Chapter 7: The Immune Response

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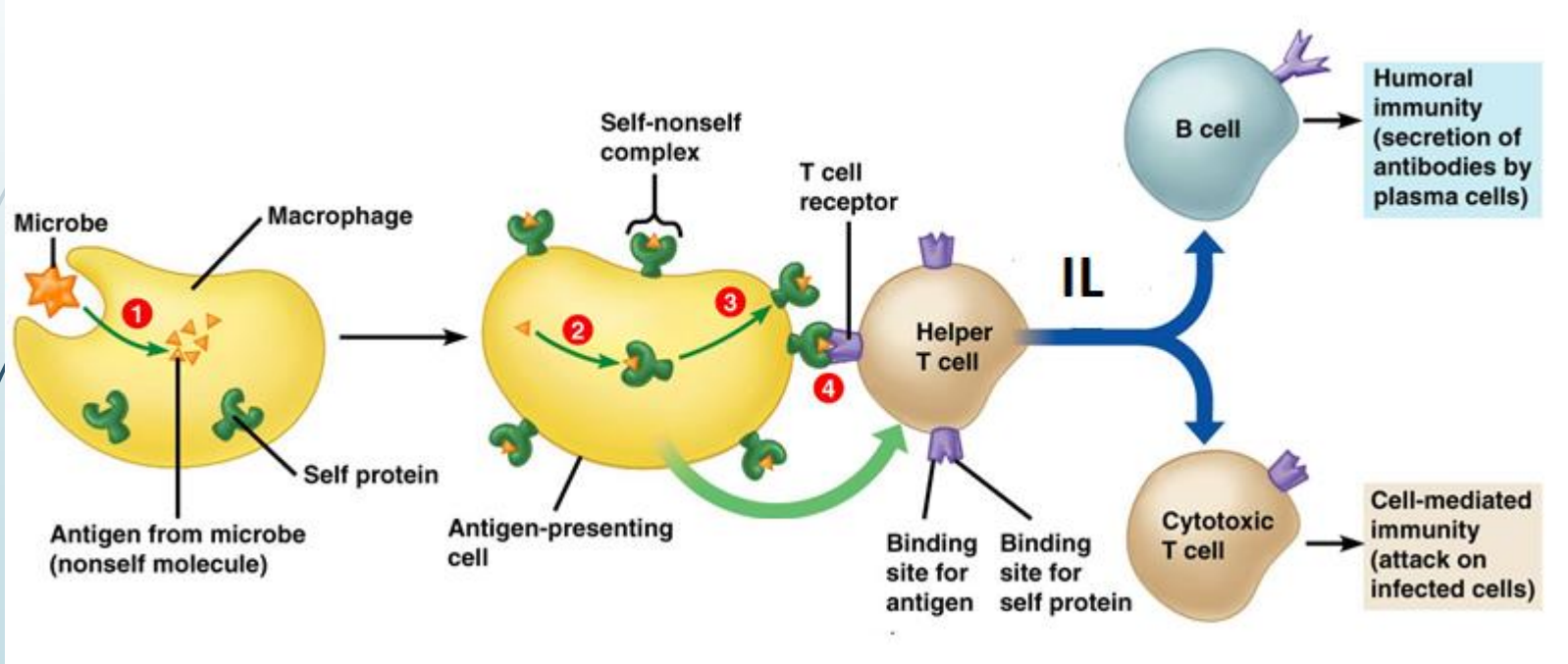
Document 4

Role of TH in the Specific Immune Response



I. Importance of TH cells in the specific I.R:

- Nude mouse: mouse without thymus since birth. It has neither specific humoral or specific cell mediated I.R, despite it has mature BL. This is due to the absence of mature TH that activates BL.

-Application 1:

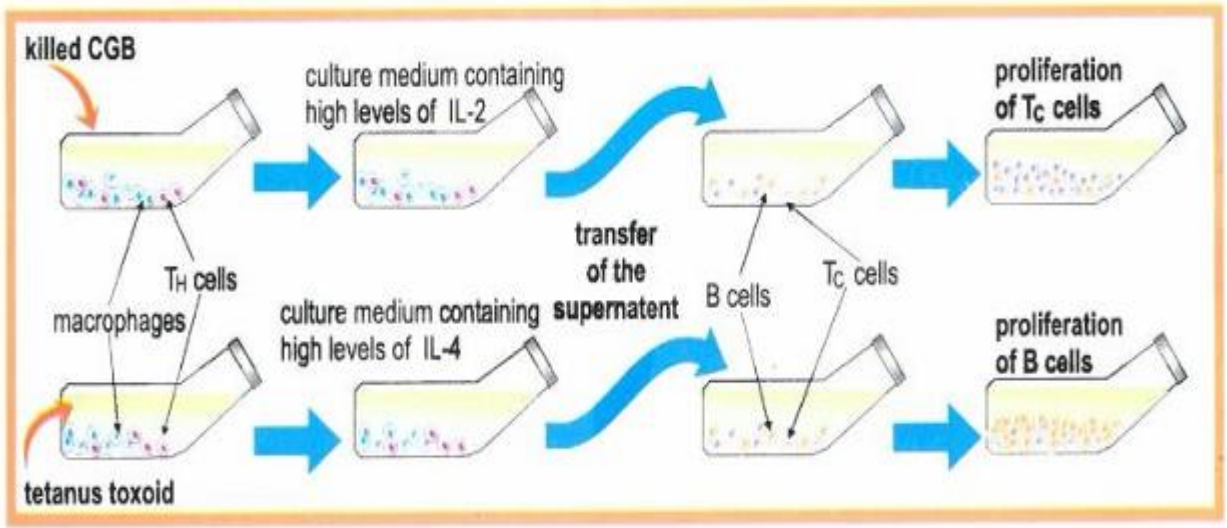
The injection of tetanus toxoid induces a specific humoral immune response and that of CGB induces a cell-mediated immune response. In order to understand the role of TH cells in the determination of the type of specific immune response, the following experiments are performed:

TH lymphocytes are cultured in the presence of antigen and macrophages. A few days later, the culture medium contains interleukins secreted by activated TH cells. The culture medium is added to a mixture of TC and B cells. Each cell population is counted 48 hours later; its proliferation indicates that this population is activated ***(Doc.b)***.

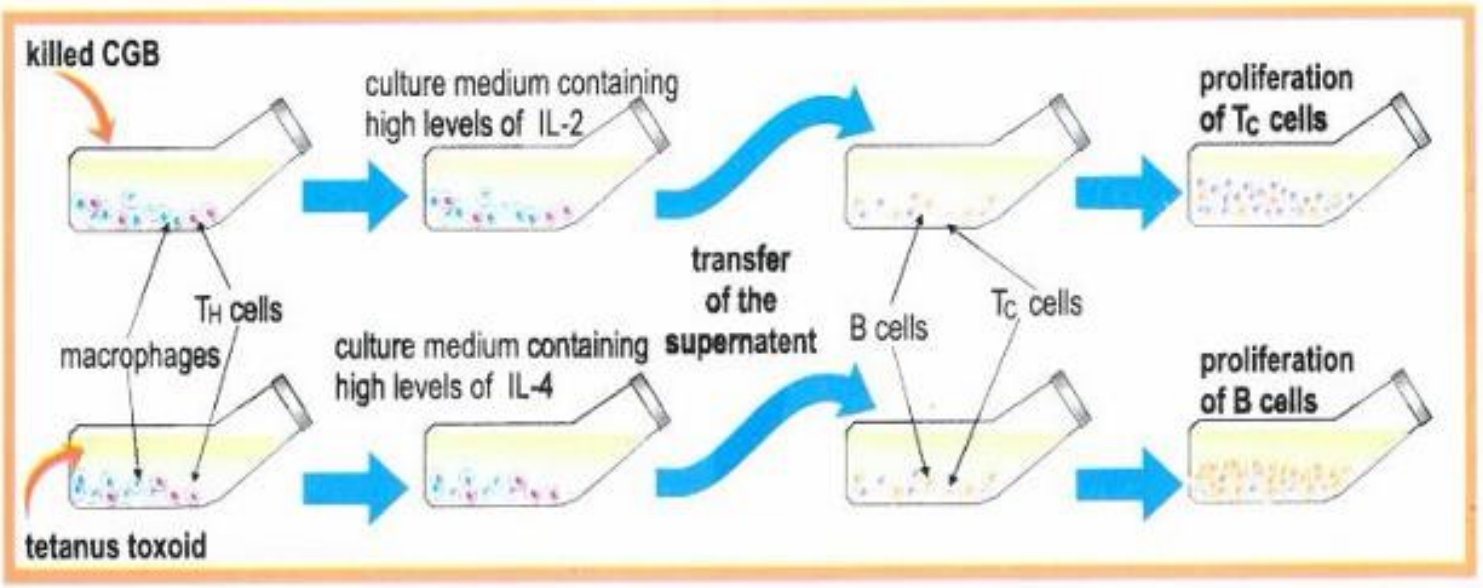
- Referring to Doc.a, p.144, answer the following questions:

1. Pick out the aim of the experiment.

To understand the role of TH in the determination of the type of S.I.R.



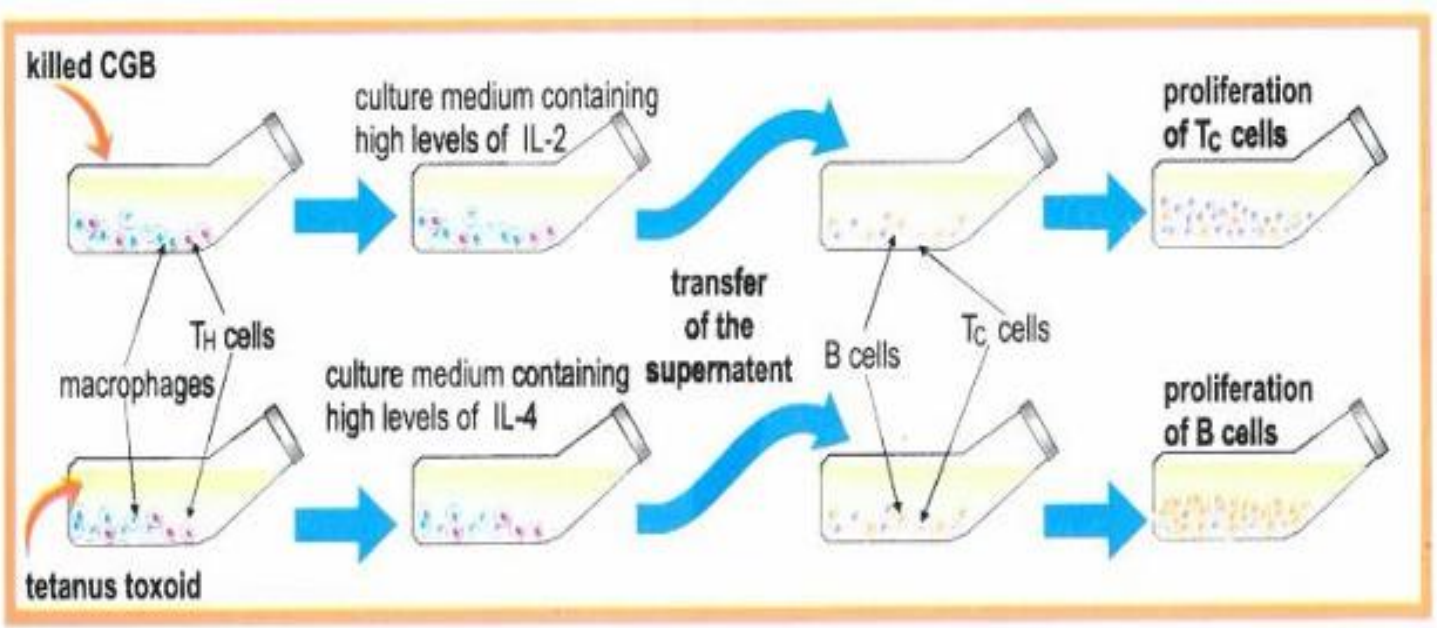
Doc.b *Experiments illustrating the role of TH cells.*



Doc.b *Experiments illustrating the role of TH cells.*

2.1- Analyze the experimental results.

Upon culturing killed CGB with macrophages and TH1, high levels of IL-2 were produced and transferred to another culture medium containing B-cells and Tc cells, resulting in proliferation of Tc cells. While, upon culturing tetanus toxoid with TH and macrophages, high levels of IL-4 were produced, and then transferred to another culture medium containing B –cells and Tc cells, resulting in the proliferation of B-cells.

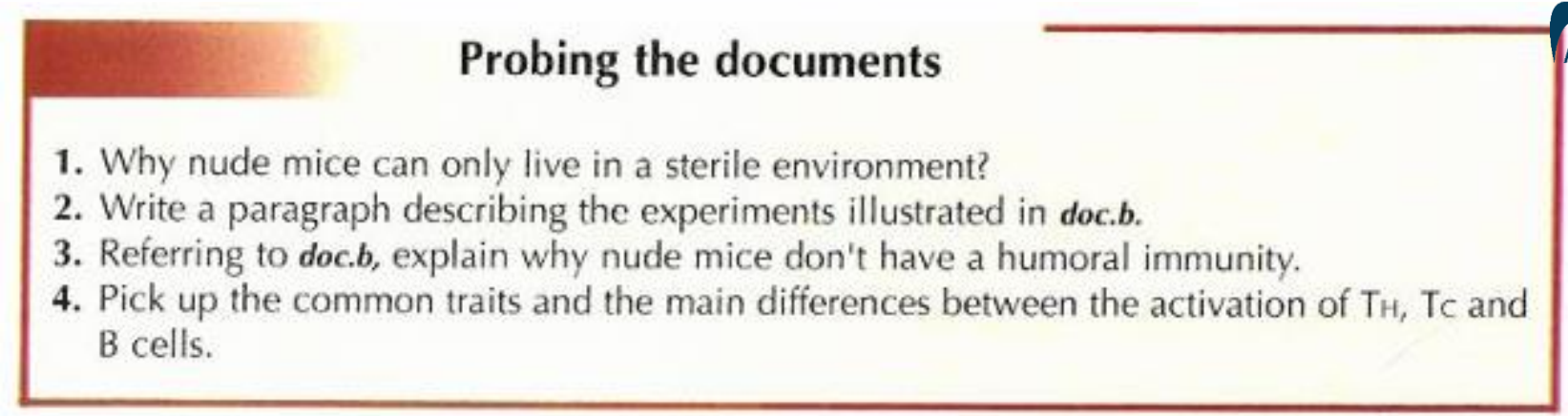


Doc.b *Experiments illustrating the role of T_H cells.*

2.2- What do you conclude?

Thus, IL-2 secreted by TH activates Tc cells and IL-4 secreted by TH activates B-cells.

- Probing the documents: p:145



Probing the documents

1. Why nude mice can only live in a sterile environment?
2. Write a paragraph describing the experiments illustrated in ***doc.b.***
3. Referring to ***doc.b,*** explain why nude mice don't have a humoral immunity.
4. Pick up the common traits and the main differences between the activation of TH, Tc and B cells.

1) Nude mice can live only in a sterile environment, to prevent infection by microbes, because they don't have thymus responsible for T-cells maturation and thus absence of specific immunity,

3)Since nude mouse doesn't have mature TH that secrete IL-4 responsible for activation of specific humoral immune response.

***Note (to study):Activated TH activates humoral and cell mediated specific immune response by secreting IL-2 that activates Tc, and IL-4 that activates BL.**

II. Fate of activated B and Tc cells:

- Doc.c & paragraph p.145.

Among billions of B cells expressing different membrane Ig, only those that are specific for the antigen undergo clonal selection and are activated.

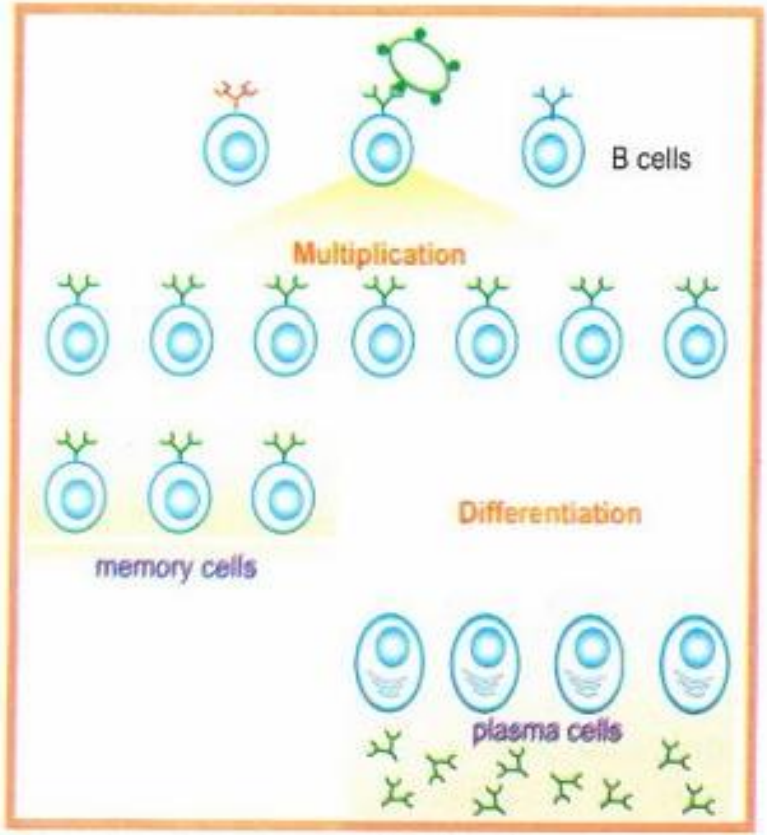
A selected B cell proliferates in response to IL-4. Some cells of the resulting clone keep their membrane Ig and become memory B cells. Others complete their differentiation into short-lived plasma cells that secrete antibodies of the same antigenic specificity as the mother B cell. A plasma cell secretes about 3000 antibody molecules per second ***(Doc. c)***.

Similarly, among billions of Tc cells expressing different TCR, only those that are specific for the antigen undergo clonal selection and are activated.

A selected Tc cell proliferates in response to IL-2. Some daughter cells become memory cells while others complete their differentiation into short-lived "effector" cytotoxic T cells that are able to kill their target cells (***Doc.d***).

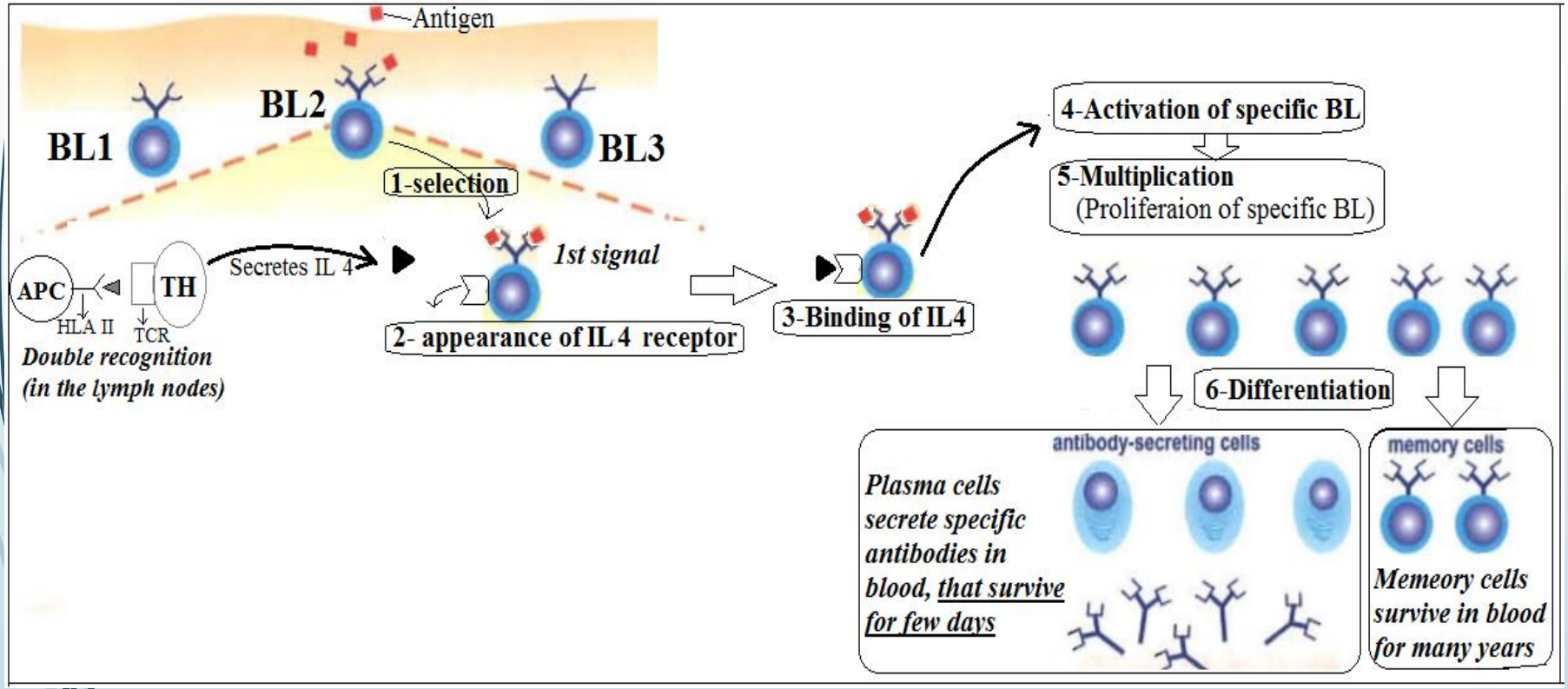
- **Fate of Activated BL**

1. Clonal selection of specific BL, following the binding to a free or soluble antigen.
2. Appearance of IL4 receptor on specific BL.
3. Binding of IL4 released by activated TH (after double recognition between TCR of TH and HLA II carrying non-self-peptide of an APC in the lymph nodes) to its specific receptor on BL.
4. Activation of BL.
5. Multiplication or proliferation of a clone of BL all carrying the same antibodies.
6. Differentiation into memory BL that survive in blood for many years, and into plasma cells that secrete antibodies into blood and survive for few days.



Doc.c Evolution of activated B lymphocytes.

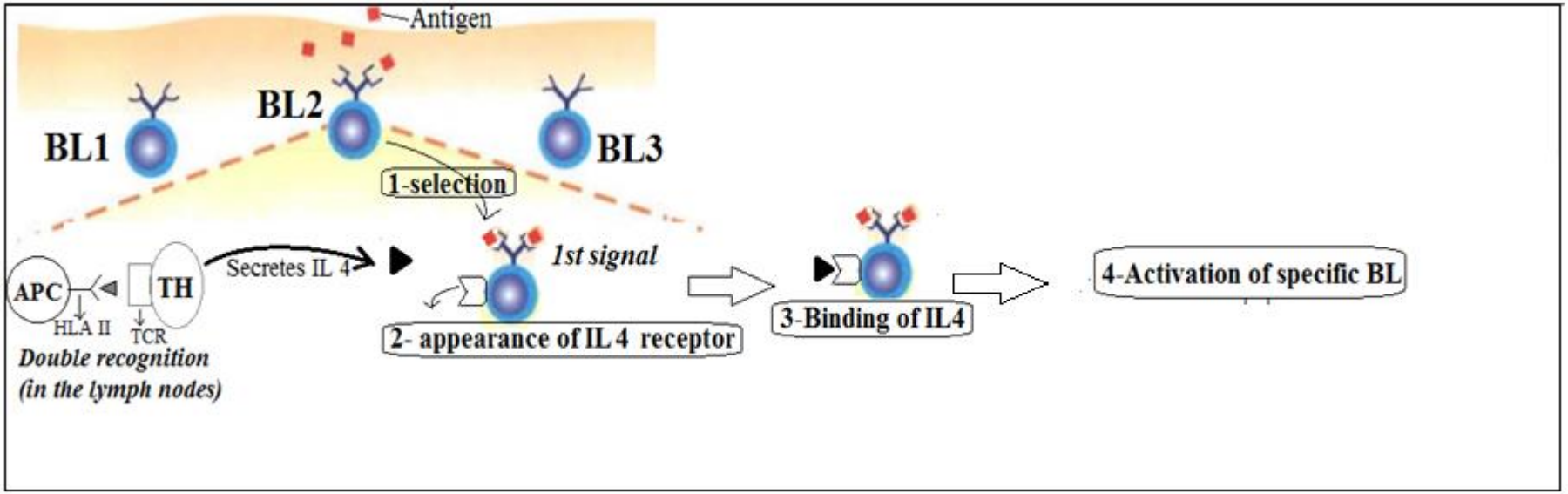
- **Title: schematic diagram showing the fate of activated BL.**



- **Formulate 2 hypotheses explaining the inactivation of B-cells in the presence of its specific antigens and TH1.**

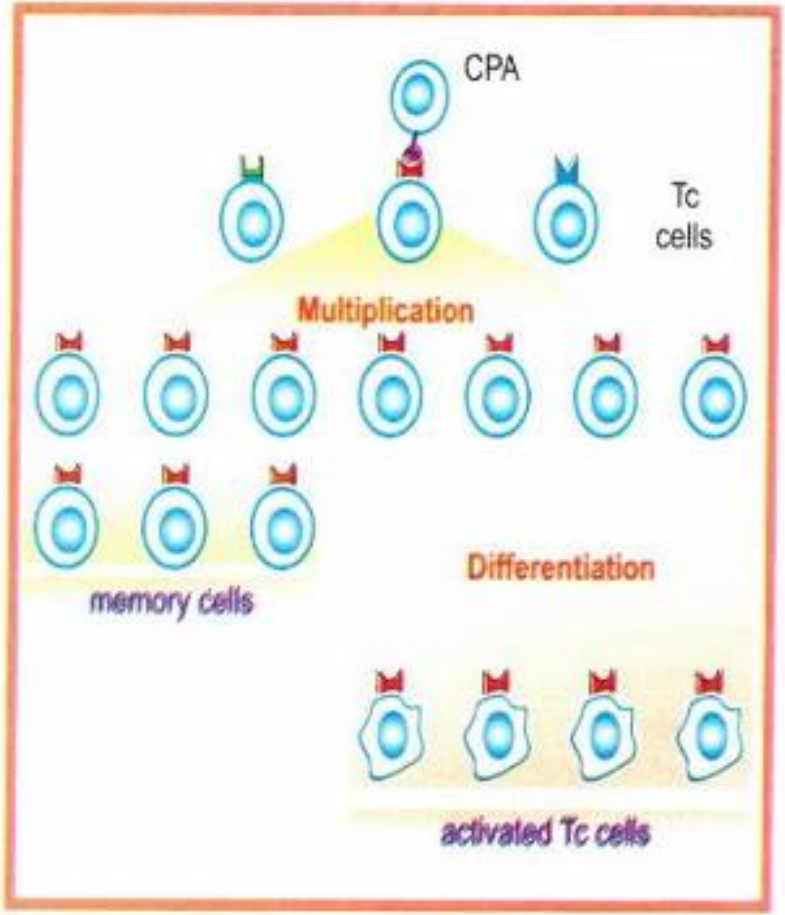
- Hypothesis 1: BL have abnormal IL-4 receptors (or doesn't have).

- Hypothesis 2: TH secretes abnormal IL-4 or no IL-4 secreted by TH.



- **Fate of Activated TC:**

1. Double recognition between TCR of a specific TC and an infected body cell carrying HLAI-non self peptide.
2. Appearance of IL2 receptor.
3. Binding of IL2 secreted by activated TH cells to its specific receptors.
4. Activation of the specific TC cells.
5. Multiplication of specific clone of TC carrying the same TCR.
6. Differentiation into memory TC that survive in blood for many years and into killer TC that survive in blood for few days and attack the target cell by cytotoxicity (to be discussed in Document 6).



Doc.d *Evolution of activated Tc lymphocytes.*

Probing the documents

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3. Referring to ***doc.b,*** explain why nude mice don't have a humoral immunity.
4. Pick up the common traits and the main differences between the activation of TH, Tc and B cells.

4) * Common traits are: clonal selection, proliferation and differentiation into memory and effector cells.

*Differences are:

-Type of antigens recognized: TH recognizes self HLA II carrying non self-peptide, while Tc recognizes self HLA I carrying non self-peptide, while BL recognizes the antigen itself.

- TH are activated by macrophages; Tc is activated by IL-2 while BL is activated by IL-4.