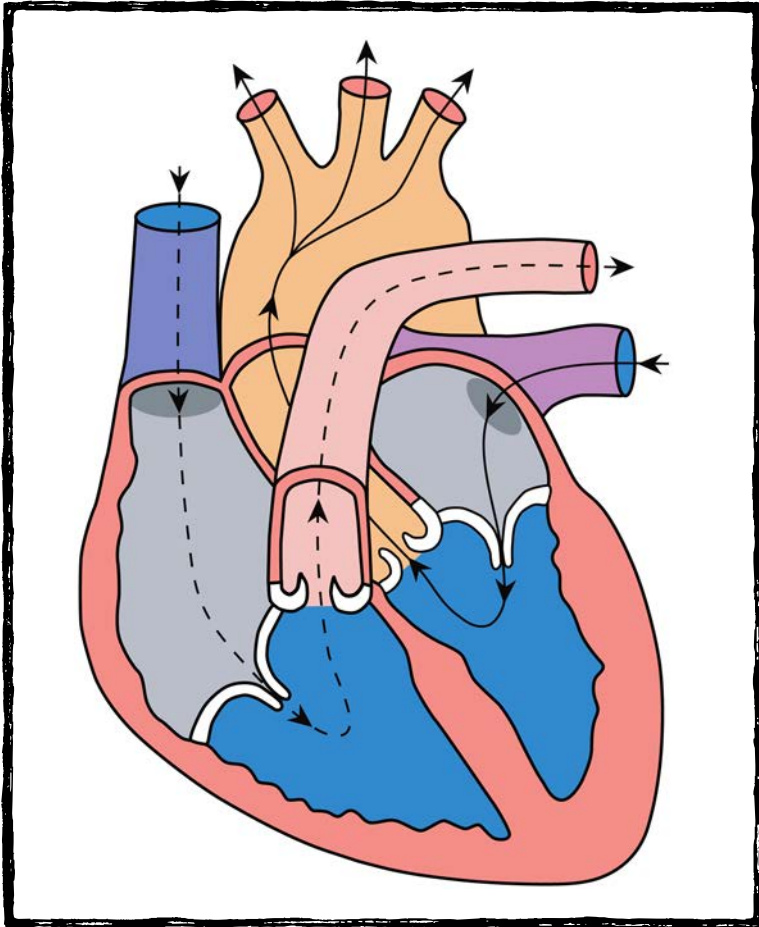


# Book of Blood

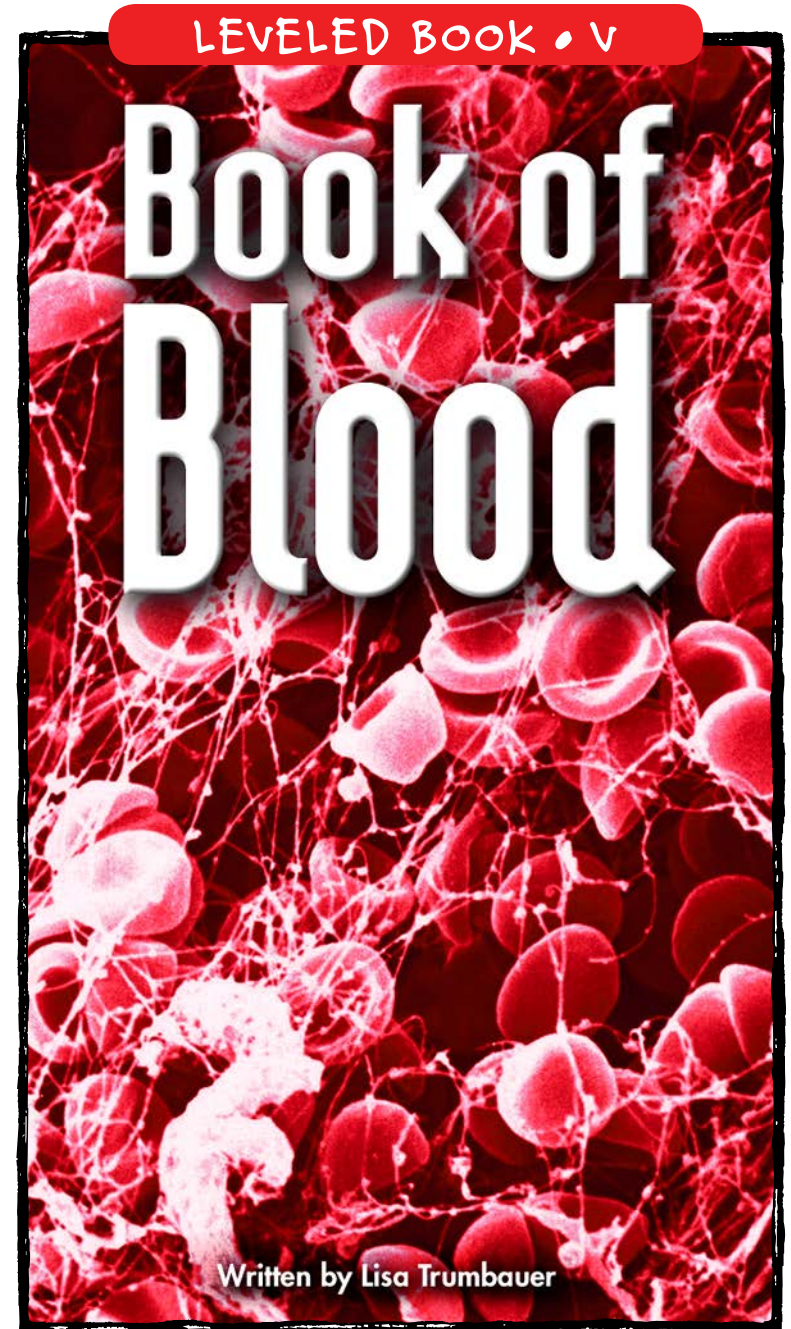
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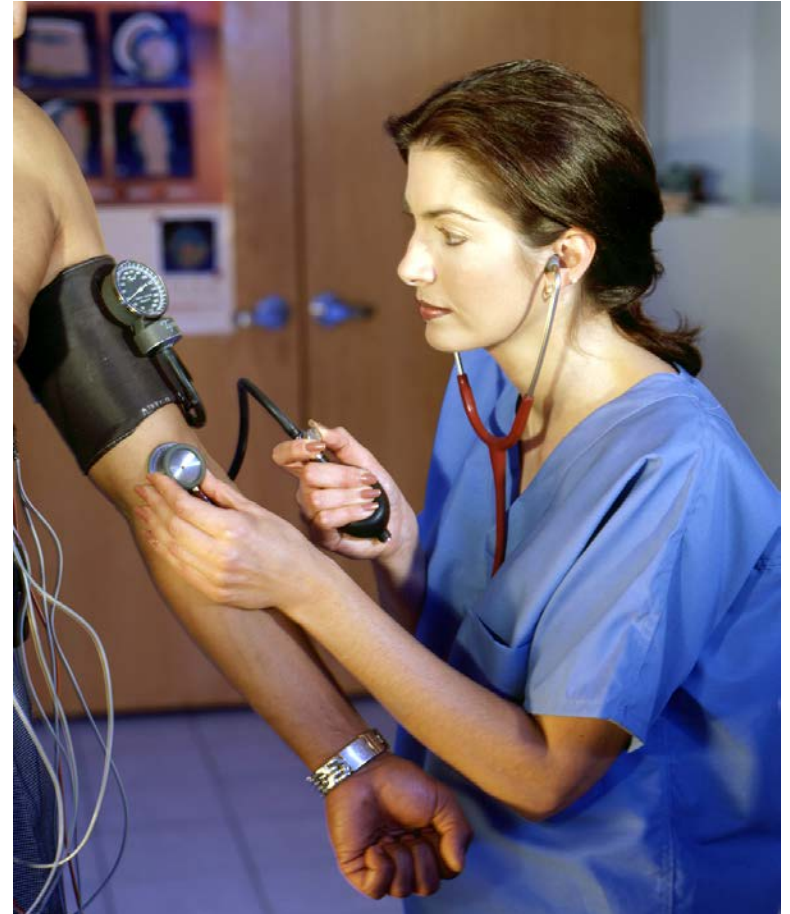
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# Book of Blood



Written by Lisa Trumbauer

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Book of Blood  
Level V Leveled Book  
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ISBN 1-59827-704-9  
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#### Correlation

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## Glossary

<b>analogy</b> ( <i>n.</i> )	a comparison of two things not normally thought of as alike (p. 4)
<b>antigen</b> ( <i>n.</i> )	a substance that helps the body fight infection (p. 21)
<b>bacteria</b> ( <i>n.</i> )	one-celled organisms that can cause disease (p. 14)
<b>circulation</b> ( <i>n.</i> )	movement in a circle or circuit within the body (p. 5)
<b>clot</b> ( <i>v.</i> )	to thicken and make a liquid stop flowing (p. 16)
<b>depleted</b> ( <i>v.</i> )	emptied (p. 8)
<b>oxygenated</b> ( <i>v.</i> )	mixed with oxygen (p. 9)
<b>plasma</b> ( <i>n.</i> )	the fluid blood cells flow in (p. 13)
<b>protein</b> ( <i>n.</i> )	an essential part of all cells in the body (p. 18)
<b>pulse</b> ( <i>n.</i> )	heartbeat felt through blood vessel walls (p. 11)
<b>transfusions</b> ( <i>n.</i> )	transfers of blood into the circulatory system of another person (p. 21)
<b>viruses</b> ( <i>n.</i> )	tiny organisms that infect and reproduce inside living cells (p. 14)





Children keep their hearts in shape with exercise.

### Conclusion

Have you ever heard the expression that your body is like a well-oiled machine? Well, if that’s true, then your blood is the oil that makes your body run. Your heart is the engine that pumps the oil through your body. And your blood vessels are the tubes through which the blood flows. All together, your heart, your blood vessels, and your blood make up your body’s circulatory system.



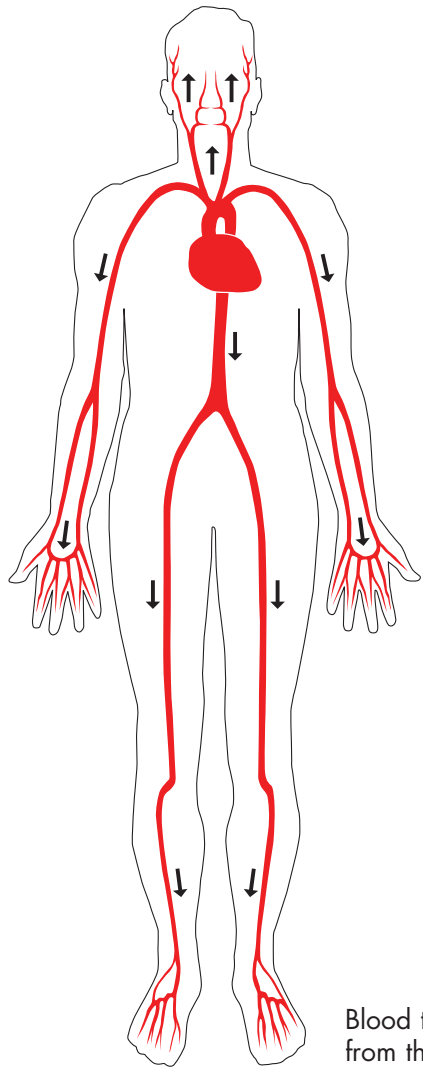
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## Special Delivery!

Imagine, if you will, a giant post office. Mail trucks enter at one end, gather new mail to be delivered, and then continue on their journey.

The mail trucks drive along their designated routes, dropping off and picking up mail as they go. The trucks then return to the post office, and the whole process begins again.



Blood travels away from the heart.

On a much smaller scale and in a much different way, this **analogy** describes your circulatory system! Your heart is like the main pumping station, or the main post office, and your blood vessels are the roads over which the mail trucks travel. And what are the mail trucks themselves? Your red blood cells!

## Know Your Type

Not all blood is the same. Blood can be categorized and sorted into four types. A substance called an **antigen** determines your blood type. Antigens cause your blood to make infection-fighting chemicals. There are two kinds of antigens—A and B. If your blood has the A antigen, you have Type A blood. If your blood has the B antigen, you have Type B blood. If you have both antigens, your blood is Type AB; and if you have neither antigen, your blood is Type O.

It is important to know your blood type. If you are ever in an accident and lose a lot of blood you will need a **transfusion** to replace your lost blood. You can only accept blood from someone who has your blood type or Type O blood.

People with Type O blood are called universal donors since anyone can accept their blood.



When people donate blood, it is put into blood banks for people who need transfusions.



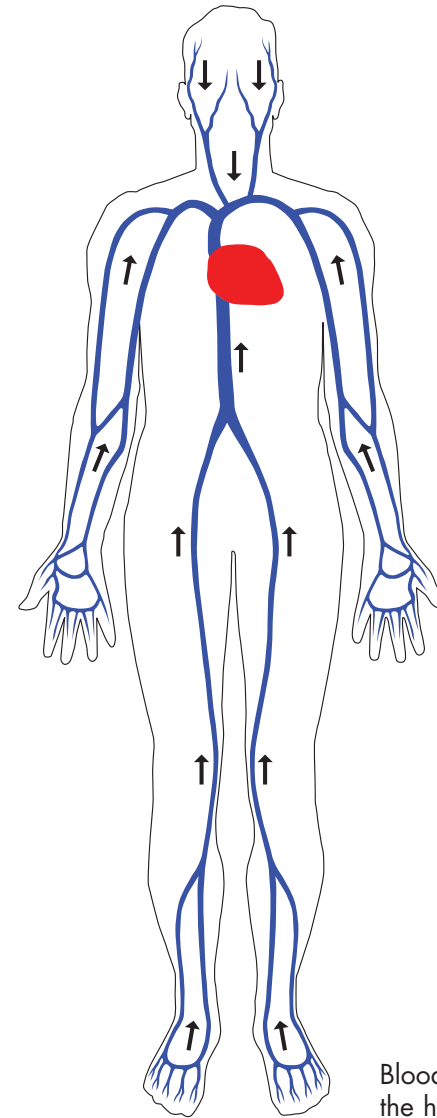
This boxer has a bruise on his eye and a busted blood vessel in his nose.

Bruises also appear purple in color. A bruise occurs when a blood vessel breaks beneath your skin, but your skin doesn't break. The blood collects under the unbroken skin, giving your skin a purplish hue. White blood cells swarm in to eat the pooling blood and over time, the blood breaks down into smaller and smaller pieces, until eventually the blood under the skin is gone. The bruise, or "black-and-blue mark," has disappeared.

Let's continue with this mail-delivery analogy. You've probably heard the saying that the mail gets delivered, come rain or come shine. Well, the circulatory system never rests, either. Your heart

is always pumping, even when you may feel too exhausted to move. Your blood is always rushing through blood vessels, circulating the blood through your body.

**Circulation** is the movement of something in a circle or circuit, and essentially, that's how your circulatory system works. Your blood travels in a circuit around your body, starting and ending at your heart.

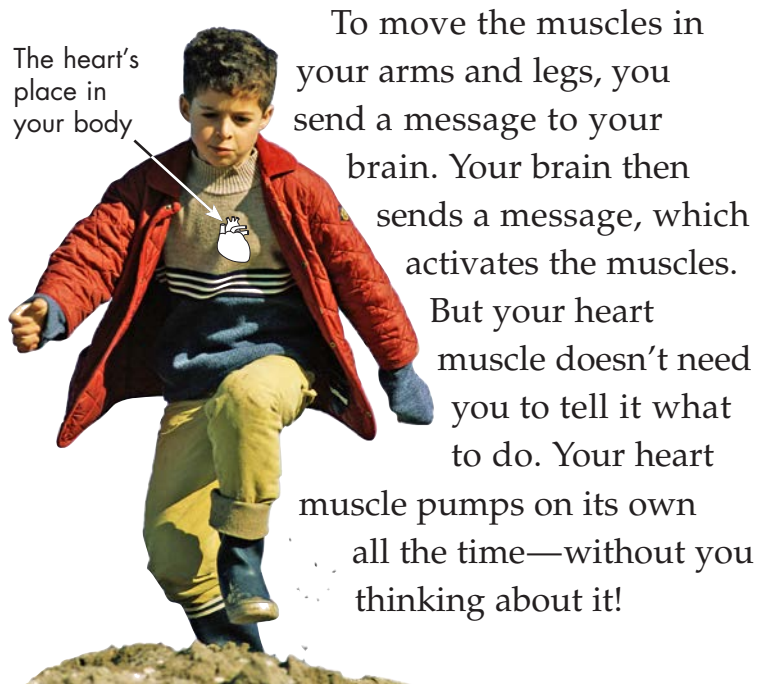


Blood that traveled away from the heart returns to the heart.



## The Pumping Station

Place your hand over your heart, and what can you feel? You can feel your heart in action! Your heart is like command central or the main pumping station for your circulatory system. The heart is a muscle, and it is about the same size as your fist, but the heart is unlike any other muscle in your body.



To move the muscles in your arms and legs, you send a message to your brain. Your brain then sends a message, which activates the muscles. But your heart muscle doesn't need you to tell it what to do. Your heart muscle pumps on its own all the time—without you thinking about it!

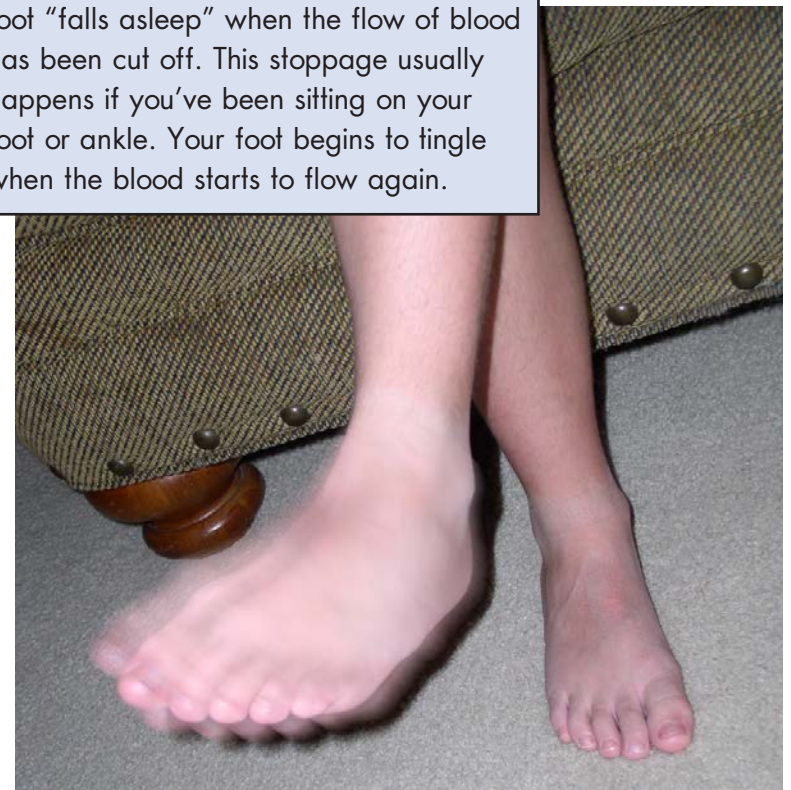
### Blood Bonus

Your heart muscle contracts about 100,000 times every 24 hours! That's 700,000 contractions a week and 36.4 million contractions a year. Imagine working around the clock without taking a break!

When blood starts to flow back to the heart, it has delivered most of its oxygen to the rest of the body. The blood lacks oxygen, which gives it a darker color. So the blood vessels that serve as veins appear darker in color, too, or purplish. The layer of skin also distorts the color of blood and blood vessels.

### Blood Bonus

Why does your foot fall asleep? Your foot "falls asleep" when the flow of blood has been cut off. This stoppage usually happens if you've been sitting on your foot or ankle. Your foot begins to tingle when the blood starts to flow again.



After your foot falls asleep you may feel "pins and needles" until the blood flow is normal again.





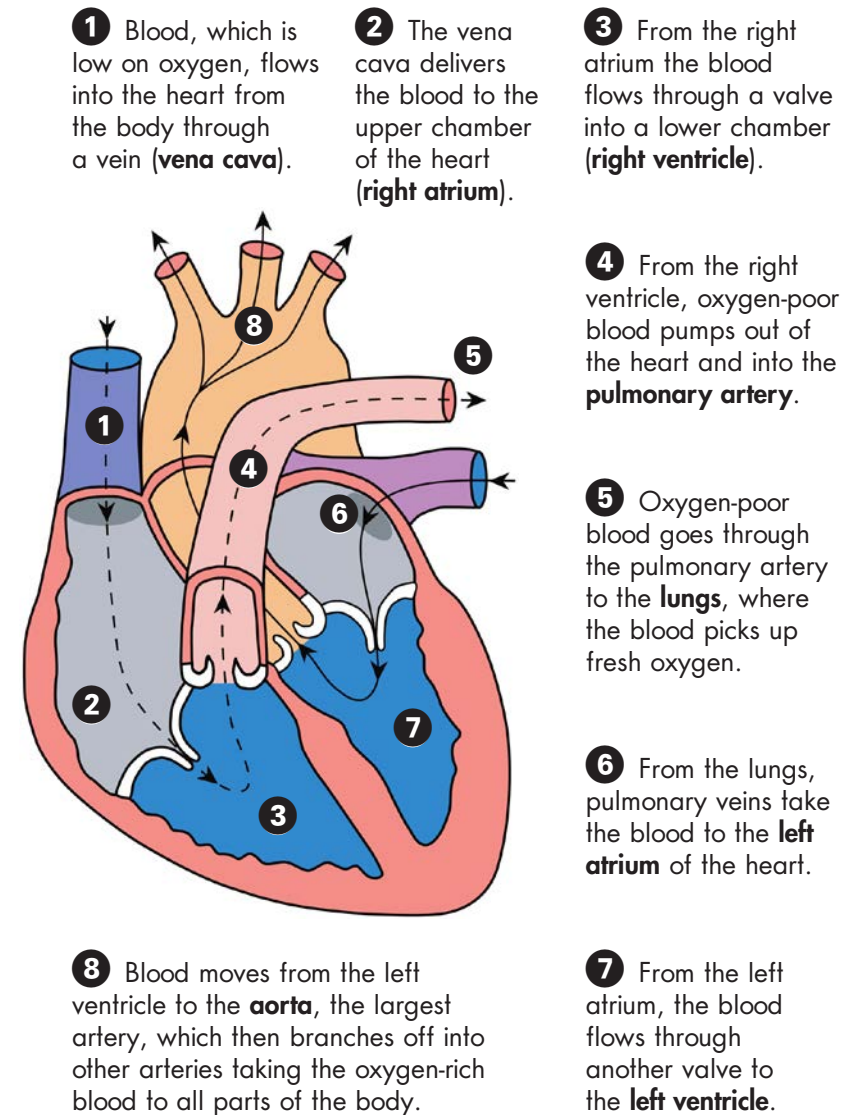
You can see blood vessels on the underside of your wrist, just below the skin.

## The Color Red ... or Purple?

If you look closely at your hand, you can see blood vessels beneath the skin. The blood vessels, however, don't appear red, which is the color of blood. Instead, they are a dark, purplish color. Why are blood and the blood vessels two different colors?

It actually has to do with oxygen. Red blood cells contain a **protein** called *hemoglobin* (HE-mo-glow-bin), which has iron in it. Iron enables the blood to absorb oxygen more easily. When iron and oxygen mix, the hemoglobin protein in the blood turns red. So that is why blood is red, especially when it is released from a cut or puncture.

The heart's main function is to pump the blood that flows through your body, keeping the blood constantly on the move. The diagram below shows how the blood pumps through the heart.



## Vessel Voyage

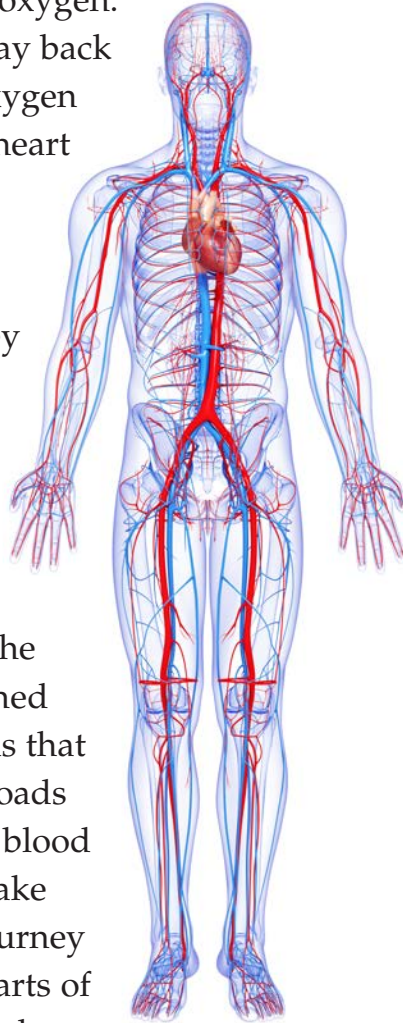
Blood that leaves the heart has been enriched with oxygen from the lungs, which then circulates to the very ends of your body, supplying your body with oxygen. The blood then makes its way back to the heart, its supply of oxygen having been **depleted**. The heart pumps the oxygen-poor blood to the lungs where it gets reenergized with fresh oxygen, and then the journey through the body begins again.

Blood does not flow just anywhere it wants, nor does it float around in a random pattern. Instead, the blood in your body is confined to tubes called blood vessels that

### Blood Bonus

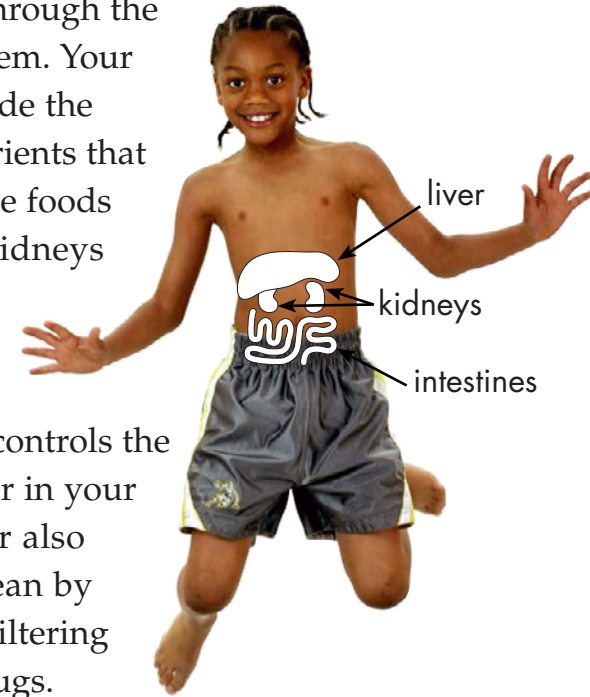
The largest blood vessel in your body is the aorta! It is the largest artery. The largest vein is the vena cava.

act as roads to help blood cells make their journey to all parts of your body.



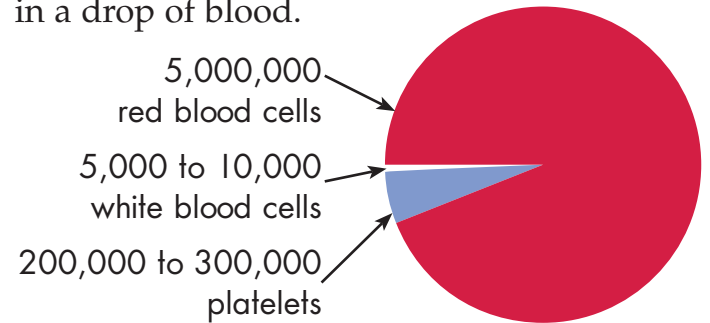
This shows the blood vessels in your body.

Many parts of your body are affected by the flow of blood through the circulatory system. Your intestines provide the blood with nutrients that you get from the foods you eat. Your kidneys remove waste products from your blood, and your liver controls the amount of sugar in your blood. The liver also keeps blood clean by removing and filtering poisons and drugs.



## A Drop of Blood

This pie graph compares the number of red blood cells, white blood cells, and platelets in a drop of blood.





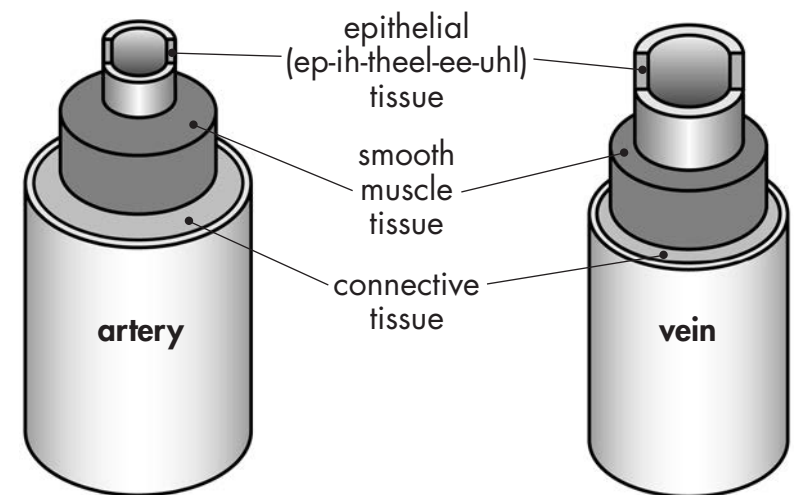
Platelets help form scabs, so cuts can heal.

Along with red blood cells, white blood cells, and plasma, blood has one more very important component—*platelets*. Platelets are smaller than red and white blood cells, but their job is crucial to the circulatory system. Platelets help blood to **clot**.

If you've ever cut yourself, you might have noticed that your blood eventually stops flowing. The platelets clot, or cause the blood cells and plasma to clump together, blocking the flow of the blood. Fibers also form over the skin, further blocking blood flow. Eventually, these fibers form a scab over the cut, allowing the skin underneath to heal.

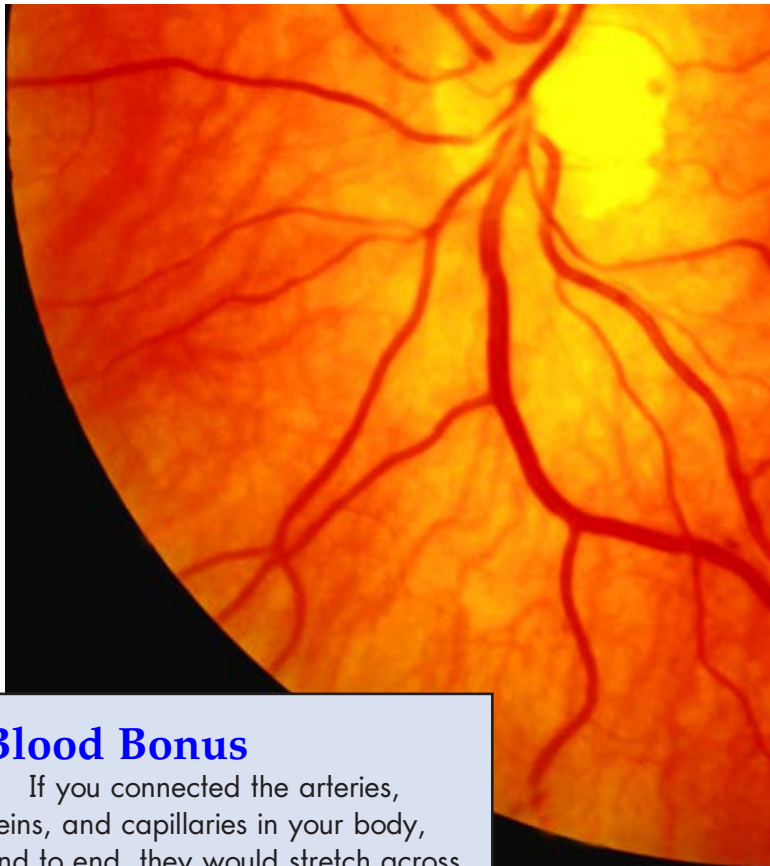
Your body has several types of blood vessels. One type of blood vessel is an artery, which carries blood away from the heart. The walls of an artery are thick and strong to handle the pressure of the heart's pumping action. The arteries carry blood loaded with oxygen and nutrients to other parts of your body.

A second type of blood vessel is a vein, which carries blood back to your heart. Veins are not as thick as arteries, because they are less at risk of bursting than arteries. Veins also have valves to prevent blood from flowing backward. The blood carried by veins does not have very much oxygen. This blood is on its way back to the heart and lungs to once again become **oxygenated**.



Veins and arteries are made of these three layers of tissue.





Capillaries in the eye

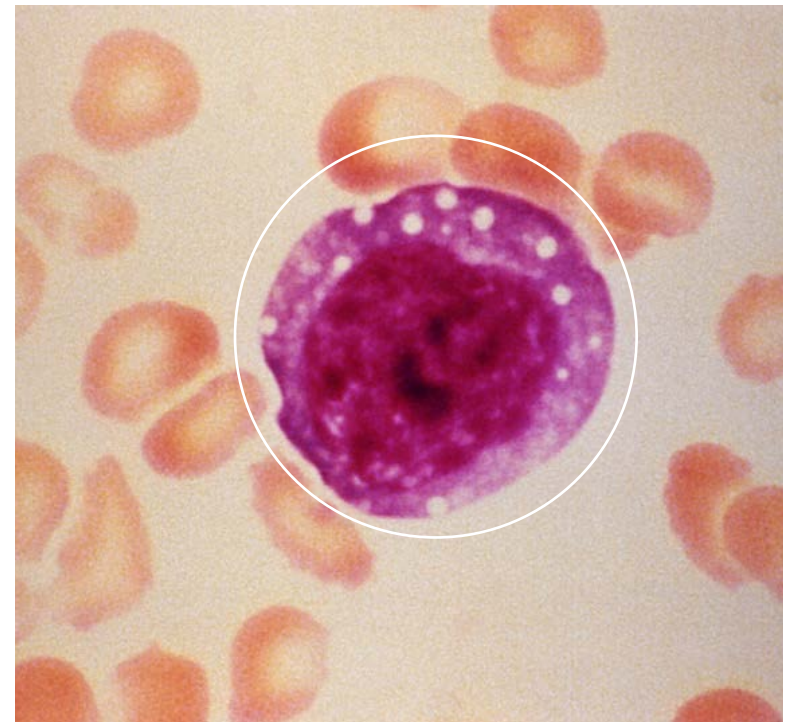
### Blood Bonus

If you connected the arteries, veins, and capillaries in your body, end to end, they would stretch across the United States—20 times! That's 60,000 miles or about 96,560 km!

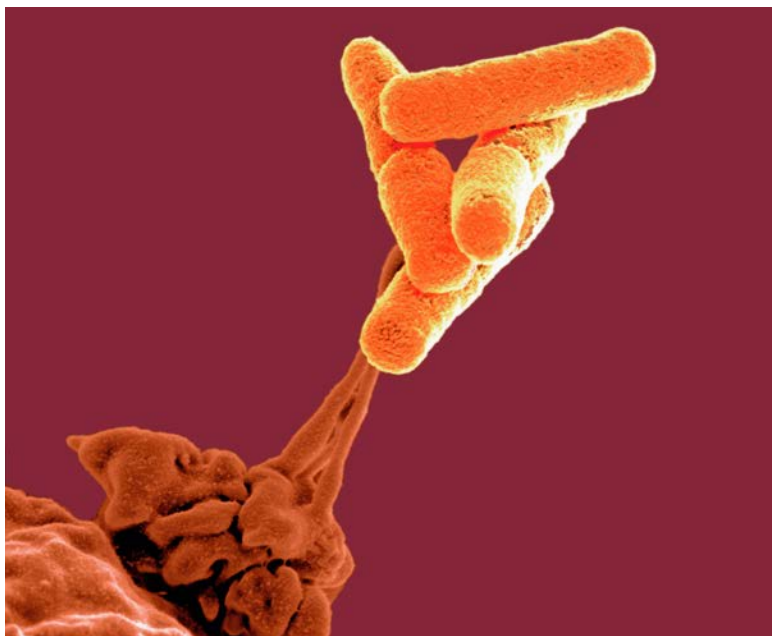
A third type of blood vessel is a capillary, which is very small and has walls that are very thin. Capillaries transfer the oxygen and nutrients in the blood that flows through the arteries to each living cell in the body. At the same time, the capillaries pass back nutrient-poor blood to the veins.

Another type of white blood cell is called the *lymphocyte* (LIM-fo-site), which produces *antibodies* to help your body combat viruses and bacteria. An antibody is a chemical that helps destroy harmful bacteria and viruses. So, instead of eating the germs, the lymphocyte tries to wipe them out using chemical warfare.

A third type of white blood cell is called a *monocyte* (MON-o-site), which works like the neutrophil, by killing unknown particles in your blood by eating them.



Lymphocyte white blood cell among red blood cells



Neutrophil cell cleaning up damaged tissue and bacteria around an injury.

White blood cells also have an important job—they keep your body healthy by fighting off diseases. Essentially, white blood cells maintain your body's health by gobbling up harmful germs such as **bacteria** and **viruses**!

The most common white blood cell is called *neutrophil* (NEW-tro-fill). These white blood cells are the lookouts, the guardians, of your body. They are always searching for harmful germs that will make you sick. When they find these germs, they wrap themselves around the germs—then they eat them!

## What Is Your Pulse?

Your **pulse** is actually the movement of blood vessels beneath your skin. When the heart pumps, it sends large flows of blood through the arteries. The walls of the arteries expand to accommodate this surge of blood.

You feel the expanding artery wall as your pulse. When you are resting, you should be able to count about 60 to 80 pulse beats a minute.

A doctor listens for a girl's pulse.



## Try This!

Count how many times your pulse beats in 10 seconds and multiply that number by 6. The answer you get is called your heart rate. Now try it again, but first hop on one foot for one minute before you count the number of beats. What happened to your heart rate? Exercise gives your heart a workout as well as the other muscles of your body.

Raising your pulse keeps your heart healthy!

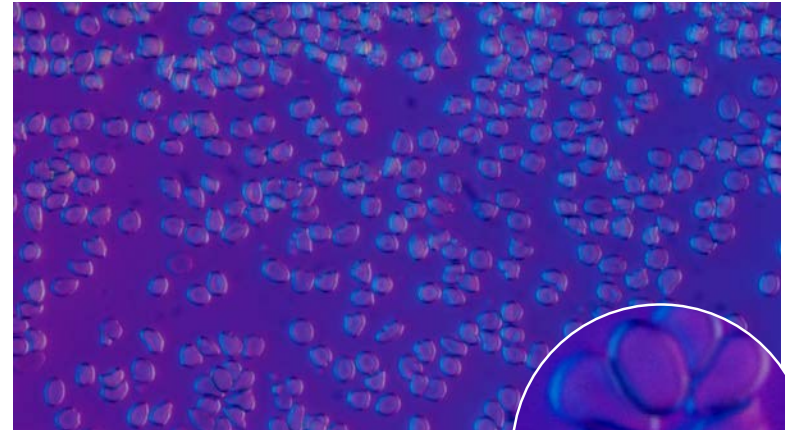


## All About Blood

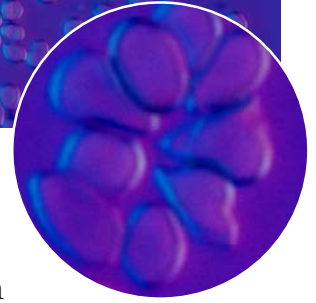
So what, exactly, is blood? If you've ever scraped your knee, you've probably seen the red stuff that oozes from below the skin. To the naked eye, blood might look like nothing more than a thick, red liquid.

Upon closer inspection, however, blood is a complicated substance, loaded with cells that are tiny and cannot be seen until you look at them using a microscope. There are two main types of blood cells—red and white. A soft tissue inside certain bones, called marrow, creates new red blood cells. A small organ near your stomach, called the spleen, is responsible for destroying old blood cells and for creating new white blood cells.

A girl examines the scrape on her knee.



blood cells



The most common blood cell is the red blood cell, which gives blood its red color. Your body has more than 25 trillion red blood cells, and each lives for about four months. Your blood also has white blood cells. The white and red blood cells flow through the body in a yellow liquid called **plasma**.

Your red blood cells look a little bit like donuts, with the holes not fully punched out. Red blood cells are the part of the blood that carries oxygen throughout your body and also carries the nutrients that your body gets from the foods you eat. As red blood cells pass through the lining of your intestines, they absorb the nutrients from digested food. Red blood cells also remove wastes from cells throughout your body.