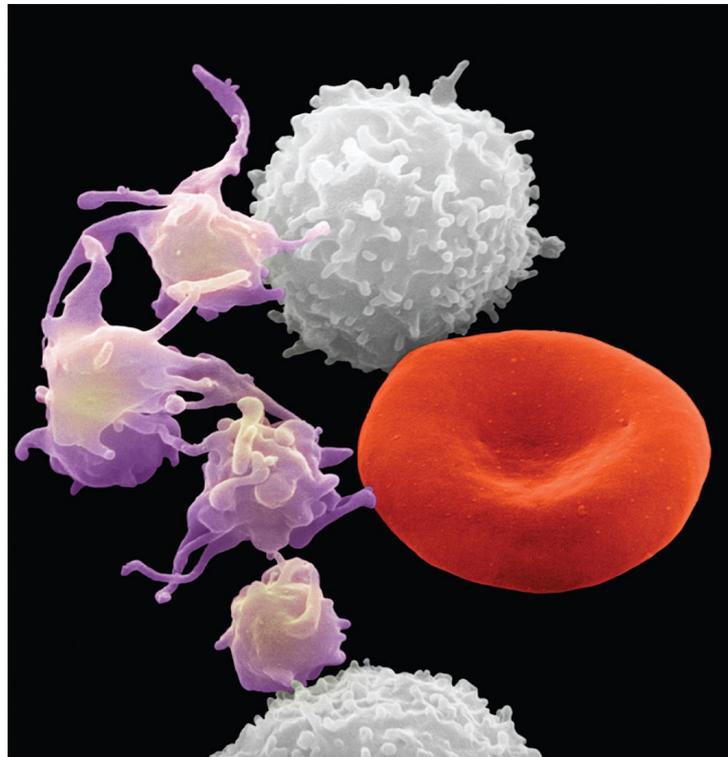


Chapter 18.2

Hemopoiesis

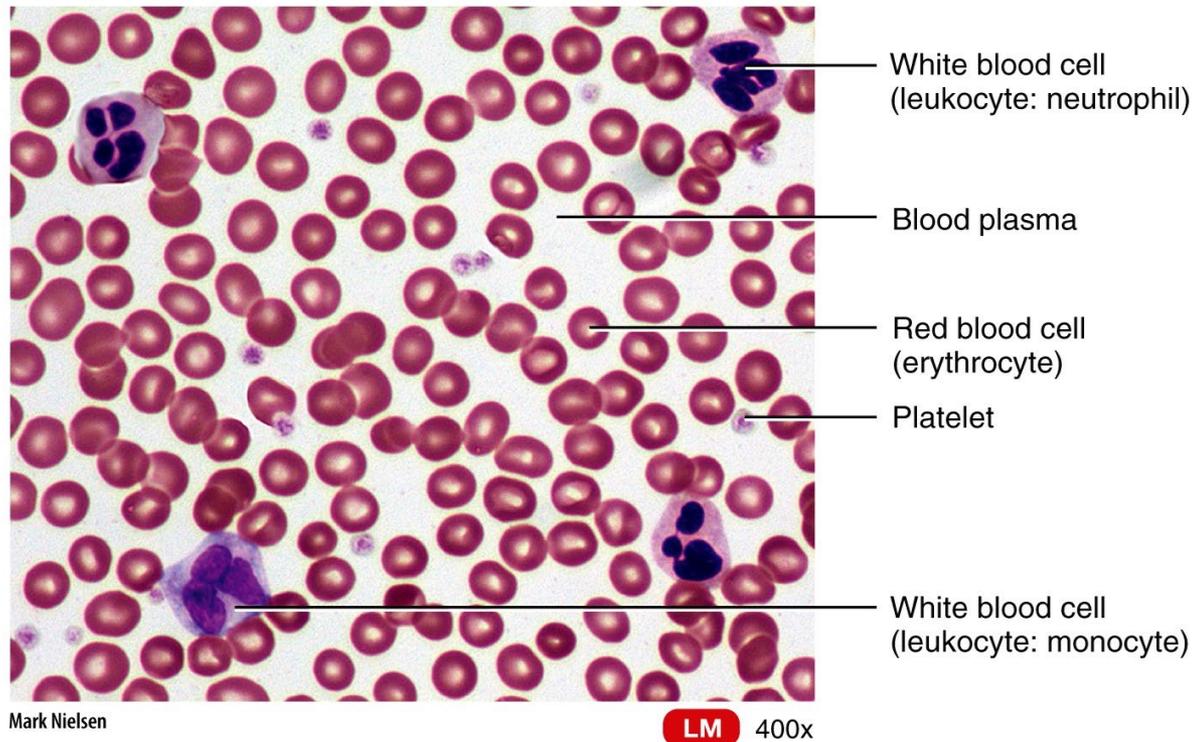
Erythropoiesis & Leukopoiesis



Hemopoiesis is the production of all the formed elements of blood. The formed elements are the cells and corpuscles in blood.

Erythropoiesis is the formation of red blood cells.

Leukopoiesis is the formation of white blood cells.



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

(Where are formed elements produced?)

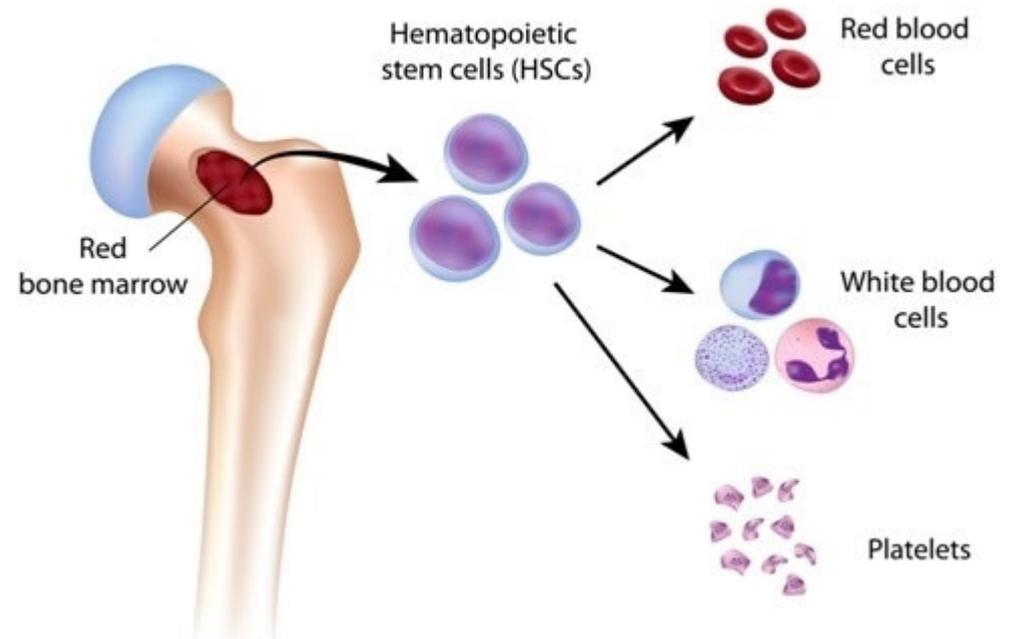
Hemopoiesis

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

Red bone marrow produces all nine formed elements
/// hemopoietic tissues is red bone marrow

Embryonic development // occurs in yolk sac – an embryonic structure that produces stem cells for first blood cells

Stem cells colonize in all fetal bone marrow, liver, and spleen // liver and spleen stop producing blood cells at birth



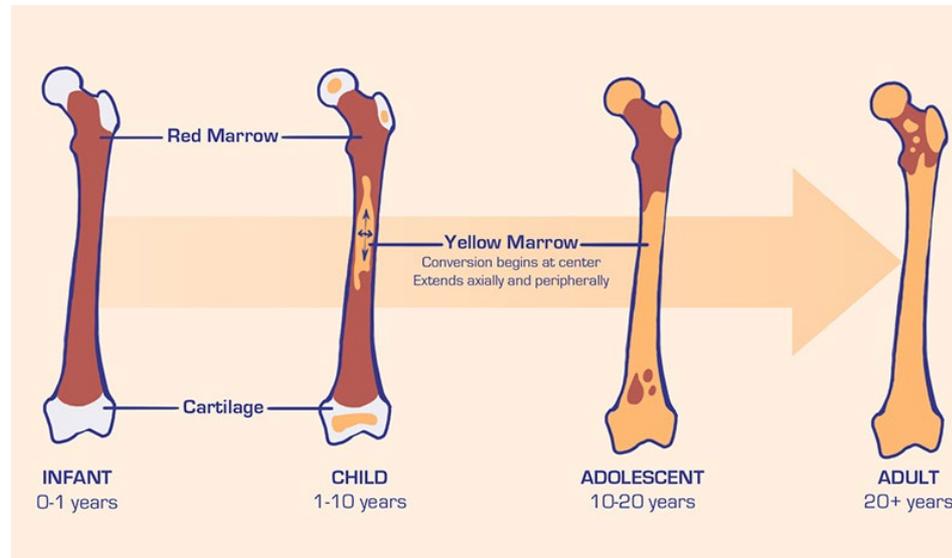
Hemopoiesis

After birth, **all formed elements “are only born”** in **red bone marrow** of axial skeleton plus proximal ends of femur and humerus

All the formed elements (**except T cells**) are formed (born) in the bone marrow then move into blood as functional cells

T cells (type of WBC) are born in bone marrow but must travel to thymus to complete their development /// then enter blood as naive immunocompetent T cells

Adult daily production = 400 billion platelets / 200 billion RBCs / 10 billion WBCs



Hemopoiesis

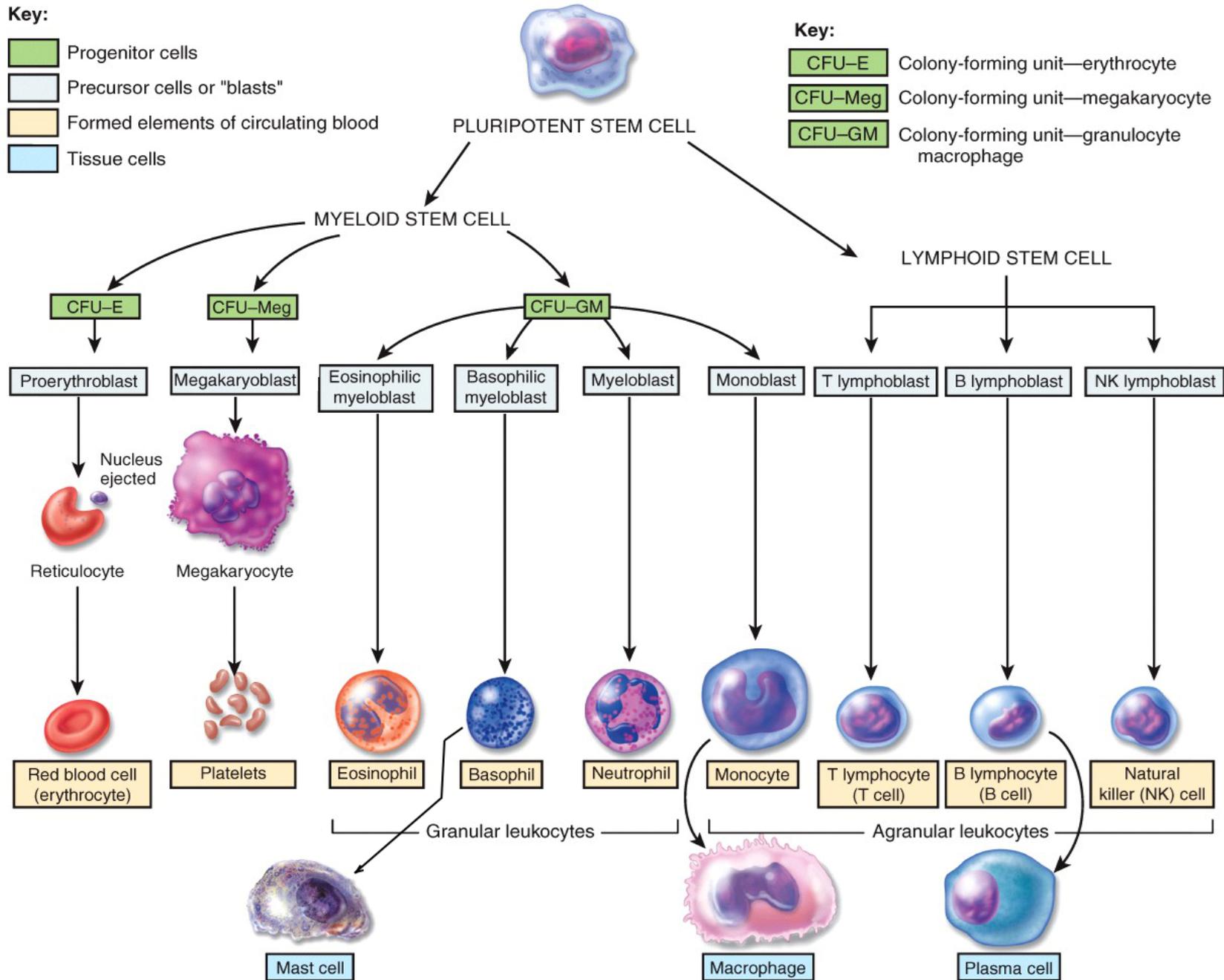


Pluripotent stem cells (PPSC) // formally called hemocytoblasts or hemopoietic stem cells // PPSC generate specific **colony forming units** for each formed element

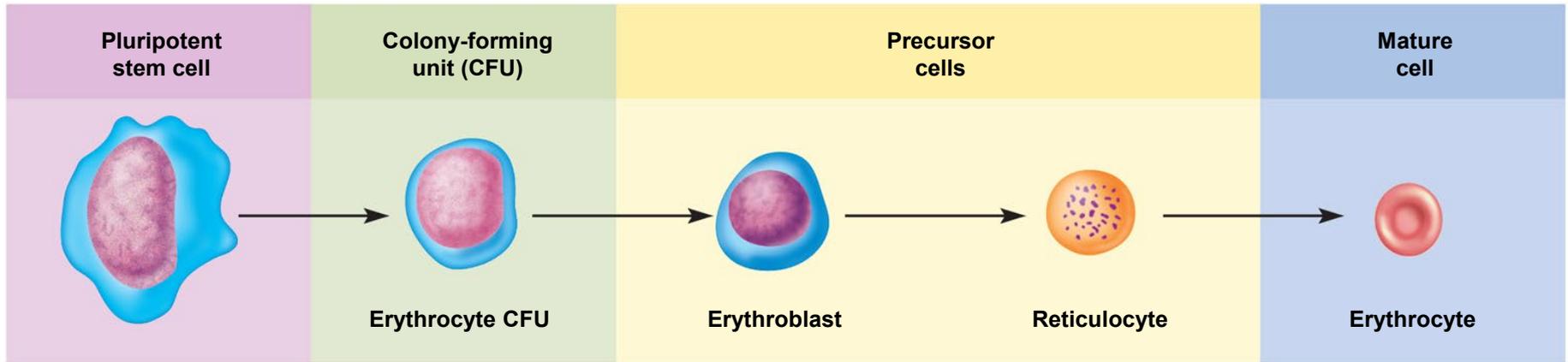
Colony forming units – specialized stem cells producing one formed element of blood

Myeloid hemopoiesis – blood formation in the red bone marrow (note: sometimes called myeloid tissue or hemopoetic tissue)

Lymphoid hemopoiesis – describes blood formation in the lymphatic organs



Erythropoiesis



Production of RBC requires 3 to 5 days to complete (**test benchmark 5 days!**)

Stimulus to start erythropoiesis = hypoxia

Hypoxia signals kidney to release **erthropoietin** (hormone)

Hormone receptors on erythrocyte CFU

Regulating Erythrocyte Homeostasis

Negative feedback regulation

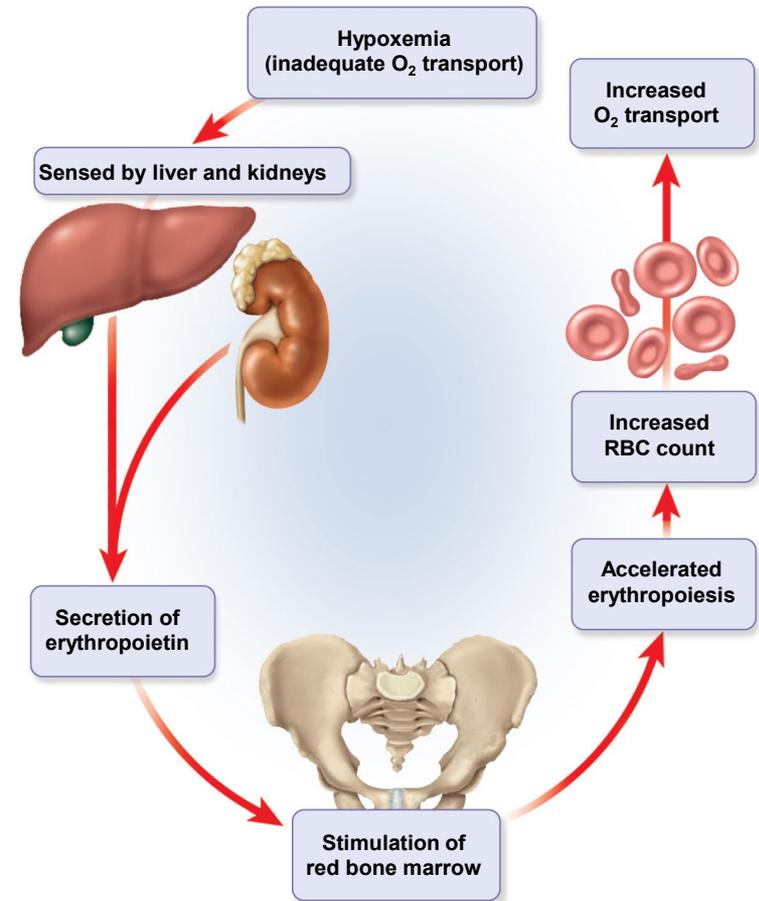
A drop in RBC count causes **hypoxemia** (low oxygen in blood) // **hypoxia** low oxygen level in tissue // this is the stimulus for kidneys

Hypoxemia causes kidney to produce and release the hormone **erythropoietin** // receptor on RBC-CFU

RBC count increases in **3 - 5 days**

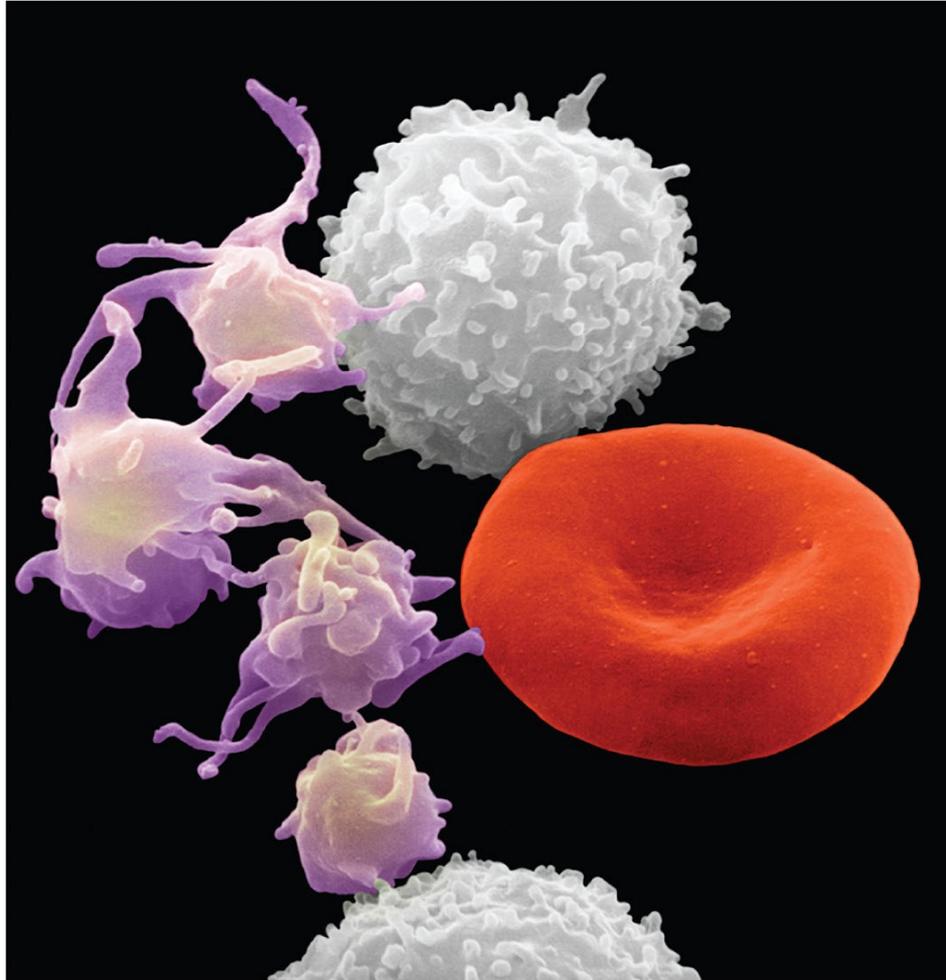
Stimulus causing hypoxemia

- **high altitude**
- **increase in exercise**
- **emphysema)**



Note: emphysema is a disease that reduces the respiratory membrane surface area making it harder to bring oxygen into the blood. Cigarette smoking is the primary cause of this disease.

Leukopoiesis



Leukopoiesis

Leukopoiesis – production of white blood cells

Red bone marrow produce and releases into blood granulocytes (neutrophils, eosinophils, basophils) and agranulocytes (monocytes and lymphocytes)

Myeloid stem cell produce monocytes (macrophage) and the NEBs

Lymphoid stem cells produce B cells, T cells, natural killer cells

Lymphocytes produce cells important to the immune system

B cells // born in red bone marrow, “educated” in red bone marrow, and released from RB marrow into blood as immuno-competent cells

T lymphocytes born in red bone // travels in blood to thymus where it T cells are “educated” then re-enters blood as fully developed T cell.

Natural killer cells (NK) // immune surveillance

Leukocytes (WBCs)

WBC **least abundant** of all the formed elements // 5,000 to 10,000 WBCs/ μ L (the overwhelming number of these cells are neutrophils)

Primary function of neutrophils = protect against infectious microorganisms and other pathogens present in blood // able to emigrate into tissue spaces if bacterial is present // called the **“first responders”**

WBCs have conspicuous nucleus

WBCs spend only a few hours in the blood stream before migrating out of blood and into the interstitial space

WBC use connective tissues of the body to “wander” throughout our bodies (i.e. reticuloendothelial system)

Retain their organelles for protein synthesis

