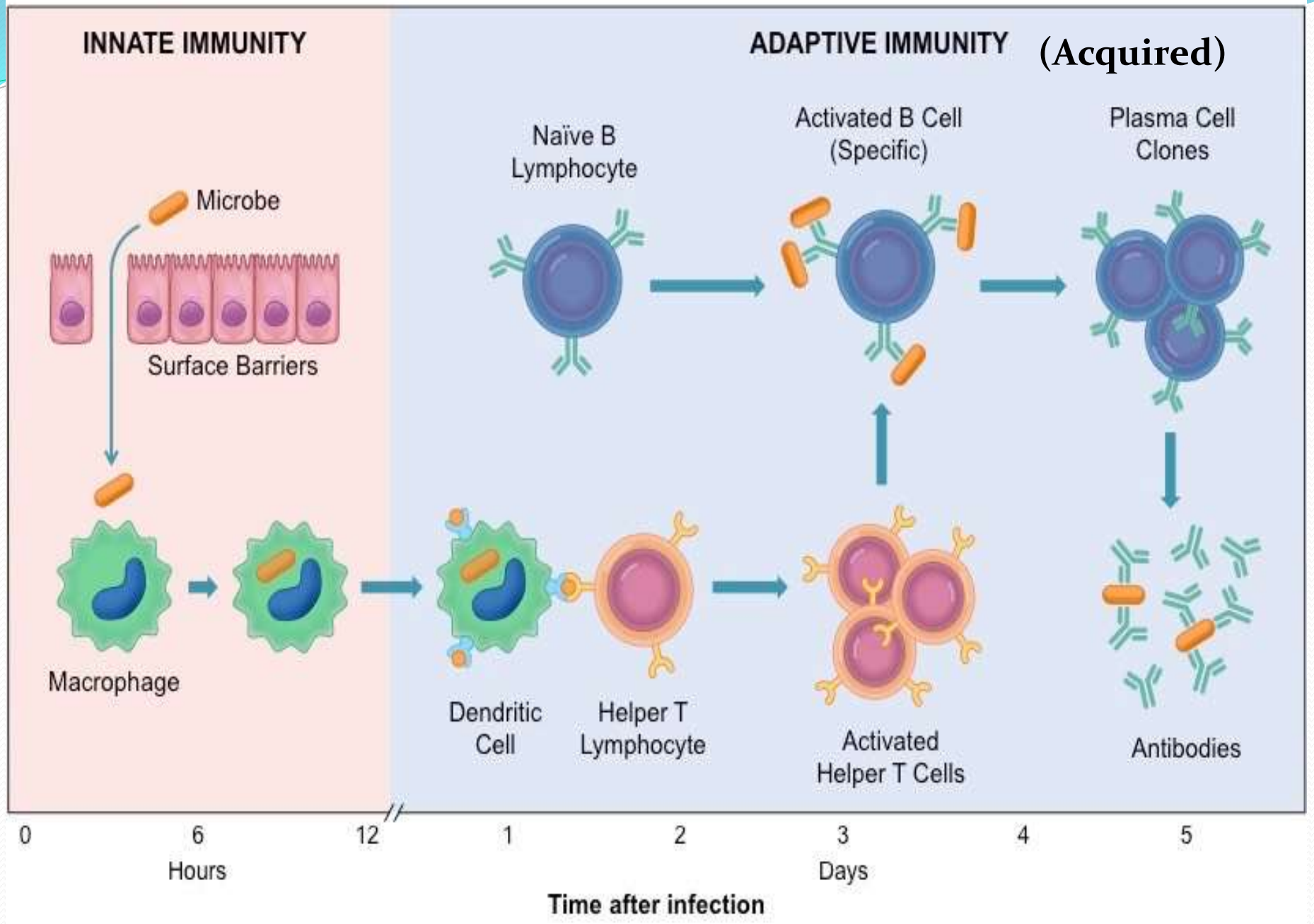
Acquired Immunity
OR Adaptive immunity



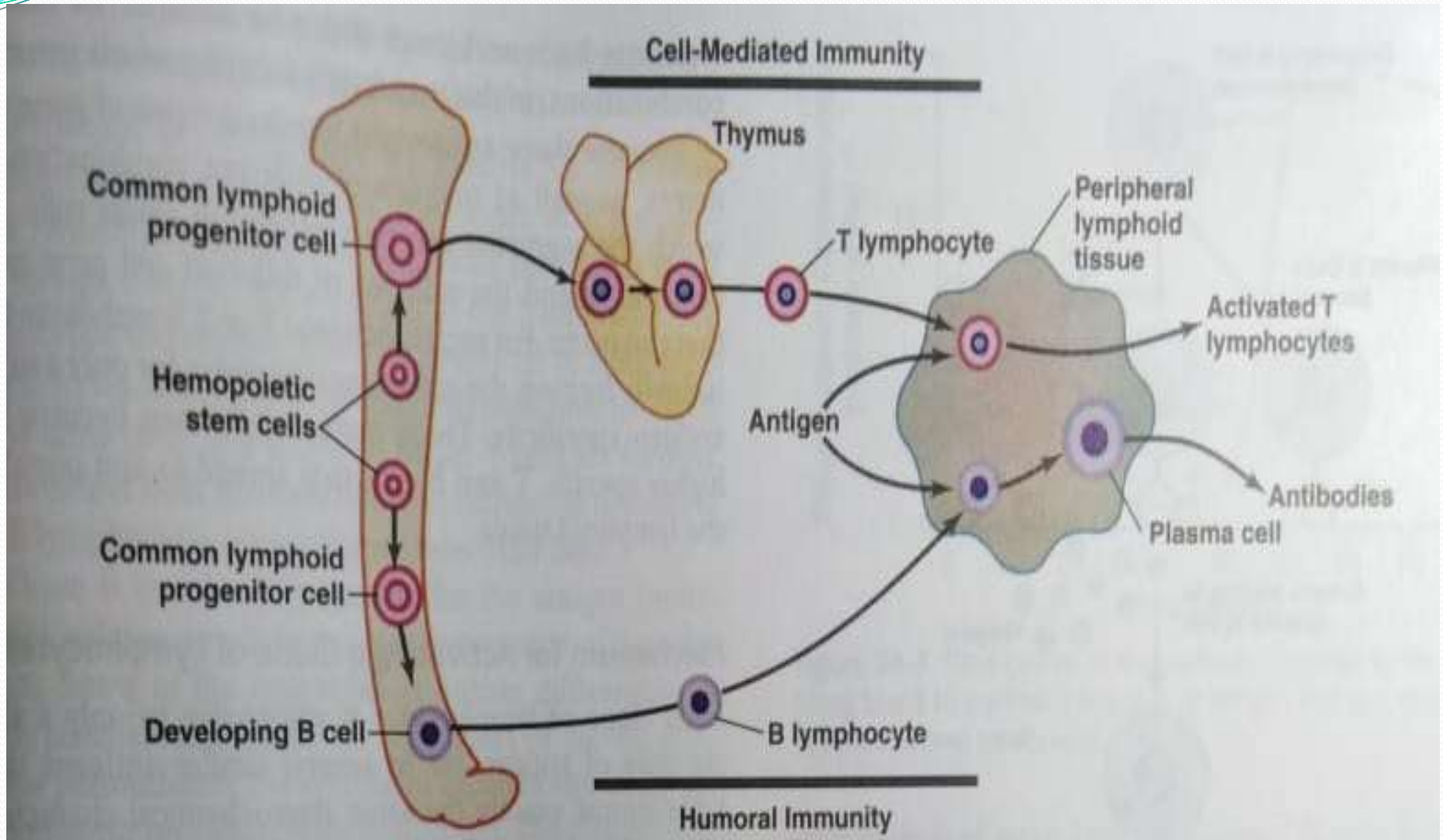

Innate
Adaptive
(Acquired)
T Cells
Antibody
Phagocytes
Inflammatory Cytokines
Interferon-Antiviral
Cytokines
Relative Activity
0
1
2
3
4
5
6
7
8
9
10
11
12
Days After Infection

Basic Types of Acquired Immunity

- Cell mediated OR T-cell immunity
- Humoral OR B-cell immunity


INNATE IMMUNITY
ADAPTIVE IMMUNITY
(Acquired)
Naïve B Lymphocyte
Activated B Cell (Specific)
Plasma Cell Clones
Microbe
Surface Barriers
Macrophage
Dendritic Cell
Helper T Lymphocyte
Activated Helper T Cells
Antibodies
0
6
12
1
2
3
4
5
Hours
Days
Time after infection

T & B Lymphocytes role in immunity



ure 34-1 Formation of antibodies and sensitized lymphocytes by a lymph node in response to antigens. This figure also shows the thymic (*T*) and bursal (*B*) lymphocytes that respectively are responsible for the cell-mediated and humoral immune processes.

Mechanism

- **Exposure—tregger----*Anti* bodies—*gen* eration (*Antigen*) ---- large molecules--- with *Epitopes***

which sites or receptors of these antigenic molecule to cause sensitization (antigenicity)

Mechanism of immunity

- ***Lymphocytes are required for acquired immunity and so for survival of life.***

- ***Lymphocytes are found in different site of the body especially lymphoid tissue in the body for protection. (lymph nodes, spleen, thymus, GIT)***

1- → Lymphocytes commited stem cells

2- → Pluripotent Haematopoietic stem cells

3- → Common Lymphoid Progenitor cells

B-Lymphocytes

Liver, (in fetal life)

Bone marrow (adults)

Bursa Fabricius (birds)

Thymus

(T-Lymphocytes)

Each Lymphocyte sensitized For specific antigen. After their desensitization against own body tissue in the thymus, then they leave And reach to the required Lymphoid tissue

Significance of Thymus removal before birth And organ transplantation

Pre-processing occur in liver and bone marrow before and after birth. Produced specific antibodies against antigens. They transferred to diffrnt lymphoid organs in the body.

Activation of Lymphocytes

Behavior of the T & B Lymphocytes against antigens

Exposure

→ Sensitization

→ Clone of lymphocytes

→ Segments of respective genes

→ fixation in one lymphocytes

→ Mature specific T& B lymphocytes

→ Clones of T- Lymphocyte
Having T-cell markers
For specific antigens

→ Clones of B-Lymphocytes
Produce Antibodies
with the help of millions
of specific surface receptors

Activation of Lymphocytes by macrophages

- **Role of macrophages, in stimulation of B-lymphocytes.**

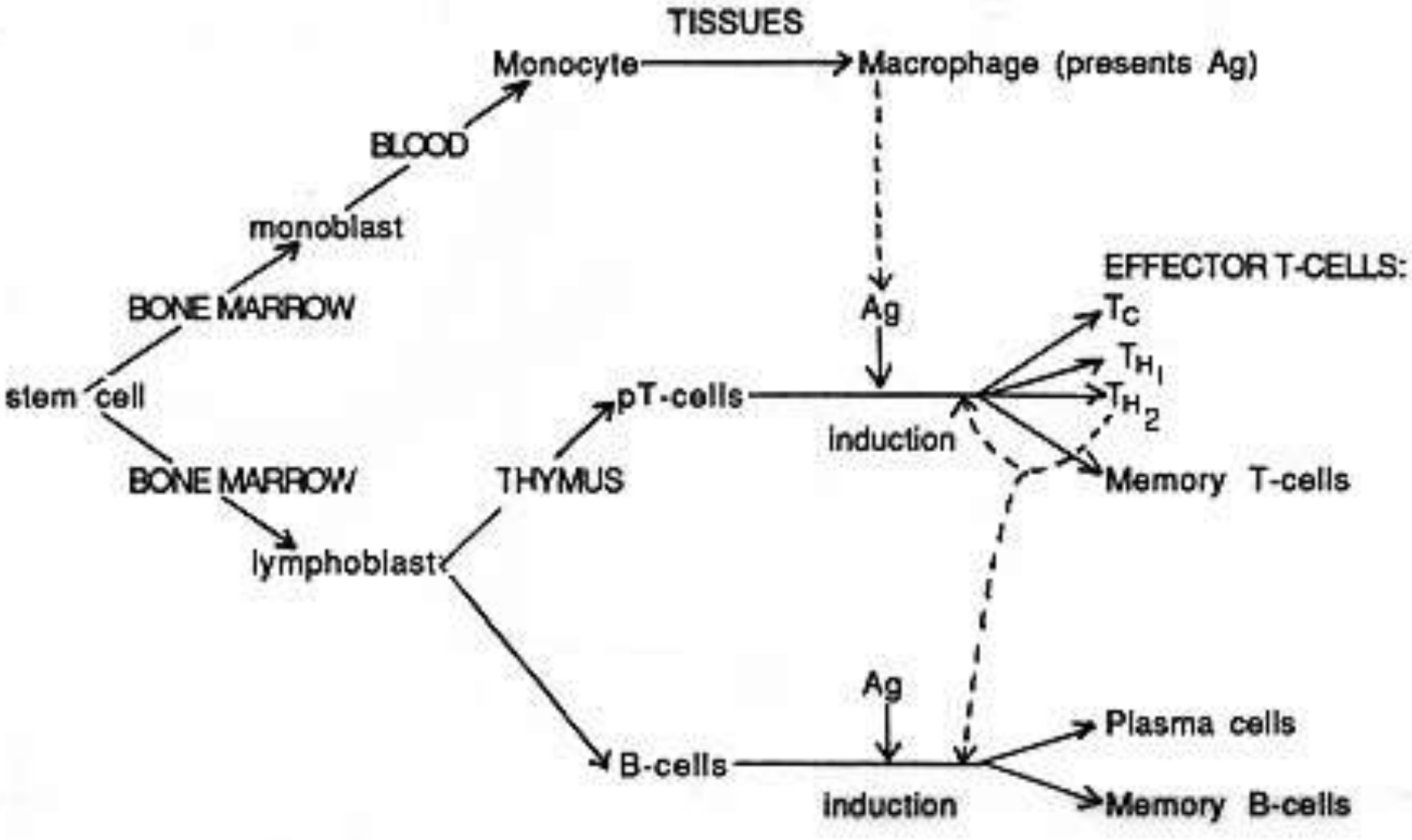
  Phagocytosis—digestion– secretion of some antigenic materials which will stimulate lymphocytes by 2 methods

Direct	Indirect
(i) Cell to cell contact With Lymphocytes	(ii) through IL-1

End result ---- Activation of Lymphocytes

- Stimulation of both T & B- Lymphocytes
- Some of T lymphocytes become T- Helper cells
- They secrete Lymphkines
- Stimulation of B-Lymphocytes
- Production of specific antibodies

Summary of Acquired Immunity



HUMORAL IMMUNITY

Behavior of B-Lymphocytes in immunity

(formation of antibodies & Plasma cells)

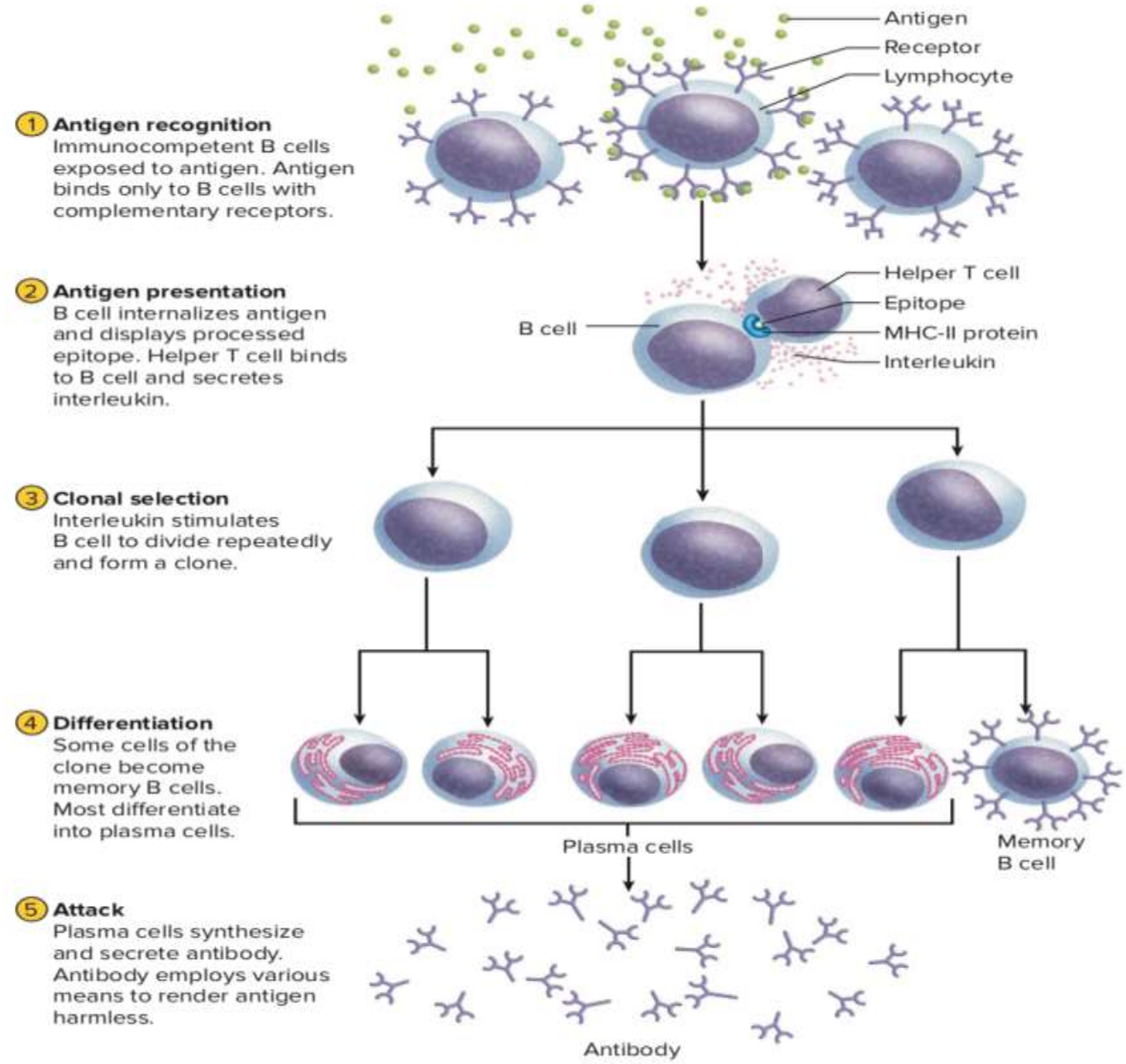
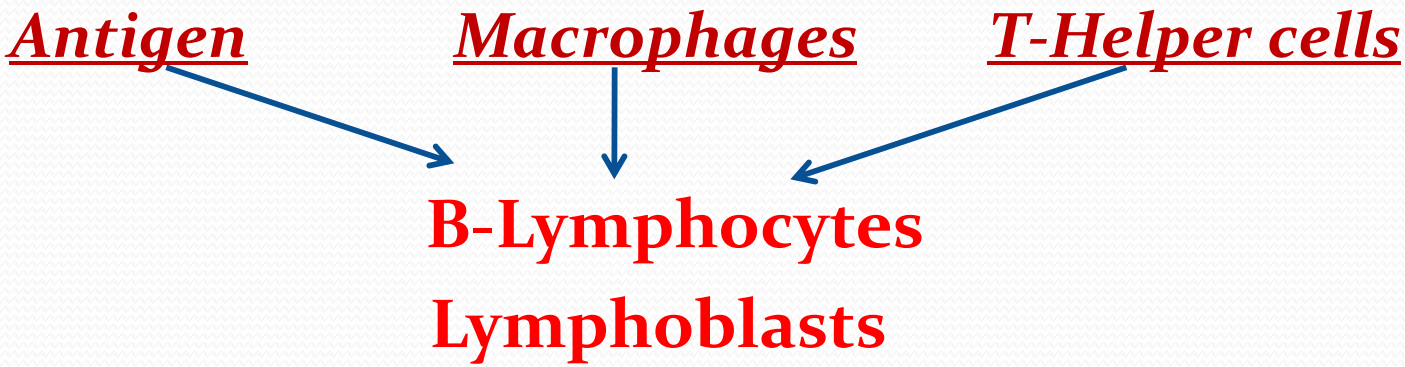


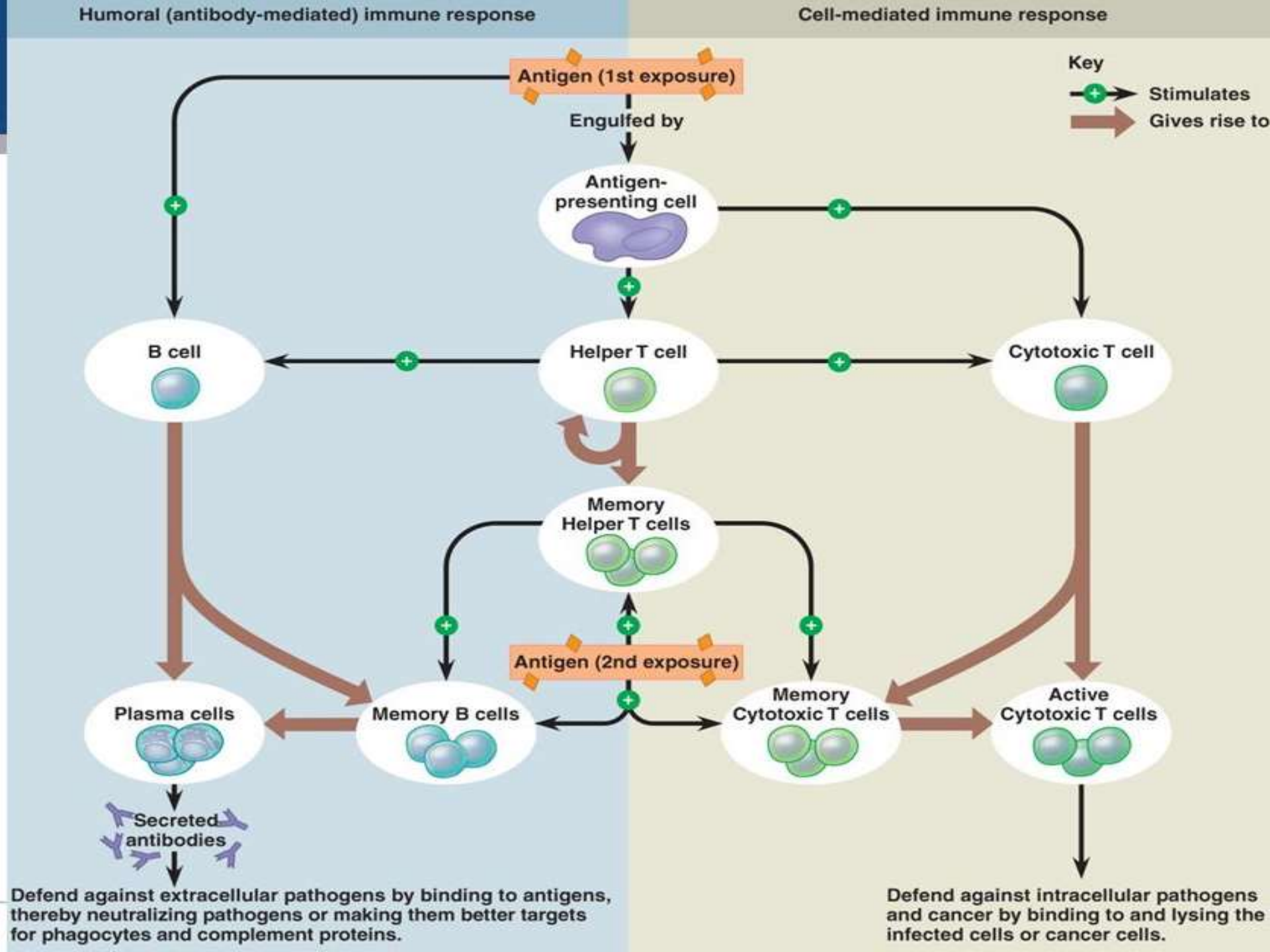
FIGURE 21.26 **Clonal Selection and Ensuing Events of the Humoral Immune Response.**

Activation and further processing of B-Lymphocytes

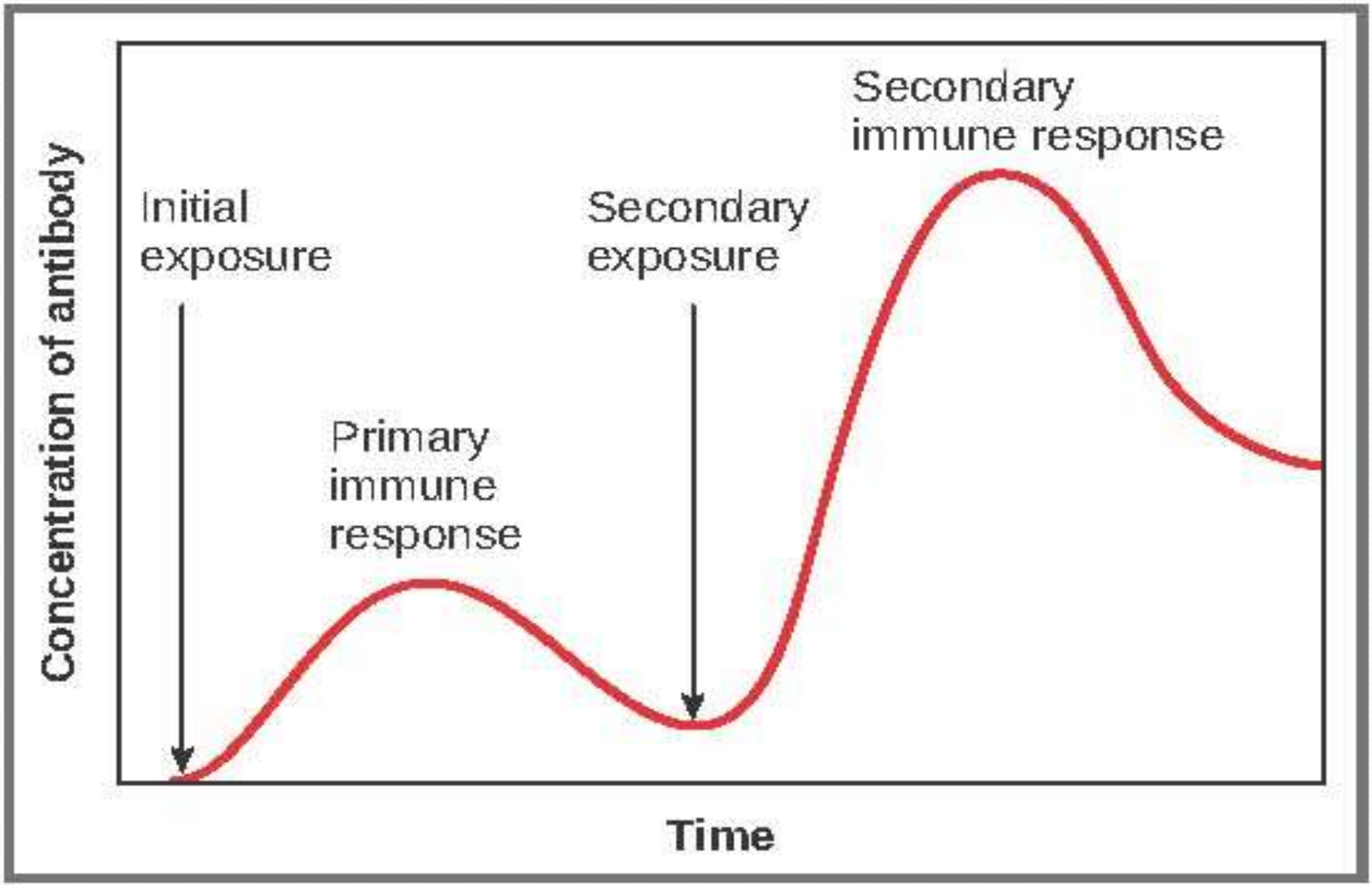


Plasmablast **(larger cell with RER)**
Each divides once after 10 hr–
in 4 days– 500 *Plasma cells*
2000 molecules of IgG/P.cell/sec.
Exhaustion and death of plasma cells
in a few days or weeks

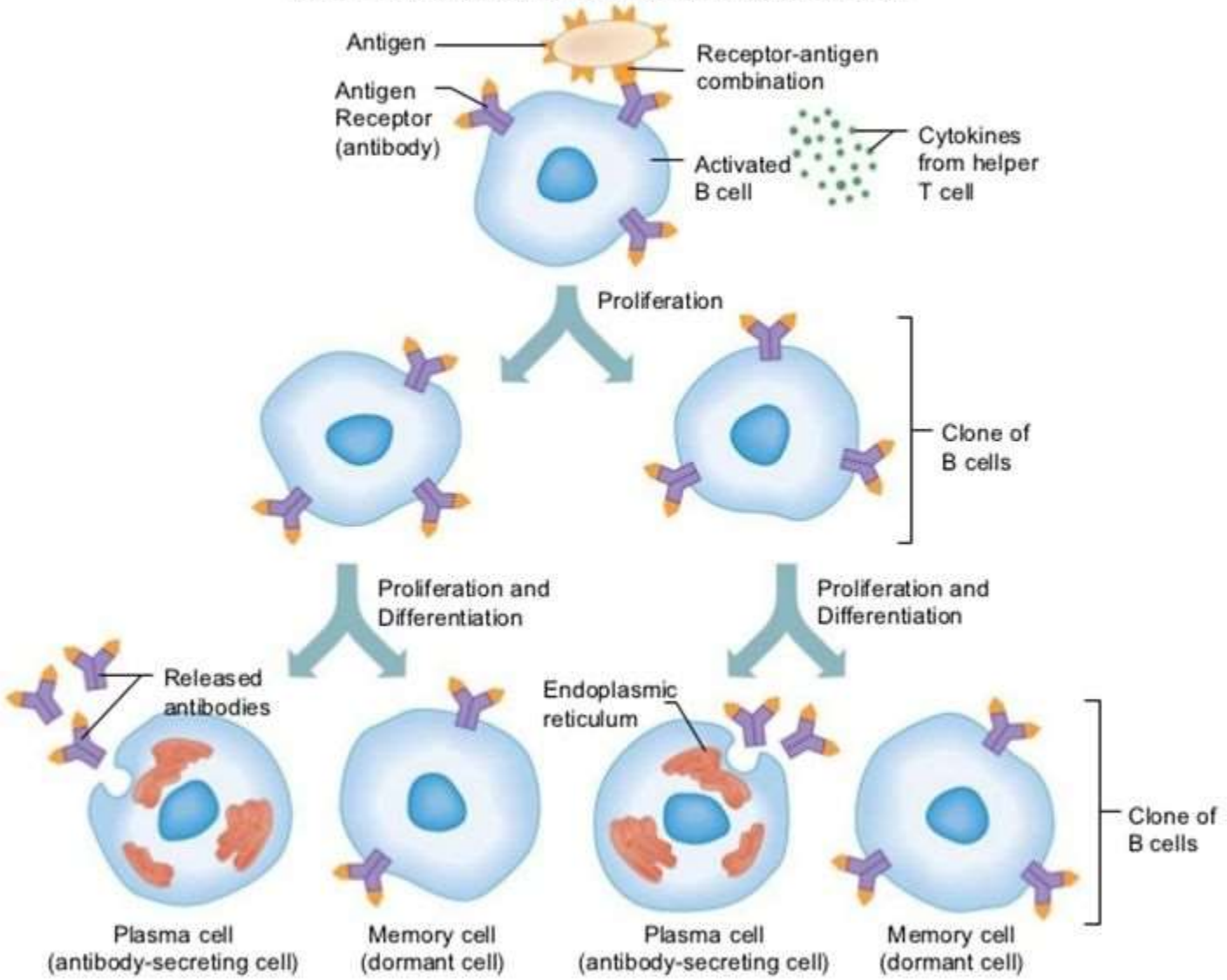
Memory Cells
(more potent B-Lymphocyte)
remained dormant in various
Sites, and produces many more
a/b on second exposure
(it explains Immunization)

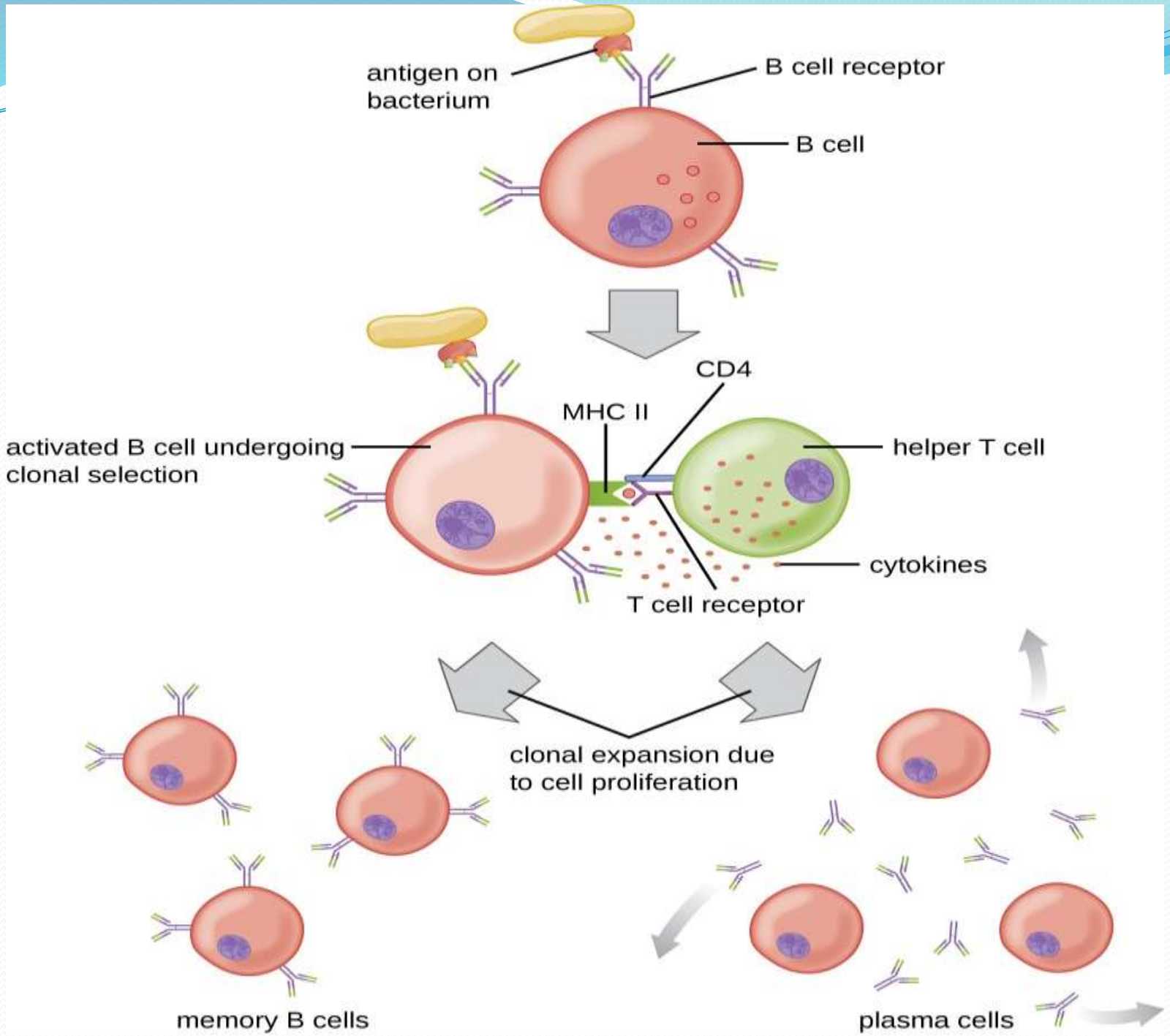

Humoral (antibody-mediated) immune response
Cell-mediated immune response
Key
Stimulates
Gives rise to
Antigen (1st exposure)
Engulfed by
Antigen-presenting cell
B cell
Helper T cell
Cytotoxic T cell
Memory Helper T cells
Antigen (2nd exposure)
Plasma cells
Memory B cells
Memory Cytotoxic T cells
Active Cytotoxic T cells
Secreted antibodies
Defend against extracellular pathogens by binding to antigens, thereby neutralizing pathogens or making them better targets for phagocytes and complement proteins.
Defend against intracellular pathogens and cancer by binding to and lysing the infected cells or cancer cells.

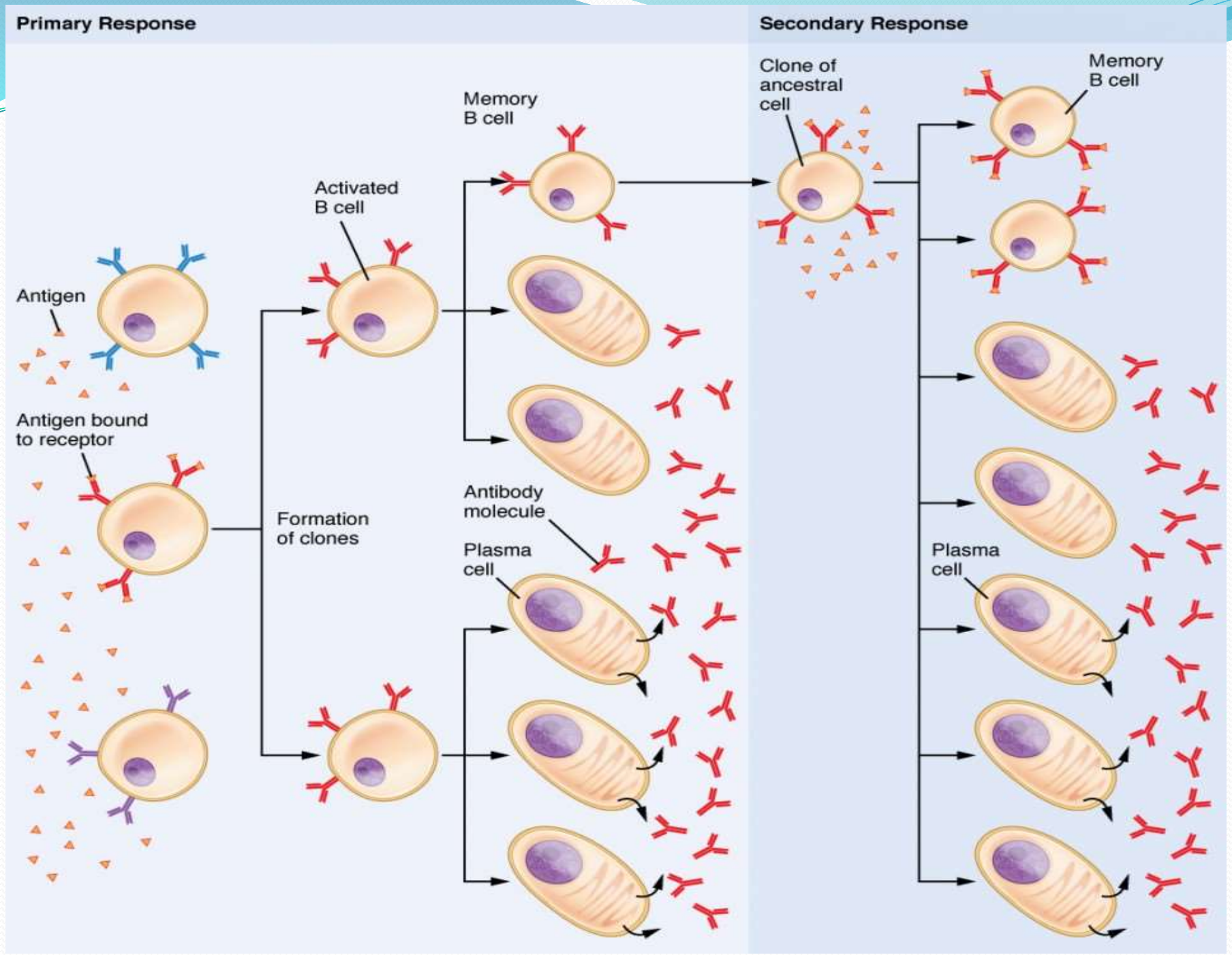
Response of memory cells



B-Lymphocytes activation

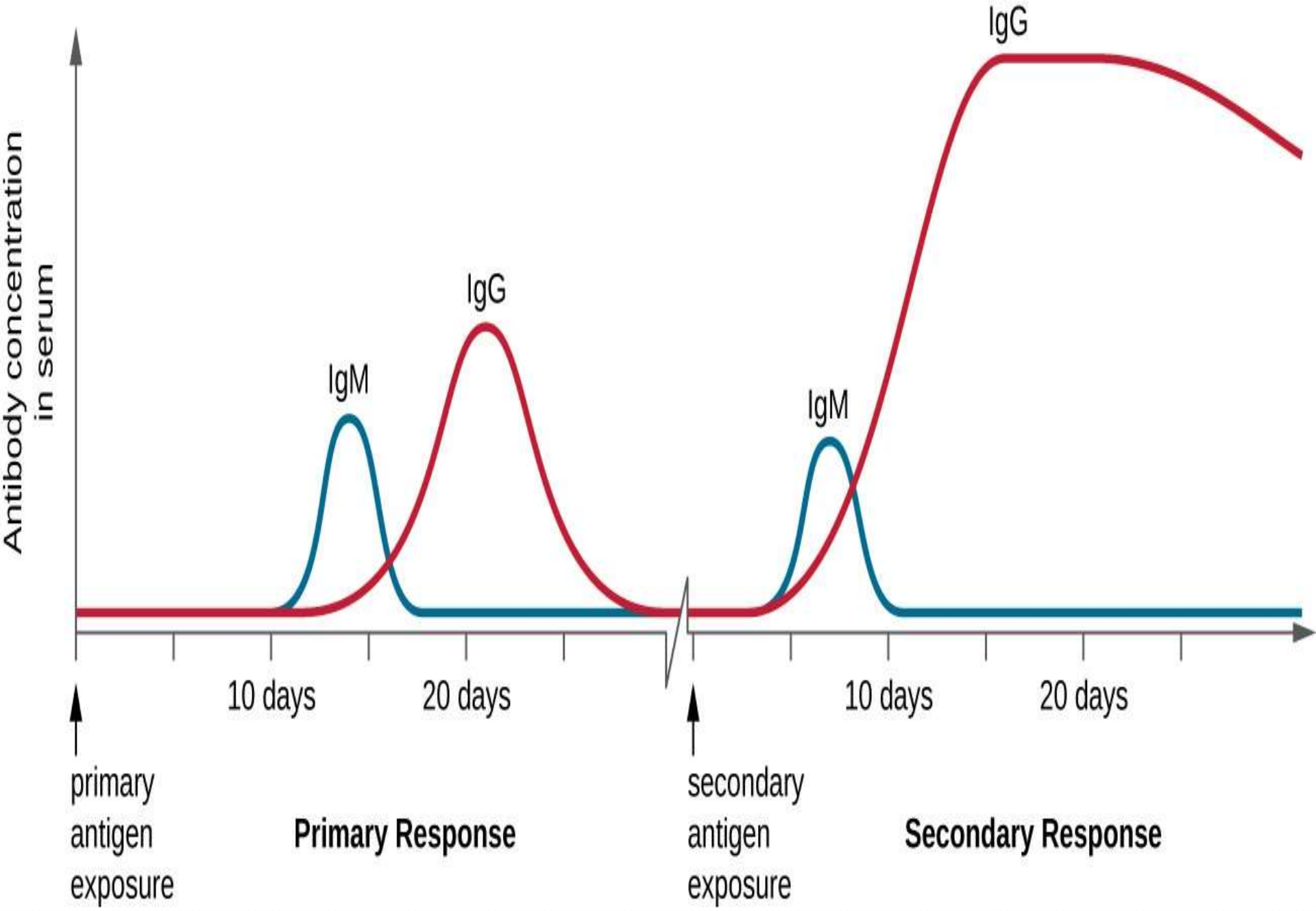



antigen on bacterium
B cell receptor
B cell
CD4
MHC II
activated B cell undergoing clonal selection
helper T cell
cytokines
T cell receptor
clonal expansion due to cell proliferation
memory B cells
plasma cells


Primary Response
Secondary Response
Antigen
Antigen bound to receptor
Activated B cell
Memory B cell
Formation of clones
Antibody molecule
Plasma cell
Clone of ancestral cell
Memory B cell
Plasma cell

Natural habits of antibodies

- Ig total wt 160,000 – 970,000 (IgG, IgA, IgM)
- Different types, specific for each antigen
- Making strong bonds with antigens i.e
  - ***Hdrophobic bonding***
  - ***Hydrogen bonding***
  - ***ionic attraction***
  - ***Van der Waals forces***


Antibody concentration in serum
IgG
IgM
IgG
IgM
10 days
20 days
10 days
20 days
primary antigen exposure
Primary Response
secondary antigen exposure
Secondary Response

Actions of antibodies in Defensive mechanism

By two process

- **Direct Action/attack**

  i- Agglutination

  ii- Precipitation

  iii- Neutralization

  iv- Lysis rupturing the cell membrane

- **Activation / amplification of Compliment system**