Unit #3: Transportation and Respiration

“Blood”
Composition of Whole Blood

Blood Plasma ~55% of Total Blood Volume
Composed of 90% Water, 8% Plasma Proteins and 2% Dissolved Solutes and Ions

Buffy Coat ~1% of Total Blood Volume
Contains White Blood Cells (WBC's) and Thrombocytes (Platelets)

Erythrocytes ~45% of Total Blood Volume
Red Blood Cells (RBC's)

Hematocrit – The Percentage of Whole Blood made up of Red Blood Cells
Blood Plasma

• The Non-Cellular Component of Blood

3 Parts:

(1) **Water**
• Water makes up 90% of Blood Plasma
• provides water for cells
• plays a role in thermoregulation and in regulating blood pressure

(2) **Ions**
• 2% of Blood Plasma is made of Ions released from salts and organic acids
(3) **Plasma Proteins**

- 8% of Blood Plasma is made up of the following proteins:
  
  i. **Serum Albumin** – used to maintain osmotic balance and pH buffering
  
  ii. **Fibrin and Thrombin** – used for clotting
  
  iii. **ImmunoGlobulins** – Antibodies involved in Immune responses
  
  iv. **α-Globulins** – transport hormones, lipids and fat soluble vitamins
  
  v. **β-Globulins** – transport iron, cholesterol and fat soluble vitamins
Erythrocytes

- More commonly known as **Red Blood Cells (RBC’s)**
- Membrane bound sacs filled with Hemoglobin which is used to transport Oxygen Gas
- Not true cells
- Do not contain a Nucleus or any Organelles
<table>
<thead>
<tr>
<th>Buffy Coat</th>
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<tbody>
<tr>
<td>Thrombocytes (Platelets)</td>
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- This small component of blood contains **White Blood Cells (WBC’s)** which are used by our Immune System to fight off pathogens and **Thrombocytes (Platelets)** that are used to repair blood vessels and to form blood clots

- Tiny cell fragments
- **Used for blood clotting**
- About 300000 platelets per mm$^3$ of blood
White Blood Cells (WBC's)

• There are 2 classes of White Blood Cells

1. Leukocytes (5 Types)
   • These WBC’s are used in the body’s **Inflammatory Response** which is a general response to pathogens

2. Lymphocytes (3 Types)
   • These WBC’s are used in the body’s **Immune Response** which is a response to a specific pathogen
Blood Typing

1. ABO Blood Typing

• Blood Cells are “typed” based on the Antigen that they carry

• **Antigens** are glycoproteins (ID Tags) that are identified by other body cells as “Familiar” or “Foreign”.

• There are two Blood Typing Methods:

  • Blood is “Typed” by the presence of **Antigen A** and **Antigen B**

  • **Type A Blood** – contains **Antigen A**

  • **Type B Blood** – contains **Antigen B**

  • **Type AB Blood** – contains **BOTH** Antigen A and B

  • **Type O Blood** – DOES NOT contain **Antigen A or B**
• An Antibody is a molecule produced by a body’s immune system that is used to identify foreign Antigens

• When an Antibody encounters a foreign antigen it reacts by causing coagulation (clumping)

• A body with Type A Blood produces Antibody B (attacks Antigen B)

• A body with Type B Blood produces Antibody A (attacks Antigen A)

• A body with Type AB Blood produces NO ANTIBODIES

• A body with Type O Blood produces BOTH Antibody A and Antibody B
2. Rh Factor

- Blood is also “typed” by the presence of the **Rhesus Factor (Rh Factor)** also known as **Antigen D**

- **A Positive Blood Type** (Rh+ or +) contains **Antigen D**

- **A Negative Blood Type** (Rh+ or +) **DOES NOT** contain **Antigen D**

Further:

- A body with a **Positive Blood Type** **WILL NOT** produce any additional Antibodies

- A body with a **Negative Blood Type** will produce **Antibody D** (attacks Antigen D)
• Rh + blood will ACCEPT Rh – blood

• Rh – blood will REJECT Rh + blood

• This becomes important in pregnancy

• IF a Mother has one Rh factor and the baby does not, the 1st pregnancy is OK BUT the 2nd pregnancy will most likely be complicated because the mother will have produced antibodies against the baby.

• This condition is called Eristoblastosis Fetalis

• If this occurs, the baby will be Jaundiced and will have lots of immature red blood cells that can’t carry Oxygen