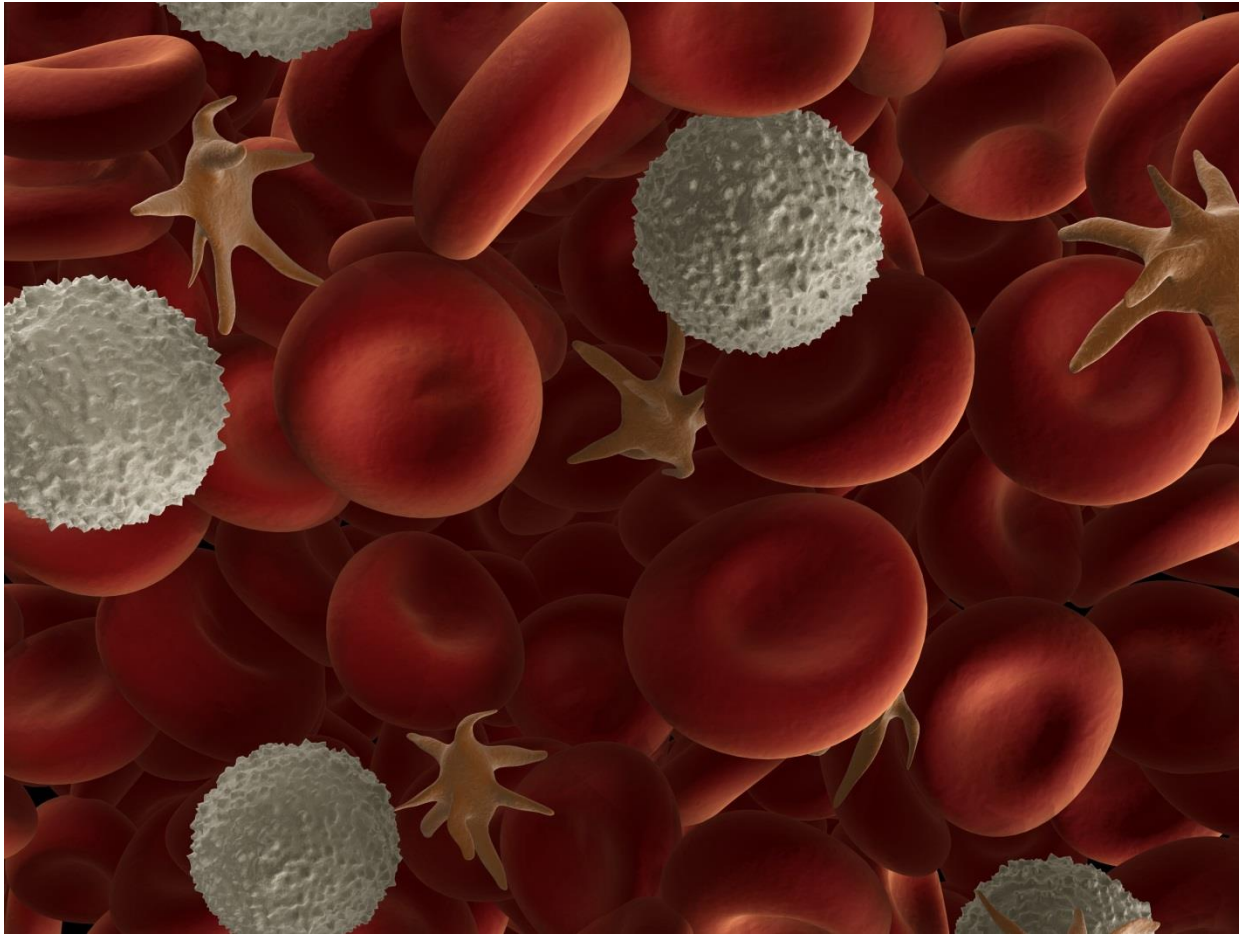
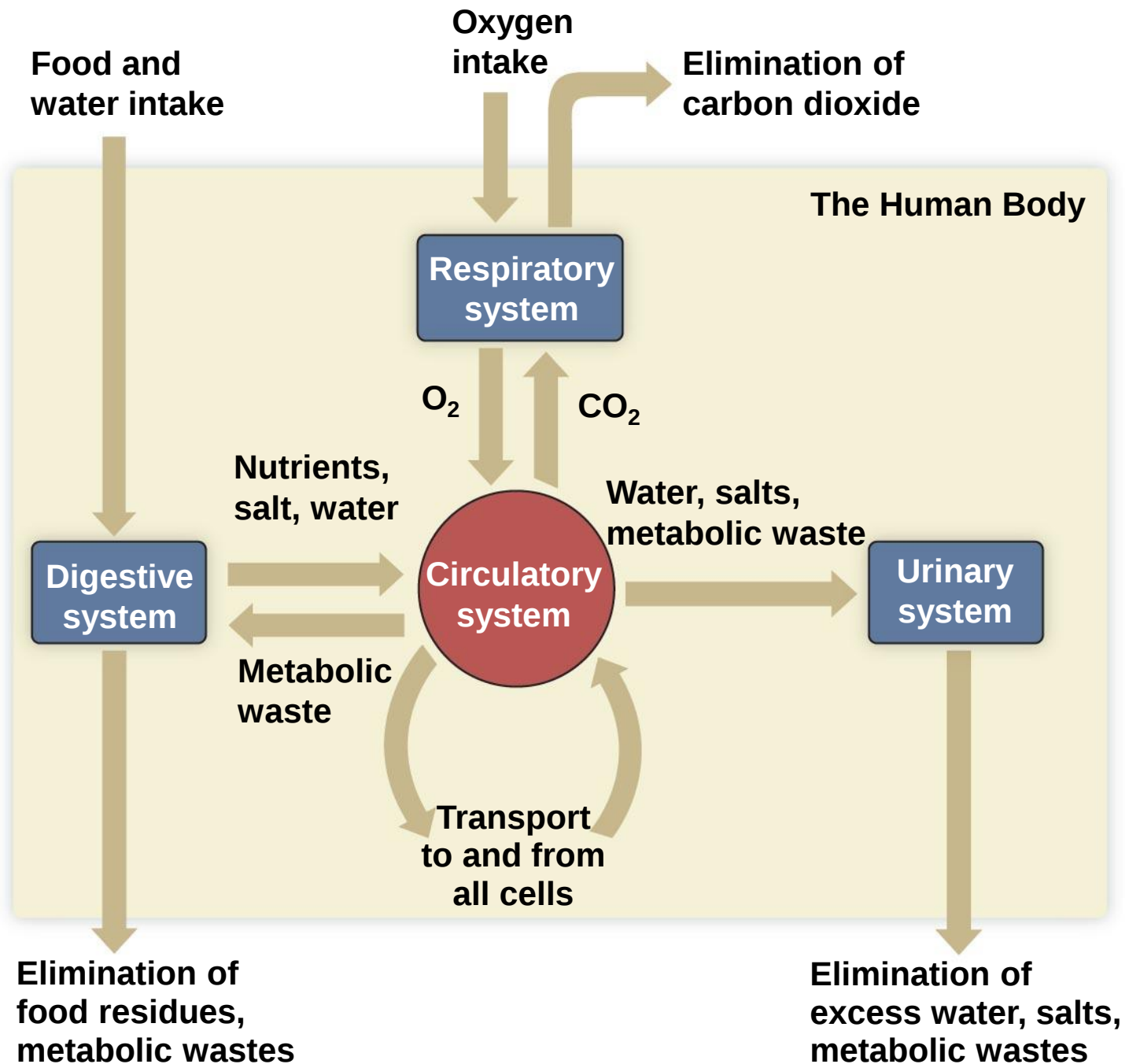


Blood



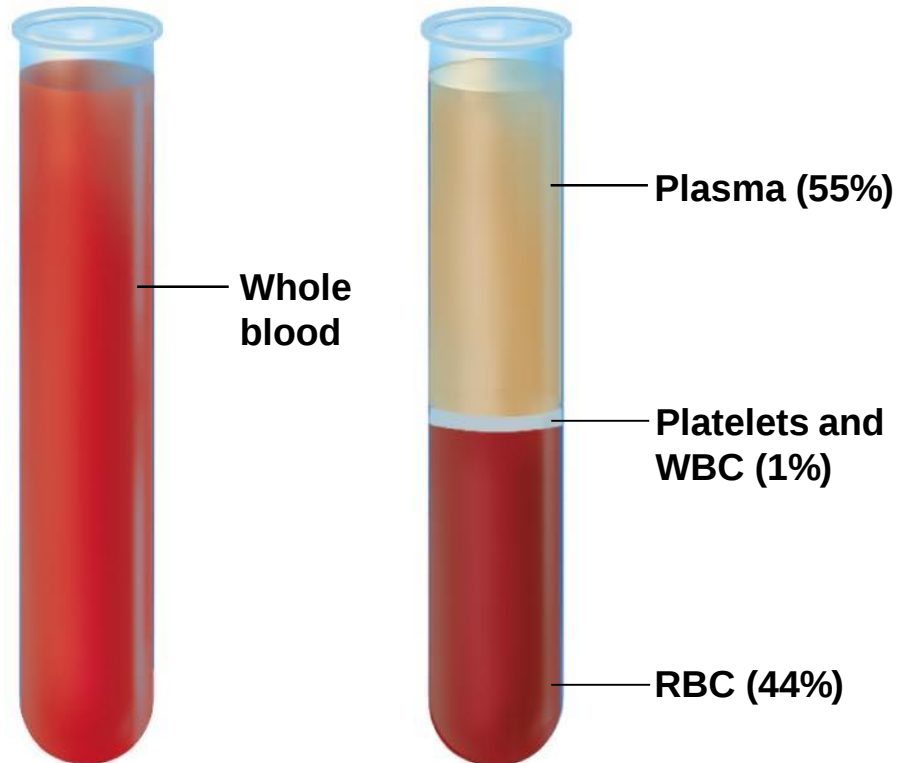


Three Primary Functions of the Blood

- Transportation
 - Nutrients, waste, hormones
- Regulation
 - Temperature, water volume, pH
- Defense
 - Against infections and bleeding

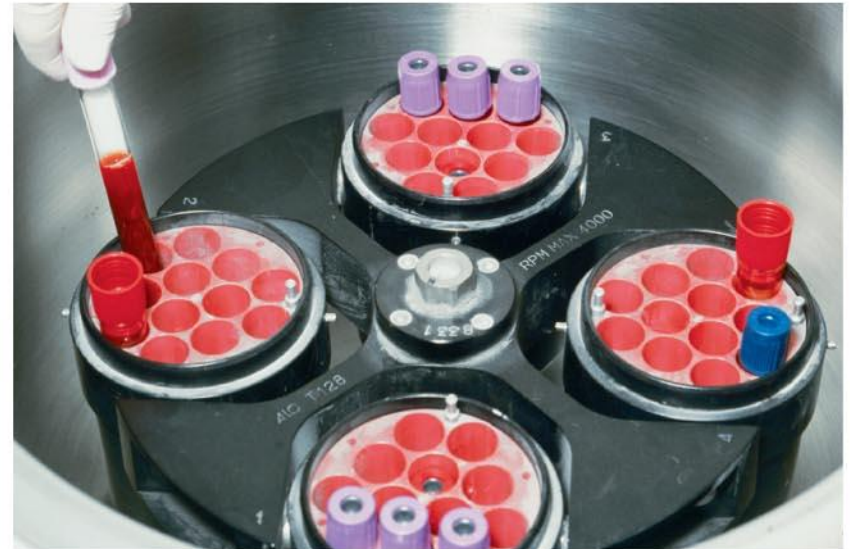
The Components of Blood

- Plasma (55%)
 - Water
 - Electrolytes
 - Proteins (albumins, globulins, clotting proteins)
 - Hormones
 - Gases
 - Nutrients and wastes
- Formed elements (45%)
 - Red Blood Cells - RBCs - (Erythrocytes)
 - White Blood Cells - WBCs - (Leukocytes)
 - Platelets (Thrombocytes)



a) Whole blood.

b) Blood after being spun in centrifuge.

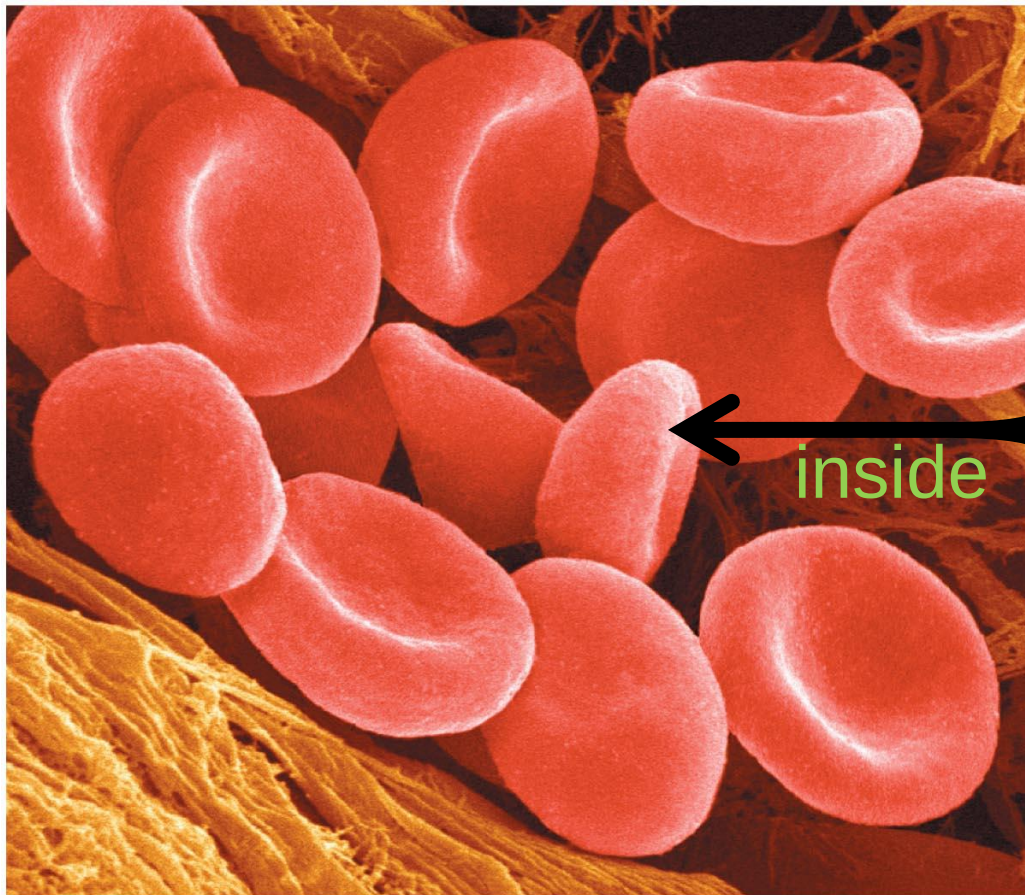


c) A table-top centrifuge.

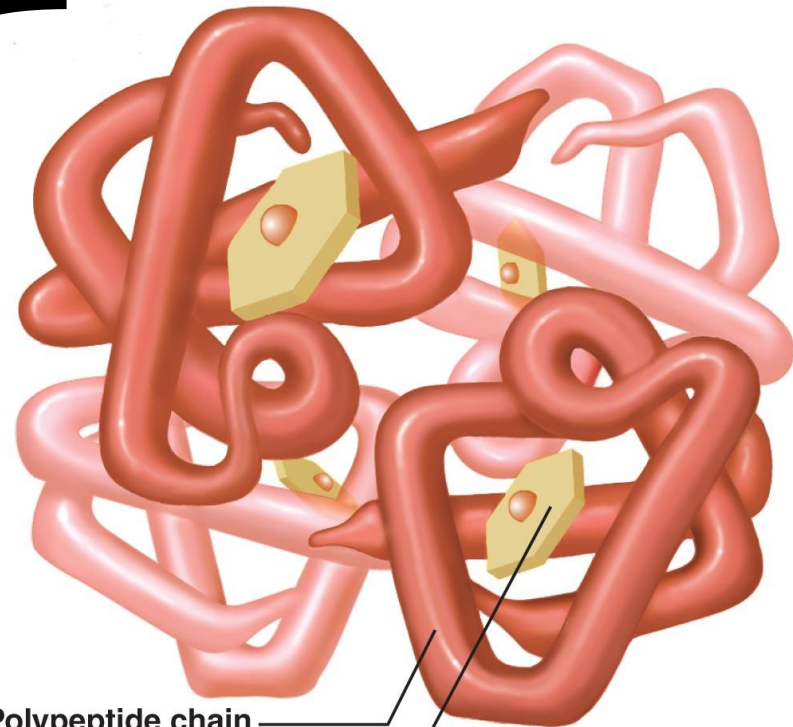
- Centrifuge – spins at very high speed & causes particles to separate by mass (weight)

Red Blood Cells

- Functions
 - transport oxygen and carbon dioxide



← inside

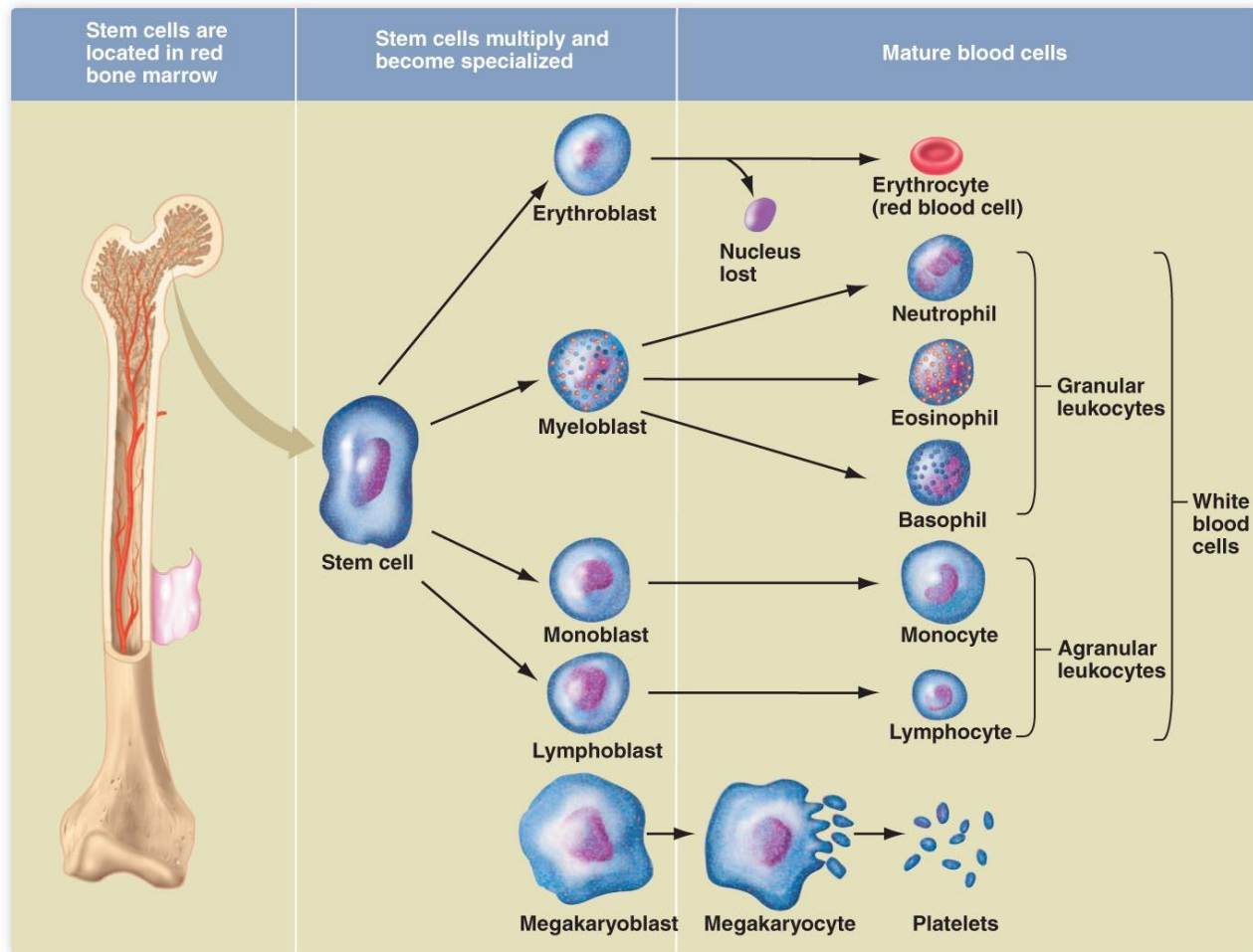


Polypeptide chain

Heme group with
iron atom

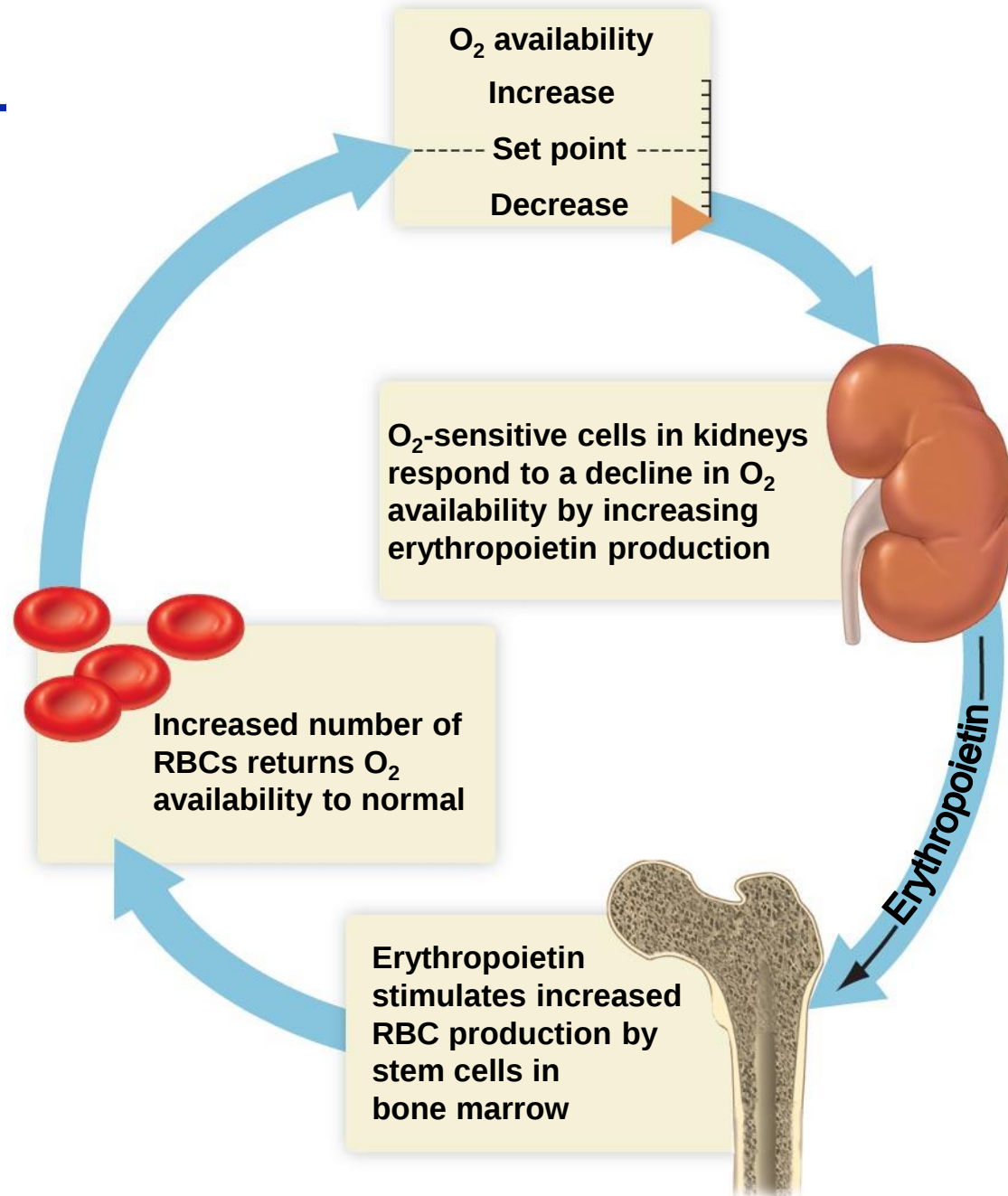
Red Blood Cells

- Origin
 - stem cells in the bone marrow



Red Blood Cells

- Life span
 - ~120 days in humans
- Control of production
 - Erythropoietin (hormone from kidneys)



White Blood Cells

- Functions
 - Protection from infection
 - Regulation of the inflammatory reaction
- Two Types
 - Granular
 - neutrophils, eosinophils, and basophils
 - Agranular
 - lymphocytes and monocytes

Granular Leukocytes

- **Neutrophils**

- Most common of WBCs
- First on the scene to fight infection by engulfing microorganisms (especially bacteria)

- **Eosinophils**

- Defend against large parasites (worms)
- Reduce severity of allergic reactions

- **Basophils**

- Rarest of WBCs
- Histamine in granules – role in inflammation

Agranular Leukocytes

- **Monocytes**

- Leave the blood and transform into macrophages
 - Macrophages – eat particles / microorganisms

- **Lymphocytes**

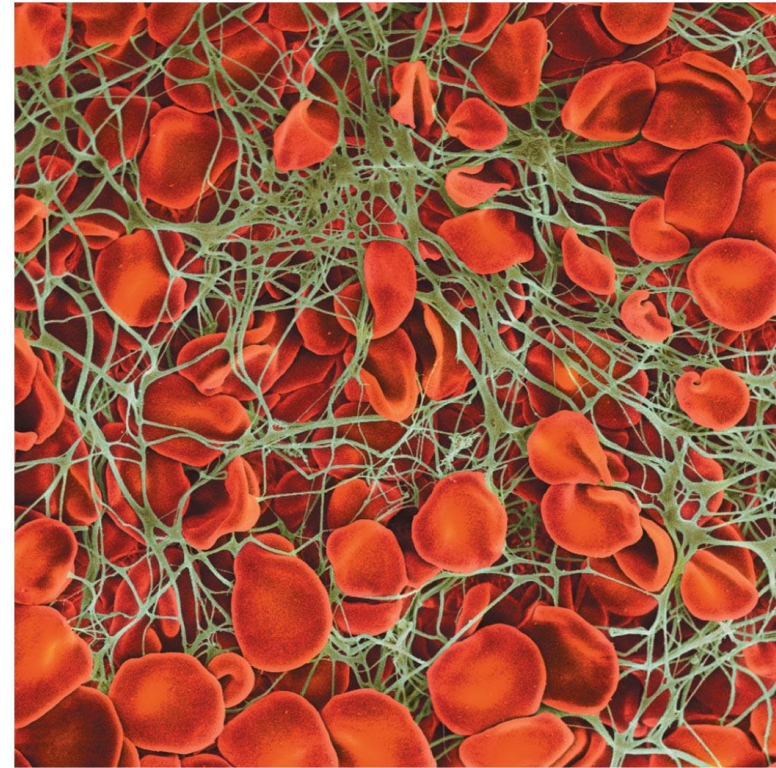
- Play a large role in the immune response
- Two types
 - B lymphocytes – eventually lead to antibodies
 - T lymphocytes – coordinate immune response

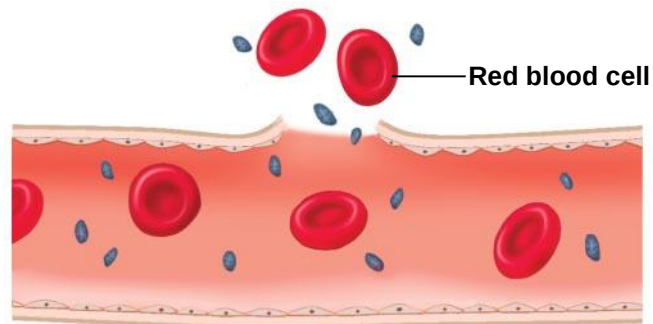
Platelets

- Small cell fragments derived from megakaryocytes
- Important role in hemostasis (blood clotting)

Hemostasis

- Three stages
 - Vascular spasm
 - constriction of blood vessels to reduce blood flow
 - Platelet plug formation
 - sealing of the ruptured blood vessel
 - Coagulation
 - formation of a blood clot through series of reactions

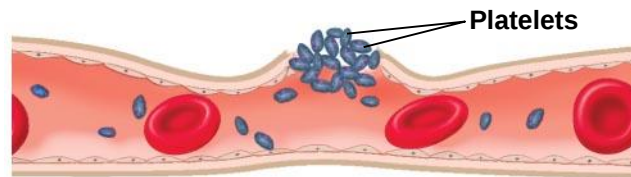




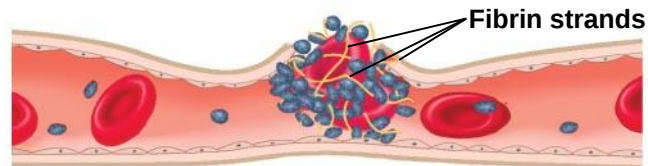
- 1 **Vessel injury.** Damage to a blood vessel exposes the vessel muscle layers and the tissues to blood.



- 2 **Vascular spasm.** The blood vessel contracts, reducing blood flow.



- 3 **Platelet plug formation.** Platelets adhere to each other and to the damaged vessel.



- 4 **Clot formation.** Soluble fibrinogen forms an insoluble mesh of fibrin, trapping RBCs and platelets.

Bleeding Disorder

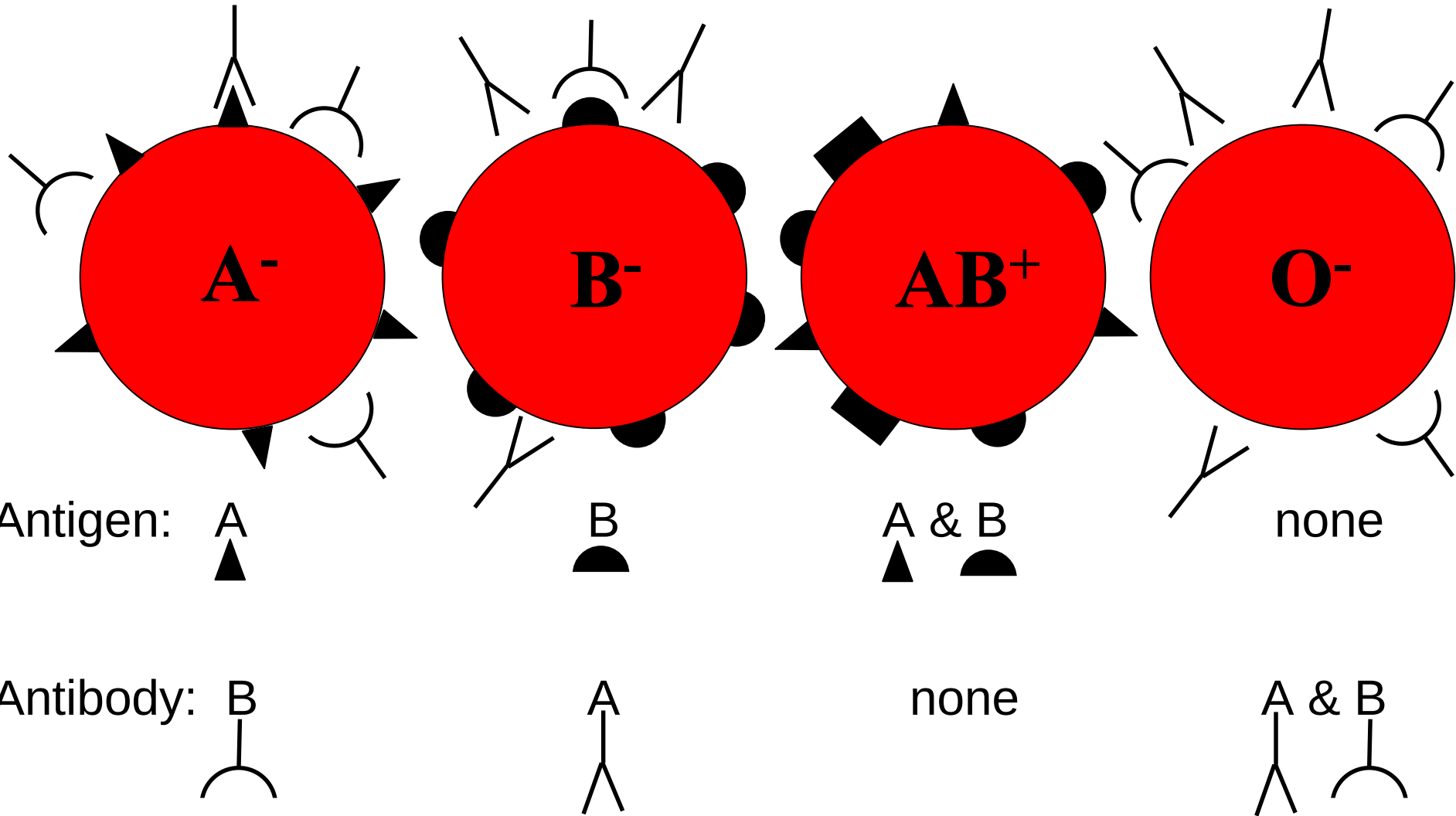
- Hemophilia
 - Genetic disorder
 - Missing one or more of clotting factors



Blood Typing Concepts

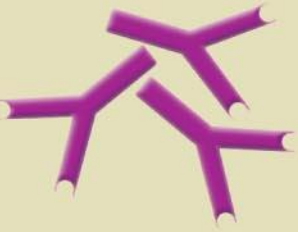
- Antigen vs. antibody
 - A and B antigens
 - surface markers on red blood cells
 - Antibodies
 - immune system protein, detects antigens
- ABO system
- Rh system
 - Give + / - blood

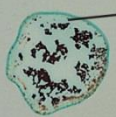
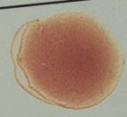
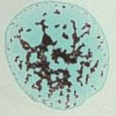
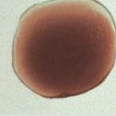
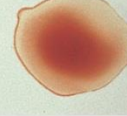
Blood Typing



Red blood cells

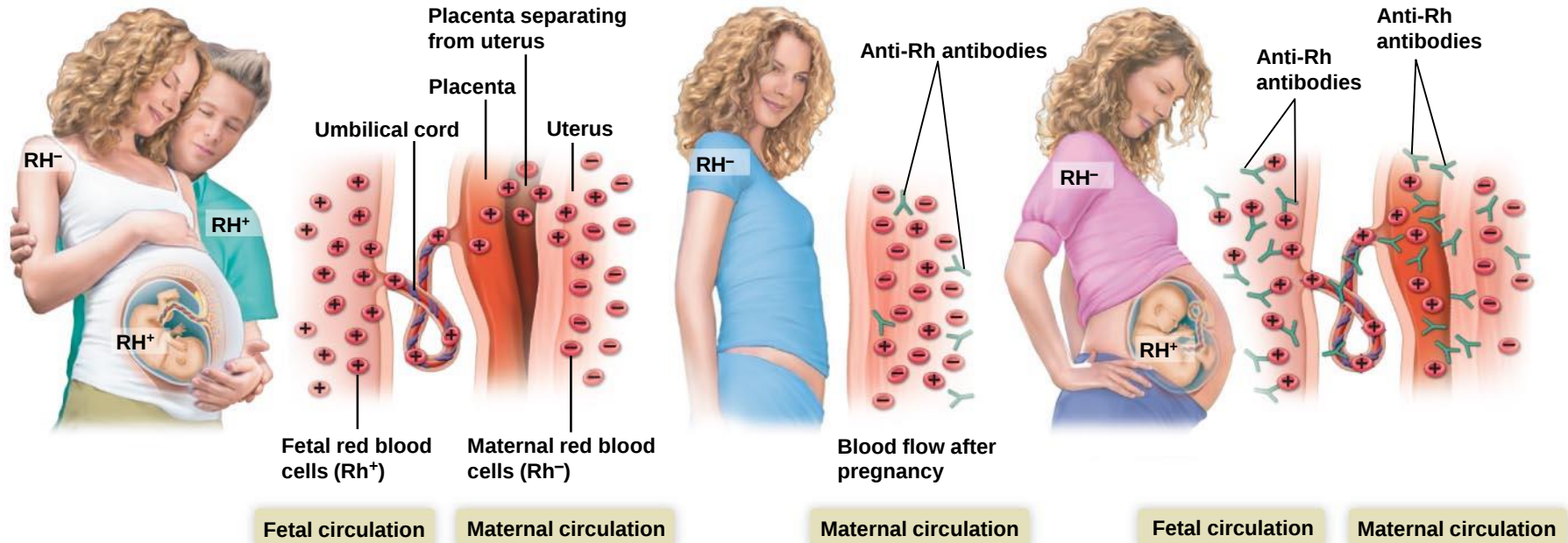
Plasma antibodies

Type A	Type B	Type AB	Type O
Antigen A 	Antigen B 	Antigens A and B 	Neither A nor B antigens 
 B	 A	Neither A nor B	 A and B

Blood being tested	Antibodies	
	Anti-A	Anti-B
Type A (Contains antigen A)		
Type B (Contains antigen B)		
Type AB (Contains antigens A and B)		
Type O (Contains neither A nor B antigens)		

Agglutinated blood

Hemolytic Disease of the Newborn



a) When an Rh positive man fathers a child by an Rh negative woman, the fetus may inherit the Rh positive antigen.

b) During pregnancy or more commonly at childbirth, a small amount of fetal blood enters the mother's circulation.

c) Over the next several weeks the woman develops antibodies and an immune memory against the Rh antigen.

d) When the woman becomes pregnant with her second Rh positive child, her immune system quickly produces antibodies that attack the fetus' red blood cells.

Blood Disorders – Red Blood Cells

- **Anemia**

- reduction in oxygen-carrying capacity due to inadequate number of red blood cells or inadequate hemoglobin
 - **Iron-deficiency anemia:** caused by inadequate intake or malabsorption of dietary iron
 - **Hemorrhagic anemia:** caused by blood loss
 - **Pernicious anemia:** caused by Vitamin B12 deficiency
 - **Hemolytic anemia:** caused by destruction of red blood cells

Blood Disorders – White Blood Cells

- **Leukemia**
 - Forms of cancer due to proliferation of white blood cells
- **Mononucleosis**
 - Contagious Epstein-Barr virus infection of lymphocytes

Blood Disorders

- **Septicemia** (blood poisoning)
 - Bacteria proliferating in blood, overwhelming body's defenses
- **Thrombocytopenia**
 - Reduction in platelet number
 - Unusual bruising and bleeding