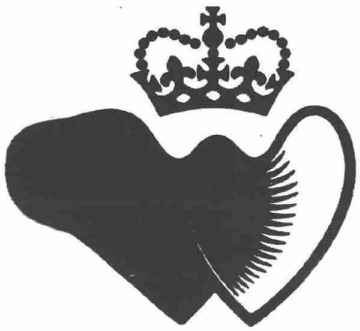
North East Thames Regional Blood Transfusion Service

BRENTWOOD CENTRE



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NORTH EAST THAMES
REGIONAL TRANSFUSION CENTRE

A BRIEF GUIDE

Revised
July 1987

GUIDE TO BRENTWOOD B. T.C.

INTRODUCTION

Although the first successful animal to animal transfusion of blood was performed in 1665 by Dr. Richard Lower and the first transfusion from a lamb into a man by Dr. Jean Denis in 1667, it was not until 1818 that it was established that the blood transfused must come from the same species as that of the recipient. Almost another century was to pass before Dr. Karl Landsteiner discovered the ABO blood groups in 1901 and another 40 years before the Rhesus system was discovered.

Between 1901 and the First World War 'matched' blood could be transfused from donor directly to recipient. During the 1914-1918 war the use of sodium citrate as an anticoagulant was established but it was not until the outbreak of the Second World War in 1939 that the first Transfusion Centres were opened in the U.K. The Emergency Medical Services and the Army Transfusion Services were amalgamated in 1946 to form the National Blood Transfusion Service (N.B.T.S.) of England and Wales.

Now there are fourteen Regional Transfusion Centres (RTC's) in England and Wales, five in Scotland and one in Northern Ireland. Three of these RTCs situated at Tooting, Edgware and Brentwood, serve Greater London and the South East. The Brentwood Centre was opened in 1955 and its function can briefly be described as that of collection and distribution of blood, blood products and reagents to the 35 hospitals blood banks of the North East Thames Region together with the provision of laboratory services for the investigation of transfusion reactions, haemolytic anaemias, antibody identification and HLA typing and continued research and development in the field of Blood Transfusion. Notable events in the history of Brentwood include the visit in 1965 of H.M. Queen Elizabeth II to mark the collection of one million donations per year in England and Wales.

In 1986 there were more than 2 million blood donations per year in England and Wales. Brentwood Transfusion Centre, serving a population of 3.4 million, collected 137,000 donations.

The Director, who is medically qualified, is in overall charge of the Brentwood Centre and its staff of approximately 275. She is in direct charge of the other medical staff comprising three other Consultant Haematologists and some Sessional Medical Officers. The Centre is managed by the Director in consultation with the Heads of the five other departments namely: Scientific, Research, Nursing, Donor Organisation and Administration. The "Heads of Departments" meet regularly to discuss matters relevant to the organisation and

running of the North East Thames Transfusion Service. The Director also receives advice from representatives of the local District Treasurers and Engineers Department, and from the Medical, Nursing, Scientific, Supplies, Personnel and Capital Planning departments of the Regional Health Authority. The current and future needs of the hospital haematologists for blood and blood products are discussed at the quarterly meetings of the Transfusion Users Group, chaired by the Director.

The Centre has its own Joint Consultative Committee, Health and Safety Committee and Senior Scientific Staff meetings. There is a good "team spirit" amongst the staff at the Brentwood Centre as they realise that each is playing a part in the collection and supply of blood, which is an important function in the community. All staff are keen to promote and advertise the work of the Transfusion Service and all worked very hard to prepare for a two day exhibition of the work of the North East Thames Regional Transfusion Service in the Guildhall, City of London in 1983.

In 1987 a new extension to the Brentwood Transfusion Centre was completed. This extension will provide further facilities for the detailed testing and investigation of blood samples both from blood donors and from hospital patients. The improved teaching and training facilities will allow more training courses to take place, more teaching to be conducted on the premises and will enable the Brentwood staff to organise conferences. Such improvements in training will increase the standard of the work performed not only at the Transfusion Centre in Brentwood but also in hospitals within the North East Thames Region.

The Brentwood Centre plans to take over provision of blood and blood products to the Bloomsbury and Islington District in 1988 and 1989 respectively. These Districts were formerly within the North West Thames Region but have now been incorporated into the North East Thames Region. The increased workload resulting from the takeover of these two Districts, plus the ever increasing requirements for blood and blood products by existing hospitals within the Region, will necessitate an increase in staffing and a requirement for a further extension to the Regional Transfusion Centre. A Phase II extension is already in the planning stage and it is hoped to start building in 1988. The next extension will comprise a new and enlarged Fractionation Department, refurbished Donor Testing and Reagents Laboratories, an enlarged Microbiology Laboratory, a new Donor Organiser's Department, a new and enlarged Nursing Department and increased Garage and Workshop space.

Because of redevelopment in the City of London, we will be required to vacate our City Donor Centre in 1988 and new premises are being sought. It is hoped

to increase the size of the City Centre operation to include not only the collection of whole blood, but also the collection of plasma and platelets by apheresis.

JEAN F. HARRISON
Director

REGIONAL DONOR ORGANISER'S DEPARTMENT

The North East Thames Region of the National Blood Transfusion Service is responsible for the area including the whole of Essex, the City of London and part of Hertfordshire, and serves a population of 3.4 million.

The Regional Donor Organiser (RDO) along with his organisers, programme, records and recruitment staff totalling 33, are responsible for all recruitment and for arranging 1,500 donor sessions yearly, including publicity and accommodation and production of a weekly programme for the teams of 31 sessions. This will expand to 35 sessions by 1990.

The Region's blood is collected by seven teams, one of which is based at our City Donor Centre, Moor House, Moorgate, where over 20,000 donations are collected annually from City firms and City commuters.

The Records section hold on computer 260,000 donor records and are responsible to the Regional Organiser for:-

1. The call-up of some 31 'public' and industrial sessions each week.

2. Maintaining the donor records on the in-house computer system, i.e. dates of donors attending sessions; change of address; awards; transfers to and from other Regions etc.

3. The issuing of certificate books to all new donors - approximately 12,000 each year.

4. Telephone calls and correspondence with donors unable to attend sessions for various reasons.

5. The issuing of special awards. Donors receive special awards as follows:

Whole Blood Donors		Apheresis Donors	
1. Bronze	10 donations	Wedgwood Plate	100 donations
2. Silver	25 donations	Crystal Paperweight	250 donations
3. Gold	50 donations	Crystal Goblet	500 donations
4. Crystal Goblet	75 donations	Crystal Goblet	750 donations
5. Wedgwood Plate	100 donations	Crystal Decanter	1,000 donations

The Regional Donor Organiser's department, which is fully computerised, controls all sessions by computer management programs. These help to control an even attendance of blood donors at the session and also provide the laboratories with the required proportions of the various Blood Groups to meet the needs of the hospitals for the many transfusions of blood and blood products taking place each week. The donors can be registered direct on to the computer and all enquiries, amendments and sessional administration are added by light pen and by VDU keyboard procedures.

Industrial sessions are organised by approaching firms for visits. Some of the donors are recruited by works management, others by a team of voluntary ladies from the Centre. We hold approximately 14 such sessions each week and constant public relations by the RDO with the 300+ factory managers and organisers is essential to the success of these sessions.

The total weekly intake averages 3,000 donations. This will increase by 1990 to 3,500 donations.

The Regional Donor Organiser must maintain careful managerial control over this activity as many factors are involved, e.g.:-

1. Hire of over 200 Church Halls, Town Halls, Hospital Clinics and Clubs accommodate our 900 'public' Sessions.

2. Close contact with the Management and organisers of industry, also British Red Cross Society, Women's Royal Voluntary Service, St. John's Ambulance and local organisers, who help with these sessions.

3. Production of the weekly rota to notify the 7 teams of the venues, starting times, expected attendance etc.

4. Appointments for industrial donors, transport pick-up times to our Transport Office for sessions where more than one firm is involved.

5. The organisation of two or three major recruitment campaigns in large towns throughout the Region each year to maintain our donor panels at strength. Over 25,000 new donors are needed annually to replace those who resign or retire.

6. The Regional Donor Organiser's Department is very busy and interesting because of its close involvement with the public. It has a difficult task as every department in the Centre relies on the average weekly attendance of donors for blood and the many blood products supplied by voluntary donors for the Service.

New developments include the takeover of blood supplies to the Bloomsbury

District in 1988 and to Islington in 1989. 25,000 extra donors will be needed to supply these Districts.

The redevelopment of Moor House in the City of London will mean that new premises for the City Donor Centre must be rented and furnished in 1988. Donor apheresis facilities will be set up and special platelet donors will need to be recruited. As part of the Brentwood Centre building programme Phase II, a new department for the RDO and his staff will be constructed.

J. DAWSON
Regional Donor Organiser

THE NURSING DEPARTMENT

The Nursing Department based at Brentwood is responsible for the management and coordination of all nursing activities within the Regional Transfusion Service. The Senior Nursing Officer, with the assistance of the Deputy Nursing Officer, manages a total of fifteen registered nurses and more than eighty donor attendants (auxilary nurse grade).

A personal secretary and a clerical officer, complete the staff. In addition to managing these staff, the Senior Nursing Officer is responsible for induction and in-service training of all nursing department staff.

Registered Nurses.

The role of Registered Nurses in the North East Thames Regional Transfusion Service, is to manage donor sessions after successfully completing an appropriate training course. The nurses enter the service at Staff Nurse grade. They undertake a six month training course which involves training in the selection of volunteers as suitable to donate blood, in venepuncture technique, in First Aid and resuscitation, in counselling and advising donors, in managing the donor team and in the organisation and function of the Transfusion Service. Throughout the six month training period, the nurses work under supervision at donor sessions. At the end of the six month course, after successfully completing assessment sessions and interview, the nurses are regraded to Charge Nurse/Sister grade and allowed to manage donor sessions as Officer-in-Charge.

After completing the course, the nurses continue to receive in-service training at regular study days. They also work at the Transfusion Centre on a regular basis, performing office work, rota preparation etc., acting as 'duty nurse' to give advice to donors and follow up sessions problems and working in the Centre apheresis department.

Donor Sessions

There are six "mobile" blood collection teams who travel throughout the Region to donor sessions and one "static" team at the City Donor Centre, Moorgate, which opens every day, Monday to Friday.

The staff of a blood collection team is as follows:

a) Session Officer (usually a nurse but sometimes a doctor)

b) 2nd venepuncturist (a Registered Nurse who assists the session officer to perform venepunctures and counsel donors).

c) Team Leader (a donor attendant)

d) 9 Donor attendants

e) Team technician (usually a junior MLSO but may be a donor attendant).

f) 2 team drivers (one drives the personnel vehicle and one the equipment vehicle).

N.B. At the City Donor Centre, drivers are not required and a clerical officer performs the reception work.

The Team Leader supervises the donor attendants. Their role is to care for the voluntary blood donor before, during and after donation. They all assist in the unloading and setting up of equipment for a mobile blood donor session.

The two team drivers are also involved in setting up and providing clerical and reception duties at the session. The personnel vehicle driver may also be required to ferry donors to and from their place of work to the session venue.

When donors enter the session, they first report to the reception desk. There they are given AIDS information leaflets if they have not already received this with the 'call up' card at home. Whilst waiting to see the team technician, the donor should read both the AIDS information and the 'disclaimer' board, which gives information about conditions which would prevent the volunteer from being suitable as a donor.

The team technician questions the donor about his/her health and asks the donor whether he/she has read and understood the AIDS information and 'disclaimer' board. The donor is then required to sign a form confirming that he/she does not know of any reason why he/she should not donate, that he/she agrees to donate and to be tested for AIDS and other infections.

Then the team technician performs a haemoglobin test on each donor. This consists of a small drop of blood taken from the donor's finger and dropped into a solution of copper sulphate, specific gravity 1.054 (green) for males and 1.053 (blue) for females. For donors who "fail" this test, a further sample is taken for haemoglobin estimation on a portable haemoglobinometer.

Donors who pass these tests have blood packs and sample tubes prepared and then proceed to the donation area. Further screening of the donor takes place at the bedside by the Session Officer, advice regarding their suitability to donate is given and if all aspects are satisfactory, the venepuncture is performed by the Session Officer (or 2nd venepuncturist - see above). The donation will then be supervised by the donor attendant staff.

On completion of donation, sample tubes are collected and the needle removed from the donor's arm; a rest period of 10-15 minutes is allowed and light refreshments are provided.

On some 'Public' sessions, voluntary services, e.g. WRVS, Red Cross, provide personnel to supervise the refreshment area. The donor attendant staff continue to care for the donors until they leave the session venue.

Regional Haemophilia Coordinator

This Nursing Officer is on the staff of the Regional Transfusion Centre, but currently has her office at the Royal Free Hospital, where there is a major Haemophilia Centre. She travels throughout the North East Thames Region,

giving advice and nursing care to haemophiliacs and their families in their homes. She also attends haemophilia clinics and works with the Transfusion Service and the Haemophilia Centres to coordinate the supply of NHS Factor VIII concentrate within the Region.

The Future

The staff of Registered Nurses will continue to expand as Medical Session Officers retire and as the Service expands to take over the Bloomsbury and Islington Districts. The takeover of blood supplies to these Districts will necessitate the employment of another mobile team.

To allow for this expansion, a new, larger Nursing Department is being planned as part of Phase II of the building extension programme. The Nursing Administration section will move into the new extension and this will free existing areas to provide an expanded Apheresis Department and a purpose-built Occupational Health Department with interview/examination room and treatment/rest room.

PAULINE BANKS
Senior Nursing Officer.

PLASMAPHERESIS DEPARTMENT

At the Regional Transfusion Centre, Brentwood, manual plasmapheresis has been performed for the last 18 years. 500 to 600 plasmaphereses are performed per year. Only voluntary, normal donors undergo plasmapheresis, never patients.

Method of Manual Plasmapheresis

Fenwal software is used. A unit of blood is bled into a double pack. This unit is centrifuged at 4,000 rpm for 7 minutes and the plasma removed. The red cells are then returned to the donor. Whilst the blood is being centrifuged saline is dripped into the donor's vein to keep the bleed line open. The whole process is repeated a second time. The time taken for this double plasmapheresis is 50-60 minutes.

Following donation, the donor drinks coffee or tea and eats biscuits and then returns home. Donors undergo plasmapheresis at fortnightly, monthly, three monthly or six monthly intervals depending on our requirements for the antibody which is being harvested.

Reasons for Plasmapheresis

At Brentwood, plasma is harvested solely for the antibodies it contains. Plasma is not harvested for clotting factors at present. The antibodies obtained are used either clinically or for the manufacture of reagents for laboratory use.

Anti D

This is obtained from Rh Negative women immunised during pregnancy or from Rh Negative men immunised, for instance, by a Rh positive blood transfusion. The anti D rich plasma is sent to the Blood Products Laboratory in Elstree to manufacture the anti D immunoglobulin which is used for the prevention of Rhesus haemolytic disease of the newborn.

In order to maintain National self sufficiency in anti D immunoglobulin, boosting of suitable volunteers is carried out from time to time to raise their anti D levels. Only donors who have been previously immunised due to a pregnancy or blood transfusion are selected for boosting with red cells from a matched, accredited donor. About 50% of those boosted responded with satisfactory anti D levels and now undergo regular plasmapheresis.

Naturally Occurring Antibodies

Good quality monoclonal ABO antibodies are now available for use as blood grouping reagents. The boosting of male volunteers to obtain high levels of anti A, anti B and anti AB is, therefore, being phased out.

Immune Red Cell Antibodies

Other antibodies to red cell antigens are required as laboratory reagents. These are obtained by plasmapheresis of women who have acquired such antibodies following pregnancy or transfusion and men who have acquired them following transfusion.

Viral Antibodies

1. Chicken Pox

Screening of donors for high titres of antibodies to herpes zoster (chicken pox) virus is performed. It has been shown that approximately 1% of donors have persistently high titres of such antibodies. Such donors will be asked if they are willing to undergo plasmapheresis. These antibodies may be given to patients with low resistance to infection e.g. children with leukaemia, to protect them if they come into contact with chicken pox. It is hoped to screen for antibodies to measles virus in a similar way.

2. Smallpox and Rabies

Donors who have recently been vaccinated against rabies or smallpox may be asked to donate plasma for immunoglobulin production.

3. Hepatitis B

Blood donors are also screened for the presence of the Hepatitis B surface antibody (anti HBs) in the plasma. The collection of plasma containing this antibody is vital for the production of Hepatitis B immunoglobulin, used to protect persons who have been exposed to the Hepatitis B virus and are not already immune. Volunteer donors who have anti HBs in their plasma, are recruited for plasmapheresis and may also have their levels of anti HBs boosted using a Hepatitis B vaccine.

Future Expansion

The demand for HLA (Tissue Type) matched donor platelets for patients with HLA antibodies is on the increase. These platelets can only be obtained in sufficient numbers from a donor with the use of a platelet machine (cell separator). Trials of different types of platelet machines are being carried out. In the near future, we hope to use machines both for plateletpheresis and plasmapheresis.

H. BORALESSA
Consultant Haematologist

THE DONOR LABORATORY

As its name implies, this department's role is that of testing blood donation samples. There is a legal requirement that all donations be tested regardless of whether or not the donor is known to the Service. This rigorous testing is necessary not only to ensure that safe blood can be provided for recipients but also to safeguard the welfare of the donors.

Samples are drawn from the donors at the same time as the main donations and are identified with the same unique, bar-coded identification numbers. Approximately 3,000 donation samples are processed by the Donor and Microbiology Laboratories each week. Whereas the Microbiology Laboratory conducts tests to detect transmissible diseases, the Donor Laboratory is mainly involved in testing for blood groups and related factors.

All samples are ABO and Rh grouped using the computerised Groupamatic blood grouping machine which automatically processes the samples, interprets the results and identifies the donation numbers. The results are all recorded on to magnetic data discs in the associated micro-computer.

On completion of laboratory testing a further micro-computer based system is used to facilitate the sorting of donation packs as to their suitability for various uses and for the checking of correct labelling. This procedure is made possible by the use of light pen wands which, when passed over the bar-code labels, automatically identify the information on the donation packs. The system checks the information on the labels against the laboratory results on the magnetic data discs and thus eliminates the possibility of mistakes resulting from transcription errors.

The micro-computer system in use throughout the Centre was only implemented as a temporary measure to enable the introduction of the bar-coded label procedure. It will shortly be replaced with a new, completely integrated computer system. This is located in a special suite and will link all users to one central processor and database.

SANDY COATES
Chief MLSO

MICROBIOLOGY LABORATORY

The main task of this laboratory is to screen all the donations (every donor, every time he/she donates, irrespective of the number of previous donations) for three transmissible infections. The donations are tested for the presence of Hepatitis B surface antigen (HBsAg , a surface coat protein produced by the Hepatitis B virus which indicates an infection with the virus)antibodies to AIDS virus (Human Immunodeficiency Virus -HIV) and antibodies to the causative organism of syphilis (Treponema pallidum). These three tests are based on the "Microtitre" system. Using this system a set of up to 96 tests and controls can be performed in what are, in effect, 96 small test tubes in a plastic frame 128mm x 86mm.

HBsAg Test

The test used for the detection of HBsAg is an amplified enzyme immunoassay. For this test the tubes are coated with antibody to HBsAg (Anti-HBs). If the donor serum contains HBsAg this becomes bound to the Anti-HBs on the tube surface. A second anti-HBs labelled with the enzyme alkaline phosphate (conjugate) attaches to any bound HBsAg. As the two Anti-HBs antibodies react with different parts of the HBsAg, these two reactions occur simultaneously during a 45 minute incubation at 45°C. After washing off the excess donor sample and labelled Anti-HBs the bound enzyme is reacted with its substrate to form a colourless product. This stage takes 20 minutes at 45°C. A third reactant (amplifier) is added, this reacts with the colourless product from the previous stage to form a coloured product. This reaction continues for 10 minutes at room temperature until it is stopped by the addition of sulphuric acid. The amount of colour produced by the donor sample is measured and compared with the amount of colour produced by HBsAg positive and HBsAg negative controls. A positive sample produces a lot of colour.

HIV Antibody Test

The test used for the detection of antibodies to HIV (anti-HIV) is a competitive enzyme immunoassay. In this test the tubes are coated with chemically inactivated HIV. Antibodies to HIV in a donor serum compete with Anti-HIV labelled with the enzyme peroxidase (conjugate) to bind to the HIV coated on the tubes. This takes place during a 1 hour incubation at 45°C. After this the excess donor serum and conjugate are washed out of the tube. The bound enzyme is then reacted with its substrate, producing a coloured product, for 20 minutes at room temperature. After this time, the reaction is stopped with sulphuric acid. The amount of colour produced by the donor sample is measured and compared with the amount of colour produced by positive and negative controls. In this test positive samples produce little colour. This is because the anti-HIV from the donor sample stops the conjugate binding to the test tube coated with HIV. Thus, after washing, there is less enzyme present, so that when the substrate is added there is less of this converted and, therefore less colour produced.

Syphilis Test

The third test performed on all donors is to detect antibodies to Treponema pallidum, the bacterium which causes syphilis. In this test the donor serum is incubated with red blood cells coated with the bacterium; if antibody is present; the cells agglutinate.

Using these three methods, it is possible to test 600 donors (including any repeat testing which may be indicated) and make the results available to the other laboratories in the RTC within 5 hours of starting work on the donor samples.

A donation which is positive for any of these tests cannot be transfused into a patient. We perform follow-up tests on all donors giving positive results with any of these tests to check our results and to enable counselling of the donors.

Other tests performed in this laboratory are:

1. Screening of donors for high levels of antibodies to various diseases.

   These antibodies do not harm the donors or prevent them donating blood. The plasma from these donations is used for the production of specific immunoglobulins for the prevention and treatment of disease. The antibodies screened for are - anti-HBs, anti-tetanus and anti-varicella-zoster (chicken-pox).

2. Screening of donors for antibodies to Cytomegalovirus (CMV)

   A small number of patients without correctly functioning immune defence systems, are very susceptible to infection with CMV, which is found in white blood cells. Evidence of prior infection with this virus can be found in approximately 50% of the population. We test donor samples to enable the supply of a small number of blood donations and products, which do not show evidence of this infection, for transfusion to susceptible patients.

3. Simple environmental sterility checks on the Red Cell Processing Clean Room and sterility checks on outdated blood and products are also performed.

   Research

   We also perform research into various aspects of Transfusion Microbiology, either alone or in collaboration with outside laboratories, for example, the London School of Hygiene and Tropical

of the service provided to hospitals in Bloomsbury and Islington.

T.J. MEACOCK
Chief MLSO

THE REFERENCE LABORATORY

The Reference Laboratory is the Department to which all the serological and compatibility problems from the North East Thames Region are referred.

Between 40 and 50 samples are sent from Regional Hospitals to the Reference Laboratory daily. Approximately half of the samples received are from antenatal clinics and are sent for antibody identification and antibody level monitoring. The remainder of samples are sent as crossmatching antibody identification, phenotyping and transfusion reaction problems.

Every sample received, irrespective of its investigation is comprehensively ABO and Rh grouped.

Some of the Investigations performed by the Reference Laboratory are:-

1. Samples from antenatal patients for antibody investigation, including genotyping of husbands.
2. Samples from postnatal patients and infants to investigate haemolytic disease of the newborn and to monitor postnatal immunoglobulin anti-D levels.
3. Samples from patients for crossmatching where the hospitals have failed to find compatible blood
4. Samples from patients who have had transfusion reactions to investigate cause.
5. Samples for identification of the specificity of antibodies from patients in whom hospitals have found irregular antibodies by screening tests.
6. Samples from donors with high levels of antibody who have been plasmapheresed for quantitation and specificity check.
7. Amniotic fluids for antibody quantitation.
8. Samples from patients to identify antibodies to plasma proteins such as IgA and Gm.

The Reference Laboratory also provides a telephone advisory service to Regional Hospitals on all serological matters.

The Reference Laboratory is sited in the new building complex and has been in use as such, since April 1987. The new laboratory was designed to meet the need for ever more complex investigations and a projected increased workload for the future.

Future trends for the Reference Laboratory are towards rapid and efficient patient records management. The use of computer technology as an aid to efficient, safe sample handling and accurate results reporting is being assessed at present.

G.M. BURGESS
Chief MLSO

REAGENTS LABORATORY

The Reagents Laboratory supplies blood grouping reagents to laboratories in the Centre and to hospital transfusion laboratories within the North East Thames Region. Most of the reagents supplied to regional hospitals are prepared by the Blood Products Laboratory (diagnostics), Oxford, but almost all the reagents used within this Centre are prepared by the Reagents Laboratory. All reagents are prepared to predetermined specifications in accordance with the 'Guide to Pharmaceutical Manufacturing Practice'.

The Reagents Laboratory provides reagents for the following uses:-

1. Blood grouping of donors and patients.
2. Detection and identification of allo-antibodies in donor/patient sera.
3. Provision of compatible blood for patients with allo-antibodies.
4. Quality control of serological tests.
5. Detection and identification of donors/patients with rare and/or unusual blood types.
6. Provision of reagents for training courses held at the Centre.

Blood Grouping Sera

Blood group system.	Antisera
ABO	Anti-A, -B, -A+B, antibody-free AB serum
Rh	Anti-D (various), -C, -E, -c, -e, -C^w, -C+D, -C+D+E.
MNS	Anti-M, -N, -S-s
P	Anti-P
Lutheran	Anti-L^1u^a, - Lu^b
Kell	Anti-K, -k, -kp^a, -Kp^b
Lewis	Anti-Le^a, - Le^b
Duffy	Anti-Fy^a, -Fy^b
Kidd	Anti-Jk^a, Jk^b

Other specificities are also prepared depending upon the supply of the raw reagent. Most blood grouping sera are prepared from donor plasma/sera though monoclonal antibodies are now becoming available as an alternative source of some reagents.

Lectins

Lectins are receptor-specific proteins which can be extracted from the seeds of many plants (notably the legumes) and from some invertebrates e.g. trout ova, snail eggs. Some lectins can be used for blood grouping, e.g. Dolichos biflorus (anti-A_1) and some for the detection and identification of red cells with altered surface receptors, i.e. polyagglutination. A range of useful lectins is prepared and supplied by the Reagents Laboratory.

Red Cell Panels

Red Cells

The Reagents Laboratory performs a full phenotype (comprehensive blood typing) of the red cells from some donors to enable them to be used in the detection and identification of allo-antibodies in donor/patient serum. The selected red cells are usually stored in the frozen state at -25°C. until required. In addition to the provision of red cells for allo-antibody screening (detection) the following red cell panels (each comprising 10 different donors red cells) are provided:-

Daily panel
D negative panel
c̄ negative panel
e negative panel
Le(a-b-) panel
ABO panel
High frequency antigen negative panel
Control cell panel
Gm panel

We also exchange cell samples of rare blood type with other laboratories around the world and maintain a large stock of donors cells for use in advanced serological investigations.

Other Reagents

Reagents required for the performance of serological tests are prepared and

supplied by the Reagents Laboratory and include:-

Proteolytic enzyme solutions, e.g. Bromelin, Papain; inhibition fluids, e.g. salivas, human milk, pigeon egg white; sulphydryl compounds, e.g. Dithiothreitol; enhancement media e.g. LISS, Polybrene; and various buffers, freezing and recovery solutions etc. In addition, the Reagents Laboratory specifically undertakes the following tasks:-

1. The development of new blood grouping techniques for use in the Centre.

2. The preparation of method sheets and formulation sheets.

3. The phenotyping of donors with anti-D whose plasma is obtained by plasmapheresis and used for the provision of immune Rh globulin.

4. The identification of donors with rare and unusual D types for which we are the foremost supplier in the world.

5. Screening of donors for selected rare types and identification of rare cell types or rare antibody specificities.

We also maintain a large stock of "raw human antisera" for future use as reagents and a large reference collection of antisera for use in special investigations. The large element of stock control and documentation in work has recently resulted in the acquisition of a microcomputer in the laboratory to assist us in the storage and retrieval of this data.

D.C.J. McDOUGALL
Chief MLSO

TISSUE TYPING DEPARTMENT

The Tissue Typing Laboratory at Brentwood BTC fulfils 4 main functions:

1. The provision of a service for those hospitals in the Region which have no tissue typing facilities of their own.

2. The recruitment and HLA typing of blood donors for the National Bone Marrow Donor Panel, which is maintained by the U.K. Transplant Service in Bristol. These donors are also used locally to provide HLA matched platelets for patients who have made HLA antibodies.

3. Screening for HLA antibodies. We do this for two reasons:

   a) To look for antibodies which may affect the outcome of future transfusions or treatment (e.g. in patients who have had transfusion reactions or who are receiving repeated blood transfusions).

   b) To look for antibodies suitable for use as typing reagents. These are needed within the department and samples are also sent to the U.K.T.S. National Serum Bank.

4. Testing for antibodies against platelets, which can lead to the destruction of the patients own platelets, the destruction of transfused platelets or the destruction of foetal platelets in pregnant women.

We are also involved in research projects in collaboration with the Blood Transfusion Department at St. Bartholomew's Hospital and have contributed to a number of recent scientific publications.

The Microlymphocytotoxicity Test

This test forms the basis of most of the HLA-serology performed at Brentwood and depends on the action of HLA antibodies which, in the presence of rabbit complement will lyse and kill lymphocytes. Killed lymphocytes may be distinquished by their altered appearance under the phase-contrast microscope and by their property of absorbing certain dyes such as eosin.

The ELISA for platelet antibodies

The Enzyme Linked Immunosorbant Assay (ELISA) is a very sensitive means of detecting antigen/antibody reactions and we have developed a version to test for platelet antibodies. We are also considering extending the technique to test for antibodies against other blood cells such as lymphocytes and neutrophils.

The field of tissue typing and transplantation is advancing very rapidly. As the demand for our services has grown, we have moved into an expanded laboratory (opened in 1987) and are about to introduce a computerised patient record and results reporting system.

J. ORD
Chief MLSO

THE FRACTIONATION DEPARTMENT

This department is situated on the ground floor, so as to provide ready access for incoming donations to be processed and proximity to the required storage and issue facilities.

This department operates an extended day from 9.0 am. to approximately 11. 0 p.m. Supervision and administration are the responsibility of a Senior Chief MLSO, with day to day running under the aegis of a Chief MLSO and Senior MLSO. The remaining staff of 8 are Junior MLSO's or ancillary grade staff. A two shift system operates with overlapping staffing.

The great majority of the 140,000 blood donations collected within the Region per annum, are returned to the Centre for immediate processing.

94% of all blood donations collected in the North East Thames Region are processed to provide more than one blood product.

Fresh blood is required for production of:

a) Platelet concentrates

b) Cryoprecipitate

c) Fresh Frozen Plasma

d) Granulocyte concentrates

e) Fresh plasma for fractionation processes at the Blood Products Laboratory (BPL), Elstree.

The main processing area is a large air conditioned room and the major equipment consists of a bank (14) of large refrigerated centrifuges for component preparation, 8 rotary platelet agitators and one flat bed bulk platelet agitator for platelet storage. Two blast freezers operating at -60°C, each with a capacity of 200 units of blood product, are installed for rapid freezing of units for processes b, c and e above. Storage facilities at -40°C. are provided in a separate area with a mixture of upright and chest type deep freezers. All the processing within the department is carried out in closed systems by use of interconnecting sterile plastic packs. This ensures sterility of the products.

A. Platelet Concentrates

Up to 45,000 donations per annum are processed for this purpose. The platelet concentrates are initially produced at 22°C. and are subsequently stored at the same temperature. These produces have a useful shelf life of 5 days maximum after donation of the blood from which they are prepared. Donations of all blood groups are processed

as single donations i.e. not pooled. Ongoing quality control exercises are constantly employed to ensure maintenance of the required minimum of 3×10^{11} platelets per adult dose. Six donations are required to produce this dose.

Platelet concentrates are used in the hospitals for pre and post operative treatment in cases requiring splenectomy, bleeding due to platelet deficiency or disfunction and in the management of leukemias and other malignant disorders. Whenever possible, platelet concentrate production from any donation is combined with the production of a second product, thus allowing three uses to be made of a single donation, i.e. platelets, a plasma product and red cells.

B. Cryoprecipitate

Up to 3,000 donations per annum are processed for this product. Cryoprecipitation is a method of preparing Factor VIII combined with fibrinogen and fibronectin. It is prepared from fresh plasma by a system of rapid freezing to approximately -60°C., followed by rapid thawing to approximately +1°C. The required clotting factors are precipitated at -60°C. and do not redissolve at +1°C. Excess plasma is then removed from the required product and may either be returned to the bag containing the red cells or alternatively, this cryoprecipitate-poor plasma may be stored in the frozen state and used when thawed to provide some clotting factors for clinical use.

The cryoprecipitate is stored at -40°C. with a storage life at this temperature of 12 months. Clinically, cryoprecipitate is used in the treatment of haemophilia and von Willebrands disease and it is also used as a source of fibrinogen in cases of disseminated intravascular clotting or fibrinogen deficiency.

C. Fresh Frozen Plasma

Approximately 14,000 donations are processed for this product, which contains the whole spectrum of clotting factors. Production is by means of centrifugal separation of plasma and removal of same from the cells. Plasma is removed within 8 hours of blood collection. Approximately 180 ml. of plasma is extracted from each blood donation. This is immediately frozen and stored at -40°C. and is subsequently issued as group specific fresh frozen plasma.

D. Buffy Coats

This product is prepared on request for specific patients. It is produced by differential centrifugation, which causes the blood donation to divide into three layers, plasma, buffy coat layer and red cells. The buffy coat layer consists of white cells and platelets and it is this layer which is used to provide transfusion of white blood cells for specific patients.

24 hours notice is normally required so that arrangements can be made to process 6 fresh blood donations to provide 1 adult dose of buffy coats. All requests are vetted by a medical officer at the Centre in consultation with the hospital medical officer prior to acceptance.

Buffy coat preparations are used where a patient has a severe deficiency of granulocytes with an accompanying infection which is not responding to antibiotics. Demand is variable and up to 500 donations are used per annum for buffy coat preparation.

E. Fresh Plasma for Fractionation at BPL Elstree

Each Transfusion Centre in England and Wales is required to send as much frozen plasma as possible to the Blood Products Laboratory in Elstree for fractionation. The United Kingdom is not yet self sufficient in manufactured blood products such as Factor VIII concentrate and albumin solutions. It is hoped that self sufficiency will be achieved by 1989. Meanwhile, every effort is being made to increase the annual supply of fresh frozen plasma sent from each Transfusion Centre to the Blood Products Laboratory.

At the Brentwood Centre fresh plasma for BPL is produced from individual blood donations in the same way as described above for fresh frozen plasma for hospital use. The fresh frozen plasma for BPL is, however, collected into a dedicated wedge shaped single plasma pack (SPP). The volume of plasma per donation varies from 180 ml. to 300 ml. dependent on the specific collection pack used. Processing is performed within 8 hours of blood collection. The plasma packs are blast frozen to a core temperature of -60°C., then are batched in volumes of 20 packs per box for despatch to BPL. Maximum plasma removal (300 ml.) has only been made practical by the introduction of optimal additive solutions, which are added to the red cells to resuspend them after plasma removal. This provides a red cell product with good flow characteristics and a shelf

life of 5 weeks, plus a maximum plasma yield per donation.

During 1986 some 97,000 donations were processed to provide fresh frozen plasma for BPL, Elstree. This equates to a volume of more than 26,000 litres of fresh frozen plasma.

In order to accommodate the increasing requirements, both for hospital blood products and for fresh frozen plasma at Elstree, plus the new requirements of Bloomsbury and Islington Districts, the Fractionation Department will need considerable enlargement. Plans are already being made for a new enlarged department and building will commence in 1988.

R. KIRKHAM
Senior Chief MLSO

RED CELL PROCESSING DEPARTMENT

This is a separate section of the Fractionation department. Day to day supervision is provided by a Senior MLSO who has a staff of 2 State Registered MLSO's.

This department is responsible for various preparations of red cells.

A. Filtered blood

B. Saline washed blood

C. Frozen blood

The department consists of office/laboratory accommodation, a storage area containing a liquid nitrogen generator and storage refrigerator and a Recovery Room. The Recovery Room is designed to Clean Room standards and all manipulative work associated with blood preparation is carried out in this area.

A. Filtered Blood

This is a method of preparing leucocyte (white cell) poor blood for treatment of patients who have had a reaction to normal whole blood and whose serum contains leucocyte (white cell) antibodies. Normal bank blood is used. The blood is centrifuged and plasma plus buffy coat is removed. The red cells are then passed through a leucocyte removal filter. Blood so processed has a 24 hr. shelf life. Leucocyte counts post filtration show a removal rate of over 99.5%. Over 5,000 units are processed per annum.

B. Saline Washed Blood

This is a method of removing plasma from red cells. Leucocytes (white cells) are also removed, but removal is not as efficient as in A above. Saline washing is not used frequently but may be required for patients with plasma antibodies.

C. Frozen Blood

This is a method for long term preservation of red cells. It is used for storage of very rare red cells for the transfusion of patients who have rare blood types. Some of the blood stored is for autologous use, i.e. patients of very rare blood type, donate their own blood in advance of planned surgery.

The method used for freezing is a low glycerol, rapid freeze method using liquid nitrogen. The red cells are glycerolised to a concentration of 18% wt/vol. and are frozen at -186°C. in liquid nitrogen. They are stored at a similar temperature and are recovered using a Haemonetics 115 continuous wash centrifuge, as the glycerol is toxic and has to be washed off. The final product is a saline suspension of red cells with a shelf life of 24 hours. The time taken to recover each frozen unit is approximately 1½ hours.

This product is leucocyte poor (but the % removed is slightly less than at A above.)

Brentwood is one of four Centres in the U.K. where rare red cells are stored in the frozen state. The other Centres are in Birmingham, Leeds and Glasgow. The rare red cells held frozen in these four Centres constitute the National Frozen Rare Red Cell Bank. Rare cells may be requested from this bank by any Centres in the U.K. Occasionally, requests are received from abroad.

In addition, the Clean Room is used for separation and pooling of plasma from outdated blood returned from hospitals.

All outdated plasma is pooled in 5 litre packs which are then frozen and despatched at -40°C. Approximately 23 donations are required per pack.

The throughput of plasma is approximately 6,000 outdated units of blood per year.

R. KIRKHAM
Senior Chief MLSO

ISSUE DEPARTMENT

The department is manned by two clerical staff under the supervision of the Senior Chief MLSO.

All blood which has been fully tested and declared fit for issue is stored in a walk-in Cold Store prior to issue. Temperature is maintained at 4°C. using twin compressors on a constant run principle. Air is circulated through a false perforated ceiling to maintain even distribution. Control of stock is provided by use of a stock board utilising magnetic symbols which gives ease of adjustment of stock figures.

All requests for blood are received by the clerks and the requests are noted on record cards for each individual hospital. Various cards are used to enable a check to be kept on the type of request, e.g. regular delivery or extra call, and cards are maintained for blood products and also for blood returned. The cards are scrutinised and if necessary the amount to be issued is adjusted after consultation with the Senior Chief MLSO.

A micro computer is installed in the department and recording of all issues is made using this system. A light pen is wanded over a bar coded identity label and blood group. Each hospital is identified by a predetermined code. After the clerk has wanded the required amounts for delivery the computer prints out a delivery note. Blood products can also be entered into the system so that a complete record of any issue made is kept. At the end of each day a print out is made showing the destination of all packs issued during the day. Upgrading of the computer system is being undertaken during 1987.

Similarly, any blood returned is wanded in and records produced to show what was returned.

Issues in 1986 were as follows

Whole Blood	12,000 units
Plasma Reduced Blood	21,000 units
Red Cells in optimal additive	90,000 units
Platelet Concentrates	37,000 units
Cryoprecipitates	2,000 units
Fresh Frozen Plasma	13,000 units

BPL Products

4.5% Human Albumin Solution	20,000 bottles
20% Human Albumin Solution	2,000 bottles
Factor VIII Concentrate	5,000 bottles

R. KIRKHAM
Senior Chief MLSO

WASHING AREA

This is manned by team of Laboratory Assistants who are responsible for provision of all clean glassware used in the laboratories and for the disposal of all unwanted blood samples etc.

SOLUTION AREA

Used for the preparation of distilled water and production of saline for laboratory use. Distilled water is prepared using three automatic stills (wall mounted) each with an output of 8 litres/hr. On average over 50 litres of distilled water and 75 litres of saline are used daily.

The area also contains the deep freezers required for plasma storage and is also used for dispensing of copper sulphate solutions from bulk containers for use by the mobile teams.

AUTOCLAVE AREA

This is situated separate from the main building. The autoclave is an automatic steam operated horizontal model with a 14 cu. ft. capacity. It is used for sterilisation of dressings, reagents etc. or for sterilisation of potentially infected material prior to final disposal.

R. KIRKHAM
Senior Chief MLSO

THE COMPUTER SYSTEM

Long ago in heathen times, according to Scandinavian folklore, there was a giant who lived far up in the North. His name was Mimer, and he was the master of a remarkable well which was brimful with wisdom.

When the giant drank out of this well be could instantly give the correct answer to any question. Everybody came to the well with their problems and the giant had a prompt solution for them all.

It is said that the giant lived on the site of Uppsala in Sweden; where the MIMER Relational Database software was developed, which is the basis of the Brentwood RTC computer system.

The "MITHRAS" system has been developed to specifically meet the requirements of the Brentwood Centre. When complete, it will manage all the information involved in the management of donors, donations and blood products. It will replace the many manual clerical procedures and filing systems currently required to manage the Service, and provide safe blood and products for hospital patients.

The system is installed on a Digital VAX Computer in the computer room and the various user departments are equipped with video terminals, light-pens and printers. Every aspect of donor and donation management will thus be controlled by using the shared, integrated, Mimer Relational Database.

Maximum use of bar-coded identification is being made to provide the security necessary for a blood transfusion system. The system will control many of the processing and testing procedures to minimise the supervisory checks currently required.

The donor and session management aspects of the system have been in routine use since 1984. Approximately 200,000 active donors are registered on the system which is used to organise donor sessions and invite donors to attend them.

The Laboratory, Fractionation and Stock Control modules are currently being tested and will be due for implementation in 1988. When complete, this complex system will enable the Centre to efficiently manage the vast quantities of data generated by the Service as we seek to improve the use of our resources and meet the everchanging needs of the Region.

A. C. BLAKEMAN
Senior Chief MLSO

RESEARCH AND QUALITY CONTROL DEPARTMENT

Quality Control

Responsibility for the overall coordination of Quality Control procedures within the Centre.

In liaison with the Fractionation Department, regular quality assessments are made of the following products:-

1. The plasma volume removed from single packs during the production of fresh frozen plasma (FFP)/Plasma Reduced Cells, and Red Cells in Optimal Additive/SPP (FFP for BPL, Elstree).

2. The sterility, PCV and presence of blood clots in hospital returned blood packs.

3. The Factor VIII procoagulant level and volume of Cryoprecipitate.

4. The platelet count, ADP aggregability and volume of Platelet Concentrate.

Research

Research is in progress in the following areas:-

1. The detection of hepatitis A antibody in donor plasma.

2. The detection and quantitation of malarial antibody in donor plasma.

3. The interaction of Factor VIII von Willebrand factor with the blood platelet surface.

4. The proteins and enzymes of the erythrocyte membrane and cytosol, with emphasis currently upon the membrane acetylcholinesterase.

5. The isolation of lymphocyte nuclei and nuclear envelope; the ultrastructure of T4 lymphocytes during HIV infection.

6. The transmission electron microscopy (TEM) of proteins, enzymes and membrane fractions from erythrocytes, platelets and lymphocytes.

Publications

1. Editorship of the Plenum Publishing Company series 'Subcellular Biochemistry'. This series is to include volumes on Immunology, Virally Infected Cells, Blood Cells, and Intracellular Parasites, as well as more fundamental biochemical topics such as Reconstituted and Artificial Membrane Systems, and Fluorescence Studies on Membranes.

2. Editorship of the new journal 'Electron Microscopy Reviews: Subscellular and Biomolecular Structure', due to be published by Pergamon Journals Ltd, commencing in 1988.

J.R. HARRIS
Principal Scientific Officer

TEACHING DEPARTMENT

The teaching complex comprises Library, Lecture and Seminar Rooms, Teaching Laboratory, Preparation Laboratory, Audio Visual Suite and Dark Room. With the exception of the Teaching Laboratory and Dark Room, all these areas were completed and opened in 1987.

Library

The new library contains medical and scientific journals and text books. More shelf space is available to allow room for expansion. A library committee meets to consider allocation of funds for appropriate books and teaching aids. The library is provided with tables for study. It is sited at the back of the building and so gives a quiet atmosphere conducive to deep thought!

Seminar Room

A small comfortable room for meetings and small teaching sessions. It is equipped to allow the use of visual aids.

Lecture Theatre

A custom built lecture theatre to hold 85 people in comfort. It is provided with screen, white board and an angled screen for overhead projection. Projection of slides and films is from the small adjoining room so that interruptions are kept to a minimum. A lockable area for the storage of audio equipment is also provided.

It was decided to have a level floor rather than a 'raked' floor as in many conventional lecture theatres so the room can be multi-purpose. The Centre holds regular medical and scientific courses and the theatre will, therefore, be used in a conventional form. However, if the chairs are stacked the room can be used for First Aid courses and poster presentations etc.

The larger lecture theatre now means that the Centre can hold Regional meetings which had previously been accommodated in local hospitals.

Teaching Laboratory

The laboratory gives ideal accommodation for up to 20 persons to undertake practical exercises in transfusion and haematology. The laboratory's major role is in external training courses but it is also widely used by our own staff during the preparation for examinations, especially those involving project work.

Preparation Laboratory

The small laboratory has been provided next to the Teaching Laboratory linked by a service hatch. It contains bulk material needed for the practical work of the training courses. The preparatory work preceding the courses is carried out in this area, thus releasing valuable space in the Reagents Laboratory. This laboratory is fully staffed during courses to meet the immediate needs of course members for extra material.

Audio Visual Laboratory

This adjoins the Projection Room and storage area. It has been designed as an area which is suitable for audio recording, hence the name. However, the main use will be to have a large space where display boards and posters for lectures, seminars and exhibitions can be prepared. The equipment transferred to this room includes a heat laminator, an overhead transparency maker and a Kroy tape printer. Tracking for studio light has been included in the ceiling so that it will be possible to undertake larger photographic projects.

Dark Room

This tiny room was originally designed for the preparation of lecture slides but is now also used for the photographic recording of laboratory work such as immunoelectrophoresis and also is a base for the fluorescent microscope.

Board Room and Jenkins Museum

The Board Room is used for committee meetings, staff interviews etc. It houses the Jenkins Museum of Blood Transfusion. This is a unique collection of apparatus and records pertaining to blood transfusion. The collection was started by Dr. W.J. Jenkins (Director 1955-1981) and is maintained by the present Director, Dr. J.F. Harrison. The Board Room may also hold the cricket trophy (a large papier mâché red cell). This is the award for success in the annual match, Brentwood versus Tooting BTS. If the trophy is missing, you know we lost the latest match!

JANE MEARS
Principal MLSO