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A HISTORY of BLOOD TRANSFUSION in EDINBURGH

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Published by:
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ACKNOWLEDGEMENT

The publication of this History has been made possible by a generous donation from the Edinburgh & South East Scotland Blood Transfusion Association which is gratefully acknowledged. Dr William McCrae expertly prepared the text from the original computer disks. The cover design is by Ms Daphne Lytton.

PROBLEMS AND SOLUTIONS

"At Gresham College, there was a pretty experiment of the blood of one dog let out (till he died) with the blood of another on one side while his own run out on the other side. The first died upon the place and the other very well and likely to do well. As Dr. Croone says, it may, if it takes, be of mighty use to man's health for the amending of bad blood by borrowing from a better body".

Thus did Samuel Pepys, in 1666, describe one of the first attempts to transfuse blood. Almost exactly a year later, the brilliant coterie which comprised the recently formed Royal Society extended its researches to man. "A poor and debauched man" was hired for twenty shillings to have "some of the blood of a sheep let into his body". Afterwards, he said he was much better and "a new man" but Pepys wrote: "He is cracked a little in the head though he speaks very reasonably".

Despite the apparent survival of "the first sound man that ever had it tried on him in England", such attempts to transfuse animal blood into humans were doomed to failure. It was not until 1818 that it was appreciated that it was necessary to use human blood for transfusing human patients. The man who made this important discovery was James Blundell, a London doctor, who carried out the first human to human blood transfusions. Throughout the rest of the 19th century, sporadic attempts were made to repeat his work but the technique did not become popular. Apart from the technical difficulties of transfusion, the most compelling reason for its unpopularity must have been the poor and unpredictable results.

The cause of this unpredictability remained a mystery until Karl Landsteiner, in 1900, discovered the existence of blood groups - which he described as "the unexpected existence of clearly demonstrated differences between the bloods within one animal species". The different groups are due to the presence or absence in plasma of factors which cause agglutination (or clumping) of the red blood cells of some other people's blood. However, the significance of this fundamental discovery, at least so far as blood transfusion was concerned, was not immediately appreciated even by Landsteiner himself. It was some time before it was realised that the transfusion of blood of one group into a patient

with a different blood group might cause a serious or even fatal reaction because of the presence of these factors. Ten years were to elapse before the inter-reactions of the individual blood groups were worked out and it was not until World War I started that compatibility tests were generally known and applied. Indeed, it was stated, with truth, that "except for asepsis and better technique, blood transfusions in Edinburgh in 1913 and before were no safer than if Blundell had done them."

The Problem of Clotting

Even after blood groups were identified, other formidable difficulties had to be overcome before blood transfusion could become a practicable proposition. The main problems were the technical difficulty of the procedure and the prevention of clotting. At first, in order to prevent clotting, patient and donor were physically connected. A small artery or vein of the blood donor was actually stitched to the vein of the patient. Later, the junction was created by means of a small cannula between the blood vessels of the two. The donor was required to lie alongside the recipient, "his left arm grasping the patient's left arm well above the elbow, bringing the donor's radial artery almost into apposition with the patient's vein". It was a very unsatisfactory procedure for many reasons. It was not possible to measure how much blood was transferred; the operation involved tying off an artery of the donor; it was difficult to give more than one transfusion; it was a harrowing experience for the donor and not really suitable for use during a surgical operation or in an emergency. The main problem, however, was that it was technically very difficult and time-consuming. The American pioneer, Lewisohn, wrote: "It is no exaggeration to state that, during that period, a blood transfusion was frequently a more difficult technical procedure than the operation to which it was incidental."

Ways of preventing clotting were investigated. It was found that, if the walls of a container were made very smooth, for example by coating them with paraffin wax, clotting was delayed. Various techniques using wax-lined syringes were devised. One involved blood being withdrawn into a series of up to ten syringes and injected almost immediately into the recipient. This seemingly simple technique, however, required a well-trained and well-organised team since a minor delay would result in clotting. An alternative to syringes was the use of a wax-lined container, the most popular of which was the Kimpton tube, designed in Boston and used in World War I by army surgeons. For reinfusion, a syringe was attached to an air tube to apply gentle pressure. The Kimpton tube reduced the need for haste and the patient and donor could, for the first time, be accommodated in different, if adjacent, rooms.

These techniques, however, merely delayed and did not stop the clotting process. The solution to the problem was found almost simultaneously by four men, working independently of each other, in three countries. Hustin in Belgium (1914), Agote in the Argentine (1915), Weil in the United States (1915) and Lewisohn (1915) also in the United States evolved a method in which sodium citrate was added to the blood to retard clotting. Agote was the first person actually to use citrate (14th November 1914) but it was Lewisohn who worked out the maximum and minimum doses. As a result of the use of citrate, transfusion became a much easier and safer procedure and the donor could be removed to a greater distance from the recipient.

The Influence of World War I

The test bed for many of these developments was in France where, on the battlefields of the First World War, surgeons saw shocked patients in numbers previously unimaginable. Even there, however, blood transfusions were not given until the second half of 1916. Most of the pioneering work was done by Canadians and Americans. Dr. I Bruce Robertson, a Canadian Army surgeon, used the syringe technique in 1916. The quantity of blood he gave was small - usually 500 to 600 ml - though he used up to 1,000 ml in some patients to good effect. In 1917, he described 36 cases and, in 1918, he reported a series of just over one hundred cases. However, just as it took time for people to realise that blood grouping was an essential prerequisite for transfusion, so it took time for the value of citrate to be recognised. Of the 36 transfusions Robertson reported in 1917, citrate was used in only four. Even in 1918, he wrote: "the citrate method is by far the simplest but, up to now, there is not sufficient evidence to show that it is the method of choice".

Another notable pioneer was the U.S. army surgeon, Oswald Robertson, who was the first person to use stored blood. In 1916, Rous and Turner discovered that red blood cells of rabbits could be preserved in good condition for several weeks if dextrose was added to the citrate and the blood kept cold. Oswald Robertson tested this discovery on human blood in 1917, using an ice box to keep the blood cold and he applied this finding in 1918 by setting up the world's first blood bank. Robertson attempted to improve the supply by storing Group O blood in anticipation of a major action. The numbers he treated were very small - in 1918, he described "one series of 22 transfusions" - but he had demonstrated that it was possible to store blood and give it later. It was an important experiment but it was no more than an experiment, of value in the treatment of mass casualties. That storing blood could have other advantages was not foreseen.

The blood donors were usually men with minor injuries or members of field ambulances, officially known as "resuscitation men". A roster was kept of volunteers whose blood had been grouped and who could be called upon for the immediate treatment of casualties. Since a fortnight's leave in Great Britain was granted to each donor after every transfusion, there was no shortage of volunteers. But when casualties were heavy, they swamped the available resources and the volunteer donors were urgently needed for other jobs.

The extent of the influence of the war on the practice of blood transfusion might be gauged by an estimate of the total number of transfusions given. That number is not known but the evidence suggests that it was probably not more than a few hundred - in a war in which battle casualties were numbered in millions. In all, fewer than a dozen reports of its use appeared in the columns of *The Lancet* or the *British Medical Journal* and most of them described the experiences of the two Robertsons, Bruce and Oswald. The use of blood was restricted almost entirely to the Canadians and Americans.

The British Experience

The British Army doctors favoured the use of a colloidal solution of gum or gelatin which, though less effective, was more readily available and therefore more practicable in the trenches. Blood transfusion was outwith the experience of the vast majority of British surgeons. One of the few exceptions was (Sir) Geoffrey Keynes who first saw it used when he visited an American Army Casualty Clearing Station. He became an enthusiastic exponent of the practice. He described later how, during a lull in the fighting, he began to visit "the moribund ward" (of patients considered to be past surgical aid), choose a patient, transfuse him and then operate. He had the satisfaction of saving many who had been left to die.

Even among those who appreciated the value of blood transfusion in war, few believed that it would have any value in peacetime. A Colonel Wallace wrote: "In civil practice, the reasons for transfusion are few" and an editorial in *The Lancet* in 1918 on "Transfusion of Blood in Military and Civil Practice" claimed that "the large number of transfusions to be performed and the readiness with which donors may be secured have greatly facilitated the work in the army: but it is otherwise in civil practice when the operation is much less frequently demanded and there is a greater reluctance on the part of relatives and friends to give blood". The novelty of the procedure is evident from the statement: "We doubt whether any English surgeon could have been found to perform the operation of blood transfusion even so recently as four years ago". Only one person challenged this statement - Moynihan (later Lord Moynihan) wrote that the operation had been

done in Leeds for the previous ten years. It is pertinent to observe, however, that Moynihan too had learned the technique from the Americans. He had worked in 1908 with Crile in Cleveland where he had seen direct transfusions carried out on four patients.

After the war, Keynes returned to London where he "was astonished to find how seriously this extraordinary therapeutic advance was undervalued". In 1920, he wrote: "Since the end of the war, there has ceased to be any pressing need for doing blood transfusion on a large scale and its importance has therefore tended to fall into the background". He tried to introduce blood transfusion but met resistance and had considerable difficulty in persuading his surgical chiefs to allow him to transfuse their patients. They were apparently afraid that his activities might "get in their way". He persisted and, despite being a lone voice in the wilderness, his persistence began to pay off. Transfusion became routine practice in the hospitals in which he worked. He also began to advocate the value of transfusion in both the lay and the medical press. In 1922, he published the first textbook on the subject ever printed in Great Britain. It made no great stir and was not reprinted though he edited a second, much larger, textbook on the subject, in 1949.

As his work became accepted, Keynes formed a small band of medical students as donors for his private practice, though relatives and friends were the usual donors in his hospital work. The need for some sort of organisation for the supply of donors was brought to the notice of a Red Cross worker, Mr. P L (Percy) Oliver, when, in October 1921, he received a request for a donor from King's College Hospital. Oliver, with three other members of the Camberwell Division of the County of London branch of the British Red Cross Society, responded by founding the London Blood Transfusion Service which was administered for many years by Oliver from his house in south east London, under the auspices of the Red Cross. They organised a panel of volunteers who could be instantly available, day or night, and who would give their blood without charge.

The medical profession in general was slow to appreciate the value of blood transfusion. Years after the war, it was practised by only a few enthusiasts. One of the reasons for this was that the results of transfusion were often less impressive than they might have been. When blood was given, it was often too little and too late. Direct transfusion was partly responsible since a specific donor had to be found for each individual patient. Since the donor had to be summoned and brought from home or from work, some delay was inevitable. More serious, however, was the absence outside London of an organised donor panel. Elsewhere, relatives, friends, students or, in some cases, professional donors were sought.

In summary, the fundamental discoveries of Landsteiner and Lewisohn had created interest in blood transfusion and solved the problem of clotting. The First World War had encouraged its use although its value was not fully appreciated because of the small number of patients involved. Blood transfusion could not become widely practiced until the techniques of administration had been improved and an efficient organisation created to provide blood donors. A major boost to the universal acceptance of the value of blood transfusion, and blood storage, was, however, delayed until the next major conflict - the Spanish Civil War.

EDINBURGH'S EARLY INVOLVEMENT

"The scope and indications for transfusion are not yet realised"

Some of the earliest attempts to emulate James Blundell were carried out in Edinburgh. In 1845, Richard Oliver reported in the Edinburgh Journal the successful transfusion of 22 ozs of blood to a woman with severe uterine bleeding. Twenty years later, Peter Handyside, a surgeon in the Royal Infirmary, reported three transfusions, two of which were successful. One was given to a patient of Professor Simpson, the obstetrician and discoverer of the anaesthetic effects of chloroform. Handyside reported another case in 1874.

What was probably the largest series of transfusions in the 19th century was carried out in Edinburgh Royal Infirmary between 1885 and 1892. The first took place on 21st October 1885, the patient being a man who required an amputation following a railway accident. The surgeon, John Duncan, was a colourful character. "His tall silk hat, benign features, long grey beard and a pair of high stepping horses which he drove in a yellow dog cart made him a well-known figure in the Edinburgh streets". Duncan carried out perhaps a dozen or so transfusions. In some, he used autotransfusion. Today known as autologous blood transfusion, this means the reinfusion of the patient's own blood. Duncan said that this idea "would probably not have occurred to me had I not in the previous six months had considerable experience in transfusing the blood of one human being into another". In most cases he used phosphate of soda to delay coagulation. The donors included "my House Surgeon, Dr. Carmichael", "Mr. Handyman, a healthy and powerful young student", "one of my Clinical Clerks" and "a very strong healthy student". Most of his transfusions seem to have been on amputation patients but, in five, he transfused blood into patients with pernicious anaemia which was at that time an incurable disease. These were carried out at the instigation of a physician colleague in the Royal Infirmary, Dr. D J Brackenridge.

Duncan was not the only surgeon involved with transfusion at that time but he was the main one. Perhaps the most notable individual case of the series was carried out in January 1886 by Thomas Annandale, Professor of Clinical Surgery in Edinburgh. A young quarryman, James Philp, was admitted to Edinburgh Royal Infirmary seriously injured in an explosion at work. Part of an arm and a leg had to be amputated. A blood transfusion was carried out and Philp survived.

He died in 1940 at the age of 77, four years after celebrating his golden wedding. A successful business man, he was survived by his wife and seven of his family of nine.

Duncan did not record his problems but problems there must have been. The fact that blood transfusions in Edinburgh appeared to cease about 1892 suggests some disenchantment with the procedure. (Duncan did not retire until 1897.) It is likely that it fell into disrepute because of technical difficulties or because of deaths due to incompatibility. The latter was at the time an unknown hazard but the former is mentioned by one of Duncan's surgical colleagues, Joseph Cotterill, who wrote in 1902: "Immediate transfusion of blood by any form of syringe or instrument is mentioned only to be condemned as the risk of inducing clotting is very great while the difficulty of preventing admission of air is considerable".

A very remarkable paper, clearly stimulated by Duncan's work, was published in 1887. It was a report to the Scientific Grants Committee of the British Medical Association by William Hunter "late assistant to the Professor of Physiology, Edinburgh University" and was from the Physiology Laboratory, University of Edinburgh. Entitled "Duration of Life of Red Corpuscles after Transfusion in its bearing on the value of transfusion in man", it described work on various animals and man. The introduction stated: "The question of the normal life duration of red blood corpuscles may be regarded at first sight as of comparatively little importance either from a scientific or a clinical point of view. I propose to show in my present paper that such is far from being the case and that a study of the subject is not only of scientific interest but is one of prime practical importance when viewed in its relation to the important question of the value of transfusion of blood in man". This serious scientific work was far-sighted and well ahead of its time and is perhaps the first major investigation into the effects of blood transfusion.

James Graham's Thesis

After Duncan's series of cases, there is a gap of more than twenty years. The next recorded case was not until 12th December 1913. On that day, in Ward 13 of Edinburgh Royal Infirmary, a patient suffering from pernicious anaemia was given blood - the first of a series of transfusions given by a young surgeon, James Graham. As with Moynihan and Keynes, his interest in blood transfusion had been stimulated by the work the Americans had done. In 1919, he submitted his ChM thesis on "Blood Transfusion" for which he was awarded a Gold Medal. In all, he carried out 46 transfusions on 39 patients between 1913 and 1919. The indications for transfusion in this series were pernicious anaemia (21 cases), secondary anaemia (6), purpura - (a bleeding disease) (2), and haemorrhage in

only 10, most of these being cases of secondary haemorrhage in soldiers evacuated from France in 1917 and 1918 with grossly infected wounds.

That so few patients were transfused after primary haemorrhage might well be a reflection on the time and trouble needed to obtain donors in an emergency, as well as on the technical difficulties of setting up an infusion in the pre-citrate era. "It was clear", wrote Graham, "that the operation (of transfusion) was sufficiently difficult to make it impracticable as a routine...in clinical cases". The close contact required between patient and donor "may be a disadvantage in emotional circumstances". It could also lead to unexpected difficulties, as in the case of one of his patients, an elderly lady, who was transfused when unconscious in her own home and who recovered consciousness while the transfusion was proceeding. She was somewhat embarrassed and indignant at the presence in her bedroom of her chauffeur who was acting as donor until the reason for his presence was made clear to her.

The introduction of sodium citrate (used on eight occasions) made life easier for all. In two cases, Graham used citrated blood to transfuse private patients in their own homes. Blood was withdrawn, probably from students in the Royal Infirmary, and "the flask containing the blood was surrounded with cotton wool and transferred by motor car".

It would appear that Graham sometimes had difficulty in getting donors. Normally he used relatives of the patients although, in 1918, several soldiers donated blood for their comrades who had been evacuated to Edinburgh after being grievously wounded in France. However, he wrote of a patient bleeding from a secondary haemorrhage: "Since no relative or other likely donor was at hand, it was decided to ask a student to volunteer" but since he was sitting his final examinations two days later, it was thought advisable to take only a small amount of blood. In all, the patient was given 600 ml blood and this was taken from "one nurse, two residents, three students and the writer". Small amounts were taken from each because they "could not be readily spared on account of temporary indisposition".

Despite his pioneering efforts and the reports published about that time from base hospitals in France, he noted that "there is no doubt that the scope and indications for transfusion are not yet thoroughly realised by civil practitioners and there must be many surgical, medical and obstetric cases which die from haemorrhage without transfusion having been attempted, suggested or even thought of. I am not aware of a single instance in recent years in which transfusion has been employed in Edinburgh in a case of placenta praevia or of postpartum haemorrhage".

The First Donor Panel

During the twenties, there was an upsurge of interest in blood transfusion in Edinburgh, due largely to the influence of James Graham and two other surgeons, David Wilkie and Charles Illingworth. Wilkie's pioneer work on the surgical removal of the spleen was the main reason for his involvement, and Illingworth was his able and energetic assistant. At that time, no one less senior than a Clinical Tutor actually carried out a transfusion.

One unusual indication for transfusion was sepsis. There was a belief that the anti-infection properties of the blood could be boosted by transfusion. The donor was previously injected with nucleic acid or a staphylococcal vaccine which caused a prompt rise in the antibacterial action of his blood. This action reached a peak in about four hours at which time blood was taken off and injected into the patient. The brief vogue of this ineffective method of treatment ceased with the discovery of the antibiotics, but, in the ten years or so preceding that happy event, a significant number of "immunotransfusions" were performed and infection ranked high among the indications for blood transfusion.

It was still customary, in most cases, to invite relatives to be donors. If no relative were willing and suitable, students were asked. No organised system existed other than a sheet of paper in the ward on which students volunteered their names. A Royal Infirmary Board of Management minute of 22nd July 1929, for instance, records that "a letter was read from Mr. Graham with reference to an operation performed by him on 18th ultimo when no voluntary donor could be got. A student gave 22oz blood at the termination of the operation" and Mr. Graham suggested that £5 be sent to him.

One day in late September or early October 1929, a young surgeon, R L Stewart, telephoned from Goldenacre to Wards 13/14 to ask for a donor for a private patient who was bleeding. The sheet for volunteers contained no names. Three students, D M Blair, A Desmond Stoker and W I C Morris, who were in the ward, telephoned the BBC to ask if they would broadcast an SOS for "Group 4" donors to come to the Surgical Out Patient Department (SOPD) of the Infirmary. There was apparently no response and so the students typed their own blood on the bottom of an upturned teacup. Morris's blood was Group 0 and he dashed out to give blood. On his way out of the hospital, he passed a queue of people at the Out Patient Department!

These three were, at the time, members of the Royal Medical Society, the oldest student society in the world. On 24th January 1930, a motion was laid before the Society: "I beg to propose that the Society endeavour to form a nucleus which

would be willing to act as blood donors for the Royal Infirmary". It was proposed by Blair and seconded by Morris. Speaking to the motion, Blair described "the utter futility of the present list of volunteer blood donors kept by the Infirmary".

About eighteen members were recruited though with some difficulty since it was feared that blood donation would have an adverse effect on their health. This fear was expressed later that year by the Superintendent of the Infirmary who "explained that the method at present employed was to obtain the services of medical students who, from the nature of their training, were aware of the dangers involved". Stoker was appointed "Convenor of Blood Donors" because, he alleged, "it was thought that, as my blood was Type 0, I could always give my own blood when I could not find a donor". In all, he gave ten pints before being advised by the Professor of Midwifery to desist. The service provided by the Royal Medical Society lasted for about two years but then ceased because all the students involved had graduated and dispersed. By that time, another donor service had come into existence.

THE CRUSADER ERA

"It is impossible for one Crusader to carry on unaided"

J R (Jack) Copland was an Edinburgh dentist who lived and worked at GRO-C GRO-C Edinburgh. One day, late in 1929, he learned from a recently bereaved friend of the circumstances of his wife's death. She had required a blood transfusion but no donor could be found, her husband's blood being incompatible. This event was to change Copland's whole life. Shocked that anyone should die in Edinburgh for want of a blood donor, he determined that such a thing should never happen again. From that time on, he was to devote himself increasingly, with near evangelical fervour and boundless energy and enthusiasm, to promoting the cause of a blood transfusion service. His home gradually became the centre of the activities of the service he was to create, while his time and talents were devoted less and less to dentistry and more and more to his personal crusade. Crusade is an appropriate word. Copland was, at that time, an office-bearer in the Holyrood Conclave of the Order of Crusaders, a body he enlisted in his cause. Founded in 1921 by Lt. General Sir Edward Bethune, the Order was pledged to give service and to practise self sacrifice - "a brotherhood of man drawn from all classes and parties, pledged to honour God, to be loyal to King and Country and to relieve suffering and distress in all forms and to further the cause of good will and social betterment".

Copland was to ensure that the members of the Holyrood Conclave paid more than lip service to these high ideals. On 6th January 1930, he suggested that a "Blood Transfusion Centre" in aid of the Royal Infirmary should be organised by the Conclave, a suggestion which was warmly approved. It was agreed that "a report should be obtained from the Headquarters of the Order of any similar scheme that may have already been arranged by other Conclaves and from this report, to construct a scheme that would be suitable for Holyrood Conclave prior to submitting any suggestions to the Managers of the Royal Infirmary". The Conclave minutes do not disclose what response, if any, was received but it seems likely that some information was obtained from London about what was then the only blood transfusion service in the country, the one started in 1921 by Percy Oliver.

In September 1930, Copland was authorised to set up a blood transfusion service in Edinburgh on broadly similar lines. The organisation of recording and tabulating the names of volunteers was to be carried out by the Conclave but it was to be open to any member of the public to volunteer as a "blood transfusionist" and to assist in the general working of the scheme. Copland set to without delay, and had a list of 24 donors within two months. He had wanted many more: "The response has really been very poor and we will need more donors".

The first call upon the service for a blood donor came in January 1931 from Ward 6 of the Royal Infirmary. Even by this time, the implications of running a service were becoming apparent. As the Minutes record: "the time had arrived when Crusaders must help in financing the service as it was impossible for one Crusader to carry on unaided" - a plea which was to be repeated in the years to come.

The Donors

The most important task was to get enough donor volunteers. To recruit them, Copland became something of an expert in the use of publicity. He reached his audience by word of mouth, by letters to the press, by lectures, feature articles and by "wireless" appeals. He organised concerts which were primarily fund raising exercises but were also very useful in attracting new donors. Later, flag days were even more successful in both respects. In its early years, the transfusion service owed much to the publicity given by the local newspapers, together with the willing involvement of the Lord and Lady Provost and many of the city's leading citizens. Their help was essential in the crisis to come.

The theme of the publicity was that blood donation was a service which could be given by anyone who was between the ages of 18 and 60. It was, moreover, both easy and safe. People had to be educated, not only in the reasons why blood was necessary but to remove the fear of donation. Irresponsible publicity had to be countered. Sometimes, though not in the local newspapers, frightening comments appeared. In August 1936, some London newspapers carried the story of a well known athlete who had given blood to a friend who was a popular sportsman. The donor died, allegedly as a result of blood poisoning from the needle puncture. An inquest found that his death had had nothing to do with the blood donation but the incident caused a considerable loss of donors. Such sensational reporting brought pressure to bear on existing donors and caused distress to friends and relatives: "One of the bravest men in the country" (about a man who had given blood on several occasions) "He was off work for only a week although he still has to attend his doctor"; "Blood donor dies in poverty"; "Saved life - lost job". When this last story was investigated, no confirmation of its authenticity could be

obtained. Complaints about such misleading headlines were not always printed. Even if they were, damage had already been done.

Once found, the donors then had to be encouraged and protected. They were encouraged by direct feed-back of information from the hospital about the results of the transfusion (each donor having been called in for a specific patient) and the provision of a certificate of donation which carried the emblem of the Crusaders. Copland tried to protect them from the exploitation of overfrequent demand and from inadvertent neglect at the hospital. In November 1933, a memorandum was circulated to all the Royal Infirmary resident doctors "embodying your (Copland's) suggestions for the more efficient carrying out of blood transfusions". This stated: (1) that donors were available at all times, day or night, on application to J R Copland, (2) that the patient's blood should be typed first so that universal donors should not be called upon so frequently (3) that donors should not be kept waiting unduly and that, if wanted for "stand-by", this should be so stated and (4) that, if possible, the vein of the donor should not be incised.

Resistance on the part of some employers had to be overcome. In 1931, a letter from the Controller of the Post Office to a volunteer told him: "You are not to be regarded as eligible to offer your services for blood transfusion". The conditions imposed by the Post Office were, first "that the operation shall be by needle or fine cannula but not by dissection; second, if the absence is for part of a day only, the volunteer will receive his pay for the day and the cost of substitution will be charged against him. If the absence is for a day or more or if sick leave results from the operation, no pay will be allowed for the period of absence, the cost of substitution being borne by the Department and, third, volunteering is normally restricted to officers within the ages of 19 to 25". (These regulations were unchanged in 1939 when they were the subject of a parliamentary question).

Copland's service made up the pay of those losing money as a result of blood donation as well as looking after them in other ways. The Dispatch of 10th January 1932, for instance, reported that "one of the donors, a widower with three children, fell out of work recently. Efforts by those organising the service to find him work were without avail. At Christmas, a well packed hamper arrived at his house. This unemployed man has given nine pints of his blood. One of the organisers" (almost certainly Copland himself) "has given fourteen pints, his sister eight".

One of the donors who started giving blood in 1933 was Mr. George T Gibson who became a life-long supporter of the Service. In 1933, he generously presented the Service with a motor car, a two seater Morris Oxford, 1927 model. In 1936,

he was one of three members appointed to the Committee of the Edinburgh Blood Transfusion Service to represent blood donors. An active fund raiser, he helped the Service in many ways, not the least of which was that he designed and built the first purpose-built mobile withdrawal vehicle. He was a donor until 1951 when he had to withdraw because of age but he remained a member of the Regional Executive Committee until his death in 1960.

Administration

The work involved in administration was considerable. Each enquiry had to be answered, each volunteer typed and the blood group, availability and address recorded and filed. Each call from hospital or nursing home, at whatever time of day or night, came to Gilmore Place and had to be answered immediately. A donor had to be found, taken to the hospital to give blood and then taken back home. Wherever he went, Copland was available at the end of a telephone to answer such a call. Often, he collected the donor himself and frequently he gave his own blood. As the demands on the service increased, the donor panel was called upon at shorter and shorter intervals until, again and again, yet more had to be sought, each appeal and each new batch of volunteers generating additional work. In 1934, the administration was large enough to require the services of a paid assistant for daytime duties and she was paid 30/- (£1.50) per week.

That, of course, was only a small part of the total cost. Most was taken up in providing transport for the donors to and from the hospitals. Although a car had been donated, the maintenance and running costs were considerable. There were also the out-of-pocket expenses of the donors and the increasing administrative costs of stationery, telephone and postage. Raising funds to keep the service going was a problem which ran in parallel with the need to find more donors. Copland was equal to the task and proved himself as imaginative and energetic in fund-raising as he was in the recruitment of donors. Bazaars, concerts and appeals were promoted, all of which took an increasing amount of his time.

But the donors gave their blood without financial reward. From the start, it was a principle of the service, as it was with the Red Cross Service in London, that no payment was made to them. Private patients and those who could afford it were encouraged to give money as a donation to the service itself but not to individual donors. Such payment was encouraged but not demanded.

The End of the Crusader Involvement

In the six years of the involvement of the Order of Crusaders, no call from a hospital was unanswered. From the early days in 1930 when a small band of twelve people comprised the original donor panel, a list of 350 was available in 1936. In

1931, there were only about twenty transfusions given in the city and about 36 in 1932. This number rose to several hundreds only three years later. Copland claimed more than 1,000 in 1934 but it is unlikely that the true figure was as high. It probably seemed that way to him especially when, on occasion, he had as many as eight calls in one day!

The original service created the demand because doctors in 1930, with very few exceptions, were not aware of the potential benefit of blood transfusion or, if they were, the difficulty of getting a donor in time meant that transfusion was not attempted when it might have been. But, as they began to appreciate its value and donors were available when needed, many more began to practise blood transfusion. The demand for blood began to escalate and the supply, the blood transfusion service, had to expand to keep pace with the demand it had created.

Copland himself was the driving force. He ran the whole organisation from his house, he organised publicity, he initiated the fund raising and he provided the essential link between patient and donor. As the demands on him increased, he warned Conclave several times that he could not carry on alone but the stresses and strains and the sheer size of the enlarged organisation finally caused things to come to a head in 1936. By that time, the few members of Conclave were enmeshed in an ever-expanding enterprise which not only was taking up a great deal of their time but was creating considerable anxiety particularly about their possible financial liability. The service could not continue as it had done. Conclave had reached the end of the road.

THE EDINBURGH BLOOD TRANSFUSION SERVICE

"It would be unthinkable to allow such a valuable service to lapse"

On 17th February 1936, the Treasurer of the Holyrood Conclave resigned. "The Secretary moved a resolution that an endeavour should be made to secure the attendance of the Honorary Organiser of the Blood Transfusion Service (Copland) in order that the next meeting would be in a position to discuss the engagements of the Service being taken over by the Royal Infirmary of Edinburgh or other competent body who would be better able than Conclave to cope with any financial crisis arising out of the activities of the Service". In plain words, the Service was bankrupt.

Copland moved quickly to preserve the Service he had created. Within two weeks, he "had every hope that, in the near future, he would be able to intimate the formation of a Committee of independent citizens who would be willing to take over the affairs of the Service". Although he was seeking a local solution, he had, even at this time, a greater vision - "a national transfusion service is required". High on his list of local candidates for chairing a Committee was the Lord Provost. As far back as 1931, Copland had expressed the desire to a Crusaders' meeting that the Lord Provost might become Chairman of the Service "when it became strong enough". He had, some time previously, enrolled the Lady Provost as an active fund-raiser for the Service.

In a letter to the Scotsman (12th May 1936), Copland wrote: "The Edinburgh Blood Transfusion Service has now been active for nearly six years.... The Committee that has carried on since the inception of the Service has unfortunately been compelled to give up as the Service has grown to such an extent that it can no longer cope with it. Meantime, I am carrying on the Service but the job is too big for one person and I will be reluctantly compelled to withdraw soon unless another Committee is formed quickly. I will, of course, put the hospitals in touch with donors but will be unable to transport the donors to the hospitals as before. This is a very important point, time being a great factor as nearly all transfusions are emergency cases. It would be unthinkable to allow such a valuable service to lapse and I trust this letter will have the desired effect".

The Edinburgh Blood Transfusion Service is Born

The letter had the desired effect. Intensive consultations took place among the various interested parties, with the Lord Provost, the Right Honourable Louis (later Sir Louis) S.Gumley and the Chairman of the Honorary Staff of the Royal Infirmary, Mr. W J (Pussy) Stuart being particularly involved. They wrote on 26th May to the Board of Management of the Royal Infirmary about "the difficulties which have arisen in connection with the Blood Transfusion Service in Edinburgh" and a proposal that a special meeting should be held in the City Chambers on 10th June 1936 "for the purpose of constituting a Blood Transfusion Service in order that this important work might be carried on in the future". A list of about sixty names was put forward of eminent citizens representative of professional, commercial, charitable and other public bodies in the City. These included the Sheriff of the Lothians and Peebles, the Lord President of the Court of Session, the Vice-Chancellor of Edinburgh University, the Presidents of the Royal Colleges of Physicians and Surgeons and representatives of hospitals, churches, the British Medical Association, the Red Cross Society and the St. Andrews Ambulance Association.

At the meeting, W J Stuart spoke of the need for blood and explained the origins of the Service and the fact that, owing to diminishing numbers of Crusaders, they had withdrawn from the scheme. It was proposed and agreed that a Blood Transfusion Service be constituted in Edinburgh with a committee to take over the list of typed donors. It was also agreed to leave to that committee consideration of matters such as the maintenance and extension of that list, the centre from which the Service would be worked, finance, the question as to whether institutions should pay a fee to the Service for each transfusion and whether the donors themselves should receive a fee. On this last point, the President of the Royal College of Surgeons, Mr. Wade, expressed the view that the blood "must be the free will offering of men who loved their fellow mortals" - a fundamental tenet of the original service.

As a result of the meeting, the Edinburgh Blood Transfusion Service (EBTS) was formed. An executive committee was created with the Lord Provost as Chairman and among its members were W J Stuart, Professor (Sir) John Fraser, and Mr. George T Gibson who was a representative of the donors. The Honorary Secretary and Treasurer of the new scheme was Charles S Gumley, W.S., son of the Lord Provost and Robert Burnett, C.A. was appointed Auditor. All of these gentlemen were to serve the cause of the Service faithfully, energetically and without fee for many years. When the new Executive Committee met on 25th June, one of its first actions was to appoint J R Copland as a paid Organiser for the Service and a member of the Executive Committee.

The First Executive Decisions

A small subcommittee, appointed to consider the reorganisation of the Service, reported without delay. It recommended that the Service should be run more or less as it always had done but with more financial control from the Executive. "The question of charging patients with a fee for each transfusion was fully discussed but it was decided that, in the meantime, this is impracticable in the case of the Royal Infirmary and similar charitable institutions - about 50% of the total blood transfusions in each year are given to patients in such institutions. However it is hoped that the revenue from patients in private nursing homes and other such institutions will form a substantial and steady source of income". It was also agreed that a paid assistant for Mr. Copland should be appointed. The person chosen for this post was Miss Helen White, of whom much more will be heard for she became a key figure in the Edinburgh Service which she served with devotion for many years. The letter of appointment read: "I write to confirm your engagement as part time secretary to the Organiser at a salary of £40 per annum, the hours of business being from 9-30 am to 1 pm, except at the commencement of the work when this may require to be slightly extended". It was often very much extended.

To lighten the heavy load on Copland's shoulders, it was agreed that the Royal Infirmary would take over the responsibility for collecting donors. A porter was to be kept in readiness, day or night, to call for the donor by taxi, deliver him to the institution and return him to his residence or place of work. In order to keep the Infirmary free from the expense of this arrangement, the Service undertook to pay in full the wages of an additional post (£150 pa) and the costs of transport. This allowed the Organiser to concentrate on acquiring new donors and more income for the Service.

The changeover took place on 1st November and, after a temporary reduction in calls, the system began to work well. Donors reported that they "were treated with the greatest courtesy by the porters who fetched them". In the first full year of operation, 560 calls were answered, 303 from the Royal Infirmary, 69 from the Simpson Maternity Hospital, 47 from nursing homes, 40 from the Western General Hospital, 38 from the Royal Hospital for Sick Children and the rest from eleven other hospitals in the city. 368 donors were used, 269 of whom were Group O. The cost of the first year's operation was about £1,100. About one third of the income to meet this expenditure came from a flag day collection, one third from entertainments (a Ball and concerts in the King's Theatre and the New Victoria Theatre) and one third from a "wireless" appeal and donations.

The Constitution and Rules for the Service were promulgated in February 1938. Article 2 stated: "The object of the Service shall be the continuation, development and expansion of the Service known as the Blood Transfusion Service in and about the City of Edinburgh as carried on for some time by the Holyrood Conclave of the Order of Crusaders and, in general, the advancement of medical science with particular reference to the study of blood".

The first Annual Report of the Executive Committee contained the emblem of the Service. It was a modification of the emblem of the Crusaders which had appeared on the original certificates given to donors by Copland. It was the well known emblem which, again with minimal modification, became the badge of the Scottish National Blood Transfusion Service when it came into being.

The First Three Years

The first three years of the reorganised Service were relatively peaceful (perhaps the most tranquil of its entire existence). The number of transfusions rose year by year from 560 to 619 to 700 and, thanks to the stalwart efforts of Copland and Miss White, these were matched by an appropriate increase in donors and in income. 22 Gilmore Place remained the hub of the organisation though the Infirmary provided facilities for the typing and screening of donors and for the transport of donors as already described. Grouping of all potential donors was carried out personally by Dr. W R Logan, of the Bacteriology Department, as it had been since Copland started in 1930. Logan carried on this task even after the numbers had increased enormously during the war and only gave up in 1943 when a technician was appointed. That he should do all this additional work quietly, willingly and unobtrusively was typical of the man.

The EBTS missed a unique opportunity to set up a small blood store which would have been one of the first in the country. In June 1938, a meeting of the Executive considered a letter from "the senior assistant surgeon at the Western General Hospital asking for the co-operation of the Service in an experiment of storing blood for transfusion purposes. After full consideration, it was decided that no action should be taken and the Secretary was instructed to write to Dr. (later Sir Charles) Illingworth accordingly explaining the reasons therefor and as to how the interests of the blood donors were affected in this matter". Sir Charles, nevertheless, claims to have established the first blood bank in Edinburgh - "very simple. On one occasion, the recipient died before we had time to administer the blood so it went into the refrigerator and thereafter we always had one pint available for any emergency".

PREPARATION FOR WAR

"Start bleeding"

Before resuming the story of blood transfusion in Edinburgh, it is necessary to consider events outwith Scotland which were to shape the future of blood transfusion.

Throughout the thirties, transfusion began to be much more widely practised and interest in and knowledge about transfusion were also increasing. In 1935, the first International Congress on Blood Transfusion was held in Rome. A second was held in Paris in late 1937 when it was decided that, from 1st January 1939, the international (ABO) nomenclature on grouping should be adopted. At this time, no fewer than three different systems of nomenclature existed. This was, at best a confusing, at worst a very dangerous, situation.

The problem had arisen because Landsteiner, who was an Austrian, had originally classified three groups - A,B and C. A few years later, a Czech, Jansky, described four groups and gave them numbers - I,II,III and IV. Then in 1910, an American, Moss, again numbered the groups but his numbers were the reverse of Jansky's. Consequently, Jansky's group I was the same as Moss's group IV and vice versa. The difficulty probably arose because the three papers were published in different languages.

In 1935, an important paper by Marriott and Kekwick of the Middlesex Hospital was published in *The Lancet*. Entitled "Continuous Drip Blood Transfusion", it was a landmark and brought the technique of transfusion into the modern era. Saline had been given by continuous drip but "as far as we can discover, the drip device has not hitherto been applied to the prolonged continuous introduction of large quantities of blood". Seventeen cases were described for which 100 donors were used and one patient received 5,620 ml blood. "It is our conviction", the authors stated, "that blood transfusion is today exploited only to a very small extent of its potentiality because it is still being employed in homeopathic doses". They claimed the additional advantage of being able to give the blood slowly - important in patients with anaemia. Before this time, a transfusion meant that approximately a pint of blood (600 ml) was given in about twenty minutes,

irrespective of circumstances. With the new device, much larger transfusions could be given and the rate of administration could be adjusted as required. So successful was this innovation that it is still today the standard method of administering blood.

In June 1937, the first meeting in Britain devoted to the subject of blood transfusion was held at Hastings by the Association of Clinical Pathologists. Dr. Brewer, Keynes's successor as medical officer to the London Transfusion Service, spoke on organisation and medical administration and paid tribute to the work of Mr. P L Oliver, founder and honorary secretary of the London Service. A second session was devoted to "Stored Blood" and, at a final session on "Transfusion Reactions", one of the participants in the discussion was Dr. Janet Vaughan of the Postgraduate Medical School in London.

The First Blood Banks

Oswald Robertson's experiments with stored blood in 1918 were not repeated until the mid 1930s when a blood bank was set up at the Skyfivosky Emergency Hospital in Moscow. There, they used cadaveric blood, a technique which found little favour elsewhere. Then, in 1937, Bernard Fantus started a civilian blood bank at the Cook County Hospital in Chicago.

The most important event, however, was the Spanish Civil War which, from 1936, began to dominate the blood transfusion scene and which demonstrated, on a large scale, the indisputable value of blood banks. In August of that year, Dr. F Duran Jorda, chief of the Blood Transfusion Service of the Spanish Republican Army, set up a blood bank in Barcelona and the techniques he developed were later adopted throughout the Republican army. By the time the Republicans surrendered in January 1939, the Barcelona Service had provided thousands of units of blood, as had one in Madrid. Large numbers of military and civilian casualties were adequately resuscitated with blood which had been withdrawn beforehand. Blood was, as never before, immediately available when it was needed and could be given in such quantities as were required. The potential of blood transfusion was at last realised.

Britain Prepares for War

With the rise of Nazi militarism in the early 1930s, the international situation deteriorated. By 1937, Britain was taking its first hesitant steps in preparation for a possible war. In Parliament at that time, the major preoccupation seemed to be the protection of the civilian population from gas attack. However, in April 1937, the Secretary of State for War was asked what supplies, if any, were available of human blood suitable for transfusion for large scale emergency treatment. He

replied: "Army policy is not to store blood for large scale emergency treatment as the period for which this can be done is very limited". When he was asked if he was aware that in Russia, large stores of human blood were available and had been used successfully, he replied that "there were reports to that effect but it was more satisfactory to store our blood in our people" (sic).

Throughout the rest of 1937 and 1938, air raid precautions were debated with increasing frequency in the House of Commons. Extra hospital beds were created, shelters built, stretchers, gas masks, plaster of Paris and bleaching powder provided. No further mention of blood transfusion was made until 24th November 1938 when the Minister of Health, the Right Honourable Walter Elliot, said, in answer to a question, merely that "he knew that transfusion of stored blood has been extensively adopted in Spain during the Civil War and his advisers were in touch with the arrangements for blood transfusion which are proposed in this country by the British Red Cross Society and the hospitals".

These arrangements were described in the Annual Report of the London Blood Transfusion Service for 1938. "The international crisis of September made it necessary for emergency measures to be adopted to cope with the possibility of a sudden and huge demand for blood, far surpassing any peacetime requirement. Steps were taken accordingly to establish a large blood supply depot within convenient distance of London". This was in a "bomb proof" building in Cheam, with a capacity of 1,000 pints of blood, provided "by the generosity of a donor". "Preparations were so far advanced that it would have been possible to commence the supply within seven days of the outbreak of hostilities". In addition, four London County Council hospitals each stocked two pints of blood for emergency maternity requirements. These were the arrangements referred to by the Minister of Health, two months after the Munich crisis and they constituted the total emergency preparations so far as blood transfusion was concerned - eight pints of blood to cover the first seven days of war! Even that was initiated privately by the London Service.

Official inactivity seems even less excusable when it is realised that, at the weekend of the Munich conference, the Postgraduate Medical School in London at which Dr. Janet Vaughan worked was told in confidence to be prepared for something like 57,000 casualties. On receipt of this news, Janet Vaughan, together with Guy Elliott, a South African working there on a sabbatical year, got translations of Russian papers on stored blood and Vaughan's research assistant, Olive Booth, was given £100 to buy up quantities of rubber tubing, corks, clips etc to make up transfusion sets. They then set about bleeding volunteers. Someone later remarked that "the only blood lost at Munich was what Janet collected at Hammersmith!" In the event, the blood was not needed for air raid victims but,

having collected it, Vaughan and her colleagues took the opportunity of using it rather than let it go to waste. The fifty transfusions they gave were the subject of a paper in *The Lancet* in 1939.

Janet Vaughan's Contribution

This experience made Dr. Vaughan acutely aware of the unpreparedness of the country. The Emergency Medical Services had made no provision at all for blood transfusion. Her concern was heightened by discussions she had with Dr. Jorda who, early in 1939, had escaped from Barcelona and was actually working in her laboratory. When nothing had been done by the end of March, six months after Munich and only six months before the war actually started, she initiated discussions among the pathologists of the ten sectors into which the London area had been divided in the emergency war plans.

At a private meeting at her flat on 5th April 1939, they agreed that an organised blood transfusion service for the London area would be essential. It would be necessary to enrol large numbers of donors and determine their blood groups ahead of a declaration of war. Much detailed discussion took place and it was proposed that there should be four depots for London, situated at Sutton, Bedford, Maidstone and Slough. They looked at every sort of bottle and decided to use milk bottles because they were readily available in large quantities and could be handled in milk bottle crates. (A modification of the milk bottle, with a narrow waist for easy handling and known as the Janet Vaughan or the MRC bottle was later adopted nationwide.) Wall's ice cream vans were considered ideal for transporting the blood. These and many other proposals were incorporated in a memorandum which was sent to Professor Topley, a member of the Medical Research Council (MRC) which was the official advisory body to the Minister of Health.

The memorandum entitled "The Supply of Blood for Transfusion" in the London area was adopted on 20th April, with only slight modification. Depot directors (Drs. Vaughan, Brewer, Maizels and Oliver) were nominated. They were asked to group 20,000 donors and find suitable premises. Transfusion equipment and donor enrolment cards were standardised. It was also agreed that the service should be based on the use of Group O blood to avoid the necessity for grouping at the time of transfusion.

"The Proposals are rather Expensive"

Initial expenditure was expected to be in the order of £20,000 (£5,000 per depot) and "since these depots are to serve all sectors, it would seem that this outlay

should be provided from some general source". Consequently, the MRC approached the Ministry of Health on the matter.

The Ministry of Health asked the Treasury to sanction this expenditure and assured them that no such provision was needed for anywhere outside London. "While expenditure might be required for coordinated regional plans or for towns such as Birmingham or Manchester, the Ministry is advised" (presumably by the MRC) "that, in general, hospitals should be able to make adequate arrangements of their own". "Special expenditure for that purpose was not contemplated".

This might seem extraordinary but the reply from the Treasury was even more so. On 22nd May 1939, just over three months before the outbreak of war, they wrote: "We note that, in most places outside London, you think that satisfactory arrangements can be made by local coordination and the use of existing facilities" (facilities which were non-existent!) "and one would have hoped that more could have been done in this way for the London supply. We have got to approve.... At the same time, we cannot help feeling that the proposals in your letter are rather expensive and we should like to be assured that they represent the absolute minimum cost". Before the Treasury finally agreed to provide the money, further notes were exchanged between them and the Ministry of Health.

The clinching argument put forward by the Ministry seems to have been that "the provision [of blood] which would be made by the four depots would be considerably under the total amount which might be expected to be needed in London for the treatment of casualties in the early weeks of a war if any reliance is to be placed on the Air Ministry's estimates". It was believed that the four depots would produce enough blood to treat about 5,500 casualties a day for the first week or so of a war and about half that number thereafter. "On the assumption that those depots serve one quarter of the population, it will be seen that the number of casualties which can be treated is substantially less than those which would arrive should casualties reach the number of 35,000 a day, accepted by the Ministry for Coordination of Defence as likely to be reached in the first two weeks of aerial attack". On this basis, the provision of the four depots was "not an excessive insurance". Treasury authorisation followed on 5th June 1939 and orders for equipment were placed by the MRC on behalf of the Ministry of Health.

At the depots, the work of organisation went on through the summer. Local Red Cross nurses were enrolled to look after the donors. Medical and technical staff from the different medical schools were allotted to the many emergency services that were set up. By August, the equipment was installed and in working order

and, on 1st September, the depot directors received a laconic telegram from the MRC "Start bleeding".

The army transfusion service likewise, by hasty improvisation, was ready for action at the outbreak of war. The ostrich-like attitude of the Ministry of War in 1937 has been noted. Munich changed all that but, because of its lack of foresight, the army had to depend on others to start its service. The original technical staff of the Army blood transfusion service was drawn almost entirely from the laboratories of the Royal College of Surgeons and the Middlesex Hospital.

This is an incredible tale. It is only thanks to a few private individuals, Janet Vaughan in particular, that any arrangements existed at all, at the outbreak of war, other than the modest bank planned by another private body, the London Blood Transfusion Service. It defies belief that government could be so complacent; that the Treasury could be so penny-pinching; and that the whole of England outside London could be left to its own devices. Spanish experience had clearly demonstrated the necessity for blood transfusion to treat civilian and military casualties. Yet the government apparently expected hospitals, most of which were voluntary and underfinanced, to create facilities which had never existed and to do it without additional aid or guidance. Few places outside London even had a donor panel. Since they were the advisers to the Ministry of Health, the MRC must take a major share of the blame for this deplorable state of affairs. In November 1938, they did nothing despite the matter being brought to their attention. It was only after Dr. Vaughan and her colleagues drew up a detailed blueprint for depots for the London area that they became convinced of the urgent need for action. It was only just in time.

SCOTLAND'S FIRST BLOOD BANK

"I have not hitherto paid any special attention to the subject"

In Scotland, action came a little earlier, but not much. In contrast to England, it was initiated by the government. In the spring of 1938, as part of the creation of an emergency hospital service, the government had set up a new organisation whose medical staff was recruited from the Regional medical staff of the Department of Health for Scotland (DHS). Scotland was divided into five regions of which the first to be formed were the Western District, based on Glasgow and the South East District, based on Edinburgh. A DHS memo of 10th November 1939 claimed that "towards the end of 1938, DHS were seriously concerned as to the facilities for blood transfusion in the event of air raiding". This seems to refer to consultations in October 1938 on "Emergency Preparations made by the Department of Health for Scotland", at which Dr. Walker of the Western District had suggested discussions on the coordination and organisation of an emergency blood transfusion service.

On 2nd February 1939, Dr. Wylam of the DHS circulated a memorandum within the DHS which recommended that a small committee should be appointed to look into existing arrangements for blood transfusion in Scotland "to determine their adequacy or otherwise to meet a war emergency and, if inadequate, to advise on appropriate steps to remedy the situation".

The response of the DHS to Wylam's suggestion was unusually swift and decisive. A letter was sent on 10th February to its Scientific Advisory Committee (SAC) as follows:

"Blood Transfusion in Emergency"

"The Department have under consideration the question of the existing arrangements for blood transfusion with reference to the needs that might be anticipated in time of national emergency. They would be glad of the assistance of the Scientific Advisory Committee in this connexion and I have to ask that the Committee will be good enough to consider the available facilities for blood transfusion in Scotland and to advise the Department on any step that might be

desirable to supplement existing arrangements for the collection, storage, preparation and distribution of blood for transfusion having regard especially to war emergency needs.

In connexion with this remit, I have to suggest that it may be appropriate to set up an ad hoc subcommittee including members representative both of the local authorities and of the voluntary hospitals in each of the four cities mainly concerned".

About the same time as Wylam raised the matter with the DHS and before the Scientific Advisory Committee met, he wrote to Dr. C P Stewart, clinical chemist at the Royal Infirmary of Edinburgh. On 13th February, in a letter to the Chief Medical Officer at St. Andrew's House, Stewart replied: "Dr. Wylam has transmitted to me your suggestion that the DHS would welcome an investigation of ways in which the Blood Transfusion Service might be improved". He went on: "I have not hitherto paid any special attention to the subject" and regretted that it had "not been possible in the time to review the voluminous literature". This was an omission he was soon to rectify. Finally, he suggested that "a small ad hoc committee might be desirable in preference to entrusting the work to a single individual".

The Scientific Advisory Committee met within the week (16th February) and appointed a subcommittee to consider the points raised by the DHS - in particular, the facilities available and the action necessary to improve the situation. It also asked the subcommittee to discuss "the scientific aspects of blood transfusion and, if so advised, formulate a scheme of research with a view to improvement in the technique of blood transfusion". Sir John Fraser was nominated as Chairman of the subcommittee. The membership consisted of three representatives from Glasgow, two from Edinburgh (C P Stewart and W C Wilson, a surgeon), two from Aberdeen, two from Dundee and J R Copland.

The First Meeting of the SAC Subcommittee

The main issues for the subcommittee were the organisation of an adequate and reliable panel of donors and the creation of blood banks.

The magnitude of their task was soon apparent when, at their first meeting on 24th April, they reviewed existing supply arrangements. The realisation of just how inadequate they were must have come as a shock to the members of the subcommittee. Glasgow, for instance, had no centralised organisation. Glasgow Royal Infirmary kept a list of donors who were paid £1.1/- (£1.05) a time. The Western Infirmary was similar but it could get donors from soldiers at a nearby

barracks while Stobhill hospital obtained its blood from "hyperpietic" (hypertensive) patients. Aberdeen had a service which was run by three members of staff. Donors were paid 7/6d (37p) when they attended for typing and £2.2/- for a transfusion. A blood bank was apparently under consideration but "there are probably not enough transfusions to justify it now". In Dundee, donors were paid £1.1/- per transfusion but relatives were encouraged to volunteer where at all possible. They had no blood bank and no arrangements for storage. The municipal hospitals used relatives whenever possible. "In some cases, donors are obtained from attendants at the neighbouring poorhouse who are paid £2.2/- a time" while "substantial fees are charged for donor services in private patients".

Only Edinburgh had an adequate organisation and service. The meeting agreed that it would be beneficial if the service in the other regions could be based on the Edinburgh model. "The committee, having regard to the great experience and successful work of Mr. Copland in connection with the Edinburgh scheme, suggest that he should be concerned in an advisory capacity with the setting up and operation of the various regional schemes".

The subcommittee then went on to consider technical matters connected with blood storage. It was stressed that government aid would be essential to pay for the apparatus required and for the training and employment of technicians. It was recommended that there should be five banks in Scotland, one in each of the main cities. At this early stage, however, the subcommittee had no realisation of the potential benefits of blood storage for it stated "where donors are plentiful and the service well organised" (a clear reference to Edinburgh) "there may be little object in storage of blood in peacetime".

The Second Meeting

The second meeting was held on 15th May. It considered a draft memorandum, almost certainly written by Copland, which discussed the requirements for a national donor service, based on the existing Edinburgh model. Copland offered his services to advise local committees and to assist in launching local services. The memorandum rejected the idea of paying fees to donors and this view was endorsed by the subcommittee.

Two other decisions were taken at this meeting. The first was that, presumably because none of the subcommittee had sufficient expertise on the subject, a small subgroup should prepare and submit a report on the likely requirements for blood banks in Scotland. Three men were appointed - C P Stewart, W C Wilson and Professor J A G Burton from Glasgow - but, in the event, it was C P Stewart who

wrote this and many subsequent reports and who came to dominate the blood transfusion scene in Scotland.

The second decision was that "steps will be taken to acquaint the secretaries of the Edinburgh Blood Transfusion Service and the Scottish Branch of the British Red Cross with the existence and work of the subcommittee. The Edinburgh Service should be invited to consider arrangements for blood storage in emergency, within the framework of their present organisation".

C P Stewart wasted no time in preparing his memorandum. It was submitted to the DHS and distributed by them to members of the subcommittee on 10th June. A model of precise analytical detail, it was typical of the many he was subsequently to produce. It dealt with the organisation, equipment and cost of "Blood Storage Depots on a War Basis". He believed that four or five would be sufficient for Scotland, one in each of the principal cities, and that it would require up to 25,000 volunteers to service them. Storage arrangements "should be coordinated with similar organisations in England". Equipment was specified and costed in great detail from refrigerators (gas preferably in case the power supply should be put out of action) to deck or lounge chairs, and from "labels, gummed" to wastebins. For transport of blood to the site of administration, "ice boxes, such as those used by itinerant ice cream merchants" were recommended. Catalogue reference numbers were quoted throughout and the total cost of equipping one laboratory was precisely estimated at £1669-4-2. At 1987 values, this represents about £40,000.

The Third and Fourth Meetings

The document was considered and approved with only minor amendments at the third meeting of the subcommittee on 4th July when it was agreed that "if possible, the whole of the equipment listed should be obtained and stored". It was also proposed that the equipment should be drawn on to a limited extent "to set up experimental banks in peacetime in order that experience of their working might be obtained and a nucleus of technicians trained".

This decision was at odds with the invitation to the EBTS, approved at the second meeting of the SAC subcommittee, to "consider arrangements for blood storage within its existing resources". The result was that, in Edinburgh, two different blood banks were set up, one by C P Stewart and a small store by the EBTS.

When he received the request from the SAC subcommittee, Gumley, the Honorary Secretary of the Edinburgh Service, suggested to Colonel A D Stewart,

Superintendent of the Royal Infirmary of Edinburgh, that the Colonel, Sir John Fraser and Copland should meet and draw up a tentative scheme for "blood transfusion in emergencies" (ie a blood bank) and a meeting was arranged in the Royal Infirmary on 3rd July. The group which designated itself "a subcommittee of the Edinburgh Blood Transfusion Service" produced a memorandum which was discussed by the Executive of the EBTS on 14th July. The report was accepted and acted upon. A "suitable room" in the hospital, one which had "previously been used for the preparation of catgut" and a small refrigerator were earmarked. The total cost of the equipment was estimated to be £56-15/0 and the capacity a mere six pints of blood. The bacteriologist, Dr. Logan, was invited to take charge of the arrangements for blood storage, the Chief Dispenser to supervise the issue of blood and Mr. E L Farquharson, then a junior surgeon, to supervise blood withdrawal. All accepted. Mr. Copland "would continue to be in charge of the general arrangements of the Service" and "individual donors would still be given a note of the patient to whom their blood had been given". This was certainly an adequate response to the request to set up a bank "within the framework of their present organisation".

Meanwhile, Stewart set up an experimental bank, armed with the authority of the SAC subcommittee to purchase equipment and draw on it for that purpose. By a prodigious effort, it was in operation just before the war started and, by the end of the first week in September, 120 donors a day were being typed and there were 80 pints of blood in the bank. It was, Stewart reported, "made possible through the aid and the co-operation of the EBTS, the organiser (Mr. Copland) and the staff and officials of the Edinburgh Royal Infirmary. The Edinburgh Transfusion Service has afforded financial assistance and they have made available their voluntary donors together with the expert organisation which they control". The small EBTS bank was soon replaced by Stewart's. Logan continued to group all the donor volunteers, the Chief Dispenser was not involved because Stewart had moved the store to his own laboratory and Mr. Farquharson was replaced by Dr. Scarborough and Dr. Horne. There remained the question of Mr. Copland's position.

The fourth and final meeting of the subcommittee took place on 9th September. It considered a draft report to its parent body, the Scientific Advisory Committee of the DHS. The report summarised the work and the achievements of the subcommittee. Members gave accounts of the vastly improved service throughout the country and C P Stewart described the establishment of the Edinburgh bank. In summing up, the Chairman expressed the gratitude of the subcommittee to Dr. Stewart for his memoranda which accompanied the draft report. He was emphatic that the "chief need was further financial assistance for the blood transfusion service". He also thought that "in view of the present circumstances,

they should shortcircuit the parent Committee and transmit the Report direct to the Department" - a mistake in Civil Service terms!

Who is to be in Charge?

The question of responsibility for running the blood bank caused some heart-searching. Stewart had originally envisaged something similar to the EBTS with a bacteriologist in charge. "In peacetime, the staff would consist of a medical officer in charge (usually the hospital bacteriologist)" though "an assistant bacteriologist might be better since he could more easily become a whole time officer in charge in the event of war". "In war, it would be desirable to have the blood store attached to the main bacteriological centre in the area".

Stewart had changed his mind, however, by the time he presented his final report to the subcommittee. "The director of the area 'bank' need not be medically qualified provided he understands blood transfusion from the medical point of view". (Stewart was a biochemist and was not medically qualified). "It is important that he should have laboratory experience and be accustomed to the organisation of laboratory work and personnel". On the location of the bank, he now said: "In Edinburgh, it is suggested that the Clinical Laboratory at the Royal Infirmary" (his own laboratory) "can provide the necessary accommodation". In other words, he had decided that he himself should be in charge. This was a good decision. Stewart was the right man for the job.

The EBTS in general, and Copland in particular, did not easily accept Stewart's assumption of authority. The small EBTS subcommittee composed of Sir John Fraser, Colonel Stewart and Copland had recommended that Mr. Copland "would continue to be in charge". Not surprisingly, the Colonel complained that "while Dr. Stewart's organisation was admirable, he (Colonel Stewart), as Superintendent of the Royal Infirmary, had had no part in it and he was afraid the matter might be getting out of hand"; and Mr. Gumley, Honorary Secretary and Treasurer of the EBTS, wrote: "Just how Dr. Stewart came to be in charge has never been quite clear even to Colonel Stewart".

In order to try to clarify the situation, the EBTS wrote to the DHS on 22nd September to ask if the Department would meet a deputation to discuss who was to run the blood transfusion service - the Edinburgh Service or the Department. Both the EBTS and the DHS feared that, if the identity of the EBTS were lost, it would be difficult for the Service to resume its work on the termination of hostilities. No formal statement of the relationship between the two seems to have been made but CP Stewart's position as Director of the blood bank was confirmed by the DHS in December. He was appointed on a part time basis at a salary of

£250 per year. Dr. Harold Scarborough and Dr. Horne were appointed as Medical Officers, at £200 and £100 per year, respectively.

The argument rumbled on for a little longer. In March 1940, in one of his last letters as Honorary Secretary of the Edinburgh Service, Gumley wrote to C P Stewart to ask: "Am I right in assuming that your bank may now be considered as being attached to and under the control of the Edinburgh scheme"? Stewart did not see it that way. "The work of the Director is at least equal to that of the organiser. It might even be claimed to be more important. The blood store, set up by the DHS under my charge, is a major part of the transfusion service in Scotland while the Edinburgh Transfusion Service is a purely local organisation with a purely local committee".

The dispute seems to have been mainly between Stewart and Copland and Stewart's letter ended with the barbed remark: "I believe the Service is to be congratulated if it can secure the help of Miss White as Organiser in place of Mr. Copland". This change did come about on 1st March 1940 with the setting up of the Scottish National Blood Transfusion Association (SNBTA) which will be discussed in a later chapter. When Miss White did take over, the Executive of the EBTS left it to her, Mr. Copland and Colonel Stewart to see CP Stewart to resolve any outstanding problems.

Edinburgh's Contribution

It says a lot for the SAC subcommittee that it should have achieved so much in its short existence. At its creation, the situation in Scotland was poor and patchy with regard to the availability of blood for transfusion. Blood banking not only did not exist, it had not even been contemplated. Four and a half months later, a national organisation was emerging and the first blood bank was in operation. The Edinburgh contribution to these developments was considerable. It had, of course, a head start in having a blood transfusion service but, under the chairmanship of Sir John Fraser, the most notable contributions were made by Copland and C P Stewart. Copland greatly enlarged the donor base in the Edinburgh area, taking in the south east of Scotland and his report and advice helped other areas to set up a similar donor organisation. The voluntary organisation on the Edinburgh pattern was endorsed as it "appears to offer the best means of providing blood transfusion facilities".

In technical matters, it was C P Stewart who dominated the proceedings of the subcommittee. His detailed memoranda formed the basis for setting up the first bank in Edinburgh and gave guidance to those in other areas. It may have been that, in February, he had "not hitherto paid any special attention to the subject"

but, from the time he joined the subcommittee, he became increasingly involved in the project. The fact that it was he who produced all the detailed technical information, modified by personal research, meant that he became a leading figure in the field of blood banking in Scotland. As for blood banks, they were there to stay and they brought about a total transformation in the pattern of donation and of administration.

Blood transfusion entered a new era with this major and permanent expansion of the Service.

THE EDINBURGH SERVICE GOES TO WAR

"Immediately the all-clear is sounded, a fleet of cars will race out"

The work of creating the infrastructure and putting the bank into operation went on at a hectic pace in the days preceding the outbreak of war. At Gilmore Place and in the Royal Infirmary, willing helpers - research workers, students, laboratory assistants, sisters in the Infirmary, nursing staff, Copland, Miss White and their assistants - "with no thought of reward, worked up to 14 or 15 hours a day, seven days a week, for weeks on end".

A whole new "industry" had to be created for the withdrawal, storage, distribution and subsequent administration of large quantities of blood. Equipment had to be purchased, cleaned, sterilised and assembled. Much of it was makeshift. As in London, milk bottles were used originally and they were supplied by the Edinburgh and Dumfriesshire Dairy Company Ltd. When filled with blood, the bottles had to be clearly identified, labelled, stored in a refrigerator and checked daily for sterility till issued for use. Giving sets were made up from their component pieces - stoppers and filters, tubing and needles - wrapped and sterilised for distribution with the blood. When they were returned, rigorous cleansing and sterilisation were necessary before they were reused. C P Stewart described the organisation in an excellent paper in the Edinburgh Medical Journal.

The bank was operational in the last days of August 1939. It must have seemed just in time when, on the morning of 3rd September, the air raid sirens sounded the alarm. With everyone expecting immediate heavy bombing, the staff of the bank, "in horror and anxiety, and with some in tears, trooped down to the cellar that served as an air raid shelter".

The store was manned, day and night. Blood was sent to other hospitals by taxi during the day or by the Women's Voluntary Services (WVS) by night. During air raids, however, the arrangement was that the messenger with the blood "will be accompanied by medical students who are familiar both with the transfusion apparatus and the routes to the various hospitals and aid posts". Medical students did indeed sally forth as far as the Eastern General Hospital during air raid alerts,

carrying the precious blood and equipped with steel helmets and civil defence gas masks.

Collecting the Blood

The donor organisation run by Copland and Miss White was stretched to the limit. The catchment area was expanded to include the south east of Scotland and volunteers came flooding in at a rate of 150 a day. The tension of the atmosphere of those days can be gauged from two contemporary press reports: "Immediately the all clear is sounded, a fleet of cars will race out to collect those people" and, "to safeguard the register of donors from destruction by bombing, four sealed envelopes containing lists of names of nearly 3,000 Edinburgh men and women were deposited in safe places in the city".

The war, of course, played havoc with the donor lists. Many of the existing donors were called up for various forms of national service and the population base was constantly changing. Greater reliance had to be placed on female donors for that reason but their availability was restricted by additional wartime activities such as fire-watching and other civil defence activities.

Without any doubt, the major contribution to the recruitment of sufficient donors was made by Copland and Helen White. Early in 1939, they set up a system of voluntary honorary donor organisers which remains a lasting tribute to their organising genius. It had its origins in prewar days in the concerts and flag days which Copland instituted and ran, latterly with Miss White's assistance. The most active helpers in the flag days were roped in, and picked to arrange withdrawal sessions and recruit volunteers in the community. In the various districts within the city, and particularly when the help of people in the outlying towns and villages was enlisted, local pride played a big part and knowledge of the local community was very important. Local bodies such as the Masonic and Miners' Welfare organisations were especially supportive. Miss White's role was pivotal. Not only did she choose most of the organisers but her kindly concern and personal interest in them and their families made the system function like one big closeknit family.

Regular withdrawal sessions were held several times a week in the Infirmary. In addition, teams were sent out to local towns, factories or service units, almost every weekend and on several days each week. Dr. Harold Scarborough, who was the senior medical officer for the blood bank throughout the war years, wrote: "Usually ten people went on the team - one doctor, two drivers, a medical student, three "medical attendants", one administrator who had a local assistant, a technician to group the blood and a ward sister. The doctor and student looked after three couches; the medical attendants (students, secretaries etc) supervised

one couch each and the sister ran the restroom where donors went for half an hour after their donation". The couches were often ARP (Air Raid Precautions) beds which were so low that they had to be raised on stands before the donor could be bled properly.

"The wholly voluntary staff had little technical knowledge but made up for their lack of experience by intelligence. They soon worked together as a team and, in a good four hour session, could obtain 36 pints of blood". At the village hall, the local Honorary Donor Organiser welcomed the team and the local police, St. Andrew's Ambulance people, VADs, Boy Scouts and others all helped. Special licences for coal had to be obtained beforehand so that the halls could be heated. On occasion, unfortunately, "no-one had thought to do anything about the temperature of the hall which, when we arrive, is distinctly chilly. We all know that this augurs badly for the success of the session; the colder the room the slower tends to be the flow of blood and the higher the 'fainting rate'." Lunch was provided for the team and tea for the donors by local ladies. "We always look forward to the lunch break. For one thing it is possible to sit down; for another the lunch usually represents the co-operative efforts of a number of local ladies. It is invariably enjoyed!"

"After a long day, there was still a lot to do when they got back to the Infirmary. While the team had been away, those at the Centre were getting ready for an outside session the following day. Withdrawal sets had to be made up, wrapped and sterilised. A member of the Pharmacy Department might have volunteered to wash and sterilise the bottles. Another nasty job was the preliminary washing of seemingly miles of rubber tubing before it was boiled for the first time. These inescapable chores were all done in the same laboratory because it had large sinks and plenty of bench space. But everyone disliked it because it was dark and smelled permanently of hydrogen sulphide - the remains of someone's research work now abandoned or suspended for the duration. It was very tiring, the transfusion work being additional to the usual work but everyone gave their services freely and fully".

The whole effort at all stages depended on volunteers. A group photograph taken during early in the war shows some 27 people of whom not more than about four were paid BTS staff. The remainder were voluntary workers, many from other Infirmary departments, others from outwith the medical services, each contributing whatever relevant skills they possessed. The late Alastair Sim, the well known actor, was a volunteer driver.

Wartime Inconveniences and a Happy Event

The excitement of 1939 gave way to years of rationing, black-out, bombing (though Edinburgh escaped lightly), shortages and improvisation. Controls and restrictions were the lot of the whole population in wartime Britain and the blood transfusion Service did not escape. Petrol was rationed and the Service had to plead for petrol for those involved in taking blood. Transport for blood and equipment from the Infirmary bank was provided at first by the Mechanical Transport Corps which allotted two cars and drivers to enable the EBTS to maintain a 24 hour service. Later in the war, however, in 1944, the Divisional Petroleum Officer refused to grant a petrol allowance for "stand-by" cars and the arrangement with the Corps had to be terminated. Thereafter, a volunteer car pool arranged a duty roster to maintain the vital link from bank to hospital.

Food rationing too created difficulties. An extension of food rationing in 1942 threatened the issue of tea and biscuits to donors. The EBTS argued their case with the Divisional Food Officer. After consultation, this enlightened man solved the problem by the neat device of having the EBTS officially registered as a "catering establishment". As a result of a query from the War Office, the question of providing extra food rations for donors was referred to the Technical Committee of the SNBTA. This had been done in Spain and it was reported to be the practice in Germany but the Technical Committee rejected the idea.

The story of blood transfusion in Edinburgh during the war would not be complete if one failed to mention the foundation of the Polish Institute of Blood Transfusion. This came about as a result of the establishment in 1941 of a Polish Medical Faculty within the University of Edinburgh. The Poles who ran the Institute were trained by Stewart and blood was donated by volunteers from the Polish armoured division for use in their military hospitals.

Despite the frustrations and hardships of the war, the Service continued to thrive. Difficulties were overcome and, despite a feeling by some that "officialdom" was not supporting their voluntary efforts, there was a spirit of camaraderie. Mr. Eric Walsh, a refrigeration engineer, long involved with the Edinburgh Service, writing forty years after the war, paid a handsome tribute to the wartime transfusion workers: "Inevitably there existed a quite different atmosphere amongst the pre-1948 largely voluntary staff and the highly professional, career orientated structure of today. Each system has its advantages and disadvantages but I think that the former was more rewarding, (if not in material terms), for individual staff members in the sense that there was a degree of cohesion and unity of purpose which, once experienced, is always treasured as an example of what human relationships could and should be".

THE FORMATION OF A NATIONAL ASSOCIATION

"Having created Frankenstein ..."

The SAC subcommittee had done an excellent job in creating and improving facilities for blood transfusion throughout Scotland. However, instead of giving the nation's heartfelt congratulations on the remarkable achievement of creating a national network of blood banks out of the void which had existed only five months before, the DHS was unenthusiastic and only grudgingly acquiescent. "Increase of tension with Germany constrained the committee to go somewhat beyond their remit by encouraging the setting up of voluntary committees in various centres and, when the danger of war became acute, the setting up of blood storage depots in the four cities. The Department could not but acquiesce in the urgent need for those measures".

Now that the blood banks were in operation and war had broken out, it was necessary to provide an organisational structure so that the work of the various banks could be regulated, coordinated and standardised. The other pressing need was for money to pay for the staff and equipment for the banks. The two immediate questions for the DHS, therefore, were who was to run the Service and how it should be financed. These questions were interlinked. The avowed aim of the Department's officials was to achieve maximal control at minimal cost, to make "any large call on state funds unnecessary".

Who is to Run the Service?

The initial plan of these officials was that they would themselves take over control of a national organisation which would supersede the regional bodies. A meeting to discuss the matter was called for 22nd September 1939. However, things were not as straightforward as had been thought because, only five days later, the Department noted that "consideration of the best form that the administration of a blood transfusion service should take is proving a little complicated".

The reason for the second thoughts may well have been the suggestion (from within the DHS) that the Red Cross Society might be an appropriate body to act as central coordinators. This may have come about because the London scheme

was run by, and had always been run by, the Red Cross. However, the Department was advised that, under the terms of the Geneva Convention, the Red Cross Society could not undertake purely civil activities in wartime. On receipt of this advice, the idea was abandoned. Another meeting with regional delegates was arranged, on 19th October, this time "to consider the setting up of a Central Committee for Scotland". It was surely already a *fait accompli* because, on the following day, the Secretary of State for Scotland agreed that a Scottish National Blood Transfusion Committee should be set up. At this stage, the concept was agreed but not the details.

On 11th November, a DHS draft memorandum confirmed the arrangement that a National Council should coordinate local committees and be responsible for fund raising and propaganda. "It is hoped the Central Committee will be constituted within a week or two". However, on 19th November, their plans were again thrown into disarray when the DHS was informed by the War Office that, in fact, there was nothing in the Red Cross Society's charter to preclude its cooperation in a civilian scheme.

So it was that, on 5th December, the DHS wrote to the Secretary of the Scottish Branch of the British Red Cross Society: "It seems to the Department that the British Red Cross Society are well qualified by their experience and prestige, by the organisation at their disposal, to take the initiative in organising a Scottish Blood Transfusion Service on a national basis". A letter was also sent to the St. Andrews Ambulance Association inviting their support. On behalf of the Red Cross Society, General Maxwell-Scott rejected the invitation. "The concurrence of the various regional blood committees and hospitals would be preferable to the Red Cross". A formal reply from the Secretary of the Society confirmed this view. "While in sympathy with the scheme, my Committee suggest that, owing to the indefinite extent of the liability", it should be the responsibility of the DHS to run any national scheme. What they were really afraid of was the possible financial liability - "the meeting was very chary of committing itself to assist in any financial way" and "they may carry a financial burden of quite indefinite amount which may increase".

Unable to offload responsibility on to other shoulders, the DHS reverted to the idea of a national association. Work then proceeded on deciding on the detailed structure and composition of that body.

How is it to be Paid for?

Throughout these negotiations, the question of finance was a major consideration. In September, the primary concern of the DHS had been the

formation of a national organisation. The regional representatives were more concerned with trying to avoid bankruptcy. Considerable expense had already been incurred in bringing the banks into operation. Equipment had been bought, staff taken on and administration costs assumed. Towards the end of August, government had actually promised £1,200 but this was specifically earmarked for grouping and testing donors throughout Scotland. Nothing had been contributed, or even promised, by the government for the blood banks despite their tacit agreement with the subcommittee's recommendation that equipment should be bought.

The EBTS came to the rescue. Its Executive Committee felt that "in the circumstances, they would be justified in making such arrangements as they could and facing the financial problems later". Considering that the "cash in hand" at 30th June was a total of £429-12/5, one would agree with their comment that "that was a very brave but very right step".

The blood transfusion subcommittee, in its final report, had identified money as the "chief need". Despite this, DHS briefing notes for the 22nd September meeting state: "The deputation (from the regions) expects a clear cut statement. As, however, the Treasury have not yet been approached and their reaction to the proposals is not yet known, no definitive statement can be made". All the DHS had to offer was that the Central Committee (when formed) should appeal nationally for funds. It is not surprising, therefore, that Gumley should write to the DHS: "From what I learned, it is more obvious to me than ever that our Service may find itself in financial trouble if the position is not clarified soon".

The DHS felt that it could not request money from the Treasury until the organisation to which the money was going was clearly identified. It also had reservations about funding. In October, it rejected state funding on the grounds that it was inadvisable that a voluntary organisation should suspend its activities during the war since "state assistance would probably end with the war". A month later, another memo argued that "it might lead to a demand for payment of donors" if the state accepted full financial responsibility, as recommended by the transfusion subcommittee.

It was not that the DHS did not recognise the plight of the regions. In private, they observed that "in donors and geographical scope, the thing (BTS) has grown much beyond the size of organisation they normally expect to handle". Cash "donations will no doubt drop or cease until after the war". A memo of 14th November stated bluntly "government subvention will be necessary if blood banks are to continue". But it was not until the middle of November that they sought Treasury authority "to incur the expenditure necessary to keep the Service going".

The DHS's submission was that the Service should be run on a voluntary basis subject to the state undertaking financial responsibility to the extent to which voluntary subscriptions proved to be inadequate. The Treasury disagreed. They were not prepared to meet a shortfall "on the general ground that it meant an uncertain liability". They were prepared to give a grant and, on 24th November, agreed to provide £3,000 for equipping the banks and to meet running costs till the end of the year.

The Treasury clearly thought it was being far too generous because, on 5th December, the War Emergency Expenditure Committee noted: "Consideration is being given to the question of whether a charge should be made for any blood which may be used for hospitals for non-emergency patients but it will be appreciated that, however much it may be stressed that such charges are for the service of blood taking and transport, this question must be handled with great care if we are to retain the cooperation of the large number of volunteers who are freely giving their blood". The prudent view prevailed. The matter was dropped until it was raised again at the end of the war.

Subsequently, on 20th December, the Treasury extended their subsidy to 31st March 1940 "on the understanding that the DHS will endeavour to bring the Central Committee into existence as soon as possible and that an appeal to voluntary effort will then be made with all possible expedition".

The Problems are Resolved

Once it had been agreed with the Treasury that a new Central Committee should be formed, events moved swiftly. The Department approached Lord Craigmyle to be Chairman. He declined but offered a very generous donation to the funds of the new Service. On 11th January 1940, Lord Rosebery was approached and he agreed. He was a good choice and, in the years to come, he was a loyal supporter of the SNBTA. He went out of his way to support progressive plans and "could be a pretty formidable ally when it came to getting a little extra cash".

Rosebery met officials of the Department on 16th January to discuss matters such as the role of the central committee, blood banks, recruitment, voluntary effort and finance. An assurance was given that, apart from voluntary donors, the state would be responsible for the maintenance of blood transfusion services during the war. Suggestions on the composition of the Council were discussed. They included the Lord Provosts, representatives from the voluntary hospitals, the Red Cross Society and the St. Andrews Ambulance Association, the medical schools, the British Medical Association, the Women's Voluntary Services,

Scottish Command, labour representatives and two from each regional committee.

So, after months of tentative and exploratory moves, a national organisation came into being. The regional committees were left with some autonomy. The regions welcomed the end of a long period of uncertainty and financial hardship. So far as the DHS was concerned, however, at least some of its officials viewed the new organisation with less than unconcealed joy. When the Constitution and Rules were being discussed, and, in particular, one to establish "a capital or reserve fund to guarantee as far as possible the permanent existence and usefulness of the Association", one official commented sourly in a departmental memo: "I take it that, having created Frankenstein, the Secretary of State has no further control of it".

THE SCOTTISH ASSOCIATION AND THE EDINBURGH SERVICE

"The Association's difficulties are very real"

The first meeting of the Scottish National Blood Transfusion Association (SNBTA) was held in St. Andrew's House, Edinburgh on 9th February 1940. It was opened by the Secretary of State for Scotland who welcomed the newly appointed members and introduced the Earl of Rosebery. Having explained the background to the setting up of the Association, he went on to discuss the financial position.

He said that the Chancellor of the Exchequer had "generously" agreed to assist by contributing £3,000 for equipment and pound for pound of subscription income up to a limit of £5,000 for the first year's running costs, estimated at £10,000. He also made it plain that "Exchequer assistance was limited to the period of the war emergency, the ground for it being the needs of civil defence" and he hoped the service would continue effectively under voluntary auspices when peace returned.

This, then, was the solution which the Treasury and the DHS had come up with. Having rejected charging for blood or making good any shortfall, they agreed to contribute only in proportion to the amount of money raised by voluntary efforts - even setting an upper limit! Moreover, the strictly temporary nature of that contribution was emphasised.

Lord Rosebery then took the Chair and the meeting went on to discuss the organisation and staffing of the Association.

The Committee Structure

Since the Association itself represented so many interests, its full Council was too big to transact day to day business and this was delegated to its three main committees - Executive, Technical and Finance. All of these met without delay.

The Executive Committee was a small group with Lord Rosebery in the Chair. The other two committees reported to it and it dealt with relations between the

Council and the local committees, propaganda, transport, donor enrolment and relations with other organisations such as the armed forces and the English Blood Transfusion Service. At its first meeting, a draft Constitution and Rules were approved. These were drawn up by Mr. Gumley who was the only man on the committee with legal training and he had also been responsible for the Constitution and Rules of the Edinburgh Service. Gumley, who had been Honorary Secretary and Treasurer of the Edinburgh Service since its foundation in 1936, was made Honorary Secretary of the National Association. Its headquarters address became that of his office at 10 Duke Street, Edinburgh. On the recommendation of Lord Rosebery, the Executive also adopted as the badge of the Association that of the Edinburgh Service (and before that, the Crusaders) with only slight modification.

The Technical Committee was very important. It laid down a standard policy for Scotland for transfusion practice, encouraged research and development and maintained a close liaison with research elsewhere, especially that organised by the MRC. Its Chairman was Sir John Fraser, W J Stuart was a member and, at the first meeting, it was agreed to co-opt five more members, one of whom was C P Stewart. Another member was Charles Illingworth, now Regius Professor of Surgery in Glasgow, who had sought permission from the Edinburgh Service to start a bank in 1938 (Chapter 4). Subjects discussed at the first meeting were equipment, (Janet Vaughan bottles and a Scottish type of delivery apparatus), research (including the question of storing plasma for an indefinite period) and the need to keep careful records of transfusion reactions.

The Finance Committee decided that all the funds must be controlled centrally since this was the national body and state money was now involved. Someone in the DHS may have facetiously suggested that the Secretary of State could not control the monster it had unleashed but, because the Association was starved of funds and had as its Treasurer a DHS official, Mr. Mowat, tight financial curbs were ensured. The Association insisted that all sums subscribed to the funds of local committees should be remitted to the central funds of the Association. "This might discourage subscribers to local committees but it was felt that control must rest with the central Council as the national body". That control was strictly enforced.

In October 1942, secretaries of the regional Services were reminded that "all decisions ... which involve finance require the approval of the DHS before they may be given effect to". In 1943, the Edinburgh Service was reminded that all sums subscribed had to be paid to the central fund. As a result, the Finance Committee of the EBTS agreed to realise an investment of £300 and hand it over. The Association received all the cash but it also accepted the responsibility of

payment of all salaries, honoraria and expenses properly incurred by local committees. This necessitated a review of payments made by all the regional services which were harmonised and then approved by the DHS. Throughout the war years, the Edinburgh Service was a net contributor to the funds of the Association.

The Finance Committee also approved a national flag day and an appeal for funds and "recommended strongly that the Council should have an Organiser - necessary if funds were to be raised in adequate amount". Mr. Copland's name was discussed but it was suggested that, were he to be appointed, he should be dissociated entirely from the EBTS.

Mr. Copland and the SNBTA

Mr. Copland, who had for so long been accustomed to acting on his own initiative, had some difficulty in coming to terms with officialdom and officials were anxious about his overenthusiasm and lack of accountability. In October 1939, when a national organisation was just being discussed, Copland had started to raise funds on a national basis. He approached Edinburgh's Lord Provost for support but, apparently, did not apprise him of the fact that, at the time, the national organisation was still an idea rather than a reality. "This will never do", wrote Gumley, as Secretary of the EBTS, to the DHS. Copland is doing "an immense amount of useful - essential - work but will have to come under control of some department soon". Four days later, the DHS wrote to Gumley: "Mr. Copland was asked to call and told that there was no SNBT Service in existence and therefore he had no authority to issue letters and notices under that heading". He was told that no more expenditure was to be authorised without the Department's prior approval.

Mr. Copland was appointed as National Organiser to the SNBTA at a salary of £600 per year which Mr. Westwood MP thought excessive. He asked that his dissent be recorded though he was in favour of the appointment. Copland's contract, however, was quite restrictive. It stated that he had no power to authorise expenditure except on the express authority of Council. He had to submit a weekly report of his activities. He was to submit no advertisements or press material or other propaganda except with the knowledge and approval of Council through its Secretary and, finally, any suggestions or criticisms of the work of the Association were to be transmitted in writing to the Secretary.

Copland also had disagreements with the EBTS. He had, of course, to resign from the EBTS when he took up his new appointment as National Organiser. The Executive of the EBTS noted, on 29th March 1940 that "as a result of his

resignation, the Service would require to transfer to other premises and this might mean taking offices with rent up to £70 and additional cost of furnishing". Copland said the move need not be immediate and the matter was left over meantime. It was raised again a year later (March 1941) at an Executive meeting which was attended by Copland. Rooms attached to the blood bank were suggested. The majority felt that centralisation would result in considerable saving of time in communication between the departments and in a greater coordination of effort.

Copland, however, was very distressed at the idea. He considered that such a move would be unnecessary, inadvisable and would not improve the Service. After discussion, it was decided that the organising staff should move and that the transfer should take place on 1st September 1941. Copland "expressed himself in complete disagreement with this decision". However, by December, nothing had happened, and the Executive, after "considerable discussion" decided that "in view of the new expression of opinion and the fact that the change had not taken place, present arrangements should continue meantime". The question of moving again came to the fore in 1945 and 1946 when a claim for a retrospective increase in the rent charged for Gilmore Place was made but it was not resolved until after Copland's death in 1949.

The Finance Committee had, as has been noted, specified that Copland should be dissociated entirely from the EBTS. Apparently, that did not happen because, in 1943, when he had been National Organiser for more than two years, there was a debate in the Executive of the EBTS about his right to attend their meetings. R W Johnstone, Professor of Midwifery at Edinburgh University, and Colonel Stewart put forward a motion that Copland, as a representative of the Scottish Association, should not attend any future meetings of the Executive Committee of the EBTS unless invited to do so. Councillor Gibson and Dr. Logan, both long time associates of Copland, opposed the motion. A vote was taken and, by four votes to three, it was agreed that he should not attend. The matter was not then finally laid to rest for it was raised again in December 1945 when "after a very full discussion", the earlier decision was confirmed.

Funding the Association

The attitude of the Treasury to the blood transfusion services in general has already been a matter of some comment and the parsimony continued. They appeared to be divorced to some extent from reality. In December 1939, they "were inclined to regard the proposals for London as somewhat extravagant, with too many doctors at too high a salary". They asked if the London service could be put on a skeleton basis which could be expanded if the need arose.

This was still the period of the so-called "phony war" and the anticipated air raids had not yet materialised. However, when the fighting began in earnest, attitudes changed. On 27th May 1940, the evacuation from the beaches of Dunkirk began. On 30th May, a question was asked in Parliament about the adequacy of arrangements for blood transfusion. The Ministry of Health's advisers now (belatedly) observed that "nowhere in the provinces can the organisation be considered adequate to meet the needs of very heavy casualties" and they stated bluntly "the position is untenable". They recommended that a proper and systematic organisation "must" be inaugurated without further delay and that each region should appoint a full time Transfusion Officer. The cost of all this would be £15,000 in capital costs plus £52,000 per year plus some other expenses. Treasury agreement to this meant that the whole English organisation was government funded.

This generous, but realistic, funding contrasted markedly with the grant for Scotland. Even the DHS considered that the money allocated to Scotland was "not very high" and, when the large sum of money for the provinces was announced, the DHS wrote to their London office stating that this decision would have awkward repercussions north of the border. "It was with some difficulty that we got the voluntary scheme on foot as a number of people had thought that blood transfusion, like other emergency services, should be a state service. If the Ministry of Health get away with this scheme, we are going to have difficulty in meeting the objections which are bound to be raised as regards the different treatment in the two countries". For instance, it was proposed that Regional Directors in England should be paid £800 a year. "This would be another sore point with some of the Directors of the banks in Scotland who have been induced to undertake the work for about £250 per annum". The objections were overruled and the schemes for Scotland and England went their separate ways. The organisation and financing, north and south of the border, were established on different bases.

Despite the fact that its subsidy was so much less, the Treasury was not disposed to be generous to the Scottish Association. Not surprisingly, the main preoccupation of the SNBTA throughout 1940 was with finance. Government policy of providing money only in proportion to that raised by voluntary donation put great pressure on the Association. That pressure was deliberately applied. The Treasury memo authorising the first annual grant of £5,000 stated: "If later in the year you should get into difficulties, we can, of course, reconsider the limit but we should prefer that you should say nothing to the Council about this at the moment". This was a tactic which they and the DHS were to use repeatedly.

In November 1940, when negotiations began about the size of the grant for the following year, the DHS had to emphasise that "the Association's difficulties are very real". They had had great problems in raising even £3,000 although their expenses were £10,000. After the annual argument, the Treasury agreed to increase its share of the grant from 50% to 75% with a maximum of £7,500 per annum. Again, this was "to be regarded as a wartime measure which will not be continued in peacetime".

In Conclusion

"The Association will issue a full report of the work of the various Services at the close of the Association's current financial year on 31st March 1941". That may have been the intention but that report did not appear and, as a result, the figures of blood donations for the early part of the war are sketchy. Another consequence was that the 4th Annual Report of the EBTS did not appear, the only year that that happened. "In view of the formation in March 1940 of the SNBTA, it is not proposed to continue the issue of printed Reports meantime". However, they were resumed the following year, though during the war they appeared in stencilled form. Printing was considered in 1944, when an estimate of £17-10/- for printing 250 copies was submitted by Messrs. Morrison & Gibb Ltd. It was explained that previously Messrs. Lindsay & MacLeod charged £4-10/- for stencilling 100 copies of the 1942/43 Annual Report and Accounts. It was felt that the cost of printing was excessive and that the Reports should be stencilled as formerly. Printing of the Report was resumed in 1946.

The formation of the SNBTA had a considerable impact on the Edinburgh Service, which lost two of its leading members when Copland became its National Organiser and Gumley its Honorary Secretary. To replace them, Miss White, Copland's assistant since 1936, was appointed as regional organiser and Mr. Dobbie succeeded Mr. Gumley.

On the whole, relationships within the organisations were quite friendly. The SNBTA and the EBTS cooperated well, which was not surprising considering their strong mutual links and the expressed desire of the Association not to interfere with the existing services. In financial matters, though, changes were inevitable. The most important functions of the SNBTA were coordination and standardisation. They covered the whole field - advertising, propaganda, fund raising, techniques of blood withdrawal, storage and administration. In the long term, perhaps the most influential committee was the Technical Committee. Its decision to press for a unit in Scotland to process plasma was of the greatest importance to the Edinburgh Blood Transfusion Service.

A MOMENTOUS DECISION

"I do not consider there is much else to be said in favour of dry plasma"

The use of plasma was a novelty in 1939. The initial impetus for its use came from the desire not to waste blood. In those days, whole blood had a very short shelf life and deteriorated after only a week in store. Since only Group 0 donors were taken, they were called upon to donate repeatedly while the other 60% of the volunteer population with blood groups other than 0 were rarely called. It was realised that plasma could be given to patients of any blood group since pooling the plasma from people of different groups reduced the level of ABO agglutinins to insignificant levels. It had, therefore, the considerable advantage that it could be given without the need to cross match the patient's blood. Consequently, it was decided to use non-0 blood for plasma and also to try to preserve the plasma of time-expired blood.

Preparation of plasma was difficult, however, and there were problems with storage. Separation of cells from plasma was easy. The blood could just be allowed to stand, or it could be centrifuged. But before the plasma could be collected, the sealed bottle had to be opened and this inevitably introduced the possibility of infection. It was essential to test all bottles of liquid plasma frequently for sterility and this testing was both time-consuming and costly.

Research into the preparation of plasma led to the development of plasma filtration, a process in which the fluid was passed through bacteriological filters to produce a sterile end product. It was found that this liquid plasma had a long shelf life - up to a year - though it did deteriorate in time due to the precipitation of fibrinogen, one of its constituent proteins. Another enormous advantage was the fact that the plasma, with guaranteed sterility, did not need to be inspected daily.

Dried plasma was potentially better than liquid plasma because it could be kept indefinitely. In 1938, it had been demonstrated by Greaves and Hartley (later Sir Percival Hartley of the MRC) that therapeutic sera could be preserved by certain drying methods, without damaging their delicate protein structure or their activity, and also that the same methods could be applied to human plasma or

serum. In anticipation of war, a pilot plant had been set up by the Department of Pathology at Cambridge to produce dried tetanus antitoxin. This plant was now converted for the production of dried plasma. The advantages of dried plasma for the Army, and more especially for the Navy, were enormous. It could be carried on naval ships, stored indefinitely, and given when required, without having to group the patients.

Every week, plasma from out-of-date blood was taken from the London depots to Cambridge, where it was processed and then brought back for clinical trials. The first clinical trials of the dried plasma, reconstituted with sterile water, were carried out in 1939/1940. They were very successful. The product was shown to be safe and the MRC decided to establish a Plasma Drying Unit at Cambridge on a production basis by enlarging the existing plant. Production started in the spring of 1940. In 1941, another unit was built at the Wellcome Physiological Research Laboratories at Beckenham in Kent while a third followed in Bristol to supply the needs of the army.

The first major clinical use of liquid plasma in Britain came about by force of circumstances. When the evacuation from Dunkirk started in May 1940, all the available blood was rushed to the coast to treat the casualties. When it had all been used up and the flow of casualties still continued, it was decided to use plasma. One potential problem was that the early preparations of plasma did not seem satisfactory since they appeared cloudy due to the presence of fibrin clots. The risk was taken to use the cloudy preparation and "it worked like magic". Plasma was found to be an excellent "blood substitute", particularly useful in the treatment of burns.

The increasing popularity of plasma created another problem. As a leading article in the *British Medical Journal* in 1940 commented: "It remains to find a use for the discarded red cells". That did not take long. They were used to treat patients with anaemia, in whom there is a shortage of red blood cells.

Scottish Interest in Dried Plasma

In Scotland, the preparation of dried plasma was first discussed at the inaugural meeting of the Technical Committee of the Scottish Association in February 1940, when it was noted that the equipment necessary to produce it would be very expensive. There was no further discussion about it until May 1941 when Mr. Gumley called a meeting of the Technical Committee to discuss the question. There is no doubt that it was CP Stewart who played the leading role in the efforts to site a drying plant in Edinburgh. He and Professor Cappell of Dundee had become members of the Blood Transfusion Research Committee of the MRC

and were consequently well informed about developments in England. In fact, both had recently visited one of the English centres where large scale filtration and drying of serum and plasma were carried out.

One of the ways C P Stewart set about preparing the ground was by the use of publicity. Just before the meeting of the Technical Committee in Edinburgh on 12th June there was a flurry of articles about plasma in the local newspapers. On 7th June, an interview was reported in which "Dr. C P Stewart explained to a representative of the Scotsman" this "new practice in blood transfusion". The advantages of plasma and freeze drying were described. On 9th June, the papers carried a statement to the effect that "every ship leaving port carries plasma" and on 13th June, there was a feature about plasma from Edinburgh being used for casualties on board one of the ships that had helped to sink the German battleship Bismarck. This publicity was to continue for some time.

At the meeting, Stewart and Cappell explained the difficulties they had experienced in the preparation of sterile plasma in adequate quantities. They were, of course, still using the prefiltration method of preparing the liquid plasma. The main argument in favour of a filtration plant for Scotland was the effect it would have on staffing. Their staffs, they said, being mainly part time, were not sufficiently large to test large batches of plasma for sterility, being fully occupied with the already heavy routine work. The time had come to consider the establishment of a central depot to produce sterile liquid plasma and perhaps also dried plasma. Not all of the committee were convinced by the argument. Some thought the costs of the equipment and full time staff were not justified, but with the support of the Service representatives, the matter was referred to a subcommittee of C P Stewart and Professors Todd, Morris and Illingworth.

The subcommittee met five days later in Glasgow and drew up a memorandum in which they "unanimously recommended" that two plasma filtration units should be set up in Scotland, one in Glasgow for the South west area and one in Edinburgh for the rest of Scotland. The plasma they produced would form a reserve supply for emergencies and would be able to supply the armed forces as well as hospitals which had no blood bank.

A most important further recommendation was that equipment for drying plasma be installed in Edinburgh. This was considered desirable because (1) the SNBTA had undertaken to assist the Services, and the Navy in particular preferred dried plasma; (2) the MRC had expressed a desire that, if possible, a plasma drying unit should be installed "in the north" and (3) a reserve of dried plasma for use in Scotland would reduce the necessity for constant inspection of stock. Edinburgh was suggested "because it is the location of what is believed to

be the safer of the proposed serum units" (by "safer" they meant that it was less likely than Glasgow to be damaged by bombing) and it would provide enough for all Scottish requirements. "There was, however, nothing to stop Regional Directors continuing their present methods of preparing plasma". The cost, it was estimated, would be £1,500 for capital costs, £200 per annum for upkeep plus the cost of technical assistance.

The main opposition came from Stewart's fellow member on the MRC Research Committee, Professor Cappell, who wrote expressing his strong disagreement. He doubted if enough donors would be available. He felt that a blood withdrawal team would be costly and unproductive, especially in sparsely populated areas like his in Dundee, and he ended: "With regard to the plasma drying unit, I think the establishment of such a unit in Scotland is to be justified principally on political grounds. I do not think there is much else to be said in favour of dry plasma".

A Drying Plant in Scotland is Approved

Stewart carried the day. On 22nd July, the Technical Committee endorsed the recommendations. Just over a month later, the Executive and Finance Committees of the SNBTA "after further full discussion" unanimously approved the recommendation of the Technical Committee and asked the Department of Health for its approval. As might be expected, the Department took a sceptical view of the request. They were aware of a leading article in *The Lancet* of 26th July which had stated that "some regions have a surplus already" and "in this country, it is likely that liquid plasma or serum will always be preferred since it is available for instant use" although dried plasma had great advantages for overseas use. Moreover, the Technical Committee had been divided. A DHS official who had been at their meeting stated: "My interpretation is that they were on the whole dubious of the medical needs of a plasma drying unit in Scotland. Stress was laid rather on a (presumably verbal) statement made by an MRC representative to Dr. C P Stewart that the MRC would appreciate - or even request - the establishment of such a unit in Scotland. You may wish to get a definite statement from the MRC".

The DHS telephoned to authenticate the report about the MRC and were told that "the MRC recommended a drying plant should be set up in Scotland - that is what they meant by the phrase 'in the north'." A minute of the Scientific Advisory Committee was produced in which Sir Edward Mellanby (of the MRC) "welcomed the addition of C P Stewart to the MRC Committee especially in view of his interest in filtration and plasma drying in Scotland". He also stated that, in Scotland "they should not be afraid to spend a few hundred pounds on what might

be worth thousands in the value of human life". That, together with Stewart's rebuttal of the argument that there was already enough capacity, convinced the officials, who now took the matter to the Treasury at a meeting of the War Emergency Expenditure Committee.

There they argued that the two plasma units would be of great value in spreading the danger of damage from enemy action and would together involve a capital outlay of £1,820 with running costs of £3,210. "The Department regard these estimates as reasonable". A subsequent Telex to London compared costs in England with the proposed costs in Scotland. "In the light of these figures, the cost of the Scottish Service is remarkably reasonable. In the first year of working (1940-1941), the Scottish National Blood Transfusion Association received a grant of only £3,750 in place of the grant of £5,000 sanctioned. Even if the scheme on the present basis should cost the Treasury the limit of £7,500" (the limit having been increased) "plus the extra £2,000 now asked for, it is suggested that the Treasury are getting off lightly so far as the Scottish service is concerned". To get an idea of 1987 values, these figures should be multiplied by about 25. £1,000 then would be worth about £25,000 today. One would agree that the sums were eminently "reasonable".

Storm in a Teacup

The War Emergency Committee approved the expenditure at a meeting at the end of September. They did suggest, however, that the Scottish Association might get the filters from the Ministry of Health, perhaps on loan, and this was the cause of a good deal of unnecessary acrimony. The Association had already ordered the filters and were rapped over the knuckles by the Department of Health who told them that they should not have gone ahead without official approval. Attack being the best method of defence, Mr. Gumley wrote to the Department on 12th November: "While in view of the urgency of the matter, we had hoped to obtain formal approval in the course of a day or two, it was appreciated that this was a matter which the Department might have to pass to the Treasury. At the same time, the matter being an important one, it was felt that every effort should be made to place provisional orders with the suppliers".

"As a month passed without a reply from the Department, the Directors were much concerned in view of the growing difficulties of obtaining supplies and of the inevitable delay occasioned by completion of the various 'priority forms'. In the circumstances, it was decided that, as there was no indication that the proposals were to be refused, the Association must place the essential orders forthwith. If the Association's decision to proceed before receiving the formal approval of the Department or the Treasury has in any way, led to some

embarrassment, it is very much regretted but perhaps it will be appreciated that in view of the many difficulties in the way of obtaining material without considerable delay, we had no option but to place the orders”.

A Director, probably C P Stewart, wrote: “I think the criticism by the Department is most unfair. It is usual to have to wait three months before supplies are available. Had it turned out that we were being severely and frequently blitzed and we could not meet the demand for plasma, we would justifiably have been severely criticised, especially if we had allowed valuable months to elapse and had done nothing”.

All this fuss and delay about the filters was quite unnecessary since the Department eventually, on 2nd December, wrote to say that the Ministry of Health had, in fact, no spare filters and could make one available only “in the event of desperate need”. Gumley replied recalling the criticism which had been levelled at his Committee and himself by the Department and asked to be told if the matter was now finally resolved, which it was. The cost of the filters was only £200 to £300!

The Drying Plant becomes Operational

Thereafter, things proceeded rather more smoothly, though perhaps more slowly than Stewart would have wished. In May 1942, he “hoped the plasma drying unit would be in operation in the course of the next few days” and, in June, a newspaper reported that the unit in Edinburgh Royal Infirmary was “now being installed in underground premises safe from air raid risks” (“a small unventilated cellar”). It was not, in fact, functioning until March 1943.

The plant room contained the drying plant, a spin freezer cabinet and vacuum pumps. The refrigerator for the drying unit in Edinburgh was installed at a cost of £530, paid for by a remarkably generous gift of £560 received at this time from the pupils and staff of Edinburgh Ladies’ College (later Mary Erskine School for Girls) and a plaque was affixed to the unit to commemorate the beneficence.

The drying plant itself, built of “bits and pieces” ran on DC current and sat on a concrete pit sunk into the floor. It had a capacity of one hundred 500 ml bottles, dried in a length of steel pipe (“large diameter city water supply pipe”), with its internal refrigerated coil operating at what was then the very low temperature of -35C. The refrigerant was methyl chloride which was both toxic and inflammable.

The plant ran day and night for years. That it did so was thanks to the devotion of Andrew Crosbie whose special responsibility it was. “Any breakdown, and

there were many, found him in the cellar, often dazed and ill from the effects of the methyl chloride gas, trying to put things right or save the plasma". In the two years from the time it came into operation until March 1945, 10,126 units of dried plasma were issued from the Edinburgh unit, 9,616 to the armed forces. This was additional to 11,000 units of liquid plasma issued to Scottish hospitals in the same period by the SNBTA, most of which came from Edinburgh and Glasgow.

C P Stewart was proved right in the end. Production of plasma in the U K was, at this time, not excessive and it was to be needed especially for casualties in naval ships and in the invasion of Europe. Some was also sent from Edinburgh to be dropped for the defenders of Warsaw in its agony in the later stages of the war. In the long run, the importance of the unit was that it put Edinburgh in the forefront of blood processing technology and gave it the necessary basis for further developments. All the subsequent events and progress in plasma fractionation in Edinburgh owe their origin to the siting of the drying unit there.

WARTIME RESEARCH

"He is the second member of my staff to develop jaundice"

Blood banks were a tremendous stimulus to research. There were so many unanswered questions. Could blood be made to last longer than seven days? How could waste be avoided? Even the basic questions of whether stored blood was safe and, if so, whether it was as satisfactory as fresh blood, were unanswered in 1939. Shock itself was ill understood and resuscitation, in consequence, was often inadequate.

The longer the shelf life of blood, the less that has to be withdrawn because less is wasted. When only sodium citrate is added, the red cells last seven days. In 1940, it was found that the addition of glucose to the citrate extended red cell survival time to between two and three weeks. Then, in 1943, in London, Loutit and Mollison introduced the use of ACD, an acid salt of sodium citrate plus dextrose. This mixture which is now standard throughout the world, preserves the cells for up to four weeks.

Until 1943, Group O blood was used for virtually all blood transfusions. At that time, it was appreciated that there was going to be a problem in providing enough Group O blood for the anticipated needs of the army in the invasion of Europe, if this policy were to continue. The solution adopted was to transfuse blood of the patient's own blood group. It soon became clear that, not only did this provide better utilisation of blood, but it also gave better results.

A comparison of the safety and effectiveness of stored blood and fresh blood was a major research project. In 1939, almost no one had any experience of the use of stored blood, and most people suspected that fresh blood was better. The results of transfusions of bank blood were, therefore, carefully observed and recorded. In July 1940, C P Stewart published a paper on the results of 427 transfusions. "Transfusion with stored blood", he wrote, "is still sufficiently novel, in this country at least, to justify publication of the results obtained in a series of such transfusions". He found that, if the blood had been stored for less than fourteen days, it produced no more reactions than fresh blood. Others found that stored blood was as efficacious as fresh but that the incidence of mild reactions

was increased. In Edinburgh, Dr. Scarborough carried out a series of investigations into stored blood with the aid of a Crichton Research Scholarship from Edinburgh University.

Complications of Transfusion

Throughout the war, a close check was kept on both donors and recipients for possible complications. In donors, few were noted other than occasional fainting. As for the recipients, one of the great fears had always been of the possible transmission of disease with the donor blood. To prevent the possibility of, for example, syphilis being transmitted, serological tests for that disease had always been required. Bacterial contamination of the blood was another obvious risk and two deaths in the early days were attributed to Diphtheroid organisms, probably due to inadequate sterilisation of equipment. Transient rigors, or shivering attacks, were common and they continued despite the most careful preparation of equipment and transfusion material.

Suspicious began to be aroused about a possible link between transfusion and jaundice about 1942. The association was difficult to detect, because jaundice following transfusion was rare. What made it more difficult was the fact that, when it did occur, it might be up to sixty days after the transfusion. The incident which gave rise to concern was the development of jaundice by several people who were found to have been given plasma from the same batch, some fifty to sixty days previously. It was then found that the incidence of jaundice (mostly mild) following plasma infusion was 7-10% but that from whole blood was less than 1%.

What had happened was that, when filtration was introduced, loss of plasma was minimised by pooling plasma from as many as 500 to 1,000 donors. This greatly increased the chance of infection, since many people were exposed to the same batch. The episode established two things. One was that jaundice was a possible complication. The second was that the risk of contracting it increased in proportion to the number of donors whose plasma was in the pool. As a result, a recommendation was issued that pooled plasma should be from a maximum of ten donors and that plasma should be given only when whole blood could not be used. In July 1943, Professor Todd in Glasgow wrote to Gumley: "A member of my staff must be taken off processing as he has developed a mild chronic jaundice, origin unknown, but he is the second member of my blood staff to develop this. There may be no connection between the blood and these two cases of jaundice but if we produce a batch of plasma which, as has happened in England, causes a serious outbreak of viral jaundice, we might justifiably be called in question". True words but these were among the first cases recorded of the risk to staff handling the blood.

Later that year, the MRC Research Committee reported that six volunteers had been inoculated from an icterogenic (jaundice producing) pool of serum which had been used in the preparation of a yellow fever vaccine, the use of which had been associated with an outbreak of jaundice. Two of the volunteers developed jaundice within sixty days of the injection. As a final test, the MRC Committee decided to prepare special batches of material from pooled serum or plasma from a very large number of donors. They issued it in bottles all containing identical material to special investigators working to exactly the same standards. The plan was nearly in operation when serious doubts arose as to the ethics of such an experiment and the investigation was abandoned. Except for jaundice, there was no evidence during the war of the transmission of disease by transfusion fluids.

Important Discoveries

Experience in the plasma drying units, particularly in Cambridge, threw light on basic problems involved in the processing and in the preservation intact of the unstable natural proteins. Between 1942 and 1944, this led to the discovery of a method of centrifugal vacuum spin freezing which overcame many of the technical difficulties in processing small quantities.

The most fundamental work was carried out by E J Cohn and his colleagues in the United States. In a comprehensive series of original papers and reviews, they described techniques for the separation of human plasma constituents into a limited number of fractions and the clinical trials of some of these fractions. At first, albumin was isolated, then gammaglobulin, and their clinical value was quickly recognised. Samples of these products were generously provided from American sources for trials in this country and the results were so successful that the MRC's Research Committee decided that facilities should be made available in this country for the preparation of plasma fractions. In 1943, the Blood Products Research Unit was set up as a joint enterprise of the MRC and the Lister Institute and, since much of the equipment necessary for Cohn's procedure was not immediately available, research was undertaken there on the development of an alternative method. Kekwick and Mackay carried out fractionation under rigidly aseptic conditions and prepared albumin, gammaglobulin, fibrinogen and thrombin in consistently pure form and with good yield.

The other major discovery of the war years also came from America. In 1940, the Rhesus blood group was described by Landsteiner and Weiner. Although full information about the importance of the Rh factor did not reach this country until the end of 1941, the American work had been confirmed and additional findings recorded within a year. The Galton Serum Unit described a whole series of Rh factors and determined their interrelationship. (The Galton Serum Unit had been

set up by the MRC on behalf of the government, in the Department of Pathology, Cambridge, to supply serum free of charge for blood transfusion purposes.) In December 1943, all Scottish hospitals and medical officers of health were circulated with a memorandum on the Rh factor. This greatly expanded the work imposed on blood banks. The impact of the discovery on the transfusion services will be described in a later chapter.

From the time blood banks were set up, research into blood, blood products and blood usage was vigorously pursued, locally, nationally and internationally. To coordinate and further the research effort, the MRC, in 1940, created a Blood Transfusion Research Committee, of which Stewart and Cappell were later members. This had the important effect not only of promoting investigations but also of ensuring the rapid dissemination of information about work in progress throughout the land (and beyond), so that all important findings could be acted upon without delay. At first, the investigations were strictly pragmatic, simple answers being sought to simple questions but, by the end of the war, the research effort had burgeoned into a major preoccupation, with ramifications undreamt of a few years earlier.

The science of blood transfusion had come a long way in the six years from 1939 to 1945. The advantages and the risks, both to the recipient and the staff handling the blood, were much more clearly defined and the two fundamental discoveries of the Rh factor and protein fractionation opened the way for many of the important advances of the following twenty years.

PLANNING FOR AFTER THE WAR

"The Association is going to be in serious difficulties"

Despite the fact that, in 1943, the war was still at a critical stage - "the end of the beginning" rather than the "beginning of the end" - discussions started then about the structure of the postwar social and health services. In June of that year, a conference was held at the Ministry of Health in London to discuss three alternative strategies for the future of the blood transfusion services - an area service, an area service with local recruitment of donors or each hospital being responsible for its own service. The discussions were of an exploratory nature and were followed by a series of meetings attended by as many as 120 individuals representing the British Red Cross Society and other organisations with an interest in transfusion in England. At a meeting in November of that year, a DHS official "took the opportunity to refer to the organisation in Scotland which (I said) had worked very well since its inception". It was agreed that a representative from Scotland should be invited and Dr. C P Stewart was nominated by the Technical Committee of the SNBTA.

The Scottish View

In Scotland, the Technical Committee of the SNBTA appointed a subcommittee of its Regional Directors, in December 1943, to consider postwar organisation in Scotland. It produced an important memorandum which set out in considerable detail its views on the Scottish transfusion service, past, present and future. Although not signed, the document bears the unmistakable imprint of C P Stewart.

The main objective, it stated, was "to maintain and further develop" the service which had been created, the essential features of which were recruitment of voluntary donors, grouping and serological testing, withdrawal and storage of blood, its processing to produce plasma (liquid and solid) and the supply of blood or plasma, wherever and whenever required.

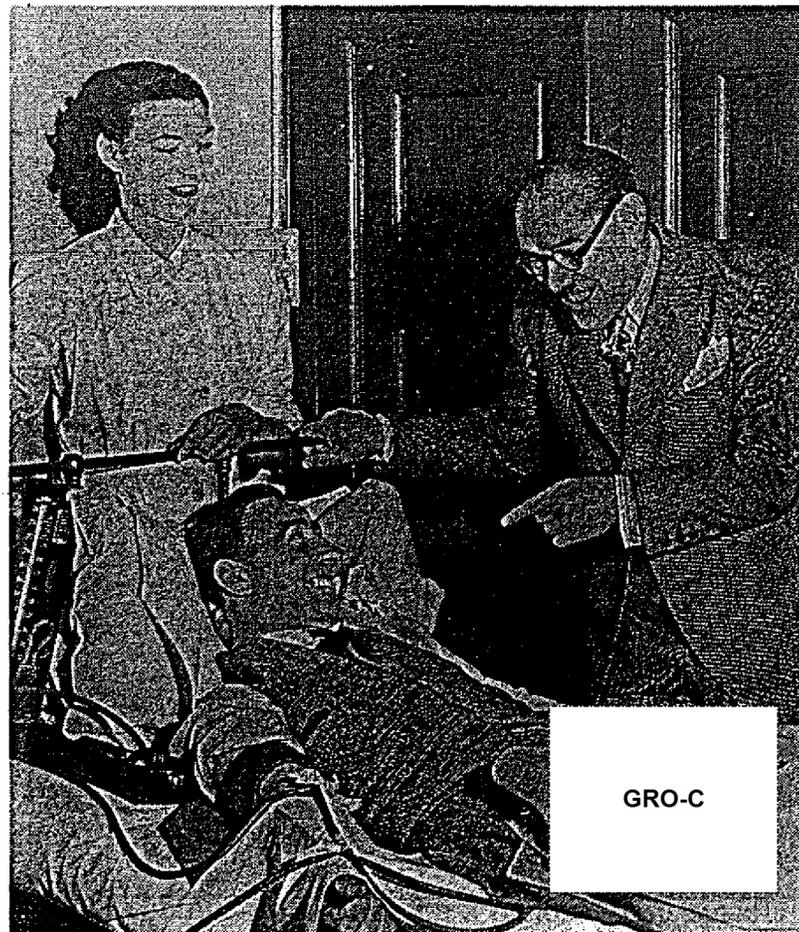
It was considered that the Service should be associated primarily with the hospitals but should continue to operate on a regional basis since it would be uneconomic and less efficient if independent services were to be set up within



Mr Stobo, one of the earliest donors



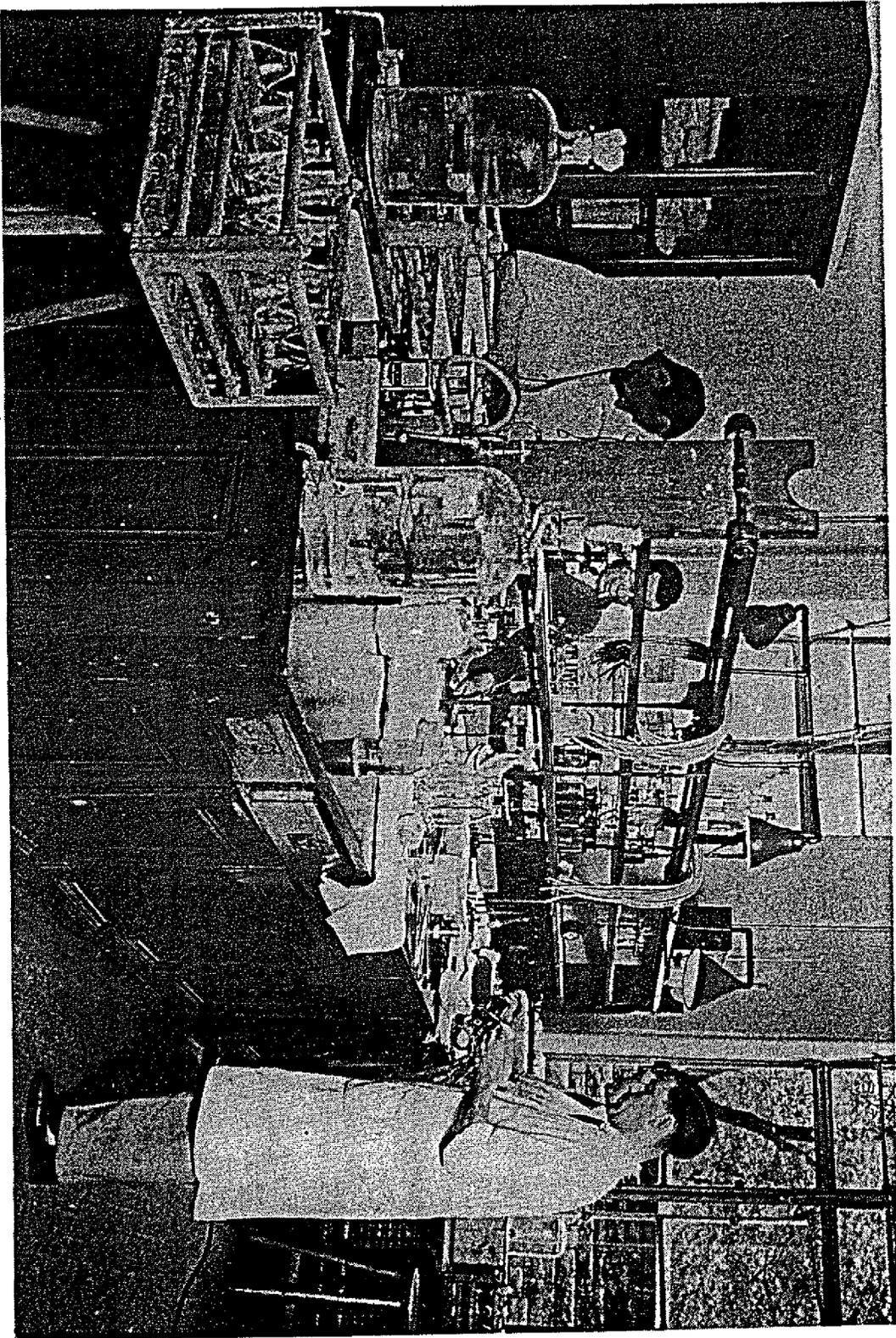
Flag Day



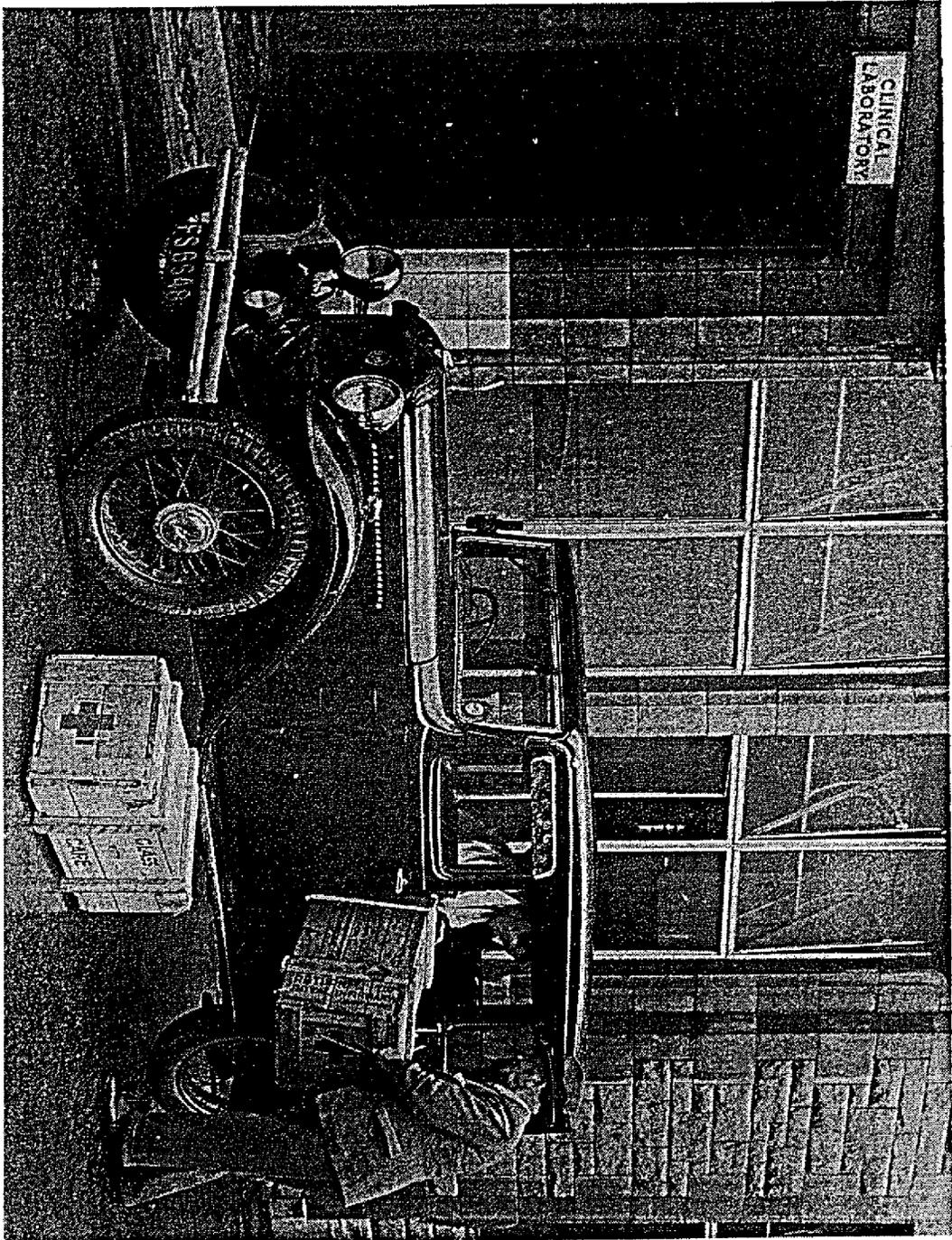
Comedian Dave Willis talks to Tommy Walker (Hearts FC) 1949



22 Gilmore Place



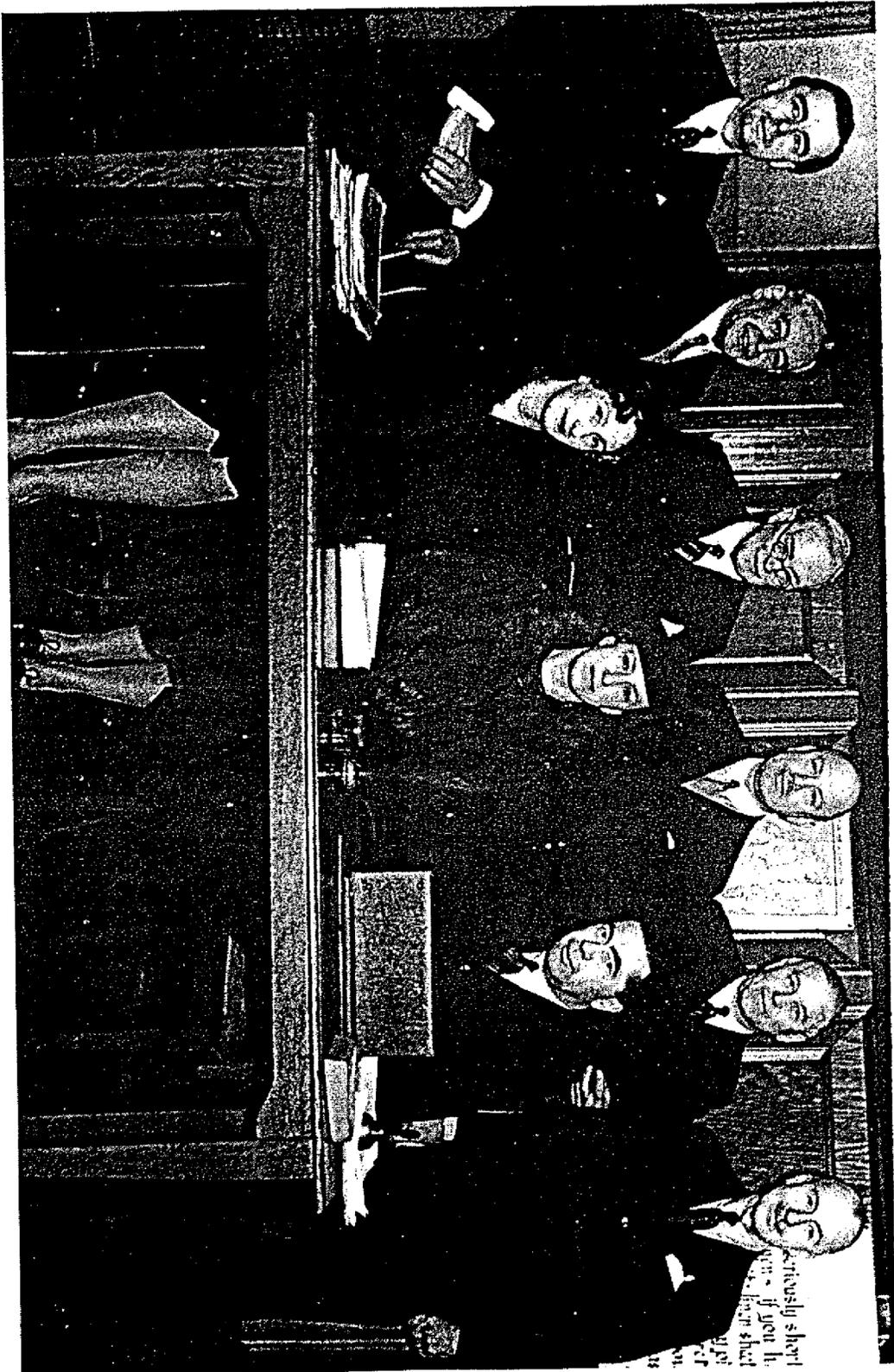
Clinical Laboratory, 1. Dr Scarborough and Dr C. P. Steiner in the background.



Blood leaving the Clinical Laboratory



Post-donation cup of tea



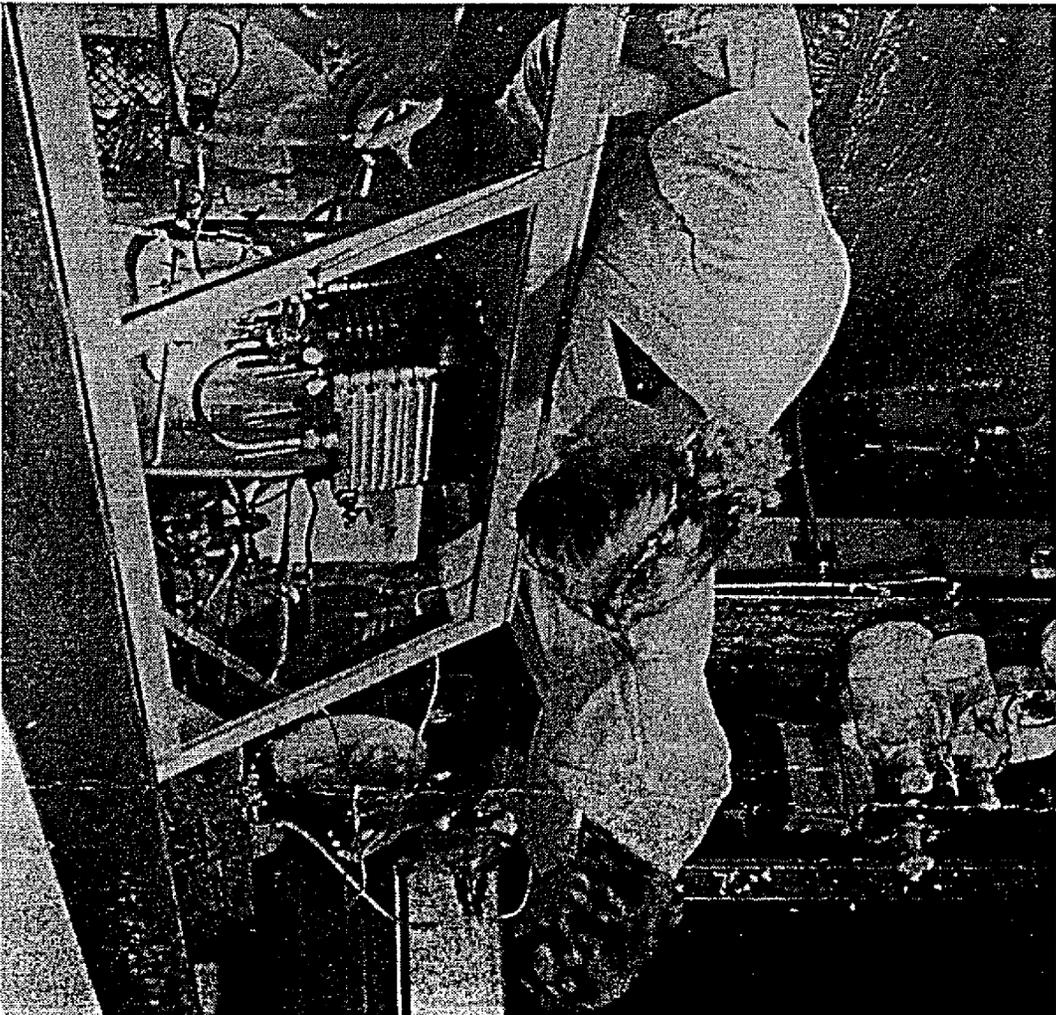
J. GUMLEY J. COPLAND M. LITTLE LORD ROSEBERY SIR JOHN FRASER COL. STEWART
H. WHITE PRINCESS ROYAL C. P. STEWART

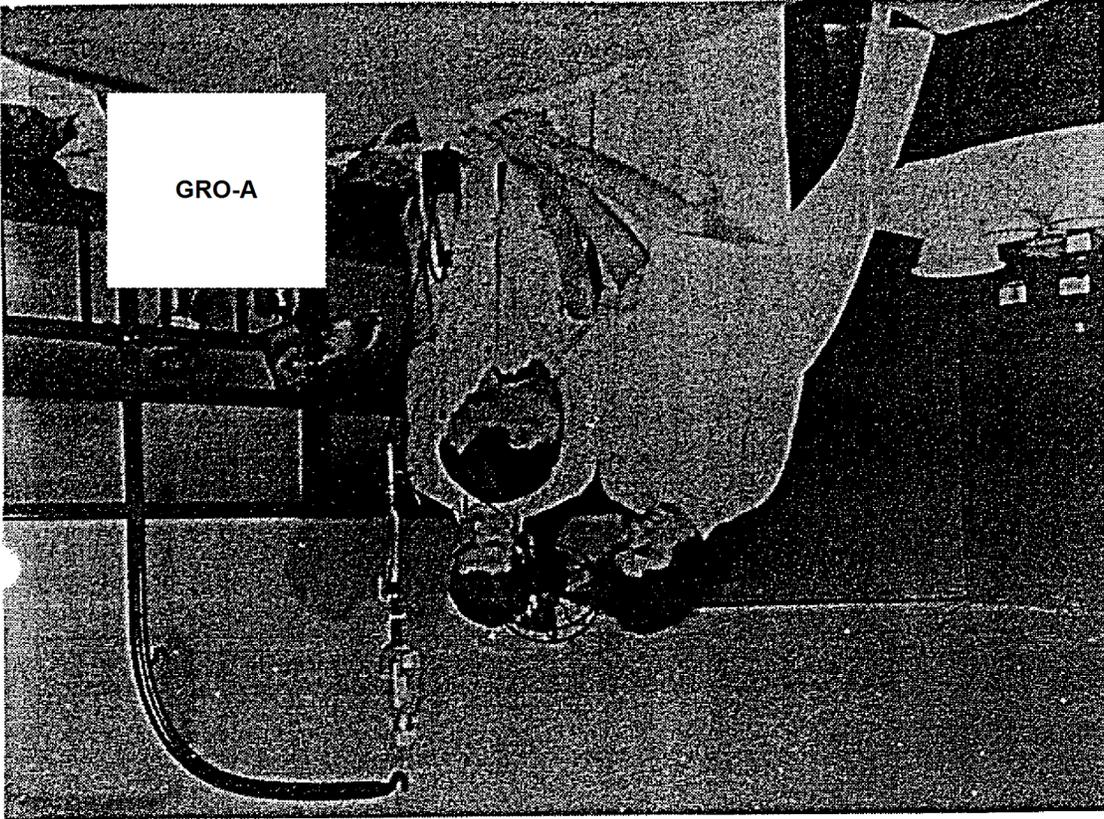
BTS Committee members

Dr. Cummins

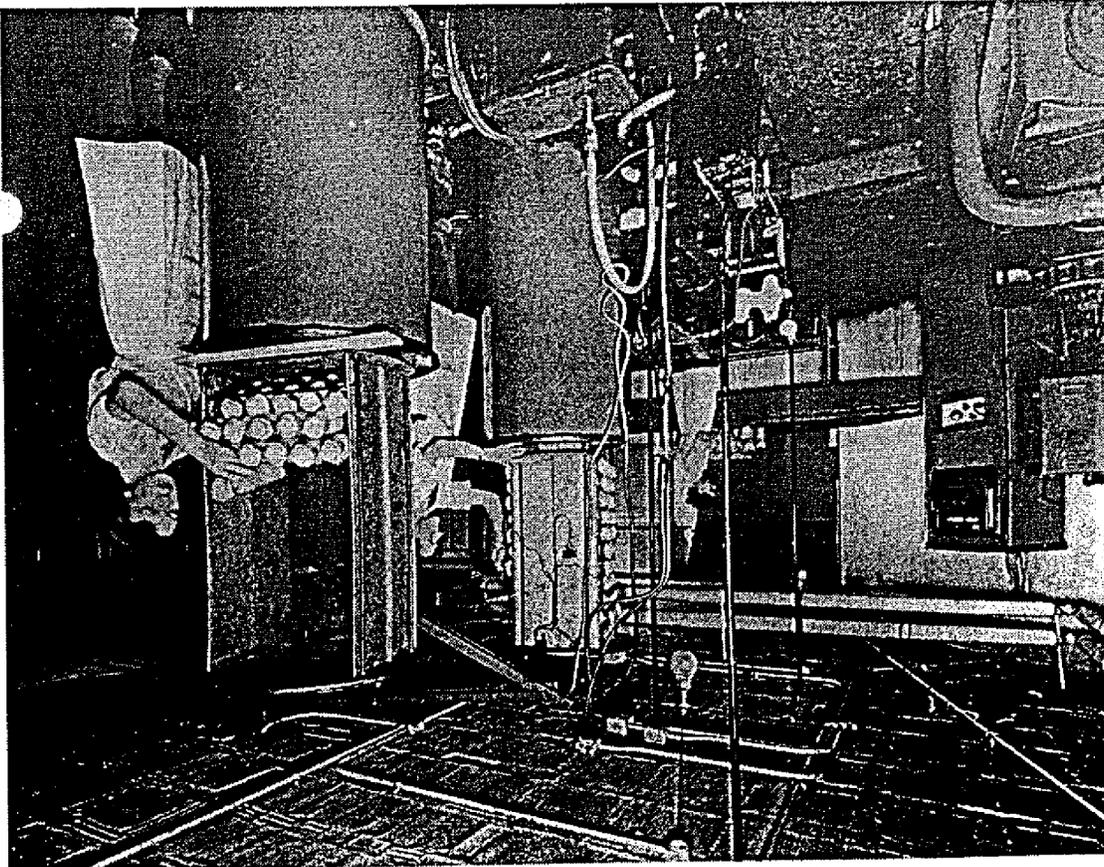


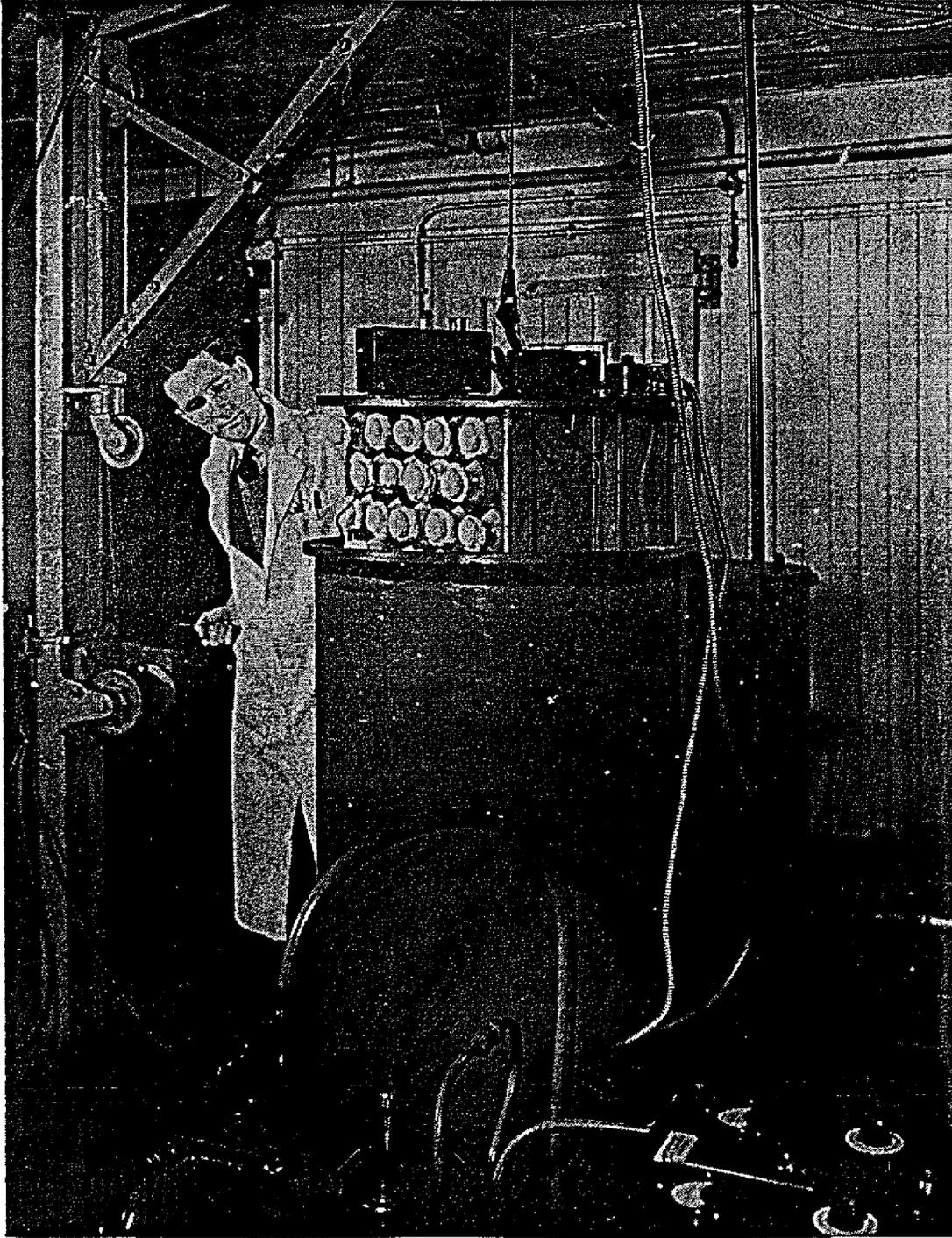
Plasma separation



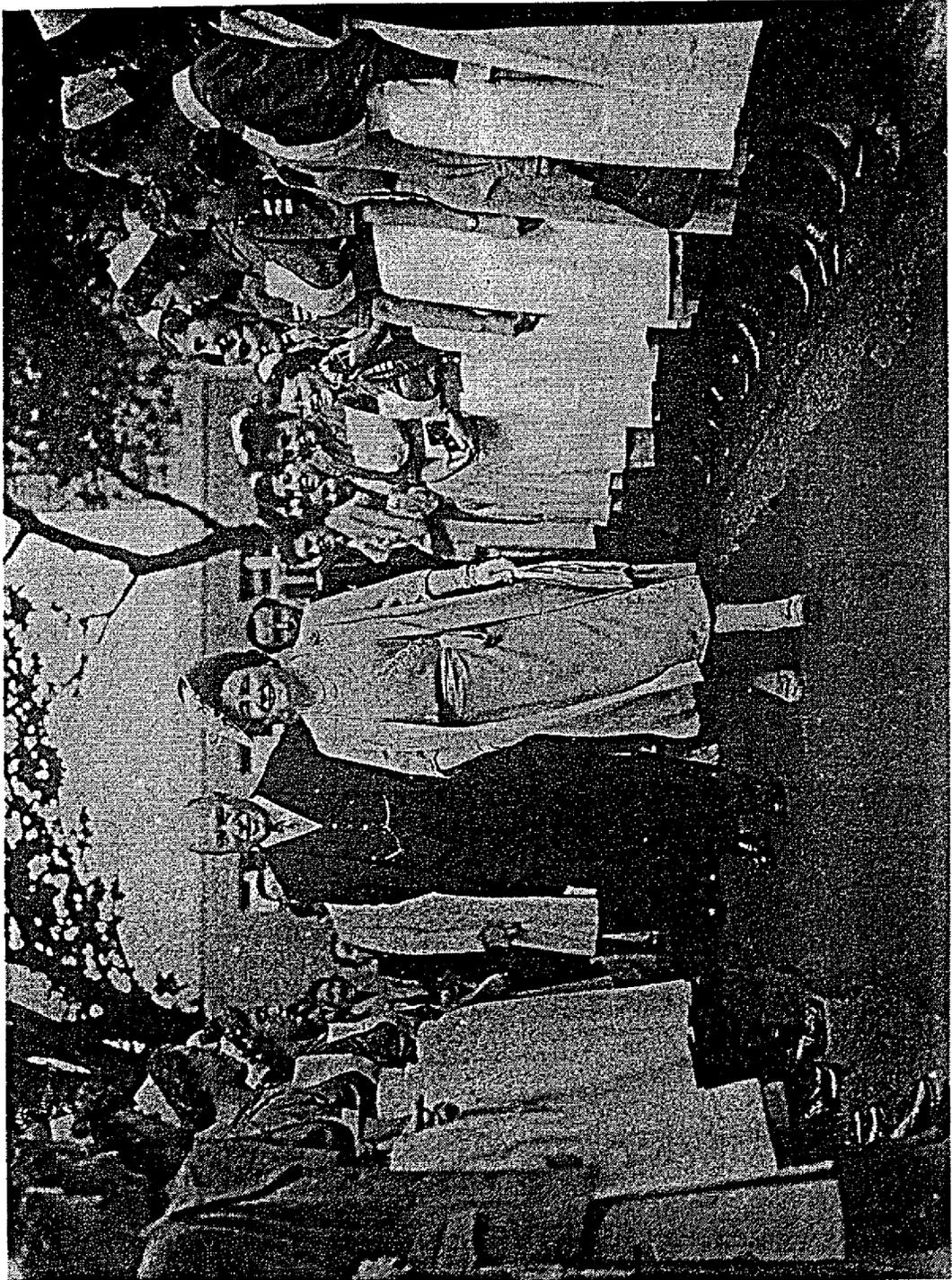


Plasma drying unit in RIE basement

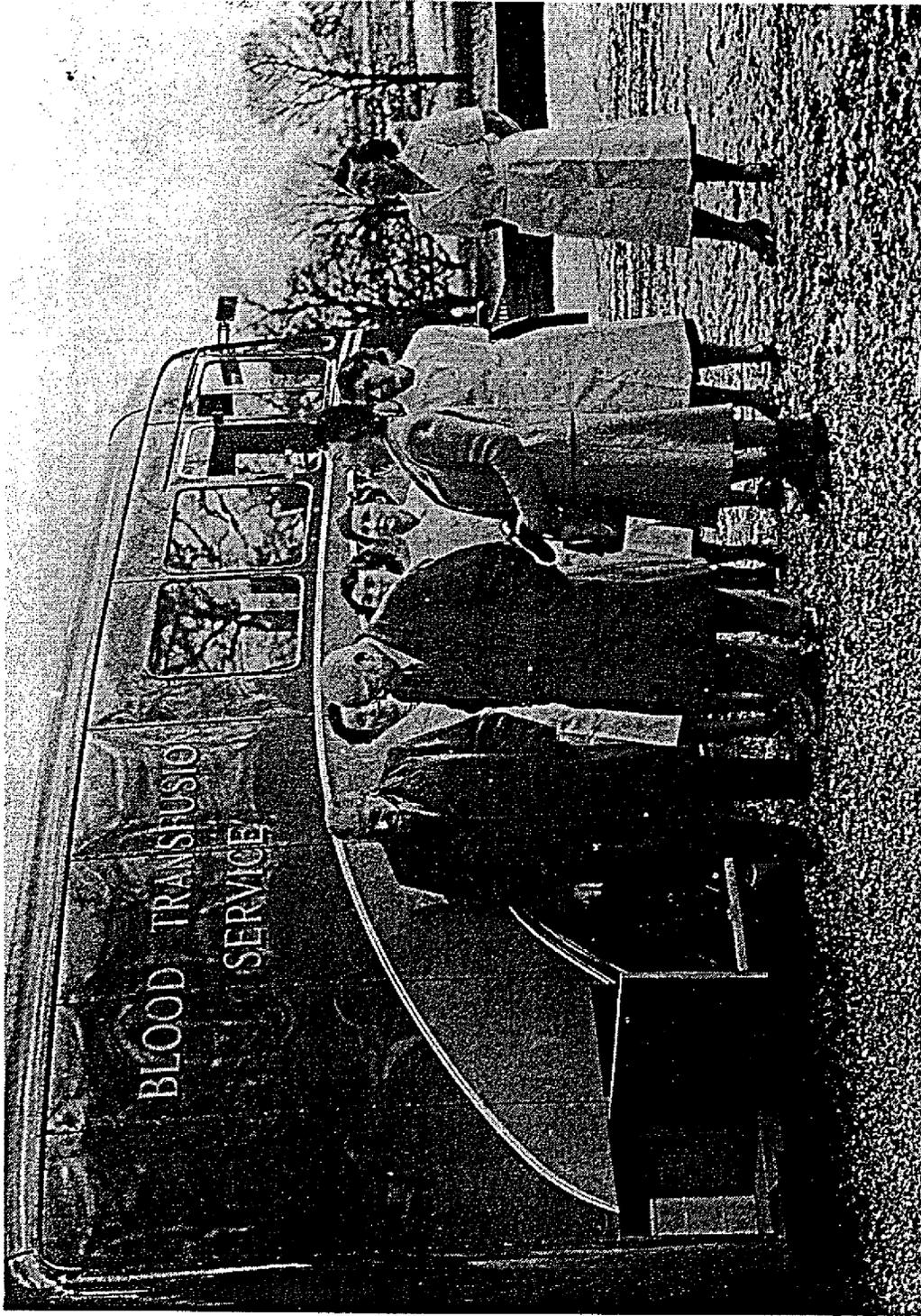




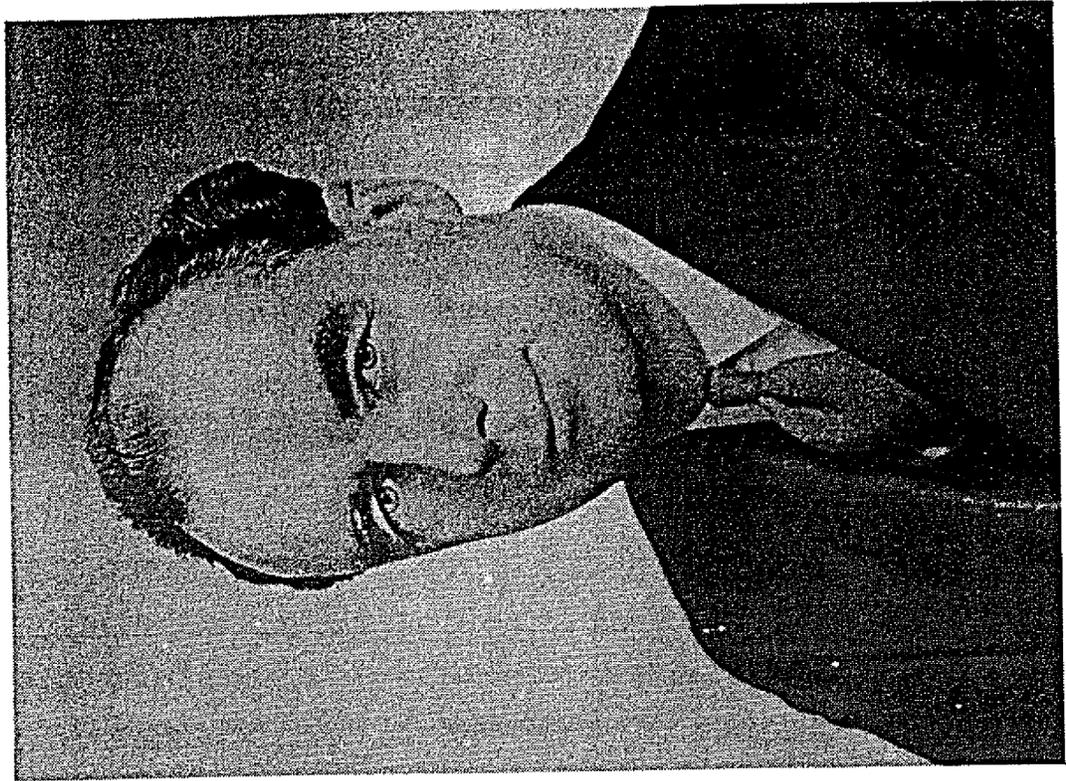
Andrew Crosbie with first plasma drying plant



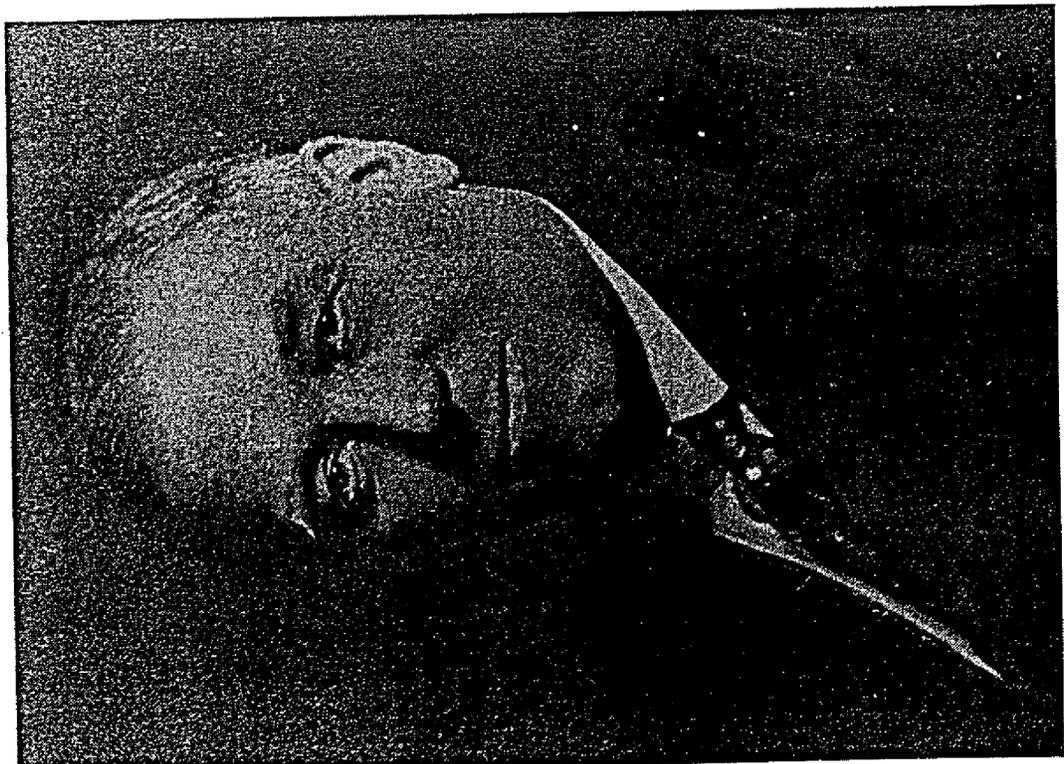
Queen Elizabeth and Lord Rosebery visit the Centre 1950



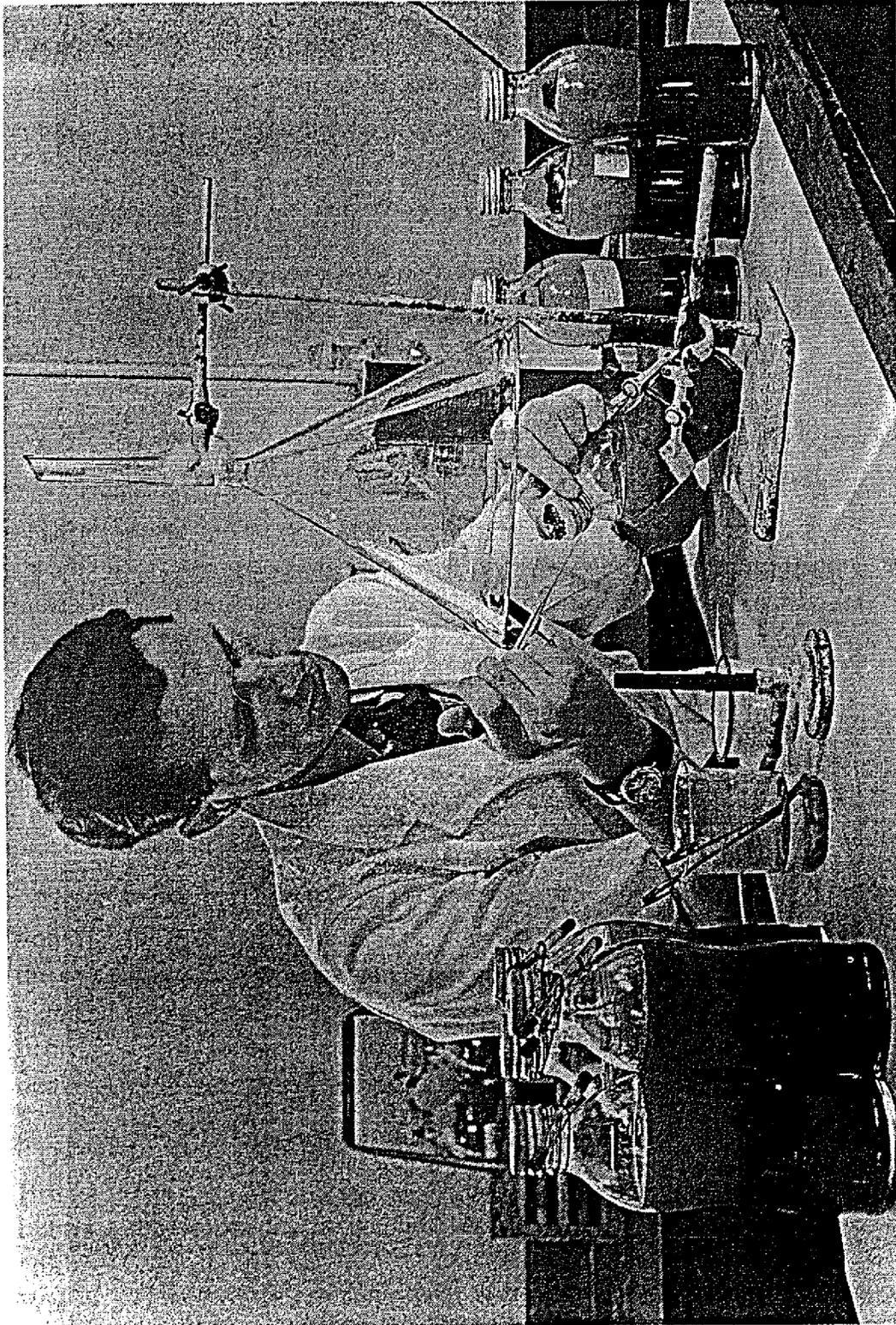
Earl of Rosebery inspects first BTS van 1952



Charles Gumley



Sir John Fraser



Andrew Crosbie



Helen White



Jack Copland

each regional board. It was believed (rightly) that the volume of work would not diminish after the war.

On donors, it reiterated its attachment to the voluntary principle in recruitment even though "it is possible to conceive of donors giving blood for payment to commercial firms who would process and market products under licence". However, "the introduction of a commercial element even in the processing stage would undoubtedly prejudice donor recruitment". It was optimistic about the supply of donors. "It might be thought that recruitment will fall off but one survey found that two thirds of donors would agree to continue" after the war. It opposed the idea of donor panels being taken over by the British Red Cross Society or the St. Andrews Ambulance Association since "it would be undesirable to divorce the donor organisation from the technical side".

General organisation and research were then discussed but, on finance, it warned "the present state of efficiency cannot be maintained in the postwar period without adequate and assured financial backing". It pointed out that the smooth running of the Scottish Association was due in no small measure to a large number of voluntary and part time workers, in particular, the Regional Directors themselves, who had given their services for small honoraria or for no payment at all - a situation which could not continue in peacetime. Income would have to come, in part, from contributions from the public but, in the main, from a government grant. Flag days were disapproved of since they placed an undue strain on the organising staff which, in some cases, "interfered with the routine work of the Service for several weeks".

The document concluded "the postwar recruitment and organisation of blood donors can best be tackled as at present on a regional basis but, keeping in view the extraordinary development of the Service over the past four or five years, the highly technical character of the work, the implications of the government's proposals for a national health service, the opportunity should be taken now of dealing with the technical and financial problems of the work on a national basis".

One suggestion which had been made at the London discussions was that the British Red Cross Society might take over the service in Scotland after the war but the Scottish view was that "we were content with existing arrangements" and "did not contemplate any change such as amalgamation with the English body". When, in March 1944, Brigadier Mudie of the Red Cross Society asked Mr. Gumley what help the Society could give the Scottish Association, Gumley could only thank him and say he would inform his Executive though "I have no doubt what their answer will be". "We do not wish to offend any organisation but we do

not wish to be too closely associated with them officially". The Scottish Association valued its independence.

The Political Background

The plea for national funding was significant because it epitomised the new thinking on the role of the state in health matters which was finally expressed in the passing of the National Health Service Act. It ran directly contrary to established government concepts which had always tried to distance the state from such involvement, other than for public health projects.

From the turn of the century, however, gradually and reluctantly, the state had been forced to intervene in medical care. Following the public outcry and concern about the state of health of recruits for the Boer War and the conditions of poverty in the country, Lloyd George had introduced the National Health Insurance Act in 1911. It provided access to medical advice for all employed people. It did not cover wives or dependents of those in work, nor did it include provision for any kind of hospital treatment.

The next major legislation concerning hospital care was the Poor Law Reform Act of 1929. This discontinued parish councils and transferred poor houses and poor law hospitals to the local authorities. In Edinburgh, the former parish institutions at Craighleith, Seafield and Pilton became the Western, Eastern and Northern General Hospitals and they became the responsibility of Edinburgh Town Council.

Between the wars, hospital care was provided in one of three ways. Private patients were treated in nursing homes, though there was little in the way of medical insurance to help cover the fees. The poor were looked after in poor law hospitals or local authority institutions. The rest were looked after by the voluntary hospitals whose funds came entirely from donations, legacies or collections. As medicine became more sophisticated, costs rose and these hospitals found it increasingly difficult to make ends meet. High prices, high taxes and high unemployment after the First War reduced the money available for voluntary donations. The London hospitals were virtually bankrupt in the 1920s and took in private patients, starting private wings and pay beds. The Scottish voluntary hospitals were in similar, though less acute, difficulties. The annual deficit of expenditure over income in Edinburgh Royal Infirmary rose from £25,000 in 1914 to over £50,000 in 1937. It, however, was precluded by its charter from taking in private patients.

The Emergency Medical Service was started in 1938. The intention was that heavily populated areas would have casualty clearing hospitals while fully equipped base hospitals would be sited in rural areas, safe from the threat of bombing. Prefabricated hospitals were built at Law, Ballochmyle, Killearn, Bangour, the Astley Ainslie Hospital, Peel, Bridge of Earn, Stracathro and Raigmore. To deal with the anticipated war injuries, specialist units were organised for the treatment of fractures, burns, head injuries and hand injuries. Anaesthesia, radiology and pathology were encouraged. As has been noted earlier, blood transfusion was completely overlooked. The planners of the EMS probably had not even thought of it.

In the event, the beds in the base hospitals were so little used that the Secretary of State for Scotland, Tom Johnston, made them available for the civilian population to reduce hospital waiting lists. By the end of the war, they had become indispensable and were not given up. During the war, the government committed itself to the provision of a national health service though the exact form of that provision was not then decided. It was against this background that the political debate about the future of the blood transfusion service took place.

Government Tries to Off-load Responsibility

When the SNBTA memorandum on the future of the Scottish Service was submitted to the DHS, its reaction was unenthusiastic. "It is a plea to continue on its present basis". The Department accepted the need for a Service after the war and realised it would cost more. "It will not be possible after the war to get voluntary service from first rate experts to the same extent as the Scottish Association has been successful in doing during the war, so more money will have to be found".

The Department officials were not clear about how this could be achieved. They felt that it was desirable to retain a voluntary association for the enrolment of donors and for public appeals, but this was at variance with the intention to do away with flag days, the most effective type of appeal. The major issue was control. If the Association were to be fully funded, it should, they felt, be fully controlled by those with the money - i.e. government. "A voluntary Association wholly financed by the state would be a somewhat anomalous institution". Whether such funding "is compatible with maintaining the Association in some form as an independent voluntary body is not yet clear".

In April 1945, the DHS asked its English colleagues at the Ministry of Health about the situation south of the border, and was told that there they proposed to have ten to twelve Regional centres in university towns and one or two processing

plants. Their intention was that the Blood Transfusion Services would be directly administered by the Ministry of Health as part of the new Health Service. However, a suggestion was made that the cost might be reduced by selling the blood. The proposal was put to the Treasury that "the blood and blood products supply to hospitals etc would be charged for and the cost of the Service therefore almost wholly recovered from the users of the blood". One justification for this suggestion was that blood and its derivatives were now "almost a factory product - also potentially very dangerous".

The DHS felt it had to follow the English example. "In view of the English proposal that the national service should wash its own face, we could not hope to spend state money on the Service in Scotland. Besides continuing voluntary support, therefore, the Association would need to find additional income presumably from the various hospitals ... on some basis of services rendered". There was, however, one fundamental difference which was not mentioned. In England, even if a charge were made, any shortfall would be made up by government. In Scotland, it was expected by the DHS that voluntary donations of money by charitably minded citizens would make up any difference.

In pursuance of the aim of raising money by the sale of blood, the DHS prepared a draft letter which it proposed to send to the local authorities. "It is clear", the letter stated, "that when the national emergency interest disappears, there will no longer any justification for Exchequer subsidy". In fact, that was not at all the case. A letter from the Ministry of Health to the Treasury stated "It is clear that the matter cannot revert to the prewar position" because of the complete transformation in practice. The DHS letter then went on: "Arrangements will have to be made to recover costs from hospitals". "For the same reason as makes us favour a voluntary organisation in preference to a departmentally administered service, it is felt that those arrangements should avoid the appearance of the sale of blood at so much a unit and also avoid the direct payment by the customer hospitals to the Association". In other words, they wanted the users to pay for blood but it must not appear as if they were being charged for it! The draft was submitted to the Treasury which authorised the DHS to "open negotiations with interested parties along the lines you propose".

Two of the "interested parties" approached in the summer of 1945 were the Convention of Royal Burghs and the Hospitals Authority. The former considered that "the service should be a voluntary one as regards donors but costs should be met through the National Health Service", while the Hospitals Authority said it was "desirable that it should continue to be run by the SNBTA". The SNBTA, for its part, proposed that any grant should come from either the government or the proposed regional hospital boards.

Officials of the DHS met in October 1945 to discuss what was to them a bleak prospect. Expenditure was now £20,000 and the grant only £7,500. They realised that the view of those approached was that the service should be financed by the National Health Service, and that, in consequence, there was no point in convening a conference as had been intended. Their policy of seeing "how far the hospital authorities are prepared to go" had failed.

The DHS officials were well aware of the gravity of the position of the SNBTA. "Unless some interim arrangement is agreed, the Association is going to be in serious difficulties. We cannot contemplate that the blood transfusion arrangements developed during the war should disappear merely because satisfactory arrangements cannot be made to finance them" - an uncharacteristically sympathetic comment. In consequence of this assessment of the situation, the DHS informed the Treasury that negotiations were not possible along the lines originally proposed and there was no option but to continue the grant.

For the time being, that ended attempts to find a permanent solution to the postwar organisation of the blood transfusion services. Throughout 1946, the debate shifted to Parliament where the National Health Service Act became law in November. As blood transfusion was part of the medical services, its future could not be decided in isolation but had to await decisions on the broader general provisions of the health service.

THE POLITICAL DILEMMA

"We risk a breakdown in supply"

The Blood Transfusion Services faced many difficulties after the war ended. They had grown up as a wartime emergency service and the adjustment to peacetime conditions was not easy. New premises had to be found, because the existing ones had to revert to their previous purposes. There were major problems with the supply of blood since the public perception was that it was no longer necessary. Staffing caused great stress as temporary staff left and others became available with demobilisation. The two overriding anxieties of the immediate postwar years were, however, the future of the Service and, as always, money.

Economic Pressures Mount

The financial situation deteriorated very rapidly and to such an extent that an overdraft became necessary for the first time. Income dropped because of public expectations that in the new Health Service, everything, including the provision of blood, would be state funded. People were consequently reluctant to support the BTS financially as they had done in the past, perceiving it to be a state responsibility. At the same time, expenditure rose because considerable additional costs were incurred in, for example, the greater complexity of the work and the necessary replacement of part timers (from the Director downwards) by permanent, full time staff.

In May 1946, the Association had to ask that the government grant be trebled, from £7,500 to £22,500. On the basis that the state provided only 75% of the costs, this implied that voluntary donations would also have to increase threefold. The reply from the DHS showed the iron hand in the velvet glove: "While the Department would not wish to query the suggested increases in honoraria and salaries or the proposed expenditure on transport in the Eastern region and while they also appreciate that there will be considerable additional expenditure in the next financial year, I feel sure that we must come to you for a much more detailed statement of estimated income and expenditure before we can agree to the increased grant for which the Association asks".

When they brought the matter to the Treasury, however, the DHS described the salary increases as "modest and unexceptionable - in most cases, no more than the normal scale increments" and regarding the drop in receipts from donations and flag days, they observed that "a further decline seems likely". The Treasury agreed to increase the annual grant.

By June of the following year, the deficit was over the limit of £22,500. The DHS wrote to Gumley: "Since it is likely that the deficit will be repeated or even increased owing to salary rises, it appears that the Association will not be able to cover expenditure. While the Secretary of State would be prepared to consider raising the limit, how can the Association increase its income to retain the 25% liability?" Gumley could only reply that the NHS was making it difficult to raise money, and future income would depend on whether flag days were allowed to continue. He also stressed that it was "still true that expenditure in Scotland was small compared with any comparable region in England and Wales".

By November, the Association was overdrawn by £2,000, a sum which was expected to increase by £1,500 per month, with no prospect of any income until the 1948 flag day. The Treasury was unsympathetic. "I should be grateful to know the justification for the excess over the year's provision for which you seek authority". The answer was that it was due to a sharp decline in subscriptions, income from flag days etc, increased expenditure on salaries and the purchase of cars "since private owners were most unwilling to lend their cars".

The gravity of the financial situation can be seen in the following figures:

SNBTA	1943/44	1944/45	1945/46	1946/47	1947/48
Income	£11,860	19,336	13,526	7,033	6,038
Expenditure	£21,910	28,671	23,594	30,577	38,625
Govt grant	£ 7,500	7,500	7,500	22,500	32,000

Even the EBTS, which hitherto had always managed to pay its way, went into debt.

	1943/44	1944/45	1945/46	1946/47	1947/48	1948/49
£	+2,060	+3,197	+1,000	-450	-600	-2,749

The DHS urged the SNBTA to do better but, at the same time, they agreed that flag days, far and away the main source of revenue, should be discontinued. A letter of 27th November 1947, stated:

“I am directed by the Secretary of State to refer to previous correspondence regarding the future of the Blood Transfusion Service and the financial position of the Association and, in particular, your letter of October 30 stating that the Association could not predict what degree of voluntary support they could expect to receive in the future and could only estimate financial requirements from year to year.”

“The accounts of the Association over the past few years and the draft accounts for 1947/47 bring out clearly, on the one hand, the increasing expenditure on the Service which is inevitable in view of the heavy demand for blood and the greater complexity of the work undertaken and, on the other hand, the very substantial fall in income from subscriptions, donations and flag days since the end of the war. The present level of income is substantially below what is desirable for a voluntary and independent organisation and, if voluntary income is to bear to total expenditure anything like the proportion it had in 1946/47, it will have to be increased by about 50%.”

“In the past year, the grant available to the Association from the Exchequer has not proved sufficient. A considerable overdraft has resulted which, it is understood, is increasing at the rate of £2,000 per month. The Secretary of State cannot undertake indefinitely to make up any deficit that the Association may incur from year to year; and if the Association felt that they could not ensure a substantially higher proportion of income from voluntary sources, he would have to consider whether he would be justified in continuing the grant”.

The Political Debate

By this time, the political debate was in full swing and there is little doubt that the DHS was exerting financial pressure to help achieve its political objectives. The twists and turns of attitudes within the DHS are reflected in their correspondence with the SNBTA which was at times conciliatory, at other times frankly threatening. While the officials argued, agonised and discussed, they made life extremely difficult for those in the SNBTA, especially Gumley, who defended the interests of the Association vigorously and unremittingly. This was no mean task for an unpaid, part time volunteer with the might, money and influence of the DHS ranged against him.

Throughout 1946 the DHS was preoccupied with the enormous task of creating the National Health Service, a monumental task, in which the fate of the Blood Transfusion Services was but a small detail. However, once the Scottish Act reached the Statute Book in May 1947, a considerable degree of urgency was injected into reaching a decision. There was an important deadline, July 1948, when, on the "appointed day", the National Health Service would come into being. The fate of the BTS had to be decided before that day.

Very shortly after the Act was passed, the Department wrote to the SNBTA on "Future Arrangements for the Blood Transfusion Service having regard to the Provisions of the NHS (Scotland) Act of 1947". The letter stated that the Secretary of State considered the Regional Hospital Boards should look to the SNBTA for blood and blood products. He "would maintain the identity of the Service, which is of value in the recruitment of voluntary donors, and would involve no major change in an existing organisation which has functioned successfully". The Secretary of State assumed the Association would prefer to continue the present system of supply without direct charge and, on this assumption, he would be prepared in principle to make a grant towards the Association's expenditure.

This was an encouraging letter. Gumley accepted the principles and promised to try to attract a substantial volume of public support. Between then and 27th November, there was a considerable change of heart. The DHS letter of that date carried an implied threat, reinforced by a reminder of the economic difficulties of the SNBTA.

"As the Association will be aware, the Regional Hospital Boards have now been constituted and it would be possible to ask them in due course to take over the responsibility for the provision of blood and blood products."

"The Secretary of State would, however, be reluctant to take this step and he would prefer to consider first, in detail, in what way the Association could be continued and linked with the work of the Boards. He would be glad, therefore, to receive from the Association detailed proposals in this matter on the lines suggested in your letter of 3rd June and to learn also what are the proposals of the Association for maintaining and increasing the level of voluntary subscription with a view to reducing the dependence on the Exchequer grant and retaining the character of a voluntary and independent organisation".

There had always been those within the DHS who were antagonistic to the BTS. The DHS appointed secretary of the SNBTA, Dr. Westwater, wrote in a departmental memo: "I find it a little difficult to see how the voluntary facade can

be maintained and I am not personally convinced that it should though I realise it has some advantages and moreover that it may not be easy to destroy what I tend to regard as the Frankenstein we have made for ourselves". (The earlier Frankenstein remark was made, years earlier, by someone else.)

A letter to the Treasury about this time revealed considerable hostility towards the SNBTA:

"There is some reason to believe that if the Association really made an effort, they could attract more voluntary income. In fact, we are not at present satisfied with the Association's organisation. The Council contains a great many figureheads and the effective work is done by a part time Secretary who must be unable even if he were prepared to give the work the time it needs". "On the whole, we feel if we could strengthen the Association, it might yet justify the voluntary basis because undoubtedly there are great advantages in it. It is not that we believe that, at present, it is extravagant or inefficient because its expenditure and the service it gives seem to compare not unfavourably with England. The difficulty is rather that it is unorganised and uncontrolled".

The grounds for believing that the Service was either unorganised or uncontrolled were not stated. The DHS was greatly exercised about the fund-raising capability of the Association. The income from the whole of Scotland had dropped from a peak of over £19,000 in 1944/45 to just £7,000 in 1946/47. The reasons for this had been explained but were, apparently, not accepted by the DHS. It may have been this "failure" on the part of the Scottish Services which prompted the comment.

Whatever it was, the DHS had a much bigger problem than it were prepared to admit. It had threatened to get the Regional Hospital Boards to take over the functions of the SNBTA but it were far from certain of the wisdom of this action. A letter to the Treasury frankly acknowledges the dilemma. Two alternatives were considered. The first was to limit the grant and force the Association to tap other sources to make up the balance. The second was to take over the Service either directly or through the Hospital Boards. But if the first were adopted, there was "the risk of breakdown in the supply of blood". The second "involves the risk of losing donors or having to pay them and a liability for their whole expenditure instead of a large proportion of it".

Unaware of these internal difficulties, the Regional Directors discussed the Secretary of State's letter of 27th November. They considered that "no matter what effort might be made by the Association, it would be impossible to obtain by voluntary support more than a small amount of the necessary income - at best,

say 10%. There would also be the difficulty that the Association might not be considered as being on entirely good grounds in inviting the public to subscribe to a service which was so closely linked to hospital treatment and which was to become a social service to which everyone had to contribute".

They proposed to widen the representation on the Council by having fifteen members on a central council - five from the RHBs, five from voluntary organisations such as the Red Cross and St Andrews Ambulance Association and five nominated by the Secretary of State (to include people with technical knowledge). "There seemed no need for Regional Committees except possibly for the purpose of donor recruitment in which the help of local voluntary organisations would be required". A Technical Committee like the present one was considered important and they felt the Service should remain a separate entity from the hospital service. They rejected splitting the Service into a Technical side run by the NHS and a voluntary one run by a service such as the Red Cross. "Another possibility would be to allow the Association to continue as a separate entity and to enter into contracts with the RHBs for the supply of blood and blood products. The argument against this was that the voluntary donors might object to blood being 'sold' by the Association to a hospital even though in fact the charge being made was not for the blood but for the services rendered". Finally, the Directors concluded "there appeared to be no reason why the Association under its present Constitution - which was a sound and adaptable one - should not continue to function subject to a certain amount of adjustment to meet the new circumstances".

The DHS did not like this response. "Naturally enough, the Association want to continue as a separate entity free though connected with the new Health Service". "If the Exchequer is to bear 90% of the cost of the Association's work in future, it is difficult to see how we could agree to the Association continuing in substantially its present form. Moreover, the argument that public support will decline after next July is an argument for bringing the BTS within the scope of the NHS". "However economically the Association has functioned in the past, it is difficult to believe that it would not be even more economical if blood transfusion were to be administered by the RHBs". (The unpaid voluntary effort of many people in the Association and the regions was ignored completely). It was felt that the RHBs might take on all the work - "whether this is done or not depends on the extent to which we want to keep the good will of the present Association". There remained some doubts, however, and it was agreed that a further meeting should take place "once we are clearer what the functions of the Association should be".

The DHS itself was under great pressure to resolve the situation at this time because the Health Service was due to come into operation in July. It, in turn exerted unremitting pressure on the SNBTA. Mr. Gumley, the Honorary Secretary of the SNBTA, was recognised at the DHS as the "key man" and the "linch pin" of the organisation. In April 1948, he considered resigning. "When I first became associated with the blood transfusion movement in 1936 as the Honorary Secretary and Treasurer of the Edinburgh Blood Transfusion Service for the purpose of rescuing a small but valuable local service from virtual bankruptcy, the work was of an entirely voluntary and charitable nature and the present highly organised and highly technical set up on a national basis was never envisaged".

The DHS response suggests that it would have welcomed such a move which would certainly have made life easier for the Department. "Gumley wishes to resign and he is the linch pin of the whole organisation. If he retires, the reasons for winding up the Association seem to be stronger". There is no doubt that the SNBTA owes a debt of gratitude to him for staying to see the fight through to the end. Part time and unpaid he may have been, but no one could have done more to preserve the organisation he had served for so long.

Towards an Agreement

A meeting between the SNBTA and the DHS took place on 14th April 1948 with a full discussion of the financial situation and the Constitution but it was not conclusive. Eventually, at the last moment, just before the NHS started, the DHS finally accepted that retention of the Association was better than either of the two alternatives which it had considered. The risks involved in their strategies were too great. What precipitated the climb down was the fear that they would otherwise alienate the donors.

In a letter to the Treasury on 17th June, they stated: "We feel that the governing consideration is still the ability to attract donors on a voluntary basis and that this is something that, in Scotland at any rate, a voluntary association will do better than RHBs. In addition, RHBs have so much on their hands, we would rather not burden them further. The blood transfusion service had to be provided as part of the hospital and specialist services under Section 3 of the Act. Organisation on a national basis was desirable because technical matters required specialised central control and there was a greater degree of elasticity in emergency. Central control was essential since the 85% funding of costs was likely to rise to 95%". They proposed that the existing Executive Committee should be dissolved and replaced by a new Committee with representatives from the five RHBs and one

from the DHS so that control of activities and expenditure would be effectively exercised on behalf of the Secretary of State.

On 28th June, a meeting attended by Lord Rosebery, C P Stewart, Professor Todd, Gumley, Pearson and six representatives from the DHS discussed the future along these lines. They agreed on a letter setting out the changes and believed that no formal agreement would be necessary. Most important, they agreed that the "Department's financial guarantee will be extended up to 100% of the expenditure the Association is unable to meet". Thus, after four years, agreement on the future was concluded and, after the animosity and hostility apparent in the Departmental memos, it is satisfactory to record that a note after this meeting recorded that "our relations at present are very cordial".

A formal letter from the SNBTA to the DHS on 4th November 1948, listed the heads of agreement as follows:

1. There was to be an annual review.
2. The Constitution and autonomy of the Association and its identity as a voluntary and charitable body was unchanged.
3. The Secretary of State was to cover any expenditure shortfall.
4. The Secretary of State was to nominate two representatives to the Executive.
5. Five representatives of the RHBs were also to be on the Executive.

The DHS met Gumley and Pearson in February 1949 to discuss the Association's financial position. The DHS agreed to meet all liabilities as at 4th July 1948, the day on which the health service started, from which time all equipment and moveable property would be owned by the DHS. Just a month later, the man who had started it all in Edinburgh, J R Copland, died after a long illness.

Despite the belief by both sides that it would not be necessary, a formal agreement was in fact signed but not until May 1952 because of delays due to prolonged quibbles. It incorporated the points set out at the meeting of June 1948.

THE ACCOMMODATION CRISIS

"The need is one of the greatest urgency"

The end of the war brought an upheaval in the day to day affairs of the EBTS as well as to the administrative structure. Donations of blood dropped from a wartime peak of nearly 12,000 in 1944/45 to little more than 7,000 in the following year. Demand too was reduced. Plasma in particular was no longer needed in large quantities for the armed forces. However, wartime advances in resuscitation, and the impact of blood banks on medical practice, ensured that the need for blood would remain greatly in excess of prewar demand.

Many changes in personnel took place as men and women were demobilised and returned to pick up the threads of civilian life. C P Stewart resigned to devote himself to his university duties as Clinical Chemist though he did retain a life-long interest in the Blood Transfusion Service. To replace him, a full time Director, Dr. D A C McRae, was appointed. Despite the apparent fall off in volume of work, the pressure on the laboratory staff began to increase as a result of its increasing complexity.

One of the most pressing problems was accommodation. The blood bank had to move. It had been accommodated in Stewart's laboratories since 1939 because research work there had been discontinued for the duration of the war. The University now wanted them back. Similarly, when the Plasma Filtration Unit was established in the basement below the Clinical Laboratory, the Managers of the Infirmary had stipulated that "it was not to be regarded as a permanent but purely as a wartime measure" which would "if required, be removed thereafter, all costs being met by the EBTS".

The Question of a Site

C P Stewart had always been very strongly in favour of closer integration of the technical and the donor services which he felt should be brought together on one site within the Royal Infirmary. As has been noted, this had always been resisted strongly by Copland and he reiterated his objections at a meeting of the EBTS in December 1945. However, when pressed, he was unable to suggest any alternative acceptable site outwith the hospital.

A possible site within the hospital had been identified in November 1945, by C P Stewart and Colonel Stewart. It was the area then occupied by the Dispensary. Its availability was conditional, of course, on permission being granted by the Managers of the Infirmary and the University. The University Court approved the use of "the Lecture Room and anteroom of the Department of Tropical Medicine at present being used as a wartime measure by the Dispensary of the Infirmary" on condition that the blood transfusion service paid the cost of conversion and an annual rent of £75 a year. The Infirmary architect, Mr. Turnbull, estimated that the cost of conversion would be £750 but he was of opinion that this "should be regarded as temporary and that more permanent plans should be made when the Royal Infirmary reconstructed the whole of the medical side"! (Such was the optimism and expectation even before the Health Service that a new hospital would soon be built!)

The use of an existing building was not an ideal solution, and when the Radiology Department acquired a new building within the Infirmary grounds, the Technical Committee of the Scottish Association, in September 1946, agreed that it would be better for the blood transfusion service also to have a new building "of the size and type built for the Radiology Department". These premises would be larger and would allow for expansion of laboratory and other facilities. Altogether it would be "a more suitable and more permanent arrangement". They proposed to build on a site between the two eastmost medical pavilions.

On 1st October, the House and Buildings Committee of the Infirmary considered a letter from the SNBTA which suggested that their requirements would be met by such a building. The letter stated that the existing accommodation had too few rooms, the rooms were too small, did not allow the Service to run efficiently and precluded "the development of new activities which were anticipated". They had considered a site outwith the Infirmary but rejected the idea because of the attraction of donors to the Royal Infirmary - "the principal centre for work of this kind". Other advantages of a site within the hospital were the immediate availability of staff, of facilities for research and teaching and the fact that "the Infirmary is and probably always will be the largest user in the area".

The Developments Committee of the Infirmary also considered the letter and, on 18th December, it recommended "a single storey temporary building between the two westmost medical pavilions". The reasons for choosing the west rather than the east side of the medical corridor are not stated. Accordingly, plans were prepared for a new department between Wards 28 and 31. The EBTS about this time (18th December 1946) noted that "a hut near the nurses' home" had also been considered but was not suitable.

Processing of Plasma

A vital decision, which was to shape the whole future of Edinburgh as a centre for blood transfusion, was taken about this time. In November 1945, Stewart persuaded the Technical Committee that the Unit which made dried plasma should extend its activities to produce fibrin foam and thrombin. These were constituents of plasma which were useful for stopping bleeding, particularly in neurosurgical operations. One of the first actions of the new Director, Dr. McRae, who took up his post on 18th September 1946, was to submit to a meeting of the Technical Committee a memorandum on "Plasma Fractionation and the Drying of Products so Obtained".

The memorandum stated that a plant for drying plasma fractions was highly desirable at a site alternative to the Lister Institute in London and the fact that a Drying Plant existed in Edinburgh was an excellent reason for siting such equipment there. To house the plant, however, it was "very necessary" that a new building be found or built in the Royal Infirmary. McRae stated that, at the request of the Technical Committee, he had visited the Lister Institute and obtained details of the plant there which was "costly but beyond the experimental stage". The estimated cost was £2,579. There was considerable demand for, for example, thrombin, fibrinogen and fibrin foam and "Mr. Dott [the Senior Neurosurgeon in the Infirmary] obtains his supplies from the Lister Institute". "There is only one plant of this kind in Britain at the Lister Institute and it is unlikely that it will be able to meet all demands".

Although the memorandum bore the name of McRae, it is to C P Stewart that the credit must go for bringing this advanced technology to Edinburgh. "Dr. Drury, Director of the Lister Institute, discussed this with my predecessor, Dr. C P Stewart and both agreed that Edinburgh would be a good alternative site". McRae predicted great developments in this field and strongly advocated that the plant should form part of the proposed new building. "It would be feasible to construct a basement to the proposed new Depot to house it and the existing drying plant and the filtration unit". Coming as it did when the demand for dried plasma had fallen markedly, the decision to instal equipment for fractionation was timely as well as important.

With the site and the need for a new building agreed between the Infirmary and the Blood Transfusion Association, Gumley wrote to the DHS in March 1947 inviting them to approve and finance it. He stated the reasons which made a move necessary and informed them that a vacant site between the two eastern (sic) pavilions of the medical block had been agreed and approved by the EBTS which "would move entirely from Gilmore Place".

"Why is it necessary to start this work now?"

The DHS had some reservations. "Your letter gave us some anxiety because it looked as if a further building, even a temporary one, within the precincts of the already very overcrowded site of the Royal Infirmary might prejudice future development and construction". Having been assured that it would not, the Department "was prepared to entertain a proposal of this kind". When they put the case to the Treasury, however, their reply (August 1947) said that both the timing and the cost required "more precise justification". "You do not tell us why a new blood transfusion depot is urgently needed in Edinburgh at the present time - in the present circumstances, I am sure you would agree that anything that is not urgently needed ought to be postponed for the time being. Would you be good enough to explain why it is necessary to start this work now?" As to costs, the Department was asked to justify the cost "as compared with the more modest standards that appear to have sufficed in England and Wales".

The accommodation situation was by this time difficult throughout the country. A report from the Ministry of Health in 1947 stated: "In certain areas, particularly in London, the limits of capacity of blood collection, imposed by accommodation, have almost been reached". Certainly, the situation was becoming critical in Edinburgh. Although the number of donations had fallen markedly in 1946, it was picking up again and likely to continue to do so. When the Department asked for further information for the Treasury, Gumley, who was already under great pressure from the DHS in the negotiations about the whole future of the transfusion service (Chapter 13), displayed, unusually for him, the exasperation and frustration felt by all of those involved. "The need is one of the greatest urgency". "It is impossible to explain or emphasise the seriousness of this matter". "There will be wholesale resignations if there is further delay". When he got no reply, he wrote again on 22nd December: "Kindly let me know how the matter stands - it is one of the greatest urgency. In the matter of laboratory accommodation, it looks as if we are heading for a first class crisis". This time, the delay was not the fault of the Department as the Treasury letter of 24th January 1948 acknowledged. "Re our talk ten days ago, your letter and two reminders". This letter gave formal approval to a grant of £21,600 - £17,600 for the building and £4,000 for equipment.

In GRO-A 1947, after only fourteen months in post, Dr. McRae died GRO-A
GRO-A at the age of 32. C P Stewart again took over the Directorship until Dr. R A Cumming was appointed on 1st April 1948. That month, a meeting of representatives from the SNBTA, the EBTS, the Royal Infirmary and the DHS took place in the Clinical Laboratory and plans for the new building were approved. They were put out to tender and excavation of the

site started on 14th June 1948 - three years from the time the need for the new premises had first been expressed. The target completion date was the autumn of 1949 but it was early in 1950 before the building was occupied and two years more before the fractionation unit was installed and in production.

Part of the reason for the delay in starting fractionation was the speed of advance in knowledge. New fractions were becoming available and production techniques were improving all the time. Dr. Cumming was prompted to remark that it was "just as well we have been marking time on equipment for the lab here". At the end of the war, the products in greatest demand were fibrin, fibrinogen and thrombin but, by the time the Edinburgh plant came into production, gammaglobulin and antihæmophilic (AH) fraction were the main fractions in use. To run the new unit, an experienced biochemist, Dr. Drummond Ellis, "the only available person then in the U.K. with the necessary expertise" was appointed Deputy Director in June 1950.

On his appointment, Ellis planned the installations and indeed designed much of the equipment himself. The new plans, however, meant that more space had to be found in the new building. Meantime, the old drying plant was transferred to the new building from its cellar and modified to operate on the new, non-toxic freon gases. Its copperwork gleaming and with a fresh coat of paint, it continued in constant operation.

The new building was opened by the Queen (the present Queen Mother) in September 1950. On the day of the official opening, a lorry-load of red carpet and potted plants was laid along the upper and lower corridors of the centre. While the Queen was being shown the new drying plant room, a squad of workmen was bundling the carpets and plants from upstairs back into the lorry. She left by the back door and within the short time taken to reach the nearby nurses' home, the venue of her next visit, the same carpets and potted plants were awaiting her arrival!

The premises were completed not a moment too soon. The number of blood donations had doubled between 1947 and 1951, reaching a figure then of 1,200 to 1,400 donors a month. The complexity and the volume of the work began to escalate. It meant that, for a time, the conditions for the staff, who now numbered fifty, became more tolerable. But Dr. Cumming's hope that "a peak will shortly be reached and time will be available to consolidate", was a vain hope. In only ten years, the service would have outgrown the new premises!

15

FROM 1950 TO 1985

"The new unit will last ten years"

The establishment of the blood products unit marked the start of a new era in blood transfusion in Edinburgh. There was more and more emphasis on the use of plasma fractions and the art of blood transfusion became a science of ever increasing complexity. The turbulent decade of the forties ended with the Service securely funded for the first time. This enabled it to meet the increasing demands for research and development. Protein chemistry, immunology and virology became integral parts of a Service whose horizons were constantly expanding as new therapeutic opportunities presented themselves. At the same time, the Service had to cope with the many new developments in medicine and surgery which demanded increasing quantities of blood for transfusion or protein fractionation.

The Rise in Demand for Whole Blood

The causes of the greater requirement for whole blood were varied but one important factor was the increasing complexity and extent of the surgical procedures being undertaken. New anaesthetic methods, antibiotics and resuscitation with blood and other fluids, made it possible to carry out very major surgical operations on very ill or seriously injured people. They also permitted a considerable extension of the scope of surgery. During the 1950s and 1960s, major operations on the heart, lungs and large blood vessels first became possible and then commonplace.

The effect on the blood transfusion service was considerable. In the first place, and most obviously, there was the need for many more blood donations. But the BTS also had to keep much larger stocks of blood of each group since any one patient might require many litres of blood. An additional strain was that these procedures were often of an emergency nature and the blood had to be matched and issued in the middle of the night.

Blood was also needed in substantial amounts for new techniques such as renal dialysis and open heart operations. The first open heart operation in Edinburgh was carried out on Sunday, 15th January 1961. In these operations, the circulation

to the heart and lungs is bypassed through a machine which oxygenates the blood (the function of the lungs) and pumps it round the body (the function of the heart). To prevent blood clotting in this bypass circuit, it is necessary to inject an anticoagulant (heparin) into the patient, a process which must be reversed at the end of the operation.

In the early operations, twenty pints of fresh blood were obtained for each operation. Eight were needed to prime the rather primitive oxygenator and twelve for blood loss during the operation. The Service used to call about 20-30 donors in advance of each operation for grouping and preliminary screening in case any of the stipulated twenty did not turn up or were "rejected". The donors then had to attend about 8 a.m. on the morning of operation. The start of each operation was delayed until word was received that the donors had arrived and sufficient blood was on its way to the operating theatre. In a way, with the advent of open heart surgery, the wheel had turned full circle. Direct transfusion had given way to the use of stored blood and now donors were attending to give blood at the time of operation for a specific patient!

Fortunately, the second generation of oxygenators required little or no blood to prime and it was no longer necessary to use fresh blood. So blood was withdrawn on the day prior to operation and the number of donors could be reduced to fourteen - still a large number for each patient.

Open heart surgery was a considerable challenge to the BTS. It was bad enough having to provide enough blood for any one patient, especially if he or she had a rare blood group. But sometimes, when the Service was already committed to calling up specific donors, there was a last minute change of patient.

Bleeding was a major complication of heart operations. Sometimes it was due to technical (surgical) difficulties or to loss of clotting factors. Sometimes, it occurred because of difficulties associated with the reversal of the injected heparin, which had the effect of preventing the patient's blood from clotting.

Dr. Howard Davies was originally appointed by the Medical Research Council as a Research Fellow and later became the first Consultant Haematologist in Edinburgh Royal Infirmary. He had a special interest in the clotting problems resulting from haemophilia, and gave valuable assistance to the surgical team. One measure of the magnitude of the involvement of the BTS in this one aspect of haematology is that the laboratories carried out 13,000 tests for coagulation in 1966.

As a result of these and other developments, the demand for whole blood rose. For example, in the Royal Infirmary, blood usage rose from 349 units in 1938/39 to 5,177 in 1957/58. In the Simpson Memorial Maternity Pavilion, the respective figures for the same years were 68 and 729. Whole blood consumption continued to increase, reaching a peak about 1970.

By 1960, most patients were routinely cross-matched prior to all types of major surgery and blood was available in the operating theatre in case of need. About 32,000 units were requested for some 10,000 patients in 1962. It was then realised that, of the blood issued, only 30% was actually used. The rest did not go to waste since the unused blood was returned to the BTS. The BTS, however, was obliged to keep larger stores of blood than were necessary. Since that time, "education" of the medical staff has led to a more prudent policy of "grouping and screening" before surgery, blood being requested only when required. At the same time, the process of testing the blood became much more complex. For instance, it was found that no less than 3 - 5% of the population had unusual antibodies which could cause transfusion reactions. The identification of these people and the provision of suitable blood were far from simple matters.

The Rhesus Factor and its Effects

The discovery of the Rhesus factor made the work of the Transfusion Service more complicated. It is present in 85% of people. If blood with the D antigen (Rhesus positive) is transfused into a patient without that factor (Rhesus negative), the D antigen acts as an unwanted invader. Antibodies are formed to destroy it. A subsequent transfusion of Rh positive blood will then provoke a transfusion reaction. This provided an explanation for some hitherto unexplained reactions, particularly in patients who had had a previous uneventful transfusion.

As a result of the discovery of the Rh factor, it became necessary to test all donors and prospective recipients of blood for the presence of the D antigen, in addition to the usual A and B factors. But, since the minority of patients who were D negative had to have D negative blood, the BTS now had to keep in the bank, a stock of D negative blood as well as D positive of all the major ABO groups. A much bigger donor pool was thus required, the amount of blood stored had to be increased and the work of the Blood Transfusion Centre was greatly increased. By 1945 it was "practically the whole time function of a specially trained member of staff to test for Rh factor".

That was just the beginning. It was then realised that the serious condition known as haemolytic disease of the newborn was due to Rhesus incompatibility. This mysterious disease affected newborn children in some families, but never

the first born. A healthy first infant would be followed by a deeply jaundiced infant and then possibly by successive stillbirths. The condition had been thought by some to be due to congenital syphilis, a diagnosis which must have increased the anguish already suffered by the bereaved parents. In fact, it occurs when a D positive father has a D positive infant to a D negative mother. Some of the foetal blood escapes into the mother's circulation which causes antibodies to be formed. In subsequent pregnancies, the level of antibodies in the mother's blood may be sufficient to haemolyse (destroy) the infant's blood. Obviously, only the children of D negative mothers were at risk. To anticipate the condition, the decision was taken in 1946 to screen all antenatal women routinely. That meant that 1,200 to 1,500 of these tests were performed each month.

Prediction of those at risk did not prevent or treat the condition. It could only warn of its likelihood. Treatment was the next stage. The jaundiced children died because their blood was destroyed by their mother's blood. The technique of exchange transfusion (transfusing fresh blood which would not be destroyed) was pioneered in Boston and the first time it was carried out in Edinburgh was in 1949. By 1965, 55 exchange transfusions were being done each year in addition to 2,422 serum bilirubin estimations on over 500 babies. (This is a test to find out if the baby's blood is being destroyed.) Exchange transfusion reduced the mortality of affected babies to 25%. Some still died in the womb, but when intrauterine transfusion was introduced in New Zealand in 1963, the mortality was further reduced to 10%.

The ultimate answer was prevention. The mother produces antibodies to the baby's blood. If, however, an injection of anti-D globulin is given to the mother after delivery, any D cells from the baby will be destroyed before they can elicit an immune reaction. At first, anti-D globulin was obtained from affected mothers but, when the preventive measures began to work, it was obtained from male volunteers who had been injected with D positive cells to produce anti-D plasma. The first Scottish volunteers were from Inverness and the first batch of 70 litres of anti-D plasma from there was sent to Edinburgh on 1st August 1969. When some of the men were apparently slow to develop antibodies, the director, Dr. Cook wrote: "I feel that the anti-D content of some of these men will improve, like good wine, with age".

Later, when the Edinburgh Service joined in, two of the early volunteers were members of the staff of the EBTS. Dr. Cumming's blood was Group 0, D negative and that of one of his technicians, Frank Cochrane, was Group A, D negative. Both were immunised to form anti-D serum. They had a bet on which one would produce antibodies first and Dr. Cumming won! Some of the early trials of this successful technique, which has eliminated the scourge of haemolytic disease of

the newborn, were carried out in Edinburgh in the late 1960s and early 1970s. The discovery of a blood antigen thus led to a significant advance in medical treatment.

Plasma Fractions

The story of plasma over the past 35 years has been one of the progressive refinement of its fractions. Many specific factors have been isolated of which factor VIII and factor IX are among the most important. Haemophilia is a serious bleeding disease which is due to the absence of factor VIII. Early plasma fractions were rather crude and, at first, antihæmophilic globulin (AHG) was used to treat these patients. Over the years, extraction was improved and the active ingredient, factor VIII, isolated. This was a great break-through in the treatment of haemophilia. Since it was first produced, the quality and yield have improved. It now has the advantage of bulk consistency because it is obtained from a large pooled plasma batch. The vials are checked for potency and sterility.

Factor VIII transformed the lives of hæmophiliacs. Formerly they died, usually before the age of twenty, often crippled and at risk from any accident or surgical operation. Now they have an almost normal life expectancy. Many, however, have had to pay a heavy price for this progress as will be seen.

Dr. Davies worked very closely with Dr. Cumming, and the treatment of hæmophiliac patients was a major part of his job. A consequence of being able to treat these patients was the identification of patients with similar disorders (eg factor IX deficiency) or with less than the full blown disease. Another consequence was that the demand for factor VIII rather than the demand for blood became the prime determinant of the amount of donor blood required. For example, it requires 1,000 blood donations to provide sufficient factor VIII for one patient for one year. Sixty hæmophiliacs in Scotland, therefore, need 60,000 donations per year. It is to the credit of the Service that this demand has been met from local donors and all the blood processed locally. Table 15.1 shows how the use of plasma expanded and then exceeded that of whole blood in Scotland.

Year	Units used as Whole Blood	Units used as Processed Blood
1966	99,765	68,515
1967	105,323	73,939
1968	105,421	73,897
1969	107,117	80,937
1970	104,773	97,109
1971	100,852	85,400
1972	95,699	88,513
1973	89,151	100,237

Table 15.1 The amount of whole blood and processed blood used in Scotland between 1966 and 1973.

Some of the production techniques for plasma fractions were developed in Edinburgh. The 6,000 gallon capacity tanks with very large centrifuges were done away with and replaced by pipes where plasma, alcohol and mild acids were brought together in precise amounts controlled by computers, as they flowed to the centrifuge. Preparation time was reduced from one week to two hours. By the 1970s, fractionation was being carried out in tonne quantities. So much blood was being used for fractionation that there was a problem in using the red blood cells.

In 1975, a major evaluation was carried out to improve the utilisation of red cells and increase the plasma yield from the existing donor input. Since then, by agreement with the clinicians, the first two units of blood supplied are in the form of "packed cells" from which plasma has been removed. By this means red cell usage was increased and the plasma available for fractionation was doubled from 5,000 litres to 10,000 litres between 1974 and 1975. Plasmapheresis, in which blood is taken from a donor, the red cells being returned to the donor and the plasma alone retained, is another method of increasing plasma availability, especially from those with a high level of desirable antibodies.

Factors VIII and IX are only two of the many fractions which are used. The BTS provides Plasma Protein Fraction (PPF which is plasma without fibrinogen or gamma globulin), albumin, fibrinogen, concentrates of several factors, platelets, white blood cells, "washed" red cells etc, all of which have specific important uses. PPF is used to increase the blood volume, especially in burned patients; albumin in medical conditions in which the albumin level is low; fibrinogen in massive bleeding; platelets when their level is reduced by disease or toxins; white cells in severe infections or when the cells have been destroyed by, e.g, irradiation; and washed red cells in some complex immunological situations. The globulins are used for a variety of immunisations. Today, one can select which product is needed by any particular patient. Indeed, parts of a donation from one donor may go to many recipients.

One will not be surprised that, with all these changes, space became a problem again, quite soon after the opening of the Blood Products Unit in 1950. Only four years later, it was "at the limit of capacity for further expansion to work without major addition to accommodation". In 1957, the situation was, once again, described as "critical". In the following year, a £70,000 extension was planned, the work load having quadrupled since 1950. This new unit, in the Royal Infirmary, was opened in 1961, with the modest expectation that it would "last ten years". The estimate was about right. The cycle repeated itself so that, by 1967, laboratory facilities were once more inadequate and the situation in 1970 was again "critical".

In the early 1970s, a new Unit for fractionation was opened at Liberton and the name changed from the Blood Products Unit to the Plasma Fractionation Unit. Even with the new unit, space was so short in the Infirmary that, as a temporary measure, an empty property at 21 Lauriston Place was acquired and opened in 1972. It housed a donor suite, offices and laboratories for transplantation, immunology, virology and blood components. Further expansion took place in the 1980s with the acquisition of a blood components laboratory in the Cowgate. The latest development has been the opening of the present offices and laboratories in Phase I of the Royal Infirmary in August 1982.

The Problem of Infection

The danger of spreading infection, especially jaundice, by blood or blood products was recognised during the war. It was brought home with a vengeance in 1970 when a young technician and a surgeon working with kidney dialysis in Edinburgh died of hepatitis. The disease was acquired from the blood of an infected donor. Following this tragedy, screening methods were developed to detect hepatitis and they have been successful in preventing any similar catastrophe. The 1980s, however, brought a new and hitherto unknown epidemic - AIDS.

It will be appreciated that, because of the amount of factor VIII needed by haemophiliac patients, they are particularly vulnerable to these infections and many, especially in America, have developed hepatitis or AIDS. A small group of patients, less than twenty, appears to have developed HIV infection (AIDS) following exposure to a single batch of factor VIII prepared in Scotland. That occurred very shortly before the introduction of donor screening (October 1985) and heat treatment of the batches, since when no further infections have taken place. The danger of infection has been greater with foreign supplies of factor VIII and, in the United Kingdom as a whole, several hundred haemophiliacs have developed HIV antibody. An exciting new era seems imminent, however, because factor VIII has now been produced in the U.S. by genetic engineering but it will be some time before it is available commercially. The Aids epidemic, however, has pointed out, once again, the great potential danger associated with handling or receiving blood or blood products and the need for eternal vigilance and scrupulous care.

The Changing Scene

Many other developments have taken place, medical, technical and organisational. For instance, as a result of the expertise acquired in immunology, the Service became involved in organ transplantation. Tissue typing, which is essential to find the right "match" for an organ which is being donated, has been

carried out by the EBTS since the first successful kidney transplant in Britain was carried out in Edinburgh in October 1960. Tests are also carried out subsequent to operation to detect and prevent rejection. Nowadays, transplants of kidneys, bone marrow and splenic tissue are carried out in Edinburgh.

In 1972, plastic packs replaced glass bottles, allowing much greater flexibility in the handling and processing of blood. The packs enabled the separation of plasma from red cells without exposing the blood to the air with the consequent risk of contamination.

In 1980, computerisation was introduced to organise data flow. Computers provide a detailed analysis of donor and recipient and deal with many other aspects of blood handling. They are of particular importance in documenting the origin and distribution of the many products from every single unit of blood. The whole centre has now become dependent on computers which help with everything from calling up donors to controlling the blood testing equipment, from printing publicity posters to keeping track of the blood bank stock.

Many changes in personnel occurred during this period. Dr. Cumming retired in 1973 and was succeeded by Dr. (now Professor) Cash who became National Director in 1979. He, in turn, was succeeded in the EBTS by Dr. McClelland while, in the fractionation unit, Dr. Watt took over from Dr. Ellis.

A major organisational change occurred in 1974 when the Common Services Agency took over responsibility for the Service from the Scottish Home and Health Department. A year later, "the Constitution and Rules of the Edinburgh Blood Transfusion Service, adopted in 1938" were altered so that the Service became the "Edinburgh and South-East Scotland Blood Transfusion Association".

The EBTS, later the Edinburgh and South East Scotland BTS, was chaired by W J Stuart from 1936 until his death in 1959. Thereafter, James Graham, "Sandy" Alexander and Ronald Girdwood continued the very considerable voluntary work that this entails. Over that time, the complexity of the blood processing activities became such that it was realised that the BTS should be an entirely separate organisation dealing with the recruitment of donors, the withdrawal and processing of blood and blood products and all other activities which one might expect in a major service of this nature. However, it was decided to retain the Edinburgh and South East Scotland Blood Transfusion Association as a separate voluntary body with a committee consisting of donors, donor organisers and representatives of the community and of the medical profession under the Chairmanship of Professor Girdwood to "promote the interests of the voluntary

donors of blood and the voluntary helpers and to encourage and support the Blood Transfusion Service in this and other Regions of Scotland”.

This arrangement, with two independent organisations working amicably together, is unique in Britain and perhaps the world. One of the most important consequences is that the welfare of donors can be safeguarded better since the Association is independent of the Service and is not subject, therefore, to the same pressures.

Although this has been but a sketchy outline of the activities of the last 35 years, enough has been said to indicate the scale of the expansion of the work involved in blood transfusion. It is not difficult to realise why several extensions of space became necessary; why the staff numbers have increased from dozens to hundreds; why there were serious problems in recruiting and training sufficient senior staff; why there should now be a considerable involvement in research; or why the cost of providing the service should have risen to more than three million pounds per year. It is a safe prediction that the process is likely to continue for the foreseeable future.

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DONORS

"If more blood was needed, we worked jolly hard to get it"

In the fifty years of the Edinburgh and South East Scotland Blood Transfusion Service, the inhabitants of the area have donated a total of two million units of blood - a staggering amount. But, as the demand for blood has grown, the burden of satisfying it has become ever more difficult. It was one thing to find twenty donors in a year, quite another to supply over 80,000 units. Moreover, that figure increases each year. The task is made more difficult by the fact that the donor population is not a static group. Donors move away, fall ill, get older. They have to be replaced as well as added to, and they form a growing proportion of the adult population.

The Person

The type of person who has donated blood has changed somewhat over the years. Prior to 1930, donors were almost exclusively male. From then until the war, men predominated, outnumbering women by about two or three to one. When the war started, however, the young men were called up for military service and, throughout the war, more women than men gave blood. Since then, men have again predominated but by only a small margin (55/45).

The age also has varied. Donors were young before the war but, in 1948, it was noted that most were "middle aged". More recently, they have again tended to be young. Dr. Sheena Parker, in 1976, found that 32% were under 30 years of age and 62% were under 45. In 1984, the average age of 62,000 donors was 34.2 years.

Before the war, a factor which limited the donor population was that the donor had to be available at any time and be prepared to leave home or work, immediately, to give blood. Blood banking removed that restriction and blood could be given at a convenient time and place.

Copland tried to target special groups such as Rover Scouts but without much success. His best response came from members of the general public. In her survey, Parker found that there was a relatively low proportion of married women, housewives or people in part-time employment. She attributed this to the greater

difficulty these groups had in attending sessions. There was also an under-representation of people from social classes I, IV and V, perhaps for the same reason. Students, on the other hand, were "good" donors (over 13%).

The motivation

Donor motivation has been studied for many years and the conclusion has almost invariably been that "giving blood fulfils a social requirement. It is also intrinsically rewarding, the individual feels good through having his or her needs as a responsible member of society satisfied" (MacAskill et al 1984).

In the early years, when the donor was a relative or a medical student, there was a very personal and immediate reason for giving blood. In the 1930s, this personal factor was continued since the donor went to the hospital to give blood for a specific patient and later received a report on that patient's progress. It was often an exciting and sometimes an emotional experience. One of the earliest Edinburgh donors, Henry Coghill, who helped Copland run the service, described how on one occasion: "I was asked to take off my jacket and waistcoat and roll up my shirt sleeves. I was then put into whites and taken into a room on a trolley. When I looked around me, I found that I was in an operating theatre and, on another trolley alongside mine, there lay a very sick looking young man. There was a rather strained silence while we looked at each other and I asked him what he was doing in the theatre. Before he could reply, a tall man, dressed in white and wearing long rubber boots, entered the theatre and, with the help of a sister, began to draw a pint of blood from my right arm. While this gentleman was busy doing this, I quietly asked who the sick looking young man was and he told me that the young man was about to have one of his legs amputated and that he was the surgeon who was going to perform the operation".

The dramatic nature of donation was thought to be enjoyed by some of the donors. The Scotsman commented in 1937 on the newly established blood bank in Chicago: "The contribution to a depot of a pint of blood once or twice yearly might lack the romance and excitement which attaches to the sudden call and a hurried journey to hospital. It would also lack its inconvenience. Whether the prospect of contributing to an impersonal pool, rather than to an individual sufferer, would dry up the springs of altruism, remains to be seen".

The huge increase in donors at the time the blood bank was established showed beyond doubt that contributing to an impersonal pool did not in fact dry up the springs of altruism. People flocked to give blood, spurred on by the thought of personal contribution at a time of common danger. Gone were the drama and sense of contact with a patient but, instead, there was a camaraderie and unity in

the country, such as has seldom been seen. It was another way of "doing one's bit" for the war effort.

The fact that donations have increased nearly sixteenfold since the war shows that these were not the main reasons for volunteering. It is generally recognised that many first time donors are persuaded by friends or colleagues to donate and often attend for the first time with them. The best recruiter may be another donor. Propaganda does not seem to play much part in first donations but appeals on human grounds are more effective than appeals on medical grounds. Cash believed that some people are "good samaritans" but that the vast majority were "ordinary folk who do not see themselves as good samaritans but donate because they understand modern medicine cannot function without blood transfusion". Donors nowadays seem to be "young, modern and socially committed".

Rewards

Rewards are of little value in recruiting Scottish donors, it would seem. One "inducement" offered to donors (if it can be called that) is the award of a certificate or badge. In prewar days, Copland gave a certificate to donors and Oliver gave a badge. Since 1951, a national scheme has been in operation. A bronze badge is awarded for ten donations, a silver one for 25 and a gold for 50. In her survey, Parker asked donors and others what they felt about inducements. Her conclusions were that "there seemed to be a general sense of disapproval in the replies that donors should even be asked about reward schemes". "There is no reason to suppose that a reward scheme would at all influence recruitment among ex-donors or the general population. A reward scheme would be very unpopular, unnecessary and possibly counterproductive".

Selling blood might seem to be the ultimate inducement but Parker said that "the concept of selling blood is alien to donors". Nevertheless, this has been a matter which has been debated, time and again, throughout the history of blood transfusion. The originators of the first donor panels, Oliver and Copland, were both idealists. Oliver was a member of the Red Cross and Copland of the Crusader organisation. Both saw blood donation as a form of service to their fellow men and not as a commercial transaction.

Oliver positively distrusted those who gave their blood for money. He stated: "Payment attracts a very different class of person from the voluntary donor. In Belgium, 38 out of 97 volunteers were rejected for various reasons. In London, 22 were rejected out of 591". More recently, similar reservations have been expressed about blood or blood products available commercially from other countries, which were thought to have a higher risk of hepatitis or AIDS.

The first occasion in Edinburgh on which the issue was actually debated was when the EBTS was formed in 1936. A committee formed to consider the matter reported: "The question of charging patients with a fee for each transfusion was fully discussed but it was decided that, in the meantime, this is impracticable in the case of the Royal Infirmary and similar charitable institutions".

The SAC Subcommittee in 1939, the War Emergency Expenditure Committee in 1940, the Technical Committee of the SNBTA in 1944 and both the Ministry of Health and the DHS in 1945, all argued the question of payment. The idea was favoured by government but rejected by those directly involved with the transfusion service. Government went along with rejection because they, ultimately, were afraid of losing the good will of the donors. In February 1948, C P Stewart raised the question of possible payment of donors under the new Act but Copland argued that many donors would be lost if that were to happen.

In recent times, the issue was raised by the Labour Member of Parliament, Mr. George Foulkes. With the resurgence of private medical practice, Mr. Foulkes tried to make private hospitals pay for blood - or at least for the cost of handling. This was exactly the same argument as had been used by the government in 1945 and the result was the same - at first. The suggestion foundered because of the legitimate fear that donors upon whose good will the whole service depends would withdraw their support. A charge on blood given voluntarily would seem like an attempt to make money out of other people's generosity. Despite this, a "handling charge" has been levied since 1985 by the government for blood or blood products supplied to the private sector.

Periods of shortage

From time to time, shortages did occur. Before the war, these were met by bleeding the donors more frequently, sometimes as often as once every two months. Copland's Report of February 1937 read: "On the morning of 9th (January), only one universal donor was available. He was used at 5.30 am. Two other calls by 11.30 am were satisfied by universal donors whose two months were not quite up and, at one o'clock that day, Dr. Logan sent me the new list since when we have had no difficulty in being prepared for all calls".

There was a time of real shortage in 1942/43 when the plasma drying unit opened. This coincided with a smallpox epidemic in Edinburgh and "an ever increasing number of calls for blood from civilian hospitals and nursing homes". The situation was adjudged sufficiently serious for Sir John Fraser to issue a national appeal for economy in the use of blood.

When the war ended, many people thought that the need for blood no longer existed. Donor attendances fell off. In England and Wales, the attendance rate for donors summoned for bleeding fell from a wartime average of 55-65% to about 40%. The Technical Committee of the SNBTA pressed for an urgent campaign to recruit new donors and money was sought from government for publicity. The Treasury, however, thought that the cost was excessive and suggested that the Scottish Service should use advertising material provided for the English service. "Why don't you use Ministry of Information material? Surely there is not all that difference between Scotch (sic!) and English blood!"

The years 1946 to 1949 are the only time in the first fifty years of the EBTS when there was a significant fall in blood donations. As demand began to grow again, Dr. Cumming "turned the heat on Helen White". She and her staff reopened the wartime sources outside Edinburgh. They also recalled previous local organisers and recruited new ones. By sheer hard work, they improved the supply. Asked how she dealt with shortages, she replied: "We worked jolly hard" to overcome them. Like Copland, she was dedicated to the Service and to meeting all the demands put upon it.

Another period of national shortage occurred in 1967/68 when it was said that operations were being postponed as a result. This allegation provoked considerable discussion among economists in particular about the economics of charity and the question of whether paying donors might improve the supply. The argument, which developed into one between "altruism" and "market forces", generated more heat than light. In the end, there was insufficient evidence to allow of any definitive conclusion. However, the supply since then has increased markedly without recourse to payment for donations.

Edinburgh's Contribution

Table 16.1 shows the rise in giving, in Scotland, between 1949 and 1982. The proportion of the population who donated blood in those years rose from 8.4 per 1,000 in 1949 to 57 per 1,000 in 1982. Table 16.2 shows that these figures are considerably in excess of the rate of contribution in England and Wales or in Northern Ireland.

Rate per 1,000 of Population

Year	Units of Blood Given	Rate per 1,000 of Population
1949	43,000	8.4
1954	97,000	18.9
1959	131,000	25.3
1964	164,000	31.5
1969	208,000	40.1
1974	231,000	44.4
1979	280,000	54.0
1982	297,000	57.2

Table 16.1 Total donations of blood in Scotland 1949-1982 and the rate of donation per 1,000 of population.

Rate per 1,000 of Population

Year	Scotland	England & Wales	Northern Ireland
1949	8.4	10.4	5.5
1954	18.9	15.8	12.1
1959	25.3	21.1	18.8
1964	31.5	26.2	24.2
1969	40.1	30.7	30.9
1974	44.4	35.1	36.2
1979	54.0	39.4	44.7
1982	57.2	42.0	43.5

Table 16.2 Rate of donation per 1,000 of population of Scotland compared to England & Wales or Northern Ireland.

A comparison of the figures for South East Scotland relative to those for the rest of Scotland is even more revealing. Not surprisingly, Edinburgh dominated at the beginning of the war before the other areas had properly established their blood banks. By 1942, it was contributing little more than its due share. Since 1949, however, South East Scotland has been consistently more generous in its donations than the rest of Scotland. Indeed it probably has one of the highest donation rates in the world. Table 16.3 shows the rate per 1,000 of population of South East Scotland relative to the rest of Scotland.

Rate per 1,000 of Population

Year	Scotland	SouthEast Scotland	Rest of Scotland
1949	8.4	10	8.0
1954	18.9	22	18.0
1959	25.3	32	23.0
1964	31.5	43	28.5
1969	40.1	51	37.0
1974	44.4	50	42.0
1979	54.0	63	51.5
1982	57.2	61	54.5

Table 16.3 Rate of donation per 1,000 of population of Edinburgh and South East Scotland relative to the rest of Scotland.

Why should the record of giving be better in Scotland than in England and Wales? In notes issued to the press for guidance on the occasion of the Millionth Donor celebrations in England and Wales (22nd November 1963), it was stated that it could be explained partly by the scattered population, partly by the smaller population which needed a larger panel of donors to satisfy the need for rare blood groups and partly because large quantities of blood were required for the fractionation unit in Edinburgh. These do not seem very convincing reasons. Other parts of the United Kingdom have scattered populations and there is more than the one fractionation unit in the country. It is more probable that the donor organiser network and the enthusiasm and commitment of those involved are important factors. Of the Scottish regions, the East and the South East have contributed more than would have been expected on a per capita basis, the North and the North East about average and the West, which combines industrial areas with very remote rural areas, a little less than average. It may also be that the West had a greater proportion of social groups IV and V which, in the South East, gave less blood than groups II and III.

All areas in Scotland have consistently been good donors and the figures have kept going up and up, despite increasingly efficient use of blood. In 1956, the Senior Administrative Medical Officer of South East Scotland Regional Hospital Board is quoted as saying: "I cannot see any likelihood of a marked increase in the demand for blood" to which an obviously exasperated Dr. Cumming retorted: "It will take more than an expression of uninformed opinion to flatten out the accompanying graph". That graph still shows no sign of levelling off and, as Parker said, "it seems unlikely that this rapid growth pattern will change in the near future. There appears to be no predictable limit to demand and potential demand

in countries like Britain". The effect of AIDS may have caused change but whether that is temporary or permanent, time alone will tell.

PERSONALITIES OF THE EDINBURGH SERVICE

"How well run your unit is!"

The EBTS is one of the foremost in the country and indeed it is one of the most successful in the world. It is one of the very few which is self-sufficient to the point of being a net "exporter" of blood products to other parts of the country. That such a unit should be located in Edinburgh owes much to Jack Copland. That it should be a leader in technical terms must be attributed to CP Stewart and Robert Cumming.

Jack Copland

Copland, a GRO-C by birth, gave Edinburgh a head start in matters of blood transfusion in Scotland by not only starting the Service but sustaining it through many trials and vicissitudes. Edinburgh and London were the only major donor organisations in Britain till 1939 and the similarities between them suggest that Edinburgh must have been modelled, to some extent, on the preexisting London Service. There were differences, of course, and there was undoubtedly an interchange of ideas to the mutual benefit of both Services. In his espousal of the cause of blood transfusion, Copland displayed a visionary zeal and tenacity which made him a remarkable man. He was a great humanitarian and his selfless devotion to the cause ensured that Edinburgh and the South East of Scotland had an efficient donor organisation available to meet even the emergency of war. The introduction of blood banks removed Copland from the pivotal position he had previously enjoyed but he devoted his considerable energies to providing donors and finance on a national scale. An accident during the war and ill health afterwards, however, diminished the role he was able to play in the last few years of his life.

Helen White

It is to Helen White that the credit must go for developing the organisation Copland started. Starting in 1936 as a part time secretary, she succeeded Copland in the EBTS in 1940 when he became national organiser. They were both involved in the massive expansion of the Service throughout Scotland in 1939 and 1940 but

Miss White's major achievement was the creation of voluntary organisers in all parts of Edinburgh and the South East of Scotland. The network is highly successful and highly efficient and characterised by its friendliness. Her humanity showed in many little ways. For instance, before the war, she always used stamps for letters to donors and refused to have franking machines because, she thought, people do not like getting official letters. The atmosphere she created was expressed by one donor who wrote: "I have been a donor for almost four years and have often wondered if anyone ever tells you how well run your unit is. It is efficient, yes, but so much more than that. All your staff are so friendly and charming that one feels that each one must have served a long apprenticeship elsewhere before being transferred to the corps d'elite! Your correspondence too exhibits the same gracious approach to donors. You make one's calls at the unit an occasion not to be missed for anything!"

A kindly, thoughtful person, she had considerable personal authority though she was always self-effacing and shunned personal publicity and personal credit. Her care and concern for the individual organiser and the individual donor and her unswerving faith in the voluntary donor system characterised her tenure as Regional Organiser. Since she retired in 1974, she has retained her interest and involvement with the Edinburgh and South East Scotland Blood Transfusion Association of which she is an Honorary Life Member.

Charles Gumley

Charles Gumley's contribution was enormous. A son of the then Lord Provost, he was appointed Honorary Secretary and Treasurer of the EBTS when it was founded in 1936. In 1940, he became Secretary of the SNBTA when that body was formed. He resigned in 1959 on his appointment as Chairman of the (then) South-East Scotland Regional Hospital Board.

He played a crucial role in the blood transfusion scene. His dogged support for the Service was a most important factor in the decision the DHS ultimately took to leave the Service more or less as it was. He was highly respected by the officials of the DHS who would have found things much easier had he not been there to stand up for its interests. He was an ideal administrator. He made it his business to keep in close touch with every detail of blood transfusion practice and he was responsive to change. He had the refreshing gift of making rapid decisions with a minimum of words and time - never more so than when the problem was ventilated by telephone. According to Cumming, he and Lord Rosebery did more for the progress of the Service than any other "administrators". They were on friendly personal terms and Cumming suspected that "they had worked out the decisions for the Executive Committee agenda prior to the meeting!" After he

left the SNBTA, he continued to keep a considerable interest in the Service even when severely handicapped by illness. Blood transfusion in Edinburgh owes much to him.

W J Stuart

W J Stuart was another good servant of the Edinburgh Blood Transfusion Service. He was appointed as the first Chairman of its Executive Committee when it was formed in 1936 and he held this post until his death in 1959. He was also Chairman of the Executive Committee of the SNBTA. Stuart was a surgeon in Edinburgh Royal Infirmary from 1907 until 1938. It is of interest to note that he was actually a nephew of John Duncan who pioneered blood transfusion in Edinburgh in the 19th century. A widely respected man, "Pussy" Stuart possessed a calm, unruffled temperament and had an outstanding sense of duty. A "splendid and good man", he scorned the motor car as a sign of decadence and used to ride his bicycle to and from the Infirmary every day!

Stuart was succeeded as Chairman of the EBTS by another Infirmary surgeon, James Graham, the man who wrote the thesis on blood transfusion. Graham was a surgeon in the Royal Infirmary from 1919 to 1946. He was "a sincere sensitive man and a perfectionist in his work". With his background of a lifelong interest in blood transfusion, his appointment as Chairman gave him a new lease of life. He took a great interest in the committee work, in the Centre and in the staff until he died in 1962.

C P Stewart

As has been said, C P Stewart is perhaps the most important of all those who were involved, so far as the subsequent history of blood transfusion in Edinburgh is concerned. Stocky, beetle-browed, chain smoking to the point of never being without a cigarette in his mouth, "C P", as he was known, was 42 when the war broke out. An undemonstrative, unpretentious, unhurried, reserved individual, he espoused the cause of blood transfusion with determination and vigour. It was his forceful personality and political astuteness that overcame weighty opposition and brought about the decision to site the plasma drying plant and a fractionation unit in Edinburgh.

Although he resumed his full time University duties in Clinical Chemistry after the war, Stewart retained a considerable interest in the Service. He was appointed Honorary Consultant to the Regional Service and, in 1959, he was elected Vice-President of the SNBTA and Chairman of its Executive Committee, offices he held until 1970. He died in April 1971.

Sir John Fraser

Behind Stewart's drive and determination, there was the important, quiet influence of Sir John Fraser. Fraser, like W J Stuart, spanned the years from the beginnings of transfusion in Edinburgh. He had been house surgeon to Annandale (though that was twenty years after Annandale's successful transfusion). He served as a surgeon in the first World War when he was awarded the Military Cross. At that time, he was a member of the MRC Committee investigating wound shock and he was one of the first to use intravenous gum saline in its treatment. He was appointed Regius Professor of Clinical Surgery in the University of Edinburgh in 1924. He had great influence in high places during the 1939 - 1945 war for he was, inter alia, Chairman of the Medical Advisory Committee (Scotland) and Adviser in Surgery to the DHS. He was thus a logical choice for chairmanship of the Blood Transfusion Subcommittee of the SAC which set up the service in Scotland. From 1940 when it was formed until he died in 1947, he was Chairman of the important Technical Committee of the SNBTA. That Committee initiated, considered and advised on all developments in blood transfusion in Scotland. In consequence, Sir John's support must have been necessary for the developments which Stewart brought in. The Technical Committee ceased to exist after Fraser died. It was replaced by a committee of the Regional Directors.

Robert Cumming

If "C P" was the leading figure in the developments which led to Edinburgh becoming an internationally renowned centre for blood transfusion, Robert Cumming was not far behind. It was he who presided over the Service at the time of its great expansion. When he was appointed in 1948, the Centre had a staff of 6. When he retired in 1974, over 200 were employed.

Cumming was quick to acknowledge the help and support he always received from C P Stewart, describing him as "a tower of strength". Cumming wrote of "CP": "He always supported me even when it destroyed some of his pet theories". His advice on scientific matters was "invaluable" and he was particularly helpful on committees where he upheld Cumming's requests and "gave him advance knowledge of where the opposition lay".

During the war, Cumming had been a prisoner of war in the Far East. Early in 1947, he resigned from the post of "acting Professor of Pathology" in Singapore and applied "almost on impulse" for the Edinburgh post vacated by the death of McRae. Its attractions were that, as Stewart pointed out, it was "wide open for development", it was, to all intents and purposes, "independent" and the possibility existed of protein fractionation. Problems there were in plenty, with

the plans for a new Centre and for fractionation as well as the difficulties associated with a wholesale reorganisation. By tact, good humour and a flair for organisation, he overcame difficulties without confrontation and inspired affection and loyalty. Selfless, shrewd, receptive to new ideas, hard working, persuasive, he was totally honest and devoid of personal ambition. He had an abiding interest in and concern for people, whether they were donors, patients or members of his staff.

He trusted those, like Miss White and Andrew Crosbie, whose different roles were vital and was repaid with their unswerving support. The result of these qualities was that the Centre grew in size and influence. Its research capabilities were increasingly recognised, and Cumming became in the 1960s a crucial figure in the development of a coordinated and integrated Scottish National Blood Transfusion Service.

And Many Others

Influential and indispensable though the contributions of these eminent individuals may have been, the quality of the Edinburgh Service is equally attributable to the dedication, past and present, of many others - the directors, doctors, (typified by Professor Harold Scarborough and Dr. Robertson), technicians, (from Andrew Crosbie to today's professionals), ancillary staff and the organisers, (especially Miss White and Mrs. Thornton).

What makes the BTS different from almost all other major organisations is its dependence on the voluntary efforts of so many people. The multimillion pound industry exists only because of the efforts of the volunteer organisers and the hundreds of thousands of individuals who have given their own blood, freely and willingly, without thought of reward. Without donors, the whole transfusion empire would cease to exist. Without the donors, countless thousands of people would have died prematurely. Because of their generosity, the quality of life has been improved for many. Because of the advances in knowledge about transfusion, some diseases have been eliminated and others controlled. By immunisation or transfusion, by transplantation or the treatment of bleeding disorders, the lives of ordinary citizens have been transformed.

The internationally recognised Edinburgh and South East Scotland Service which has sprung from his pioneering efforts is a worthy memorial to Jack Copland who said, prophetically, in 1936, that "with proper organisation, Scotland could have one of the best blood transfusion services in the world".

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1. For tributes to C P Stewart and Robert Cumming, I am indebted to the recollection of people who knew them, to retirement and obituary notices.
2. Ross James A, *The Edinburgh School of Surgery after Lister*. Edinburgh, London and New York. Churchill Livingstone. 1978 For comments about Sir John Fraser.

3. Again, the sources of information about Copland, Crosbie and Gumley are many and varied.

Much of the information in this work has been gleaned from the minutes of the committees of the Edinburgh Blood Transfusion Service and the Scottish National Blood Transfusion Association and from the Annual Reports of these two organisations. The Annual Reports of the Royal Infirmary of Edinburgh have also been consulted freely. Comments quoted from these and from contemporary press accounts and Scottish Records Office documents are often attributed in the text and only the more important of the references are referred to individually.

ACKNOWLEDGEMENTS

I wish to express my sincere thanks to the many individuals who have contributed to my greater understanding of the events which make up this history. Some, like Dame Janet Vaughan and Professor Harold Scarborough took the trouble to write to me about some of the problems of the early war years. Professor Morris and Dr. Desmond Stoker drew my attention to a little known episode when the students of the Royal Medical Society formed the first Edinburgh donor panel. Professor Girdwood provided a great deal of useful comment and information and Dr. Andrew Doig was good enough to read a draft. Dr. Howard Davies, Mr. Cochrane of the Wilkie Laboratory, Mr. Eric Walsh and Mr. Charles Smith took considerable time and trouble to fill in some gaps in my knowledge. To Dr. Malcolm Nicholson I express my gratitude for starting me off on this task. He originally designed the project for one of his postgraduate history students in Edinburgh before he went to the Wellcome Institute in London. His encouragement and helpful comments at the outset were much appreciated. My warm thanks are due to Mrs. Mairi Thornton and all the staff of the Edinburgh and South East Scotland BTA for their never failing cheerfulness and help at all times. I wish also to express my thanks to Mr. Peter Taylor and the Edinburgh and South Esat Scotland Blood Transfusion Association for the generous donation of money to purchase a word processor, without which it would have been difficult to complete the work. To all these and all the others who have helped with encouragement or information, I give my thanks. The deficiencies in the work are mine alone.