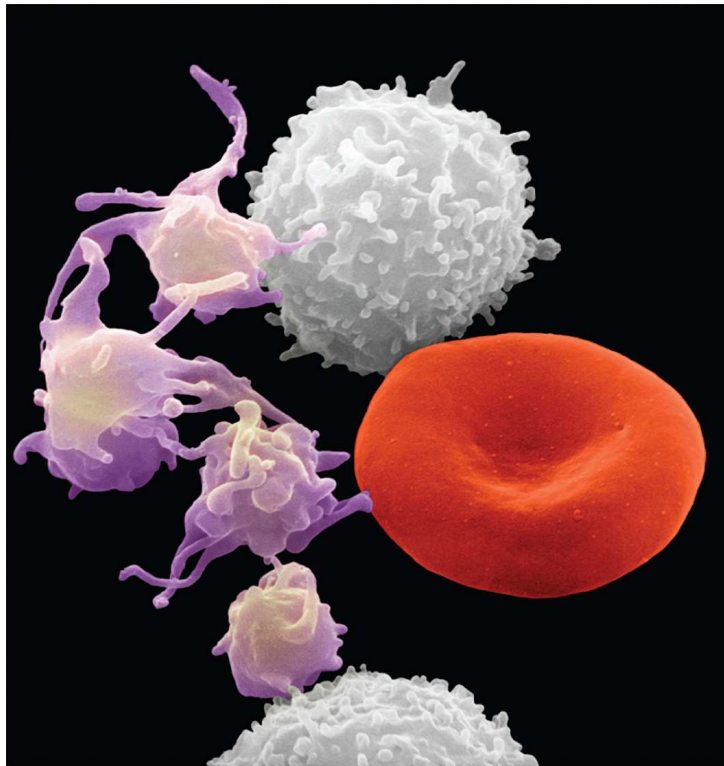


## Chapter 18.2

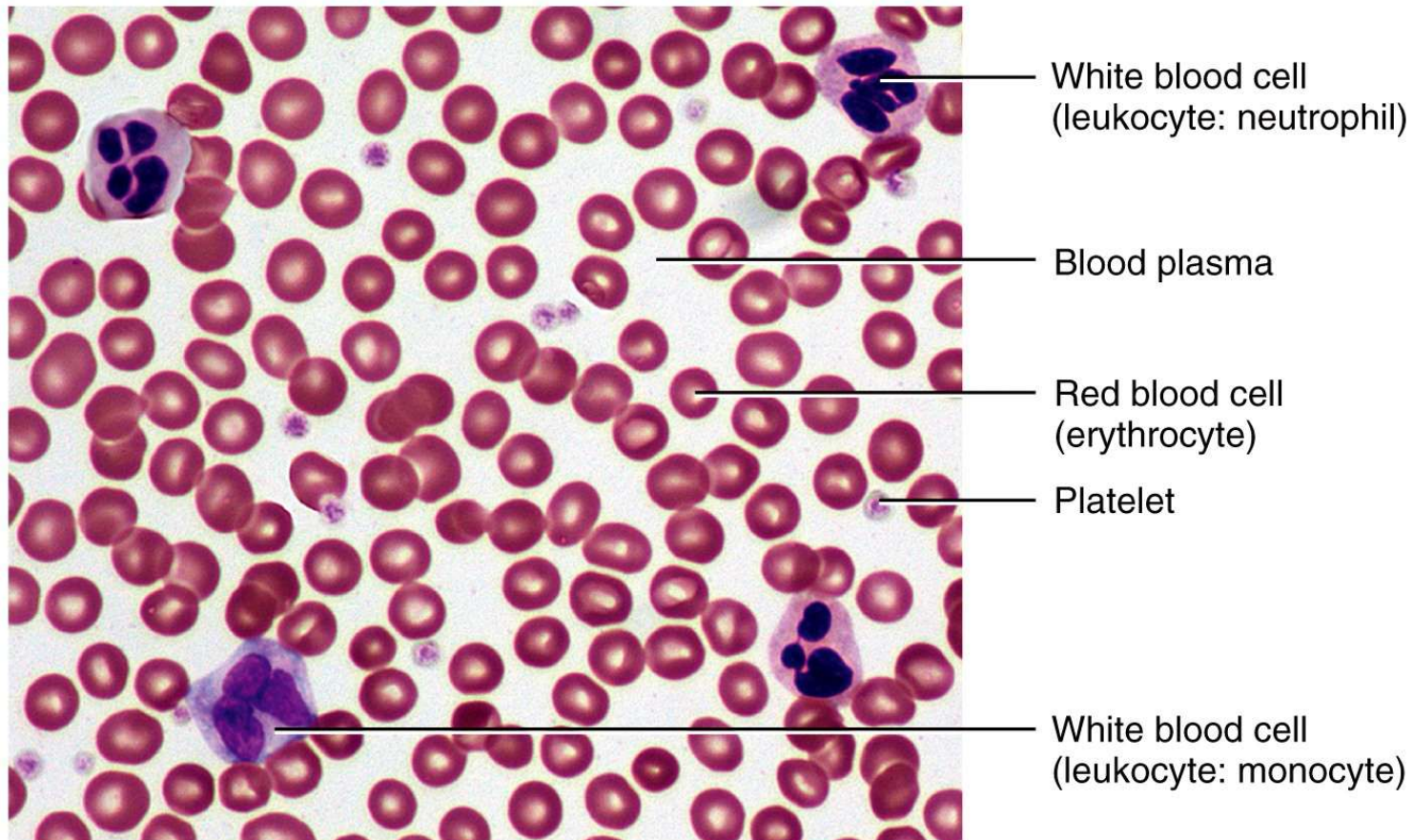
# Hemopoiesis

## (Erythropoiesis and Leukopoiesis)



# Hemopoiesis is the Production of the Formed Elements

**Where are they formed? How are they formed? Why 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 producer of blood cells (WBC / RBC / Platelets)
    - embryonic development from 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

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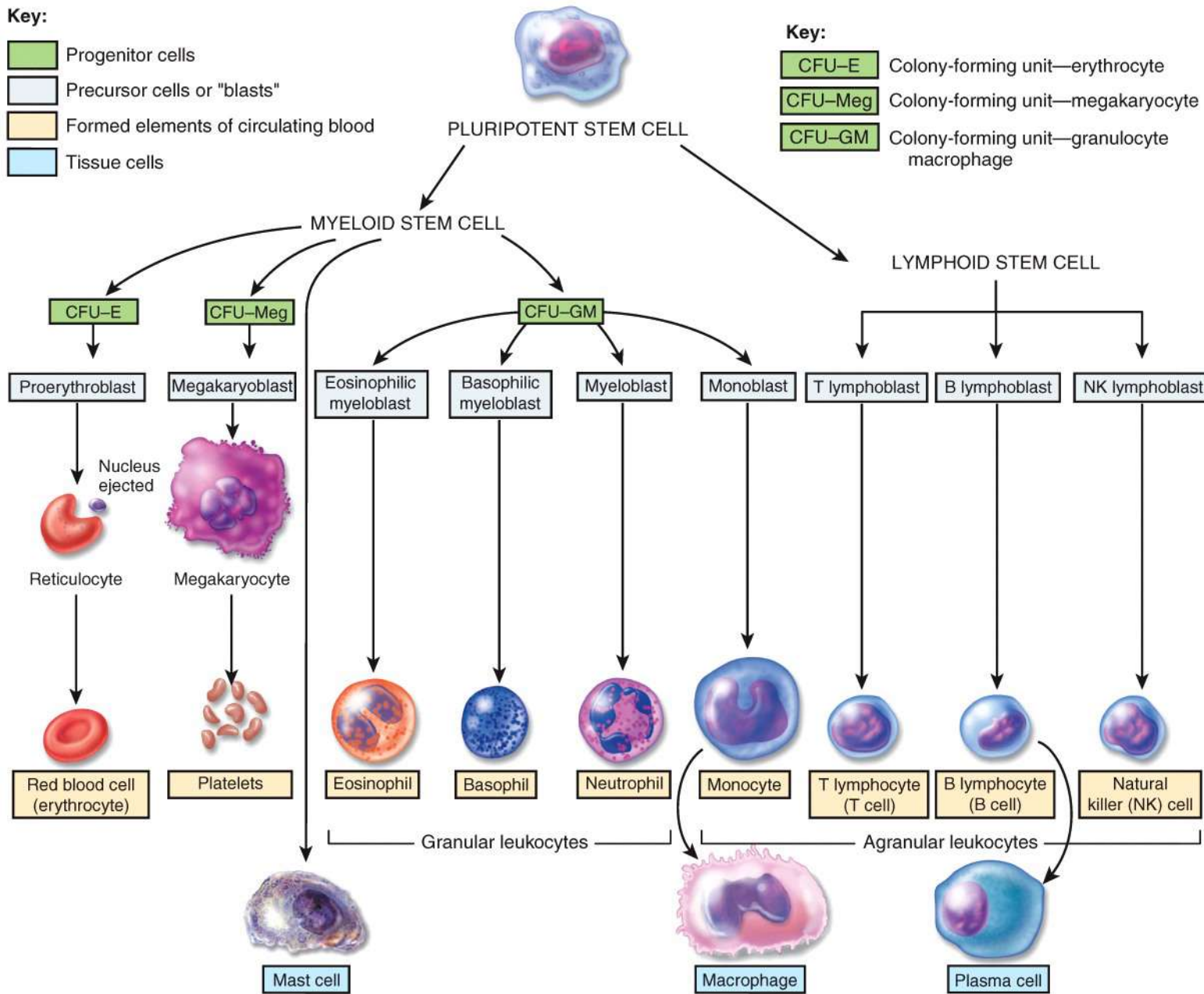
- pluripotent stem cells (PPSC) // formally called hemocytoblasts or hemopoietic stem cells // PPSC generate specific colony forming units for each formed element
- colony forming units – specialized stem cells only producing one class of formed element of blood
- myeloid hemopoiesis – blood formation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

**Key:**

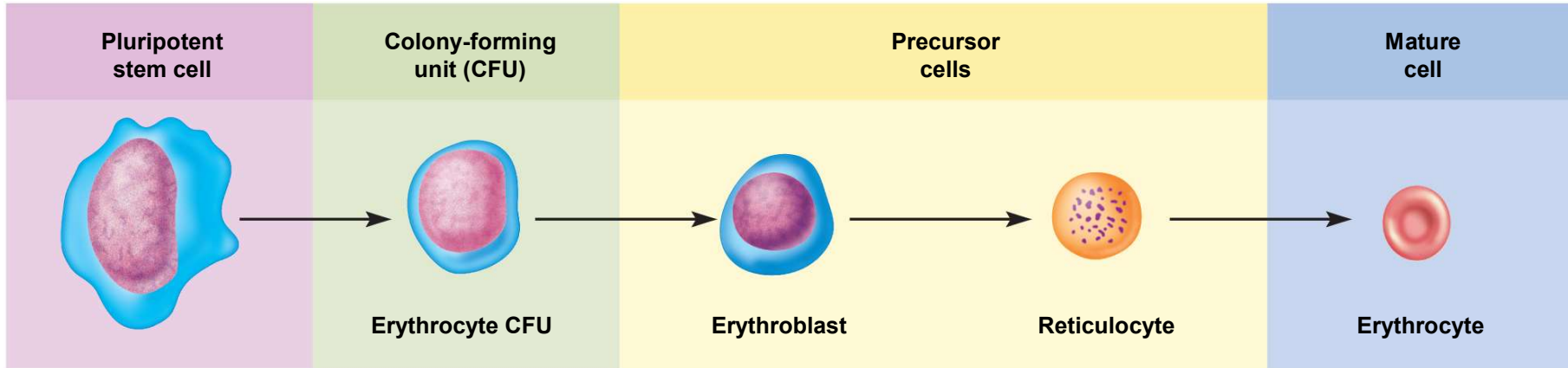
- Progenitor cells
- Precursor cells or "blasts"
- Formed elements of circulating blood
- Tissue cells

**Key:**

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



# Erythropoiesis



Production of RBC

3 to 5 days to complete

Regulatory mechanism stimulus = hypoxia

Hypoxia signals kidney to release erythropoietin (hormone)

Hormone receptors on erythrocyte CFU

# Regulating Erythrocyte Homeostasis

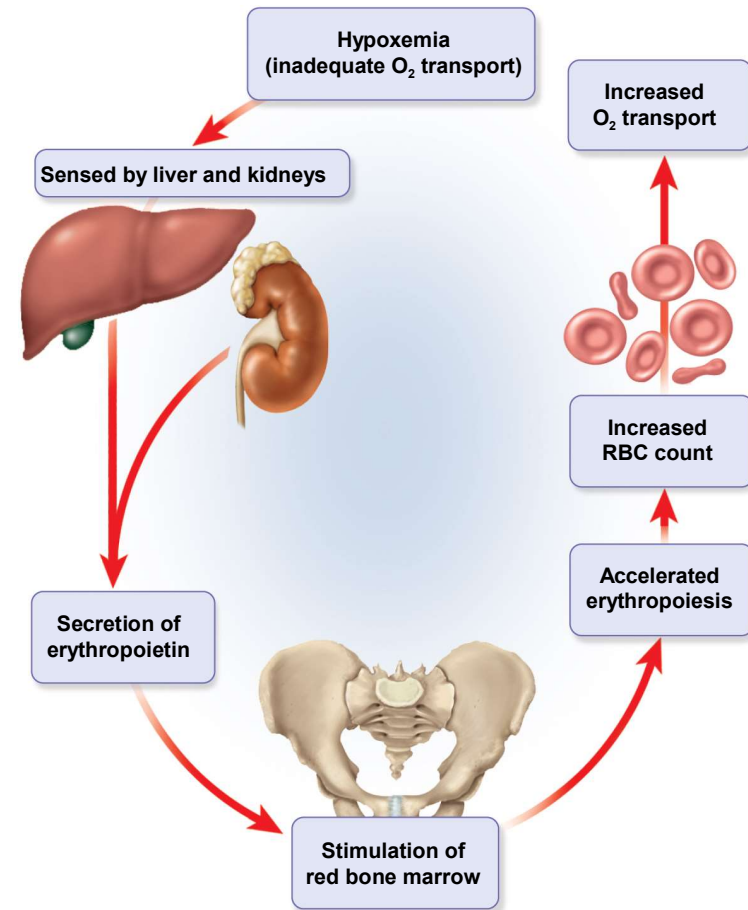


- negative feedback regulation

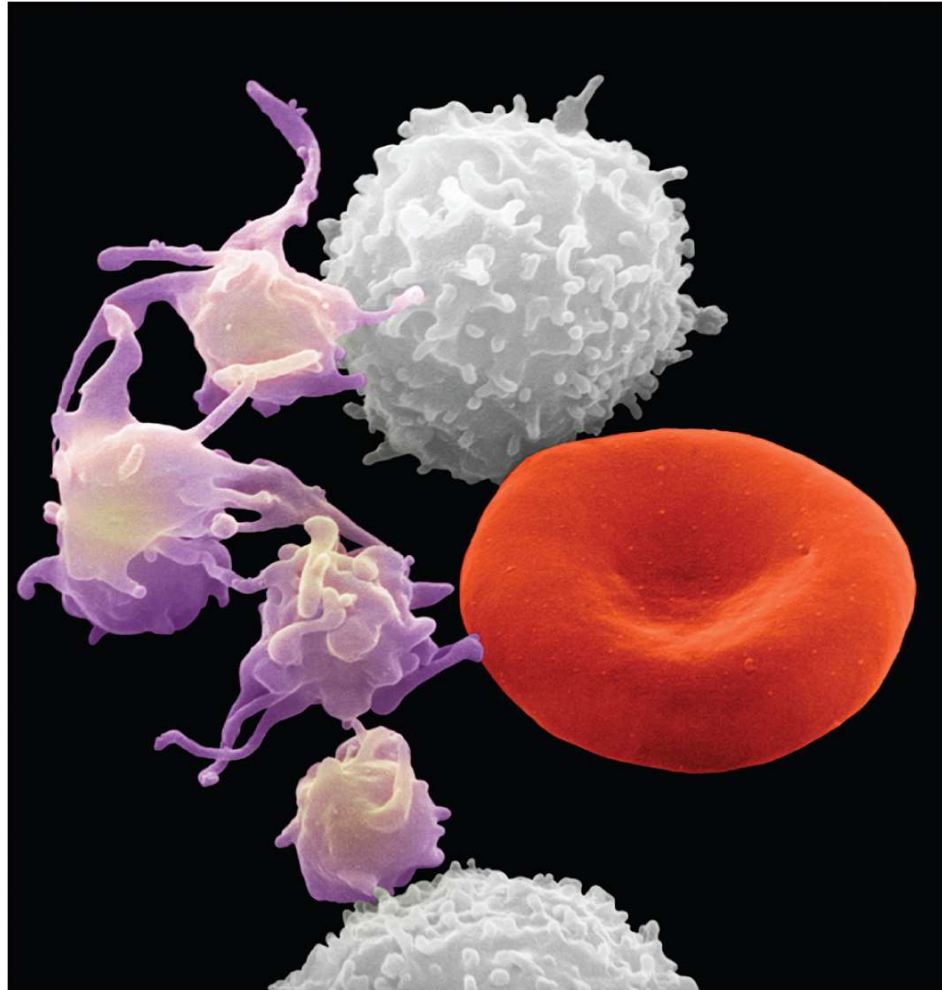
- A drop in RBC count causes **hypoxemia** // the stimulus for kidneys
- kidney produces **erythropoietin** // hormone // stimulates RBC-CFU
- RBC count increases in 3 - 5 days

- stimulus **causing** erythropoiesis

- low levels  $O_2$  (hypoxemia) results from
  - **high altitude**
  - **increase in exercise**
  - **loss of lung tissue as in emphysema**



# Leukopoiesis





# Leukopoiesis

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- 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)

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- **WBC least abundant** of all the formed elements // 5,000 to 10,000 WBCs/ $\mu$ L
- 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

**Key:**

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

**Key:**

- CFU-E Colony-forming unit—erythrocyte
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