

Adaptive (Acquired) immunity. Host defenses that are mediated by B cells and T cells following exposure to antigens (Ag) and that exhibit specific immune response which characterized with (specificity, diversity, memory, and self-non self discrimination).

Requires expansion and differentiation of lymphocytes in response to microbes before it can provide effective defense; it adapts to the presence of microbial invaders. **It have two mechanisms**

Humoral Immunity

Humoral immunity is mediated by antibodies that bind to extracellular microbes and their toxins, which are neutralized or targeted for destruction by phagocytes and the complement system. Humoral immune responses to nonprotein antigens are initiated by recognition of the antigens by specific immunoglobulin receptors of naive B cells.

In humoral immune responses, B lymphocytes are activated by antigen and secrete antibodies that act to eliminate the antigen. Both protein and non-protein antigens can stimulate antibody responses. B cell responses to protein antigens require the contribution of CD4⁺ helper T cells specific for the antigen.

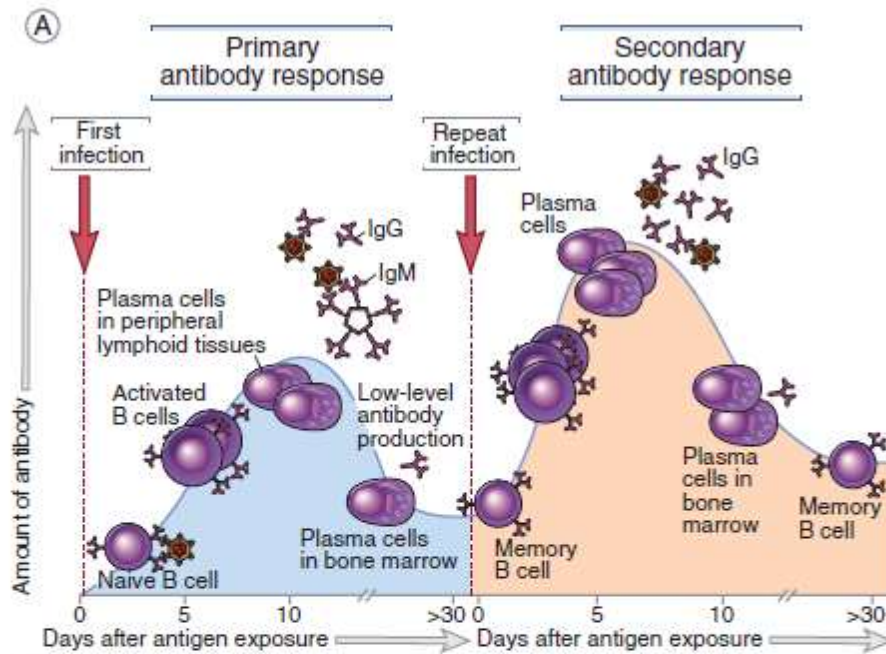
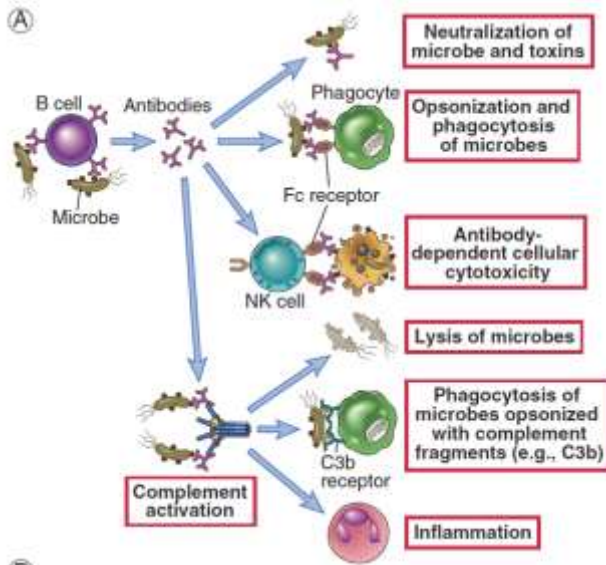
Helper T cell–dependent B cell responses to protein antigens require initial activation of naive T cells in the T cell zones and of B cells in lymphoid follicles in lymphoid organs. The activated lymphocytes migrate toward one another and interact at the edges of follicles, where the B cells present the antigen to helper T cells.

Stimulation of activated B cells at extrafollicular sites by helper T cells leads to the formation of extrafollicular foci where some isotype switching occurs and short-lived plasma cells are generated.

Affinity maturation occurs in germinal centers and leads to increased affinity of antibodies during the course of a T cell–dependent humoral response.

T-independent (TI) antigens are generally nonprotein antigens that induce humoral immune responses without the involvement of helper T cells.

Effector Humoral Immune Response:



	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)
Antibody affinity	Lower average affinity, more variable	Higher average affinity (affinity maturation)

Secondary immune response ,It is called **memory response** (Figure above)

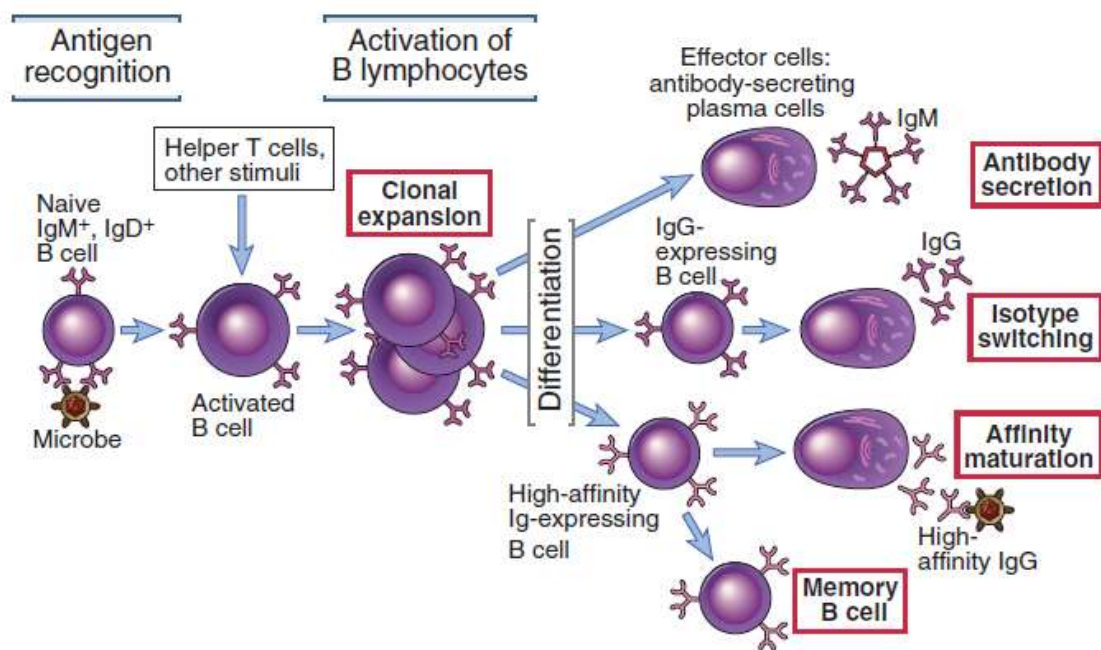
- a) Lag phase - In a secondary response there is a lag phase by it is shorter than that observed in a primary response.
- b) Log phase - The log phase in a secondary response is **more rapid and higher Ab levels are achieved.**
- c) Steady state phase
- d) Decline phase - **The decline phase is not as rapid and Ab may persist for months, years or even a lifetime.**

. **Secondary immune responses are higher, faster , more specific (highly affinity) that is lead to memory response.**

Phases of Humoral immune Response; B lymphocyte (B cell).Production antibodies in humoral immunity.

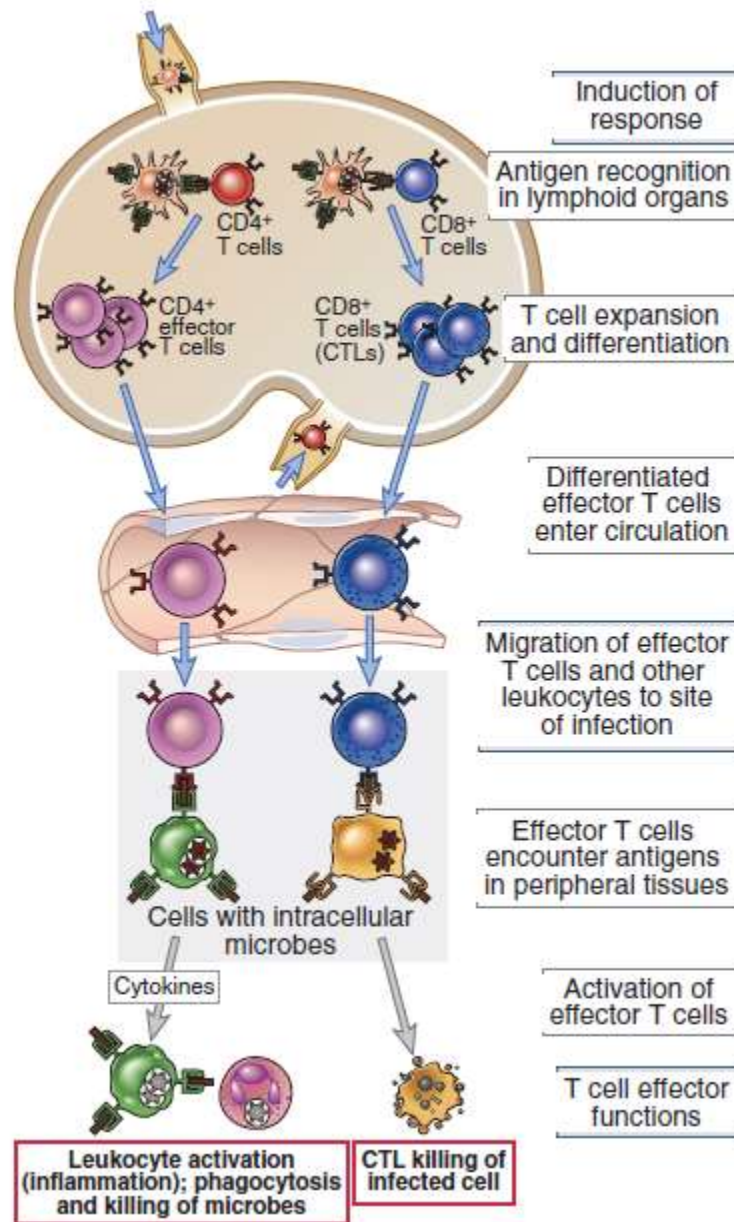
the bone marrow is its major site of maturation in humans,. Mature B cells are definitively distinguished from other lymphocytes and all other cells by their synthesis and activated B cells differentiate into effector cells known as **plasma cells which can produce different type of antibodies (Ab) as a response against extracellular pathogens.**

it can sharing in cellular response against intracellular pathogen if cytotoxic T cell enhance B cell and corporate with it to produce Ab.



Cell-mediated immunity (CMI) The form of adaptive immunity that is mediated by T lymphocytes and serves as the defense mechanism against various types of microbes that are taken up by phagocytes or infect non-phagocytic cells. Cell-mediated immune responses include CD4+ T cell-mediated activation of phagocytes and CD8+ CTL-mediated killing of infected cells. Phases

Cell-mediated immunity: T lymphocytes (T cells) derive their letter designation from their site of maturation in the thymus. Like the B cell, the T cell expresses a unique antigen-binding receptor called the T-cell receptor. T lymphocytes are divided into two major cell types—**T helper (TH) cells** and **T cytotoxic (TC) cells**—that can be distinguished from one another by the presence of either **CD4** or **CD8** membrane glycoproteins on their surfaces.



Natural Killer Cells

Natural killer (NK) cells are a class of lymphocytes that recognize infected and stressed cells and respond by killing these cells and by secreting the macrophage activating cytokine IFN- γ . NK cells and macrophages are examples of two cell types that function cooperatively to eliminate intracellular microbes: Macrophages ingest microbes and produce IL-12, IL-12 activates NK cells to secrete IFN- γ , and IFN- γ in turn activates the macrophages to kill the ingested microbes.

