The National Blood Transfusion Service

The National Blood Transfusion Service

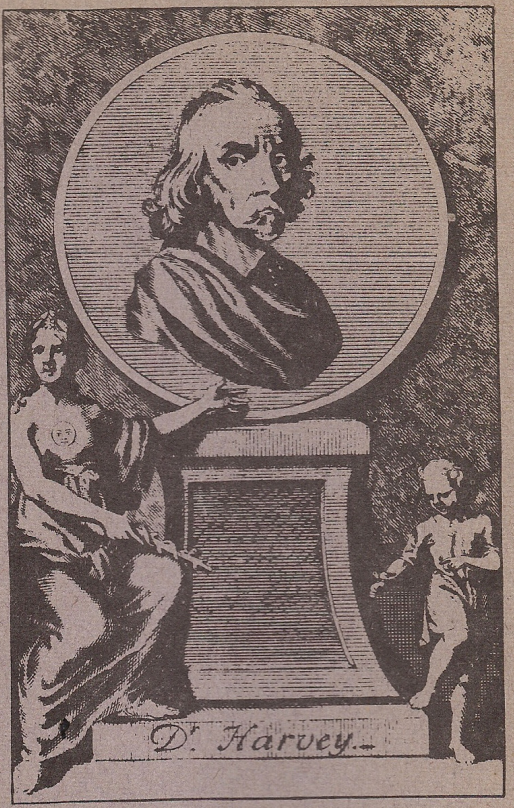
Introduction

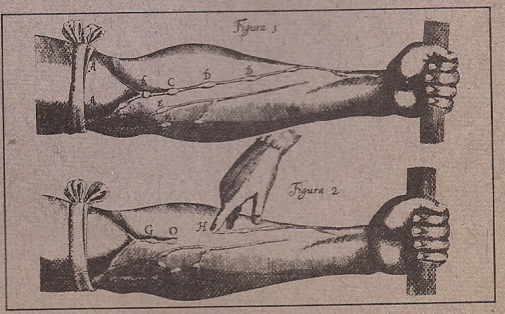
In recent years some substantial advances have been made in our knowledge of blood and methods of treatment by blood transfusion to restore health and save lives. The National Blood Transfusion Service of England and Wales, together with similar services in Scotland and Northern Ireland, provide, throughout the United Kingdom, a life-saving service of which we can be justly proud.

The Service exists to provide, through the goodwill of ordinary men and women, aged 18 to 65, blood and its components to patients in hospitals and nursing homes throughout the country, together with advice based on its specialised knowledge of the ever-widening range of blood transfusion.

Our Transfusion Service is an indispensable part of the country's life-saving service.

William Harvey (1578–1657) demonstrated the circulation of the blood. The lower illustration is Harvey's own drawing of what he observed

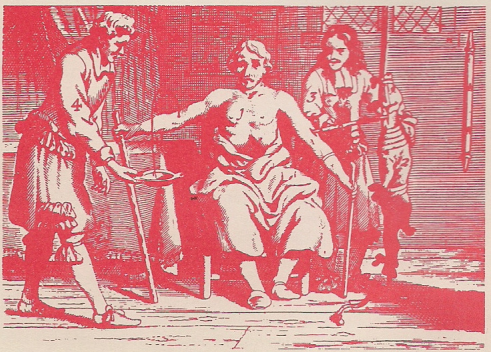




History of Blood Transfusion

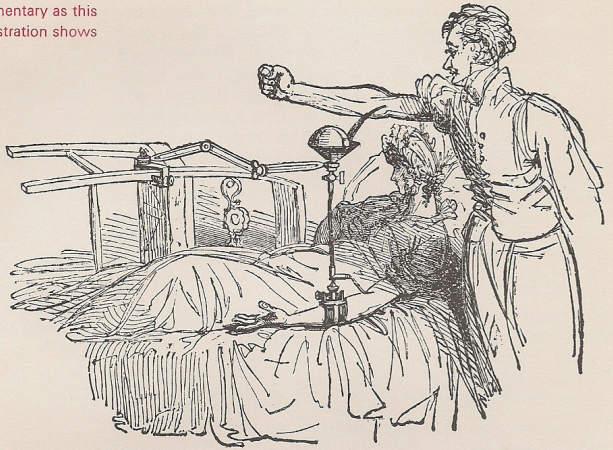
From the earliest days of recorded history the heart has been regarded as the centre not only of the affections but also of such desirable qualities as courage and generosity, and blood has been looked upon as the carrier of these qualities. In the Dark Ages no witches' brew could have been effective without its complement of blood (often human), and even today such phrases as 'a loving heart', 'a heart of gold', 'blue blood', and 'it's in the blood' carry unmistakable echoes of these beliefs. The Romans are said to have drunk the blood of slain gladiators in order to rejuvenate themselves. Speculation about injecting blood to bring about rejuvenation or cure disease continued over the centuries. The first practical steps were taken in the seventeenth century. The demonstration of the circulation of the blood published by William Harvey in 1628 was the stimulus to the experimental work that led to the actual performance of transfusion. In 1657, Sir Christopher Wren, the famous architect, using an instrument devised by Harvey, injected various fluids into the circulation of living animals and in 1665 Dr Richard Lower performed the first successful transfusion of blood from one animal into another.

The first transfusions in man followed soon after; on 15 June 1667 Dr Jean Denis in Paris transfused the blood of a lamb into a young man and on 23 November 1667, Dr Lower and Dr King in London transfused blood from a sheep into a certain Mr Arthur Coga. Both patients recovered. Mr Coga received 20 shillings for his co-operation and gave an address in Latin to the Royal Society on his experiences. In 1668 Denis gave calf's blood to a further patient, who died soon after. This event led to the recognition of the dangers of transfusing animal blood to man.



Jean Baptiste Denis transfused blood from animals to humans

James Blundell successfully performed human to human transfusions. His equipment was rudimentary as this contemporary illustration shows



Karl Landsteiner

Further progress waited until in 1818, an obstetrician in London, Dr James Blundell, having shown that the blood transfused must come from the same species, performed the first transfusions of human blood in cases of haemorrhage after childbirth. By these means he was able to save the lives of a number of his patients. However, progress was still slow. Transfusion of blood was not always successful and sometimes caused death.

In 1900, Dr Karl Landsteiner of Vienna, discovered the ABO blood groups, and demonstrated that blood from two individuals could be mixed successfully only if the individuals' blood groups matched. Landsteiner's discovery constituted a landmark and removed one of the most serious hazards to transfusion. It was also the starting point of our present vast knowledge of the blood groups and their practical and scientific importance.

Two great advances occurred during World War I. First, it was found that blood that had been removed from the body could be prevented from clotting by mixing it with sodium citrate. Second, it was demonstrated that blood could be preserved in a safe condition for short periods in a refrigerator, thus rendering it unnecessary always to transfuse blood immediately after its collection. By the end of the war the stage was set for the development of civilian transfusion services, but the

In World War I ways were found of preventing clotting and preserving blood in a safe condition for future use

stimulus, so often provided to medicine by war, had gone. In 1921 four members of the Camberwell Division of the County of London Branch of the British Red Cross Society volunteered to give blood needed at King's College Hospital. This was the start of the first voluntary blood donor service in the world. By the end of 1925 voluntary 'donor panels' had begun to be established in other large cities of the British Isles. These panels were autonomous, existing to supply the needs of local hospitals for fresh blood. They were generally formed by members of well-known voluntary organisations, for example, Toc H, The Rover Scouts, The St John Ambulance Brigade and The British Red Cross Society.

The first blood bank, in the present sense of the term, was opened in 1936 at Cook County Hospital, Chicago. During the 1930s the value of plasma for the treatment of surgical shock, particularly that associated with burns, began to be appreciated and the use of this fluid gradually grew.

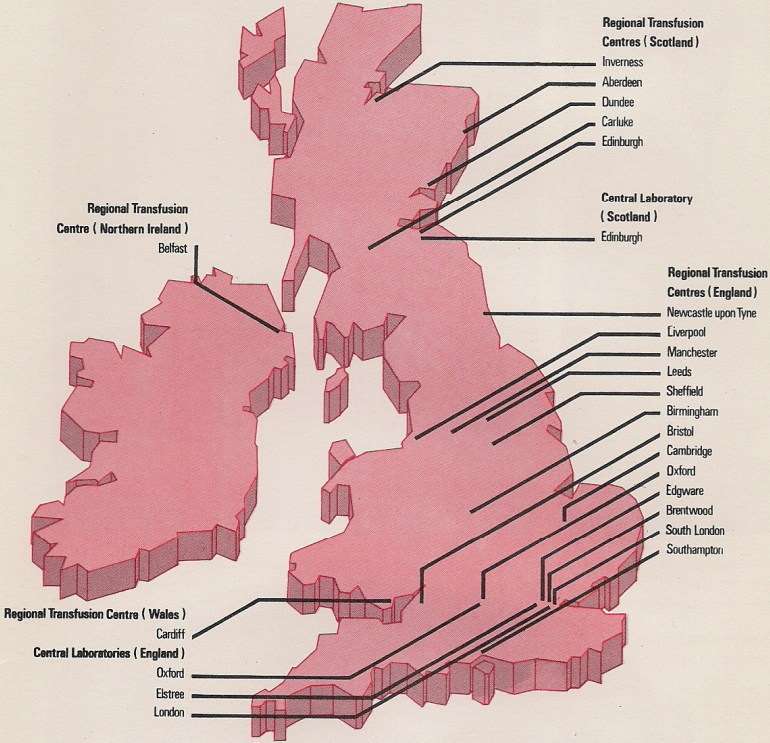
Following the outbreak of war in 1939, five large transfusion centres were opened (four civilian centres near London and the Army centre at Bristol) to provide blood and plasma for civilian and service casualties. In 1940, eight regional transfusion centres were opened as part of the Emergency Medical Service (EMS).

In World War II
the lives of many service
and civilian casualties
were saved by
donations of blood
from hundreds of thousands
of voluntary donors

The storage life of blood was increased by the use of a more effective preservative solution of citrate and glucose and more simple and readily assembled transfusion equipment was introduced.

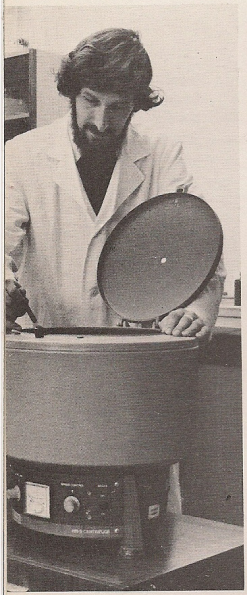
By the end of the war many hundreds of thousands of men and women had acted as voluntary blood donors and their donations of blood had helped to save the lives of many service and civilian casualties. The EMS and Army transfusion services were amalgamated in 1946 to form the National Blood Transfusion Service of England and Wales. On 5 July 1948 the Service became part of the National Health Service administered by Regional Hospital Boards (now Health Authorities).

Organisation



Each of the 14 Regional Health Authorities in England is responsible for meeting the transfusion requirements of its hospitals and, with one exception, each Region has its own Transfusion Centre. These are at Newcastle, Leeds, Sheffield, Cambridge, London (three centres), Southampton, Oxford Bristol, Birmingham, Liverpool and Manchester. In Wales there is a Transfusion Centre at Cardiff.

There are three central laboratories, the Blood Group Reference Laboratory and the Blood Products Laboratory, Elstree, with which is associated the Plasma Fractionation Laboratory, Oxford. They are administered under the direction of the Department of Health and Social Security.



Separating cells and plasma in a centrifuge (above)

Mechanised blood grouping (right)

In Scotland there are five Regional Transfusion Centres and a Protein Fractionation Centre at Edinburgh.

In Northern Ireland the service is provided on a regional basis by the Department of Health and Social Services and run by the Northern Ireland Blood Transfusion Service.

The Regional Transfusion Centre

A typical Regional Blood Transfusion Centre would supply 2 000 blood donations weekly to some 50 hospitals, serving a population of about 2 000 000, although some Centres, especially those in London, have larger responsibilities.

Each Regional Transfusion Centre is under the control of a Consultant Medical Director appointed by the Regional Health Authority.

Among the functions of the Centre are the following :

1. Recruitment and organisation of voluntary donor panels by the Regional Donor Organiser, the organisation of blood donor sessions and the calling of donors to attend them.

2. Organisation of special panels of donors so that fresh blood

needed, for example, to treat certain diseases such as haemophilia or for cardiac surgery, can be readily obtained. Collection, by means of self-contained mobile teams, of sufficient blood within the region for the needs of its hospitals and the quota required by the three central laboratories.

3. Blood grouping and testing; cross matching; tissue typing in connection with organ transplantation.

4. Maintenance of a blood bank at the Regional Transfusion Centre and of banks in hospitals with pathology laboratories; in some places hospitals are grouped together, one hospital providing an 'area bank' service to all hospitals within the group.

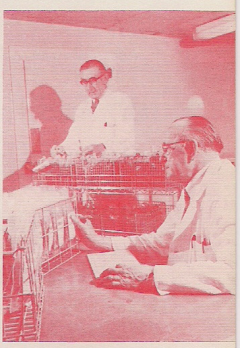
5. Preparation and distribution of blood grouping sera and sterile water for the reconstitution of the dried plasma fractions supplied by the Blood Products Laboratory.

6. Provision of a consultant service on all transfusion matters for the hospitals in the region, e.g. the investigation of reactions, serological investigations, the giving of transfusions, clinical consultation.

7. Provision of facilities for the blood grouping of ante-natal patients.

8. *Teaching:* This is one of the important activities of the Regional Transfusion Centre. Many of the Directors hold honorary appointments in medical schools and formal instruction on blood transfusion is given at several of them. Courses of instruction are also given to doctors, nurses and technicians, and all centres take visiting workers for training.

9. *Research:* All the constituent parts of the National Blood Transfusion Service do research with the object of increasing the safety and value of treatment by transfusion. Many problems, both laboratory and clinical, which need investigation are encountered in the course of the normal work of the service. Many of these are concerned with the blood groups and the techniques for their detection.



Checking blood donations

The Central Laboratories

The Blood Group Reference Laboratory distributes all types of blood grouping sera; it maintains stocks of rare sera and accepts blood samples from the Regional Centres for the identification of unusual blood group factors. It also maintains the National Panel of Donors of Rare Blood Types, a record of donors with very rare blood group patterns.

The Blood Products Laboratory at Elstree prepares blood products, undertakes research into the production and uses of plasma fractions and plasma substitutes, and operates a freeze-drying plant. The Plasma Fractionation Laboratory, Oxford, which comes under its control, prepares special products needed for the treatment of haemophilia and related diseases.

Recruitment of blood donors

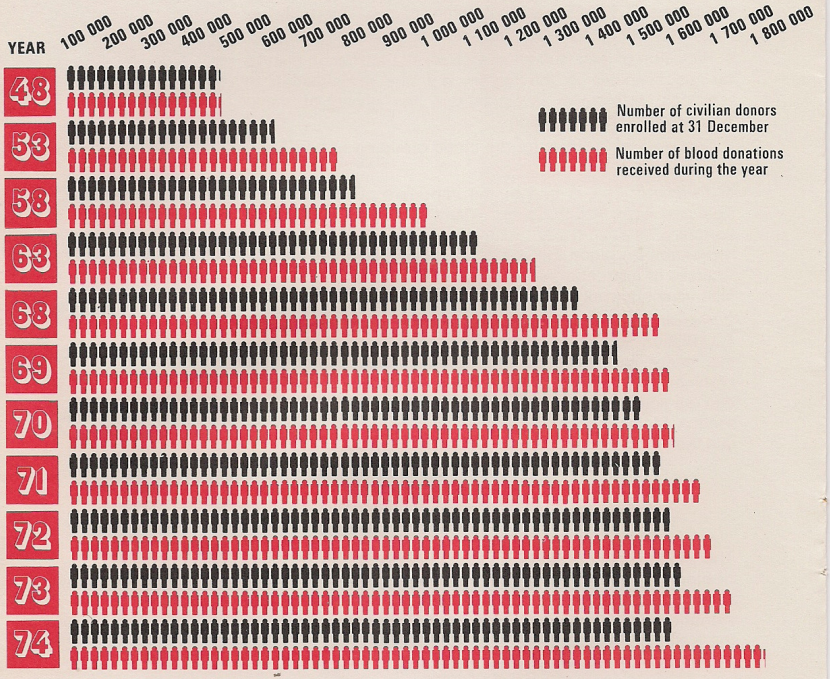
Appeals for donors are addressed to those between the ages of 18 and 65 and especially to the younger generation, who alone can safeguard the future of the National Blood Transfusion Service.

Donors should be normal, healthy people but a history of certain illnesses may prevent acceptance.

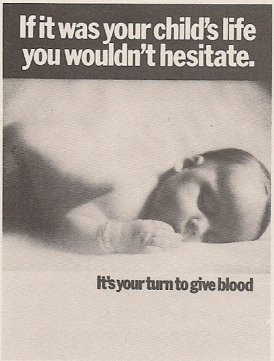
Development of the Service

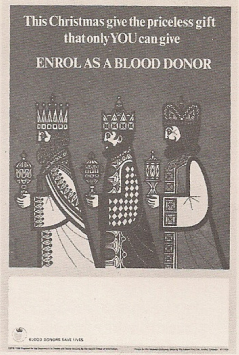
There has been a steady increase in the number of blood donors enrolled and blood donations received.

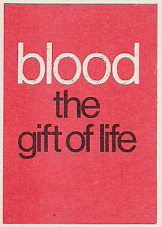
The service needs the constant reinforcement of new donors

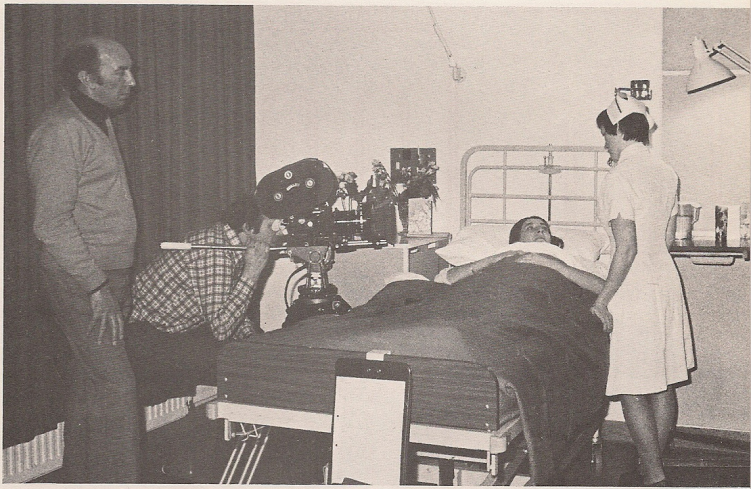


to keep pace with the many calls on it, to cover normal 'loss' of donors due, for example, to age or illness, and to avoid having to call upon individual donors more than twice a year. With this aim, the Department of Health and Social Security produces centrally a range of publicity material, including posters, press advertisements, leaflets, booklets and short









television films. Close liaison is maintained with hospital authorities and with voluntary organisations, who help with recruitment and assist in looking after donors at sessions.

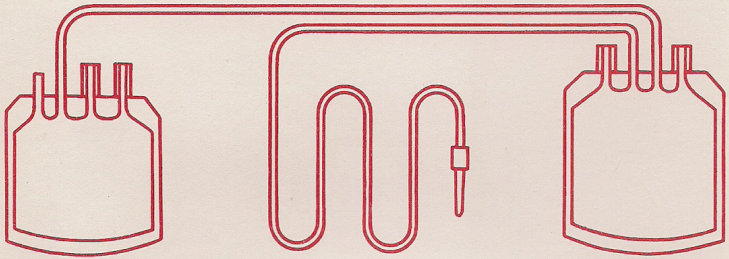
How the Service operates

Donor sessions are organised in towns and villages, in factories and on the premises of commercial firms, in departments of national and local government and in establishments maintained by the Armed Forces. Donors, who must be between the ages of 18 and 65, are asked to give about

three-quarters of a pint of blood after suitable checks have been made to determine that they are in good health. These checks are made each time a donor gives a blood donation. At the end of the session the containers of blood are taken to the Regional Transfusion Centre where they are placed in the Regional Blood Bank until issued to a hospital. Some of the blood received is set aside and processed for specialised use.

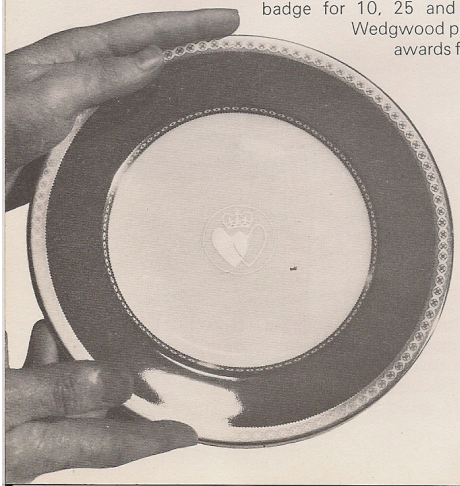
Containers for collecting blood

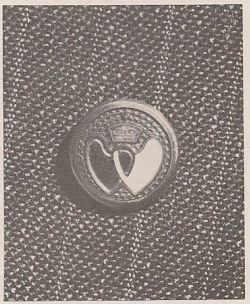
Most blood donations are now collected in Plastic containers, resembling bags, instead of in glass bottles. Plastic containers are more convenient than glass bottles because they allow certain manoeuvres, such as those used in separating components, to be carried out more easily; they weigh less and take up less storage space. These containers also have the advantage of having a surface to which, unlike glass, the blood will not adhere, and this property helps to prevent clotting.



Donor awards

These are divided into four classes: a bronze, silver or gold badge for 10, 25 and 50 donations respectively, and a Wedgwood plate for 100 or more donations. These awards feature the NBTS symbol – two linked hearts surmounted by a crown.





What Transfusion Means...

To the patient

Numerous examples are given on other pages of the medical conditions necessitating treatment by blood transfusion. To the patient receiving a blood transfusion, however, the reason for it is not as important as the advantage he derives from it. Many patients have declared that they have felt renewed life and strength flowing through their bodies during the administration of the blood. Disability arising from long periods of illness, in turn followed by surgical treatment, at one time resulted in prolonged and painful convalescence. This undesirable state can be minimised or even eliminated by a strength-giving transfusion.

So we say that blood transfusion relieves suffering.

Similarly, post-operative transfusions, or transfusions for blood diseases, bring about recovery often in surprisingly short periods of time.

So we say that blood transfusion restores health.

After an accident or after severe blood loss from some other cause, blood transfusion may very well be the only method of saving life.

So we say that blood transfusion saves life.

To the donor

Why give to strangers?

The people of the United Kingdom have accepted voluntary donation of blood as something which is normal. Whereas 25 years ago many people were reluctant to give their blood, this form of social service is now widely accepted and practised to an extent hitherto thought unattainable. But in spite of the fact that the National Blood Transfusion Service has on its panels more than $1\frac{1}{2}$ million donors, i.e. about 1 in 20 of the population eligible to give blood, this number may be too low to meet future needs, for example those associated with organ transplantations, new surgical techniques and advances in treatment of blood diseases.

There are no tangible rewards for giving, nor are there penalties for not giving. Donors know that their gifts are for unnamed patients, without distinction of age, sex, religion, income, status, or colour. But perhaps there is some sense of obligation, approval or interest on the part of the donor; some awareness of the need for the gift; some expectation that he may himself need and receive a gift at a future date.

The unpaid donation of blood is an act of free will, most commonly motivated by a desire to help people in need. It is significant that some of the countries now dependent upon paid donors are attempting to establish transfusion services modelled on the British pattern.

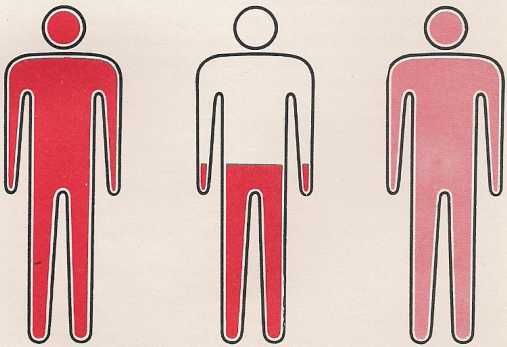
Treatment by Transfusion

Blood, when circulating within the body, is a liquid substance and consists of three kinds of cells (red cells, white cells and blood platelets) and the fluid, called plasma, in which the cells are suspended.

The plasma, besides carrying the cells round the body, contains many chemical substances, some of which control the process of blood clotting and all of which are vital to the maintenance of our good health.

Whole blood transfusion

The transfusion of whole blood (i.e. the cells and the plasma) from one individual to another is indicated for two main reasons: firstly, when the volume of fluid within the circulation of the patient is less than that required to sustain life and, secondly, when the red blood cells are deficient either in quantity or quality. In each instance the supply of oxygen to the tissues and principal organs becomes inadequate. It is, for example, essential that the brain be very well supplied with oxygen; death will occur after the brain has been deprived of oxygen for six minutes even though the heart may still be beating. Oxygen is carried by the red blood cells which contain a material called haemoglobin. Haemoglobin has one of the most complicated chemical structures known. Tucked away in its labyrinth of some 10 000 atoms there are four atoms of iron in each molecule upon which our lives depend. The iron atoms are exposed in our lungs to the oxygen in the



Normal blood volume

Total blood volume low after haemorrhage

Red cell deficiency

air which we breathe. The haemoglobin then becomes saturated with oxygen and as the red cells travel round the circulation the oxygen is released in the tissues. If we have insufficient red cells, or if our red cells are abnormal, there will not be enough haemoglobin to maintain the body efficiently and we are then said to be anaemic.

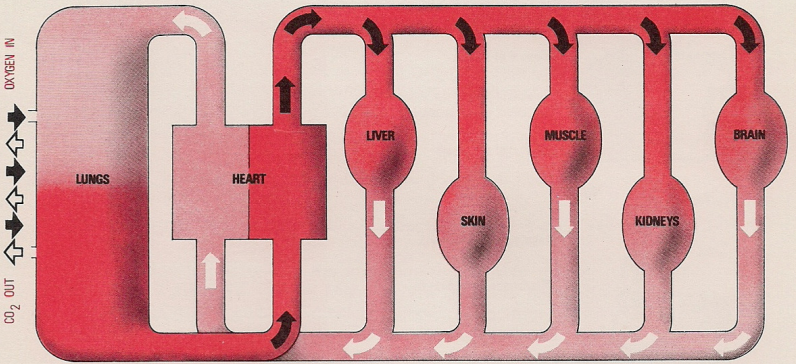


Diagram showing the distribution of oxygen by blood flow through the body

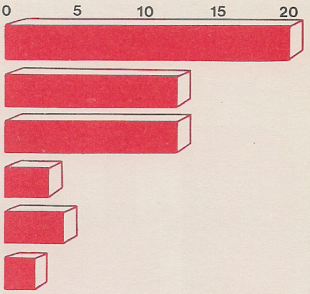
Blood loss through accident, surgery, or haemorrhage at childbirth, or from such a condition as the rupturing of a stomach ulcer, may reduce the amount of circulating fluid in our bodies beyond safe limits and we may die unless this loss is speedily replaced.

In addition to the two main indications for blood transfusions, that is restoration to normal of the amount of fluid within the circulation and restoration of the red cells, whole blood is also used in other ways; for example, in the 1950s surgery of the heart and great vessels became possible by the invention of a machine which could take over the action of the heart and lungs. 'Open-heart' operations, as they are termed, became possible, and this form of surgery is now widely practised. Hearts which have become diseased or are defective can be repaired even late in life. Many children are born each year with congenital heart defects. There may, for example, be a hole in the septum, the membrane dividing the left and right chambers of the heart; if the hole is not repaired, this condition renders its victim physically infirm with a short life expectation. Such cardiac operations may require from five to forty donations of whole blood, together with transfusions of blood platelets.

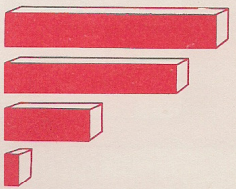
How blood is used

It may be of interest to list the various uses to which donations were put in a period of 24 hours in a typical hospital blood bank.

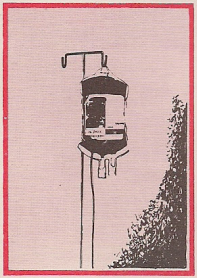
Surgical operations

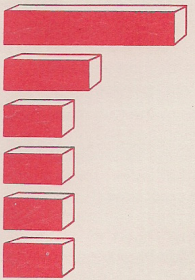


Midwifery



Miscellaneous conditions





*It must be emphasised that blood transfusion does not offer a cure for leukaemia, but it has been used with success to maintain life long enough to allow the new and powerful drugs to combat the disease. In children's hospitals especially, donated blood is playing a greater role in the treatment of children suffering from this blood condition, and there have been significantly longer periods of 'remission'.

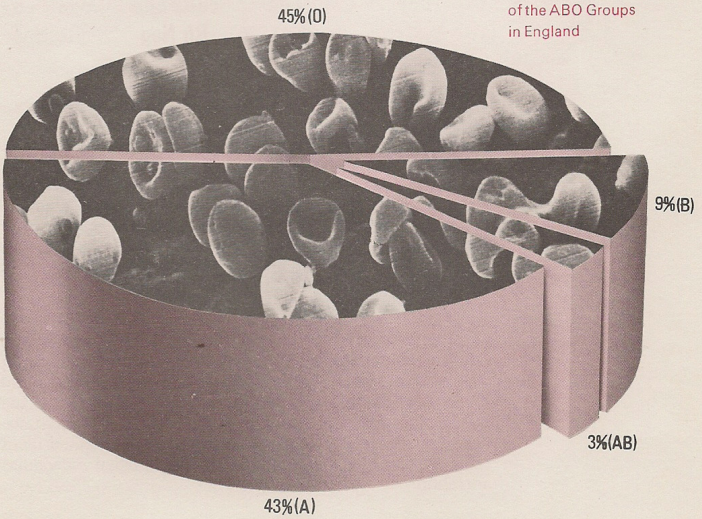
The Blood Groups

The ABO blood group system

Although the blood of all human beings, whatever the colour of their skin, is red in colour, there is, in fact, a difference in the red blood cells from individual to individual. This difference lies in the presence (or absence) of chemical substances in the cell envelope which are inherited from the parents. There are two different chemical substances which are termed 'A' and 'B', and transfusion of 'incompatible' cells will generate a reaction which may be fatal. Persons who possess neither of these substances are said to belong to Group O. Much less frequently substance 'A' and substance 'B' are found in the same red cell. We can see therefore that there are four main categories denoted by 'A', 'B', 'O', and 'AB'. The distribution of these categories around the world is by no means regular and consistent, and there does not seem to be any way now whereby the uneven distribution can be accounted for. Most members of the white races are either Group A, or Group O. Group B is more common amongst the peoples of Asia and, interestingly, in the Gypsy population of Europe. Group B is rarely present in the indigenous Indian tribes of North and South America.

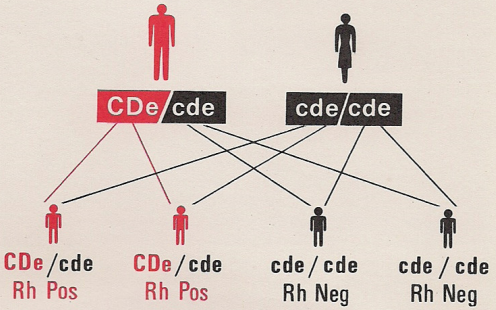
In Scotland, Wales and Ireland there is a marginal difference in the distribution of Group O and Group A blood, possibly arising from the Celtic origins of the peoples concerned.

The average distribution of the ABO Groups in England



The Rhesus blood group system

This system, discovered in 1939, was originally thought to consist of a simple division of human blood into Rhesus Positive and Rhesus Negative, but with continuing research it was found that there were finer sub-divisions or factors, which have been denoted by the letters c, C, d, D, e, E. The significance of capital and small letters lies in their use to show within the medical field the *full* Rhesus structure of the individual. Each of us inherits three components from each parent in various combinations. More than 33 per cent of the population of the United Kingdom are designated CDe/cde, the first set of three components being inherited from one parent and the second set from the other. A 'Rhesus Negative' would be cde/cde. Although when a capital letter D appears



Inheritance of the Rhesus factor

in a person's Rhesus structure (or 'genotype') the person is said to be 'Rhesus Positive' as a donor, if the D factor is not present in his genotype, he must be considered 'Rhesus Negative' as a patient, because D is the most potent stimulator of a response by the patient's natural defence mechanisms. C and E, although capable of producing a similar response are much less likely to do so and for practical purposes need not be considered.

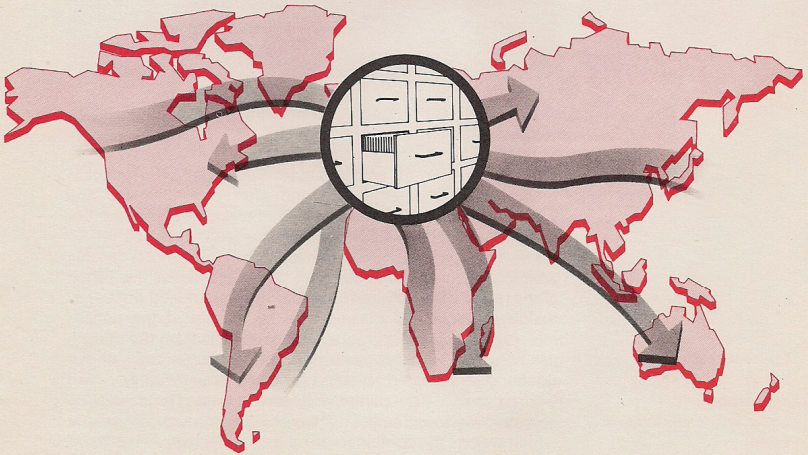
The frequency of Rh Positive and Rh Negative individuals varies in different parts of the world. Thus among white races, usually about 83 per cent of individuals are Rh Positive and 17 per cent Rh Negative. However, about 30 per cent of the people of the Basque areas of north-east Spain and south-west France are Rh Negative. Among yellow-skinned races (Chinese and Japanese) very few Rh Negative individuals are found.

Other blood group systems

The ABO and Rhesus blood group systems are the most important ones in transfusion work, but several other blood group systems are known, some designated by letters such as M, N, K, and P, and others by contractions of the names of the persons in whom they were first identified, e.g. Lu (Lutheran), Le(Lewis), Fy(Duffy). It is fortunate, however, that few of these are of importance from the point of view of blood transfusion because it would not be practicable to investigate fully all the blood group systems in each donor and patient.

Very occasionally, however, it is necessary to find a donor or donors whose blood is of a very rare group or combination of groups. The National Blood Transfusion Service has accumulated over the years a special panel, known as the National Panel of Donors of Rare Blood Groups. It is a list of the names and blood groups of about 2 000 people, each of whom has been fully blood grouped to determine all the known blood group systems. A copy of the panel is kept at each Regional Transfusion Centre and it is therefore possible to select and trace, without delay, the appropriate donors should the need arise. More recently an International Panel of Donors of Rare Blood Types has been formed with the co-operation of transfusion services in all parts of the world. This international panel is organised and maintained by the Blood Group Reference Laboratory.

The panel of rare blood groups means that a request from anywhere in the world for blood from a rare group can be quickly met

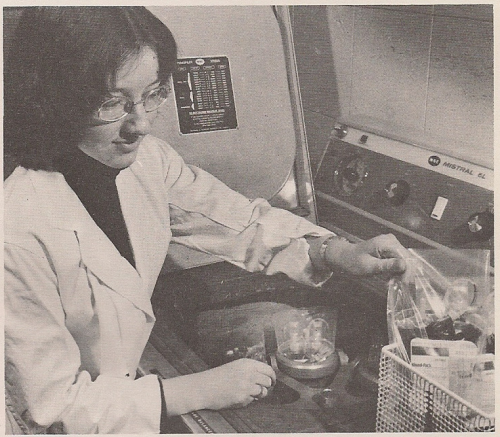


Components and Plasma Fractions Therapy

Blood being placed in a centrifuge ready for cell separation (right)

Blood donations are kept under refrigeration (below)

In addition to being used as whole blood, blood can be separated into its *components* (red cells, white blood cells, blood platelets, plasma, cryoprecipitate) which are used to treat certain conditions. One of the components, plasma, can be further subdivided by chemical procedures into its constituent parts, the so-called *plasma fractions* (fibrinogen,



anti-haemophilic globulin concentrate, immunoglobulins, plasma protein fraction and albumin).

Red cell transfusion

The transfusion of whole blood has long been a well-recognised life-saver during and after major surgery and where there has been massive loss of blood in an accident or in childbirth. There are, however, various conditions which do not need whole blood replacement. For example, chronic anaemia requires transfusion of the red cells of the blood alone rather than both red cells and plasma. Indeed the transfusion of unwanted plasma may be harmful if the patient has a weak heart. Separation of the red cells from the plasma can be achieved either by allowing the container in which the donation is collected to stand for some hours during which the red cells will separate themselves from the plasma by gravity, or by spinning the container in a centrifuge, a machine which swings the containers around a central axis. Adjustment

Opposite, red cells seen through an electron microscope (left) and an ordinary microscope (right)

of the number of revolutions per minute and the duration of spinning allows the different cells, e.g. red cells and blood platelets, to be separated from each other.

White cell transfusion

Active research continues on the transfusion of white blood cells but this is still in the investigational stage. Successful transfusion of white cells could, for example, assist a patient to cope with infection if, as sometimes happens, the patient is unable to produce his own white cells.

Blood platelets

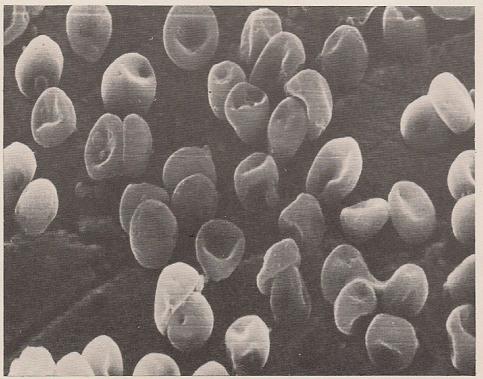
These tiny cells circulate in our bodies with the red and white cells and play a vitally important role in the clotting process of blood, for example, post-operatively. Sometimes the platelets from at least two donations of blood are transfused to patients approximately one hour after a heart operation. These have the effect of correcting leakage at the site of the stitching in the outer walls of the heart. Platelet transfusion is also an important part of the treatment of leukaemia and of certain haemorrhagic disorders.

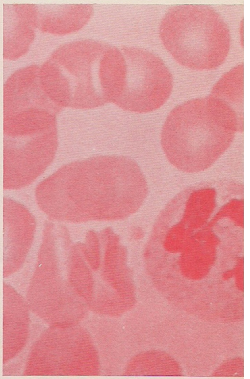
Plasma transfusion

Plasma protein fraction (or stable plasma protein solution) as well as reconstituted dried plasma is used widely for the treatment of surgical shock and burns or, in remote areas, to restore safely the volume of fluid in the circulation, in order to sustain life until the patient can be moved to a hospital with full transfusion facilities or until matched whole blood can be provided. Thus it could be extremely valuable in such places as small hospitals and ships which have traditionally carried dried plasma.

Treatment of haemophilia: Factor VIII

Haemophilia is an inherited bleeding disorder affecting males. The blood of sufferers from this complaint lacks a substance called anti-haemophilic globulin or Clotting Factor VIII. As a consequence prolonged bleeding may follow even minor





injuries or operations. Sufferers from haemophilia are treated at special Haemophilia Centres or at hospitals by the infusion of Factor VIII either in the form of cryoprecipitate or anti-haemophilic globulin concentrate.

Cryoprecipitate

To prepare cryoprecipitate the plasma is first separated from freshly collected blood by spinning it in a centrifuge (see above under Red Cell Transfusion) to separate the blood cells. The plasma is immediately frozen at minus 80 °C. It is then allowed to thaw under conditions so adjusted that the Factor VIII remains as a solid substance. This is separated by spinning the thawed plasma. The greater part of the plasma is removed, leaving the concentrated Factor VIII behind. A typical Regional Transfusion Centre keeps a stock of from 300 to 500 units of cryoprecipitate, which can be stored at minus 30 °C for several months.

Anti-haemophilic globulin concentrate

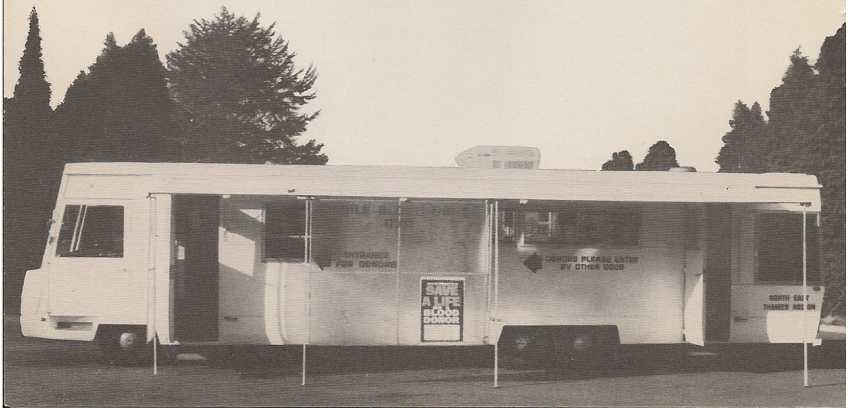
This plasma fraction has certain advantages over cryoprecipitate for treating haemophiliacs. It is prepared at the laboratories at Elstree and Oxford from freshly separated plasma provided by Regional Transfusion Centres. It is of particular use in enabling sufferers from haemophilia to be treated at home and for controlling bleeding when they undergo major surgical operations.

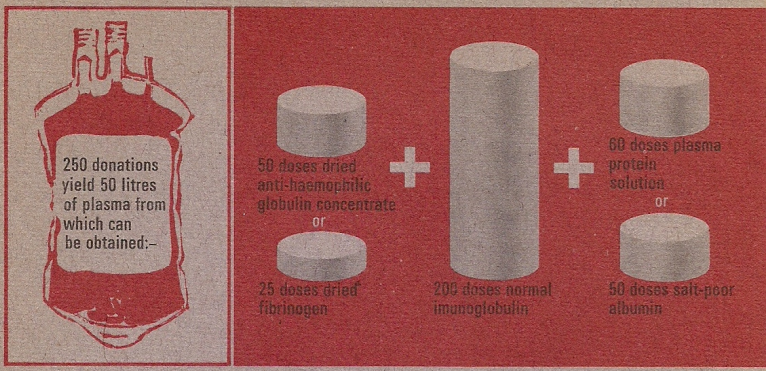
Fibrinogen

Fibrinogen is essential for normal blood clotting. In some conditions it disappears temporarily from the blood, and bleeding ensues. Transfusion of fibrinogen rapidly corrects the deficiency and stops the bleeding. Fibrinogen is also used as an adhesive material to keep skin grafts in position.

Fibrin foam

Fibrin foam is a sponge of clotted fibrinogen. When it is soaked in a clot-promoting substance it acts as a scaffold on which blood will clot. Thus it is used to control bleeding in operations in which tying of blood vessels is not feasible or is to be avoided.





Blood and its components

Immunoglobulins

These are substances carrying the 'antibodies' which the body forms to protect itself against infectious diseases and foreign materials. Immunoglobulins separated from the blood of healthy adults are valuable in preventing or attenuating certain infectious diseases such as measles, German measles and hepatitis. The blood of certain persons may contain particularly large amounts of one antibody, for example, antibody against chickenpox or antibody against Rhesus factor D (see p.18). The immunoglobulin prepared from such blood will contain high levels of the antibody and is called, for example, anti-chickenpox immunoglobulin, or anti-D immunoglobulin. Such specific immunoglobulins are of great value. Where Rhesus incompatability between father and mother may lead to the birth of a child affected with haemolytic disease the mother at risk can now be treated with anti-D immunoglobulin.

Plasmapheresis

The volume of plasma obtainable by blood donation can be considerably increased by a procedure known as plasmapheresis. In this the donation is centrifuged to separate the red cells from the plasma; the red cells are then transfused back to the donor. A second donation is taken straight away and treated in a similar manner. Thus the donor may give up to 500 millilitres of plasma, which can be used as a preparation of plasma fractions, but has lost no red cells and may safely continue such donations at four-weekly intervals.

Opposite, mobile blood collecting caravan

Addresses

Regional Transfusion Centres

England

Northern Region
Regional Transfusion Centre
Westgate Road
Newcastle upon Tyne
NE4 6QB.
Tel: 0632-37804–6

Yorkshire Region
Regional Transfusion Centre
Bridle Path
Leeds LS15 7TW.
Tel: 0532-645091–3.

Trent Region
Regional Transfusion Centre
Longley Lane
Sheffield S5 7JN.
Tel: 0742-387201

East Anglian Region
Regional Transfusion and Immuno-Haematology Centre
Long Road
Cambridge CB2 2PT.
Tel: 0223-45921.

North West Thames Region
North London Transfusion Centre
Deansbrook Road
Edgware
Middlesex HA8 9BD.
Tel: 01-952 5511.

North East Thames Region
North East Thames
Regional Transfusion Centre
Crescent Drive
Brentwood
Essex CM15 8DP.
Tel: 0277-223545.

South East and South West Thames Regions
South London Transfusion Centre
75 Cranmer Terrace
London SW17 0RB.
Tel: 01-672 8501/7.

South London Transfusion Sub-Centre
David Solomon's House
Southborough
Nr Tonbridge, Kent
Tel: 0892-28172.

Wessex Region
Wessex Regional Transfusion Centre
Coxford Road
Southampton SO9 5UP.
Tel: 0703-776441.

Oxford Region
Regional Transfusion Centre
Churchill Hospital
Headington
Oxford OX3 7LJ.
Tel: 0865-65711.

South Western Region
South West Regional Transfusion Centre
Southmead Road
Bristol BS10 5ND.
Tel: 0272-628021–3.

West Midlands Region
Regional Transfusion Centre
Vincent Drive
Edgbaston
Birmingham B15 2SG.
Tel: 021-472 3111.

Mersey Region
Regional Transfusion Centre
West Derby Street
Mount Vernon
Liverpool L7 8TW.
Tel: 051-709 7272.

North Western Region
Regional Transfusion Centre
Roby Street
Manchester M1 3BP.
Tel: 061-236 8181.

Regional Transfusion Sub-Centre
Quernmore Road
Lancaster LA1 3JP.
Tel: 0524-63456

Scotland

Scottish National Blood Transfusion Service
Headquarters Office
Ellen's Glen Road
Edinburgh EH17 7QT.
Tel: 031-664 2317.

North of Scotland Blood Transfusion Service
Raigmore Hospital
Inverness IV2 3UJ.
Tel: 0463-34151.

Aberdeen and North-East Scotland Blood Transfusion Service
Royal Infirmary
Foresterhill
Aberdeen AB9 2ZW.
Tel: 0224-23423 ext. 2322.

East of Scotland Blood Transfusion Service
Ninewells Hospital
Dundee DD1 9ND.
Tel: 0382-68351.

Edinburgh and South-East Scotland Blood Transfusion Service
Royal Infirmary
Edinburgh EH3 9HB.
Tel: 031-229 7291.

Glasgow and West of Scotland Blood Transfusion Service
Law Hospital
Carluke
Lanarkshire ML8 5ES.
Tel: 06983-73315.

Wales

Regional Transfusion Centre
Rhyd-Lafar
St Fagans
Cardiff CF5 6XF.
Tel: 0222-890302.

Northern Ireland

Blood Transfusion Service
89 Durham Street
Belfast BT12 4GE.
Tel: 0232-46464.

Central Laboratories

England

Blood Group Reference Laboratory
Gatliff Road
Ebury Bridge Road
London SW1W 8QJ.
Tel: 01-730 2152.

Blood Products Laboratory
Lister Institute of Preventive Medicine
Elstree
Boreham Wood
Hertfordshire WD3 6AX.
Tel: 01-953 6191.

Plasma Fractionation Laboratory
Churchill Hospital
Headington
Oxford OX3 7LJ.
Tel: 0865-65711.

Scotland

Protein Fractionation Centre
Ellen's Glen Road
Edinburgh EH17 7QT.
Tel: 031-664 2317.

Acknowledgements
We are grateful to the following for their help with illustrations:
British Medical Association Library
Diagram design group
Imperial War Museum
Dr S. M. Lewis, Royal Postgraduate Medical School, Hammersmith Hospital
Mansell Collection
Dr D. Melville, Southampton University
Wills Library, Guy's Hospital

Prepared by the Department of Health and Social Security and the Central Office of Information 1976.
Printed in England for Her Majesty's Stationery Office by Beck & Partridge Ltd., Leeds and London.

Dd 085264. Pro. 8025