

P.L.E.P: Parts of Blood

Activity 1A

Activity Objectives:

Students will be able to:

- ▼ Work in a collaborative group to complete a given task
- ▼ Examine the different parts of blood
- ▼ Identify the parts of blood and construct a model of human blood
- ▼ Present their models to the class

Activity Description:

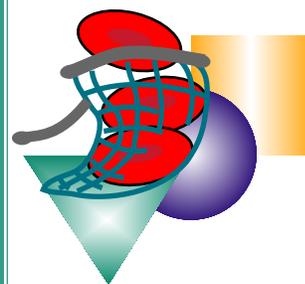
By performing this activity, students will determine the various components of blood and their functions. Students will construct simulated blood and examine its physical characteristics including density.

Activity Background:

Blood has been called our most precious commodity. Without this life sustaining substance, oxygen would not be circulated throughout the body, waste products could not be removed, and our infection fighting abilities would be lost. While the importance of blood has been known for centuries, it was not until 1658, when Jan Swammerdam first discovered red blood cells, that its composition was finally revealed.

Blood is comprised of four main parts which include *Plasma*, *Leukocytes* (white blood cells), *Erythrocytes* (red blood cells), and *Platelets* (thrombocytes).

- **Plasma** is a pale yellowish colored liquid that carries blood cells, glucose, hormones, nutrients, enzymes, and waste products. Plasma is comprised of approximately 90% water. It accounts for a total of 55% of blood's total composition.
- **Leukocytes** are also known as white blood cells, and they make up 1% of blood's composition. These cells are responsible for fighting infection in the body. There are three types of leukocytes and each have a distinct function. These types are *lymphocytes*, *granulocytes*, and *monocytes*.
- **Lymphocytes** primarily aid the immune system. There are two different kinds of lymphocytes which are T cells and B lymphocytes.
 - **T cells** direct the immune system to fend off infection.
 - **B lymphocytes** produce antibodies.



Activity Overview



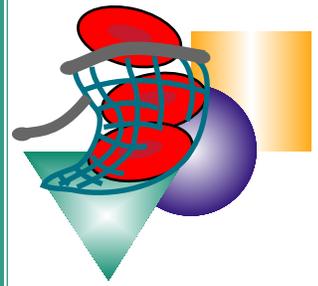
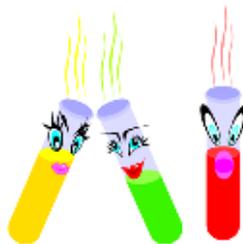
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- **Granulocytes** carry digestive enzymes. The three types are neutrophils, eosinophils, and basophils.
 - **Neutrophils** are responsible for killing bacteria.
 - **Eosinophils** destroy various parasites and are involved in allergic responses.
 - **Basophils** are capable of digesting micro-organisms. These cells are responsible for allergy symptoms.
- **Monocytes** are the largest of the various white blood cells. These cells can transform into macrophages, which kill bacteria and are capable of digesting damaged cells.
- **Erythrocytes** are also known as red blood cells; they are flat, disc-shaped cells that comprise 45% of blood's composition. These cells derive their red color from hemoglobin, an iron-containing protein that allows the cells to transport oxygen from the lungs to all parts of the body. The proportion of blood consisting of packed red blood cells is called *hematocrit*, which is written as a percentage by volume. For example, a hematocrit of 50 % means that there are 50 mL of red blood cells in 100 mL of blood.
- **Platelets** (*thrombocytes*), play a significant role in blood clotting. These cell fragments have a sticky surface which allows them to bind together with fibrin molecules to form a clot.



Activity Materials: (per group)

- Simulated Blood Samples made as directed below from:
 - 1% milk
 - Vegetable oil
 - Red food coloring
 - Blue Food Coloring
- 20 mL Sample A Simulated Blood
- 20 mL Sample B Simulated Blood
- 20 mL Sample C Simulated Blood
- 3 Test tubes
- 3 Test tube stoppers
- 1 Test tube rack
- 1 Plastic soda bottle
- 2 m Strong String
- 1 Pair Scissors
- Safety Goggles for each student
- 1 Copy *Student Information Page*
- 1 Copy *Student Data Page* (per student)



Activity Overview Continued



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Cast Your Net: Adventures With Blood

Teachers will need to make the following “blood” samples:
 For a class of 24 students (6 groups of 4), you will need 150mL of each blood sample. Each group will need 20 mL of each sample.

Sample A (Normal Blood): Mix 67.5 mL of 1% milk with 82.5 mL of oil. Add several drops of red food coloring and one drop of blue food coloring to simulate blood.

Sample B (Low Hematocrit Blood [anemia]): Mix 45 mL of 1% milk with 105 mL of oil. Add red and blue food coloring.

Sample C (Elevated Hematocrit Blood [polycythemia vera]): Mix 105 mL of 1% milk with 45 mL of oil. Add red and blue food coloring.

Hematocrit Values

Normal Hematocrit (%)		Low Hematocrit (%)		High Hematocrit (%)	
Male	Female	Male	Female	Male	Female
42–54	35–46	<42	<35	>54	>46

** Be sure to shake or stir the simulated blood well before allowing the students to remove their samples.

As shown in Figure 1, teachers will also need to make one student “centrifuge” per group. These can be reused for all classes.

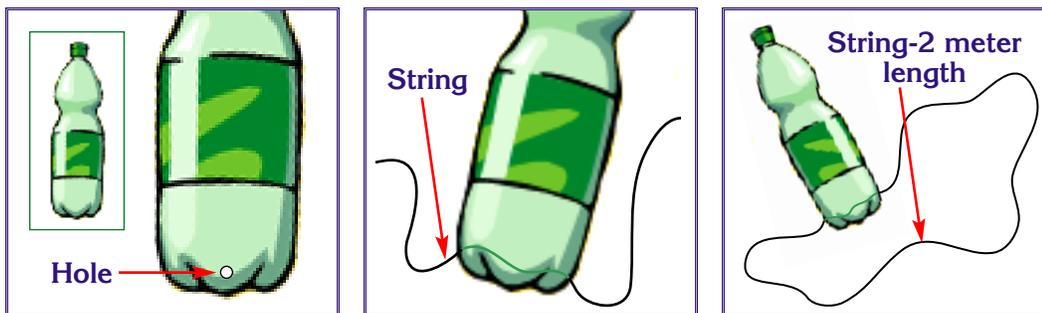
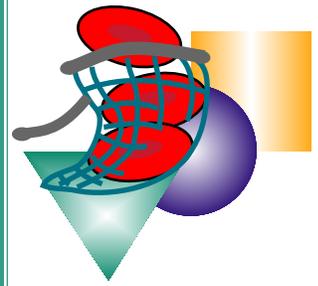


Figure 1 Making A Centrifuge

Take one plastic soda bottle (16 ounces) and make a hole on each side of the bottom of the bottle. Thread a 2 meter length of strong string through the holes and tie a knot in the string. Students will put the stoppered test tube containing their blood sample into the bottle by removing the cap. Students will replace the cap and use the string to swing the bottle over their heads for one minute. They will then carefully remove the test tube from the centrifuge and place in a test tube holder and allow it to settle overnight. The centrifugal force of the centrifuge will start the process of settling the blood into layers. Students should be able to see a thin layer of “plasma” in their test tubes after using the centrifuge.



Activity Overview Continued



Activity Management Suggestions: Modifications:

For students needing more assistance:

Group these students with peers who can assist them during the activity. Check often for understanding.

For highly able students:

Allow these students to do research on the parts of blood and their functions. Students may also be grouped with other students to provide peer assistance.

Extensions:

Students can research disorders involving the blood cells and platelets.

Activity References Used:

Anemia Website

<http://www.anemia.org/patients/faq/>

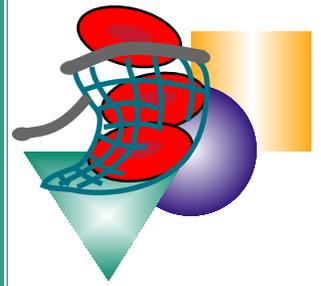
Medline Plus website:

<http://www.nlm.nih.gov/medlineplus/ency/article/001303.htm>

National Heart Lung and Blood Institute Website

<http://www.nhlbi.nih.gov/>

Sklar, A.H. (1998). Effects of normal as compared with low hematocrit values in patients with cardiac disease undergoing hemodialysis and receiving epoetin. *The New England Journal of Medicine*, 339, 2023-2034.



Activity Overview Continued



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Cast Your Net: Adventures With Blood