Immunology

B-Lymphocytes cells

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Introduction of B-cell

B-Lymphocytes, named after their site of origin in the bone marrow in humans form the basis of humoral immunity by their production of immunoglobin.

It belongs to adaptive immunity.
Antigen septicity.

Humoral immunity
Final destination for B-cell: Plasma cell

Lymphoid tissues

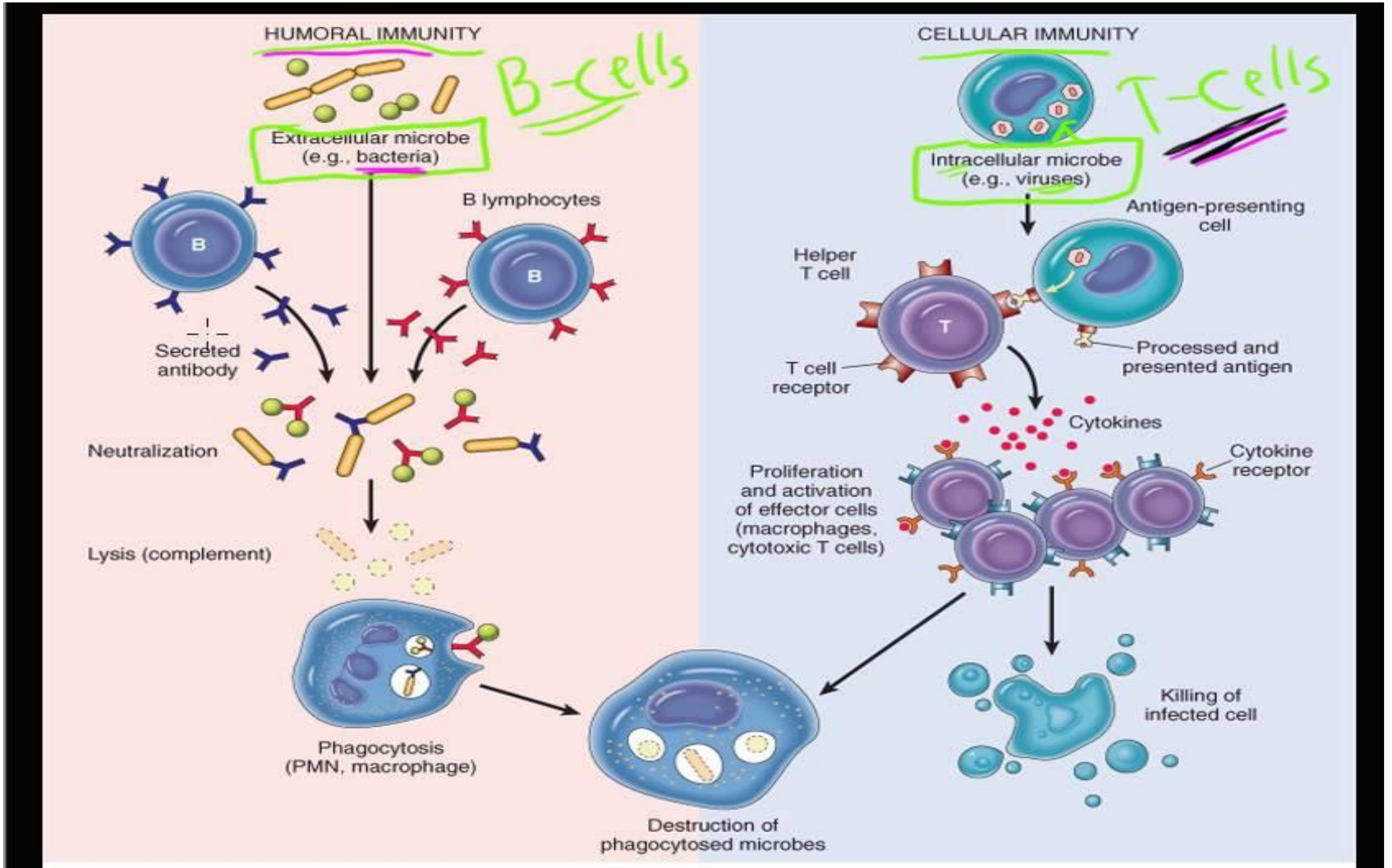
Primary

–Bone marrow
–Thymus Secondary
–Lymph nodes
–Spleen–Tonsils

-Lymphoid tissue within GI and respiratory tracts

Overview of B cell development

B cells are generated in the bone marrow Takes 1-2 weeks to develop from hematopoietic stem cells to mature B cells Sequence of expression of cell surface receptor and adhesion molecules which allows for differentiation of B cells, proliferation at various stages, and movement within the bone marrow microenvironment Immature B cell leaves the bone marrow and undergoes further differentiation •Immune system must create a repertoire of receptors capable of recognizing a large array of antigens while at the same time eliminating self-reactive B cells.


HUMORAL IMMUNITY
B-cells
Extracellular microbe
(e.g., bacteria)
B lymphocytes
B
B
Secreted
antibody
Neutralization
Lysis (complement)
Phagocytosis
(PMN, macrophage)
Destruction of
phagocytosed microbes
CELLULAR IMMUNITY
T-cells
Intracellular microbe
(e.g., viruses)
Antigen-presenting
cell
Helper
T cell
T
T cell
receptor
Processed and
presented antigen
Cytokines
Cytokine
receptor
Proliferation
and activation
of effector cells
(macrophages,
cytotoxic T cells)
Killing of
infected cell

Function of B cells

- To interact with antigenic epitopes , using their immunoglobulin receptors.

To present antigenic peptides to T-cell, consequent upon internalisation and processing of the of the original antigen.

- As the B-cells are responsible for the humoral arm of the

adaptive immunity system, it act against extracellular pathogens .

- Ig when bound to the cognate antigens , can activate the complement system and help phagocyte to take up antigens

B-cell activation

Occurs in the peripheral lymphoid organ
Antigen- driven activation and clonal selection of native B-cells
Generation of plasma cells and memory B-cell of
In absence of antigen -induce activation ,naïve B-cells die within few weeks by apoptosis

Plasma cell

Membrane from Ig changes to secreted from the rate of transcription of heavy and light chain genes significantly greater .

Memory cell

Seen in T- dependent immune response
Survive for long periods
High –affinity antigen receptors
Capable of mounting rapid response to subsequent introduction of Ag
Remain in the lymphoid organ where generated or recirculates.

Development of humoral immune response :

Humoral immune response refers to the production of secreted Antibodies by plasma cells following antigenic stimulation of B-cells.

Involves activation of B-cells by antigen followed by their proliferation and deafferentation into plasma cell and memory cells.

Primary and secondary

Primary immune response

- The first contact of an exogenous antigen with an individual generates a primary humoral response , characterised by the production of antibody- secreting plasma cells and memory B-cells .
- The Kinetics of the primary response , as measured by serum antibody level , depend on the nature of the antigen, the of antigen, the route of antigen administration, the presence or absence of adjuvants , and the species or stain being immunized.
- Gradual rise in antibody production taking days to weeks
- Antibody level declines.

Secondary immune response

- Activation of memory cells by antigen results in a secondary antibody response that can be distinguished from the primary response in several ways.

- The secondary response has a shorter lag period . Reaches a greater magnitude , and last longer .

- The secondary response is also characterised by secretion of antibody with a higher affinity for the antigen,

- And isotype other than IgM predominate ,second exposure to same antigen .

- Recognition of Ag is immediate

- Results in immediate production of productive antibody , a mainly IgG but may see some IgM

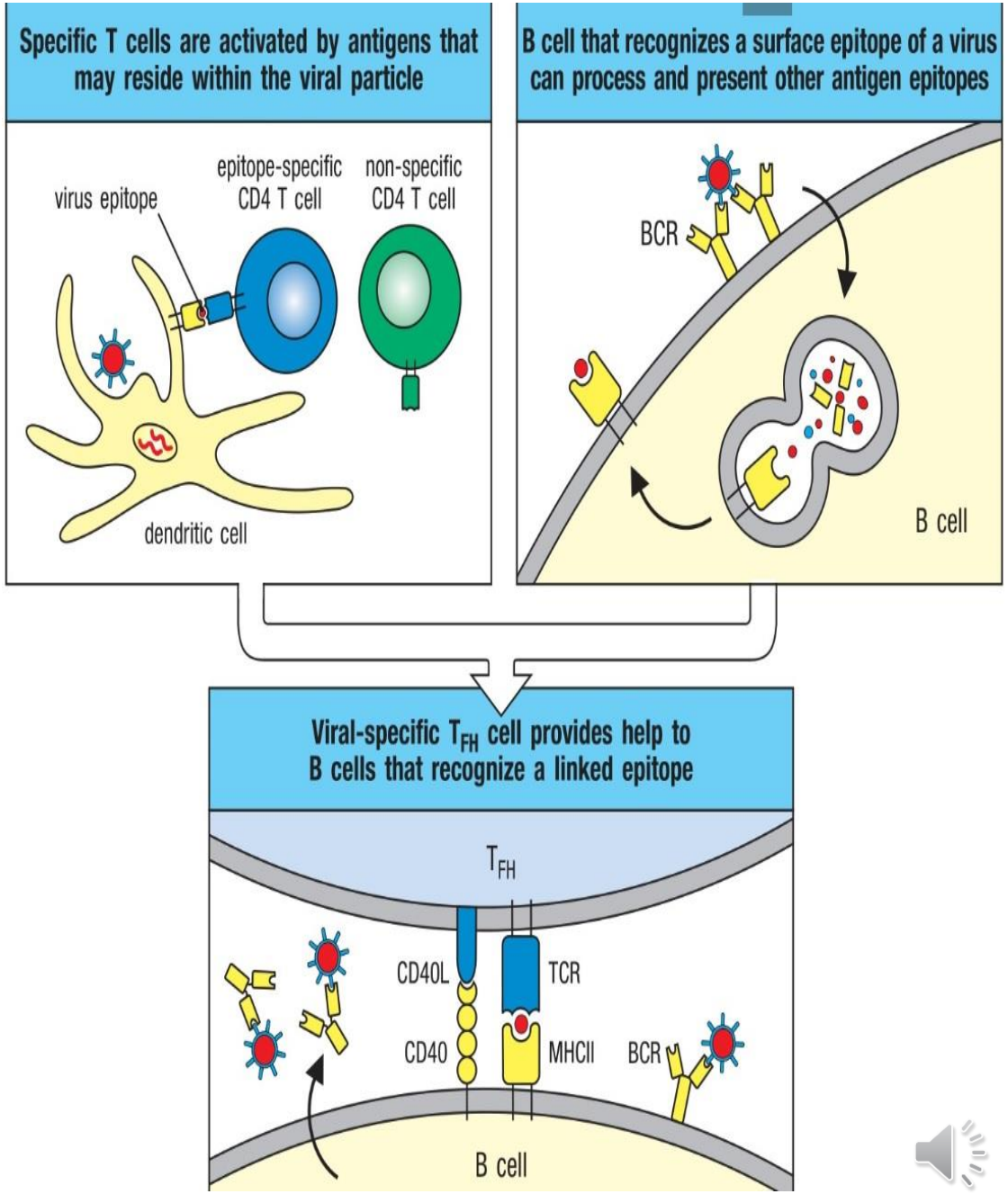
Maturation of activated B cells in absence of T cells

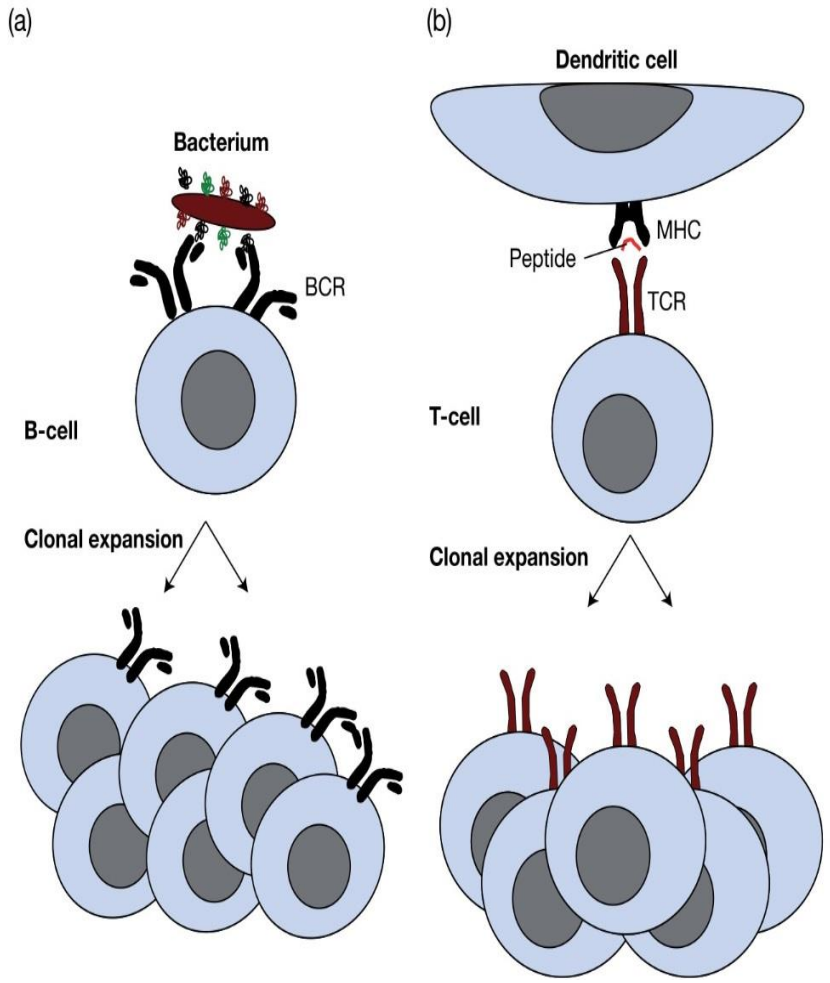
Rapidly mature into short-lived plasma cells without undergoing somatic hypermutation or class switching

- Secrete IgM antibodies of low affinity
- Do not contribute to memory B cell pools
- B-1 cells may preferentially follow this non-follicular differentiation pathway as they appear to be much less dependent on T cell help for antibody production.

T cells and B cells must recognise antigens contained within the same molecular complex in order to interact.

In this example, an internal viral protein harbors a peptide epitope (shown as red) that is presented by MHC class II molecules and is recognized by a CD4 T cell. The virus also harbors a native epitope on an external viral coat protein (shown as blue) that is recognized by the surface immunoglobulin on a B cell. If the virus is captured and presented by a dendritic cell, a peptide-specific CD4 T cell (blue) becomes activated (top left panel), whereas nonspecific T cells (green) remain inactive. If the virus is recognized by a specific B cell (top right panel), peptides derived from internal viral proteins are processed and presented by MHC class II molecules. When the activated T cell recognizes its peptide on this B cell (bottom panel), the T cell will deliver various accessory signals to the B cell that promote antibody production against the coat protein. This process is known as linked recognition.





B-cell and T-cell interaction with dendritic cells and pathogen.

B-cells and T-cells “see” antigen in fundamentally different ways. (a) In the case of B-cells, membrane-bound immunoglobulin serves as the B-cell receptor (BCR) for antigen. (b) T-cells use distinct antigen receptors, which are also expressed at the plasma membrane, but T-cell receptors (TCRs) cannot recognise free antigen as immunoglobulin can. The majority of T-cells can only recognise antigen when presented within the peptide-binding groove of an MHC molecule. Productive stimulation of the BCR or TCR results in activation of the receptor-bearing lymphocyte, followed by clonal expansion and differentiation to effector cells.