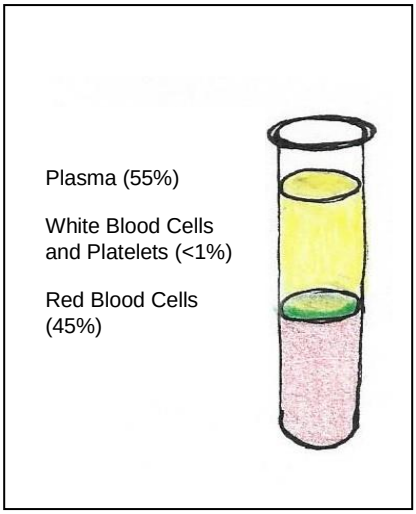
Investigation

3.4B: The Role of Blood

Now that we have used an examination of Ronald's **blood** to help us solve this investigation, let's look more deeply into what a laboratory can learn from a blood sample.



In addition to our examination findings, we asked our nurse to take a sample of blood from Ronald's arm. That blood sample was sent to a laboratory that specializes in analyzing **blood**. Technicians at the lab can look at the blood under a microscope and **estimate** the numbers of each of the types of blood cells in the specimen to gain information about how Ronald's body is reacting to his illness. Today, we also have the ability to analyze blood using computerized banks of sensors. How does that work, you ask?

By looking at the blood of thousands of 'normal' people, we have been able to learn what 'normal blood' looks like. We then **compare** 'normal' blood to the blood samples received from sick patients and see how they are different.

What types of cells are found in blood? First, there are three basic parts to blood:

1. **Plasma**
2. **White Blood Cells** & **Platelets**
3. **Red Blood Cells**

Each of the parts has a basic responsibility in our bodies. Blood can be separated into the three basic parts by spinning the samples in a **centrifuge**. Why do you think the blood parts separate by the process of spinning?

_____

Look at the blood specimen in the tube at the right.

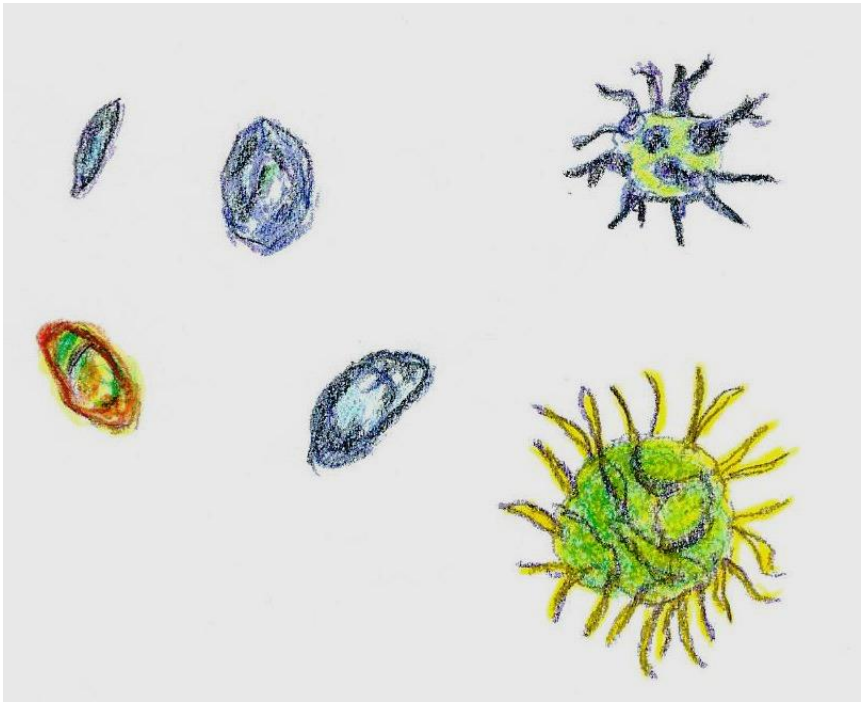
Notice there are three separate layers after blood is spun in a centrifuge.

So, what is the job of each?

Let's start with **plasma,** the top layer after spinning. Plasma is the liquid part of your blood. It acts as a delivery agent, allowing the solid parts of your blood (white cells, platelets, and red blood cells) to **suspend** within it as it travels to all parts of your body. Plasma is about 90% water and salts, but the other 10% is **protein.**
The protein adds density to the plasma and helps the cellular blood parts stay **suspended**. Plasma is yellowish in color. When we give patients additional plasma with a plasma **transfusion**, we must match the patient's and the plasma **donor**'s blood type to avoid an allergic response. Since the proteins play a key role along with platelets in stopping the bleeding from an injury to a blood vessel, we might give our patient plasma if they have a blood **clotting** abnormality.

Platelets and white blood cells remain together in the middle band as you can see in the picture. Why do you think they stay together during the spinning process?

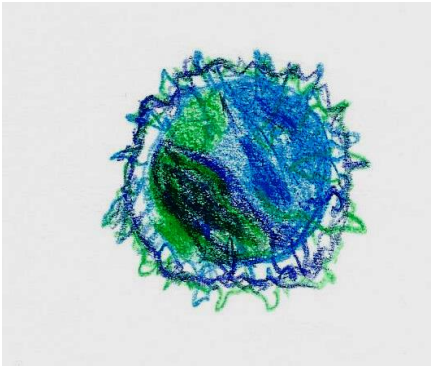
Platelets are the reason you don't bleed to death when you get a paper cut. Platelets clump together to form a blood clot when platelets sense they have come into contact with a break in a blood vessel. We can give a platelet transfusion to a patient having a very low platelet count in their blood to prevent bleeding.



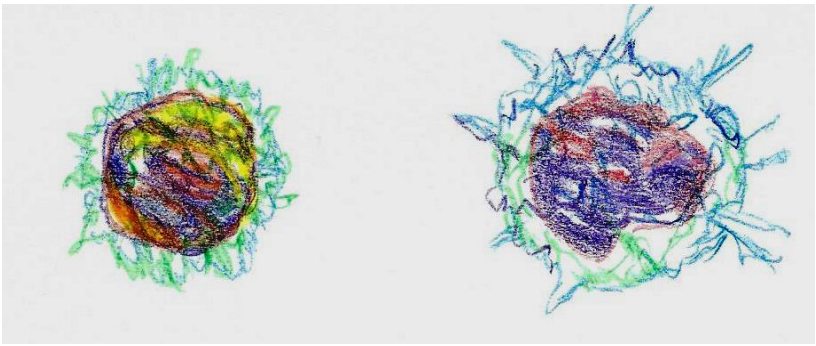
Unlike plasma and red blood cells, platelets do not have a blood type, so they can be transfused freely regardless of blood type. **Hemophilia** is a disease where certain blood **clotting** proteins are missing from the plasma; these patients have to be very careful and also receive treatment so they don't bleed to death.

White blood cells provide our bodies with its natural defense against infection or exposure to **toxins** or **allergens**. There are five types of white blood cells found in our blood, but they work together to protect us.

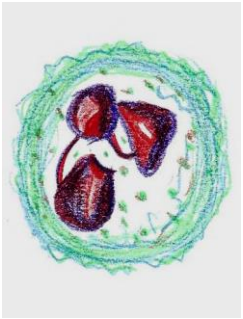
Monocytes are the largest white cells. They are immediate fighters of infection.



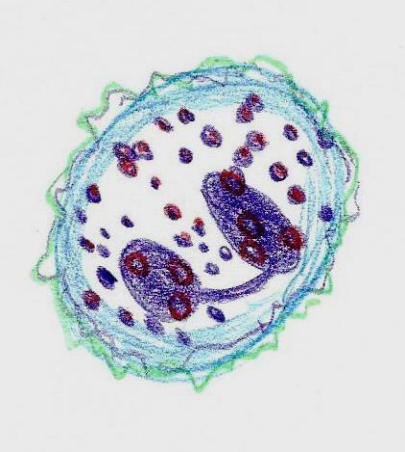
Lymphocytes are our main ‘immunity’ cells. They recognize and provide a sustained attack on foreign substances such as bacteria and allergens.



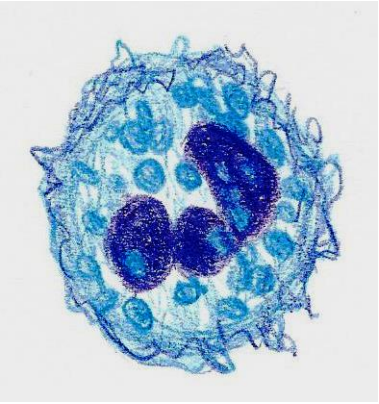
Neutrophils are the most abundant white cell, usually between 40-70 percent of all white cells in your blood. They represent your body’s first line of defense against infection.



Eosinophils send signals to other white cells telling them to attack. Our blood level of eosinophils goes up when we have an infection or allergy attack.



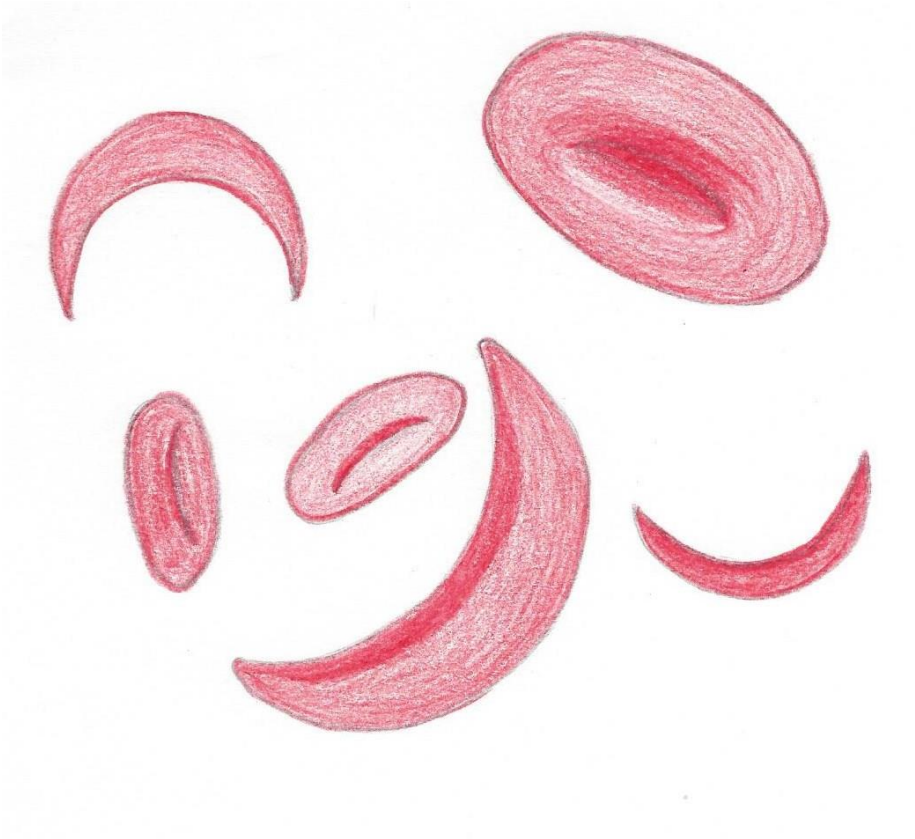
Basophils have two important jobs: first, they prevent blood from clotting too quickly. If our blood started clotting too much whenever we cut ourselves, we would have blood clots flowing through our bodies. It wouldn't take long for a blood clot to move to our lungs and block the flow of blood. We wouldn't survive long in that condition. Basophils also promote the flow of blood into the area needing help by enlarging the size of the small arteries in the region of the body. If you have an infection in your foot, your basophils will send more blood there, bringing along all of the white cells needed to fight the infection.



Red blood cells carry **oxygen** to every cell in our body. is the **red blood cell**. Also called **erythrocytes**, they make up about half of the total blood **volume** and are the most common blood cell.

Erythrocytes utilize **hemoglobin** to pick up oxygen in the lungs and deliver it to tissues throughout the body, releasing it as the cells pass through the **capillaries**. The hemoglobin inside the erythrocytes give these blood cells their red color and their easier to remember name “red blood cells”. As the red blood cells give up their oxygen they pick up **carbon dioxide** (a waste product of chemical energy production in the cells) from the tissues and return it to the lungs, where it is released when you **exhale.** Before you give a patient a blood transfusion you should know their blood type to avoid an allergic reaction, and indeed hospitals do several tests on blood for a transfusion to make sure you can safely administer it to a specific patient.

Sometimes children are born with abnormal hemoglobin in their red blood cells. Look at the picture above to see the shape of a normal red blood cell. In children born with **Sickle Cell Anemia**, some of their red blood cells under certain situations of stress no longer remain round because of their abnormal hemoglobin. If under stress their red cells become elongated they will not pass through capillaries easily and the patient will develop severe pain from lack of oxygen delivery to specific organs or regions of the body. (Look at the image of a sickled red blood cells that follow)



Red Blood Cells of Sickle Cell Anemia patient

Can you see why they call it “Sickle Cell” Anemia?

How does losing a lot of red blood cells when you sustain a major cut affect the body?

_____

_____