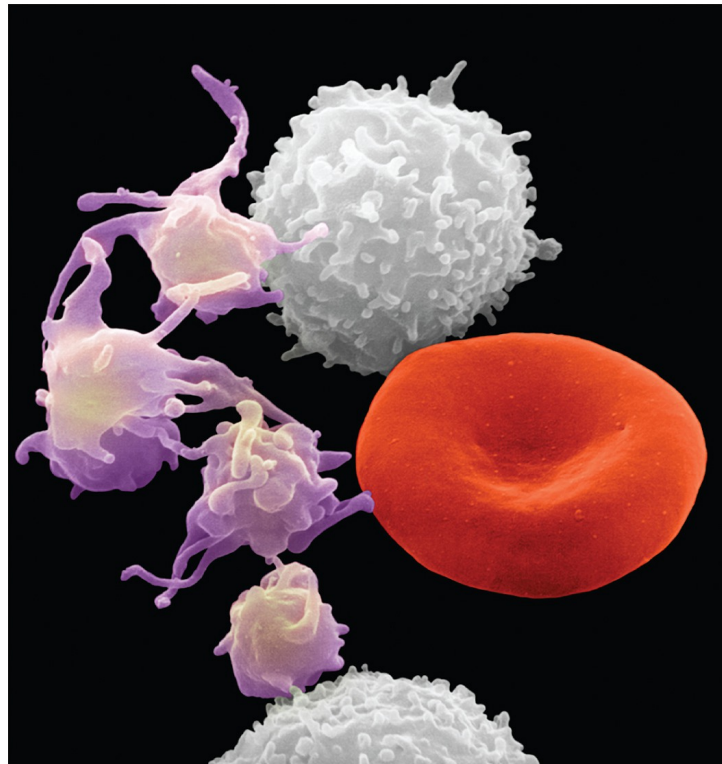


Chapter 18.2

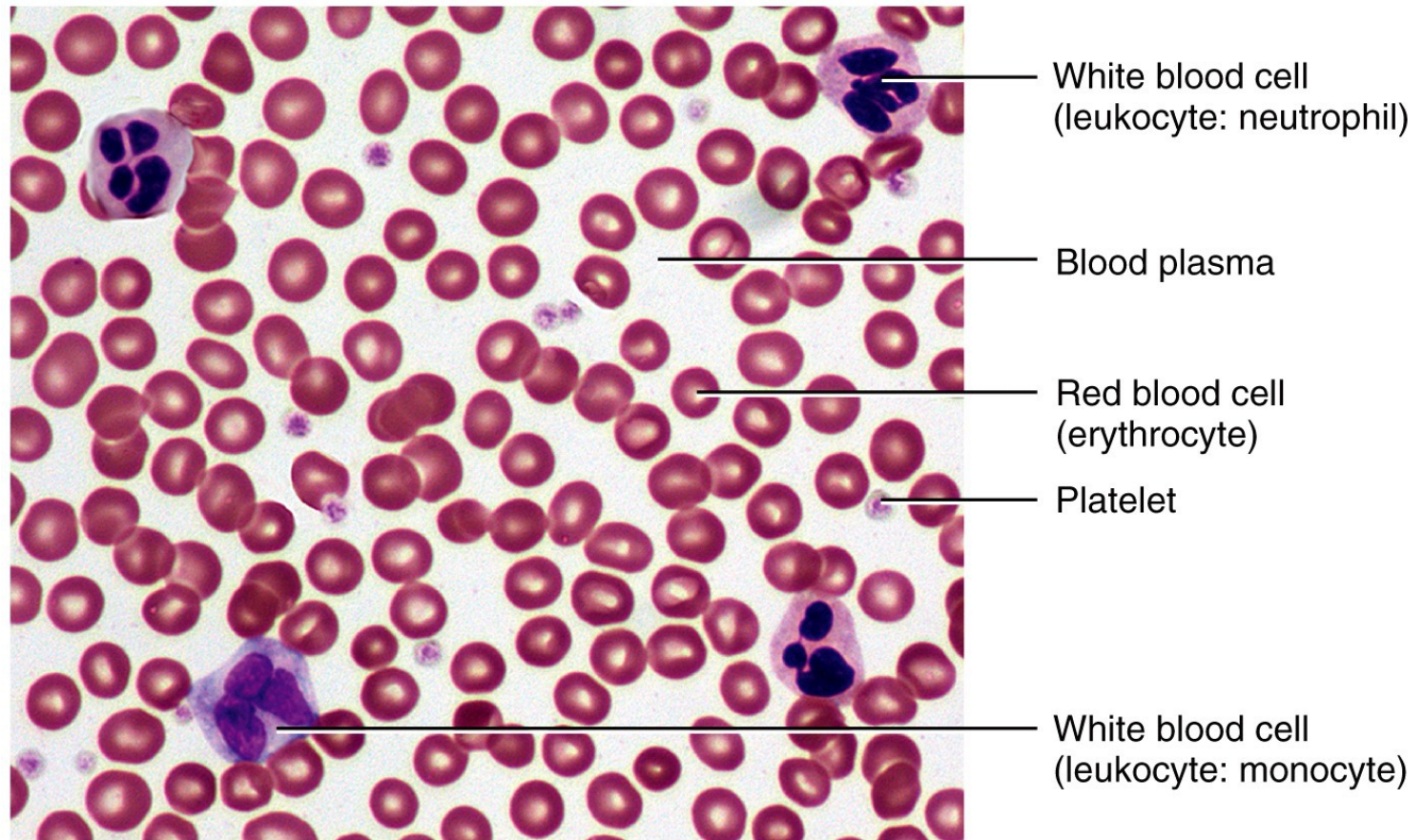
Hemopoiesis

(Erythropoiesis & Leukopoiesis)



Hemopoiesis is the production of the formed elements.

(Where are they formed?)



Mark Nielsen

LM 400x

(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 is red bone marrow
 - embryonic development from yolk sac = embryonic structure - 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
 - 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

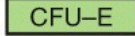
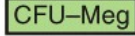



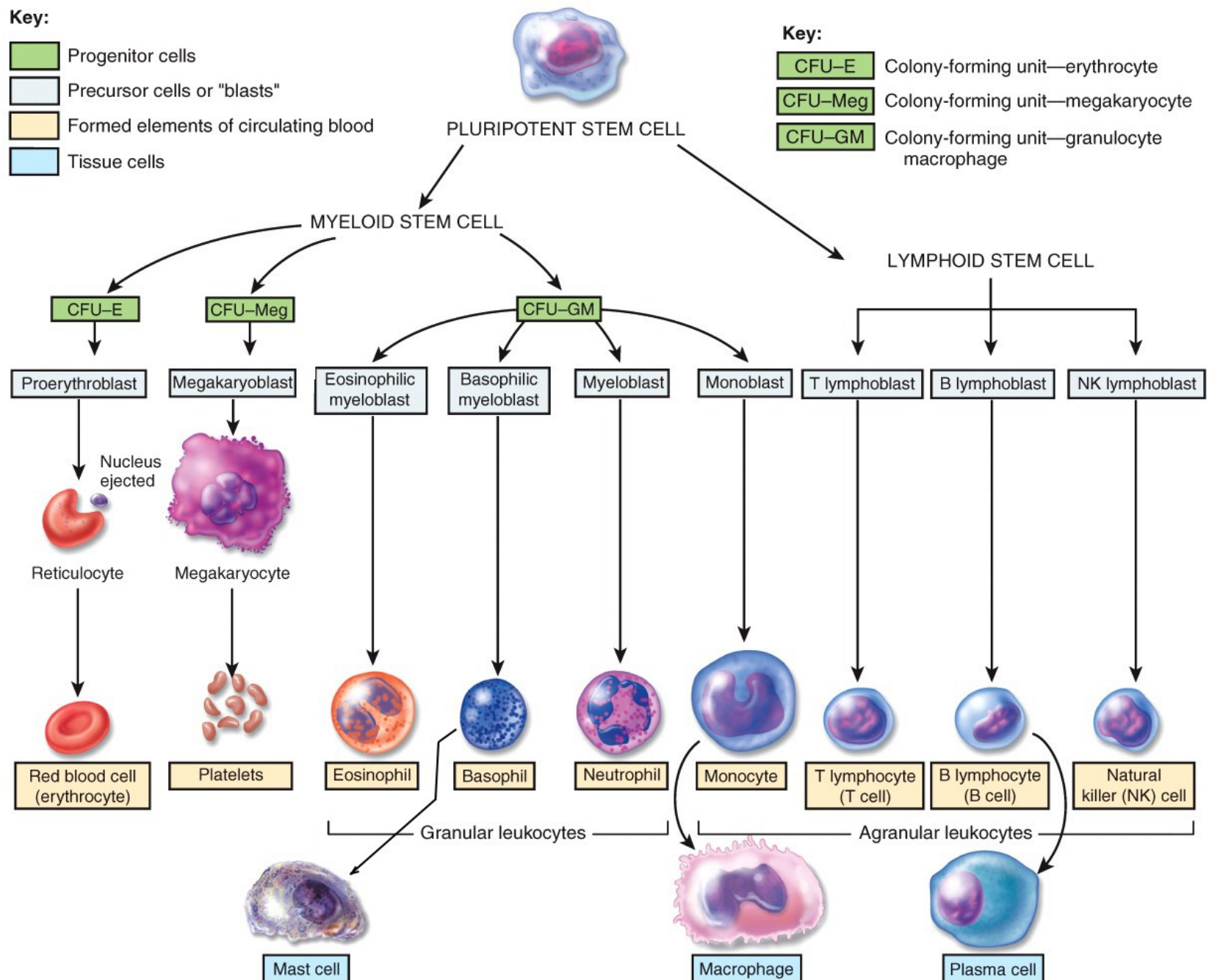
- pluripotent stem cells (PPSC) // formally called hemocytoblasts or hemopoietic stem cells // PPSC generate specific **colony forming units** for each formed element
- colony forming units – specialized stem cells producing one formed element of blood
- myeloid hemopoiesis – blood formation in the red bone marrow (note: sometimes called myeloid tissue or hemopoetic tissue)
- lymphoid hemopoiesis – describes blood formation in the lymphatic organs

Key:

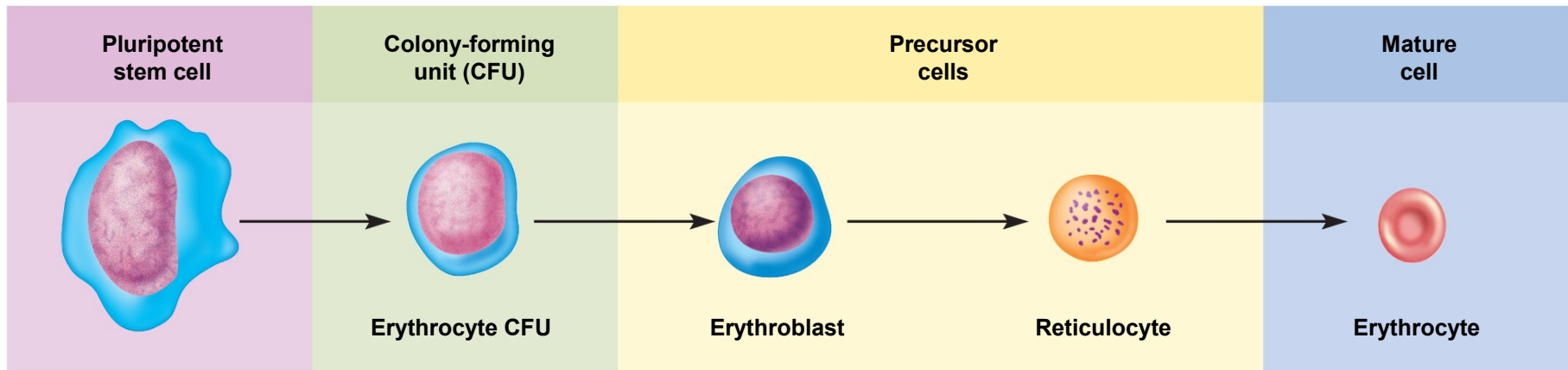
-  Progenitor cells
-  Precursor cells or "blasts"
-  Formed elements of circulating blood
-  Tissue cells

Key:

-  CFU-E Colony-forming unit—erythrocyte
-  CFU-Meg Colony-forming unit—megakaryocyte
-  CFU-GM Colony-forming unit—granulocyte macrophage



Erythropoiesis



Production of RBC requires 3 to 5 days to complete (test bench mark 5 days!)

Regulatory stimulus = hypoxia

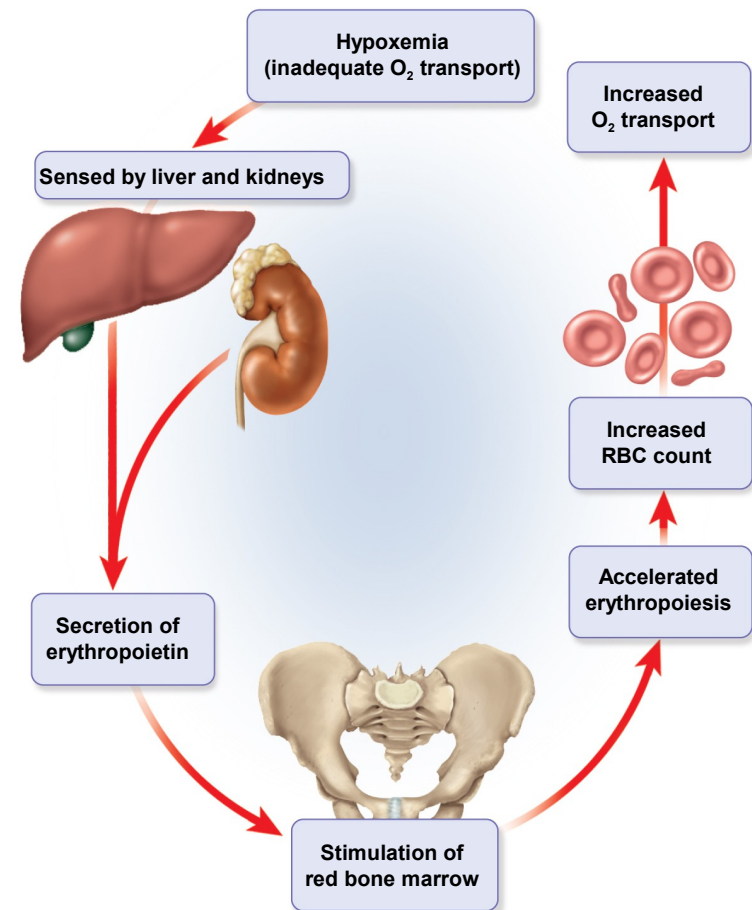
Hypoxia signals kidney to release **erthropoietin** (hormone)

Hormone receptors on erythrocyte CFU

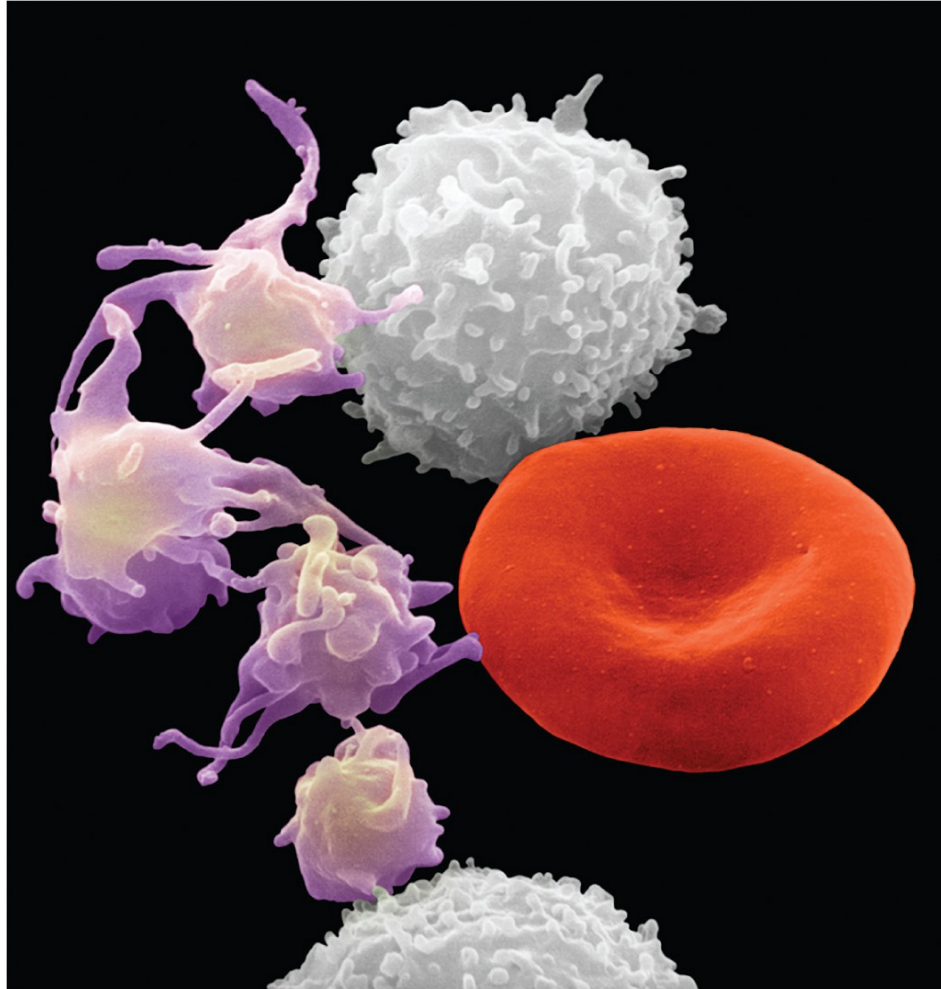


Regulating Erythrocyte Homeostasis

- negative feedback regulation
 - A drop in RBC count causes **hypoxemia (low oxygen in blood)** // **hypoxia** /// the stimulus for for kidneys
 - Hypoxemia causes kidney to produce and release **erythropoietin** // hormone // receptor on RBC-CFU
 - RBC count increases in 3 - 5 days
- stimulus **causing** erythropoiesis /// all cause low levels O_2 (hypoxemia)
 - **high altitude**
 - **increase in exercise**
 - **loss of lung tissue (emphysema)** // reduces the respiratory membrane surface area



Leukopoiesis



Leukopoiesis





- leukopoiesis – production of white blood cells
- pluripotent stem cells (PPSCs)
 - Myeloid stem cell produce monocytes (macrophage) and the NEBs
 - Lymphoid stem cells produce B cells, T cells, natural killer cells
- red bone marrow produce and releases into blood granulocytes (neutrophils, eosinophils, basophils) and agranulocytes (monocytes and lymphocytes)
- 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



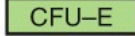
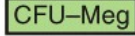

Leukocytes (WBCs)

- **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

Key:

-  Progenitor cells
-  Precursor cells or "blasts"
-  Formed elements of circulating blood
-  Tissue cells

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