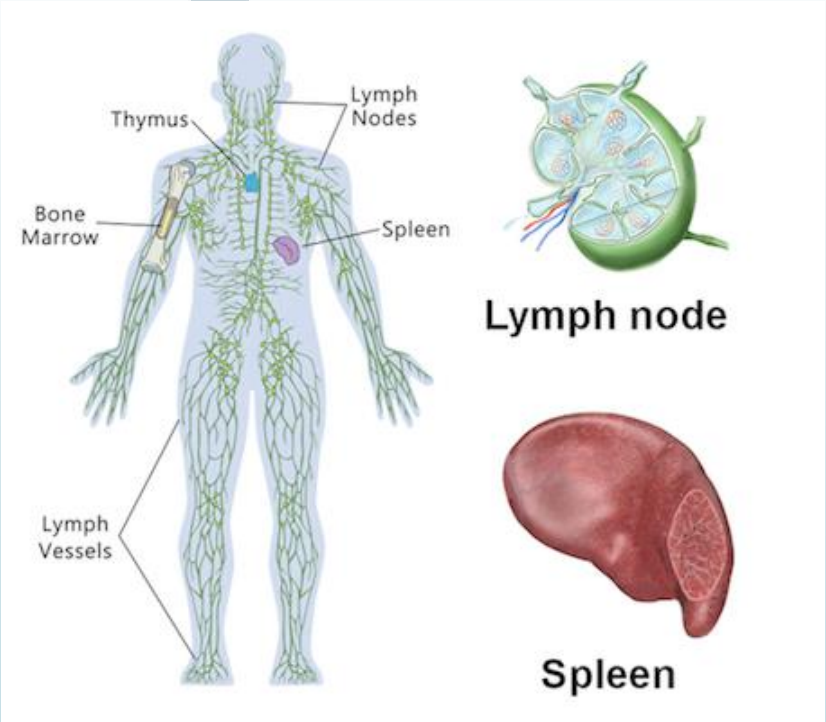
Document 5

Lymphoid Organs



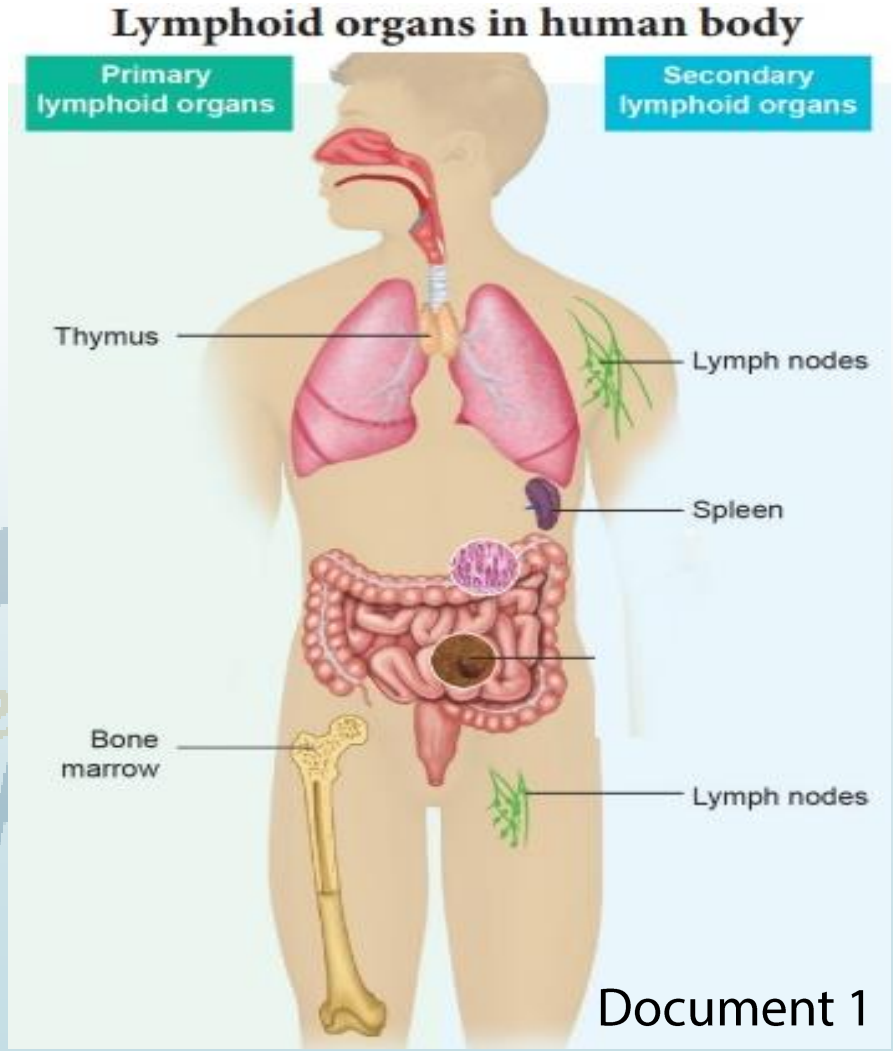
- In addition to cells, the immune system includes lymphoid organs. These organs are the sites of production and maturation of lymphocytes where immune reactions occur.

- What are these organs?

- How does lymphocytes maturation take place?

- **Lymphoid Organs**

  -Document 1 shows primary and secondary lymphoid organs.



Document 1

-Application 1:

- In order to determine the site of production and maturation of lymphocytes, experiments were carried on three lots of mice. the experiments realized and the results obtained are given in Doc.a, p.123.

→ Referring to Doc.a , answer the following questions:

Irradiation of bone marrow= destruction of the bone marrow.

1. Pick out the aim of the experiment.

To determine the site of production and maturation of lymphocytes.

Mice	Experiment realized	Results obtained
lot A	Irradiation + graft of bone marrow	Production of B and T lymphocytes
lot B	Ablation of the thymus – irradiation + graft of bone marrow	Production of immature T lymphocytes and B lymphocytes
lot C	Ablation of the thymus + irradiation + graft of thymus	There is no production of T or B lymphocytes

Doc.a *Experiments illustrating the roles of the bone marrow and the thymus.*

2.1- Analyze the experimental results.

Analyze = conditions + results.

After irradiation and graft of bone marrow in mice of lot A, there was production of B and T lymphocytes. **While**, after the ablation of the thymus followed by irradiation and graft of bone marrow in mice of lot 2, there was production of immature T lymphocytes and B lymphocytes. **However,** after the ablation of the thymus followed by irradiation and graft of the thymus in mice of lot C, there was no production of T or B lymphocytes.

Mice	Experiment realized	Results obtained
lot A	Irradiation + graft of bone marrow	Production of B and T lymphocytes
lot B	Ablation of the thymus – irradiation + graft of bone marrow	Production of immature T lymphocytes and B lymphocytes
lot C	Ablation of the thymus + irradiation + graft of thymus	There is no production of T or B lymphocytes

***Doc.a** Experiments illustrating the roles of the bone marrow and the thymus.*

2.2- What do you conclude?

Conclude: Don't justify.

Therefore, bone marrow is the site of production mature B lymphocytes and immature T lymphocytes where thymus is the site of maturation of T-lymphocytes.

Mice	Experiment realized	Results obtained
lot A	Irradiation + graft of bone marrow	Production of B and T lymphocytes
lot B	Ablation of the thymus – irradiation + graft of bone marrow	Production of immature T lymphocytes and B lymphocytes
lot C	Ablation of the thymus + irradiation + graft of thymus	There is no production of T or B lymphocytes

Doc.a *Experiments illustrating the roles of the bone marrow and the thymus.*

I. Primary Lymphoid Organs

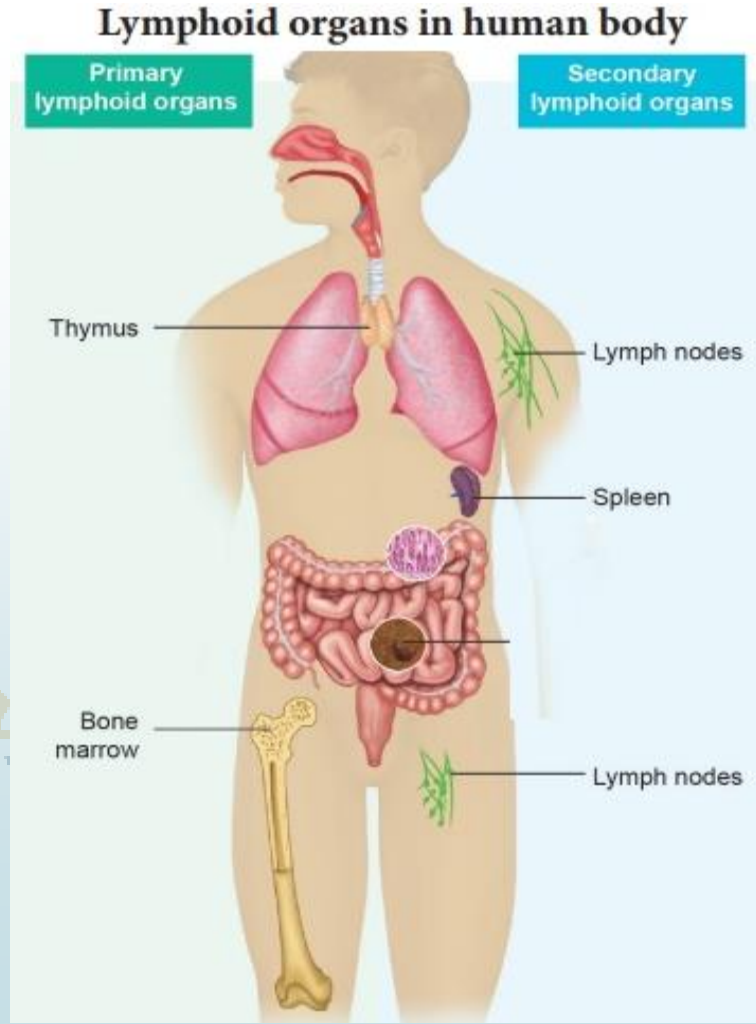
1) Bone Marrow:

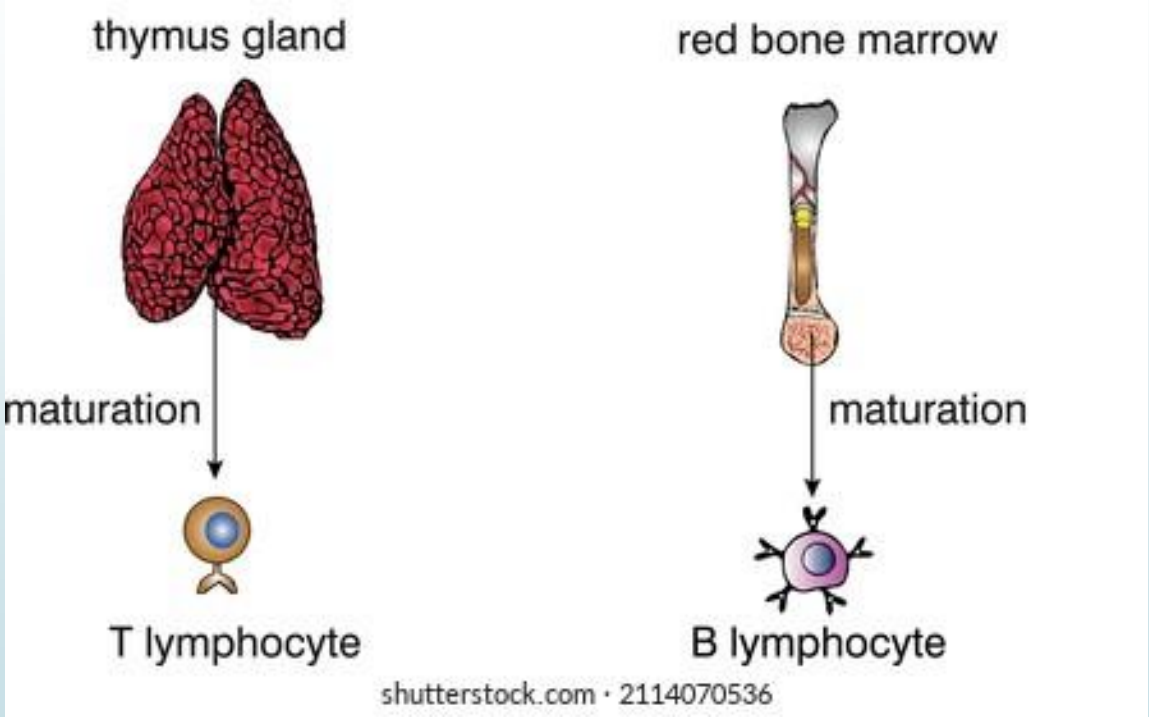
- It is the site of **production** of red blood cells and **all white blood cells.**
- It is the site of **maturation of B-lymphocytes.**

Irradiation of bone marrow causes the destruction of all its cell so there will be no production of W.B.C.

2)Thymus:

- It is the site of **maturation of T-cells.**
- T-cells are produced in the bone marrow but they mature in the thymus.

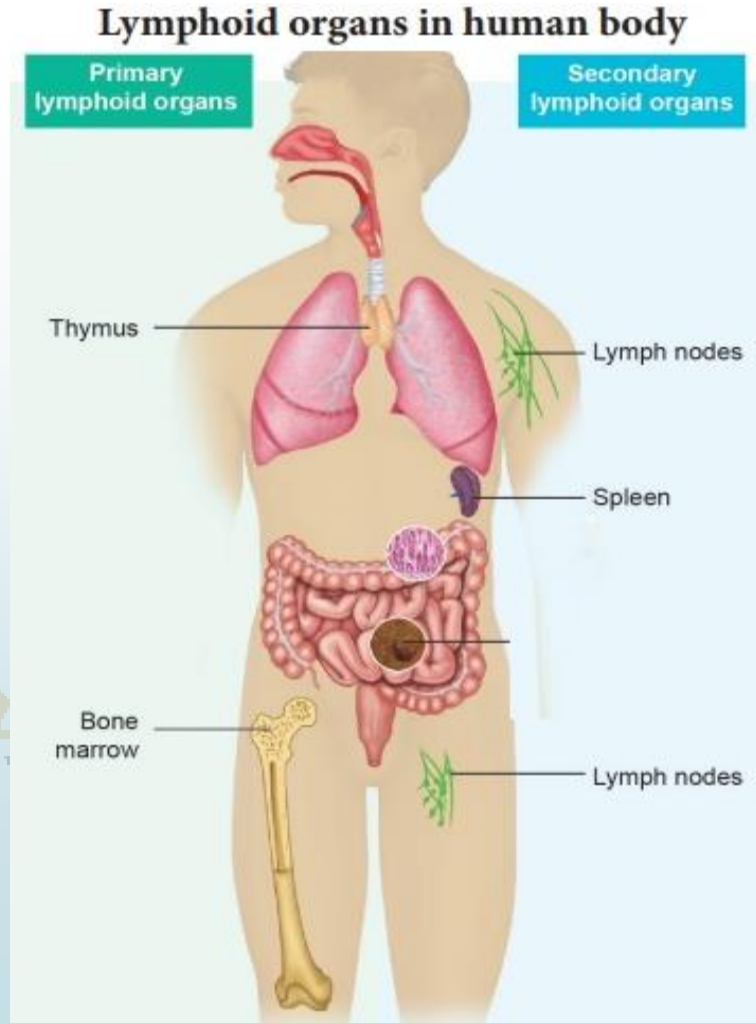



thymus gland
red bone marrow
maturation
maturation
T lymphocyte
B lymphocyte
shutterstock.com · 2114070536

II. Secondary Lymphoid Organs

1) Spleen:

- It is the site of accumulation of W.B.C.
- Immune reactions against antigens which is carried through the blood take place inside the spleen.

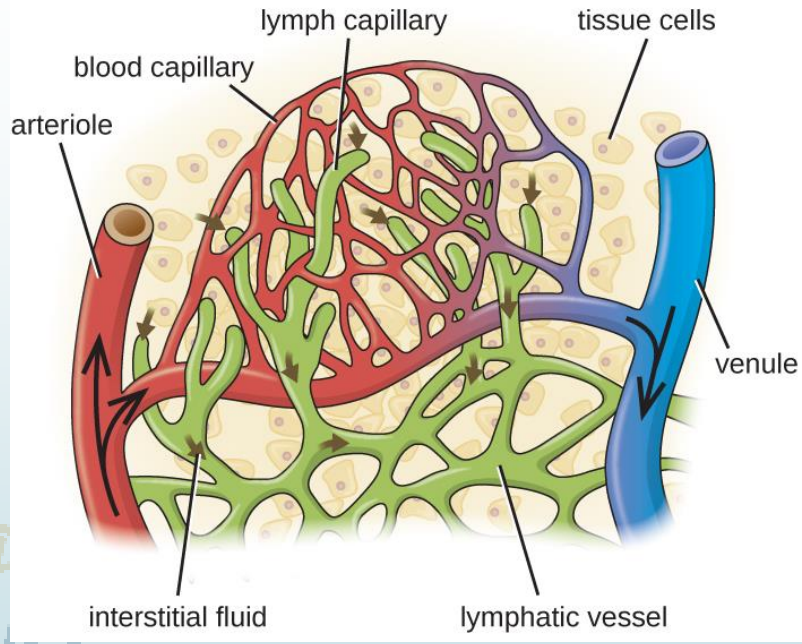


*There are two networks of circulation in the body:

1- **Blood circulation:** where blood circulates in blood vessels.

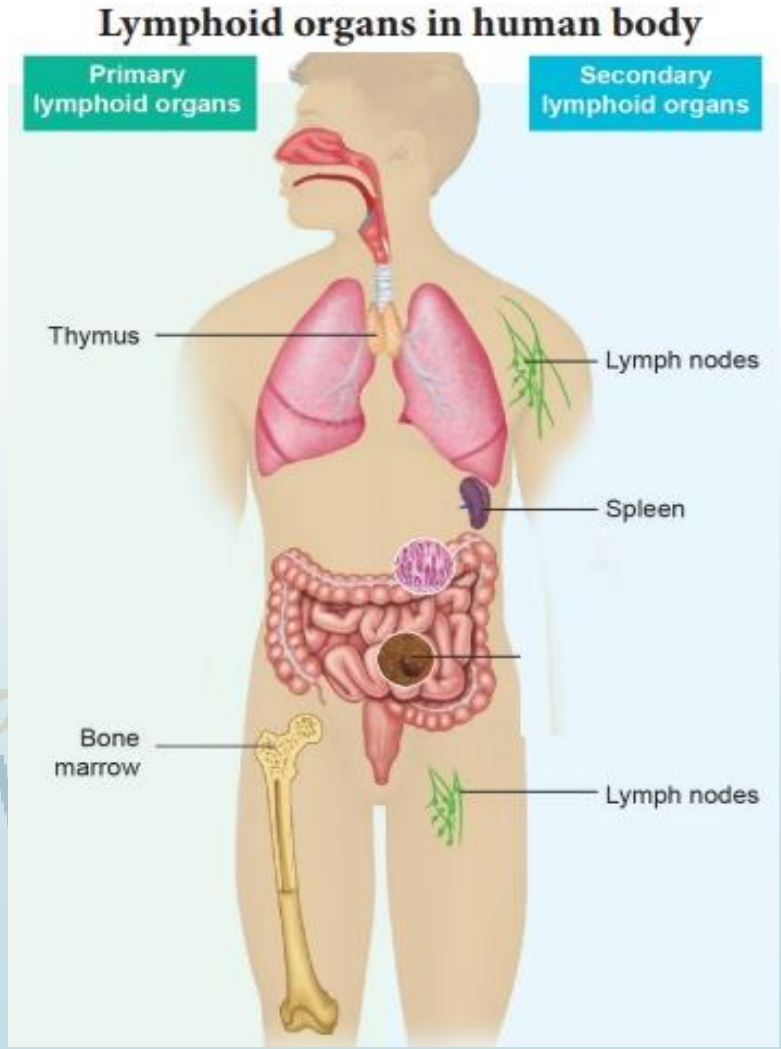
2- **Lymphatic circulation:** where lymph circulates in lymphatic vessels.

***Lymph:** is a colorless fluid that contains plasma and W.B.C.



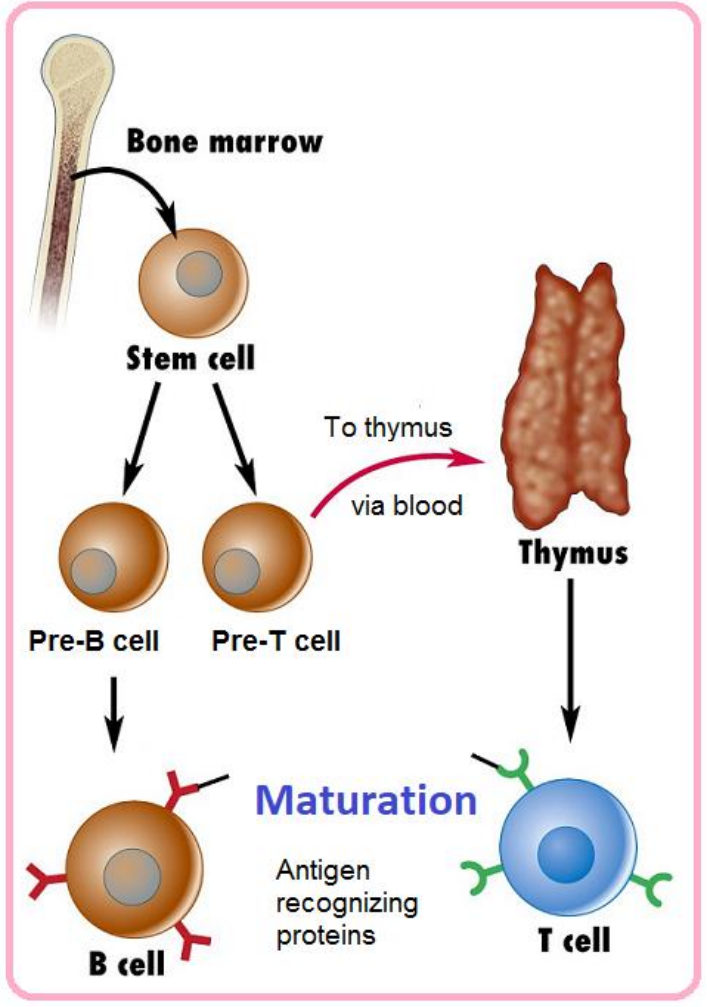
2) Lymph nodes:

- They are the site of accumulation of W.B.C.
- They are found all over the body (neck, shoulders..)
- Immune reactions against antigens carried by the lymph take place in the lymph nodes.

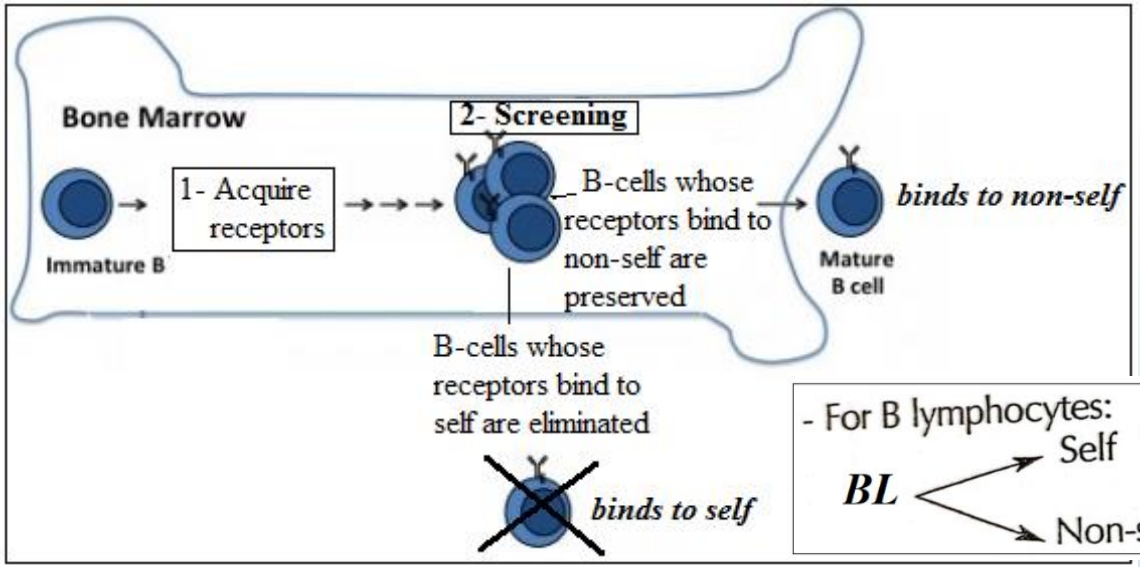


III. Lymphocytes Maturation

- Lymphocytes maturation: is the mechanism by which lymphocytes become immunocompetent (functional), able to differentiate between self and non-self-antigens, and bind **specifically to non-self.**



1- B-lymphocytes maturation in the bone-marrow:

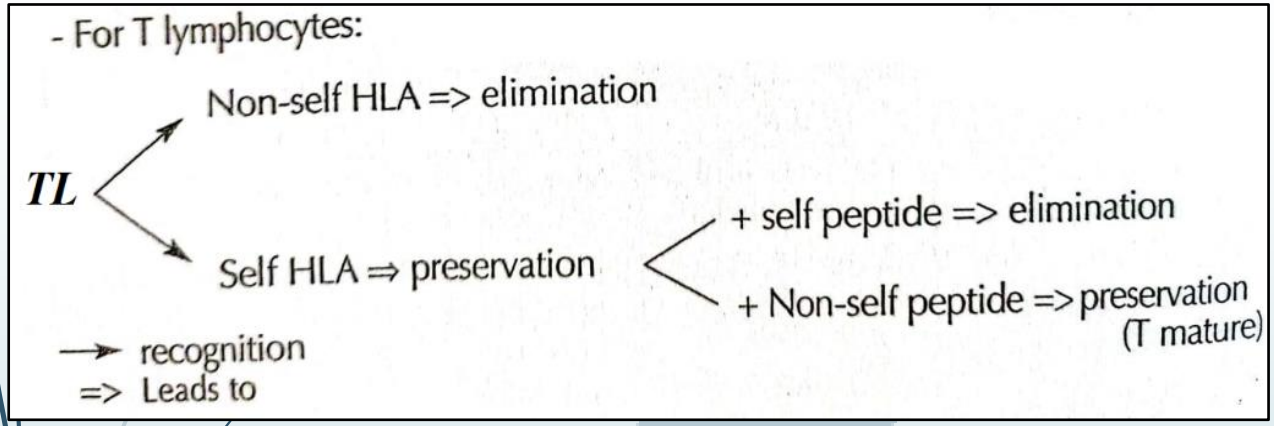


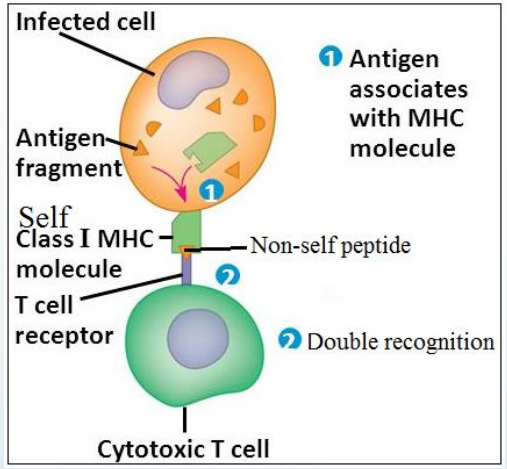
- For B lymphocytes:
  - recognition
  - => Leads to
- BL
  - Self => elimination
  - Non-self => preservation, selection (B mature)

- B-cells whose receptors bind to self are eliminated.
- B-cells whose receptors bind to non-self are preserved.

2- T-lymphocytes Maturation in the Thymus:

- Immature T-cells must acquire receptors to become mature.

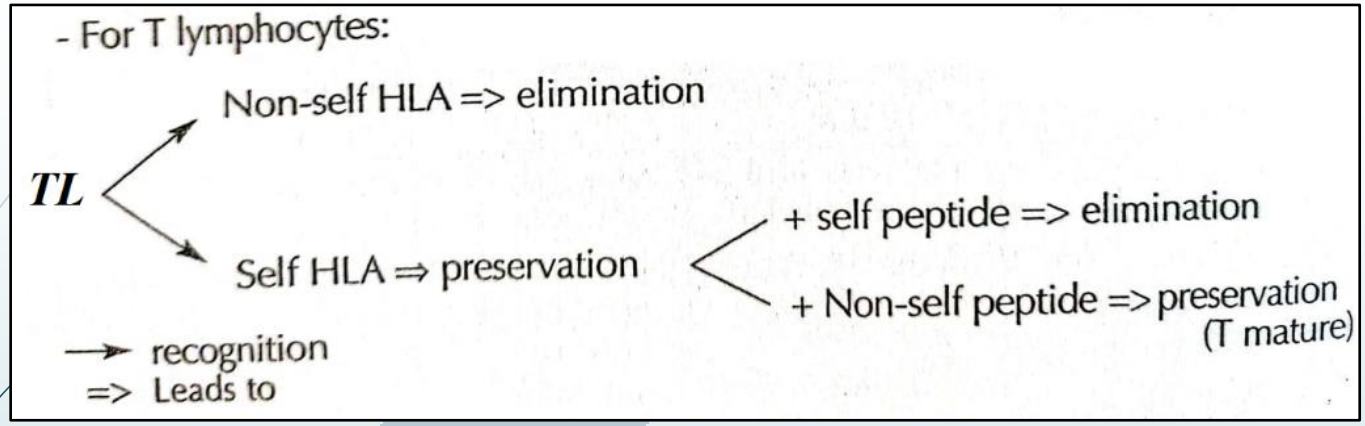




-In the thymus a <u>double selection</u> takes place for T lymphocytes (hence their name T: thymus):

→ 1) -T lymphocytes whose receptors **can bind to HLA molecules of the self are <u>preserved.</u>**

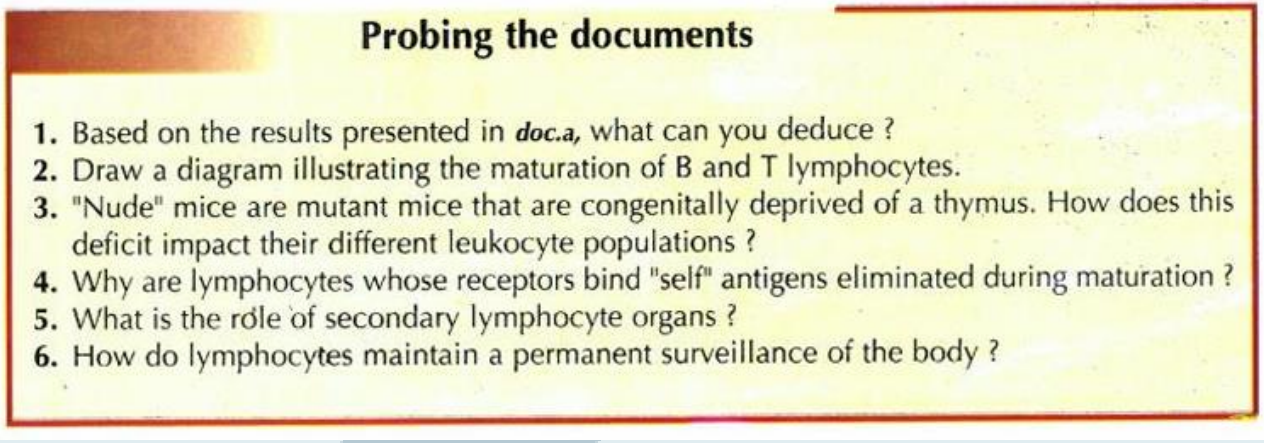
- T lymphocytes whose receptors **can bind to HLA molecules of the non-self are <u>eliminated.</u>**



- → 2) -T lymphocytes whose receptors **can recognize self HLA carrying self-antigens are <u>eliminated.</u>**

-T lymphocytes whose receptors **can recognize self HLA carrying non self-antigens are <u>preserved.</u>**

- **Probing the documents p.124**



Probing the documents

1. Based on the results presented in ***doc.a,*** what can you deduce ?
2. Draw a diagram illustrating the maturation of B and T lymphocytes.
3. "Nude" mice are mutant mice that are congenitally deprived of a thymus. How does this deficit impact their different leukocyte populations ?
4. Why are lymphocytes whose receptors bind "self" antigens eliminated during maturation ?
5. What is the rôle of secondary lymphocyte organs ?
6. How do lymphocytes maintain a permanent surveillance of the body ?

3- The thymus is the site of T lymphocyte maturation, in which they acquire their immunocompetence and became able to distinguish "self" from "non-self". In the absence of thymus in "nude mice", T lymphocytes cannot mature, so they do not enter the circulation.

4- To avoid auto-immunity, or the destruction of the body constituents by the immune system.