University of Al-Ameed

College of Nursing

Anatomy and Physiology I

1st Year, 1st Semester, 2025-2026

Lecture (3):

The Blood

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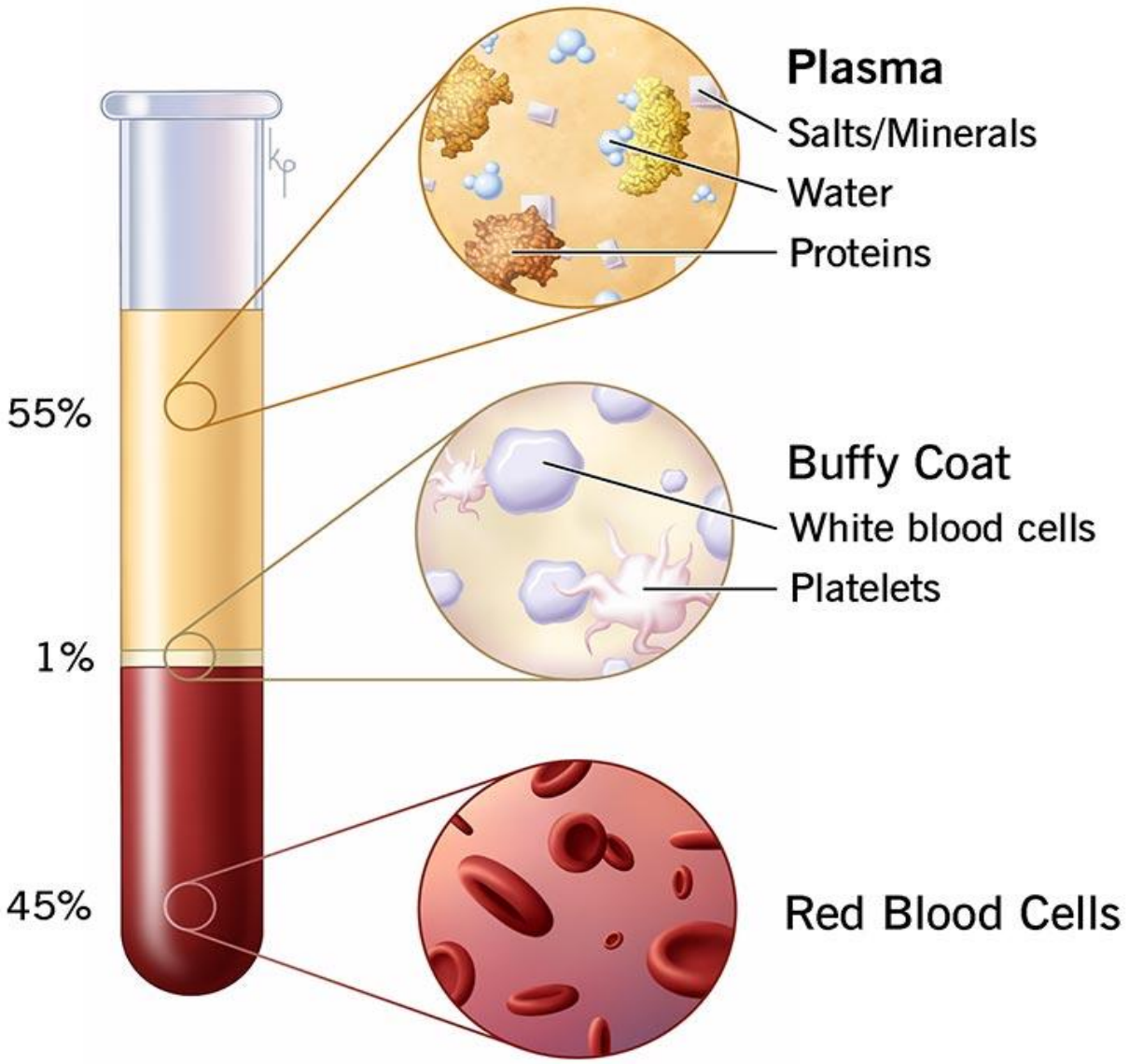
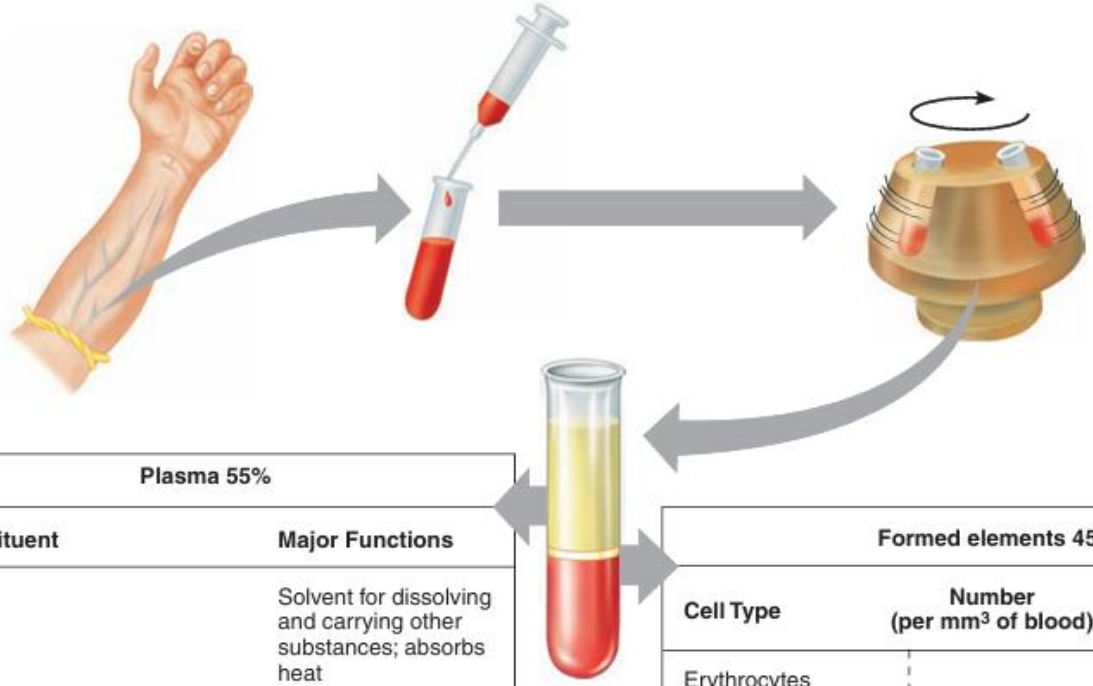
Outlines:

- Blood properties
- Hemoglobin
- Life cycle of blood cells
- Hemostasis

Blood components



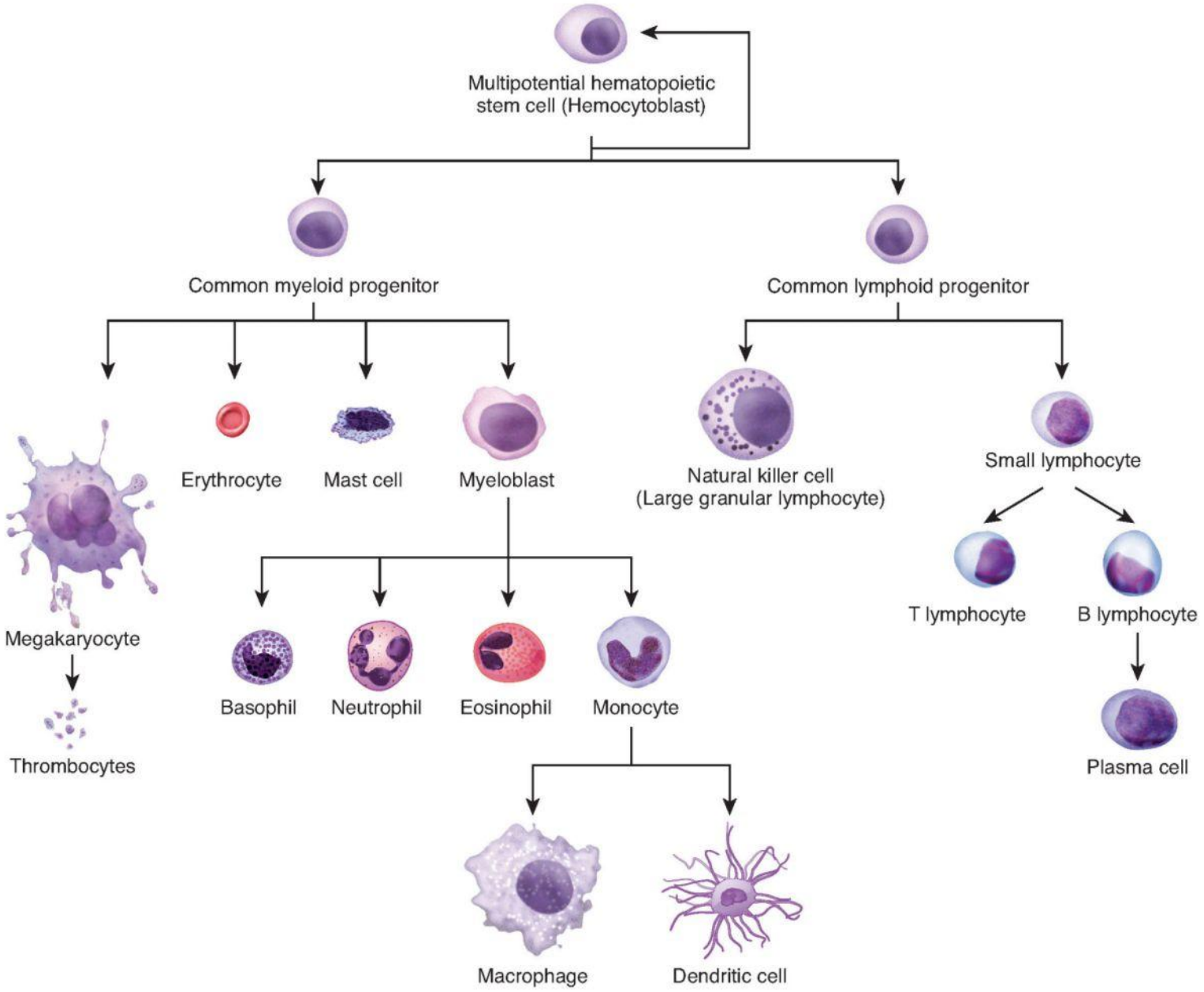
Blood properties



Plasma 55%	
Constituent	**Major Functions**
Water	Solvent for dissolving and carrying other substances; absorbs heat
Salts (electrolytes) Sodium Potassium Calcium Magnesium Chloride Bicarbonate	Osmotic balance, pH buffering
Plasma proteins Albumin Fibrinogen Globulins	 Osmotic balance Clotting of blood Defense (antibodies) and lipid transport
Substances transported by blood Nutrients (glucose, fatty acids, amino acids, vitamins) Waste products of metabolism (urea, uric acid) Respiratory gases (O_2 and CO_2) Hormones	

Formed elements 45%		
Cell Type	**Number (per mm^3 of blood)**	**Functions**
Erythrocytes (red blood cells)	4 – 6 million	Transport oxygen and help transport carbon dioxide
Leukocytes (white blood cells)	4800 – 10,800	Defense and immunity
Basophil		
Eosinophil		
Lymphocyte		
Neutrophil		
Monocyte		
Platelets	150,000 – 400,000	Blood clotting

Production of blood cells by the bone marrow.



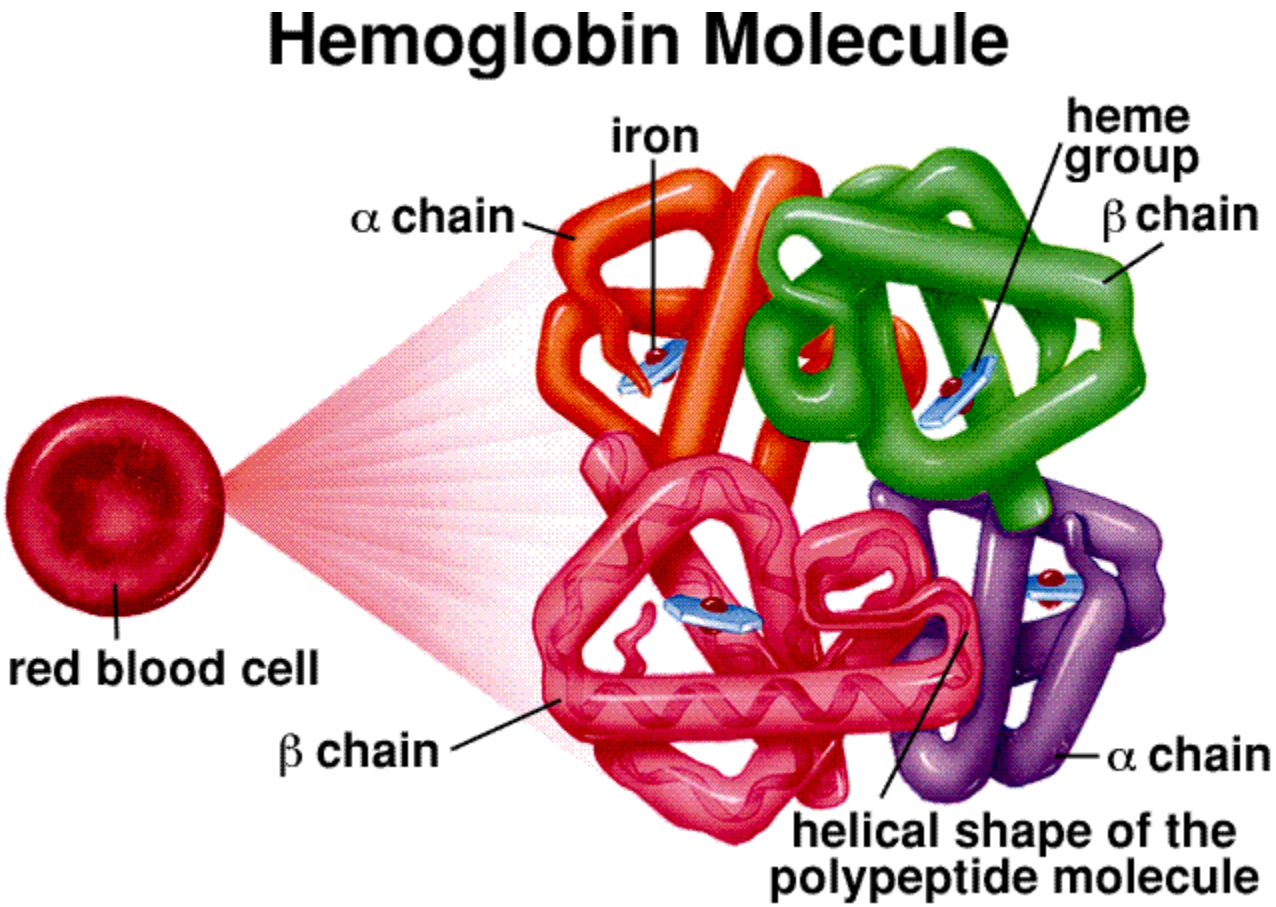
An overview on erythrocytes:

- Because **erythrocytes lack nuclei and most organelles**, they can neither reproduce themselves nor maintain their normal structure for very long.

- The **average life span of an erythrocyte** is approximately 120 days, which means that almost 1% of the erythrocytes is destroyed and must be replaced every day. This amounts to 250 billion cells per day!

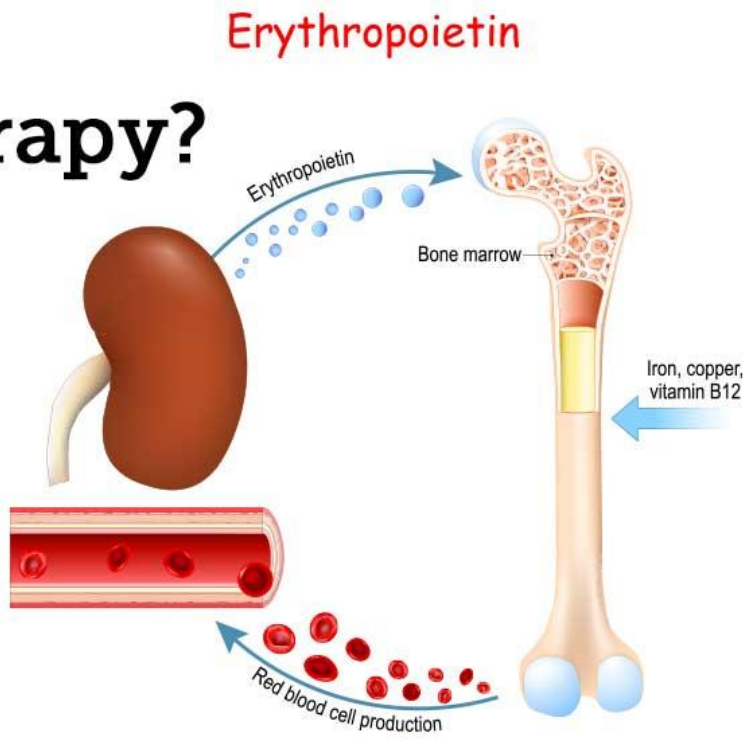
- Destruction of damaged or **dying erythrocytes** normally occurs in the **spleen** and the **liver**.

- The **major breakdown product** of **hemoglobin** is **bilirubin**, which is returned to the circulation and gives plasma its characteristic yellowish color.
- Several substances are **necessary** for the production of healthy erythrocytes, including **iron**, **vitamins**, and **hormones.**

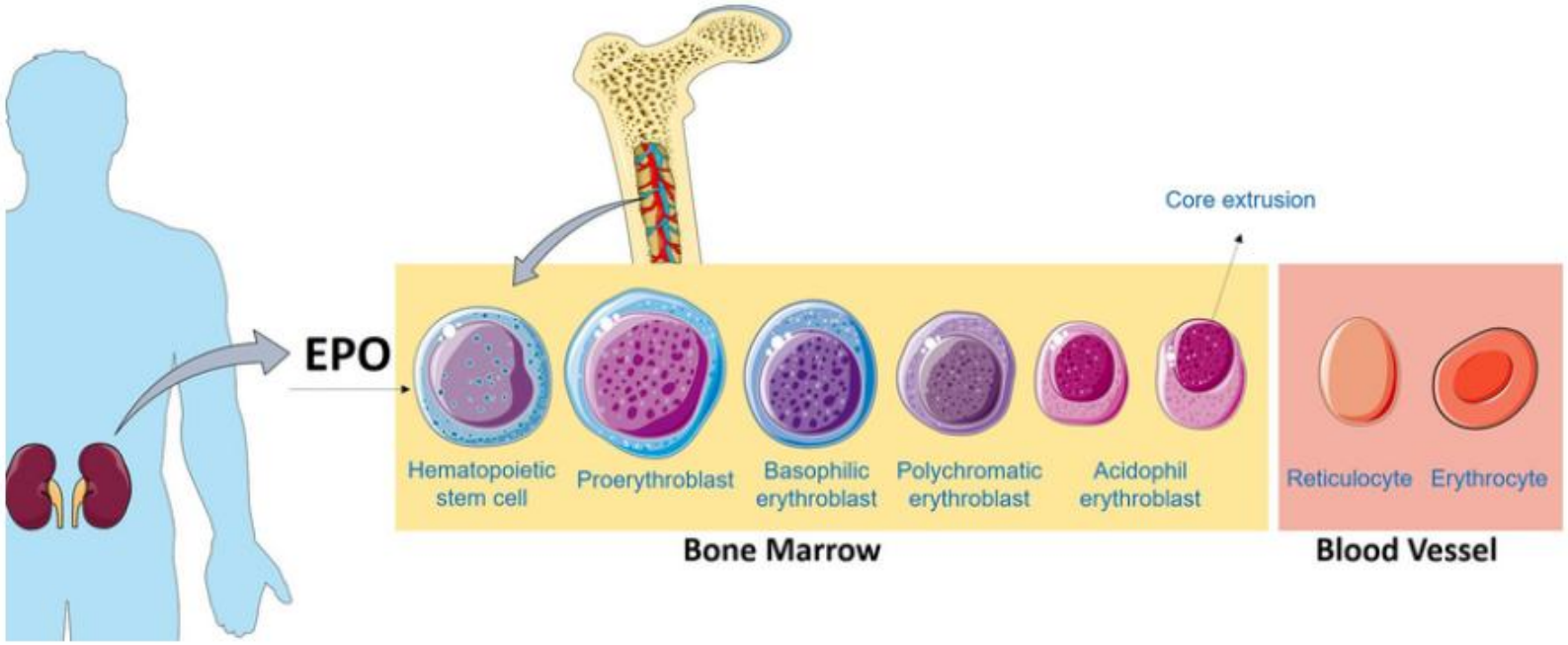

Hemoglobin Molecule
iron
heme group
α chain
β chain
red blood cell
β chain
α chain
helical shape of the polypeptide molecule

What is Erythropoietin therapy?

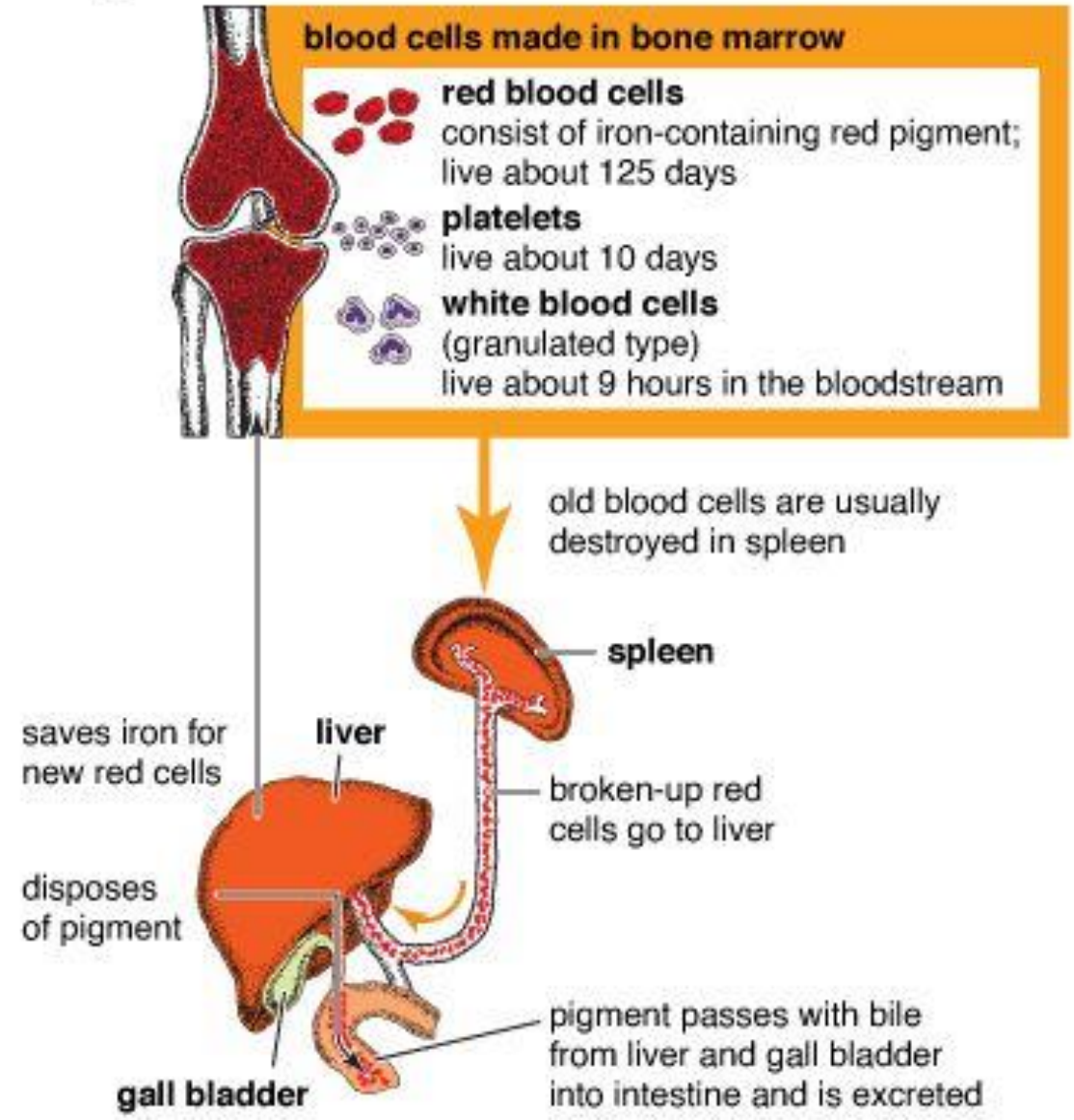
Erythropoietin therapy, also known as EPO therapy, is a type of medical treatment that uses a man-made form of erythropoietin (EPO) to increase red blood cell production and treat anemia.



Erythropoiesis



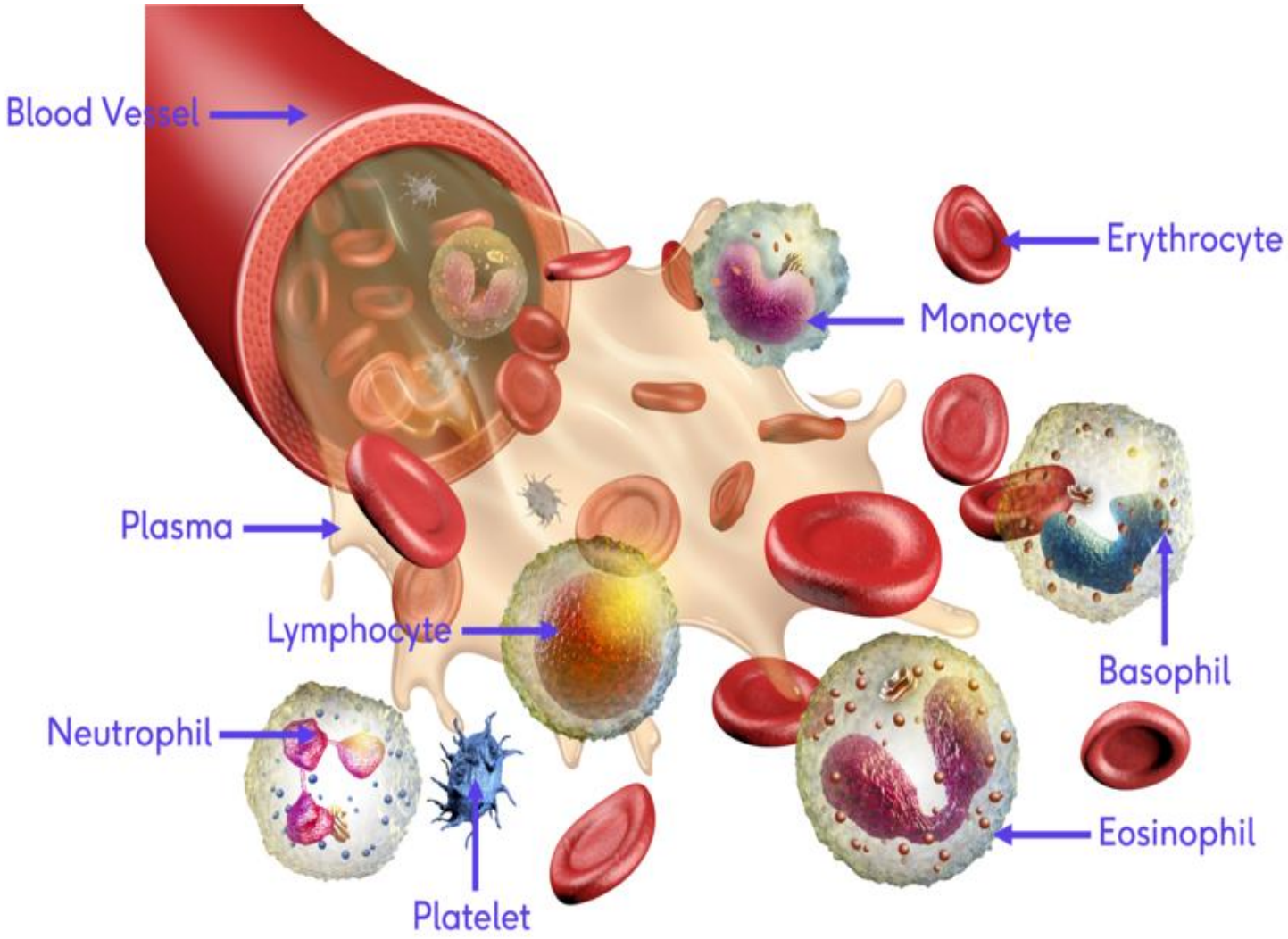
Life cycle of some blood cells



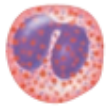
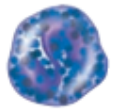
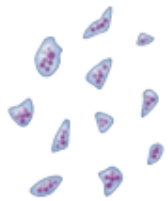
Major Hematopoietic Growth Factors (HGFs)

Name	Name Stimulates Progenitor Cells Leading To:
Erythropoietin	Erythrocytes
Colony-stimulating factors (CSFs) (example: granulocyte CSF)	Granulocytes and monocytes
Interleukins (example: interleukin 3)	Various leukocytes
Thrombopoietin	Platelets (from megakaryocytes)
Stem cell factor	Many types of blood cells

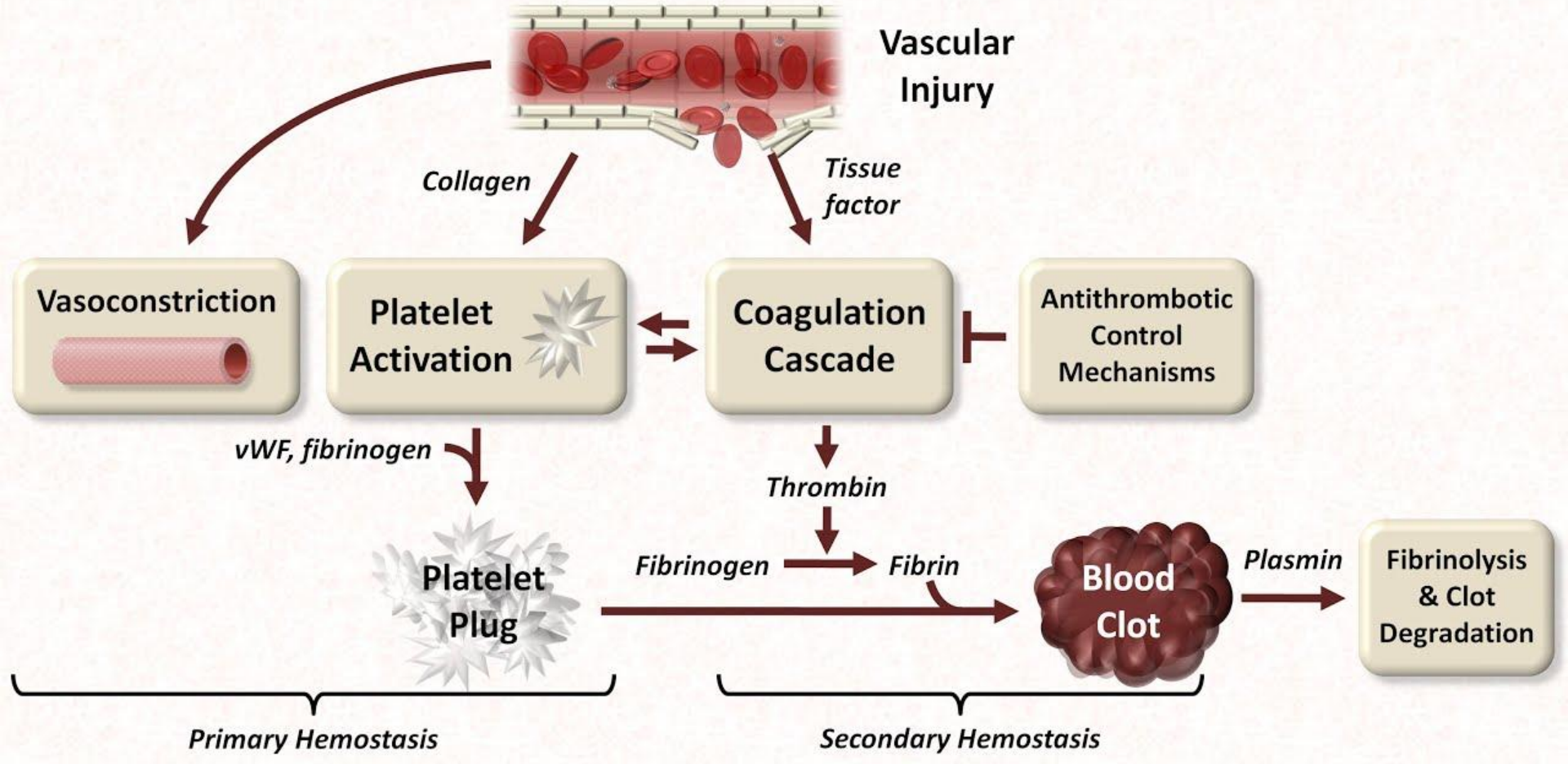
Blood cells


Blood Vessel
Erythrocyte
Monocyte
Plasma
Lymphocyte
Basophil
Neutrophil
Eosinophil
Platelet

Blood cells

Cell type	Illustration	Description*	Cells/mm³ (μl) of blood	Function
Erythrocytes (red blood cells, RBCs)		Biconcave, anucleate disc; orange-pink color; diameter 7–8 μm	4–6 million	Transport oxygen and carbon dioxide
Leukocytes (white blood cells, WBCs)		Spherical, nucleated cells	4800–10,800	
Granulocytes Neutrophil		Nucleus multilobed; pale red and blue cytoplasmic granules; diameter 10–12 μm	3000–7000 Differential count: 50–70%	Phagocytize pathogens or debris
Eosinophil		Nucleus bilobed; red cytoplasmic granules; diameter 10–14 μm	100–400 Differential count: 2–4%	Kill parasitic worms; slightly phagocytic; complex role in allergy and asthma
Basophil		Nucleus lobed; large blue-purple cytoplasmic granules; diameter 10–14 μm	20–50 Differential count: <1%	Release histamine and other mediators of inflammation; contain heparin, an anticoagulant
Agranulocytes Lymphocyte		Nucleus spherical or indented; pale blue cytoplasm; diameter 5–17 μm	1500–3000 Differential count: 25–45%	Mount immune response by direct cell attack or via antibody production
Monocyte		Nucleus U- or kidney-shaped; gray-blue cytoplasm; diameter 14–24 μm	100–700 Differential count: 3–8%	In tissues, develop into macrophages that phagocytize pathogens or debris
Platelets		Cytoplasmic fragments containing granules; stain deep purple; diameter 2–4 μm	150,000–400,000	Seal small tears in blood vessels; instrumental in blood clotting

Major Components of Hemostasis



THANK YOU