Components of Blood

Blood circulates through the body, delivering essential nutrients, oxygen, and hormones to organs and tissues. It is composed of four parts: plasma, red blood cells, white blood cells, and platelets.

**Plasma:** Plasma is the liquid component of blood, making up about 55% of its total volume. It contains water, electrolytes, proteins, hormones, and waste products. Plasma plays a crucial role in maintaining the body’s fluid balance and transporting substances throughout the circulatory system.

**Red Blood Cells:** Red blood cells are responsible for delivering oxygen and removing carbon dioxide from the body’s organs and tissues.

**White Blood Cells:** White blood cells defend the body against infections (i.e. bacteria and viruses), and other foreign invaders, helping to maintain overall health and fight diseases.

**Platelets:** Platelets are tiny cell fragments that play a crucial role in stopping bleeding. When a blood vessel is damaged, platelets gather at the site to form a clot, seal the wound, and promote the healing process.

Types of Blood Donations

**Whole Blood:** Whole blood donations are the most common type of blood donations. The entire process, from registration, to screening, to donation takes approximately 45 minutes. The actual blood collection step, the time in the donor chair, averages about 10 – 12 minutes. The donor will give about a pint of blood. Most of the blood is sent to a blood processing center, where it is separated into transfusable components like red cells, platelets, and plasma.

**Red Cell:** During a red cell donation, the donor is connected to an apheresis machine, which separates whole blood into its component parts. Red blood cells are removed and stored, and the remaining blood is returned to the donor’s blood stream. The appointment takes about 90 minutes and collects twice as many red blood cells as a whole blood donation.

**Platelets:** During a platelet donation, the donor is connected to an apheresis machine, which separates whole blood into its component parts. Platelets and a small amount of plasma are removed and stored, and the remaining blood is returned to the donor’s blood stream. The appointment takes around 2-3 hours and collects several transfusable units of platelets. It takes about 5-6 whole blood units to collect a single transfusable unit of platelets.

**Plasma:** During a plasma donation, the donor is connected to an apheresis machine, which separates whole blood into its component parts. Plasma is removed and stored, and the remaining blood is returned to the donor’s blood stream. The appointment takes around an hour and collects several transfusable units of plasma.
USES OF DONATED BLOOD

Donated blood saves lives every day. One whole blood donation can save up to three lives. Doctors use donated whole blood and red blood cells to help patients experiencing severe blood loss due to accidents, surgeries, or childbirth complications. Donated platelets help patients with low or non functional platelets including cancer patients undergoing chemotherapy. Donated plasma is invaluable for patients with immune deficiencies and coagulation disorders.

In addition to medical emergencies, donated blood products support patients with chronic conditions like cancer and sickle cell disease that require regular transfusions to manage their conditions.

LAB TESTS ON DONATED BLOOD

During a blood donation, a phlebotomist will collect several test tubes of blood, in addition to the donated blood or blood product. These test tubes are sent to the lab, where they are tested to establish the donor’s blood type and to screen for infectious diseases. If any of the screening tests are positive, the blood will be discarded, and the donor will be notified. If the screening tests are negative, the blood will be labeled and stored until someone needs it. When a sick patient needs blood, their blood will be tested for type (A-, B+ etc) and screened for antibodies.

Blood typing tests are essential to safely donate blood or receive a blood transfusion. Blood typing divides blood into four major blood types: A, B, AB, and O. It also tests for a protein on the surface of red blood cells called Rh factor. The results are combined for a blood type like O- or B+.

**ABO Typing:** ABO typing is 2 steps:

- **Forward Grouping:** A small amount of blood is mixed with antibodies that are known to react to type A and type B blood. If the blood clumps together it means the blood reacted to one of the antibodies.

- **Reverse Grouping:** The cells are removed from the donor blood using a centrifuge. The liquid part that remains (called serum) is mixed with blood that is known to be type A and type B. The reaction shows what type of antibodies the donor blood has. Type A blood contains anti-B antibodies. Type B blood contains anti-A antibodies. Type O blood contains both, and type AB contains neither.

**Rh Factor Testing:** A small amount of blood is mixed with an antibody called “Anti-D” to detect the presence of Rh factor protein. If the blood clumps together, it means the donor you has Rh factor protein on their blood cells and they are Rh positive.

INFECTIONIOUS DISEASE TESTING IN THE UNITED STATES

These are the screening tests used on blood donated in the United States. Other countries may have different screening protocols based on local disease outbreaks and concerns. If donated blood tests positive for an infectious disease, the donor will be contacted, and the blood will be discarded.

**Babesia:** This test screens for microscopic parasites called Babesia, which can cause a disease called babesiosis. Babesia are usually spread through tick bites and babesiosis is more prevalent in the northeastern and upper midwestern regions of the United States. Donor blood is tested via a nucleic acid test (NAT).

**Hepatitis B:** These tests screen for viral markers of hepatitis B. Hepatitis B can cause life-threatening liver infections. If the donor was vaccinated against hepatitis B within the last 30 days, there is a high probability of a false positive test result.

**Hepatitis C Virus (HCV):** These tests screen for viral markers of hepatitis C. Hepatitis C can cause life-threatening liver infections. An HCV antibody test checks to see if the donor has ever had a hepatitis C infection. If the test is reactive, it means that the donor has had hepatitis C at some point. If it is non-reactive, it means that the donor has never had hepatitis C. If the test is reactive, then the blood is tested with a nucleic acid test (NAT) to see if there is an active hepatitis C infection.

**Human Immunodeficiency Viruses (HIV):** These tests screen for HIV-1 and HIV-2. Both HIV-1 and HIV-2 infections can lead to AIDS (acquired immunodeficiency syndrome), a deadly chronic immune disease.

**Human T-Lymphotropic Virus (HTLV):** This test screens for antibodies associated with HTLV-1 and HTLV-2. HTLV-1 is a virus that can cause adult T-cell leukemia/lymphoma.

**Syphilis:** This test screens donor blood for antibodies associated with syphilis infection. Syphilis is a bacterial infection that usually spreads through sexual contact. It causes sores near the genitals and/or the mouth and can cause serious complications if not treated.

**Trypanosoma cruzi:** This test screens for the presence of the parasite Trypanosoma cruzi, which causes Chagas disease. If left untreated, Chagas disease can cause serious stomach and heart problems.

**West Nile Virus:** This tests screens for West Nile Virus, a virus that usually spreads by mosquito bite. In most people, it does not cause any symptoms, but about 1 in every 150 people infected develop a very severe disease that affects their brain or other parts of the central nervous system.
LAB TESTS FOR BLOOD TRANSFUSION

When a patient needs blood, it is important to confirm that the donor blood used is compatible. If incompatible blood is transfused, it can lead to a severe immune response, potentially causing life-threatening complications.

In emergency situations, there is often not enough time to test the patient’s blood, group O blood is the only type of blood that is safe to use. Group O red blood cells are considered a universal donor because they do not contain A, B or RhD proteins. If there is enough time, the patient’s blood will also be typed and crossmatched to confirm that the donor blood and the patient’s blood are compatible. For plasma products, Type AB is considered universal plasma because it does not contain antibodies to the A or B red blood cell proteins.

During a crossmatch a lab professional will mix a sample of the patient’s blood with a small amount of the potential donor’s blood to check for the presence of antibodies in the recipient’s blood that may damage the donor’s red blood cells. If the test is positive, there are antibodies that could pose a risk to the patient. If it is negative, it means there are probably no risky antibodies, and the transfusion should be safe.

BLOOD DONATION ELIGIBILITY

To donate blood in the United States, you must be at least 16-years-old, weigh more than 110 pounds, and be in good health. If you are feeling unwell, you will be asked to defer your donation until you are feeling better. Some blood centers may use slightly more conservative requirements such as 115 pounds as their minimum weight requirement. For many states, donating at the age of 16 requires parental/guardian consent.

There are additional restrictions on donations based on medications, medical conditions, recent travel, and personal information. These can vary from state to state, so please check with a local blood bank to determine eligibility.

The frequency a donor can donate is determined by the type of blood product they are donating.

- Whole blood can be donated every 8 weeks (56 Days)
- Double red cells can be donated every 16 weeks (112 Days)
- Platelets can be donated a maximum of two times in a 7-day period, but no more than 24 times a year
- Plasma can be donated every 2 days, but no more than 2 times a week

WHERE TO DONATE

If you would like to donate blood in the United States, you can search for blood drives on the Advancement of Blood and Biotherapies, America’s Blood Centers, and Blood Center’s of America websites. These resources can also help you organize a blood drive of your own in your community or place of work.

If you live outside of the United States, check with your health ministry to find out how you can donate blood locally.
In September 2021, Charlie woke up before her kids and headed out to work on a project at the brewery she owned with her husband. She settled in and got started sanding a chalkboard. Unbeknownst to her, a few yards away, a gas can was leaking, seeping out fumes all around her. When she dropped her belt sander and it sparked on the ground, Charlie was engulfed in flames.

Charlie was medevacked to the nearest hospital with a burn unit. Over the next six months, she underwent 58 surgeries and procedures, each requiring up to 2 units of blood. Without the hospital’s blood bank and help from anonymous blood donors, her recovery would have been impossible. To confirm the blood was compatible, both Charlie’s blood and the donor blood were tested in the laboratory. Laboratory scientists determined the blood types, tested for diseases, and confirmed whether the blood had harmful antibodies.

The treatment was exhausting, but she was determined to go home as early as possible. After six months in the hospital, and three months at a rehab facility, Charlie finally got to go home.

Over two years after the accident, Charlie is determined to embrace life with her family and friends. Adapting to using a wheelchair has been challenging, but she doesn’t want to slow down. “Some people are overly cautious, but I have to live life because I almost didn’t have one.”

Blood donations save lives every day. Hear from our other Champions who have relied on donated blood products during their treatment:

- Kya, Aplastic Anemia
- Laurel, Liver Transplant
- Anthony, Kidney Transplant
- Malik, Sickle Cell Anemia