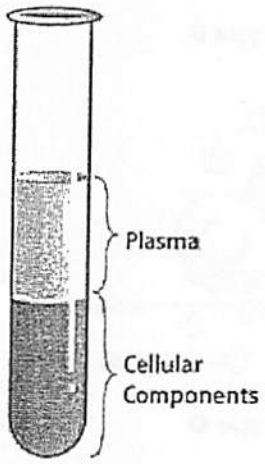
ABO-Rh Blood Typing Using Neo/BLOOD

Objectives

- *Determine* the ABO and Rh blood type of unknown simulated blood samples.
- *Prepare* a simulated blood smear.
- *Examine* a prepared blood smear under the microscope to locate and identify red blood cells, white blood cells, and platelets.
- *Estimate* the number of simulated red blood cells in a given area.

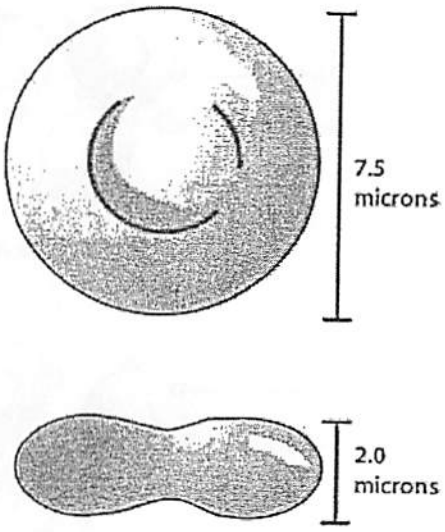
Background

Blood is a tissue comprised of four components: plasma, red and white blood cells, and platelets. Plasma is a clear straw-colored liquid portion that makes up 55% of the blood. It is composed of a mixture of water, sugar, fat, protein, and various salts. In addition, plasma contains a number of blood-clotting chemicals that help to stop bleeding.



Red and white blood cells and platelets make up the remaining 45% of the blood. Red blood cells or "erythrocytes" are tiny biconcave disks. Each red blood cell contains the oxygen-binding protein, hemoglobin. Hemoglobin contains four iron ions which bind with oxygen (O_2) and carbon dioxide (CO_2).

The shape of a red blood cell provides a greater surface area through which gases can diffuse and bind to the iron groups. The average normal red blood cell is about 7.5µm in diameter and 2µm in thickness.



Red Blood Cell

WARNING — This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

ACTIVITY 1

Determining the ABO-Rh Blood Type of Simulated Blood Samples

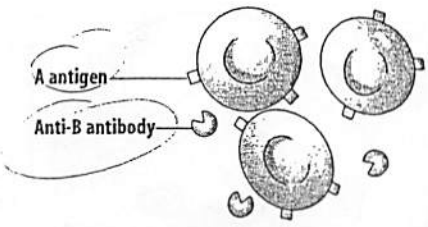
Surface proteins on red blood cells determine an individual's blood type. These surface proteins are called "antigens."

The system used to classify human blood is called the "ABO system." Dr. Karl Landsteiner, an Austrian physician, received the Nobel Prize in physiology for this discovery in 1930.

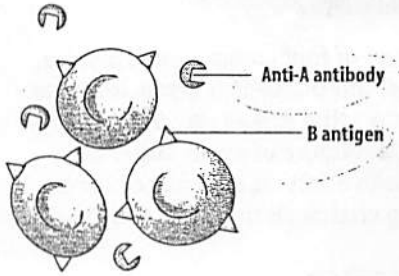
With the ABO system, the kinds of antigens present on red blood cells determines the blood type. An individual with A antigens has blood type A, one with B antigens has blood type B, one with both A and B antigens has blood type AB, and one with no antigens on the surface of his/her red blood cells has type O.

Blood plasma has circulating proteins called "antibodies". For example, individuals with A surface antigen have anti-B antibodies; those with B surface antigen have anti-A antibodies. Those with both A and B surface antigens have no antibodies. Individuals with no surface antigens have both anti-A and anti-B antibodies.

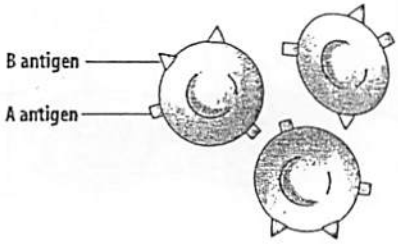
Blood typing is performed using "antiserum" - blood that contains specific antibodies. "Anti-A Serum," which contains anti-A antibodies, and "Anti-B Serum," which contains anti-B antibodies, are used in ABO blood typing.



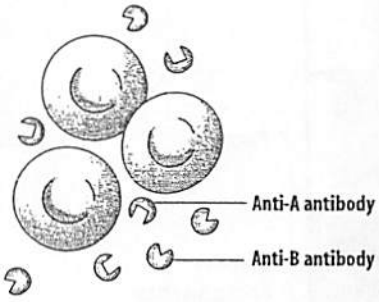
Blood Type A



Blood Type B



Blood Type AB



Blood Type O

To perform a blood typing test, anti-A and anti-B sera are each separately mixed with a drop of sample blood and observed for "agglutination" or clumping.

Another important antigen on the surface of red blood cells is the Rh protein, named for the rhesus monkey in which it was first studied.

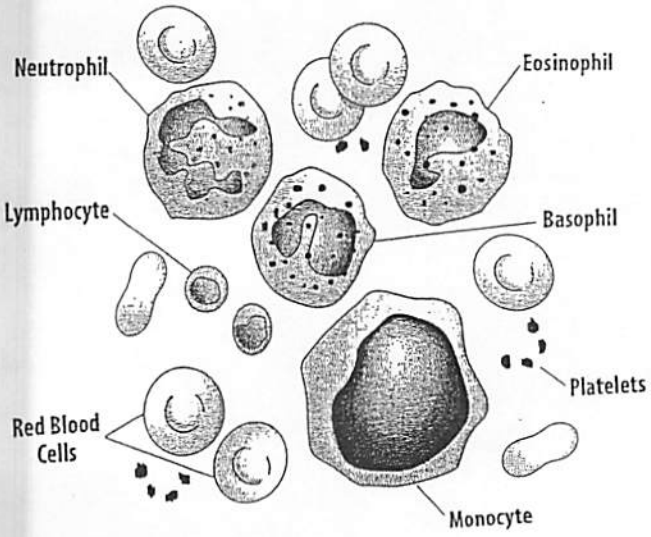
People who have this protein are "Rh-positive," and those who lack it are "Rh-negative."

Rh-negative individuals who have been transfused with Rh-positive blood can produce Rh antibodies. They may develop a transfusion reaction, during which agglutination may occur, if they are transfused again with Rh-positive blood. Usually Rh compatibility is tested when the ABO blood type is determined.

Taking a Closer Look at Blood

Physicians and other health care professionals regularly examine blood under the microscope to identify infections, blood cell abnormalities and to count the various types of cells.

The cells of the blood are of two classes: red blood cells (RBCs), or erythrocytes; white blood cells (WBCs), or leukocytes, which in turn are of many different types. Platelets, or thrombocytes, are also present as are cell fragments.



Red Blood Cells (RBCs)

The red blood cells are tiny, round, biconcave disks, without nuclei, that average about 7.5 microns (0.003 in) in diameter. Red blood cells, as well as most white cells and platelets, are made by the bone marrow. The main function of the red blood cells is to transport oxygen from the lungs to the tissues. A healthy 70-kg (154-lb) man has about 5 L (5.3 qt) of blood in his body, containing more than 25 trillion RBCs. The normal life span of RBCs in the circulation is only about 120 days. Worn out RBCs are removed by the spleen and liver where hemoglobin is recycled.

A number of conditions can be diagnosed based upon the red blood cell count. A high RBC level, a condition called "erythrocytosis," can be caused by smoking, living at high altitudes, or by disease. Low red blood cell levels, a condition called "anemia," can be due to a loss of blood, loss of iron, a vitamin deficiency, or other disease conditions.

Data Table 6
Normal and Abnormal Red Blood Cell Counts

RED BLOOD CELLS		
	MALE	FEMALE
Normal (at birth)	5.1 million cells per µl	4.5 million cells per µl
Normal (adult)	5.4 million cells per µl	4.8 million cells per µl
Anemia (low RBC count)	< 4.5 million cells per µl	< 4 million cells per µl
Erythrocytosis (high RBC count)	> 6.8 million cells per µl	>6 million cells per µl

White Blood Cells (WBCs)

Leukocytes, or white blood cells, are considerably larger than red cells, have nuclei, and are much less numerous; only one or two exist for every 1,000 red blood cells, and this number increases in the presence of infection. There are three types of leukocytes, all involved in defending the body against foreign organisms: granulocytes, monocytes, and lymphocytes. There are three types of granulocytes: neutrophils (the most abundant), eosinophils, and basophils.

Platelets

Platelets (thrombocytes) are tiny bits of cytoplasm, much smaller than the red blood cells, which also lack nuclei. They are normally about 30 to 40 times more numerous than the white blood cells. They are produced as fragments of the cytoplasm of the giant cells of the bone marrow - the megakaryocytes. The platelets' primary function is to stop bleeding. When tissue is damaged, the platelets aggregate in clumps as part of the clotting process.