Bloodology

Blood: the Gift of Life

An Introduction to Blood, Blood Donation and Blood Transfusion



Blood: the Gift of Life

For thousands of years, people have had a special appreciation for the life-giving properties of blood. It has been called the "river of life". Among Native American Indians, strong allegiance to another person was symbolized by becoming "blood brothers". In other cultures, royalty is said to have "blue blood".

Yet only relatively recently have we really begun to understand what blood is, what it does in the human body and how to remedy problems of blood loss and blood diseases. Let's take a closer look...

Key Discoveries

About 350 years ago: It was discovered that blood circulates around the human body. The invention of the microscope enabled people to see the tiny cells within blood.

200 years ago: First human blood transfusion (from one person to another person) was performed.

100 years ago: Different blood types are discovered. Often blood of one blood type CANNOT be safely transfused into a person of a different blood type.

30 years ago: Tests are developed to detect **viruses** that can transmit diseases to another person through blood transfusion.

This brochure was created by New York Blood Center. The New York Blood Center (NYBC) logo represents the various roles NYBC plays in the community. The red drop represents blood while the outer triangle represents a beaker. The beaker symbolizes the testing performed on donated blood and research activities both of which promote safe transfusion. Collectively the logo depicts the local, national and global activities of NYBC.

A NewYork BloodCenter

Blood circulates (travels) throughout your body

You have a **complex circulatory system** to carry your blood. Think of it as your body's blood "highway system". Here is a simplified "road map" of your body's circulatory system.

Your **heart** is like a powerful engine pushing your blood through your body.

Arteries (shown in red) lead FROM your heart to the rest of your body.

Veins (shown in blue) travel via the lungs BACK to your heart from various parts of your body.

Capillaries (not shown) are very thin vessels that branch away from arteries and veins. There are hundreds of thousands of capillaries that carry blood to all the individual organs and cells in your body. If the veins and arteries are your body's expressways, the capillaries are like the local streets leading to every home.





Together, the blood vessels form an incredible highway system: If you laid them out in one line, the line would be up to **100,000 miles long**, or about 2 1/2 times around the world!

Your Heart: the incredible pumping machine



Your heart is the engine that moves your blood through your body.

This is a huge job. Your heart pumps one gallon of blood every minute. That is about 1,500 gallons every day!

From the moment your heart starts working, it beats tirelessly, 100,000 times a day, 365 days a year without a break.

A Health Tip: Have a heart for your heart!

Considering how hard your heart works for you, shouldn't you take good care of it with a healthy life-style, including plenty of exercise, a low-fat diet and not smoking?

What is blood?

When you look at a cut, the blood looks like a red liquid, but it is actually made up of billions of cells in a pale yellow-colored fluid called plasma. There are three main types of blood cells in your body: red blood cells, white blood cells and platelets. The red blood cells give blood its red color.





Plasma

Plasma is the liquid, mostly water, in which all of your blood cells "swim". It contains needed minerals, vitamins, sugars and hormones. The circulatory system distributes these throughout your body.

Individual blood cells are much too small to be seen by the naked eye. Here is what blood looks like when it is examined with a microscope.



Red Blood Cells Carry oxygen & CO₂ around your body

Red blood cells (also called erythocytes) get their color from the iron-containing hemoglobin that they carry.



Red Blood Cells



Each red blood cell has 300 million hemoglobin molecules.

Hemoglobin (shown on left) has the special quality that it can pick up (bind) oxygen as the blood travels through your lungs, and then drop it off (release it) at cells throughout your body.

This oxygen provides the fuel, or the energy, for all the work that your body does.

Like an exhaust system, the red blood cells take away the carbon dioxide produced when your body "burns" oxygen.

Your red blood cells exchange oxygen for carbon dioxide. When you breathe, you take in (inhale) fresh oxygen, but you also breathe out (exhale) excess carbon dioxide brought to your lungs by your blood.

Red Blood Cells are as important to life as breathing in and breathing out!

White Blood Cells Guarding your body against invaders

Your body is in constant battle against invaders. Every day, germs (viruses and bacteria) may find their way into your body and can make you sick. In your blood, white blood cells (also called leukocytes) of various kinds spring into action to combat these invaders. These cells form the immune system.



One type of white blood cell, the neutrophil (also called granulocyte), surrounds and literally gobbles up the invading germs, just like Pacman.



The four other main types of white blood cells attack germs in different ways. They are lymphocytes (T-cells and B-cells), monocytes, basophils and eosinophils.

Platelets Form clots, stop bleeding

When you cut yourself, you create a hole in both your skin and blood vessel. As a result, you not only start to bleed, but germs can enter your body. When this happens, many processes go into action to:



Plug the hole to stop the loss of blood



Remove dirt and germs that find an easy way into your body through the hole



Repair the damage done to your body

Platelets are actually fragments or pieces from a large blood cell (megakaryocyte). At the first sign of damage in your blood vessels, platelets swing into action. The platelets work together with a protein called fibrin, and with red blood cells to weave a temporary plug or clot to stop the bleeding.

It's like putting a band-aid INSIDE your body.





Like a beaver building a dam, platelets glue together many different substances in the blood to form what we see as a scab. This closes the cut and stops the bleeding until your body grows new cells.

Bone Marrow Your body's incredible blood factory

All blood cells are made in the marrow, deep inside your bones. They originate from a group of "master cells" called stem cells. The stem cells multiply and grow to become the various kinds of blood cells the body needs. When the cells mature they are released into the blood vessels.

The bone marrow is a busy workshop millions of new red blood cells are made every second.



Life-saving Stem Cells

Stem cells can be collected from bone marrow and from placenta. Remarkably, these stem cells can be stored and, after a careful matching process, be transplanted to patients so that the diseased stem cells are replaced with healthy ones. In this way, doctors are curing diseases and saving more lives.

There's no substitute for human blood





- It cannot be manufactured.
- Animal blood cannot replace it.
- People are the only source of blood for those who need it.

In the U.S. someone needs a red blood cell transfusion every 3 seconds.

1 in 3 people will need a blood transfusion in their lifetime.

Approximately 38,000 donations of blood are needed every day in America.

Therefore, many people are needed to donate blood.



Courtesy of the Puget Sound Blood Center (www.psbc.org

Do I have blood to spare?

An average adult has 8 to 10 pints (or 4 to 5 quarts) of blood.

That is plenty for your body's needs and gives you a "pint to share".



Who needs your blood?



Normally your body easily makes all the blood you need. But accidents or disease can cause people to need more blood than their bodies can produce. They depend on blood donated by healthy people.



Accident victims and patients having major surgery

Patients may lose so much blood that their body cannot replace it quickly enough. Dangerously low blood levels can cause serious harm, even death if the lost blood is not quickly replaced.



People with blood diseases

People with sickle cell disease need healthy red blood cells to replace their "sickled" ones. People with hemophilia need the clotting factors from plasma of healthy people to help their blood clot. Many other diseases, such as leukemia, thalassemia and aplastic anemia, are treated with transfusions.



Cancer patients

Often cancer treatments not only kill the harmful cancer cells, but also healthy, bloodforming cells.

Burn patients

Many patients who are severely burned need blood plasma to quickly add blood fluids.

Let's look at the steps from donation to transfusion...

There are a number of different kinds of blood donation. Lets look at what happens with the whole blood donation.

1. Pre-donation donor screening

Only healthy people should give blood. Just as sneezing on someone is an easy way to give someone a cold, some diseases can be passed from one person to another through blood. Thus people coming to give blood are screened for their eligibility to ensure safety both for the donor and the patient.

2. Donating blood is quick, safe and easy... and your body will replace the donated pint of blood within a few days.



Before and after donating, drink plenty of liquids.

Another important type of blood donation is

Automated Blood Collection

With automated collection (or apheresis) part of your blood is separated for transfusion to a patient, while all the rest of the blood flows back into your body.



Platelets from one automated donation

Platelets from 8 whole blood donors

This enables people to "focus" their donations, giving up to 8 times as many platelets or twice as many red cells as with a whole blood donation.

3. Separation

The bag of your donated whole blood is carefully transported to our laboratories.



Plasma

Red

Blood Cells **Platelets**



4. Testing & Labeling

A small portion of each blood donation is removed for testing. It is tested for blood type (ABO and Rh), antibodies and screened for blood-transmitted



5. Storage

Up to

42 days

at 4°C

The need for blood arises often with little warning. Tested and ready for transfusion, blood components are temporarily stored at the blood center until transported to the hospital.

Up to 5 days

temperature

at room

6. Distribution to Hospitals

Up to

frozen

12 months

Blood components are transported to hospitals, daily and on an emergency basis, so they are on hand when needed.





Are you my type?

100 years ago, it was discovered that different people have different types of blood. Major types are "O", "A", "B" and "AB".

For a blood donation to be helpful to a patient, there has to be a good match between the blood type of the donor and that of the patient receiving the blood. While receiving blood from someone of exactly the same type is fine, some types can happily mix with certain others. The common Type O can be given safely to patients with A, B or AB blood. But Type O patients can only receive blood from other Type O people.



Percentage of population of each blood type

More recently, a number of other characteristics (blood groups) have been found in blood. Now, sometimes the process of finding compatible blood for someone with a rare blood type is complex and challenging.

Laboratories test and identify the exact type donated so that only the right type is given to a particular patient.

New York Blood Center has a team of world-renowned "match makers" to find just the right blood for a particular patient. It has the largest inventory of rare blood types in the U.S.

Blood, like milk, is perishable

Red blood cells, even refrigerated, can be stored for only 42



days. We make every effort and use a "state of the art" inventory system to ensure as much blood as possible is used before its "shelf life" date is up.

But most importantly, a supply is always on hand and nobody's life is threatened because donated blood wasn't there when it was needed.

Who might receive my blood?

Portraits of people whose lives have been saved with blood donations











1 Unit of Platelets Name: Ron Terwilliger Disease: Aplastic anemia, a disease that prevents the production of red and white cells and platelets. Outcome: Healthy and happy Units transfused:

Name: Mark Randall Samuel Disease: Premature baby born weighing only 1lb. 7oz. Needed two surgeries and blood transfusions during his first three months of life. Outcome: Healthy and happy 11-year-old Units transfused:

Name: Sarit Cahana Disease: Cancer Outcome: Healthy and happy 4-year-old Units transfused:

Name: Ralph Cazzetta Disease: Thalassemia, a hereditary disorder that inhibits hemoglobin's oxygen production. Outcome: Receives regular life-saving blood transfusions Units transfused: 48 units per year 1,776 units to date

Fresh donations of blood are continually needed. You can donate whole blood every 56 days. Please donate at least twice a year.

How can I help?

Community support in the form of continual donations of blood are needed every day to ensure that adequate supplies of blood are on hand, tested and ready to deliver when needed.



Become a blood donor.



Sponsor a blood drive at your job or in your community.



To donate blood you should:

- Be at least 17 years old (16 in some states)
- Be in good health
- Weigh at least 110 lbs.







