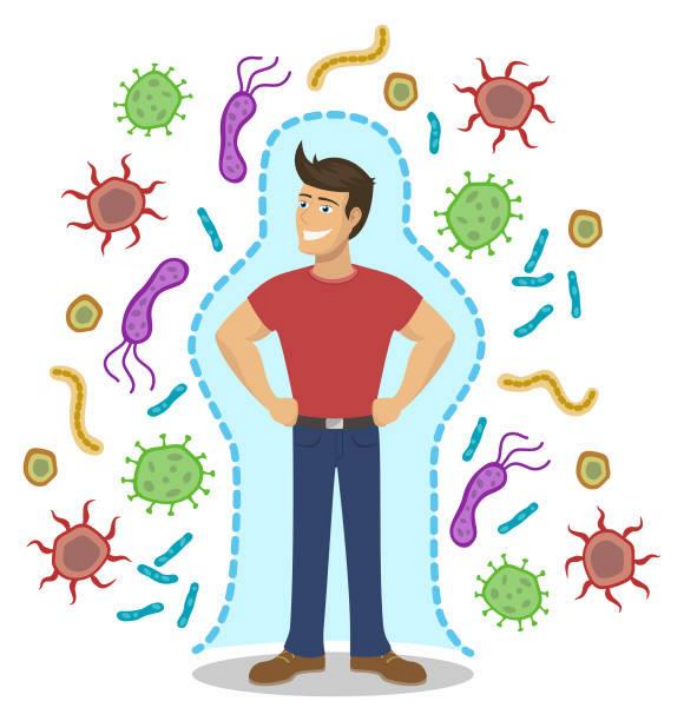
Document 3

Induction of the Specific Immune Response



- While the non-specific immune response develops rapidly at the infection site, the specific immune response must first be induced in the secondary lymphoid organs.
- ***How does the induction of the specific immune response take place?***

I. Mosier Experiment

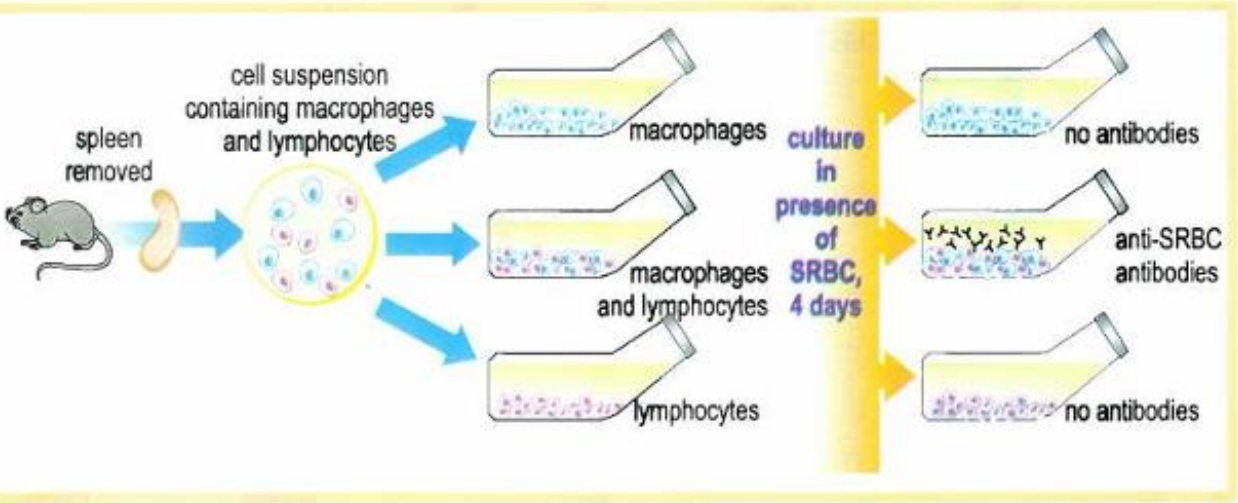
- Application 1:

Mosier and his collaborators were the first to demonstrate, in 1967, the important role of macrophages in the induction of a specific immune response. Their experimental system involved the production of mouse antibodies against sheep red blood cells (SRBC). Mosier experiment and its results are schematized in ***doc.a***.

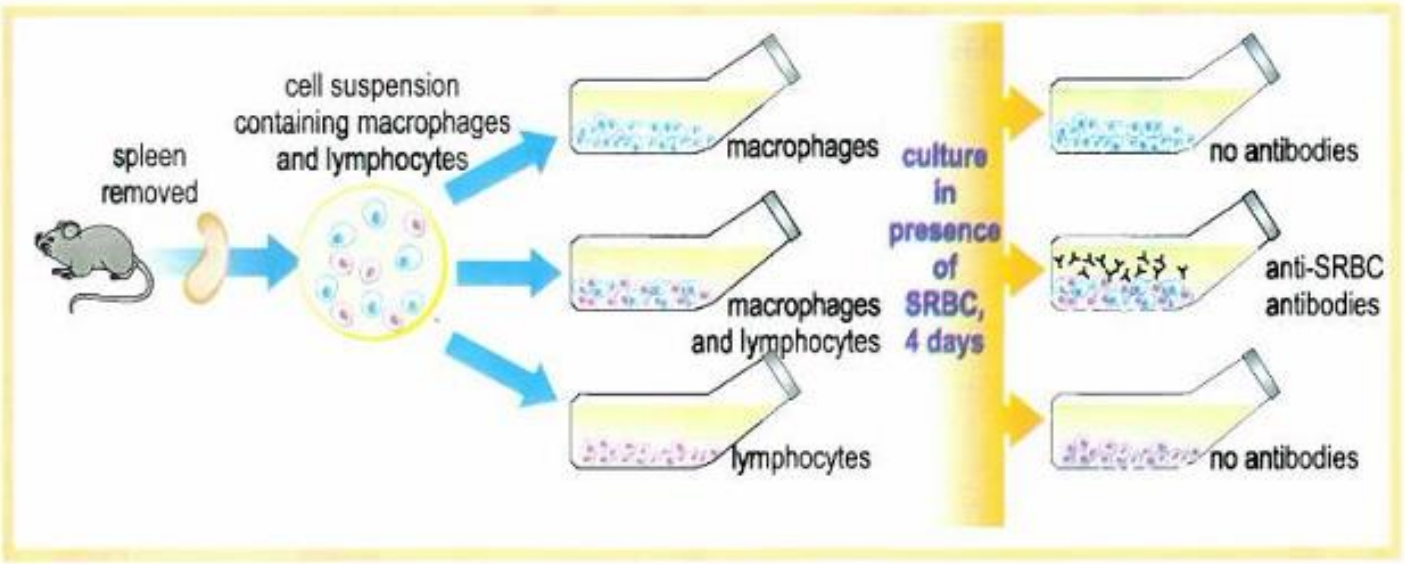
- Referring to Doc.a, p.142, answer the following questions:

1- Name the antigen used in this experiment.

SRBC.



Doc.a *Demonstration of the induction of the specific immune response.*

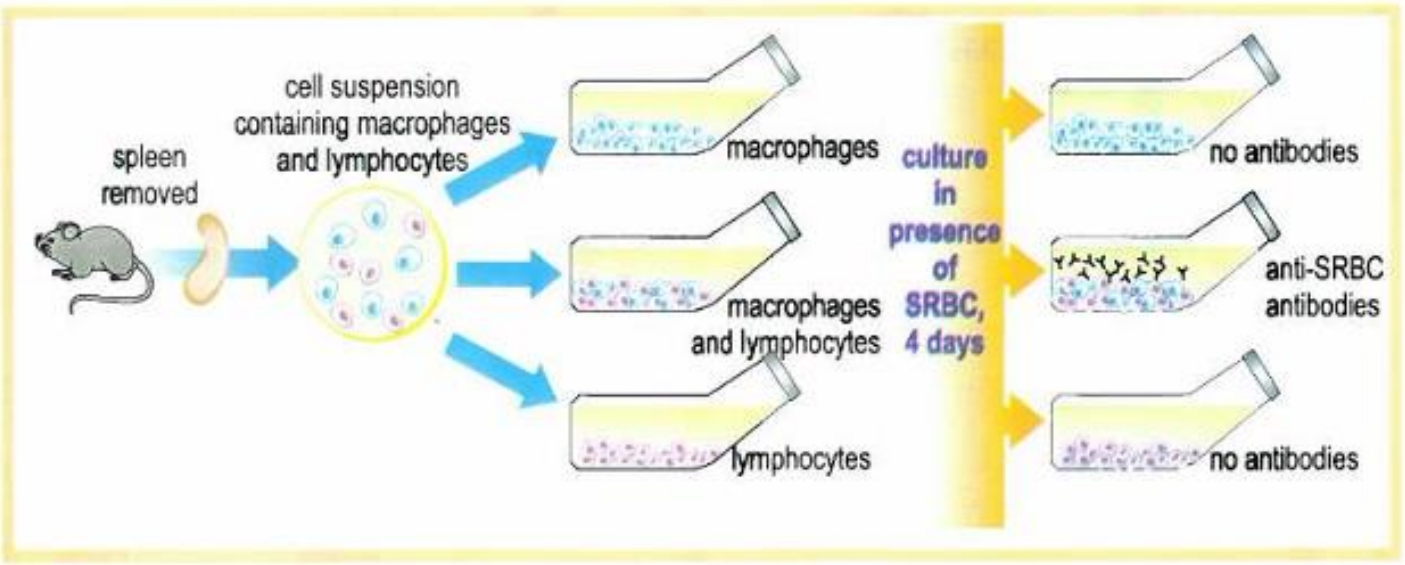


Doc.a *Demonstration of the induction of the specific immune response.*

2- Analyze the experimental results. What do you conclude?

Upon placing in culture 1 macrophages taken from a spleen of mouse in the presence of SRBC for 4 days, and in culture 3 placed under the same conditions except in the presence of lymphocytes, no antibodies were produced. While, upon placing culture 2 under the same conditions except in the presence of macrophages and lymphocytes together, there was production of anti SRBC antibodies.

Thus, the production of antibodies requires the cooperation (presence) of macrophages and lymphocytes.



Doc.a *Demonstration of the induction of the specific immune response.*

3- Specify the type of the immune response involved.

Specific humoral immune response since antibodies are the effector molecules involved in the elimination of the antigen SRBC.

*The production of antibodies take place after double recognition between APC (macrophage) and TH in order for TH to activate BL to become plasma cell and release antibodies..

II. Macrophage's Role in the Induction Phase

- Activation of specific TH cells by macrophages (clonal selection) in the lymph nodes: study paragraph + Doc.c, p143.

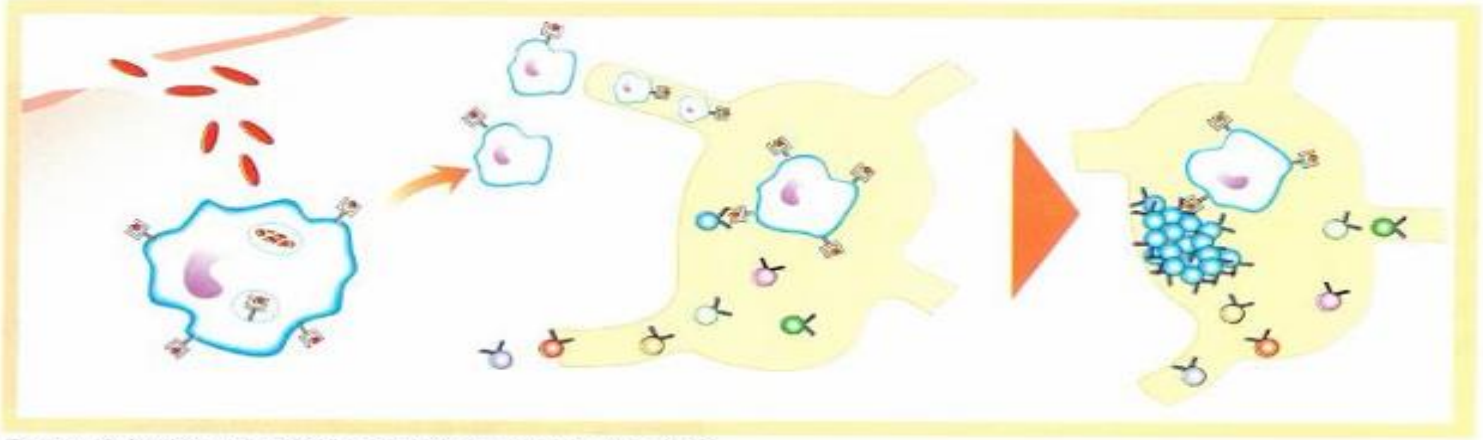
2 Macrophage's role in the induction phase

When a macrophage phagocytoses and digests a cell or a protein, resulting peptides are attached to HLA class II molecules and presented on the cell surface.

The macrophage migrates to the closest lymph node, where it becomes an "antigen-presenting cell", or APC.

TH cells circulate continuously between lymph nodes, where they "inspect" the HLA-peptide complexes of APC's.

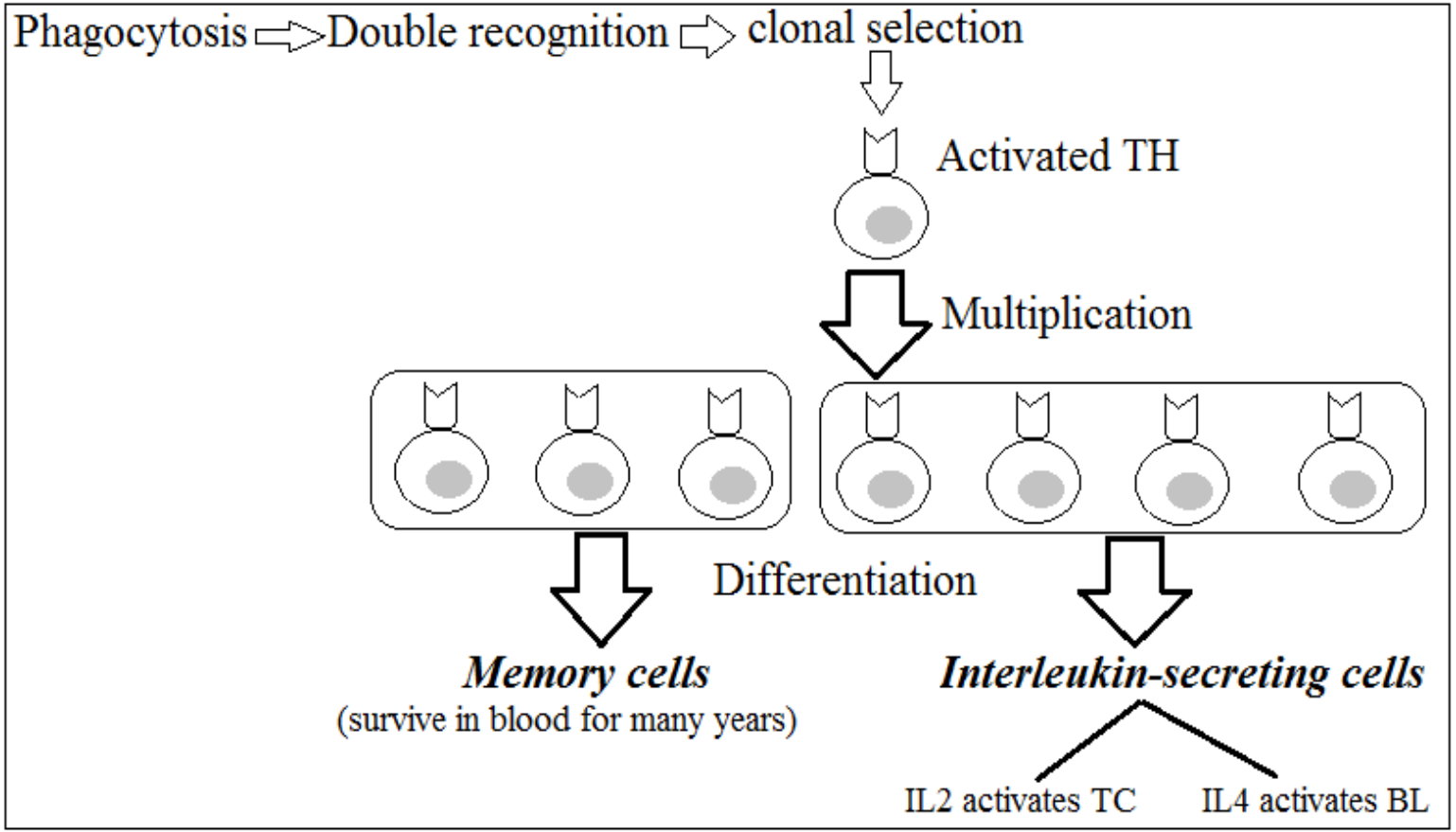
Only TH cells that are specific for the peptides presented by the APC remain attached to it. They are then activated and they proliferate. The others leave the lymph node and recirculate.



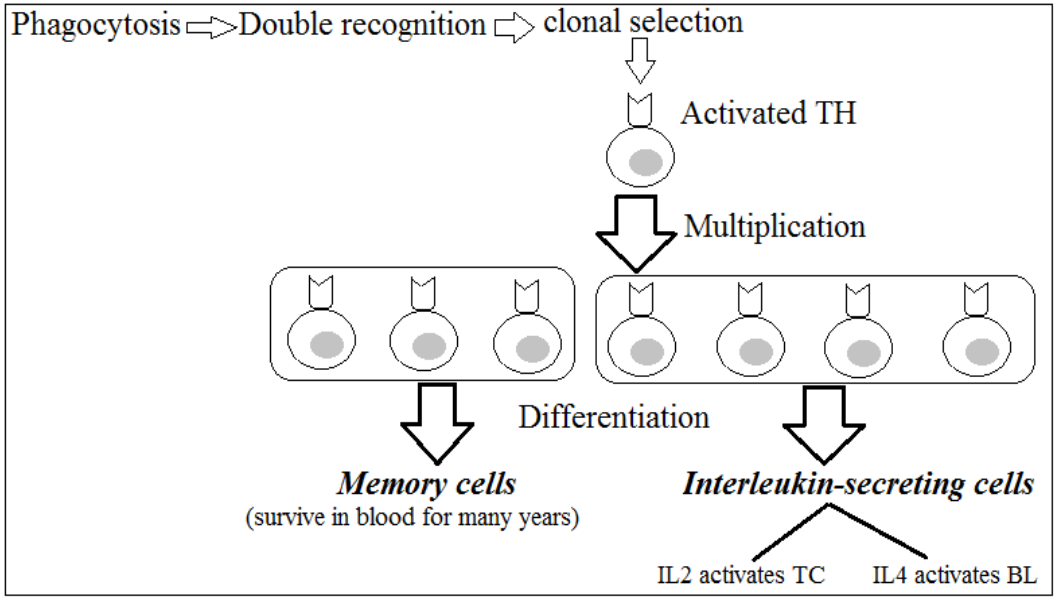
Doc.c *Selection of antigen-specific TH cells by the APC*

III. Fate of Activated TH Cells

- Fate of Activated TH Cells: Multiplication and Differentiation (Doc.d, p.143)



- After phagocytosis, macrophage become APC which presents the antigen to TH.
- Double recognition between TH and APC → **Activation (selection)** of specific TH cells: double recognition between TCR of TH and HLA II carrying non-self-peptide of APC (clonal selection)



→ **Multiplication:** proliferation of specific TH to form a clone of cells.

→ **Differentiation of specific TH cells:**

-Partial differentiation: into memory TH cells (remains in blood for many years).

- Complete differentiation: into IL (interleukin) secreting TH cells (remains in blood for few days): IL2 activates TC IL4 activates BL

- Probing the Documents p.143

Probing the documents

1. Interpret the experiment of ***doc.a.*** What do you conclude?
2. What is the characteristic of a "clone" of T lymphocytes?
3. Where does the activation of T lymphocytes take place?
4. Formulate a hypothesis explaining the role of interleukines and memory cells.
5. Based on the information provided by the documents, name the different phases in the evolution of the activated T_H cells.

2- A clone of T-cells all have the same TCR and all are specific for the same antigen or epitope.

4- Hypothesis: Interleukins activate the humoral and cell mediated specific immune response,
Hypothesis: Memory cells are activated faster after the second encounter of the same antigen.

5- proliferation (increase in number) and differentiation (into memory and interleukin secreting cell).

*Macrophage role in the Induction phase

- Macrophages induce the specific immune response by 2 steps:

1- Clonal selection of TH specific for the antigen (activation). It takes place in the lymph nodes when TCR of TH makes double recognition with APC.

2- Proliferation and differentiation of TH specific for the pathogen.