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# **INFORMATION FOR PATIENTS ABOUT BLOOD TRANSFUSION 2014**

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# TESTING

## Testing performed by the Blood Service

**All blood donations are tested by the Australian Red Cross Blood Service for the following reasons:**

1. To allow appropriate selection of blood for a compatible transfusion (eg. ABO and RhD blood group compatibility between donor and recipient)
2. To identify donations that are not suitable for transfusion (eg. from a donor who carries a transfusion-transmissible infection)
3. To minimise/prevent adverse consequences of transfusion (eg. for recipients who require special products).

Mandatory tests are performed for ABO and RhD blood groups, red cell antibodies and the following infections: human immunodeficiency virus (HIV) 1 and 2; hepatitis B and C; human T-cell lymphotropic virus (HTLV) I and II; and syphilis. Platelets have to be stored at room temperature, and they are screened for bacteria.

There are strict guidelines and standard operating procedures for these tests. All tests are performed in licensed facilities according to the principles of good laboratory and manufacturing practice.

The Blood Service checks the test results before any blood components are released for clinical use or for further manufacture.

If a screening test for infectious disease is confirmed as reactive, the donation is destroyed, and the donor is notified and counselled as per Blood Service procedure.

Only donations that have returned satisfactory blood results, which are non-reactive for infectious disease screening and meet all other specifications, are released by the Blood Service for use.

## Testing performed by the hospital

Before you receive a transfusion, the hospital transfusion laboratory requires a sample of your blood for testing to ensure they provide the most suitable available blood product for you.

# BLOOD GROUPS AND COMPATIBILITY

**When a transfusion is given, it is preferable for patients to receive blood of the same blood (ABO and RhD) group. However, in an emergency or special circumstance, if the same blood group isn't readily available, a patient may be given another group that their immune system will not react to.**

## What is the ABO group?

A and B are different antigens on the surface of the red cells. Antigens are proteins or carbohydrates that our immune system can recognise as foreign. O cells do not have either antigen. The type of antigen on your red cells is genetically determined. If you have the A antigen, you have 'Group A' red cells. It is also possible to have both A and B antigens meaning your blood group is AB.

## What is Rh?

The Rh blood group system has around 50 different red blood cell antigens. D is the most important antigen of the Rh system. It is also known as RhD or Rh factor. In Australia, approximately 83% of people will have the D antigen on their red cells. Their blood type is called Rh positive. The other 17% do not have the D on their red cells and are called Rh negative. The percentage of Rh negative people varies in different countries (eg. less than 5% of India's population are Rh negative). An RhD negative person, with an RhD antibody, will destroy any RhD positive red cells they come in contact with. This may occur with a transfusion or when pregnant with an RhD positive baby. Rh is very important for women who are or may become pregnant as the antibodies can cause problems for mother and baby.

## Red cell compatibility

As shown in the table below, O Rh- is the universal red cell donor blood that can be given to all patients. This is common practice when a patient's blood group is unknown and in emergency situations especially for women of child-bearing age.

		Donor's Blood Type							
		O-	O+	B-	B+	A-	A+	AB-	AB+
Patient's Blood Type	AB+	✓	✓	✓	✓	✓	✓	✓	✓
	AB-	✓		✓		✓		✓	
	A+	✓	✓			✓	✓		
	A-	✓				✓			
	B+	✓	✓	✓	✓				
	B-	✓		✓					
	O+	✓	✓						
	O-	✓							

continues

## Plasma compatibility

Plasma contains anti-A and anti-B antibodies depending upon the blood group. Antibodies are attack molecules made by our immune system to protect against foreign antigens, (eg. found on viruses). Our body also has antibodies to A and/or B antigens according to our blood group.

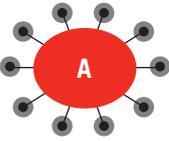
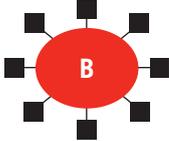
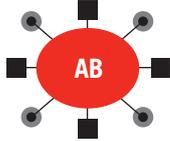
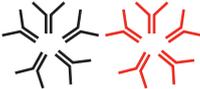
Patients should only receive plasma that does not contain an antibody which could attack the antigens present on their own red cells.

**Group A** recipients have A antigen on their red cells, so they can't receive group O or group B plasma as the anti-A will attack their red cells.

**Group B** recipients have B antigen on their red cells, so they can't receive group O or group A plasma as the anti-B will attack their red cells.

**Group AB** recipients can only receive group AB plasma.

**Group O** recipients do not have either A or B antigen, so can safely receive plasma of any blood group type.

	Group A	Group B	Group AB	Group O
<b>Red blood cell type</b>				
<b>Antibodies present in plasma</b>	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
<b>Antigens present on red cells</b>	 A antigen	 B antigen	 A and B antigen	No antigens

Patient Group	Compatible Plasma Donor
<b>A</b>	A, AB
<b>B</b>	B, AB
<b>AB</b>	AB
<b>O</b>	O, AB, A, B

Group AB donors are called 'universal plasma donors' and their plasma can be safely given to any patient as it does not contain either anti-A or anti-B.

# ANTIBODIES

## What are antibodies?

Antibodies are important molecules our immune system makes to help protect ourselves against foreign things such as bacteria and viruses. Antibodies can also be formed in response to different blood groups.

## How do I get antibodies?

Everyone is born with some antibodies. New blood group antibodies can be made in response to substances in nature that have similar structures to blood groups but are more likely to occur during pregnancy and/or from exposure to blood through transfusions.

## When would I be tested for blood group antibodies?

If you donate blood, some antibodies may be detected during routine testing, in which case you will be notified. You will also be tested if your doctor indicates that blood or blood products may be required as part of your medical treatment.

## How will I be tested?

It is a simple blood test taken from a vein in your arm.

## I have antibodies, what does this mean?

Having antibodies does not affect your general health. They become more important if you were to become pregnant or require a blood transfusion. Not all antibodies are equal in importance in a transfusion situation.

By knowing which antibodies you have, it allows laboratory staff to carefully match (or cross-match) your blood with donor blood to select the appropriate blood for your transfusion. This reduces the chance of a transfusion reaction occurring as a result of these antibodies.

## Who do I need to tell?

It is important to let your general practitioner and family know if you have antibodies in case of an emergency situation. You should also let your doctor/anaesthetist know before surgery so there is time to cross-match your blood with suitable blood for transfusion. A record of your transfusion history is kept by the laboratory that tests and matches your blood. It is useful if you know which laboratory has tested your blood previously as the current laboratory may need to contact them.

## Why is my blood cross-matched before a transfusion?

If your blood has not been cross-matched prior to transfusion, your antibodies can react to the antigens in the blood you receive. Antigens are substances which our immune system recognises as foreign and attempts to destroy with an antibody. This can cause a severe reaction known as a haemolytic reaction – where the red cells being transfused are incompatible with your red cells and are destroyed. In severe cases this reaction can be fatal.

**Use the antibody card below to record any known details you may have/know.**

### ANTIBODY CARD

Name:

**I have previously tested positive for antibodies**

My blood was cross-matched by this provider:

Telephone number:

My Doctor is:

# WHAT'S IN A BAG: RED CELLS

**When blood is collected from a donor it can be split into three parts: red cells, platelets and plasma. This way blood can be used to help at least three people. Each person only gets the part that they need.**

## **What are red cells?**

Red cells are shaped like doughnuts but with an indented centre instead of a hole. Red cells give blood its colour and make up 40% of your total blood volume. They are red due to a protein called haemoglobin. Red cells are stored in a purpose-built blood fridge.

## **What is the role of red cells the body?**

Red cells have two main functions:

- to carry oxygen to all parts of your body
- to remove waste products such as carbon dioxide in your body.

## **Why might I need a red cell transfusion?**

You may need a red cell transfusion if you develop severe anaemia. Anaemia is the medical term for low haemoglobin (not enough red blood cells). Anaemia can result from:

- a surgical procedure or injury if a large amount of blood is lost, resulting in low numbers of red cells
- cancer and cancer treatments (for example chemotherapy) can affect your body's ability to make new red blood cells
- blood diseases (for example myelodysplasia) can cause a lower number of red cells to be made or the red cells that are made may not work properly.

## **Are there options other than a red cell transfusion?**

Certain treatments or operations can't be safely carried out without a red cell transfusion. However where alternatives to a transfusion are available they should be used. For example, some causes of anaemia may be managed by treating the anaemia instead of giving a red cell transfusion. If your anaemia is caused by low iron levels, your doctor may treat you with iron supplements.

## **How is a red cell transfusion given?**

A red cell transfusion is given through a drip (also known as an IV), which is a soft plastic tube inserted into your vein, usually in your arm. The transfusion may feel cold, but should not hurt. You will be carefully monitored during your transfusion.

## **How long does a red cell transfusion take?**

The time your transfusion will take depends on your condition. In an urgent circumstance, if you are losing a large amount of blood quickly for example, it can be given as fast as your body will allow. In non-urgent circumstances, one bag of red cells usually takes about two hours to be transfused. One bag of red cells should never be transfused for longer than four hours.

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## Are red cell transfusions safe?

Blood in Australia is collected by the Australian Red Cross Blood Service from voluntary, unpaid donors. All donors are interviewed and assessed for suitability to donate blood. Every blood donation is tested for the presence of certain infections such as HIV, hepatitis B and hepatitis C. These tests must be negative before blood is released for transfusion.

## What reactions can occur as a result of a transfusion?

Most people do not feel any different during a transfusion. Reactions from receiving a transfusion are uncommon, and usually mild. However, some rare, but serious reactions can occur. Reactions can occur during, or in the weeks after, a transfusion.

Signs of a transfusion reaction may include:

- rash
- itching
- hives
- difficulty breathing
- nausea
- vomiting
- chest pain
- fast or irregular heartbeat
- high temperature
- pain at the needle site
- dark or decreased amount of urine
- chills
- shaking.

If you feel unwell during your transfusion it is important to call the nurse immediately so they can assess if you are having a transfusion reaction. If you feel unwell in the weeks after your transfusion, please contact your doctor as soon as possible.

# WHAT'S IN A BAG: PLATELETS

**When blood is collected from a donor it can be split into three parts: red cells, platelets and plasma. This way blood can be used to help at least three people. Each person only gets the part that they need.**

## What are platelets?

Platelets are small, disc-shaped cell fragments. A bag of platelets is a cloudy yellow colour. They are stored at room temperature.

## What is the role of platelets in the body?

Platelets prevent or stop bleeding. If a blood vessel is damaged by trauma, surgery or illness, platelets form a plug, which helps stop bleeding. Platelets are held in place by special proteins in blood until the damage is healed. Platelets also contain growth factors that help to repair damaged body tissue.

## Why might I need a platelet transfusion?

You may need a platelet transfusion if you have a low platelet count or platelets that do not work properly causing bleeding or putting you at a high risk of bleeding. This may be due to:

- chemotherapy
- bone marrow transplantation
- major surgery
- liver disease
- severe trauma
- some medications.

## Are there options other than a platelet transfusion?

There are no options if you need a platelet transfusion. Starting or stopping some medication may help lower some people's risk of bleeding.

## How is a platelet transfusion given?

A platelet transfusion is given through a drip (also known as an IV), which is a soft plastic tube inserted into your vein, usually in your arm. The transfusion may feel cold, but should not hurt. You will be carefully monitored during the transfusion.

## How long does it take?

A platelet transfusion can be given as fast as your body will allow, usually over 30 to 60 minutes. One dose of platelets should not take longer than four hours to be transfused.

## Are platelet transfusions safe?

Blood in Australia is collected by the Australian Red Cross Blood Service from voluntary, unpaid donors. All donors are interviewed and assessed for suitability to donate blood. Every blood donation is tested for the presence of certain infections such as HIV, hepatitis B and hepatitis C. These tests must be negative before blood is released for transfusion. Because platelets have to be stored at room temperature they are also screened for bacteria. Bacteria can cause serious transfusion reactions.

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# WHAT'S IN A BAG: PLASMA

**When blood is collected from a donor it can be split into three parts: red cells, platelets and plasma. This way blood can be used to help at least three people. Each person only gets the part that they need.**

## What is plasma?

Plasma is the pale yellow liquid part of blood. It makes up about 55% of blood and is 92% water. It is stored frozen and thawed when needed.

## What is the role of plasma in the body?

Plasma is a fluid that carries red cells, white cells, platelets, proteins and nutrients through the blood vessels in the body.

Plasma contains:

- attack molecules called antibodies to fight infections
- clotting proteins to help stop bleeding.
- albumin, an important protein which stops water leaking out of the blood vessels and protects nutrients, hormones and some medications.

## Why might I need to be transfused with plasma?

You may need a plasma transfusion to replace missing or low levels of blood proteins due to:

- a medical condition such as liver disease
- heart surgery
- severe blood loss.

## Are there options other than a plasma transfusion?

There are a number of alternative fluids and individual antibodies, albumin and clotting proteins that can replace the need to use whole plasma in some patients. Alternatives to a transfusion are used whenever possible, but whole plasma is used when there are no alternatives or when a patient needs replacement of more than one plasma protein.

## How is a plasma transfusion given?

A plasma transfusion is given through a drip (also known as an IV), which is a soft plastic tube inserted into your vein, usually in your arm. It may feel cold, but should not hurt. You will be carefully monitored during your transfusion.

## How long does a plasma transfusion take?

A plasma transfusion can be given as fast as your body will allow, usually over about 30 minutes. It may be given over a longer period of time but one bag of plasma should not take longer than four hours to transfuse.

## Are plasma transfusions safe?

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# WHAT'S IN A BAG: CRYOPRECIPITATE

**When blood is collected from a donor it can be split into three parts: red cells, platelets and plasma. This way blood can be used to help at least three people. Each person only gets the part that they need.**

## What is cryoprecipitate?

Plasma is the pale yellow liquid part of blood. It makes up about 55% of blood and is mostly made up of water (about 92%). Plasma can be divided into Cryoprecipitate and cryodepleted plasma.

Cryoprecipitate contains a number of special proteins (clotting factors) and is stored frozen and thawed when required.

## What is the role of cryoprecipitate in the body?

It contains specific proteins involved in clotting. Blood clotting proteins found in cryoprecipitate include:

- fibrinogen
- Factor VIII (the protein missing in patients with haemophilia A)
- Factor XIII
- von Willebrand factor (helps the platelets stick together).

## Why might I need to be transfused with cryoprecipitate?

You may need a cryoprecipitate transfusion if you have low levels of some clotting proteins, in particular one called fibrinogen. Clotting proteins work together to help control bleeding or reduce the risk of bleeding. The most common use of cryoprecipitate is for a patient needing a large number of blood components at one time – commonly called a massive transfusion.

## Are there options other than a cryoprecipitate transfusion?

Some of the clotting proteins in cryoprecipitate are available in specific concentrates or in 'recombinant' (synthetic) forms. When these are available, they should

be given in preference to cryoprecipitate, due to fewer complications. In some circumstances there is no other option and a cryoprecipitate transfusion has the potential to improve your health or save your life.

## How is cryoprecipitate transfusion given?

A cryoprecipitate transfusion is given through a drip (also known as an IV), which is a soft plastic tube inserted into your vein, usually in your arm. It may feel cold but should not hurt. You will be carefully monitored during your transfusion.

## How long does a cryoprecipitate transfusion take?

Normally, a cryoprecipitate transfusion involves receiving more than one bag. Each bag usually takes 10 to 30 minutes. One bag of cryoprecipitate should not take longer than four hours to transfuse.

## Are cryoprecipitate transfusions safe?

Blood in Australia is collected by the Australian Red Cross Blood Service from voluntary, unpaid donors. All donors are interviewed and assessed for suitability to donate blood. Every blood donation is tested for the presence of certain infections such as HIV, hepatitis B and hepatitis C. These tests must be negative before blood is released for transfusion.

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## What reactions can occur as a result of a transfusion?

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# WHAT'S IN A BAG: CRYODEPLETED PLASMA

**When blood is collected from a donor it can be split into three parts: red cells, platelets and plasma. This way blood can be used to help at least three people. Each person only gets the part that they need.**

## What is cryodepleted plasma?

Plasma is the pale yellow liquid part of blood. It makes up about 55% of blood and is mostly made up of water (about 92%). Plasma can be divided into cryoprecipitate and cryodepleted plasma.

Cryodepleted plasma is plasma that has had some blood clotting proteins (cryoprecipitate) removed. It is stored frozen and thawed when required.

## Why might I need to be transfused with cryodepleted plasma?

You may need a cryodepleted plasma transfusion if you have Thrombotic Thrombocytopenic Purpura (TTP). TTP is a blood disorder that causes blood clots to form in small blood vessels around your body. The usual treatment for TTP is plasma exchange where some of your plasma is removed and replaced with cryodepleted plasma. Occasionally cryodepleted plasma is used to treat other medical conditions.

## Are there options other than a cryodepleted plasma transfusion?

There are no options available to treat TTP that do not involve transfusion of blood products. Sometimes plasma or albumin is used instead of cryodepleted plasma. Both are blood products. Choosing not to receive a transfusion may have severe or fatal consequences and should be discussed with your health care team.

## How is a cryodepleted plasma transfusion given?

A cryodepleted plasma transfusion is given through a drip (also known as an IV), which is a soft plastic tube inserted into your vein, usually in your arm. It may feel

cold, but should not hurt. For the treatment of TTP, an apheresis machine is often used to remove some of the plasma from your blood and replace it with cryodepleted plasma. This process is called plasma exchange. You will be carefully monitored during your transfusion.

## How long does a transfusion take?

Cryodepleted plasma is usually only used as part of plasma exchange. The whole procedure may take a few hours and your health care team will give you more information. If you are receiving cryodepleted plasma as a single transfusion, it will take about 30 minutes. It may be given over a longer period of time, but one bag of cryodepleted plasma should not take longer than four hours to transfuse.

## Are cryodepleted plasma transfusions safe?

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## **What reaction can occur as a result of a transfusion?**

Most people do not feel any different during a transfusion. Reactions from receiving a transfusion are uncommon, and usually mild. However, some rare, but serious reactions can occur. Reactions can occur during, or in the weeks after, a transfusion.

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If you feel unwell during your transfusion it is important to call the nurse immediately so they can assess if you are having a transfusion reaction. If you feel unwell in the weeks after your transfusion, please contact your doctor as soon as possible.

# EXTRA REQUIREMENTS

**In some circumstances it is not just your blood group that is important in selecting appropriate blood for a transfusion. Sometimes extra requirements need to be taken into consideration. For example, your doctor could request blood that is CMV negative, blood that has been irradiated or washed red cells.**

## CMV negative blood products

Cytomegalovirus or CMV, is a common virus that affects people of all ages. Many people are infected with CMV and don't even know it because this virus rarely causes any symptoms and usually does not cause long-term health problems.

This virus is of no particular risk to the majority of patients receiving a transfusion as it is only transmissible when the virus is active. In the majority of the population, CMV remains inactive. As a result, CMV is unlikely to be transmitted through a blood transfusion. However, CMV can cause problems in patient's that have a weakened immune system from illness or if undergoing an organ transplant, and also in patients that are pregnant and have not previously been in contact with CMV. CMV negative blood can be requested for these patients.

## Leucodepleted blood products

Since July 2008, all platelet and red cell products provided by the Blood Service in Australia are filtered to remove more than 99% of white cells from blood products in a process known as leucodepletion. Leucodepletion reduces the risk of CMV transmission where CMV-negative products are not readily available, as well as reducing the risk of other transfusion-related reactions.

## Irradiated blood products

Irradiated blood products may be requested to prevent transfusion-associated graft-versus host disease (TA-GvHD). TA-GvHD may occur where transfused white blood cells see the recipient as foreign and attack the recipient's cells. This can lead to severe illness and even death. It is a rare but serious risk of a blood transfusion. It is an issue for people with weakened immune systems or when the recipient and donor are very similar genetically.

Gamma radiation can be used to destroy the white cells in the donated blood, preventing TA-GvHD. This process does not remove them but prevents them from multiplying and causing the disease.

The Blood Service irradiates some but not all of the red cell and platelet components, so your doctor will need to request them. Those most likely to require irradiated products include:

- patients receiving blood from
  - family members
  - tissue typed matched donors
  - granulocyte (white cell) donors
- patients with an inherited immune system disorder
- patients who have developed an immune disease or disorder such as some cancers
- patients who have developed an immune disorder as a result of treatment with certain drugs
- patient's with a weakened immune system as a result of a bone marrow or stem cell transplant
- unborn babies and babies who have received intrauterine transfusions.

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## Washed red cells

Washing of red cells removes many plasma proteins, including antibodies. People most likely to require this product are:

- patients with a history of severe reactions to transfusion despite receiving leucodepleted products
- patients with severe allergic reactions where the cause is unknown
- patients who react to transfused plasma proteins, for example those with IgA deficiency.

Washed red cells are only prepared for specific patients upon request from their doctor. This method involves several more processing steps and also shortens the shelf life of the product.

## Human leucocyte antigen (HLA)

Our HLA type or 'tissue type' is inherited from both our parents. There are thousands of human tissue types that exist on the surface of most of our cells including platelets. They are not found on red cells.

Sometimes people are exposed to foreign HLA antigens when they:

- receive blood transfusions
- are pregnant
- receive transplanted tissue.

A patient who has HLA antibodies can destroy donor platelets that are transfused to them. The best way to prevent this is for the donor and recipient to be HLA matched.

Most patients do not require HLA matched platelets.

**For further information please speak to your health care team.**

## Consent

**Before any medical procedure is carried out, you (or a family member) will be asked to give your permission or consent.**

To be involved in decisions about your transfusion, you must have enough information about your condition and the options you have. Be sure to ask questions if there is any part of your treatment that you do not understand.

When providing consent for blood, use the checklist to help you make an informed decision about your treatment.

- I am aware of which blood products will be transfused
- I am aware of how the transfusion will be given and how long it will take
- I am aware of the expected benefits of a transfusion
- I am aware of the potential risks and side-effects
- I have been made aware of potential alternatives.

Other questions to ask my doctor:

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_
4. \_\_\_\_\_  
\_\_\_\_\_

In an emergency, there may not be time to discuss your transfusion. However, the reasons for the transfusion should be explained to you when you are recovering. Where possible your transfusion will be discussed with your next of kin at the time.

# GLOSSARY

## A

**Anaemia:** The condition of having less than the normal number of red cells or less than the normal amount of haemoglobin in the blood. There are many possible causes such as blood loss or iron deficiency.

**Antibodies:** Proteins our body makes to protect ourselves against foreign substances (antigens).

**Antigens:** Any substance that causes your immune system to produce antibodies against. They may be from the environment, such as bacteria and viruses or can be found within the body, for example on red blood cells.

## B

**Blood:** The liquid pumped by the heart through the blood vessels which delivers vital substances including oxygen to cells and removes waste.

**Blood clotting:** The conversion of blood from a free-flowing liquid to a semi solid gel.

**Blood transfusion:** The transfer of blood or blood components collected from one person (the donor) into the bloodstream of another person (the recipient).

## C

**Carbon dioxide:** A gas which is the by-product of cellular metabolism and collects in the tissues. It is carried away by haemoglobin in the red blood cells and breathed out from the lungs.

**Circulatory overload:** 'Too much' fluid volume in blood vessels that causes an elevation in blood pressure and fluid to escape into the tissues, putting strain on the heart and lungs.

**Chronic:** Persisting for a long period of time, often for the remainder of a person's life.

**Cross-match:** Cross-matching blood, in transfusion medicine, refers to the complex testing that is performed prior to a blood transfusion, to ensure the donor's blood is compatible with the blood of an intended recipient.

**Cryodepleted plasma:** Plasma in which some of the clotting factors have been removed.

**Cryoprecipitate:** A concentrated blood component made from plasma that contains specific protein molecules involved in blood clotting.

## D

**Dose:** The amount of a drug or other substance to be administered at the one time.

## F

**Factor VIII:** Factor eight, a key factor in the process of blood coagulation (clotting). Lack of normal factor VIII causes haemophilia (haemophilia A).

**Fibrin:** The protein formed during normal blood clotting that forms a mesh around a platelet plug creating a clot.

**Fibrinogen:** The protein which generates fibrin, a key component of a normal blood clot.

continues

## H

**Haemophilia A:** The classic haemophilia resulting from a deficiency of clotting factor VIII. It is an inherited disorder characterised by a permanent tendency to bleed.

**Haemoglobin:** An iron containing molecule in red blood cells that carries oxygen from the lungs to the body's tissues.

**Haemolytic anaemia:** Anaemia (low haemoglobin or red cell count) resulting from the breakdown of red blood cells. There are many possible causes.

## I

**Immunodeficiency:** The immune system's ability to fight infections is reduced or absent. Some people are born with this condition or it may develop due to a number of causes.

**Iron:** A mineral nutrient essential to make haemoglobin and for the body to function normally.

**IV (intravenous):** Within a vein.

## O

**Oxygen:** A colourless, odourless and tasteless gas that makes up about 20% of the air we breathe. It is essential to human, animal and plant life.

## P

**Procedure:** The series of steps to be followed in establishing a course of action.

**Protein:** A large molecule composed of one or more chains of amino acids in a specific order. Proteins are required for the structure, function, and regulation of the body's cells, tissues, and organs. Each protein has unique functions.

**Plasma:** The liquid part of the blood, which makes up about half of its volume. Plasma contains water, clotting factors, antibodies and other proteins.

**Platelets:** Disc-shaped cell fragments in the blood that assist in blood clotting. During normal blood clotting, the platelets clump together.

## R

**Red cells:** The blood cells that carry oxygen. Red cells contain haemoglobin, which is what allows them to transport oxygen and carbon dioxide.

## T

**Thrombotic Thrombocytopenic Purpura:** A disorder in which a low platelet count causes bruising, bleeding and micro-clots which can damage the organs. Red blood cells may also be damaged resulting in anaemia (low red cell count).

**Thrombocytopenia:** Reduction in the number of platelets that affects the ability to stop bleeding and make clots.

## V

**von Willebrand factor:** A protein that plays an important role in clot formation and helping platelets stick together.

## W

**White cells:** Cells the body makes to help fight infections.