Mechanisms of Immune response

NONSPECIFIC DEFENSE MECHANISMS		SPECIFIC DEFENSE MECHANISMS (IMMUNE SYSTEM)
First line of defense	Second line of defense	Third line of defense
• Skin • Mucous membranes • Secretions of skin and mucous membranes	• Phagocytic white blood cells • Antimicrobial proteins • The inflammatory response	• Lymphocytes • Antibodies

Adaptive immune response mechanism

♣ Antigen Recognition by specific lymphocytes

♣ Activation, Proliferation and differentiation into effector cells;

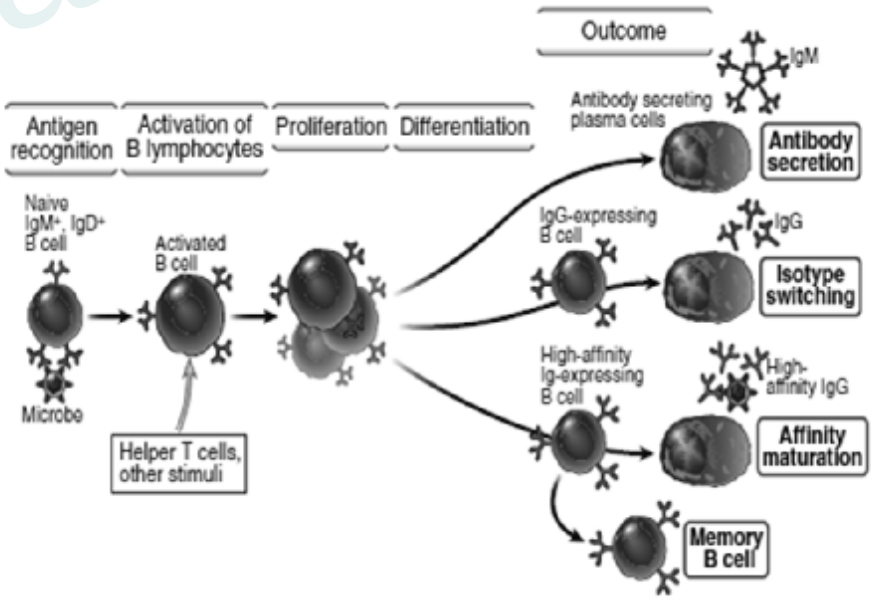
-Eliminate the antigen

-Return of homeostasis and development of memory cells

♣ Memory cells evoke a more rapid and long response on re-exposure to same antigen

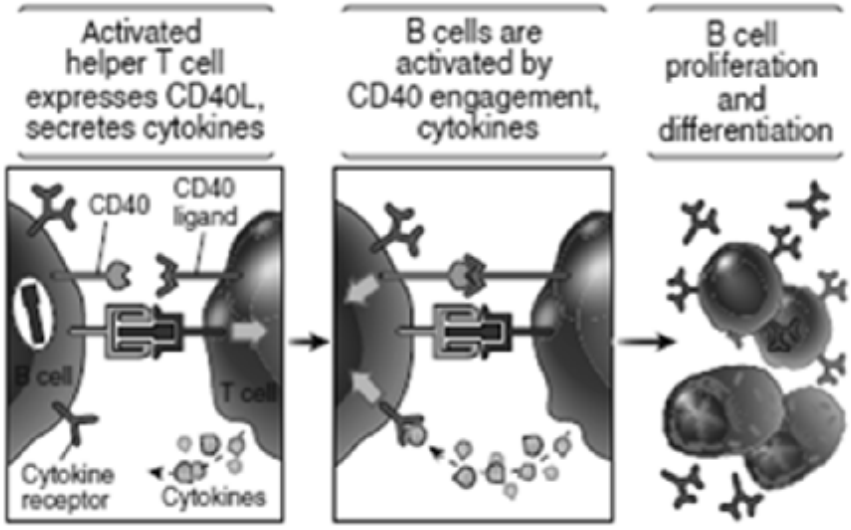
Humoral immune response

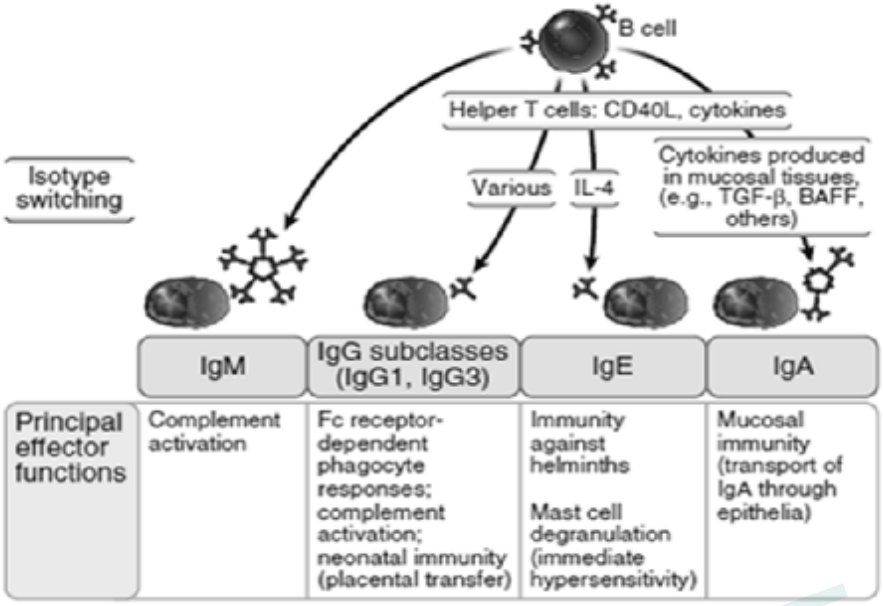
Phases of humoral immune response



Immune signals in B cell activation

helper T cell–mediated activation of B lymphocytes

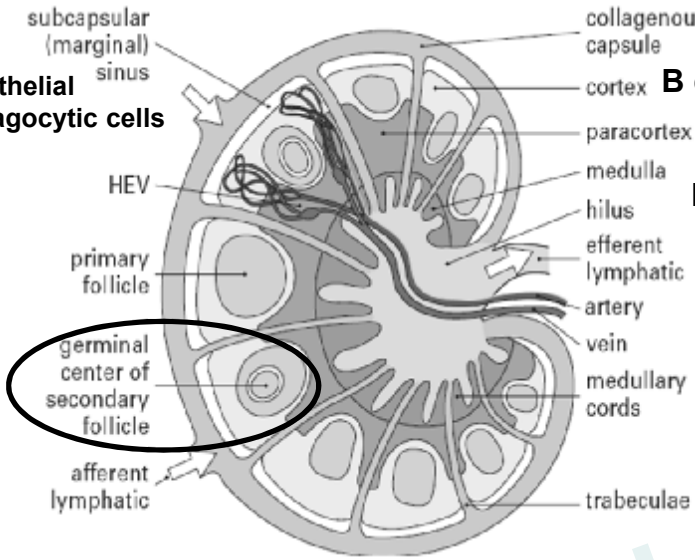




Immunoglobulin (Ig) heavy-chain isotype (class) switching

B cells migrate toward the boundaries between B-cell and T-cell areas in secondary lymphoid tissues

Structure of the lymph node

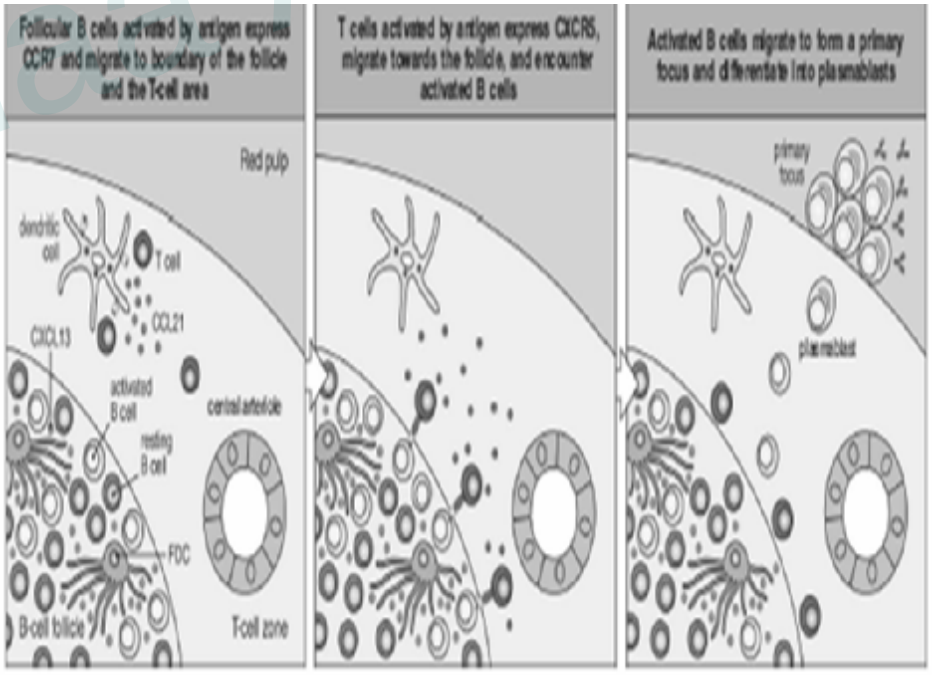


Endothelial & phagocytic cells

B cells

T cells

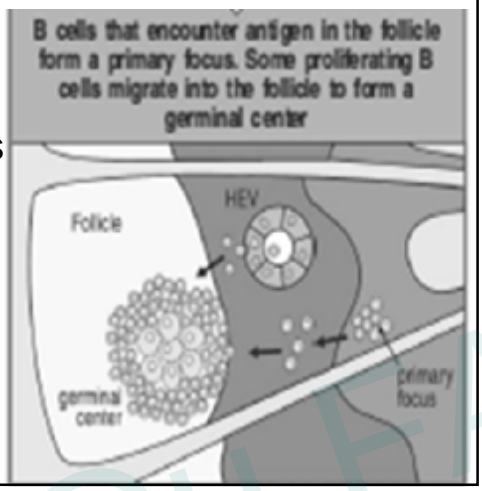
B,T, Plasma cell

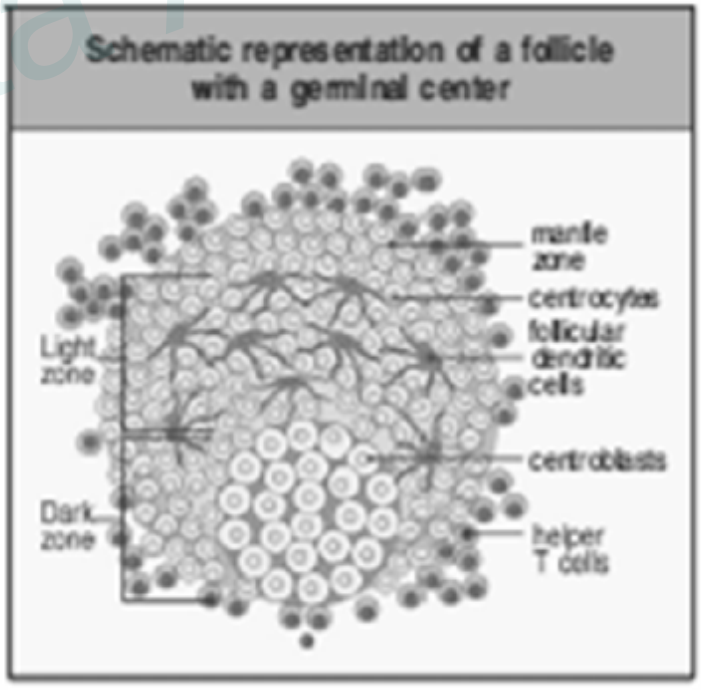


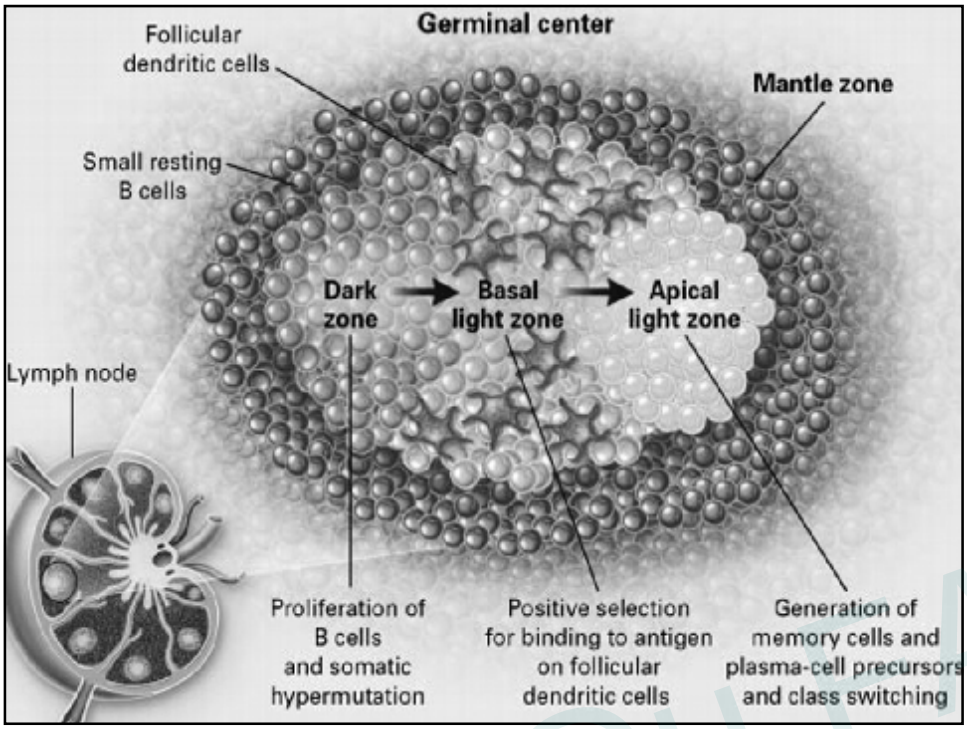
The second phase of a primary B-cell immune response

They move into a primary lymphoid follicle where they continue to proliferate and form a germinal center;

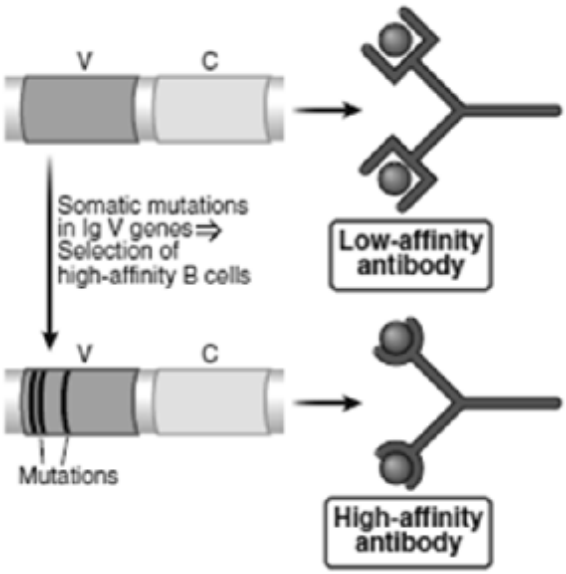
-Follicles with germinal centers are called secondary lymphoid follicles

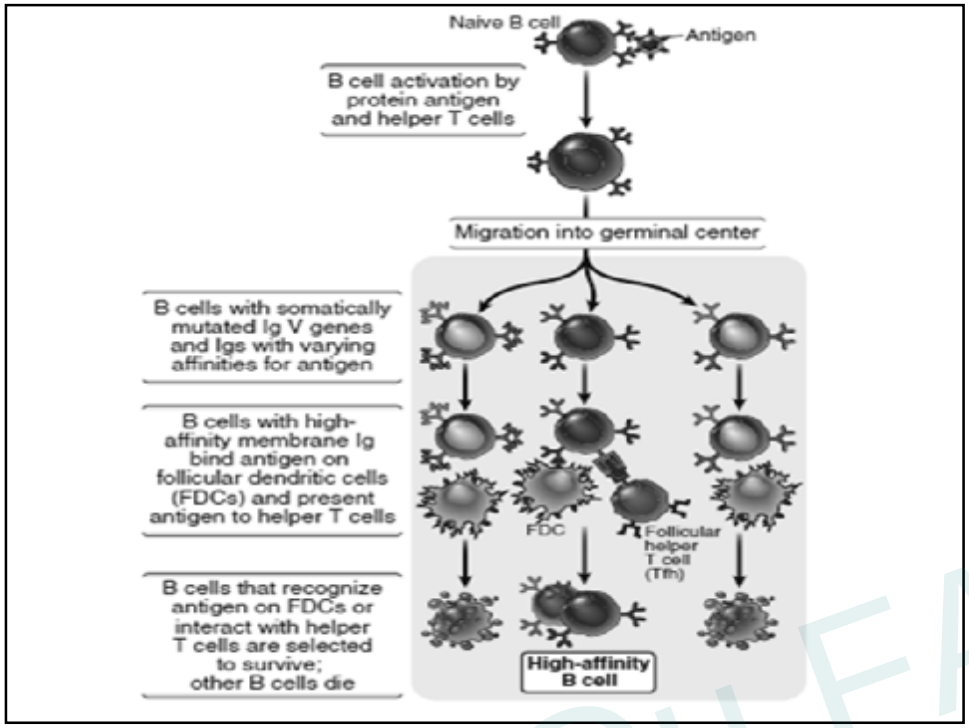


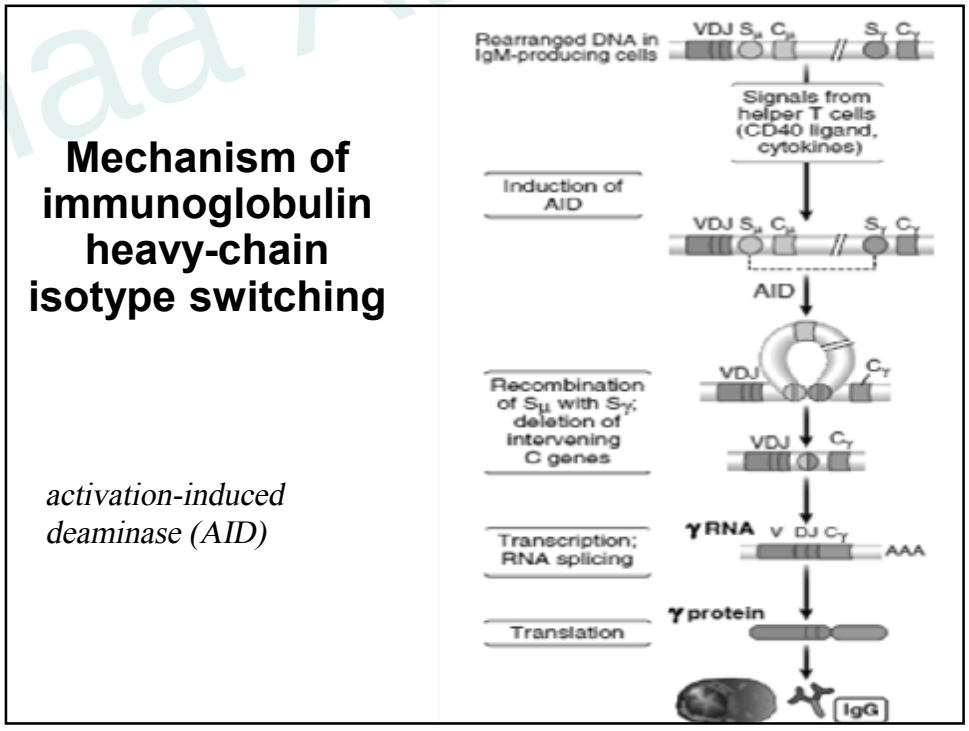




Affinity maturation







What is going on in the germinal center?

*• B – cells entering the germinal center become **centroblasts that divide** with a very short cycle time of 6 hours,*

*• then become nondividing **centrocytes in the basal light zone, many of** which die from apoptosis .*

*As the surviving centrocytes mature, they diff erentiate either into **immunoblast plasma cell precursors , which secrete Ig in the absence of** antigen, or into **memory B - cells .***

Dynamics of Antibody Production

Primary immune response

- Latent period
- Gradual rise in antibody production (days to weeks)
- Plateau reached
- Antibody level declines

Dynamics of Antibody Production

Primary immune response

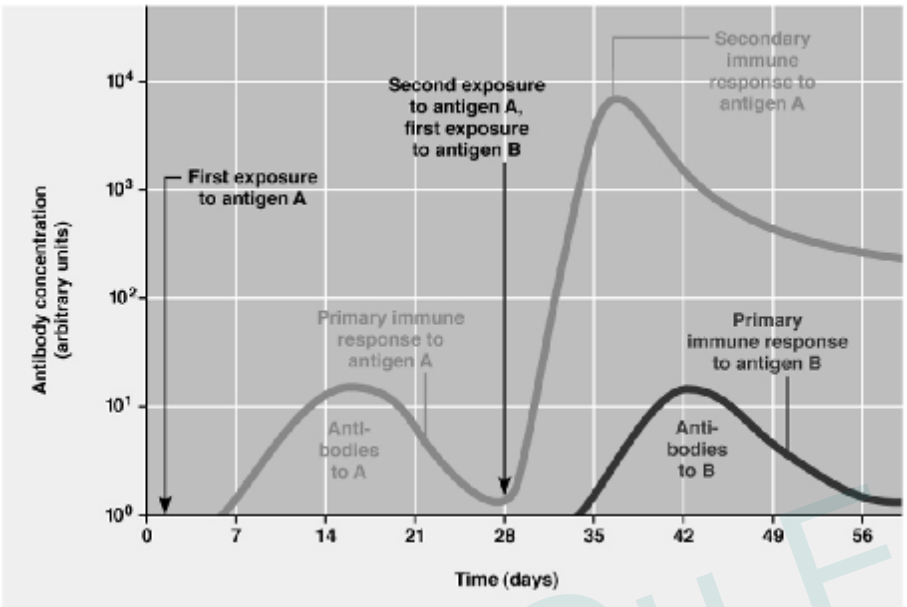
- Initial antibody produced in IgM (10-12 days)
- Followed by production of IgG (4-5 days)
- Without continued antigenic challenge antibody levels drop off, although IgG may continue to be produced.

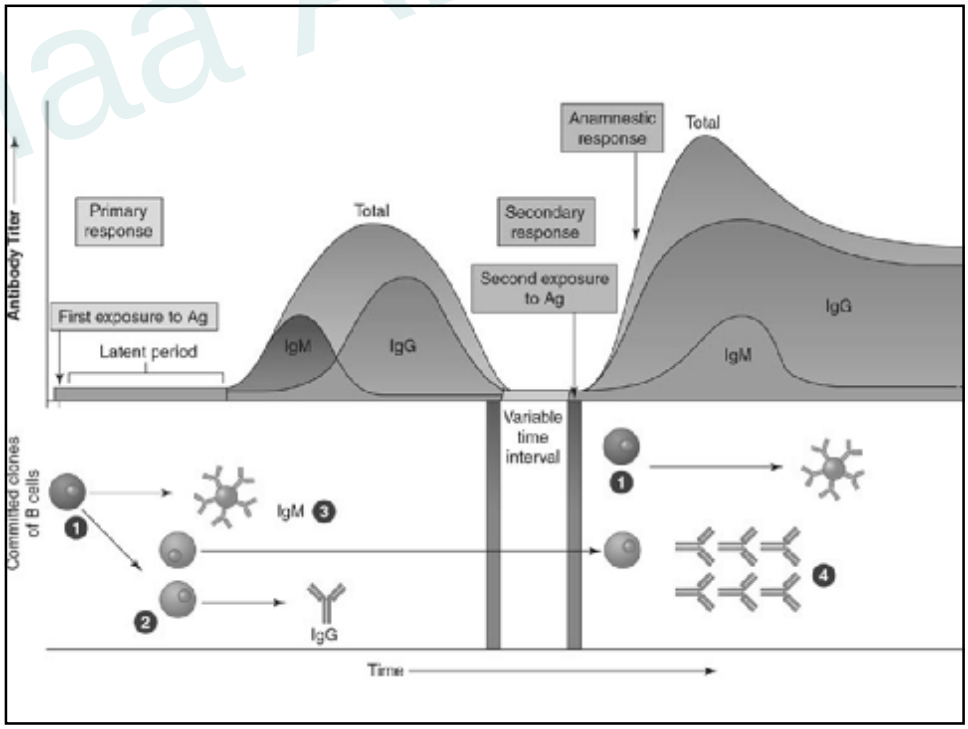
Dynamics of Antibody Production

secondary immune response

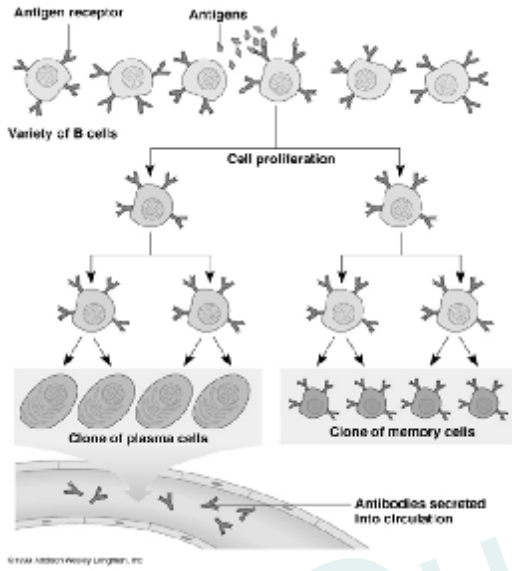
- Second exposure to the same antigen.
- Memory cells are a beautiful thing.
- Recognition of antigen is immediate.
- Results in immediate production of protective antibody, mainly IgG but may see some IgM

Antibody Response After Exposure to Antigen





Clonal Selection of B Cells is Caused by Antigenic Stimulation



Regulation of humoral immune responses

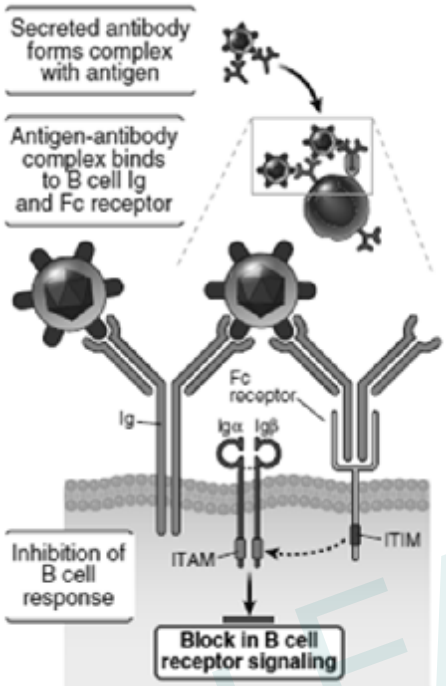
- Apoptosis

- Human body makes 100 million lymphocytes every day,? will develop leukemia.

- B cells that do not encounter stimulating antigen will self-destruct and send signals to phagocytes to dispose of their remains.

- Many virus infected cells will undergo apoptosis, to help prevent spread of the infection.

Regulation of humoral immune responses: antibody feedback



What is going on in the germinal center?

• The secondary follicle with its corona or mantle of small lymphocytes

• Secondary challenge with antigen or immune complexes induces

❖ Enlargement of germinal centers,
❖F ormation of new ones,
❖ Appearance of memory B – cells
❖Development of Ig – producing cells of higher affi nity