INTRODUCTION TO IMMUNOLOGY

- Few of us pass through childhood without contracting some sort of infection.
- Chicken pox, for example, is an illness that many of us experience before we reach our teens. It is a disease of childhood, because most of us contract it as children and *never catch it again.* Once you have had the disease, you are usually immune to it. Specific immune defense mechanisms provide this immunity.

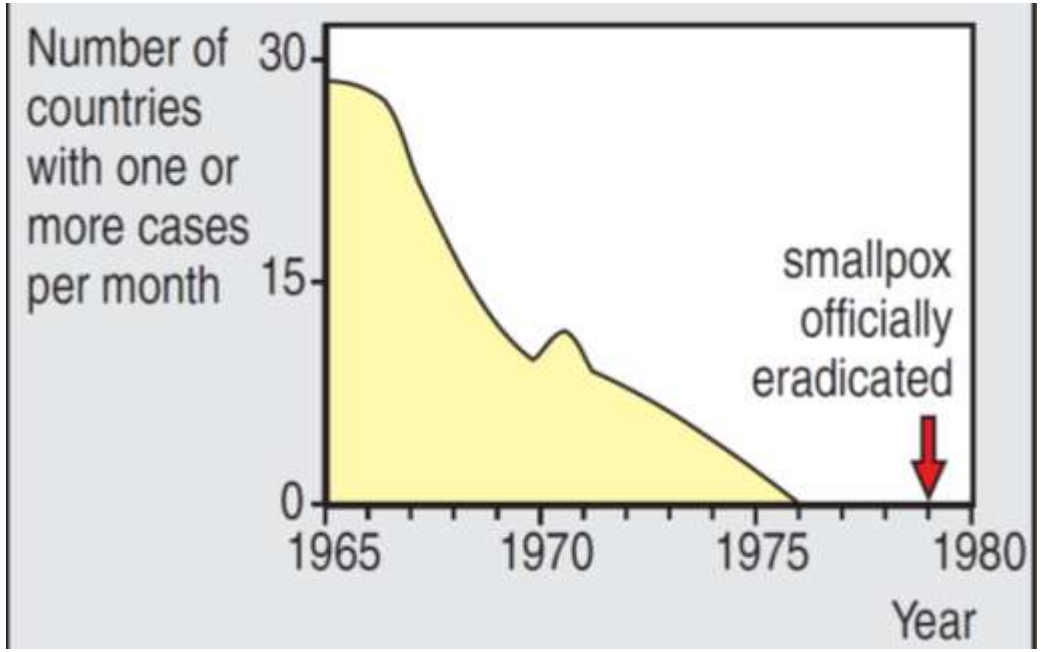
Discovery of the Immune Response:

- In 1796, an English country doctor named Edward Jenner carried out an experiment that marks the beginning of the study of immunology. Smallpox was
- a common and deadly disease in those days. Jenner observed, however, that milkmaids who had caught a much milder form of “the pox” called cowpox (presumably from cows) rarely caught smallpox. Jenner set out to test the idea that cowpox conferred
- protection against smallpox. He infected people with cowpox ,and as he had predicted, many of them became immune to smallpox.

Discovery of the Immune Response:

- **The birth of immunology.** This famous painting shows Edward Jenner inoculating patients with cowpox in the 1790s and thus
- protecting them from smallpox.

The eradication of smallpox by vaccination. Upper panel: smallpox vaccination was started in 1796. In 1979, after 3 years in which no case of smallpox was recorded, the World Health Organization announced that the virus had been eradicated.



IMMUNOLOGY AND THE IMMUNE SYSTEM

- Immunology

  Study of the components and function of the immune system

- Immune System
  - Molecules, cells, tissues and organs which provide non-specific and specific protection against Microorganisms , Microbial toxins & Tumor cells
  - crucial to human and animal survival

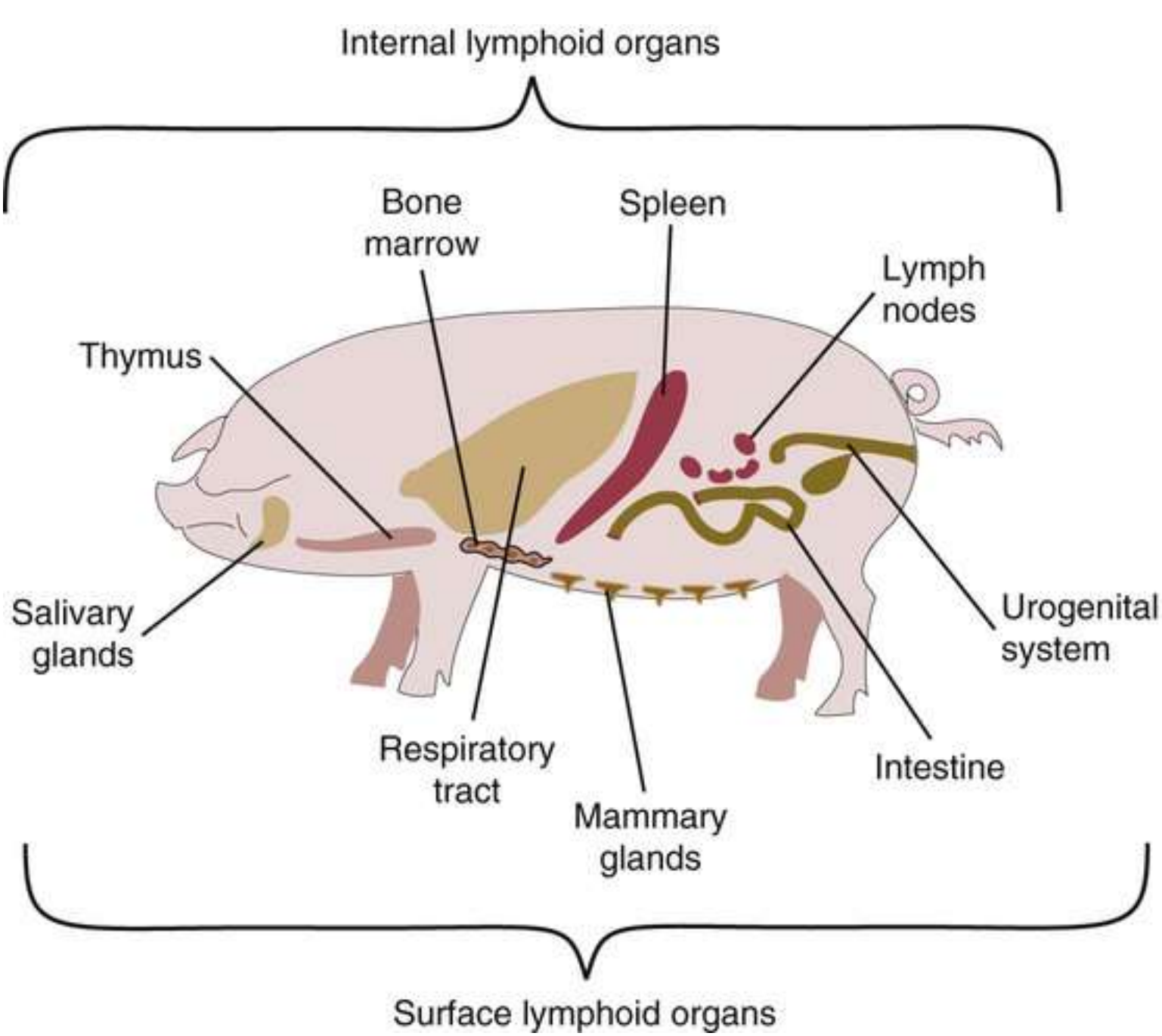
Organs of the Immune System

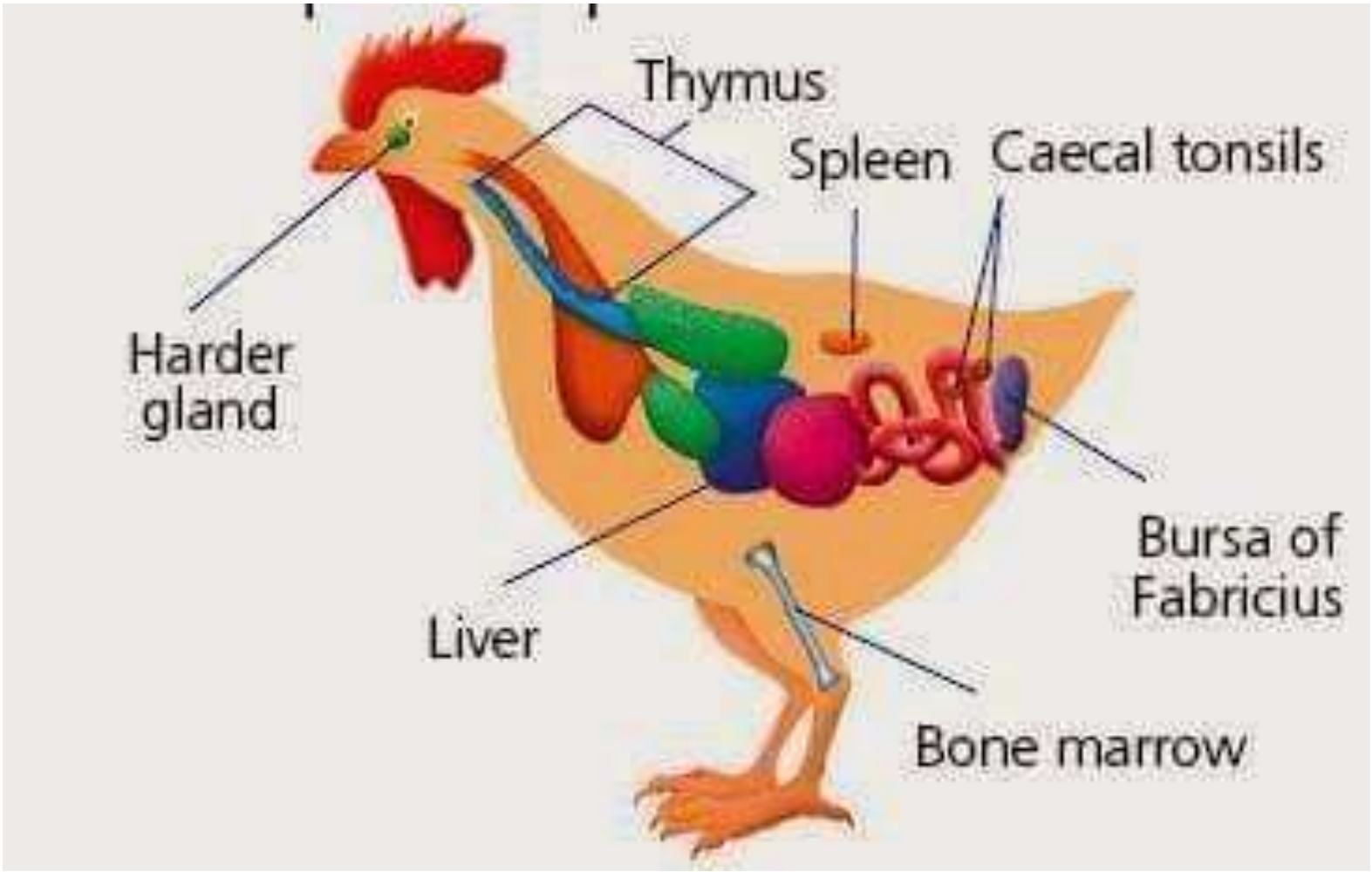
Lymphoid Organs:

1. Bone marrow
2. Thymus
3. Spleen
4. Lymph node
5. Tonsils
6. Small intestine and appendix aggregated lymphoid nodules

Organs of the Immune System

- lymphoid organs are stationed throughout the body
- they are concerned with growth, development and differentiation of lymphocyte
- the are structurally and functionally diverse lymphoid organ and tissues
- they are interconnect by the blood vessels and lymphatic vessel through which lymphocyte circulate.
- these organs are involved in specific as wells non specific immunity


Internal lymphoid organs
Bone marrow
Spleen
Lymph nodes
Thymus
Salivary glands
Respiratory tract
Mammary glands
Intestine
Urogenital system
Surface lymphoid organs


Thymus
Spleen
Caecal tonsils
Harder gland
Bursa of Fabricius
Liver
Bone marrow

Classification of lymphoid organs

Based upon the functional development of the lymphatic cells ,the lymphoid organs are classified into 2 group:

A. Primary lymphoid organs (central) als0 (generative organs)
    1. Bone marrow (all lymphocyte arise and B-cell maturation)
    2. Thymus (T-cell maturation)

B. Secondary lymphoid organs (peripheral)
    1. Lymph nodes
    2. Spleen
    3. Mucosa associated lymphoid tissue

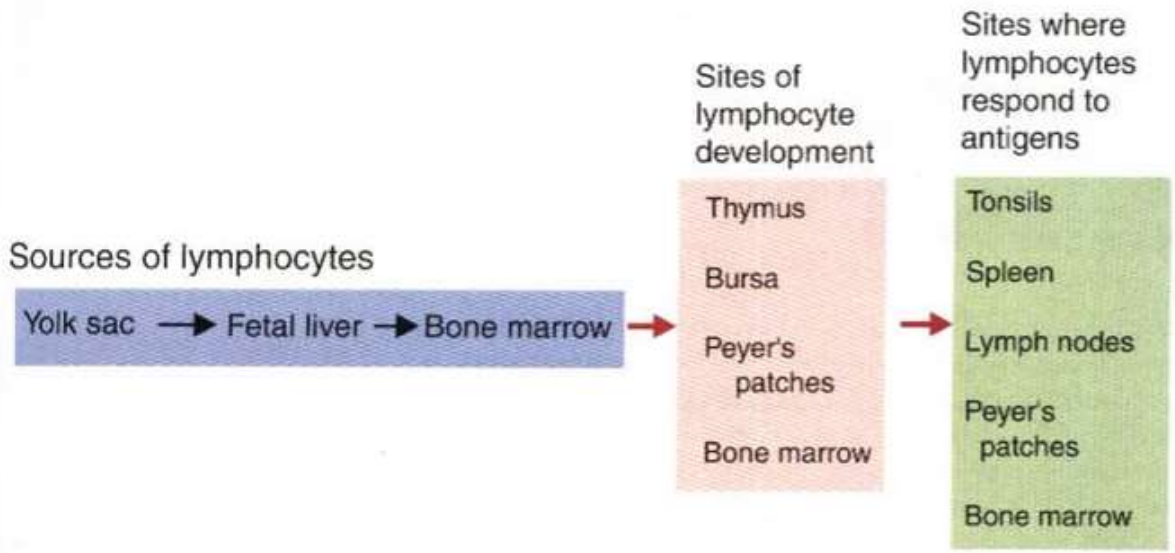
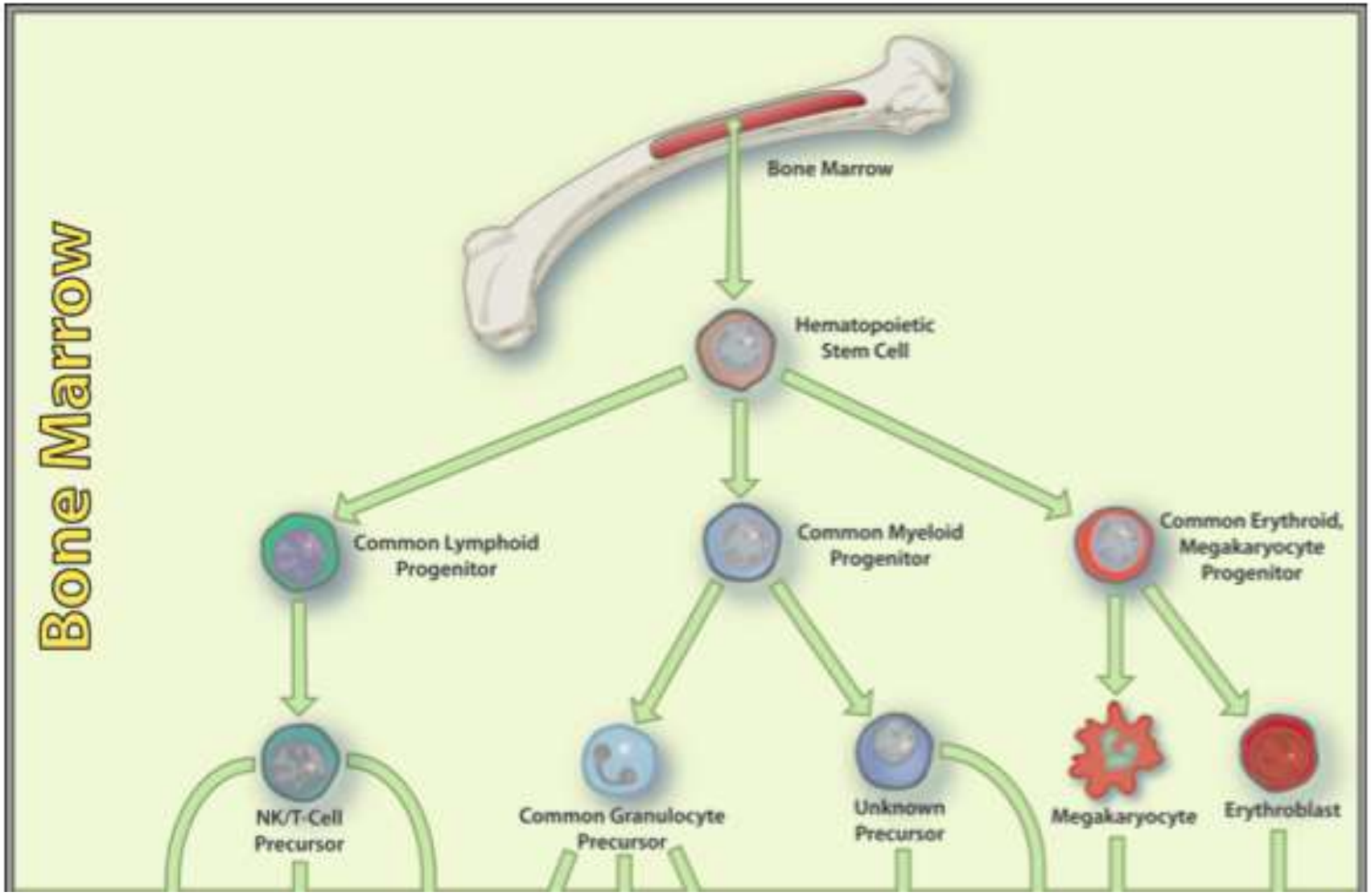


Figure 8-2. Role of lymphoid organs in the development and functioning of lymphocyte populations.

Bone marrow

- Bone marrow is the primary lymphoid organ. It is a soft tissue within the cavity of bone.
- Bone marrow is divisible into 2
    1. vascular region,
    2. haematopoietic region
- Vascular region is the circulatory system that supplies nutrient and remove waste from actively growing blood vessels.
- Red marrow is actively involved in hematopoiesis
- Red marrow contain totipotent cells called stem cells.
- The development of blood cells is called Hematopoiesis
- Hematopoiesis is forms RBC,WBC ,granulocyte, lymphocyte, monocyte and platelets


Bone Marrow
Bone Marrow
Hematopoietic Stem Cell
Common Lymphoid Progenitor
Common Myeloid Progenitor
Common Erythroid, Megakaryocyte Progenitor
NK/T-Cell Precursor
Common Granulocyte Precursor
Unknown Precursor
Megakaryocyte
Erythroblast

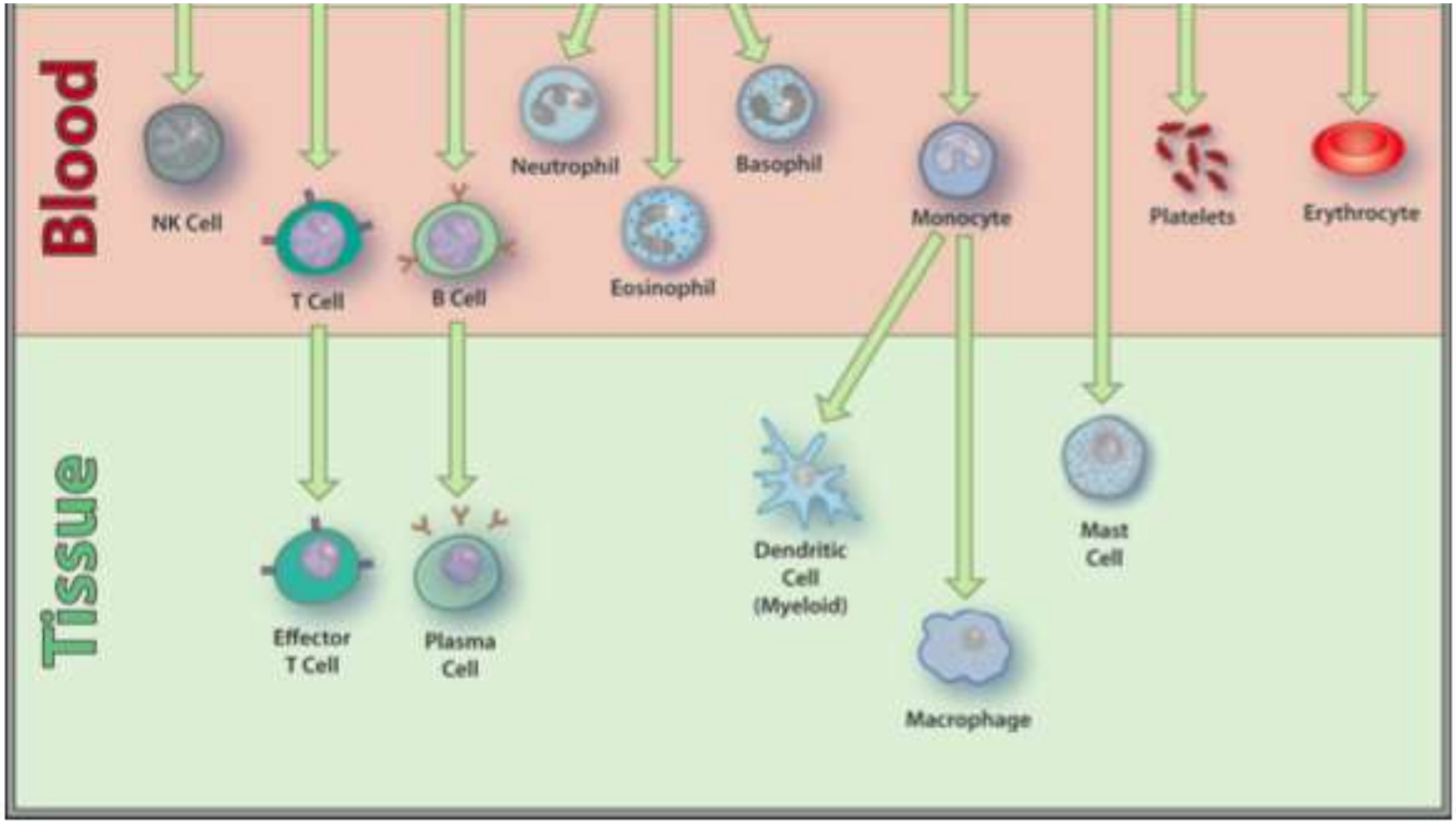
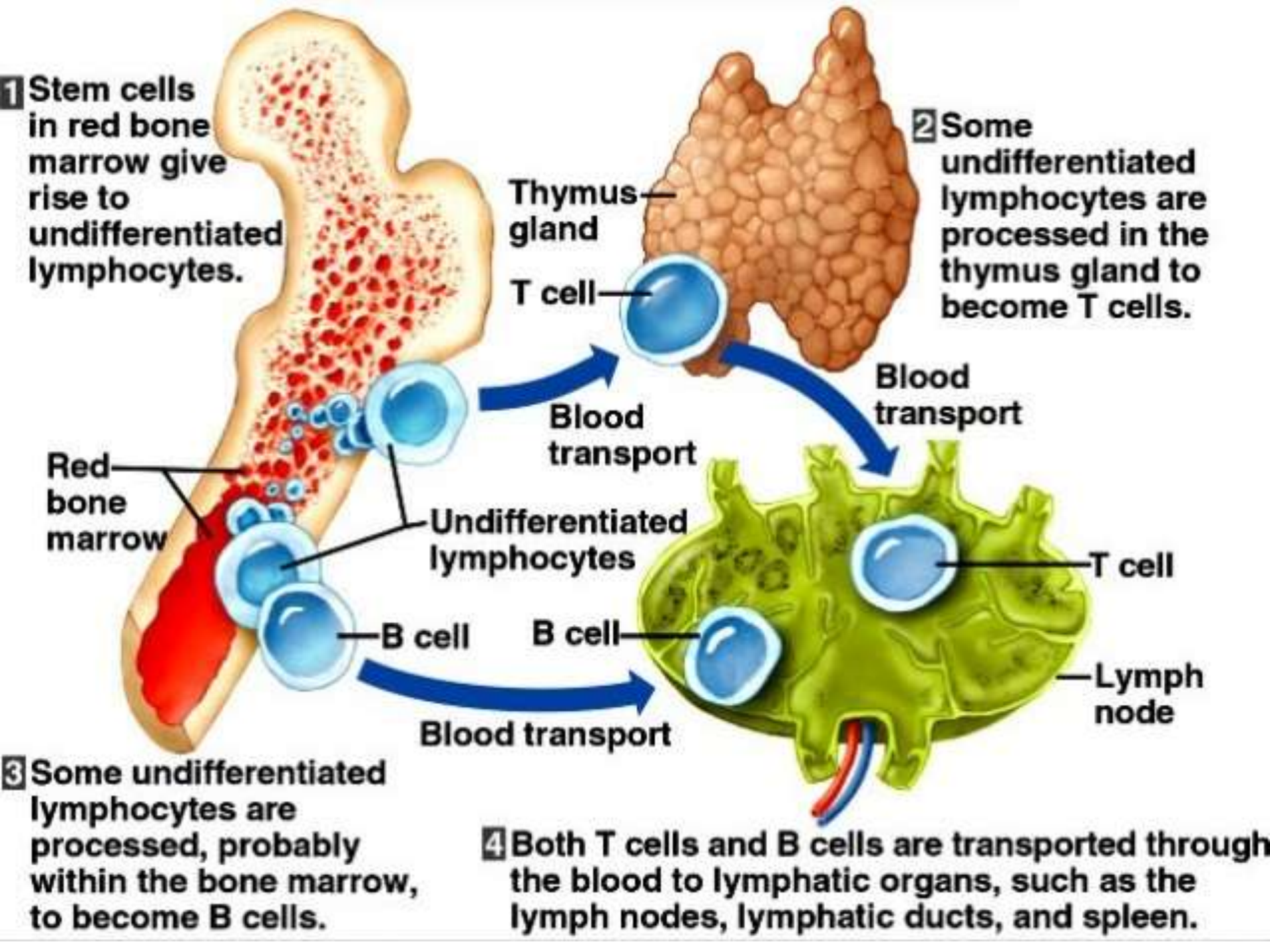


FIGURE 7.4. **Bone marrow and hematopoiesis**

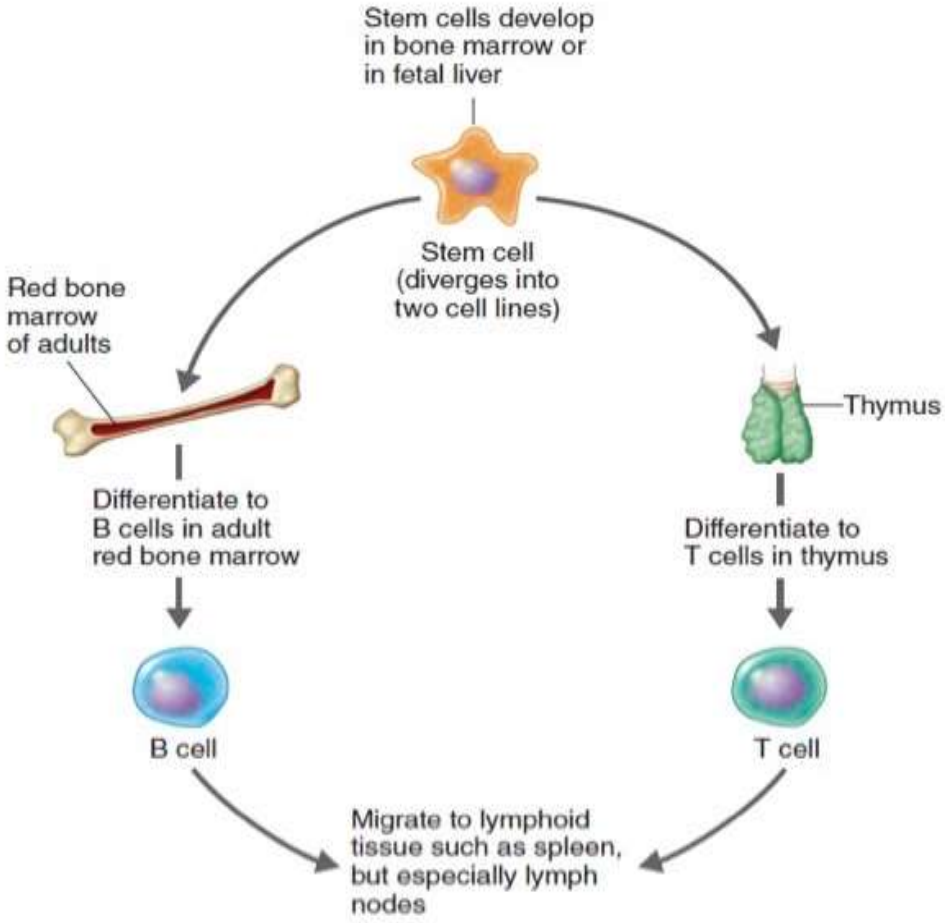
A single pluripotential bone marrow stem cell gives rise to all of the cells of the blood. Among these are the cells most important to the adaptive immune response, particularly B and T lymphocytes and monocytes, which differentiate into macrophages and DCs.


1 Stem cells in red bone marrow give rise to undifferentiated lymphocytes.
Thymus gland
T cell
2 Some undifferentiated lymphocytes are processed in the thymus gland to become T cells.
Blood transport
Blood transport
Red bone marrow
Undifferentiated lymphocytes
T cell
B cell
B cell
Lymph node
Blood transport
3 Some undifferentiated lymphocytes are processed, probably within the bone marrow, to become B cells.
4 Both T cells and B cells are transported through the blood to lymphatic organs, such as the lymph nodes, lymphatic ducts, and spleen.

Differentiation of T cells and B cells.

Both B cells and T cells originate from stem cells in adult red bone marrow or in the fetal liver. (Red blood cells, macrophages, neutrophils, and other white blood cells also originate from these same stem cells).

Some cells pass through the thymus and emerge as mature T cells. Other cells probably remain in the red bone marrow and become B cells. Both types of cells then migrate to lymphoid tissues, such as the lymph nodes or spleen.



- Majority of lymphoid progenitors develop into B-lymphocyte in the bone marrow.
- Some of lymphoid progenitors migrate into the thymus, were the developed into the T-lymphocyte.
- During secondary immune response large number of plasma cells are produced in the bone marrow.
- They secrete large amount of Antibodies (Abs).
- So bone marrow is a source of Ab synthesis.
- The bone marrow is the site of generation of all circulating blood cells in the adult including lymphocyte and is the site of B-cell maturation

- Bone marrow
  The bone marrow is the site of generation of all circulating blood cells in adult, including immature lymphocyte, and is the site of B-cell maturation

  Function of bone marrow
  1-The site of generation of all immunocytes
  2-The site of differentiation and maturation of immunocytes
  3-The site of immune response of B-cell, specifically in secondary immune response.

- What happened in BONE MARROW
  1. All the cells of immune system are initially derived from the bone marrow through a process called hematopoiesis
  2. human bone marrow is the site for B-cell origin
  3. It is the site of B-cell maturation
  4. Immature B cell arise from lymphoid progenitor proliferation and differentiate within the bone marrow
  5. The stromal cells in the bone marrow interact With B cell and secrete cytokines and help in the maturation of B-cells
  6. in Bird B-cells developed in Bursa of Fabricius Specific immune organ in birds The site of differentiate and proliferation of B-cell in bird
  7. In cattle and sheep–fetal stage spleen later large intestine
  8. In Rabbit-gut associated tissue-appendix