Chapter 19 (2)

Hemopoiesis

(Erythropoiesis + Leukopoiesis)
Hemopoiesis Produces the Blood’s Formed Elements

Where are they formed?  How are they formed?  Why are they formed?

(b) Blood smear (thin film of blood spread on a glass slide)
Hemopoiesis

• Hemopoiesis = the production of the blood (especially its formed elements)

  – Red bone marrow produces all nine formed elements /// hemopoietic tissues = producer of blood cells (WBC / RBC / Platelets)

  – embryonic development -- yolk sac = embryonic structure - produces stem cells for first blood cells // stem cells colonize fetal bone marrow, liver, spleen and thymus

  – liver stops producing blood cells at birth

  – spleen remains involved with lymphocyte production after birth

• Adult daily production

  – 400 billion platelets
  – 200 billion RBCs
  – 10 billion WBCs
Hemopoiesis

- **pluripotent stem cells (PPSC)** // formally called hemocytoblasts or hemopoietic stem cells // PPSC generate specific type of stem cells for each cell type

- **colony forming units** – specialized stem cells only producing one class of formed element of blood

- **myeloid hemopoiesis** – blood formation in the red bone marrow (sometimes called myeloid tissue or hemopoietic tissue)

- **lymphoid hemopoiesis** – blood formation in the lymphatic organs
Production of RBC
3 to 5 days to complete

Regulatory mechanism stimulus is hypoxia

Hypoxia signals kidney to release erythropoietin (hormone)

Hormone receptors on erythrocyte CFU
Regulating Erythrocyte Homeostasis

- **negative feedback regulation**
  - drop in RBC count causes hypoxemia // stimulus for kidneys
  - kidney produces erythropoietin // hormone // stimulates bone marrow
  - RBC count increases in 3 - 4 days

- **stimulus to increase erythropoiesis**
  - low levels $O_2$ (hypoxemia)
  - high altitude
  - increase in exercise
  - loss of lung tissue as in emphysema
Leukopoiesis
Leukopoiesis

• leukopoiesis – production of white blood cells

• pluripotent stem cells (PPSCs) // produce all formed elements including the leukocytes (WBC)
  • myeloblasts – form neutrophils, eosinophils, basophils
  • monoblasts - form monocytes
  • lymphoblasts give rise to all forms of lymphocytes

• red bone marrow produce, stores and releases all granulocytes, monocytes (agranulocyte)

• B cells // a type of lymphocyte // born in red bone marrow, matures and released from RB marrow

• T lymphocytes born in red bone marrow but complete development in thymus
Leukocytes (WBCs)

- least abundant of all the formed elements // 5,000 to 10,000 WBCs/μL
- Primary function = protect against infectious microorganisms and other pathogens
- WBCs have conspicuous nucleus
- spend only a few hours in the blood stream before migrating out of blood and into connective tissue (i.e. reticuloendothelial system)
- retain their organelles for protein synthesis