



Hematopoietic Stem Cells

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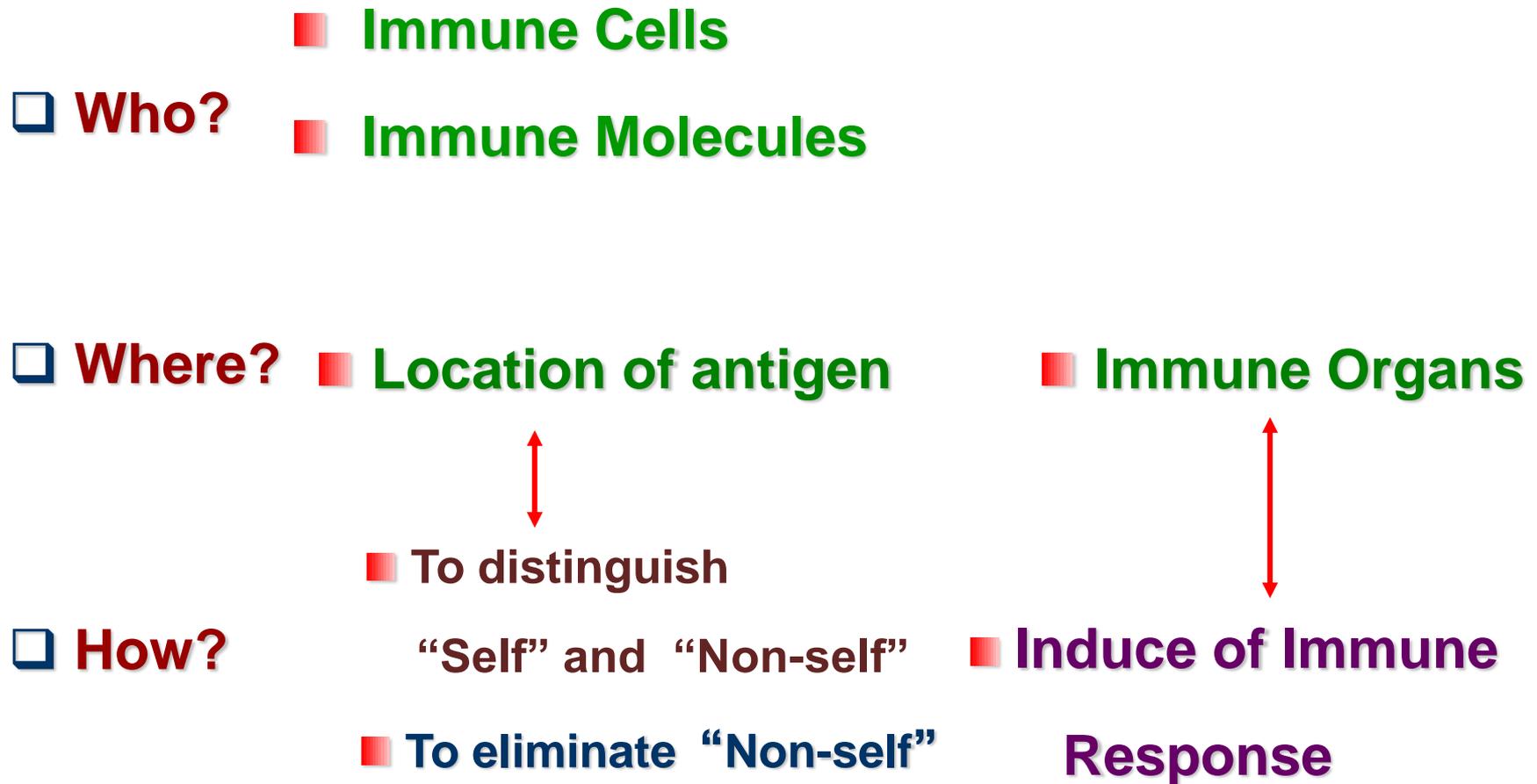
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Immune

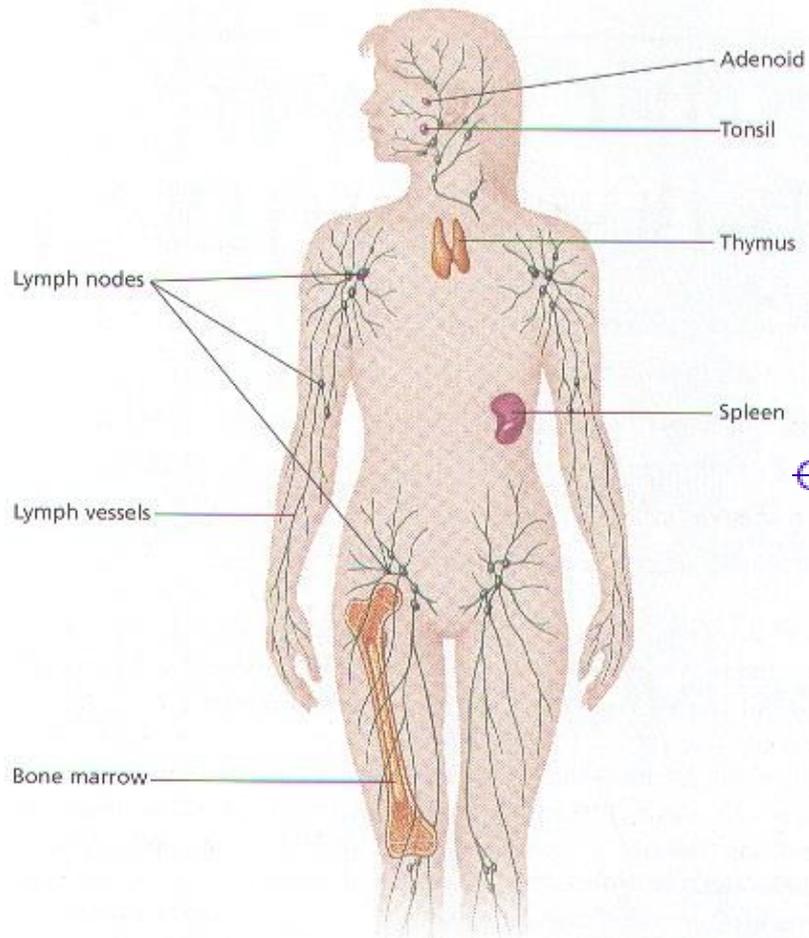
- ❑ To distinguish “Self” and “Non-self” ■ Start
- ❑ To eliminate “Non-self” ■ Process
- ❑ To protect “Self” ■ Goal

Immunology



Immune & Immune system

Immune System- Immune Organs & Tissues



■ **Primary organs** are bone marrow and thymus.

■ **Secondary organs** are lymph nodes and spleen.

⊕ These structurally and functionally diverse lymphoid organs and tissues are interconnected by the blood and lymphatic vessels through which lymphocytes circulate.

Immune & Immune system

Immune System- Major lymphoid Organs

**PRIMARY
ORGANS**



provide appropriate microenvironments for the
[ə'prəʊpriət]
development and maturation of lymphocytes.

■ Bone marrow.

⊕ Located in the middle of your bones, most specifically your vertebrae, pelvic, and leg bones, it generates B cells, macrophages..... cells that travel throughout the body .

■ Thymus.

⊕ Located in the front of the upper chest, it acts like a nursery for the development and maturation of T cells.

Immune & Immune system

Immune System- Major lymphoid Organs

SECONDARY ORGANS



- ⊕ **Trap** antigen from defined tissues or vascular spaces
- ⊕ **Be** sites where mature lymphocytes can interact effectively with antigens.
- ⊕ **Be** sites where most immune response are generated.

Immune & Immune system

Immune System- Major lymphoid Organs

SECONDARY ORGANS

■ Spleen

- ⊕ Be located in the upper left side of your abdomen,
- ⊕ Filtering out foreign organisms that infect your **blood**,
- ⊕ Removing old or damaged platelets and red blood cells,
- ⊕ Storing extra blood and Releasing it as needed,
- ⊕ Can be removed if it is damaged, but that may lower your resistance to infection.

Immune & Immune system

Immune System- Major lymphoid Organs

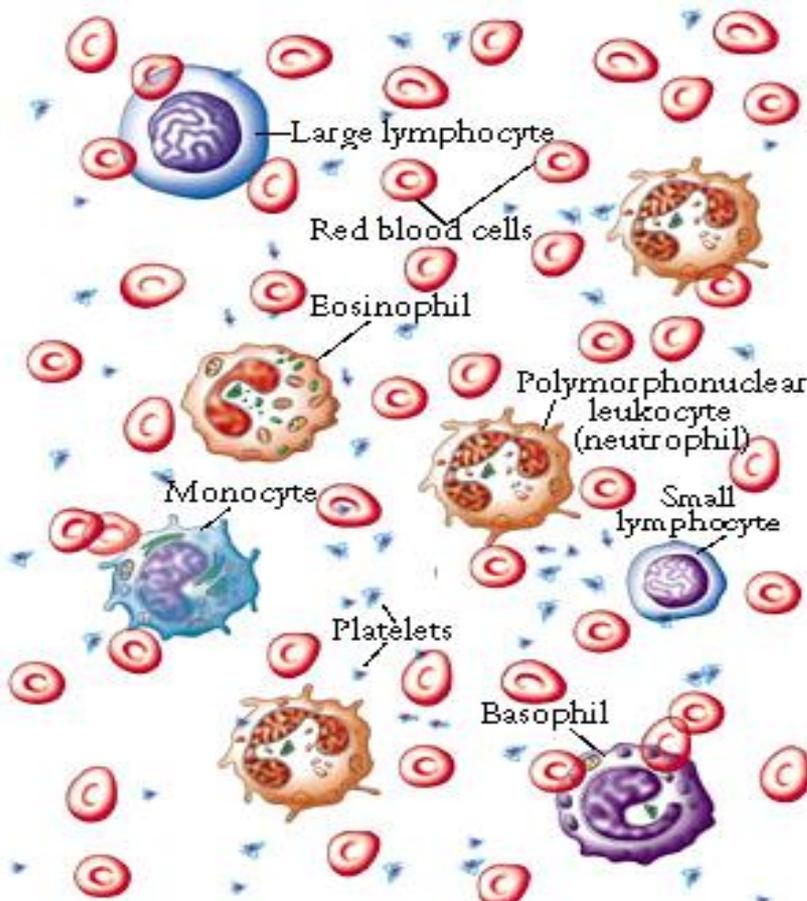
SECONDARY ORGANS

■ Lymph nodes.

- ⊕ Filtering lymph fluid, removing antigens, bacteria, and cancer cells that get trapped in their web-like structure, Where macrophages, Ab, and T cells can destroy them.
- ⊕ Hundreds of lymph nodes are located throughout your body, so removing any lymph nodes during cancer surgery does not compromise your overall lymph node protection.

BLOOD CELLS

- Every day, billions of new blood cells are produced in the body, each one derived from a hematopoietic stem cell (HSC).



- ⊕ Red blood cells
- ⊕ Neutrophil
- ⊕ Basophil
- ⊕ Eosinophil [ˌiːəʊˈsɪnəfɪl]
- ⊕ Monocytes
- ⊕ Large lymphocytes
- ⊕ Small lymphocytes
- ⊕ Platelets

Hematopoietic Stem Cells

■ Origin of HSCs

- ⊕ **Stem cells** are cells that can differentiate into other cell types;
- ⊕ They are self - renewing- they maintain their population level by cell division.

- ⊕ In humans, **hematopoiesis**, the formation and development of red and white blood cells, begins in the embryonic yolk sac during the first weeks of development.

Hematopoietic Stem Cells

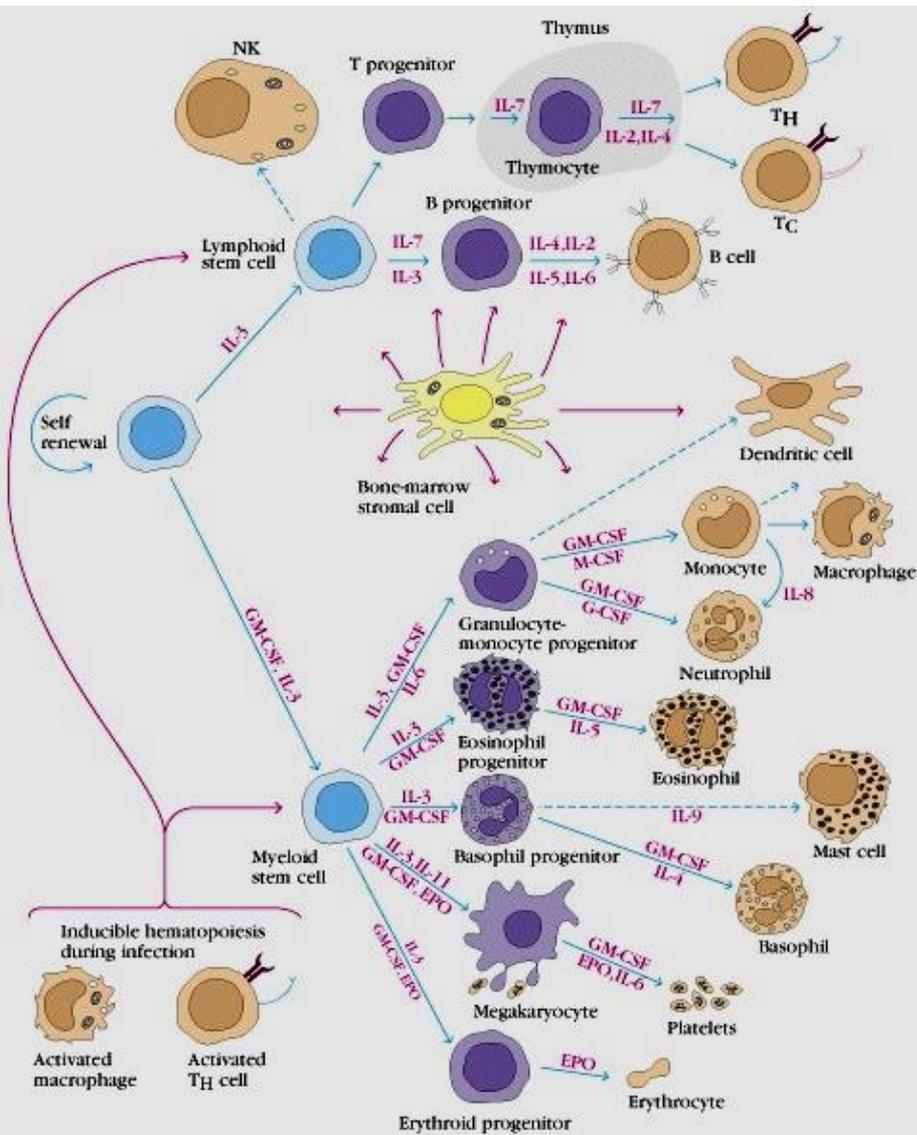
■ Origin of HSCs

- ⊕ In the **third month** of gestation, hematopoietic stem cells (HSC) migrate from the yolk sac to the fetal liver and then to the spleen; these two organs have major roles in hematopoiesis from the third to the seventh months of gestation.
- ⊕ After that, the differentiation of HSCs in the bone marrow becomes the major factor in hematopoiesis, and by birth there is little or no hematopoiesis in the liver and spleen.

hematopoiesis

yolk sac → fetal liver → spleen → ~~bone marrow~~

Proliferation and differentiation of HSCs



In the absence of infection, bone marrow stromal cells are the major source of hematopoietic cytokines (blue arrows).

In the presence of infection, cytokines (red arrows) produced by activated macrophages and Th cells induce additional hematopoietic activity, resulting in rapid expansion of the population of white blood cells that fight infection.

Immune Cells

- ❑ **The majorities of the cell types involved in the immune system derive from multi-potent hematopoietic stem cell (HSC).**

- ❑ **Cells of Innate Immunity**

- ⊕ **Phagocytes**
- ⊕ **Neutrophils**
- ⊕ **Monocytes & Macrophages**
- ⊕ **Dendritic Cells**
- ⊕ **NK cells**
- ⊕ **et al,**

- ❑ **Cells of Adaptive Immunity**

- ⊕ **T lymphocytes**
- ⊕ **B lymphocytes**