



المناعة 1

B Cell

Sawa University

College of health and medical techniques

Department of Medical Laboratories

Third Stage

جامعة ساوة الاهلية

كلية التقنيات الصحية والطبية

قسم تقنيات المختبرات الطبية

المرحلة الثالثة

محاضرة رقم 7

Lecture No. 7

الجانب النظري

Theoretical

تدريسي المادة : د. زيدون حسين مهدي

In humans, progenitors of immunoglobulin-producing cells are found in **in the fetal liver** by the eighth week, and in the bone marrow by approximately the twelfth week of gestation (Pregnancy) .

These cells are called bone marrow-derived lymphocytes or B cells because this is where most of these cells differentiate. B cells are defined as cell that synthesize immunoglobulin and display it on their cell surfaces as their BCRs.

Then they migrate out of the bone marrow, where the maturation occurs (i.e. they are mature naïve cells). They then migrate out of the bone marrow and circulate every 24 hours to the lymph nodes and tissues via the blood circulation and lymphatic circulation.

B Cell Activation

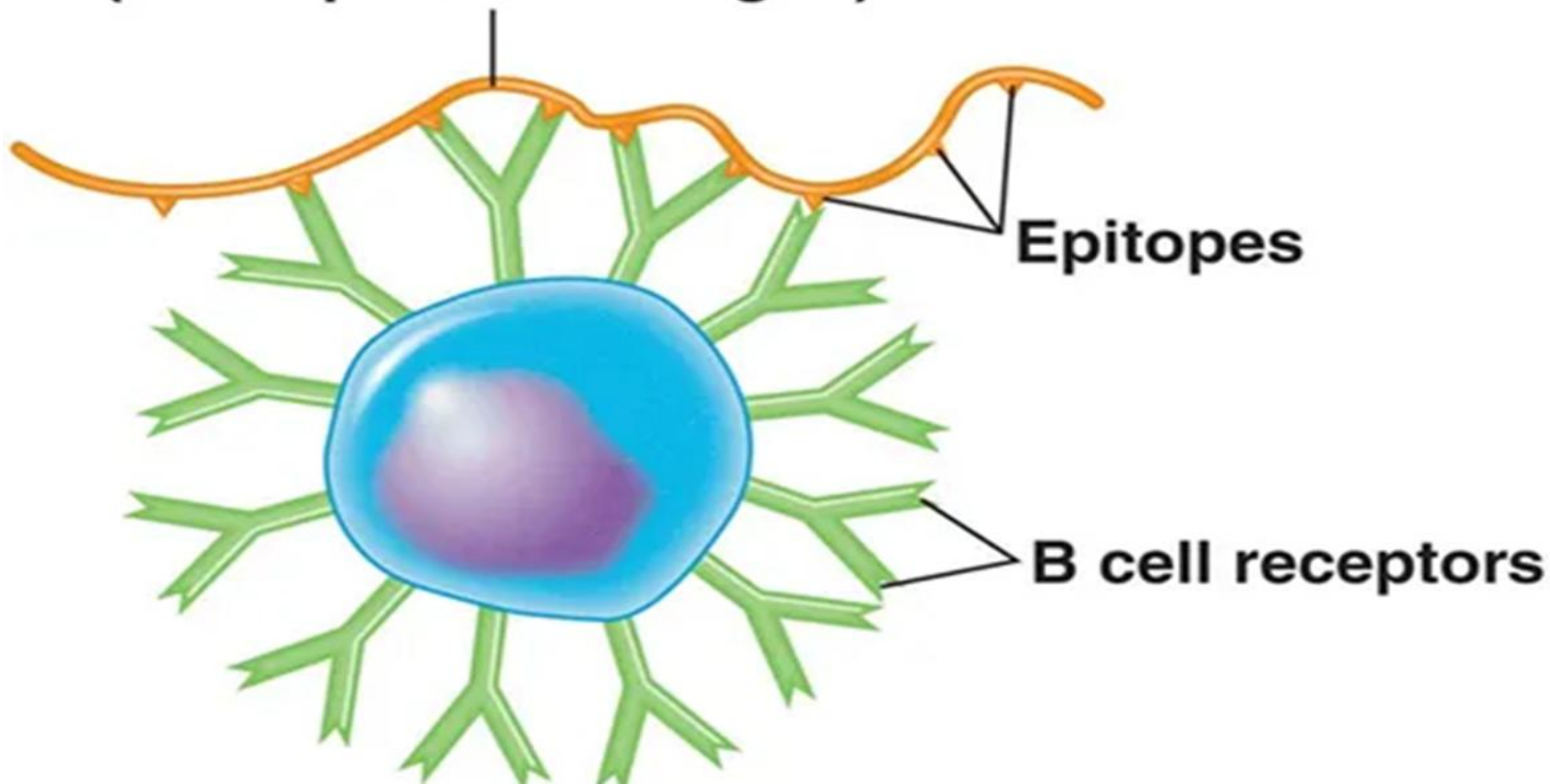
BCRs recognize **and bind epitopes on either cell-bound or soluble molecules.**

The BCR complex of mature B cells contains membrane- bound immunoglobulin monomers molecules (IgD or IgM).

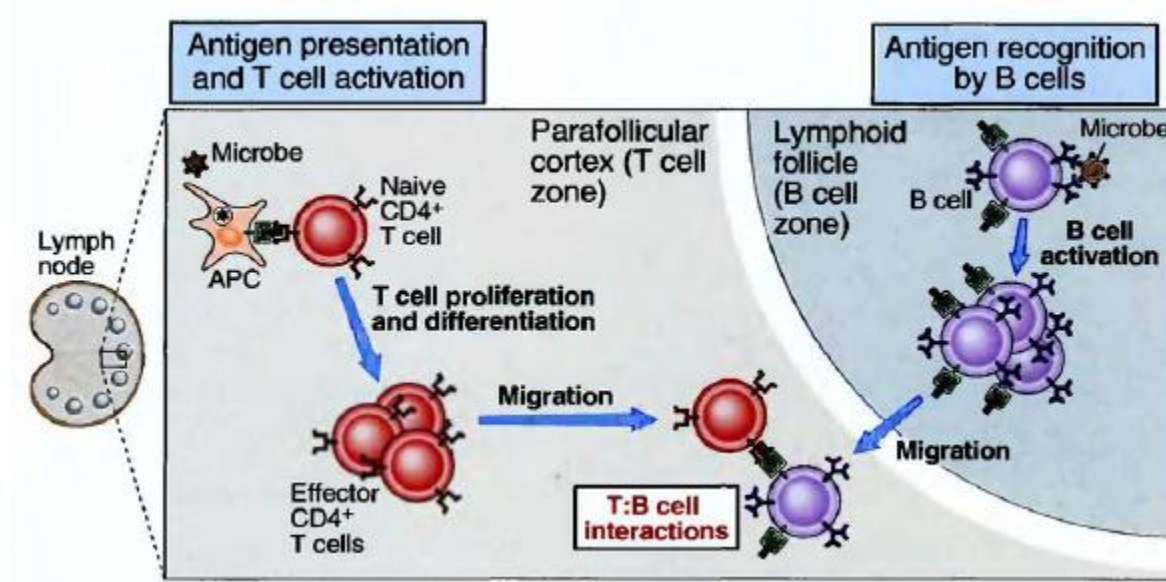
Some antigens are classified as

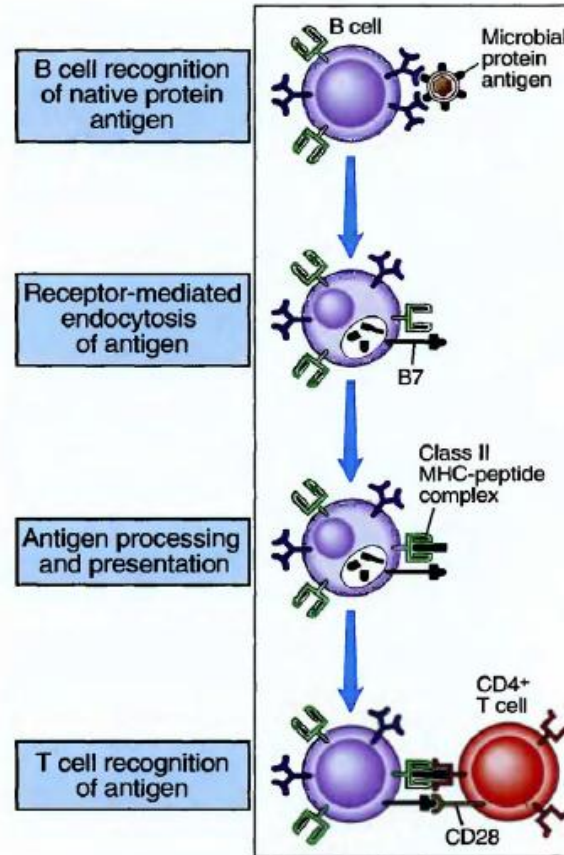
1-T-independent (TI) antigen: to indicate that they activate B cells without help from T cells. they activate B cells irrespective of BCR epitope specificity. They are typically microbial in origin such as lipopolysaccharide. In high concentration, **there are two TI-1 antigen**, which has an activity that can directly activate B cells and **TI-2 antigen**, which has highly repetitive structure and causes simultaneous cross-linking of specific [B cell receptors](#) (BCR) on B lymphocyte. **TI antigens stimulate B cells to activate, proliferate, and increase immunoglobulin production and secretion.**

Polysaccharide (T-independent antigen)



T-dependent antigens (proteins) require T-cell help → strong, long-lasting response.





T Dependent (TD) Antigen	T Independent Antigen
Soluble proteins	Bacterial cell wall components Lipopolysaccharide (LPS) , Capsular polysaccharide, flagella, etc.
Antigen is processed and displayed on the surface of antigen-presenting cells (B Cells) in association with MHC-II.	Antigen processing is not needed
No polyclonal activation i.e. Activate B cells monoclally.	Polyclonal activation of B cells occurs in high doses of Type-I TI Antigens
Immunologic memory present	No immunologic memory
Affinity maturation- Yes	Affinity maturation- No
Isotype switching occurs (i.e. antibodies of all classes are produced)	No isotype switching (Antibody response is restricted to IgM and IgG3)
Activate mature B cells only	Activate both mature and immature B cells

Antigen Uptake and Presentation

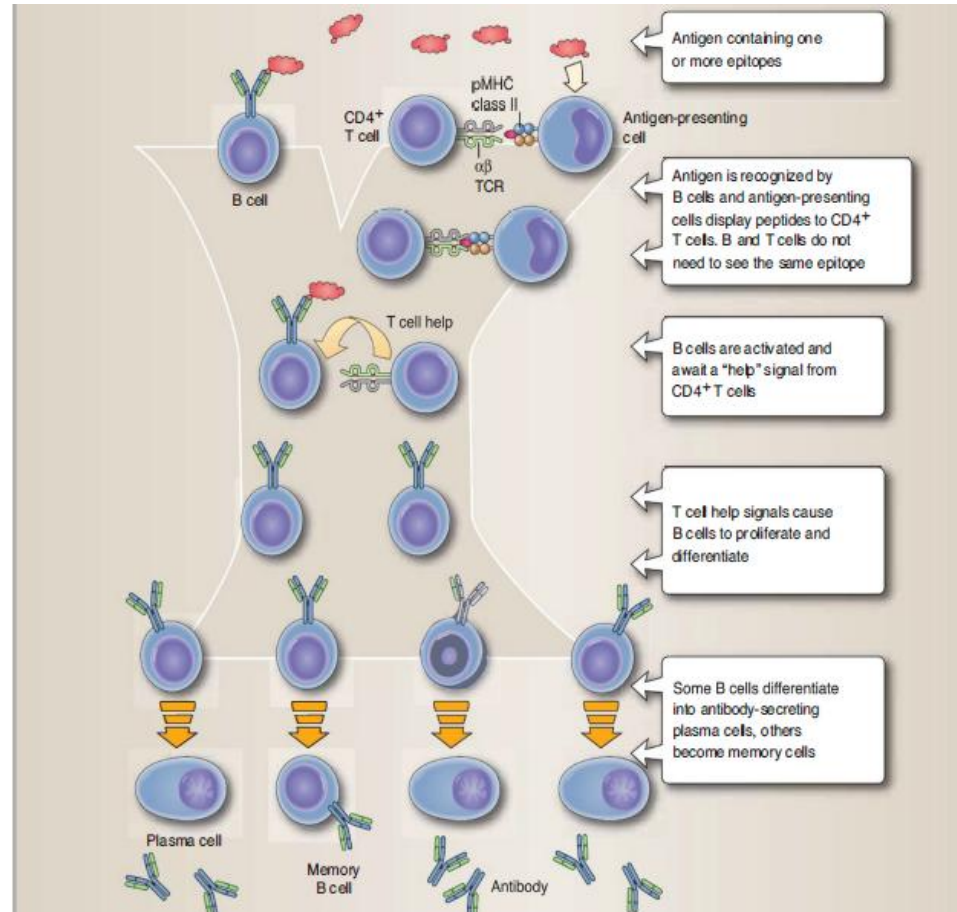
- B cells internalize antigen–BCR complexes.
- Antigen processed and presented via MHC Class II.
- Helper T cells recognize linked epitopes → provide activation signals.
- B and T cell interaction occurs at T–B border in lymphoid organs.

Plasma Cells and Memory B Cells

- • Plasma cells: secrete antibodies; short- or long-lived.
- • Memory B cells: long-term, rapid response upon re-exposure.
- • Both depend on T-cell cytokine help (IL-4, IL-21).

Plasma cells and Memory B cells

Plasma cells are terminally differentiated B cells that actively secrete immunoglobulins (Fig). The epitope specificity of the immunoglobulins secreted by plasma cells is the same as the surface immunoglobulin of the B cell from which it differentiated.



Negative Regulation of B-cell Activation

- Inhibitory receptors: FcγRIIb, CD22.
- • Prevents overactivation and autoimmunity.
- • Self-reactive B cells eliminated during development or suppressed peripherally.

Summary

- • B-cell activation involves antigen binding, signaling, and T-cell help.
- • Germinal center reactions improve antibody quality.
- • Plasma and memory cells provide immediate and long-term protection.
- • Regulation ensures immune tolerance and prevents autoimmunity.

Thank
you!

