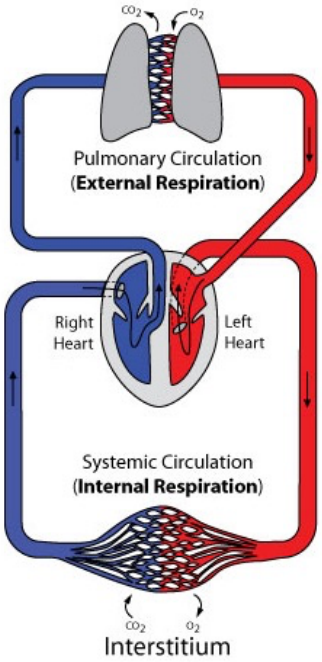
THE CARDIOVASCULAR SYSTEM: THE BLOOD



1. Introduction

   A. Blood and Circulation

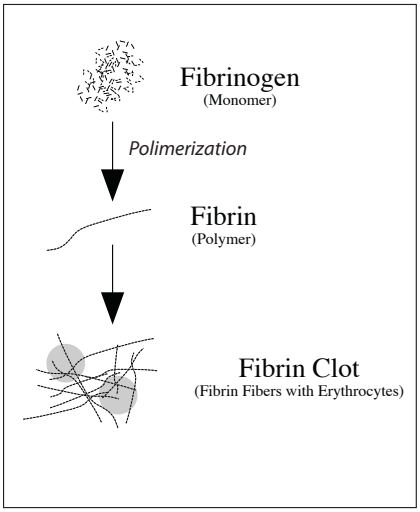
   B. Connective Tissue

      i. Fibrous Elements

         - Fibrinogen
         - Fibrin

      ii. Matrix

         - Formed Elements
         - Plasma



2. Functions of Blood

   A. Transport

      i. Gases and Nutrients

      ii. Waste Products

         - CO_2 → Lungs
         - Metabolic Wastes (ie., Urea) → Kidneys

      iii. Hormones

B. Regulates

i. Blood Clotting

ii. Body Temperature

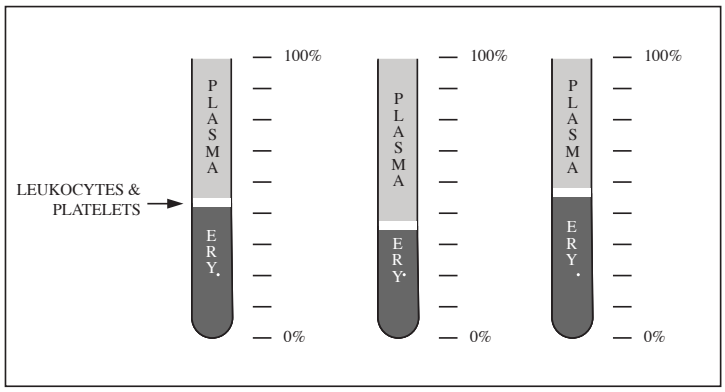
iii. pH (See Buffer System and Video)

iv. Water and Electrolyte Balance/Concentration

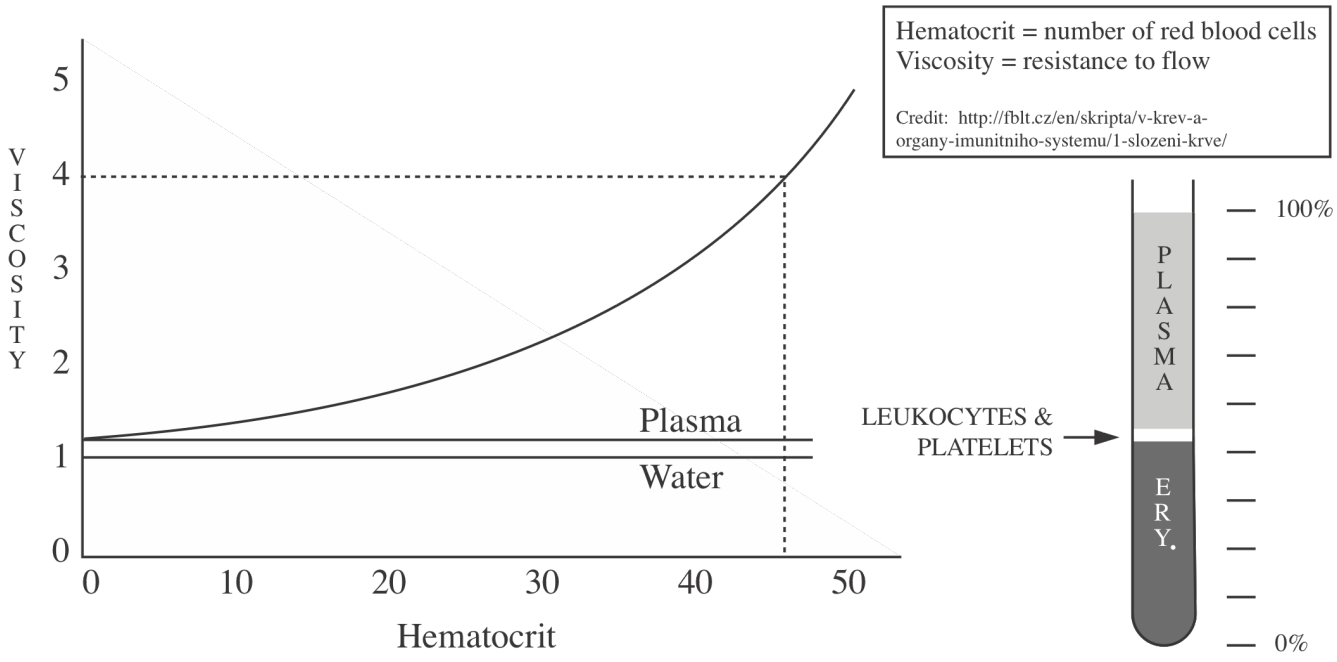
C. Protection (Leukocytes "White Blood Cells" will be examined when we do the immune system)

3. Properties of Blood

- Hematocrit →



A. Viscosity



B. Coloration

i. Oxygenated Hemoglobin

ii. Deoxygenated Hemoglobin

iii. Plasma

iv. Platelets and White Blood Cells

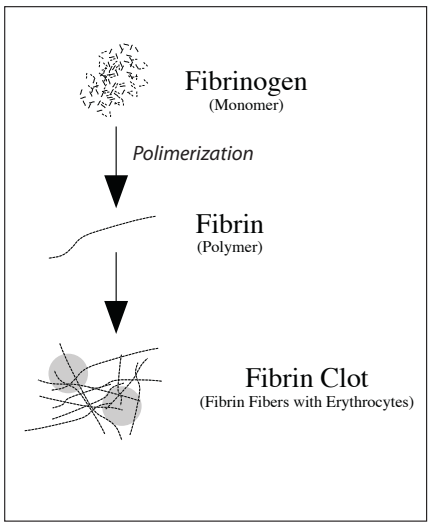
C. pH – 7.35 to 7.45

4. Blood Components

A. Plasma

i. Water

ii. Proteins



a. Albumins (See fluid Movement Handout and Video)

- Osmosis and Edema

b. Fibrinogen

- Serum

c. Globulins

- Major Histocompatibility Complex (MHC)
- Antigens
- Antigen-antibody complex
- Immunoglobulins (Antibodies)

* IgM
* IgG
* IgA
* IgE
* IgD

iii. Electrolytes

a. Sodium and potassium in water balance ***(see handout and video)***

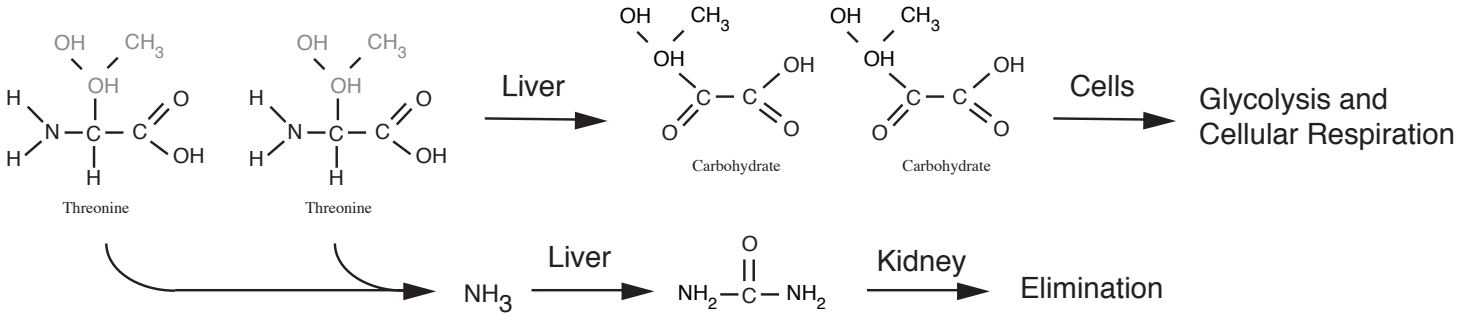
iv. Nutrients and Waste Products

a. Glucose (70 – 110 mg/dl)

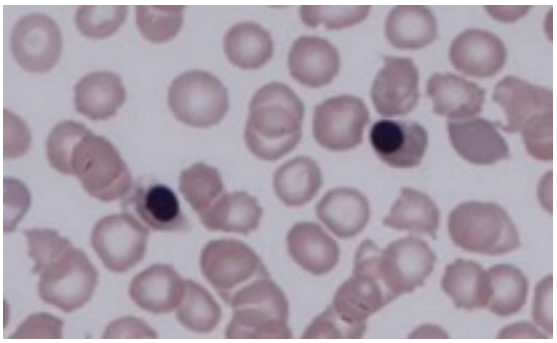
- Review Glycolysis and Cellular Respiration

b. Metabolic Wastes

- Deamination (Removal of Amino Group, - NH_2)

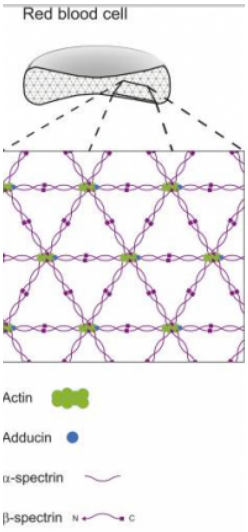


v. Gases and Buffers (See Buffer System Handout and Video)



5. Hematopoiesis – see Handout

6. Red Blood Cells (Erythrocytes)



- Spectrin

A. Hemoglobin (Hb)

i. Globin

ii. Heme

iii. Iron

In the video, some incorrect numbers are given, the correct are: Each RBC has ~250 million hemoglobin molecules Each Hemoglobin molecule can carry 4 O2 molecules each Therefore, each RBC can carry ~1 billion oxygen molecules

iv. Transport of Oxygen in Blood

a. Oxyhemoglobin (HbO_2)

b. Fetal Hemoglobin (HbF)

v. Carbon Dioxide Transport (60%) ***(SEE Downloadable Handout!!)***

a. 10% Dissolved in plasma

b. 30% as Carbaminohemoglobin

* $HbCO_2$

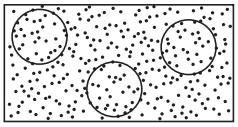
c. 60% as Bicarbonate Ions

- Chloride Shift

B. Erythrocyte Membranes and Solutes

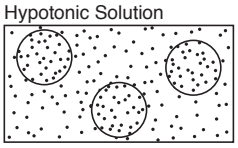
i. Flexibility

- Spectrin



ii. Effect of Solute Concentrations ***(See downloadable handout)***

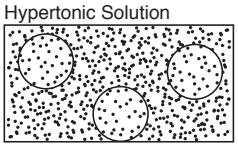
- Osmosis



a. Isotonic

b. Hypertonic

- Crenation



c. Hypotonic

i. Development Phases (See Handout)

a. Ribosome Production

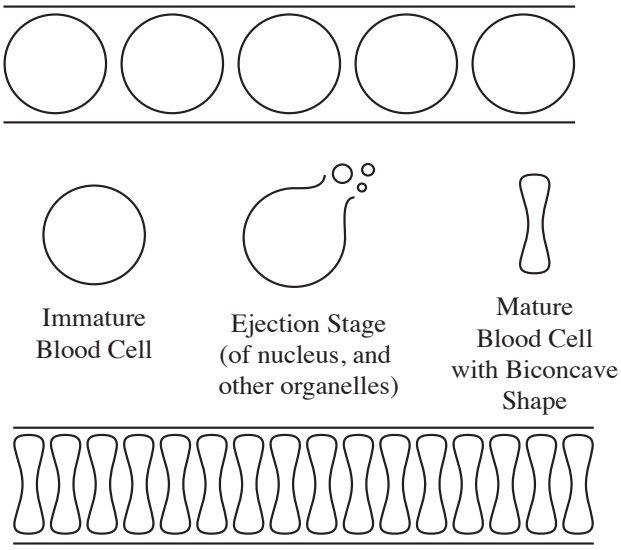
b. Hemoglobin Synthesis

c. Ejection Stage

ii. Biconcave Shape

Biconcave Shape

and the Increase in the
Gas Transport Surface Area



Note that both an immature and a mature red blood cell membrane will have the same surface area, although the mature red blood cells will have less cytoplasm.

It is the cell membrane through which the gasses O2 and CO2 will pass.

Therefore, when the red blood cells are stacked (called a Roule-aux), this will significantly increase the surface area for gas exchange.

iii, Anaerobic Metabolism (See handout)

D. Regulation (SEE handout – learn cycle!)

a. Erythropoietin

E. Erythrocyte Destruction and Removal

i. Longevity (80-120 days)

ii. Phagocytosis

- Macrophages

a. Hemoglobin **(See Handout)**

- Heme → Biliverdin → Bilirubin
- Bile

b. Iron ***(See Handout on Iron Transport)***

- Ferritin
- Transferrin

Important Note: Leukocytes is are an important group of formed elements that are critical in fighting infection! We will cover these when we begin the immune system.

7. Hemostasis: The Prevention of Blood Loss

* ***See Handout on Hemostasis***

A. Vasoconstrictive Phase

B. Platelet Phase

- Platelet Aggregation

C. Coagulation Phase (note cascade of reactions)

- Antihemophilic Factor
- Thromboplastinogenase

Extrinsic and Intrinsic Pathways

A. Extrinsic Pathway

B. Intrinsic Pathway

Common Pathways