IMMUNOLOGY AND THE IMMUNE SYSTEM

By:
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- **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 survival**
  - **The immune system characterized by:**
    - **It can respond to the vast number of antigen**
    - **Discriminate between self and non self**
    - **It has memory**

- **IMMUNE SYSTEM CONSIST OF:**
  - **Primary (central) Lymphoid Organs in which Leukocytes develop (Bone marrow & Thymus)**
  - **Secondary (peripheral) Lymphoid Organs & Tissues in which Immune Response occur which include:**
    - **Lymph Nodes and Spleen**
    - **Mucosa-Associated Lymphoid Tissue (MALT)**
      Waldeyers Ring (Tonsil)
    - **Gut- Associated Lymphoid Tissue (GALT)**
      Peyer's patch
  - **Leukocytes in Blood**
- **Mature in Marrow (B cell) or Thymus (T-cell)**

The role of stem cells

- **Myeloid Stem cell give rise to:**
  - **Monocyte → Macrophage**
  - **Eosinophil**
  - **Basophil**
  - **Megakaryocyte → Platelet**
  - **Erythroblast → Erythrocyte**
- **Lymphoid Stem cell give rise to:**

  -Pre-B cell → Late pre-B cell → Immature B cell → Mature B cell → Plasma cell → Abs

  - Pre-T cell (enters Thymus) → Helper T cell

  + Cytotoxic T cell + TDTH cell

  -NK cell

  •After maturation in Thymus or Bone marrow, Lymphocytes migrate to Spleen + LNs + MALT

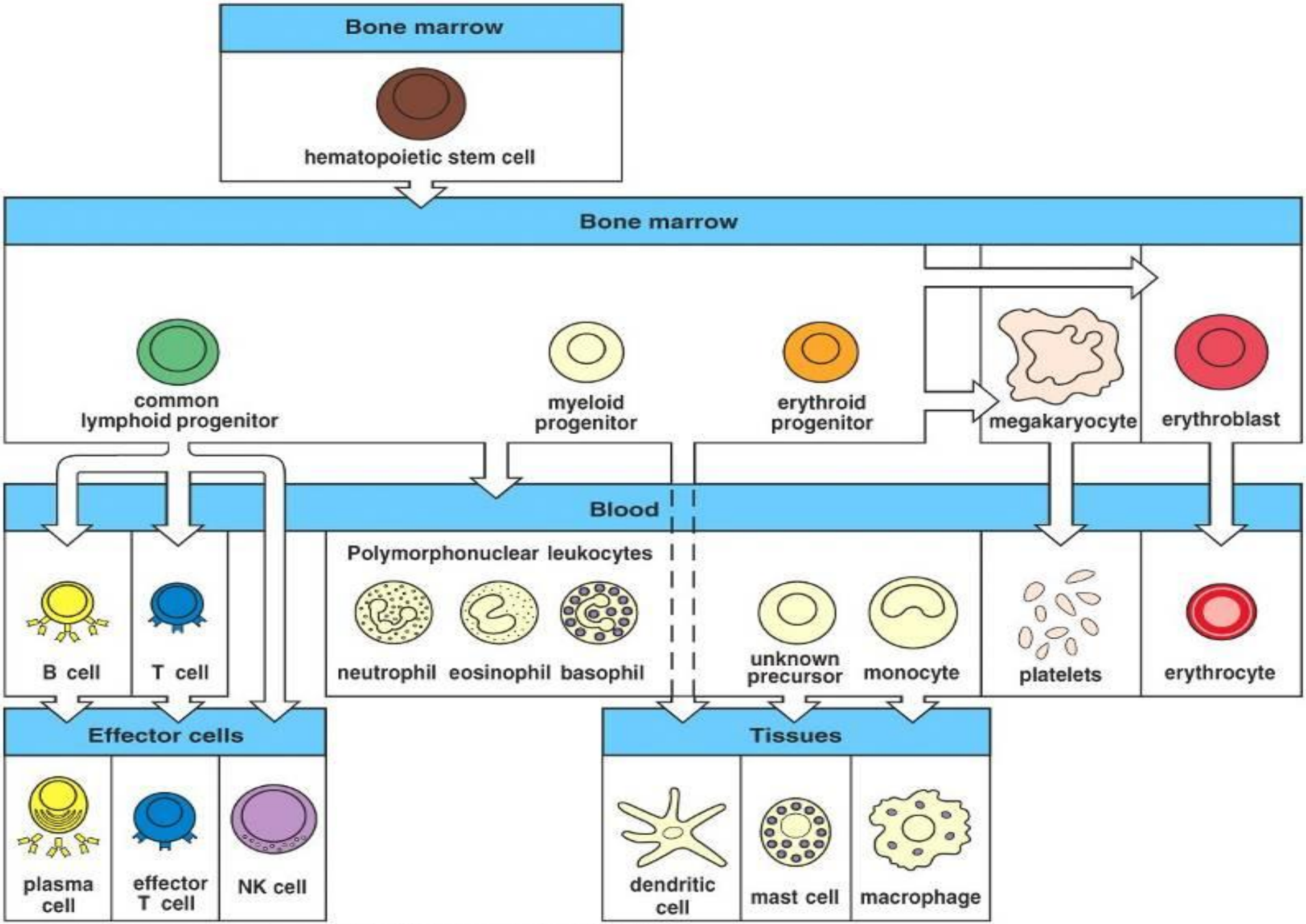


Figure 1-11 The Immune System, 2/e (© Garland Science 2005)

CELLS OF THE IMMUNE SYSTEM

- **MONOCYTES & MACROPHAGES**
- **Control infections not overcome by Neutrophils**
- **Associated with chronic infections**
- **Main role in cell-mediated immunity**
- **Act as Ag presenting cell to T-Lymphocyte**
- **Monocytes → Macrophage with different names:**

  Kupffer cell in sinusoid of Liver

  Alveolar macrophage in Lung

  Microglial in Brain

- **Multinucleated Giant Cells formed by fusion of Macrophages**

MACROPHAGES & NEUTROPHILS

– Phagocytize Bacteria coated with Complement

DENTRITIC CELLS

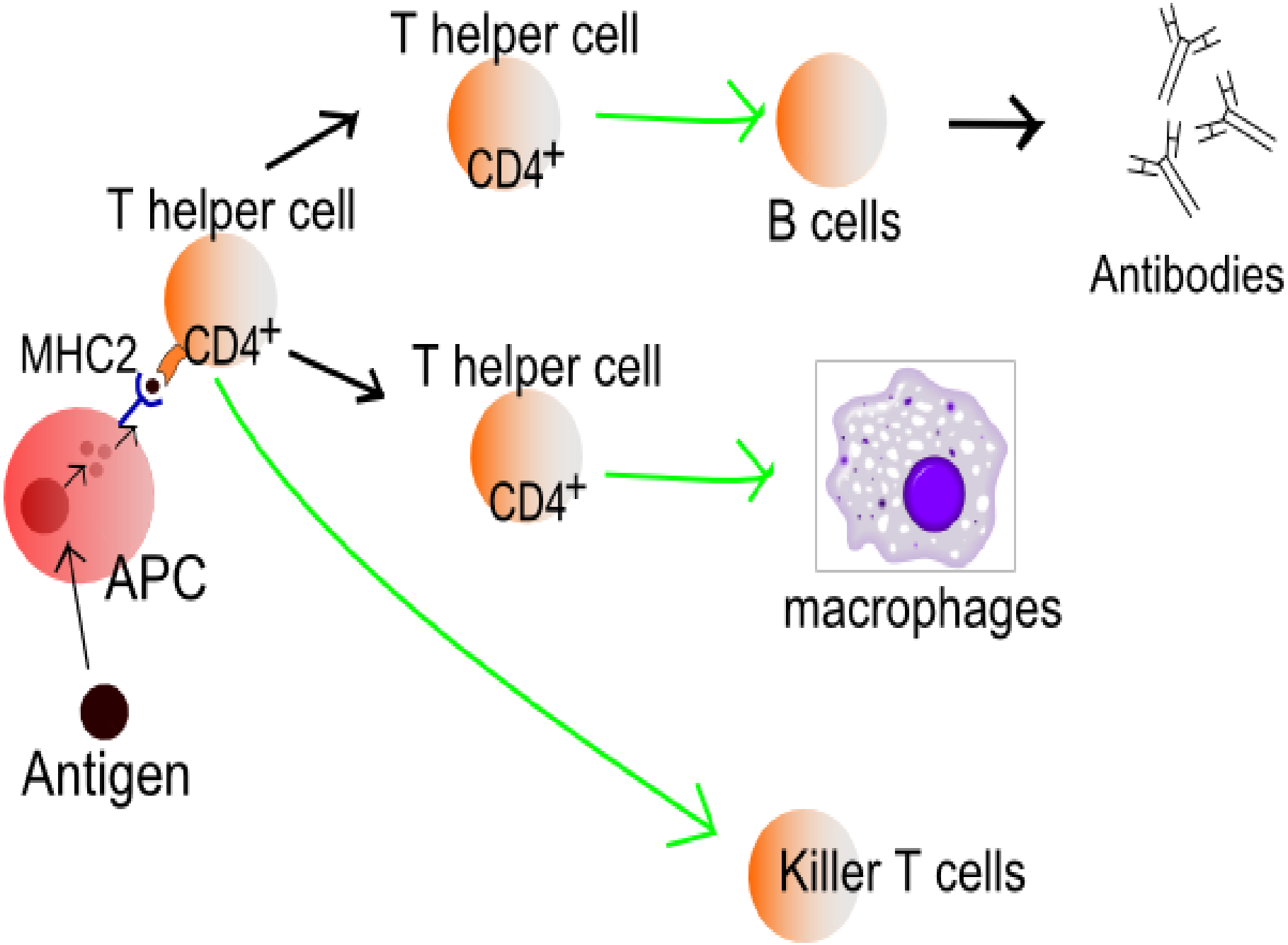
- Present in Blood, LNs, Epithelial cells
- Digest & process Ag to present to T-cells

Examples:

Langerhans cells (resides within Epithelium)

Veild cells (Afferent Lymphatics)

Interdigitating reticular cells (Spleen & LNs)


T helper cell
CD4+
B cells
Antibodies
T helper cell
MHC2
CD4+
T helper cell
CD4+
macrophages
APC
Antigen
Killer T cells

GRANULOCYTES

- **NEUTROPHILS (PMNs)**
- **60% of leukocytes (white blood cells)**
- **Have receptor for IgG & C3b**
- **Release Matrix Metalloproteinase (MMP)**
- **First to arrive in acute inflammation, actively killing bacteria, by generation of Hydrogen peroxide & Oxygen free radicals releasing LPS.**
- **Cytoplasm contain Lysosomal Peroxidase + Acid Hydrolases**
- **Cytoplasmic granules contain digestive enzyme (Myeloperoxidase) & Lactoferrin (binds Fe)**

- **EOSIONPHILS (1 –3% of leukocytes)**
- **Have receptors for Complement**
- **Mostly in parasitic & allergic conditions**
- **Contents & Functions: Histaminase Pyrogen (fever)**
  Peroxidase (kill bacteria)

- **BASOPHILS (1% of leukocytes)**
- **Contain Histamine (hypersensitivity madiator)**
- **Have receptors for Fc portion of IgE**
- **IgE binding → degranulation → Histamine**
  →allergic reactions

- **LYMPHOCYTES (30% of circulating WBC)**
- **B Lymphocytes:**
- **Differentiate into Plasma cells → Antibodies**
- **Memory B cells:generated after exposure to Ag**
- **Mature B cell: have surface IgM & IgD that bind Ag → cause B cell → Ab**

- **T LYMPHOCYTES:**
- **Helper T cells (CD4 positive)**
- **Stimulate B-Lymphocytes → Plasma cell → Ab**
- **Promote cytotoxic T- cell (CD8) response**

- **Cytotoxic T cell (CD 8 +)**
  - **Recognize Foreign Ag & Class 1 MHC**
  - **Lyse virus infected cells & tumor cells**

- **Natural killer (NK) cells (10 -15% of Lymphocytes)**
- **Kill Tumor cells**
- **Defend against Viral infections**
- **Recognize Foreign Ag independent of MHC**