Immunoglobulin's &Immune response

By
Dr. Raghed M. Jassem

IMMUNOGLOBULIN CLASSES

IgG – monomer, most prevalent in serum; provide naturally acquired passive immunity (since it is only the antibody capable of crossing the placenta) , neutralize bacterial toxins, participate in complement fixation, and enhance phagocytosis. Present on surface of B-cells, initiates primary immune response (more later).

IgM – (M for *macro*) is a huge molecule composed of five monomer (making it pentamer), attached by Fc receptors to a central J chain ,it is the first class synthesized by plasma cell fallowing its first encounter to the antigen. involved in agglutination and complement fixation. It circulates mainly in the blood and its too large to cross the placental barrier.

IgA –It has two form

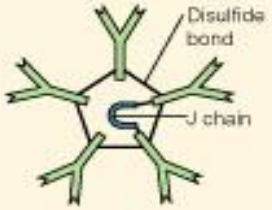
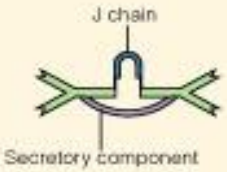
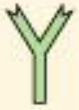
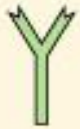
(**1-)**a monomer that circulates in small amount in the blood

(2-) a dimmer it is a secretary form ; a special class of antibody that protect mucosal surfaces from local invasion by microbes .A secretory piece is later added by the gland cells themselves

IgD – monomer, present on surface of B-cells, especially memory cells, may be important for the secondary immune response ,it dose not fix the complement ,opsonize, or cross the placenta and also it can play a role in immune suppression.

IgE – monomer, is uncommon in the blood unless one is allergic or have a worm infection , it s Fc region bind to mast cells and basophiles which lead to release a potent physiological substances that stimulate the inflammatory response

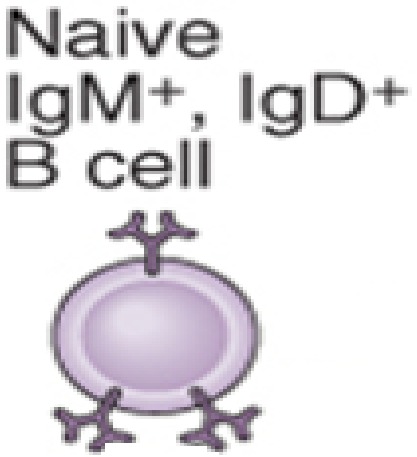
TABLE 17.1 A Summary of Immunoglobulin Classes

Characteristics	IgG	IgM	IgA	IgD	IgE
					
Structure	Monomer	Pentamer	Dimer (with secretory component)	Monomer	Monomer
Percentage of total serum antibody	80%	5–10%	10–15%*	0.2%	0.002%
Location	Blood, lymph, intestine	Blood, lymph, B cell surface (as monomer)	Secretions (tears, saliva, mucus, intestine, milk), blood lymph	B cell surface, blood, lymph	Bound to mast and basophil cells throughout body, blood
Molecular weight	150,000	970,000	405,000	175,000	190,000
Half-life in serum	23 days	5 days	6 days	3 days	2 days
Complement fixation	Yes	Yes	No†	No	No
Placental transfer	Yes	No	No	No	No
Known functions	Enhances phagocytosis; neutralizes toxins and viruses; protects fetus and newborn	Especially effective against microorganisms and agglutinating antigens; first antibodies produced in response to initial infection	Localized protection on mucosal surfaces	Serum function not known; presence on B cells functions in initiation of immune response	Allergic reactions; possibly lysis of parasitic worms

*Percentage in serum only; if mucous membranes and body secretions are included, percentage is much higher.
†May be yes via alternate pathway.

Pattern of Antibody response during infection

1- Mature B cells (Naïve B cells) will express IgD/IgM as the final set on their surface



2- When B-cells recognized Ag ,it will be internalized this Ags &it is either :-

a- Response to that Ags directly and produced of Abs molecules without any assessment from T-help cells this called ***T cells independent B-cells activation***

b- Or it processed the Ags and then presented it with MHC II molecules on its surface because activation of B cells require helping from T-helper cell inorder to complete it differentiation and this called ***T cells dependent B-cells activation***

3- Once T- helper cells recognized Ags on the surface of B-cells ,it will secrete cytokines that stimulate B-cells to produce clonal expansion

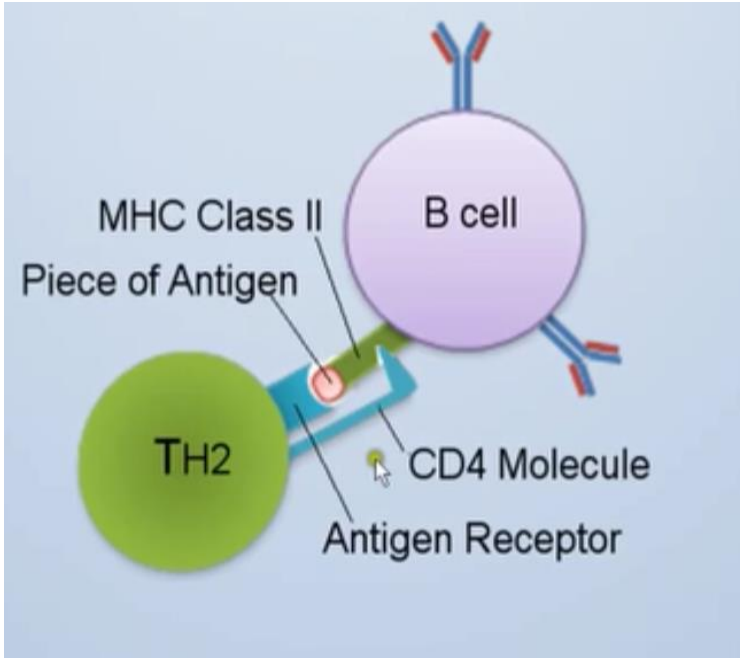
Extracellular pathogen

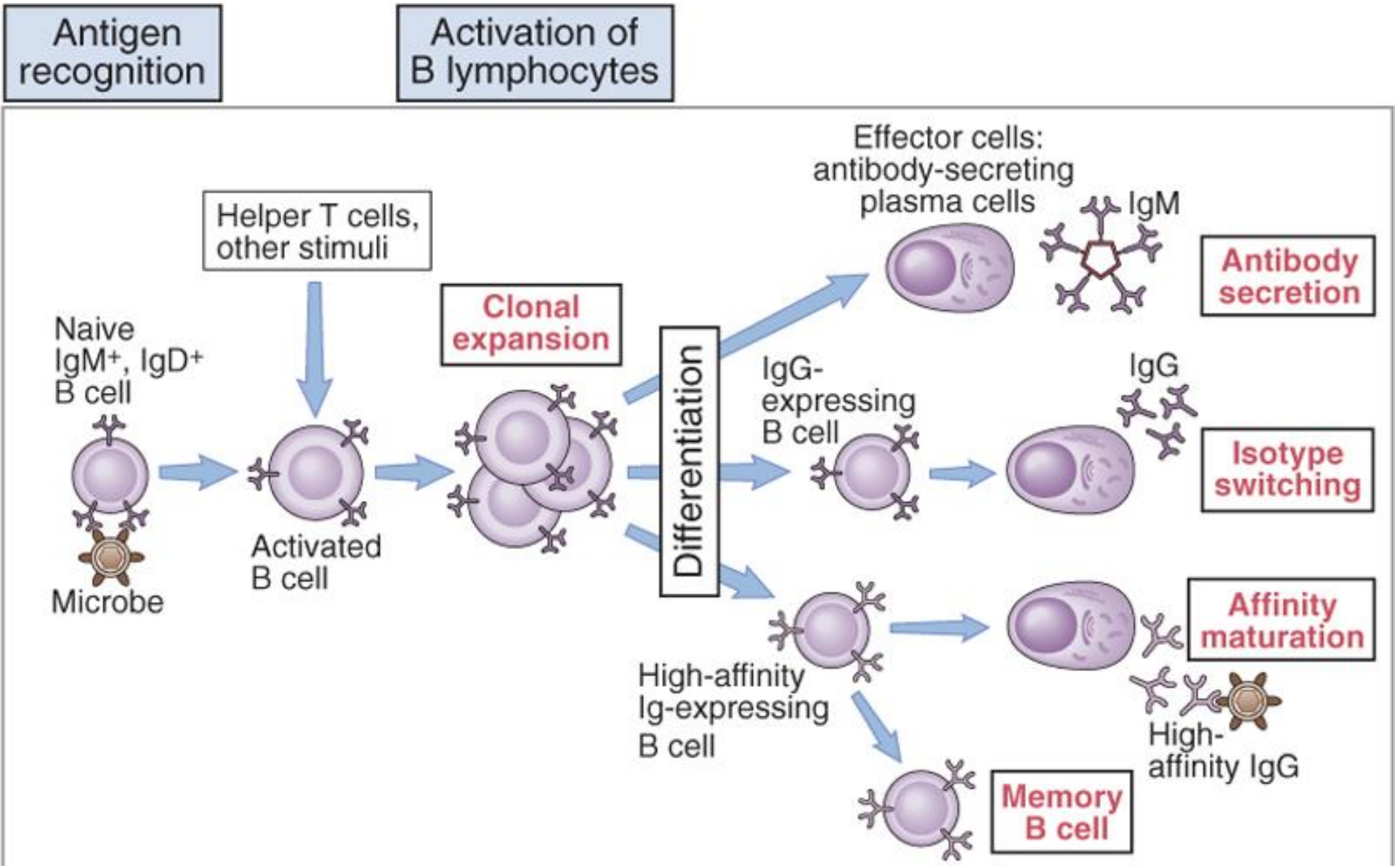
B-cell presents the antigen on MHC

Activate Th2 CD4

Activate B- Cells

Antibody production

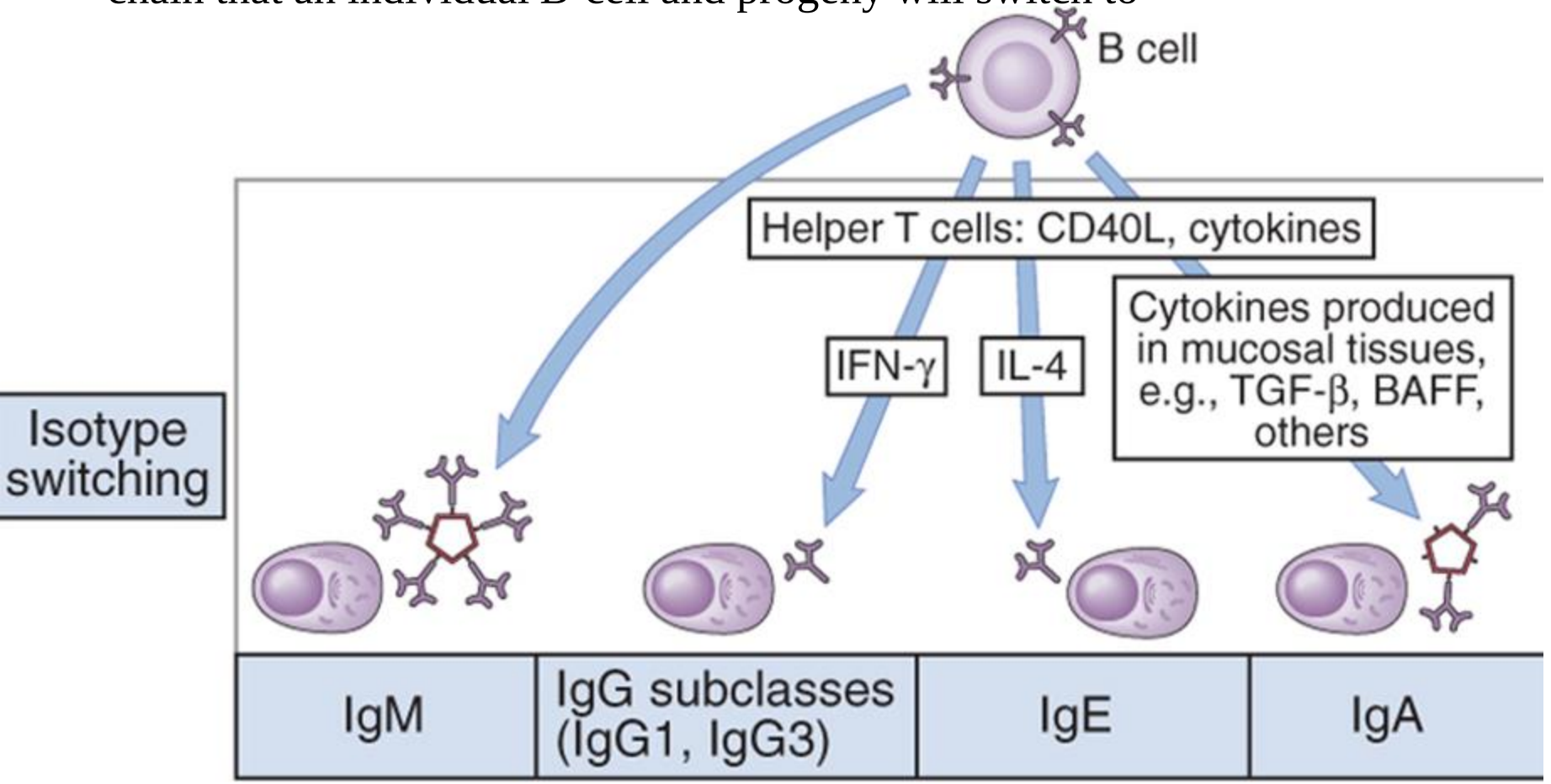



Antigen recognition
Activation of B lymphocytes
Helper T cells, other stimuli
Naive IgM+, IgD+ B cell
Microbe
Activated B cell
Clonal expansion
Differentiation
Effector cells: antibody-secreting plasma cells
IgM
Antibody secretion
IgG-expressing B cell
IgG
Isotype switching
High-affinity Ig-expressing B cell
Affinity maturation
High-affinity IgG
Memory B cell

Isotype (class) switching is mediated by -

1- CD40L:CD40 mediated signals without this signal B cell continues secreting IgM (Co-stimulatory signal)

2- T-helper cells will produce different cytokines which influences the heavy chain that an individual B-cell and progeny will switch to



What is the reason for isotype switching in B –cells?

IMMUNE RESPONSE

Primary Response:

1- After *initial* exposure to antigen, no antibodies are found in serum for several days (Latent period)

2- A gradual increase in titer, first of IgM and then of IgG is observed. Most B cells become plasma cells, but some B cells become long living *memory cells*.

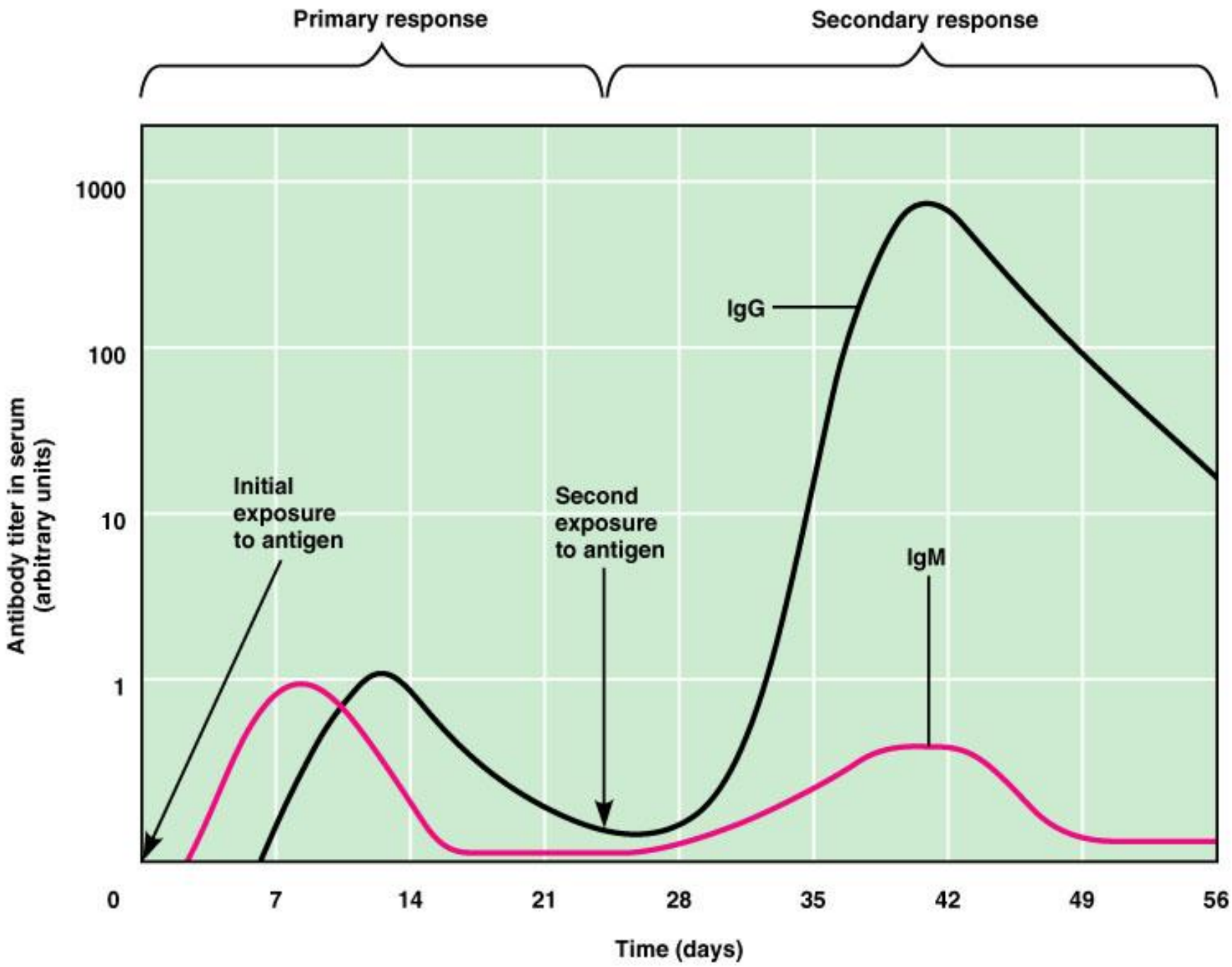
3- Gradual decline of antibodies follows.

Secondary Response:

- subsequent contact with the same antigen by memory cells results in a much stronger and faster response - antibody titer is much higher, occurs much faster, and consists primarily of IgG.

Latent period :-

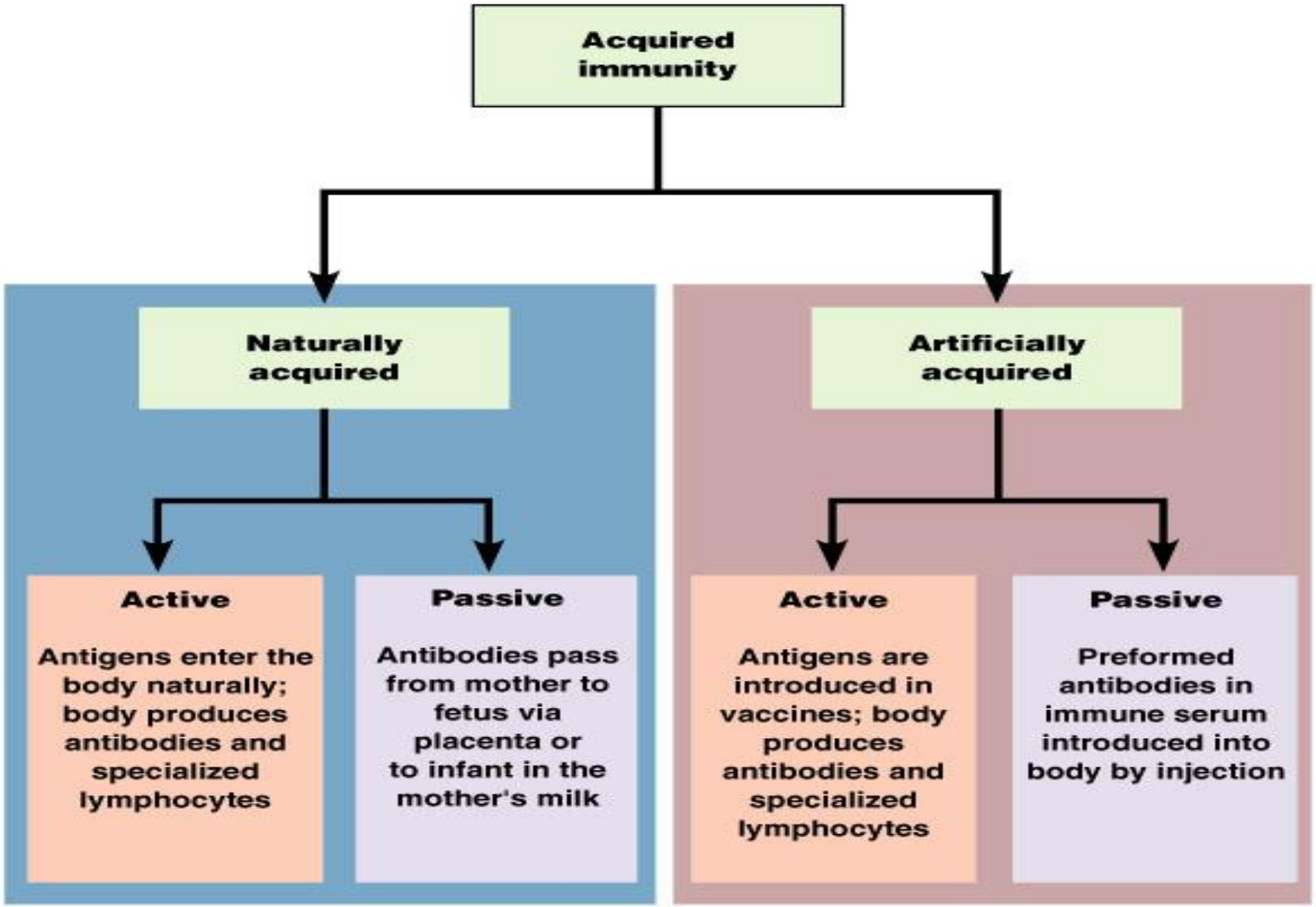
it is the period characteristic by lack of Ab for the antigen ,but much activity is occurring .During this time the antigen is being concentrated in lymphatic tissue ,taken up by macrophage ,and presented to the correct clones of B lymphocyte

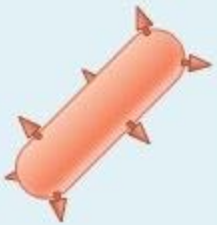
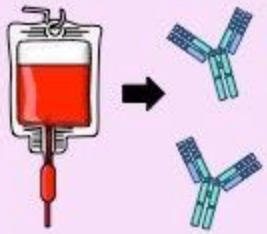


Differences	Primary response	Secondary response
Exposure to the antigen	First exposure	Second exposure (booster dose)
Latent period	Have Latent period	There is no Latent period
Cell response	Plasma cells	Memory cells
Type of immunoglobulin	IgM the first one fallowed by IgG and IgA or both	IgM the first one, the amount of IgM produced is less than that in the first contact but much more IgG is produced
Titer and length	The serum Ab titer continues to rise for several weeks and then declines, may be drop to very low levels. IgM decline sooner than IgG levels	The Ab titer rise to higher levels ,the levels of IgG tends to persist much longer than in the primary response

	Innate Immunity	Adaptive Immunity
Speed of Onset	Immediate (within minutes)	~ 3 day lag
Specificity to Antigen	Lower	Higher
Diversity of Response	Lower	Higher
Potency	Lower	Higher
Memory (Reacts quicker to subsequent exposures)	No	Yes

Types of Acquired Immunity:



ACTIVE IMMUNITY		PASSIVE IMMUNITY	
Natural	**Artificial**	**Natural**	**Artificial**
			
Infection	Vaccination	Maternal antibodies	Monoclonal antibodies