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Lecture title: B cell

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Summary:

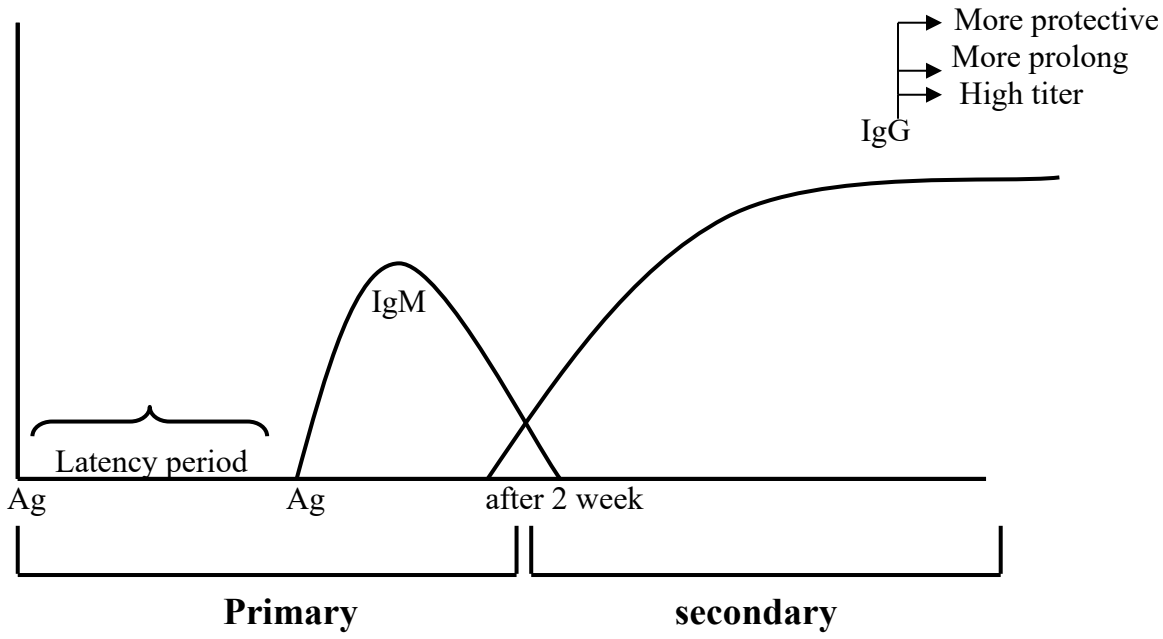
1- Learning the B cells types
2- The importance and function of B cells
3- Pathways of its activation
4- The role it plays in the immune system stimulation

Primary and Secondary Immune Response:-

In **primary immune response**, when we give an antigen for the first time after a certain period, we have no effect of antibody, this period is called (Latent period). There is the slow appearance of an antibody of the IgM class of immunoglobulins. Suppose we give after 1-2 weeks, the same Ag injection in the same animal. In that case, we will get a secondary immune response manifested by a high antibody level of IgG class and a well-protective antibody level higher than obtained in the first infection (injection), called **(secondary immune response).**

The dropping down of antibodies in the secondary immune response is slower than the primary immune response.

In secondary immune response, the production of antibodies is greater and high concentrations are detected in the serum.



Primary and Secondary immune responses

There is no latency period in secondary immune response because the body has /or possesses memory cells for the same infection (antigen) so the response becomes directed immediately to the antigen.

Latent period: - is the time from the entry of the pathogenic agent (antigen) until the appearance of symptoms of the infection, which takes a few days to months, it is for stimulation and preparation.

Difference between primary and secondary immune response

	Primary immune response	Secondary immune response
Latency period	+	-
Class of Ig	IgM	IgG
protection	Low	High
Dropping down in Ab (Ab decline)	Rapid	Slow
Memory cell	-	+
Ab affinity	Low	High
Ab titer	Low	High

Cell-mediated immunity (Immune competent cells)

The lymphocytes are the mediators of humoral and cellular immune response.

Lymphocyte Populations

we have 2 main types of lymphocytes, which are different antigenically and functionally, and they are variable in their membrane markers, These two lymphocytes are called:-

1- T- Lymphocyte or thymus-dependent lymphocyte.
2- B- lymphocyte or thymus-independent lymphocyte or Bone marrow dependent or Bursa dependent cells

Mitotic activity in prenatal life (Lymphopoiesis):-

In prenatal life, lymphopoiesis was antigen-independent, while in postnatal life, Lymphopoiesis is antigen-dependent.

The 2 main factories for immune competent cells are the thymus and the bursa of Fabricius.

Thymectomy: removal of the thymus by surgical operation, all the cell-mediated immune response will be blocked.

Bursectomy: removal of bursa by surgical operation, then we have dropped down (blockage) in antibody, gamma globulin production, primary and secondary immune response, as a result the humoral immune response will be blocked.

Lymphocyte Surface Molecules

Although these subpopulations cannot be identified by their structure, they can be identified by their characteristic cell surface molecules and behavior.

The most important structures on the surface of lymphocytes are their antigen receptors.

These are abbreviated TCR (T cell antigen receptor) or BCR (B cell antigen receptor), Null cells, a small population of lymphocytes, have neither the characteristics of T nor B lymphocytes **(no receptor).**

NK cell: - It is a natural killer cell. NK cells were identified by the presence of cytotoxic activity in lymphocytes from unsensitized animals. NK cells do not have antigen receptors like T and B cells. They have receptors that can bind molecules expressed on healthy normal cells but not diseased, abnormal cells. NK cells thus recognize and kill target cells that fail to express these surface molecules.

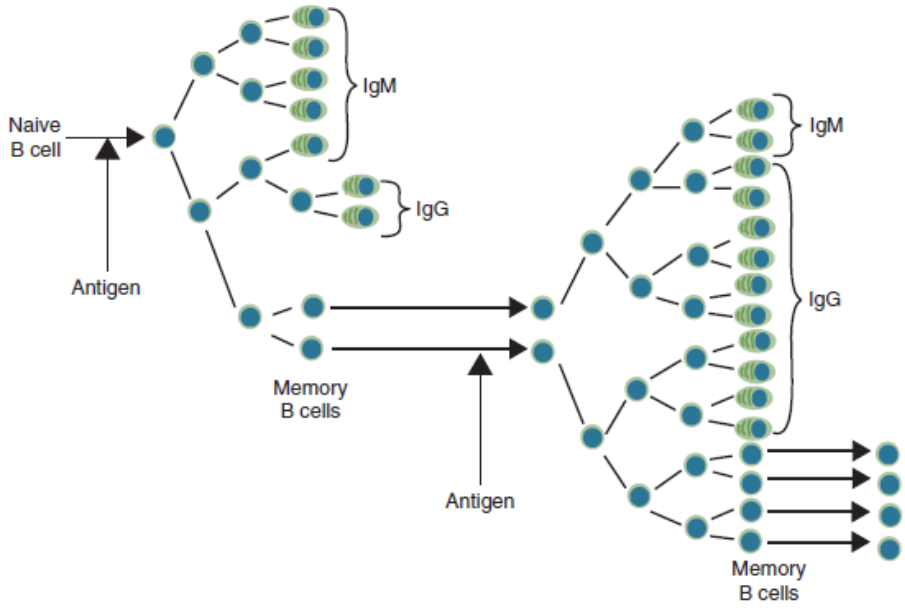
B cell:

Morphologically, we cannot differentiate between B and T-lymphocyte by blood smear, but immunologically and functionally, they are different.

B- lymphocyte from the bone marrow in the animal.

B- lymphocyte from the bursa of Fabricius in a bird.

The formation of B- lymphocyte:-



Formation of plasma cell from B-cell (Colonel theory)

Function of B-lymphocyte:-

1- B cells express multiple identical antigen binding receptors (antibodies) that can recognise most antigens without prior processing. However, an optimal B cell response normally requires additional stimulation by helper T cells.

2- Responding B cells may become either memory cells or antibody-secreting plasma cells.

Type of B cell

1- Plasma cells develop from antigen-stimulated B cells. Plasma cells are ovoid cells, they have a round, centrally placed nucleus and have an extensive cytoplasm that is rich in rough endoplasmic reticulum. Plasma cells can make and secrete up to 10,000 molecules of immunoglobulin per second. The immunoglobulin produced by a plasma cell is of identical specificity to the BCRs on its parent B cell.

2- B memory cell

The reason that the primary immune response ends is that the responding B cells and plasma cells are simply removed by apoptosis. If all these cells died, however, immunological memory could not develop. Clearly, some B cells must survive as memory cells. On subsequent exposure to an antigen, they proliferate and differentiate into plasma cells.

The second dose of the antigen meets a large number of memory B cells, which react similarly to antigen-sensitive B cells. This leads to a much stronger secondary immune response compared to the primary one. The response happens faster because more antibodies are produced and detected earlier. Additionally, IgG is produced instead of IgM, which is more common in the primary response.

3- Myeloma cells: - Cancerous plasma cells, produce large quantities of very pure immunoglobulin.