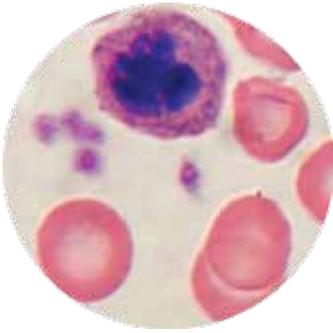
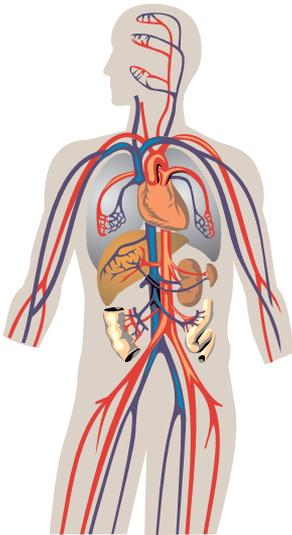


Bloodology I

Blood: the Gift of Life



An Introduction
to Blood,
Blood Donation
and 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." 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

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** was performed – from one person to another person.

100 years ago: **Different blood types** were discovered – often blood of one blood type can NOT be safely transfused into a person of a different blood type.

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

Bloodology I **Blood: the Gift of Life,** 2nd Edition

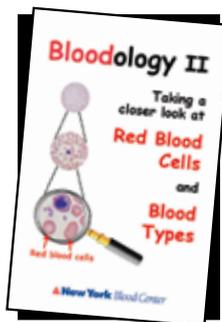
Created by Robert Ratner
and Marion Reid

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We thank numerous colleagues for
their suggestions.

For more information and/
or bulk orders of this or other
pamphlets in the *Bloodology*
series, contact: 212-570-3037 or
rratner@nybloodcenter.org
or visit www.nybloodcenter.org

Other Bloodology pamphlets:



Blood circulates (travels) throughout your body

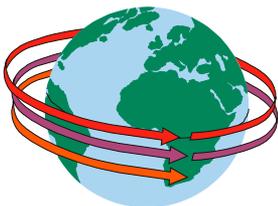
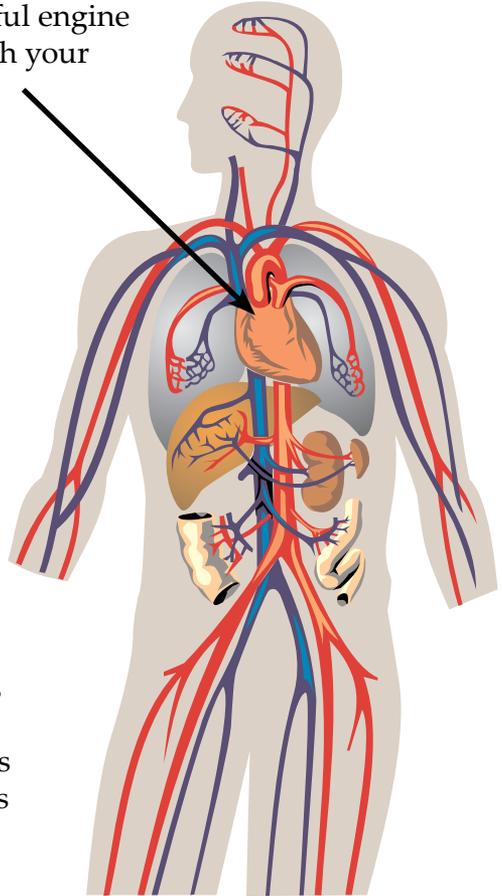
You have a complex **circulatory system** to carry the blood. Think of it as your body's blood "highway system." Here is a simplified "road map" of your body's circulatory system.

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.

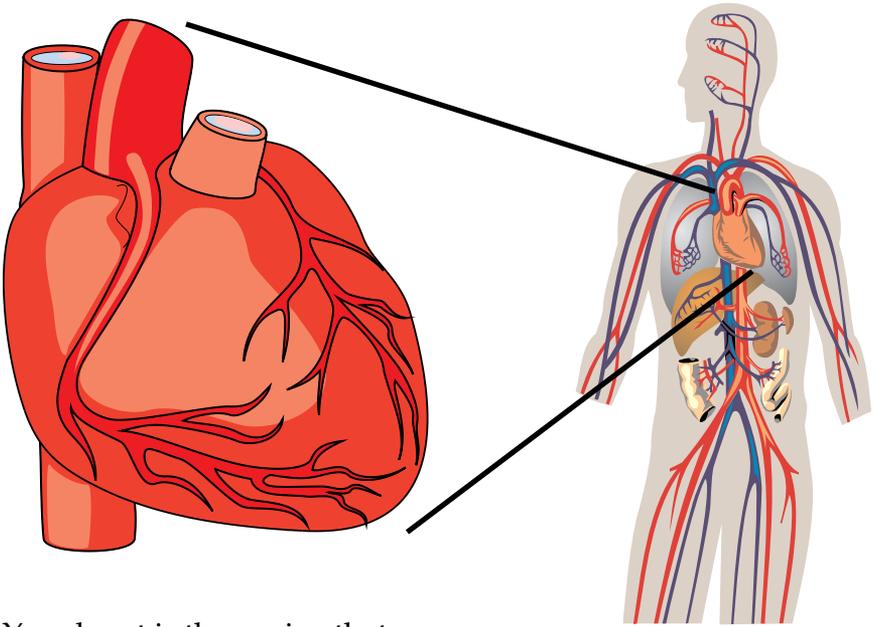
Veins (shown in blue) travel lead TO your heart, via the lungs, from various parts of your body.

Capillaries (not shown) are very thin vessels that branch away from arteries and to veins. There are thousands and 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 2½ 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.

Left, blood after being spun in a centrifuge, separated into different parts.



Plasma
50% of whole blood

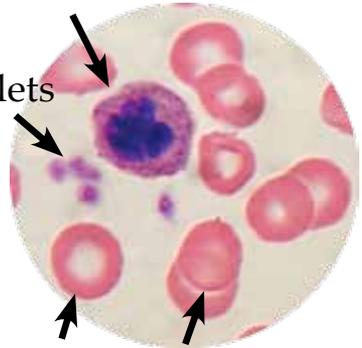
Platelets
2% of whole blood

White Blood Cells
3% of whole blood

Red Blood Cells
45% of whole blood

White blood cell

Platelets



Red blood cells

Individual blood cells are much too small to be seen with your "naked eyes." Above, blood as viewed with a microscope.

The components of blood:

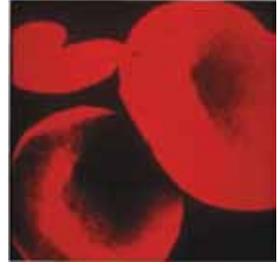
1. Plasma

Plasma is the liquid, mostly water, in which blood cells "swim." It contains needed minerals, vitamins, sugars and hormones that are used throughout your body.

The components of blood (continued):

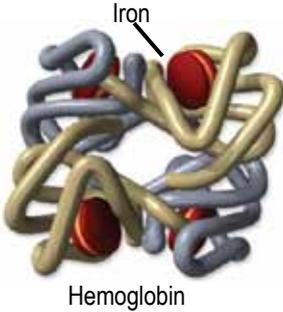
2. Red Blood Cells

Carry oxygen & carbon dioxide around your body



Red Blood Cells

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



Courtesy of Puget Sound Blood Center (www.pbsbc.org)

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 that is brought to your lungs by your blood.

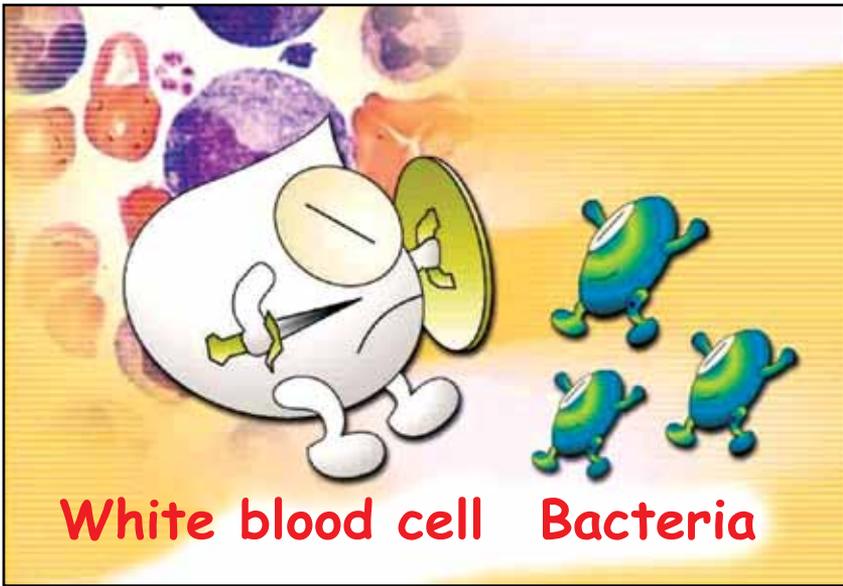
Red blood cells are as important to life as “breathing in and breathing out”!

The components of blood (continued):

3. White Blood Cells

Guarding your body against invaders!

Your body is in constant battle against invaders. Everyday, 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 are an important part of 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.

The components of blood (continued):

4. Platelets

Form clots, stop bleeding

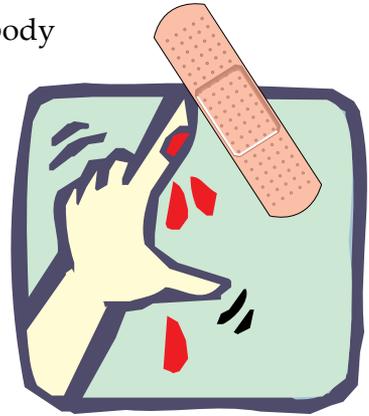
When you cut yourself, you create a hole in your skin and blood vessel. As a result, you not only start to bleed, but germs can enter your body. When this happens, many processes go into action to:

♥ **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/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/clot to stop the bleeding.



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

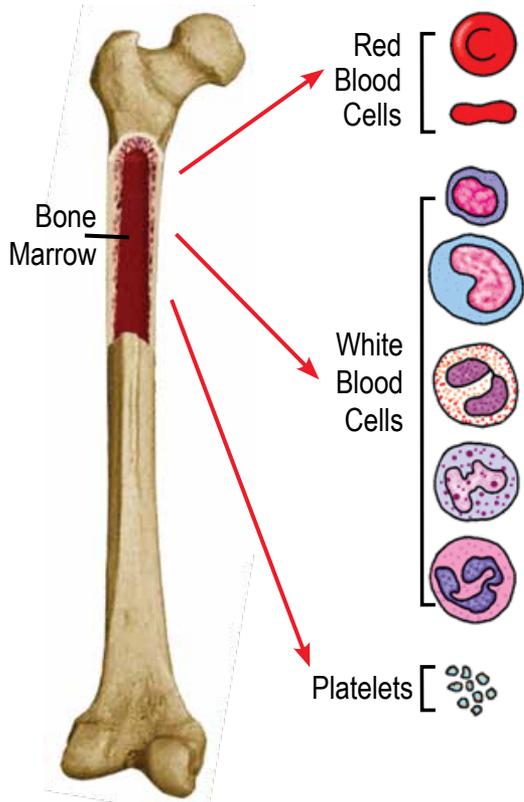


Like a beaver building a dam, platelets glue together many different substances in the blood to form a barrier to the flow of blood. This stops the bleeding as your body grows new cells and repairs the damage.

Bone Marrow

Your body's incredible blood factory

All blood cells are made in the marrow, 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.



Courtesy of the Lucile Packard Children's Hospital Health Library

The bone marrow is a busy workshop —
Millions of new blood cells are made every second!

Life-saving Stem Cells

Stem cells can be collected from bone marrow, placenta and other sources. Remarkably, these stem cells can be stored and, after a careful matching process, be transplanted to patients so that diseased stem cells may be replaced with healthy ones. In this way, doctors can treat diseases and help save lives.

There's no substitute for human blood

Courtesy Puget Sound Blood Center (www.psbcc.org)



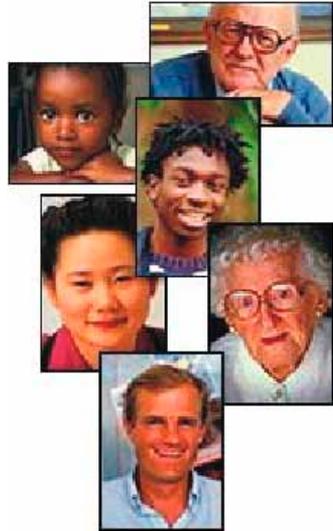
- ♥ It cannot be manufactured.
- ♥ Animal blood cannot replace it.
- ♥ People are the only source of blood for those who need it.

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.

Every day, 2,000 donations of blood are needed by patients in the New York/ New Jersey area served by the New York Blood Center!

Therefore, many people are needed to donate blood.



Courtesy of the Puget Sound Blood Center (psbcc.org)

Do you have blood to spare?

An average adult has 8 to 10 pints 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 anemia 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.



Graphic courtesy of St. Louis Children's Hospital

Cancer patients

Cancer treatments not only kill harmful cancer cells, but also many healthy blood-forming cells.



Burn patients

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

Steps from donation to transfusion...

There are a number of different kinds of blood donation. Let's 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.

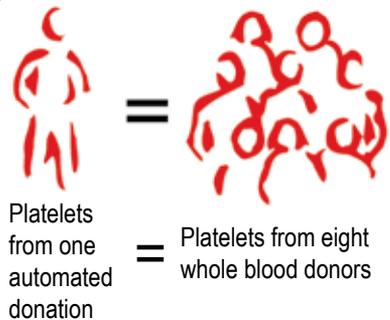


2. Donating blood is quick, safe and easy ... and your body will replace the donated pint of blood within a few days.

Another important type of blood donation is

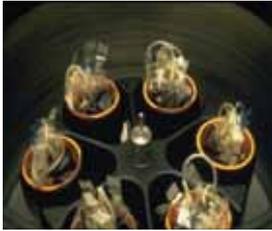
Automated Blood Collection

With automated collection, or apheresis, your blood flows into a machine where part of your blood is separated for future transfusion to a patient, while the rest flows back into your body. This enables people to "focus" their donations, giving up to 8 times as many platelets or twice as many red blood cells as with a whole blood donation.



3. Separation

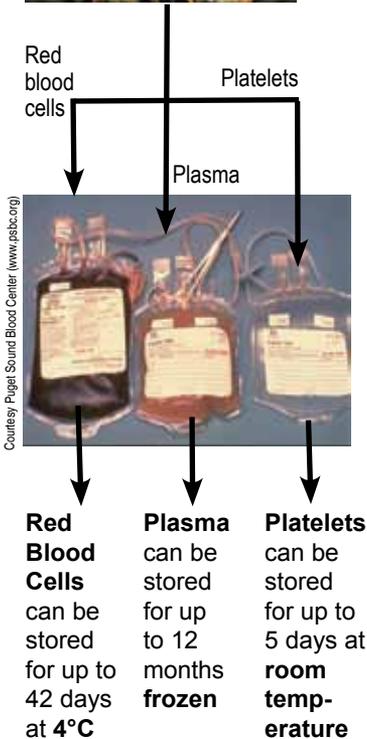
The bag of your donated whole blood is transported in an ice chest to a blood center laboratory, where it is spun in a centrifuge (left) and separated into red blood cells, plasma, and platelets.



As a result, **one pint of whole blood can actually help 3 different people**, each with needs for a particular blood component!

4. Testing & Labeling

A portion of each blood donation is separated and tested for blood type (ABO and Rh), antibodies and blood-transmitted viruses. Then, using the information gathered, each bag of blood component is labeled, identifying the blood type and other special characteristics.



5. Storage

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

6. Distribution to Hospitals

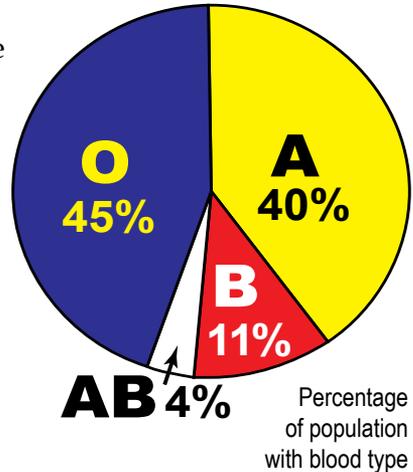
Blood components are transported to hospitals daily, to be on hand when needed. Special needs are met with emergency deliveries.

See **Bloodology III: What happens to your blood *after* you donate?** for more on the steps between donation and transfusion.

Are you my type?

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

To avoid a harmful reaction to the transfusion, **there must be a good match between the blood type of the donor and that of the patient receiving the blood.**



Receiving blood from someone of the same type is fine, and some types can happily mix with certain others. For example, 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.

Many more blood groups have now been found. Sometimes the process of finding compatible blood for someone with a rare blood type is complex and challenging.

[See **Bloodology II: Taking a closer look at Red Blood Cells and Blood Types** for more information.]

The New York Blood Center tests and identifies the exact type donated so that only the right type is given to a particular patient. The New York Blood Center's team of world-renowned "match makers" uses the largest inventory of rare blood types in the U.S. to find just the right blood for a particular patient.



Like milk, blood is perishable.

Red blood cells, even refrigerated, can be stored for only 42 days. We work to use as much blood as possible within its "shelf life." But most importantly, a supply must always be on hand, tested, processed and ready to send when needed.

Who might receive my blood?

Portraits of people whose lives have been saved with blood donations



Stacey Mason-Sotille was 11 months old when diagnosed with sickle cell anemia. The disease has caused gall bladder disease, pulmonary hypertension and temporary blindness. Treatment has required many transfusions over many years. Now a mother of two, Stacey said: "I've been in and out of the hospital three to four times a year, I need the blood provided from the New York Blood Center. Without it, I wouldn't be here and wouldn't be able to share my life with my children."



Matthew Long, a New York City firefighter and 9-11 hero, was struck by a bus in 2005 and nearly killed. He received 68 units of donated blood. "I've always given blood annually and never thought I would be a recipient of blood. In the past two and a half years, I've had over 40 surgeries, and I'm sure there was blood on hand for each one of them," he said.



Raffaello Carone Weeks before his third birthday in 2003, Raffaello was diagnosed with acute lymphocytic leukemia. While undergoing treatment, he developed respiratory syncytial virus and required blood and platelet transfusions of a difficult to find blood type and was near death. His mother credits rare blood donors that responded to an emergency appeal for saving her son's life.



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
 - ♥ **Encourage others to donate**
 - ♥ **Volunteer** at a blood drive or at a New York Blood Center location
-

Donate Blood - Give the Gift of Life!

 **New York** *Blood Center*

To donate, you should:

- Be between the ages of 16 and 76,
- Be in good health, and
- Weigh at least 110 lbs.

For more information or to make an appointment, we invite you to call **1-800-933-BLOOD** or go to our website: **WWW.NYBLOODCENTER.ORG**.
