IMMUNOLOGY

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Lac.No. 7

B lymphocytes activation

B lymphocytes recognized an antigen by means of specific antibody molecules (IgM, IgD) on the surface of B cell, there are generally only a few B lymphocytes that recognize one of the foreign epitopes of the antigen. Another small set of B lymphocytes that recognized another epitope.

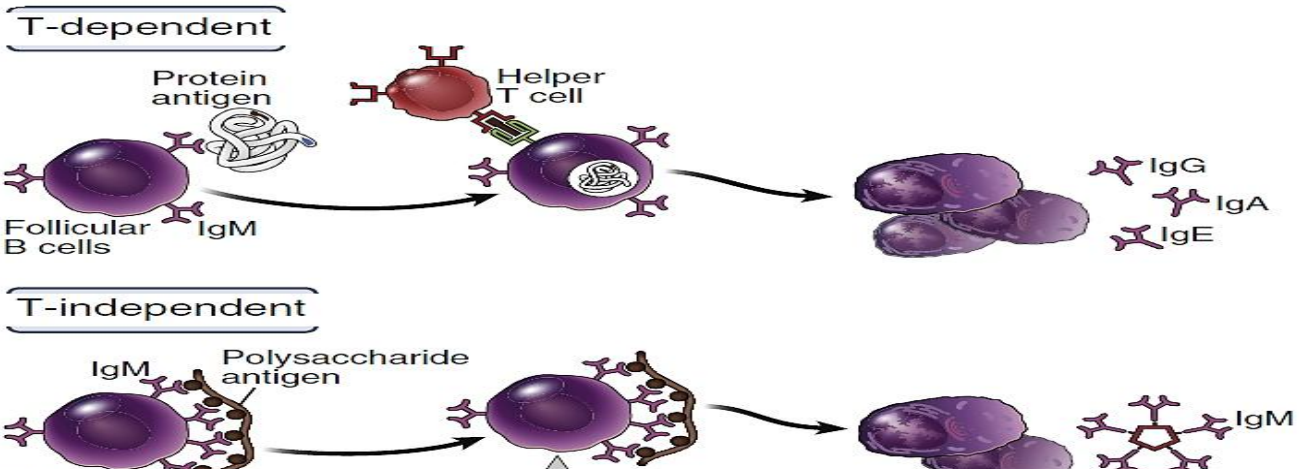
Antibody responses to different antigens are classified as T-dependent or T-independent, based on the requirement for T cell help

B lymphocytes recognize and are activated by a wide variety of chemically distinct antigens, including proteins, polysaccharides, lipids, nucleic acids, and small chemicals. Protein antigens are processed and presented by antigen-presenting cells (APCs) and recognized by helper T lymphocytes, which play an important role in B cell activation and induce immunoglobulins.

(Antigen-presenting cell (APC) *A cell that displays peptide fragments of protein antigens, in association with MHC molecules, on its surface and activates antigen-specific T cells. In addition to displaying peptide-MHC complexes, APCs also express costimulatory molecules to optimally activate T lymphocytes.)*

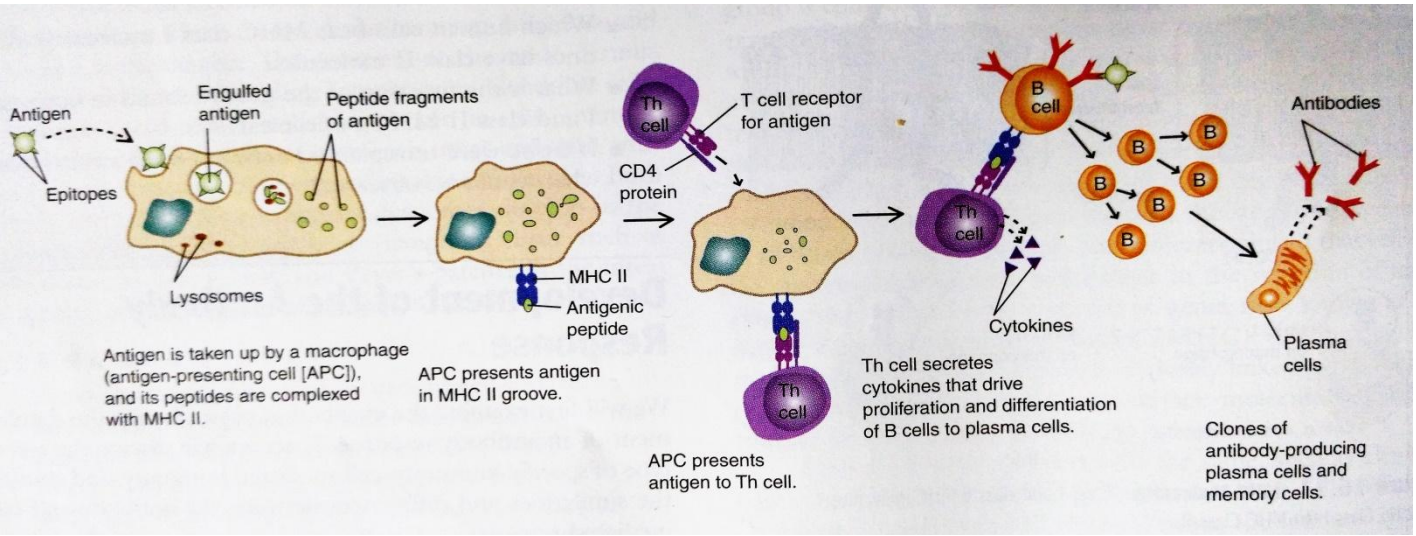
In the absence of T cell help, protein antigens elicit weak or no antibody responses. Therefore, protein antigens and the antibody responses to these antigens are called T-dependent. Polysaccharides, lipids, and other nonprotein antigens stimulate antibody production without the involvement of helper T cells. Therefore, these nonprotein antigens and the antibody responses to them are called T-independent.

NOT. Thus, the most specialized and effective antibody responses are generated under the influence of helper T cells, whereas T-independent responses are relatively simple.



T-cell-dependent Ag

To induce a response antigen protein secreted by invading bacteria must be processed by macrophages (APCs) ,the large Ag molecules are broken down in the cell in to smaller fragments, attached to the groove of MHC Ⅱ and presented to the cell surface.
When the Th cell recognized and bind to the fragment presented in MHC Ⅱ , the BCR binds a Th , the antigen is taken up into the B cell through receptor and presented to T cells as peptide pieces in complex with MHC-II molecules on the cell membrane. Already T helper (TH) cells, that were activated with the same antigen recognize .Th cell secretes cytokines such as IL4 , IL5 and IL10 that activate B cell. Now activated, B cells participate in a two-step differentiation process that yields both short-lived plasmablasts for immediate protection and long-lived plasma cells and memory B cells for persistent protection.



T-cell-independent Ag

Polysaccharides, lipids, and other nonprotein antigens elicit antibody responses without the participation of helper T cells. Recall that these nonprotein antigens cannot bind to MHC molecules, so they cannot be seen by T cells. Many bacteria contain polysaccharide-rich capsules, and defense against such bacteria is mediated primarily by antibodies that bind to capsular polysaccharides and target the bacteria for phagocytosis. Antibody responses to T-independent antigens differ from responses to proteins, and most of these differences are attributable to the roles of helper T cells in antibody responses to proteins. Because polysaccharide and lipid antigens often contain multivalent arrays of the same epitope, these antigens may be able to cross-link many antigen receptors on a specific B cell. This extensive cross-linking may activate the B cells strongly enough to stimulate their proliferation and differentiation without a

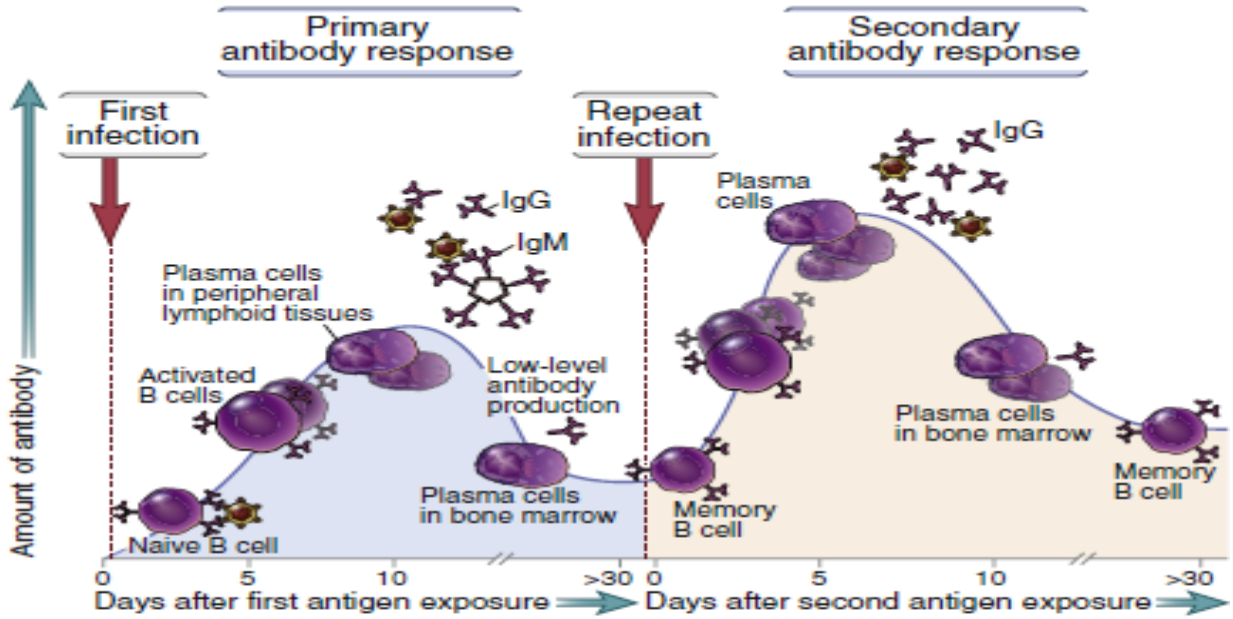
requirement for T cell help. Polysaccharides also activate the complement system, and many T-independent antigens engage BLRs, thus providing activating signals

to the B cells that also promote B cell activation in the absence of T cell help. Naturally occurring protein antigens usually are not multivalent, possibly explaining why they do not induce full B cell responses themselves but depend on helper T cells to stimulate antibody production.

The primary and secondary responses

The first time a particular antigen is introduced into the body a primary response occurs about 5 to 10 days is required before a substantial amount of antibody is detected in the blood. The amount of antibody or titer rises with time until the antigen is removed and the response wanes. A slow rise in titer is typical of antibody production during the primary antibody response. If however the same antigen is introduced at a later data, the titer of antibodies rises much faster and is much higher, due to rapid activation of the clones of memory cells present. This is typical of the secondary(memory) antibody response. IgM is the first class of antibody produced during an immune response, and it is the only class produced in response to T cell-independent Ag .With T cell dependent Ag, though, there is a switch to other classes of immunoglobulin as the response develops. In the secondary antibody response, essentially the same sort of IgM response occurs as the primary response but the IgG response is greatly accelerated and enhanced. in other words, memory develops for IgG production but not for IgM. The production of Abs of all classes contributes to the elimination of pathogens because each class can confer beneficial clearance mechanisms.

A)



B)

	Primary response	Secondary response
Lag after immunization	Usually 5-10 days	Usually 1-3 days
Peak response	Smaller	Larger
Antibody isotype	Usually IgM>IgG	Relative increase in IgG and, under certain situations, in IgA or IgE (heavy-chain isotype switching)

Clonal selection hypothesis

That acquired specific immunity depends on individual antigen specific lymphocytes that proliferation in response to Ag. The effector cells eliminate the Ag while the memory cells maintain immunity against later exposure to the Ag .during primary antibody response, B lymphocytes recognize the Ag by means of specific antibody on their surfaces. This recognition alone does not initiate antibody production rather it primes the B cells to respond to costimulatory signals given by the Th cells inducing the B cells to proliferate. Each cell divides to give tow cells with the same antibody specificity then four, then eight and so on to form large clones of B cells producing the same antibody. After a period of division some B cell differentiate resulting in the production of plasma cells, these are highly specialized antibody producing cells, capable of producing thousands of molecules of antibody per second. Plasma cells are terminally differentiated cells after they produce quantities of antibody they die, further some cells of the developing clone respond to the cytokine signals to differentiate into memory cells with the same specificity as the B cells from which they arose. These memory cells persist in the body for years and are present in number sufficient to give prompt and effective protective anamnestic or memory secondary response when the same Ag is encountered again at later time .

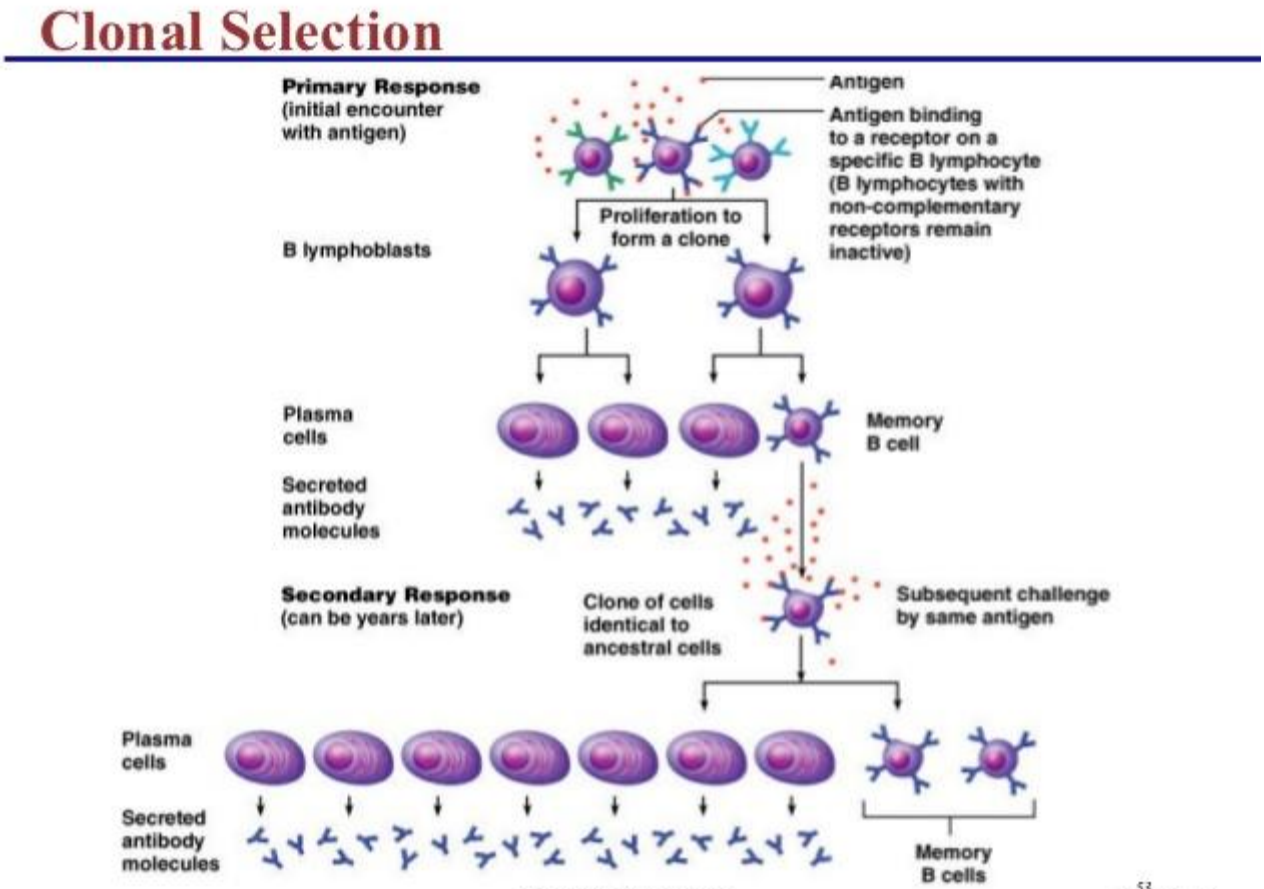


Figure 21.9