

Information about Blood

Haywards Heath & District Probus Club



Blood

Everyone has it, but few people know how it's made and what it does. Blood is a red liquid in humans and many animals. Blood is pushed through the body by the heart and brings nutrients and oxygen to our tissues. It also takes away waste and carbon dioxide from tissues. Blood is made up of blood plasma and various cells — red blood cells, white blood cells and platelets.

Where Blood comes from

Blood cells are made in the bone marrow and the spleen. The bone marrow is the soft material in the middle of bones. Special cells in the bone marrow make most of the blood cells in your body. Plasma proteins are produced mainly by the liver. The water and electrolytes in plasma come from the food and water that you eat. Although blood is a fluid, in some ways, it is a kind of connective tissue. Its cells originate in bone marrow and the spleen, and in the blood, there are potential molecular fibres in the form of *fibrinogen*. These are activated when a blood clot forms.

Red Blood Cells



Picture Credit: "Red Blood cells" by SciTechTrend is marked with CC PDM 1.0

Red blood cells get their colour from haemoglobin, which is red. There are millions of *haemoglobin* molecules in each red blood cell and millions of red blood cells in the human body. When haemoglobin has oxygen attached, it is called *oxyhemoglobin*. **Haemoglobin** is a protein in red blood cells that contains iron. It is used to transport oxygen around the human body. It is also involved in the transport of other gases. It carries some of the body's respiratory carbon dioxide (about 20-25% of the total).

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Another name for red blood cells is *erythrocyte*. 'Erythro' means red; 'cyte' means cell. RBC is an acronym for red blood cells. RBCs also help the blood stay normal pH. The blood needs to be at a pH of 7.4. If it is much more or less than 7.4, a person can get very sick or die. RBCs are a buffer for the pH of the blood. Buffer means that it stops changes in pH. The proteins and the carbon dioxide in the RBC are buffers for the blood. If you do not have enough RBCs, you will die.

Source: <https://simple.wikipedia.org/wiki/Blood> and <https://simple.wikipedia.org/wiki/Hemoglobin>

White Blood Cells

White blood cells (WBCs) help fight infections and heal wounds. White blood cells are a big part of the body's immune system as they attack things that do not belong in the body. They kill germs such as bacteria, viruses and cancer cells. White blood cells also help to fight other toxic substances.

White blood cells find where the germs are and start to destroy them. WBCs arrive in the blood. They also go out of the blood in places where there is infection. WBCs do this to fight the germs that cause the infection. If they go out of the blood to fight an infection, they may return to the lymphatic system. So WBCs are in lymph nodes.

Another name for white blood cell is leukocyte. Leuko means white, cyte means cell. There are three main kinds of WBCs: *lymphocytes*, *granulocytes* and *monocytes*. Some of the WBCs mature into cells that do similar work in the tissues.

The different WBCs work in different ways. Some WBCs kill and eat germs and cancer cells. Some WBCs make antibodies. These are proteins that stick to a cell and tell other WBCs to kill it. Some WBCs make chemicals. They release these chemicals to fight things that do not belong in the body. These chemicals cause inflammation in a part of the body. When a germ makes someone sick, the body shows it. If a bacteria gets under someone's skin and causes an infection, the skin gets red, hot, and painful. This redness, heat, and pain are signs of inflammation showing that WBCs are fighting the infection and killing the bacteria.

Platelets

Platelets help the **blood to clot**. Platelets are also called *thrombocytes*.

A clot is when the liquid blood becomes solid. The body makes blood clot when the skin is cut. It stops blood from leaking from the site of the cut or bruise. Blood needs to be able to clot. But, rarely, some blood clots are harmful. If a blood clot happens in a blood vessel going to the brain, it can cause a stroke. If it occurs in a blood vessel going to the heart, it can cause a heart attack. These things do not usually happen to young, healthy people.

Platelets are not the only things that make clots. There are proteins in the blood that help make clots. Both platelets and clotting proteins are needed to make good clots.

Source: <https://simple.wikipedia.org/wiki/Blood>

Blood Plasma

Blood plasma is the yellow liquid in which blood cells float. Plasma comprises nutrients, electrolytes (salts), gases, non-protein hormones, waste, lipids, and proteins. These proteins are albumin, antibodies (also called *immunoglobulins*), clotting factors, and protein hormones. Plasma that does not have the protein *fibrinogen* is called *serum* and cannot clot. Adults have about three litres of plasma.

Plasma is a liquid and takes up 55% of blood volume. It is mostly water (90-92%). The contents of the remaining 8-10% include:

- glucose
- hormones
- proteins
- mineral salts
- fats
- vitamins

Source: <https://simple.wikipedia.org/wiki/Blood> and <https://www.medicalnewstoday.com/articles/196001#structure>

Anaemia

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Anaemia is a condition in which you lack enough healthy red blood cells to carry adequate oxygen to your body's tissues. Having anaemia, also referred to as *low haemoglobin* or low iron levels, can make you feel tired and weak. There are many forms of anaemia, each with its own cause.

Low iron levels are usually treated with iron tablets prescribed by a GP and by eating iron-rich foods.

Common symptoms of anaemia can include:

- tiredness and lack of energy
- shortness of breath
- noticeable heartbeats (heart palpitations)
- pale skin

Less common symptoms of iron deficiency anaemia (that are not usually connected to pregnancy) include:

- headaches
- hearing ringing, buzzing or hissing noises inside your head (tinnitus)
- food tasting strange
- feeling itchy
- a sore tongue
- hair loss – you notice more hair coming out when brushing or washing it
- wanting to eat non-food items, such as paper or ice (pica)
- finding it hard to swallow (dysphagia)
- painful open sores (ulcers) in the corners of your mouth
- spoon-shaped nails
- restless legs syndrome

Untreated iron deficiency anaemia:

- can make you more at risk of illness and infection – a lack of iron affects the immune system
- may increase your risk of developing complications that affect the heart or lungs – such as an abnormally fast heartbeat (tachycardia) or heart failure
- in pregnancy, can cause a greater risk of complications before and after birth

Source: <https://www.nhs.uk/conditions/iron-deficiency-anaemia/>

Blood Types

There are eight main blood types, but some are rarer than others. The list below shows the percentage of donors with each blood type:

- O positive: 35%
- O negative: 13%
- A positive: 30%
- A negative: 8%
- B positive: 8%
- B negative: 2%
- AB positive: 2%
- AB negative: 1%

The data above comes from blood.co.uk and is believed to be accurate as at December 2018. Percentage figures have been rounded to the nearest whole number.

Can blood change?

It's very rare, but possible, for someone's blood type to change. It can occur through the addition or suppression of an antigen, which can happen during an infection, malignancy or because of an auto-immune disease. Another cause of blood type changing happens during a bone marrow transplant. People who receive bone marrow from someone with a different ABO type will eventually switch to the donor's blood type.

Blood Groups

There are four main blood groups (types of blood) – **A, B, AB and O**. Your blood group is determined by the genes you inherit from your parents.

Each group can be either RhD positive or RhD negative, which means there are eight blood groups in total.

Source: <https://www.nhs.uk/conditions/blood-groups/>

Antibodies and Antigens

Blood is made up of red blood cells, white blood cells and platelets in a liquid called plasma. Antibodies and antigens in the blood identify your blood group.

Antibodies are proteins found in plasma. They're part of your body's natural defences. They recognise foreign substances, such as germs, and alert your immune system, which destroys them.

Antigens are protein molecules found on the surface of red blood cells.

Source: <https://www.nhs.uk/conditions/blood-groups/>

The ABO System

The ABO system defines four main blood groups:

- blood group A – has A antigens on the red blood cells with anti-B antibodies in the plasma
- blood group B – has B antigens with anti-A antibodies in the plasma
- blood group O – has no antigens, but both anti-A and anti-B antibodies in the plasma
- blood group AB – has both A and B antigens, but no antibodies

Blood group O is the most common blood group. Almost half of the UK population (48%) has blood group O.

Receiving blood from the wrong ABO group can be life-threatening. For example, suppose someone with group B blood is given group A blood. In that case, their anti-A antibodies will attack the group A cells. This is why group A blood must never be given to someone who has group B blood and vice versa.

As group O red blood cells do not have any A or B antigens, it can safely be given to any other group.

The NHS Blood and Transplant (NHSBT) website has more information about the [different blood groups](#).

Source: <https://www.nhs.uk/conditions/blood-groups/>

The Rh system

Red blood cells sometimes have another antigen, a protein known as the RhD antigen. If this is present, your blood group is RhD positive. If it's absent, your blood group is RhD negative.

This means you can be one of eight blood groups:

- A RhD positive (A+)
- A RhD negative (A-)
- B RhD positive (B+)
- B RhD negative (B-)
- O RhD positive (O+)
- O RhD negative (O-)
- AB RhD positive (AB+)
- AB RhD negative (AB-)

About 85% of the UK population is RhD positive (36% of the population has O+, the most common type).

In most cases, O RhD negative blood (O-) can safely be given to anyone. It's often used in medical emergencies when the blood type is not immediately known. It's safe for most recipients because it does not have any A, B or RhD antigens on the cells' surface and is compatible with every other ABO and RhD blood group.

The NHS Blood and Transplant (NHSBT) website has more information about the [Rh system](#).

Source: <https://www.nhs.uk/conditions/blood-groups/>

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Blood Group test

To work out your blood group, your red cells are mixed with different antibody solutions. If, for example, the solution contains anti-B antibodies and you have B antigens on your cells (you're blood group B), it will clump together. If the blood does not react to any of the anti-A or anti-B antibodies, it is blood group O. A series of tests with different types of antibodies can be used to identify your blood group.

If you have a **blood transfusion** – where blood is taken from one person and given to another – your blood will be tested against a sample of donor cells that contain ABO and RhD antigens. If there's no reaction, donor blood with the same ABO and RhD type can be used.

Source: <https://www.nhs.uk/conditions/blood-groups/>

Pregnancy

Pregnant women are always given a blood group test because if the mother is RhD negative, but the child has inherited RhD-positive blood from the father, it could cause complications if left untreated. RhD-negative women of child-bearing age should always only receive RhD-negative blood.

Read more about **Rhesus disease**.

Source: <https://www.nhs.uk/conditions/blood-groups/>

Fascinating Facts about Blood

- The word "blood" appears at least once in every play by William Shakespeare.
- Not every animal has red blood. Spiders, lobsters, crabs and snails have blue blood due to the presence of the protein *haemocyanin* (it contains copper). Earthworms and leeches have green blood. Many invertebrates, such as starfish, have clear or yellowish blood.
- Cows have 800 (and possibly more) blood types.
- The amount of blood in a pregnant mother's body will have increased by 50% by the 20th week of pregnancy.
- Human blood contains around 0.2 milligrams of gold.
- Some Japanese people believe that blood type is an indicator of a person's personality. There are even novelty goods themed after blood types.
- Research has shown that mosquitoes prefer blood type O.
- There are 150 Billion red blood cells in one ounce of blood and 2.4 Trillion red blood cells in one pint of blood.
- The human body manufactures 17 million red blood cells per second. In the event of stress, the body can produce up to seven times that amount (Up to 119 million red blood cells per second.)
- A red blood cell is around seven microns in size (a micron is one-millionth of a metre).
- It takes just 20 to 60 seconds for a drop of blood to travel from the heart, through your body, and back to the heart again.
- Nearly 7% of the bodyweight of a human is made up of blood.
- An adult body has 100,000 kilometres or 62,000 miles of blood vessels running throughout the body.
- The average volume of blood present in an adult male body is 5.6 litres, while an adult female body contains 4.5 litres of blood. A newborn baby will have around one cup of blood in its body.
- The only place where blood cannot be found in the human body is the cornea (eye) because it can directly extract oxygen from the air.
- The supply of blood in blood vessels located in the nose increases when someone catches a cold. This increase happens to keep the nose warm. As a result, blood vessels dilate and increase mucus production and cause a runny nose.
- More than 400 gallons of blood are filtered by our kidneys every day.
- Nearly 1/4th of the cells in the human body are red blood cells. In an adult human body, it's estimated that there are 20-30 trillion red blood cells. The total number of white blood cells in an adult human body is between 4,000 and 11,000.
- Nearly two million red blood cells in an adult human body die every second. Fortunately, they are replaced by new cells produced in the bone marrow.
- The human heart pumps 1.5 million barrels of blood during a lifetime.
- At age 13, an Australian named James Harrison needed 13 litres of blood for major surgery. After he turned 18, he started donating blood. It was found that his blood contained a very rare antigen that was capable of curing Rhesus disease. To date, Harrison has donated blood 1,000 times (over 60 years) and is responsible for saving over two million babies from that disease.
- Kidneys regulate the production of red blood cells in the human body. Kidneys are responsible for producing *erythropoietin hormone* (EPO) that binds with the receptors in stem cell walls in the bone marrow, and after a complex set of events, the DNA of stem cells are transformed into red blood cells.
- Kidneys will release EPO only when it finds that oxygen levels in the blood have fallen below normal levels. Thus, kidneys are responsible for measuring the levels of oxygen in the blood.

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Giving Blood

Most people can give blood, but only 1 in 25 people actually do. You can donate blood if you:

- are fit and healthy
- weigh at least 50kg (7st 12lb)
- are 17-66 years old (or 70 if you've given blood before)
- are over 70 and have given blood in the last two years

Source: <https://www.nhs.uk/conditions/blood-groups/>

For further information about who can and cannot donate blood, please go to the World Health Organization website, [HERE](#).



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