DAME JANET VAUGHAN 1899-1993

A version of this article, written by Phil Learoyd, was originally published in the British Blood Transfusion Society magazine *Bloodlines*

I initially became aware of the contribution that Dame Janet Vaughan made to blood transfusion before and during the Second World War from reading Douglas Starr's book *'Blood - An Epic History of Medicine and Commerce'*. Prior to becoming the Honorary Historian of the British Blood Transfusion Society (BBTS), I had talked to my predecessor Mr Peter Howell about Dame Janet Vaughan, when he identified to me that he had written an article about her and that he had also produced some display material for a BBTS Annual Scientific Meeting about her. Most of this material had been collected together by Ms Vera Hanwright, mainly from the Contemporary Medical Archives Centre at the Wellcome Foundation and some of this was identified as 'Display Items' ('DI') in Peter's article. Peter Howell's immensely readable and informative article, together with copies of the 'Display Items' mentioned by Peter in his article are reproduced below with his permission.

The book *Women of our Century* by Leonie Caldecott, published by the BBC in 1984, documents a series of BBC programmes televised in that year about the lives of six women, Naomi Mitchison, Paule Vézelay, Dora Russell, Flora Robson, Janet Vaughan and Barbara Wootton, who were collectively identified to be 'Women of our Century'. A transcript of an interview given by Dame Janet Vaughan D.B.E., F.R.S. with Max Blythe recorded in Oxford on 4th November 1987 that formed the basis of the chapter on her in this book is also reproduced below with the king permission of Oxford Brookes (copyright holders) who would also like to acknowledge the important role played by Max Blythe.

Janet Vaughan was indeed a remarkable person and I hope that you will realise as I have that the Blood Transfusion community in England should more readily recognise her immense contribution.

"START BLEEDING"
By Mr Peter Howell

It is clear from her earlier career history that Janet Vaughan was a forthright, energetic and idealistic lady of some competence who, having achieved a first-class degree in physiology at Oxford, finally secured a scholarship to the University College Hospital Medical School in London to study medicine, qualifying as a physician in 1924. As someone motivated by a profound desire to use her medical prowess in assisting the underprivileged and victims of social inequalities, she was hardly going to succumb to the dictates of the establishment either Medical or Political. For a short period she was a member of the Communist Party and, not surprisingly, was a member of the Committee for Medical Aid to the Republican Government in Spain during the Spanish Civil War (1936-1939). In this capacity she became familiar with the work of Duran Jorda, a republican who pioneered the provision, distribution and use of stored blood to treat civilian as well as military casualties during this war. His experiences convinced her that in time of war it was essential to use stored blood taken and stored at strategically sited depots under controlled conditions rather than relying on 'donors-on-the-hoof' who would be difficult to locate. In addition, such donors would unnecessarily distract and divert hospital resources totally pre-occupied in emergency surgery and treatment to cope with the many potential victims of aerial bombardment. This clearly rational approach made commendable commonsense, particularly considering the efficacy of this policy as demonstrated in the Spanish Civil War. As the spectre of Munich loomed on the horizon in the summer of 1938 with the prediction of a possible 57,000 casualties, the time was ripe to put theory into practice to challenge the views of the establishment which, at that time, were naively insular, somewhat arrogant and certainly complacent (ref. 2 and 3). Using her persuasive powers she obtained money from her friend Colonel Proctor, Dean of the Post Graduate Medical School, Hammersmith Hospital (DI-1). This initially helped with the purchase of some basic items of equipment and, with the help of assistants and senior colleagues, including an excellent South African clinician, Guy Elliot, Janet Vaughan began the process of assembling the resources required to support a strategy of stored donated blood. For the best part of the next year there was a clear preoccupation with acquiring and evaluating a wide range of material, including bottles, glassware, needles, rubber tubing, etc., for use in the preparation of transfusion equipment. Consideration was also given to the storage and transportation requirements in time of war. At first, the apparatus was somewhat crude but adequate to bleed donors in preparation for the outcome of Munich. In the event, there were no casualties, but the team took the opportunity to use this blood to demonstrate that blood stored following collection into anticoagulant was quite satisfactory (ref. 4) and no more likely to cause reactions than blood drawn into the same anticoagulant and used immediately. Furthermore, by the beginning of the war the prototypes of the equipment to be used in the Transfusion Service over the next three decades were in place.

However, the major challenge lay in persuading the establishment, the Health Ministry and Government to seriously consider a feasible strategy of blood provision in wartime. In the absence of any action by the powers that be by the winter of 1939, Janet Vaughan convened a meeting of pro-active like-minded colleagues to consider the resources and strategies required by London to facilitate blood provision in the event of a war (DI-2). The arrival of an exiled Duran Jorda greatly helped the deliberations at this time and by the meeting of 5th April 1939 a provisional scheme had been drawn up to provide London with blood for civilian casualties. This involved the creation of four well equipped blood storage depots strategically sited around London, each headed by a Director and administratively linked to local hospitals. In classical Janet Vaughan style, the proposals were sent unsolicited to Professor

Topley, responsible to the Government for organising emergency medical services. The plans were adopted on 20th April 1939 subject to satisfactory costings that were eventually agreed by the Treasury on 5th June 1939 (DI-3). It is documented that Duran Jorda must be given some credit for introducing the use of blood banks in the UK (ref. 5), but the irrefutable fact is that Janet Vaughan, in the face of considerable odds, ensured that in London the implementation was thorough and timely.

As war encompassed the UK and hostilities preoccupied the Government, transfusion medicine and science was about to experience a learning curve of immense proportions never before or since encountered. Quite apart from enthusiasm and dedication, it required fearless courage, tenacity and an ability to initiate innovations at a rate of knots. Janet Vaughan provided the perfect catalyst to generate, motivate and implement the changes in transfusion thinking and practice which emerged in this period. As a prelude to the war and with the help of like-minded people she had masterminded the development of the transfusion equipment requirements for blood collection, storage, despatch and delivery and had shaken the establishment out of its complacency to concede that her vision of blood banking for wartime survival was the only way forward. The summer of 1939 had seen immense activity in recruiting staff and equipping the four London depots, an organisation which by then was in the hands of an official Medical Research Council (MRC) Committee rather than Janet Vaughan's original informal group. However, as one of the medical officers in charge of a depot, in her case Slough, Janet Vaughan was in the thick of things as usual and ready for the so-called laconic telegram from the Medical Research Council, received three days before war was declared, '*Start Bleeding*' (ref. 6).

Even at a very early stage it was realised that the plasma and serum collected from donations could play a significant role in the treatment of casualties. Detailed techniques for the large scale pooling of plasma and serum in Winchester bottles was documented and implemented, and the criteria for sterile room provision were defined (DI-4). These guidelines formed the basis of the methodology of plasma pooling for the next thirty years. It was fortunate that the Medical Research Council were dedicated to not only ensuring that the supply depots provided a blood service but continued with research. The experiences in treating casualties, particularly in treating wound shock and burns, were beginning to challenge established medical practices. As the only woman present at an early MRC inquest into experiences in treating wound shock, Janet Vaughan had the daunting task of being the first person to explain that her findings defied the currently acknowledged classical picture of shock. Supported by other colleagues this facilitated resources to investigate the problem of shock and resuscitation. Innovations were nearly the order of the day. In one vivid recollection, Janet Vaughan recounts coming across a badly burnt child, so severely affected that it was impossible to find a vein for normal blood infusion. She recalled how it was possible to transfuse blood into the marrow. In a 'do or die' effort she selected the largest needle available, stuck it in the sternum and suspended a unit of blood to be pumped in gradually by a young assistant nurse. Notwithstanding the danger attached to the initial insertion, two units were successively transfused and the young girl survived to have successful skin grafts (DI-1). The outcome was that special needles were made with restrictive flanges and supports to facilitate marrow infusion at times, such as on aeroplanes and landing craft, when it might be difficult to target a vein.

War had ensured that, notwithstanding the many problems that had to be addressed in a rapid learning process, the value of blood in securing life in a wide-range of traumas and conditions had risen far above any previous expectations. Blood banking was here to stay and whether it be at special depots or within the hospital

environment Janet Vaughan's views were unequivocal. Blood Banks not kept under skilled medical inspection were likely to be a source of particular danger, hence it was essential, in her view, that all should conform to accepted standards and should only be sited at a hospital with a recognised Blood Transfusion Officer (1943). By mid 1943, as it became clear that the tide of war had well and truly turned in favour of the allies, it was evident that consideration must be given to discussing the provision of post-war transfusion services. It was to this end that a significant meeting was held at the Ministry of Health (MoH) involving Alan Drury, Professor Francis Fraser (MoH) and the four directors of the London Depot in which it was emphasised that although the depots had emerged to cover air casualties the bulk of the work had involved the civilian sick. While it may have been perceived that Janet Vaughan, by recognition of the paramount role she had played in the evolution of Blood Banking, had risen to an elevated position in an establishment destined to secure a National Blood Transfusion Service, the nature of the lady precluded her from complacently endorsing a position that compromised her views. This is encapsulated in her letter of 28th January 1944 to Alan Drury, in which she soundly criticises the Ministry of Information Blood Transfusion Book of that time, in terms that could be considered caustic and to the point (DI-5). How well this was accepted and what altercations developed later we will probably never know, particularly as she seemed intent on burying the past when she made a vast bonfire of laboratory notes and records when she later moved from a large house to a small flat. However, it could be significant that later in 1944 she was replaced by Dr S. Shone and moved to pastures new.

On the other hand, there was no evidence of disharmony with the MRC, in fact, because of her infusion skills, her help was requested in treating war victims claimed to be suffering from starvation and dehydration. It was a challenge in social medicine she was hardly likely to refuse. Immediately prior to embarking on this mission she spent a day with Alan Drury carrying out last minute preparations, but no one could have anticipated the unimaginable horror of the inhumanity and level of human deprivation inflicted on the victims of Belsen. Of course, this was not part of the MRC agenda, but having examined prisoners of war in Brussels and declared they were perfectly well and not starved she was persuaded to travel to Belsen with her hydrolysates. If anyone could take this trauma in her stride it was Janet Vaughan and her conclusion was expressed in typical fashion. The hydrolysates were no damned good and what they wanted was milk and flavouring (ref. 7).

Shortly after, in 1945, Janet Vaughan returned to her earlier haunts to become Principal of Somerville College, Oxford, a post she held until her retirement in 1967. It also gave her the opportunity to indulge her obsession with bones, this time to study the incorporation of radiation products such as strontium 90 and plutonium, research that was well supported by the MRC to whom she was eternally grateful.

It is a curious anomaly that Janet Vaughan's impact on the development of blood banking in England seems to have largely evaded any floodlight of focus on the earlier 20th Century history of Blood Transfusion in this country. Certainly her role, amongst others, has been faithfully documented as one of the pioneers facilitating the emergence of the National Blood Transfusion Service at the end of World War II (DI-1). In fact, before the end of the war she was awarded an Order of the British Empire for this work, and in 1957 was made a Dame of the British Empire, suggesting that those in higher authority considered her contributions to medicine, science and humanity were significantly exceptional to merit such prestigious recognition. Of course, she indulged in a diversity of interests depending on her compulsions at the time. Her earlier work with pigeons, liver extracts and investigations on blood and bone marrow diseases contributed to the study of anaemia and resulted in one of the earliest British textbooks on haematology *'The*

Anaemias'. Although she was a notable director of the London depot at Slough during the major portion of World War II, she was succeeded by Dr S. Shone in 1944. Thereafter, she was involved in investigating the comparative value of hydrolysates, milk and serum in treating starvation victims at Belsen and subsequently she returned to an academic and research-orientated life-style as Principal of Somerville College, Oxford. Thus, although her period in Transfusion Medicine, and in particular 'Blood Banking', covered a critical time in the emergence of a Transfusion Service, it was not prolonged, covering only the period from 1938-1944 (ref. 1). This may provide one explanation why the phenomenal impact she had on the development of blood banking during the war years has never been fully appreciated to the extent that many workers in this field fail to recognise her name, never mind her contribution.

So it is that, notwithstanding and probably because of the many notable achievements of this lady, the acknowledgement of her contribution to the emergence of the Service and Blood Banking as we know it to-day, has laid dormant for over half a century.

References:

1. Gunson, H.H. and Dodsworth, H. (1996). Fifty Years of Blood Transfusion. Transfusion Medicine, 6 (Supplement 1), p12-13
2. Gunson, H.H. and Dodsworth, H. (1996). Fifty Years of Blood Transfusion. Transfusion Medicine, 6 (Supplement 1), p11
3. Starr, Douglas (1998). 'Blood' - An Epic History of Medicine and Commerce. Little, Brown and Company, p84
4. The Royal College of Physicians and Oxford Brookes University.
5. Gunson, H.H. and Dodsworth, H. (1996). Fifty Years of Blood Transfusion. Transfusion Medicine, 6 (Supplement 1), p12
6. Medical Sciences Video Archive MSVA.027.
7. Dame Janet Vaughan, DBE FRS in interview with Max Blythe, Oxford, 4th November 1987. p10 (4), p11 (6), P13 (7) (courtesy of Carol Beadle)

Display Items (DI)

Contemporary Medical Archives Centre, Wellcome Foundation (Copies acquired courtesy of Vera Hanwright)

DI.1 Personal notes of wartime experiences p80-92
DI.2 Meeting of Emergency Blood Transfusion Service Sub-Committee 24th April 1939
DI.3 Estimate of requirements of one Emergency Blood Supply Depot c.1939-41
DI.4 Notes on large scale preparation of serum and plasma
DI.5 Critical letter on Ministry of Information Blood Transfusion Book 1944

DISPLAY ITEM 1 (DI-1):
PERSONAL NOTES OF WARTIME EXPERIENCES (Pages 80-92)
Contemporary Medical Archives Centre, Wellcome Foundation

The original document of Dame Janet Vaughan's personal notes of her wartime experiences was produced by a typewriter and includes her own hand-written amendments. This thirteen page section (pages 80-92) relates mainly to 1938-1939 and concentrates on her work in transfusion. It has been transcribed below as it was originally written (grammar, punctuation and wording) and includes Dame Janet's hand-written comments and corrections. – PL.

At the time of Munich we were told at the Postgraduate Medical School in confidence to be prepared for some figure like 57,000 casualties in London that weekend. I knew, from my contacts with the government side in Spain, that they had used stored blood in the treatment of casualties. Indeed when Duran Jorda, the Spanish haematologist and his wife and family escaped to England at the end of the war, I learnt much from him about the techniques involved. I also knew that the Russians were using blood, taken from fatal road accidents and then stored at low temperatures, for civilian needs. If we ware to have large numbers of casualties at the weekend it was clear we should need stored blood. I arranged to have the Russian papers translated and went to see the Dean of the medical school, Colonel Proctor. He gave me £100 and told me to get on with the job. Fortunately I had working in the department on sabbatical leave an extremely able South African, Guy Elliott, who was a first class clinician. Somehow we managed to get translations of the Russian papers and decided on the crude sort of apparatus we would need. My research assistant, Olive Booth, and another man went off in a taxi cab with the £100 to buy up the immense quantities of rubber tubing, corks, clips, etc. we thought we should need. We set to work, helped by a clever friend of Guy Elliot's who was theoretically at Mill Hill with the Medical Research Council working on some bacteriological problem, but was persuaded that at that point in history storing blood might be more useful.

First of all we made large numbers of crude transfusion sets, and then we set about bleeding volunteers and storing their blood. As someone said later, 'the only blood lost at Munich was what Janet collected at Hammersmith'. Having collected large quantities of blood, however, Guy Elliott and I were determined to use it or at least some of it, in order to learn something about storing blood. A few months later Guy Elliott read a paper on the subject to the Royal Society of Medicine. It was also clear that though our Munich blood had not been needed the likelihood of war was very real, and that some plan should be made for the London area. A few pathologists, representatives from the ten London medical sectors and others interested therefore decided to get together and discuss possible arrangements. I have found a dusty old file which contains the minutes of those meetings held in our flat in Gordon Square. The first; meeting was held on April 5th, 1939. We apparently decided that night that there should be four blood supply depots for London. One at Sutton with Dr. J.O. Oliver, from St Thomas's Hospital in charge, one at Bedford with Dr. H.F. Brewer from St Bartholomew's in charge, one at Maidstone with Dr. M. Marzals from University College Hospital in charge and I was to go to Slough. We looked at every sort of bottle. The children complained that the flat was littered with old bottles and we finally decided to use milk bottles for our blood because they would be readily available in large quantities and could be handled in milk bottle crates. For transporting our blood we thought Wall's ice cream vans might be valuable and of course it would be necessary to install large cold rooms for storage purposes. Further, we recognised it would be essential to enroll large numbers of donors and determine their blood group ahead of the declaration of war. I can always remember George Taylor of the Galton Laboratory, the English authority on blood groups, saying with great solemnity 'you must also enroll girls to determine these blood groups and this should be done at once; it is not easy to procure young girls'. We drew up a memorandum (as I had been taught by Ashley Mills & Co) incorporating these proposals and made some attempt at costing and listing all the materials needed, together with some question as to whether the

depots should supply actual blood as well as group donors, and sent it off to Professor Topley at the London School of Hygiene who was known to be making official emergency war plans. We were of course completely unofficial.

A few days after I had sent our memorandum to Professor Topley, Professor Dibble, my boss at the Postgraduate Medical School came along to my room and told me I was 'a very very naughty little girl' (his words) to be busying myself with what didn't concern me. So that was that. However some days later came another message namely that Professor Topley wanted to see me and finally came news that the Cabinet had accepted the scheme, and please could proper estimates be provided. At this point the Dean, Colonel Proctor, an experienced administrator, gave me wise advice; 'At least double any figures you already have prepared'. We had fortunately made some estimates which I find in the minute book.

In the old minute book there is also a typed note headed Memorandum which I quote as a bit of history.

Telephone conversation with Professor Topley 13.4.39
"Professor Topley believes there will be no financial difficulty in establishing transfusion depots as suggested provided that an approximate cost of each depot can be supplied. Professor Topley is quite definite that transfusion officers will be expected to provide blood and not merely to group it. Professor Topley is anxious that arrangements should be made for blood centres with the blood probably already stored and ready for use before the emergency arises."

From this point the whole organisation of the depots was in the hands of an Official Medical Research Council committee rather then our informal group that met in Gordon Square.

We four originally self-appointed depot medical officers were however given instructions to go to our respective towns and make the necessary arrangements to set up a centre, acquire premises, metal cold rooms and prepare lists of donors. I well remember setting off alone to Slough to see the medical officer of Health with whom I had made an appointment. How fortunate I was to go to Slough where everyone - mad as I think they thought me at the time - was more than willing to help me. It had the enormous advantage of being in some ways 'a frontier town' in the American sense of the word. It had grown up after the first world war, round a vest new trading estate, full of migrant workers as we learnt when Professor R. A. Fisher and I studied their blood group distribution*. There were no settled traditions and customs to be disturbed. The M.O.H. immediately said that the man I must see was Noel Mobbs, Chairman of the Great Trading estate and also of the remarkable social centre he had created. Noel Mobbs did not expect a war but at once said I could have my cold rooms, needed for storage of blood, built on some waste land at the back of the Centre, and if need arose I could have the use of one of the big halls at the Centre with its associated smaller rooms, wash rooms, etc. Further, that I could start approaching firms to enroll and group donors.

To help me in the task of grouping thousands of prospective donors in the early months of 1939 I used to take a Dutch pathologist, Dr. Van der Vries, who was working in the laboratory. He thought it all rather beneath his dignity and importance, but the experience stood him in good stead when he went home and was put in charge of the Dutch transfusion service. He survived to meet me after the war, but his beautiful wife and two little girls, friends of Mary and Priscilla, ended their lives in Auschwitz.

Through the summer of 1939 the work of organisation went on. We enrolled local Red Cross nurses to look after the donors and medical and technical staff from the different medical schools were allotted to the many different emergency services that were set up. My husband who had been a conscientious objector in 1919 wanted active service against Fascism, but was sent to the Ministry of Supply and spent his war in Glasgow as a civil servant. The children went down to Plovers Field with their devoted nurse Ivy. Three days before war was declared I got a laconic telegram from the Medical Research Council 'Start Bleeding'. The medical personnel drove the Walls Ice Cream vans with their refrigerators

down from the Mount Royal Depot and our improvised organisation moved into action. That Sunday morning we stood in the Social Centre bar in our white coats with the locals, to hear Chamberlain state we were at war, and then went back to our bleeding. The Medical Research Council provided medical officers to actually do the bleeding of donors and later to study the problems of shock and treatment of casualties with blood products At our peak we had eight qualified doctors and two qualified scientists to determine the blood groups of donors. Later the Royal Naval Blood Transfusion service joined us and provided us with a further medical officer and considerable personnel. For our large staff of V.A.D. nurses, secretaries, telephonists, technicians and extra drivers, however, we depended on the people of Slough and Windsor. They never failed us. We were about 100 strong and ran a 24 hour service with a doctor always on duty. Two local girls were trained to make all the sterile plasma and serum, and sterile they kept it, in spite of the really unsuitable dusty conditions in which they had to work. I always remember Dr. R.B. Bourdillion, a high powered expert sent down by the Medical Research Council to advise us, looking regretfully through the glass windows of the "sterile room" where the plasma was being bottled by two pretty girls asking me if I could not persuade the girls to put his paraffin on their hair as well as on the floor and tables to keep down the dust. I pointed out that at least they were wearing caps. Paraffin might not have been good for morale.

The arrangements I had made with Noel Mobbs in the early months of 1939 for the use of rooms in the social centre proved ideal. There was a big workers canteen where the staff could eat and the bar was just across a narrow passage from where we bled the donor so in times of stress I need only go into the bar and ask for both donors and drivers. In the same bar my staff, my friends and I could nearly always get ourselves a stiff drink. In times of scarcity the barman always sent us a message if a bottle of whisky was opened. When the work load was suddenly heavy and drivers came home through the snow and the blackout, cold and weary, the bar became important and helped us to carry on. As someone once said, "Janet was the only person who had the sense to set up an Emergency Service in a bar".

We recruited in charge of our large fleet of Walls ice cream vans Mrs. E.O. Franklin's chauffeur Brady, a mad Irishman, but he kept the vans on the road. We also had two magnificent girl drivers who did the regular hospital rounds delivering blood and transfusion sets, and a number of voluntary drivers quite apart from those we called out of the bar in emergency, as on the night when Liverpool's blood depot was destroyed. We sent everything we had to spare in the way of equipment and blood up to Liverpool that night. One of our regular volunteer drivers, Lady Dunstan, must have been at least 70. She always wore several strings of pearls and a toque rather like Queen Mary, but she was never daunted. One day she came back in great pride from a Canadian military hospital somewhere in the country which had sent for urgent blood supplies. 'Yes the surgeon insisted on me coming into the theatre and seeing exactly what he was doing and why the blood was needed. I think I was able to help him', she said.

We had another remarkable old lady whose only interest in life before the war had been her string of ponies and her bridge. She came and said she wanted a job and we set her down among the young technicians to fix a singularly nasty wire filter that was being used at that time for stored plasma. This became her job, and when she was ill, as she sometimes was, she used to send her chauffeur in the Rolls Royce to fetch her a supply of filters to fit at home in bed. One of her friends said she had never been so happy in her life before. She knew we depended on her work, as we did, and through us casualties all over the country.

Blood transfusion in those early days of the war was very different from the service as it is known today. Only four blood groups A, B, O and AB were recognised. No one thought of the possible transmission of jaundice. Plasma** and dried serum*** were still in the future. One or two bottles of blood per patient were usually thought sufficient but we learnt a great deal in four years. Flow fortunate we were to be working for the Medical Research Council. From the start the Council was insistent that its four blood supply depots were not only to provide a service but were also to carry on research. Some time in that first autumn London suffered a series of raids and we found it necessary as well as providing blood and apparatus for the casualties, to administer the actual transfusions ourselves. A

hospital that received many casualties often welcomed help that came from outside. In the early days they would telephone for blood, but they soon learnt that Slough could hear and see the bombs falling and would arrive. The police, as we drove into London up Western Avenue or the Great West Road, could always tell us to which hospital the casualties were being taken, We learnt to carry an electric light with a powerful reflector to wear on our foreheads, the sort that ear, nose and throat surgeons use, so that if electricity failed or the lights were off because the windows were broken and the blackout curtains were blowing in the wind, we could still see to stick in our needles and hang up our bottles. When the first blitz was over Sir Edward Mellanby, secretary of the Medical Research Council, summoned some of the people who had been treating casualties to a conference to hear what had been happening. I was the only woman so I was asked first what my experience of treating wound shock had been. This was extremely alarming because I was a pathologist, and in my experience the casualties had not at all fitted the classical picture of shock. Basically, I had found the wounded had high blood pressures not low pressures as we had been taught to expect. Also, we had learnt, especially in the case of severe burns, that it was essential to give many bottles of blood. So I spoke with great trepidation. I was delighted and relieved to hear two or three competent young men, good clinicians, who followed me say exactly the same. At this point an elderly physiologist sitting opposite could stand it no longer and leapt up, 'but in the classical description of shock it was said …'. A very distinguished cardiologist from Guys, however, the only senior man present who had been out on the streets, supported us doctors from the depots. As a result of that meeting it was decided to attach to two of the London depots highly qualified young physicians whose job it would be to study the basic problems of shock and resuscitation. This of course was an enormous asset; we were well equipped to cope with our first real test that came at Dunkirk. By this time we had started to try and prepare plasma from the blood that could no longer be used for human transfusion. I had read about this and also heard of it by letter from George Minot in Boston, in those letters which came so regularly and which meant so much to us. This plasma however on keeping soon became cloudy and full of fibrin clots, so we were at first unwilling to use it.

We sent all the blood we had down to the coast for the first Dunkirk casualties that were landed. Then came still more casualties back to our country hospitals. We could not keep pace with the demand for blood. We knew men must die if we didn't transfuse them and so we took a risk on our very odd looking plasma. In war one had to take risks; and sometimes, in fact often, the risk won through. The plasma, bad as it looked, full of fibrin clots, worked like magic. Shortly after this I was called up to London to unpack a huge consignment of plasma sent from America under the 'Bundles for Britain' scheme. This unpacking was a solemn occasion carried out by Sir Henry Dale in person, with Alan Drury, Director of the Medical Research Council Transfusion Service. I was there to look on and later to broadcast our thanks to the U.S.A. authorities. What was our delight and amazement when the first bottle was lifted out of its crate, to find it as full of fibrin clots as our own. This was subsequently put down to sabotage at the docks. The problems caused by the fibrin clots led to the preparation of dried serum which, of course, from the point of view of storage and transport, had great theoretical advantages. Every week the plasma from the out-of-date blood had to be taken over to Cambridge where it was processed, and then brought back to us for clinical trial in the first instance. The early batches produced high pyrexia in the recipients. The Professor of' Pathology at Cambridge, the redoubtable R.A. Dean, was sure this was due to the fact that the blood had been collected without suitable sterile precautions, so he himself collected and processed a batch. Alas, the pyrexia was even worse. This, as can be imagined, presented grave problems of protocol.

One night I was called out to a number of casualties in a small hospital off the Great West Road. I was also asked to look at a case of severe burns in a child, not due to enemy action. The burnt child had both arms and legs as well as her body badly burnt; there were no veins anywhere into which one could put a needle, so as one often had to in those days, I left her to die while I put up the transfusions for those I could hope to save. We set up several transfusions and then I went back to the child. She was still alive and I remembered I had read somewhere one could transfuse blood into the marrow. There was nothing to loose by

attempting to do this. Death was the only alternative. I took the biggest needle I had in my case and shoved it into her sternum, hitched up a bottle, and told my V.A.D. nurse to pump, and left for a job in London. When I got back two hours later, the young nurse was still pumping and told me triumphantly she had got in two bottles. The little girl lived and was subsequently moved to the care of a plastic surgeon who gave her many skin grafts. Several years later when I was at Somerville, a headmistress wrote to me about one of the girls up for the entrance exam, and said perhaps I would remember her, especially if I looked at her hands. The hands were claw-like but useful, obviously the result or skin grafting. She came up to read English and did well in every way. After that night we had needles made for marrow transfusion with special side pieces to hold them in place so that they could be used on aeroplanes and landing craft when it might be easier to get into a large bone than into an invisible vein.

We served ordinary medical needs as well as casualties due to enemy action. I was called one night by a general practitioner in a remote farm house the far side of Buckingham. He sounded desperate; he wanted me to come to a woman in labour who was bleeding heavily. He told me to go first to his house in Buckingham where I would get further instructions as to how to find the farm. I set off in the dark, called for my instructions in Buckingham, and when I came to the rutted lane, I found the whole village out lining the roadside with lighted candles to show me the way. I dashed upstairs to find a weak woman sunk in a huge feather bed, cold, sweating and deadly pale with the two doctors sitting silent and hopeless in the window. There was no vein to see or feel. I just stuck in my needle and hoped. "Digging for Victory" we called it when no vein could be located. Luck was with me, the blood went in and the emergency obstetric service arrived from Oxford as the woman's colour began to come back. When I pass that lane now, as I do sometimes on my way to Cambridge, I think of the lighted candles.

On D Day, as arranged, the loaded vans went down at down from Slough to Bristol, the army blood transfusion centre. They returned at mid-day with a camembert cheese brought back from France that morning. This was indeed the beginning of the end.

Perhaps the most important thing I learnt in the war was always to say yes to any call for help. What men and women need in desperate emergency is reassurance. They can hold on if help is coming and given the lead, other men and women will always be prepared to give that help. The people of Slough, the vary miscellaneous men and women who worked whole time and part time in the blood transfusion service, the medical students who used to come for a week at a time from Westminster and St. George's Medical Schools, the men in the Social Centre bar, all rose to every demand made on them with joy and pride. Sometimes the demands were pretty tough, but we always said yes. Just before D Day, Francis Frasar, Head of the Emergency Medical Services, rang me up, 'Janet we have made no arrangements for the Ports, will you look after them'. 'Yes, of course', I replied having no idea what looking after the Ports might entail. As so often we heard no more, but I can only hope that the Ports received reassuring messages that Slough would come if needed.

* Fisher, R.A. and Vaughan, J. (1939). Surnames and blood groups. Nature, Lond. 144, 1047-1048.

** The red and white cells of the blood circulate in a fluid known as plasma. This fluid carries with it an enormous number of important constituents such as inorganic elements in solution like iron and calcium, hormones, vitamins, and different proteins and glycoproteins. If blood is withdrawn into a container the blood will clot, by an extremely complicated biological process, and the fluid element now known as serum*** will separate from the mass of cells and can he syphoned off containing all the valuable elements mentioned above. Clotting can be prevented by the addition of a suitable anticoagulant which prevents clot formation. The cells then sink to the bottom of the container and the fluid, plasma, can be syphoned off.

Under some circumstances it is useful to be able to transfuse plasma or serum instead of whole blood. Whole blood is not usually kept for more than 2-3 weeks so it is economical to syphon off the plasma and use it in certain circumstances. Serum can be dried by

complicated technical processes, and then redissolved for transfusion when needed. A dried preparation has obvious advantages over both whole blood and plasma as far as storage and transport is concerned. The use of both plasma and serum we learnt during the war; much of the necessary research work was done at Slough.

DISPLAY ITEM 2 (DI-2):
MEETING OF EMERGENCY BLOOD TRANSFUSION SERVICE SUB-COMMITTEE (24th April 1939)
Contemporary Medical Archives Centre, Wellcome Foundation

This document contains the notes of a meeting of the 'Emergency Blood Transfusion Service Sub-committee that took place on Monday, April 24th at 27 Gordon Square, prior to World War 2. Note: Although the year is not included in the document the 24th April fell on a Monday in 1939. As well as Dr. Janet Vaughan, the 'committee' also included a Mr. P.L. Oliver. The original document is produced by a typewriter and is three and a half pages long. Because of the poor condition of the original document photocopy it has been transcribed as it was originally written (grammar, punctuation and wording). – PL.

MEETING OF EMERGENCY BLOOD TRANSFUSION SERVICE
SUB-COMMITTEE

A meeting of the above committee was held on Monday, April 24th, at 27 Gordon Square. Professor G. Wright presided in the chair.

There were present:

Professor G. Wright.
Dr. H. F. Brewer.
Dr. J.O. Oliver.
Dr. M. Maizels
Dr. J. Vaughan.
Mr. P.L. Oliver.

Professor Wright said he had called a meeting to discuss the question of obtaining volunteers for the transfusion service in districts. The Medical Research Council were prepared to send a letter to employers asking them for their help. A draft was brought forward which was discussed and finally Professor Wright was asked to submit it to the Medical Research Council for dispatch. Each district supplied appropriate names of towns to be served.

Medical Research Council,
36 Old Queen Street,
Westminster, S.W. 1.

Dear Sir,

Blood Transfusion (War-Time Emergency)

It has been decided to establish a number of war-time emergency blood transfusion centres to meet the needs of London and adjacent parts of the Home Counties. These will be organised in co-operation with the British Red Cross Society and in relation to the emergency hospital arrangements which are being made under the auspices of the Ministry of Health. One of these centres will supply North-West London and adjoining areas of the Home Counties, including the towns of Watford, Northwood, Uxbridge, Harrow, High Wycombe,

Windsor, Staines, etc. This centre will be situated in Slough and will be in charge of Dr. Janet Vaughan, Clinical Pathologist, British Postgraduate Medical School.

The purpose of this centre will be to prepare and store human blood for subsequent administration to injured persons in need of such treatment. In the event of war this will be possible only if all preparations for obtaining blood have been made beforehand. For this purpose it will be necessary to test some 20,000 people so as to obtain the 8,000 or 9,000 universal donors whose blood could be used for transfusion to any patient. This is a big task and if it is to succeed, a very high percentage of the public must volunteer. Anyone between the ages of 18 and 65 is suitable, if in good health and likely to remain in or near Slough in the event of war.

It is desired to bring the following points to your notice:-

(1) In war time 10 percent of all civilian casualties will need transfusion, without which their lives will be seriously endangered.
(2) Before the emergency arises, and in fact as soon as possible, it is essential to test volunteers to see who are suitable. The test is quite painless, takes two minutes, and does not interfere with work.
(3) After the outbreak of war, but not before, the selected volunteer donors will be called upon. The quantity of blood taken would in no way interfere with a volunteer's activities. The procedure is practically painless and the long experience of the British Red Cross has shown that it is absolutely without ill effects. Direct arm to arm transfusion from donor to patient will not be employed.

It is hoped that all your suitable employees may be willing to help this important National service. Dr. Janet Vaughan would be glad to address your employees as a whole or in several groups. She would make arrangements directly with you as to a convenient time when she and her staff could attend at your premises to make the necessary tests.

I hope that you will give this request your urgent consideration. I shall therefore be glad if I may hear from you as soon as possible whether you are willing to co-operate in the matter, and what numbers would probably be available.

I am,

Yours faithfully,

A. LANDSBOROUGH THOMSON.

Professor Wright said that the Medical Research Council were anxious for the moment that no further publicity should be obtained either through the press or specially called meetings or house-to-house distribution of leaflets for the scheme. There would be no objection however, to addressing small meetings of organisations such as local conservative rallies etc.

A draft letter which might later be used for general distribution was then discussed and the following form of the letter was finally accepted:

BRITISH RED CROSS SOCIETY
EMERGENCY BLOOD TRANSFUSION SERVICE.

Dear Sir or Madam,

In the event of this country becoming involved in war, a large demand for blood for transfusion purposes will immediately arise. It is estimated that about 10 per cent of air raid casualties will need blood transfusions as an essential part of their treatment. To organise this,

a Medical Committee working with the ministry of Health has been officially appointed and a scheme drawn up to arrange for the enrolment of a sufficient supply of donors.

One part of the scheme includes the formation of several depots around London, at which blood will be drawn and stored in large quantities for instant despatch to any hospital in the area to which air raid sufferers will have been carried. Recent research into the problems of the preservation of blood have made this life-saving measure practicable.

Before donors can be enrolled, however, it is necessary to carry out a simple test to learn how many volunteers with the requisite type of blood can be obtained. Although practically any person over the age of 18 can give blood, there is one type that is especially suitable, as it can be given to any patient, and at the moment it is intended to use this group only. Roughly 45 per cent of the population belong to this group.

Maidstone has been selected as the site of one of these depots, and it is hoped to obtain at least 16,000 volunteers from this town and district. Will you volunteer for this life saving service? The donor is not in the least incapacitated giving blood, and is able to return to his or her ordinary work within half an hour of the withdrawal. Thus there is little hindrance to work or business.

Whilst there is no doubt that ample numbers would be instantly available after hostilities had begun, there would be no time then to carry out the necessary tests. It is therefore imperative that the testing should be started at once, and volunteers informed if their blood is suitable. An office has been opened at ……. and medical staff will attend there daily between the hours of …….. and ……... for the purpose of making the necessary tests. This simply entails the drawing of a speck of blood from the finger tip, and only takes a few moments. Donors will he informed if their blood belongs to the requisite group, and a formal notification will be sent them through the post with instructions as to how and when they will be called upon.

Every donation of blood you give may save a human life - possibly that of one near and dear to you. There is no risk and no after weakness nor debility. The London Branch of the Blood Transfusion Service has been in existence for 18 years, and is supplying over 8,000 donors a year, several members having given over 50 transfusions, whilst abroad, where professional donors are employed, there are many records of single donors, men and women, having given from 250 to 1,000 transfusions, without interference with their customary occupations. Will you help us?

Yours very faithfully,

……
Mayor of Maidstone.

……
Kent County Director, British Red Cross Society.

……
Hon. Secretary, British Red Cross Blood Transfusion Service.

The meeting then adjourned.

DISPLAY ITEM 3 (DI-3):
ESTIMATES OF THE REQUIREMENTS OF ONE EMERGENCY BLOOD SUPPLY DEPOT (Circa 1939 - 1941)
Contemporary Medical Archives Centre, Wellcome Foundation

This document was prepared by Dr. Janet Vaughan as an estimate of the cost of materials (in pounds, shillings and pence) for one emergency supply depot. The original document is produced by a typewriter and is two and a half pages long.

Because of the poor condition of the original document photocopy it has been transcribed as it was originally written (grammar, punctuation and wording).

ESTIMATE FOR 1 DEPOT REQUIREMENTS.

These estimates are only approximate, they do not include:

i) Alteration to premises or rent of premises.
ii) Transport.
iii) Propaganda.
iv) Petty cash for travelling expenses etc.
v) Payment of personnel.

Requirements other than collecting and distributing apparatus

AUTOCLAVES (3)	Price:	£87. 0. 0d.
Braby galvanized, price £29.	Delivery:	4 within 3 weeks
Diameter 21 x 15 x 14 ins, to carry 2 shelves.		8 within 6 weeks.
STILLS (2)	Price:	£34. 0. 0d.
From Gallenkamps. Davis still heated by gas.	Delivery	4 in 3-4 weeks
		8 in 6 weeks.
HOT AIR OVENS (2)	Price:	£16. 10. 0d.
Hearson & Co. Ltd. A.l.l size 18 x 14 x 15	Delivery	4 weeks
gas heated - burners extra.		
GENERATING PLANT	Price	£300. 0. 0d.
COLD ROOM	Price	£280. 0. 0d.
Hall's of Dartford.		
MOBILE REFRIGERATOR	Price	£196. 0. 0d.
Frigidaire.		
COUCHES (8)	Price:	£21. 0. 0d.
Fitted arm rests	Price:	£2. 4. 0d.
J. Bury & Co. 19 Nassau Street, W.1.	Delivery	10 days
DRESSING TROLLIES (8)	Price:	£8. 0. 0d.
ENAMEL STERILIZER (1)	Price:	12. 6d.
24 x 8 x 8 with lid, from Simmons Hollow Ware Co. Ltd.		
INSTRUMENT STERILIZER (1)	Price:	£2. 0. 0d.
Nickel plated; gas heated, 11" x 5½" x 2¾".		
Gallenkamps B. 6110.		
CHEALTHE'S FORCEPS (12)	Price:	£4. 16. 0d.
10 inch at 8/- each		

		£952. 2. 6d
		----------

6 sphygmomanometers - Tycos pattern	£18. 0. 0d.
6 rubber aprons	
2,000 towels as per attached estimate	£30. 0. 0d.
5 doz. 1 cc. Vim syringes	£13. 0. 0d.
Hyperdermic needles to fit Vim syringes,	
size 25, standard wire gauge, 3 gross.	£5. 0. 0d.
20 lbs. surgical gauze.	
Elastoplast — 3,000 yds 1"	
Rolls adhesive plaster 1" 10 doz.	
1 gross of rubber teats (2 cc)	16. 11d.
1 doz. Bunsen Burners	

6 calor gas burners,		
6 gas rings		
6 calor gas rings		
1 cwt. sodium citrate analar		£16. 6. 8d.
14 lbs. potassium bichromate		16. 0d.
25 kgs, sulphuric acid		£1. 18. 6d.
50 litres surgical spirit		£4. 0. 0d.
10 gallons dettol		£4. 5. 0d.
1 Winchester quart colloidin, methylated 5%		11. 0d.
1 Winchester sal volatile		
2 doz. 1 litre reagent bottles		£2. 5. 6d.
1 doz. pairs of scissors, 5”		£3. 5. 0d.
2 doz. towel clips.		£3. 4. 6d.
10,000 bandages 2”		£22. 15. 0d.
50 lbs. absorbent cotton wool		£1. 11. 0d.
50 lbs. white lint		£3. 4. 0d.
2 doz. carborundum files		
Enamel dish for sterilizing		
1 doz. Forceps.		
Emergency surgical set.		
2 scalpels		
2 pairs dissecting forceps.		
½ doz. ampoules, fine cat gut.		
Aneurism needle.		
Skin stitches and 2 curved needles for skin		
6 sterilising drums: 15”		
6 sterilising drums: 11½“ x 9½”		£19. 16. 0d.
12 measuring cylinders 2,000 cc. capacity		£3. 12. 0d.
12 measuring cylinders 1,000 cc. capacity		£1. 12. 0d.
12 measuring cylinders 250 cc. capacity		£1. 4. 0d.
24 flasks, 5 litre capacity		£4. 10. 0d.
6 aspirator bottles, 20 litre capacity		£10. 0. 0d.
1 doz. Arkansas chips.		
1 balance trip		
10 doz. reels copper wire: 20 s.w.g.		£2. 15. 0d.
2 pairs pliers		

		£174. 8. 1d.

Collecting and delivery apparatus
At 3/- a piece - 15 gross.

Short plan	Price	£324. 0. 0d.
Packing cartons - 50 gross	Price	£8. 0. 0d.
Long plan - 60 gross	Price	£1296. 0. 0d.
With addition of needle adaptors - 75 gross	Price	£250. 0. 0d.
Packing cartons - 200 gross	Price	£40. 0. 0d.

		£1918. 0. 0d

	TOTAL =	£3001. 1. 7d.

DISPLAY ITEM 4 (DI-4):
NOTES OF LARGE SCALE PREPARATION OF SERUM AND PLASMA
Contemporary Medical Archives Centre, Wellcome Foundation

This document was prepared by Dr. Janet Vaughan and originally written using a typewriter. It is nine pages long. Because of the poor condition of the original document photocopy it has been transcribed as it was originally written (grammar, punctuation and wording). The document is undated, but is believed to have been written in the late 1930's – there is a handwritten date of 1939 at the top of the first page. The document can in many ways be interpreted as an early example of an 'operating procedure'. The process described in this document formed the basis of the technique in operation for approximately the next 30 years – I have personal memories of using a similar method for 'pooling plasma' from 1968 to the early 1970's at the 'Leeds Blood Centre'. – PL.

NOTES OF LARGE SCALE PREPARATION OF SERUM AND PLASMA
APPARATUS REQUIRED AND ITS PREPARATION

Bottles and Caps. The bottles used for blood collection and for storing serum and plasma are of the Medical Research Council pattern - waisted, screw-topped and calibrated at 540 ccs. The caps are of aluminium and have two holes of 4 mm diameter, 6 mm apart, cut in the top; they are fitted with 4 mm. rubber washers.

Plasma and serum are pooled in 80 oz., screw-topped, clear glass Winchester Quart bottles. These also are fitted with aluminium, screw caps, containing rubber washers but not perforated.

Preparation of Bottles etc. When blood is to be collected for serum, the M.R.C bottles are prepared as follows: To each bottle 4 ccs. of normal saline are added, the caps are screwed on loosely and the bottles autoclaved for 20 minutes at a pressure of 20 lbs. per sq.inch. As soon as the pressure falls to atmospheric the autoclave is opened. The bottles are removed and the caps are immediately screwed down tightly. A vacuum forms in the bottles on cooling. This is destroyed by the introduction of sterile air through a previously sterilized cotton-wool filter. This filter consists of a glass tubing 15 cms. long x 2 cms. diameter packed with cotton-wool. One end of this tube is open; the other is drawn out and fits into a piece of 3/l6" pressure tubing. This tubing, in turn, fits on to a 16 S.W.G. transfusion needle. A T piece, one arm of which is connected to a manometer and the other by pressure tubing to the needle, may be inserted. The needle after flaming is passed through the previously flamed rubber diaphragm exposed by the holes in the aluminium cap. Air will immediately be sucked into the bottle through the filter. The rate can be adjusted by fitting a screw clip to the pressure tube immediately below the filter. Equalization of pressure inside and outside the bottle can be gauged by observing the return of the invaginated rubber diaphragm to the horizontal or by manometer readings. The needle is then withdrawn and the holes in the cap are covered with a strip of ½" adhesive tape.

For the reception of the serum after its removal from the clot, M.R.C. pattern blood bottles are also used. They are, however, plugged instead of capped. They are prepared as follows: 4 ccs. of normal saline are added to each bottle which is then plugged with a piece of cotton wool wrapped in gauze or butter muslin. The neck of the bottle and the mouth with its plug are covered with Kraft paper. This is kept in position by a rubber band or a string tied round the neck of the bottle. These bottles are autoclaved for 20 minutes at 20 lbs. per sq.inch.

The Winchester Quart bottles used for the pooling are similarly plugged, prepared and sterilized.

Caps, both for the M.R.C. pattern bottles and for the Winchester Quarts, are wrapped in calico towels, packed into small tins, containing a standard number, autoclaved for 20 minutes at 20 lbs. pressure and finally dried in a hot air oven for 1 hour at a 120^{o}C.

When blood is to be collected for plasma, the plasma bottles are used. To each bottle are added 120 ccs. of glucose di-sodium. Citrate solution and 3 gms. of glucose. The bottles are fitted with their perforated caps and autoclaved for 20 minutes at 20 lbs. pressure. The caps are tightened when the bottles are removed from the autoclave and the vacuums destroyed as described above. To ensure safe storage these bottles are covered with a viscose caps.

For the pooling of plasma the same 80 oz., screw-topped Winchester Quart bottles are used. They are first rinsed with pyrogen-free distilled water. To each are added 250 gms. of Kaolin. Kaolin is introduced into the Winchester quarts by means of suction. The bottle is put to one side of trip balance - a rubber bung is fixed into the neck of bottle. Into this rubber bung is fitted a length of 12 mm. bore glass tubing, which is connected by rubber tubing to another piece of 12 mm. bore glass tubing which is introduced into the Kaolin container. Suction is obtained by means of a length of rubber tubing connected to suction pump at one end, and at the other end by means of a taking needle passed through the bung. Both rubber tubes are held in position by means of a retort stand and clamp.

The weight of the Winchester is counterbalanced by having a box containing glass beads on opposite balance pan. Thus any difference in weight between bottles can be corrected by means of addition or subtraction of glass beads.

Now a 250 gram weight is added and Kaolin is siphoned over until an equilibrium is reached. The flow of Kaolin is control1ed by a clip attached to rubber tubing. The bottles are then plugged and prepared as for serum, by autoclaved at 20 lbs. pressure for 60 minutes.

Apparatus for transfer of serum and plasma. A “suction head” is necessary for siphoning serum and plasma into the 80 oz. Winchester Quart bottles. The central tube of this is connected by 12” of 3/16” rubber pressure tubing to a piece of 6 mm. glass tubing 2” long and this in turn is connected to a length of 5/16” rubber tubing 3” long, to the end of which is attached an 11” length of 6 mm. glass tubing, the lower end of which is somewhat constricted like the end of a volume-metric pipette. At its upper end this glass tubing passes through a rubber bun over which is fitted a glass bell-shaped shield. This shield is 2½” in diameter and should be made of heat-resisting glass. The other arm of the suction head is connected by way of a safety trap-bottle to the suction motor in the ordinary way, by means of rubber tubing with a glass tubing insert containing cotton wool to act as an air filter.

For some purposes it may be preferable instead of using an open ended pipette, to use a pipette with a burred end and a sub-terminal side opening, about 1/4” from the closed end.

For sterilization, the apparatus is wrapped either in one piece of calico or in two (one small piece over the bell shield and pipette, and a large piece over the composite apparatus). It is then parcelled in Kraft paper and autoclaved. Suction is preferably supplied by means of an electric pump but if one is not available a main water supply may be utilized. This has, however, the great disadvantage that it is difficult to maintain a steady pressure.

THE PROCESSING ROOM.

The processing room should contain:

a) A long bench with one or two bunsen burners.
b) 2 chairs. These should be plain and capable of being thoroughly swabbed. Adjustable office chairs with revolving seats may be preferred.
   There should be no unnecessary furniture but the following items may be included.
c) A wooden stand with a good firm base, say 15” x 6” with an upright bar 15” long at centre back. To the latter an 18” horizontal arm is fitted 5” from the top controlled by a spring so that the arm may be raised and lowered freely; on the left side of the arm 4” from the end, a Terry clip is fitted to hold the neck of the bell shield.
d) an electrical suction pump, if negative pressure cannot be laid on from outside the sterile room,

e) strong wooden trolleys with shelves not less than 1 foot apart, if the bench space is not adequate,
f) metal refuse baskets.

The floor, bench and all the wooden fittings should be treated with light yellow spindle oil at least once a week. Strong Dettol (25%) is used for swabbing the floor, bench, walls etc. whenever necessary. This should always be done at the end of the day. Windows, if present, should be tightly fitting and kept shut. Draughts must be avoided at all costs.

If possible there should be a small ante-room so that the processing room does not lead directly to a passage. It is also useful for crating and uncrating bottles, for storing apparatus, and to house the necessary electric pump for supplying suction.

The operators must wear a surgeon's gown and an operating cap and mask. In practice it is found necessary to employ two technicians for both plasma and serum processing.

PLASMA PROCESSING.

When the citrated blood has settled thoroughly, usually after standing in the refrigerator for five days or longer, it is brought into the processing ante-room where the bottles are carefully uncrated and put on the bench or trolley. Winchester bottles containing kaolin, Winchester caps in tins and siphoning apparatus are taken into the processing room.

If the wooden stand described in para.c. above is used, the siphoning apparatus is fixed to this by means of the Terry clip. In this case the calico around the pipette is not removed until everything else is ready.

Operator 1 flames the suction head and the neck of a Winchester bottle from which the covering and the plug have been removed and the suction head is screwed into the mouth of the Winchester bottle. The side arm of the suction head is connected to the suction attachment. One of the operators takes the blood bottles from the trolley, swabs the neck and shoulders of the bottles with Dettol, very carefully and without shaking removes the caps, flames the necks of the bottles, and places them in position. The other operator, either by hand or by means of a special apparatus lowers the pipette, which has been well flamed, into the plasma to within ¼" of the red cells. The negative pressure is now gently applied and the plasma drawn off. The flow can be controlled either by a spring clip or by digital pressure on the rubber tubing. Care must be taken not to draw off any red cells. The process is repeated with each bottle until 1700 ccs of plasma have been drawn over into the Winchester which is then capped and shaken thoroughly, in order that all the Kaolin becomes completely mixed with the plasma. A new siphoning apparatus is used for each Winchester bottle.

SERUM PROCESSING.

The best yield of serum is obtained when the blood is taken into bottles moistened with a small amount of sterile saline as described in the preparation of bottles. The blood taken should be an amount not to fill the bottle completely but to fill it to 3/4 or 4/5 of its capacity, that is about 450 ccs. Sloping the bottles for 3 or 4 hours at room temperature increases the rate and degree of clot retraction. When the clot has retracted well, the bottles are put in crates in the upright position in the refrigerator where they are left overnight.

The following morning the bottles are taken to the processing room ante-room, uncrated and arranged on the bench or trolleys. A similar number of sterile, plugged blood bottles are put on another part of the bench or on another trolley and boxes of sterile caps should be at hand. Everything necessary should be in the processing room before work begins so that subsequently there is no unnecessary movement or opening of doors. Operators then don gowns, masks etc., close the door, and take their position at the bench with lighted bunsen burners and trolleys etc. so arranged as to be within easy reach.

The serum from each bottle may be poured off into one of the empty sterile bottles or it may be siphoned off with the apparatus already described. (Although the apparatus is

identical in principle – the suction head has to be of different size, as the necks of the M.R.C. bottles and Winchester Quarts are of different gauge.)

In the first case, operator 1 takes a blood bottle, removes the cap, flames the top, and hands it to operator 2 who has meanwhile removed the plug from a sterile bottle and has flamed the top of the bottle. Operator 2 proceeds to pour all the serum from the clot into this bottle, the top of which is then flamed again and fitted with a sterile cap. Operator 1 flames the top of the blood bottle and replaces and cap. Corresponding numbers should be placed on the bottles of serum and clot. In the second case operator 1 swabs the neck and shoulders of the blood bottle, with a rag soaked in Dettol, removes the cap, and flames the neck and mouth of the bottle. Operator 2, having connected the empty sterile bottle by means of the suction head to the siphoning apparatus, inserts the sterile pipette of this apparatus into the blood bottle and gently draws the serum. Using this technique the serum from two or three blood bottles can be pooled in one M.R.C. bottle. When this latter bottle is suitably filled, the suction head is unscrewed, the neck of the bottle is flamed and a sterile cap screwed on.

The clots can be allowed to stand for another 48 hours in the refrigerator. A further small yield of serum can then be obtained from each bottle.

The bottles of serum are returned to the refrigerator in their respective crates and are left there for two to three days, by which time the red cells, which had been carried over in the pouring or the phoning, will have settled into a compact layer at the bottom of the bottles. When this has occurred, the bottles are brought from the refrigerator to the processing room ante-room and decrated, great care being taken not to shake the bottles. Sterile, plugged Winchester bottles, boxes or tins of sterile caps, and sterile siphoning apparatus are placed in readiness on the bench.

As before it is of the utmost importance that everything necessary is arranged before work begins, and that the operators wear gowns and masks. The suction head of the siphoning apparatus is screwed into a Winchester bottle and connected with the source of suction. Operator 1 takes a serum bottle (Great care being taken not to shake it), unscrews the cap, flames the top and passes it to operator No.2 who, with the sterile pipette and siphon apparatus, sucks off all the serum from the cells. The serum should not be sucked too fast as it is easy with too great a suction to disturb the red cell layer and to draw up the red cells with the serum. The rate of flow can be adjusted by squeezing to the required degree with the fingers the thin rubber tubing of the siphoning apparatus. When the Winchester bottle is full the suction head is removed, the neck of the bottle flamed and the sterile cap screwed on. A fresh suction apparatus should be employed for each Winchester.

Note. There may be theoretical objections to pouring serum in the way described. In practice, in the hands of trained workers, it has been found satisfactory. Broth poured in the same way has not been infected. Manual dexterity and conscientiousness on the part of the workers are essential in processing large quantities of serum or plasma.

DISPLAY ITEM 5 (DI-5):
CRITICAL LETTER REGARDING THE MINISTRY OF INFORMATION PAMPHLET ABOUT BLOOD DONATION
Contemporary Medical Archives Centre, Wellcome Foundation

This letter was written by Dr. Janet Vaughan on 28th January 1944 to Dr. A.N. Drury C.B.E. at the Lister Institute. It is written in an open, critical style that gives a possible insight into Janet Vaughan's character and manner. The original document was produced by a typewriter and because of the poor condition of the original document photocopy it has been transcribed as originally written.

N.W. London Blood Supply Depot,
Social Centre
SLOUGH, Bucks.

28th January, 1944.

Dr. A.J. Drury, C.B.E.,
Lister Institute,
Chelsea Bridge Road,
London, S.W.l.

Dear Dr. Drury,

Ministry of Information Blood Transfusion Book

The whole standard of this book falls far below that of other Ministry of Information pamphlets both as regards general style and matter. There is far too much about the donors giving their blood and too little about how it is used. We are quite certain from our contact with donors that they don't want home chat. They are quite willing to take in solid information. We feel that this solid information should be put in a solid lump and not so to speak scattered about throughout a mass of padding as is done here. Donors are really interested and want to learn and I think we have got to pay them the compliment of giving them what they want. This is a general criticism of the set up. More definite criticisms:-

1) Plasma alone is spoken of throughout. Donors in the whole of this area, however, are quite used to thinking in terms of serum as well as plasma but they do want to know the technical difference and are interested in the technical difference. Many of them will be very distressed to find there is no reference to serum throughout the document. This should be explained.
2) V.D. As I told you the V.D. Section is very badly handled. I think it should be said that all the blood is tested and if it is found to be contaminated it is discarded, and should be left at that. It should not be said as it does that the blood is tested before the donor is bled - this is untrue - and no mention should be made as to whether patients or doctors are informed. It is untrue to say that the doctors are informed. They are not.

Page 11 - It is untrue to say that the broken down remains of the red cells are filtered out of the system through the kidneys. Some of it may come out through the kidneys - most of it goes out through the faeces.

Page 45 8th line from the bottom - I think it is a pity to say "This meant great wastage at first". This is one of those things that may be true but need not be said.

Page 47, last para. but one. This is not correct in fact. Mixing A and B does not dilute. It neutralises antibodies.

Page 49 line 8. Kaolin does not act as a preservative.

3rd. para. Is it really correct to talk of smaller drying centres? Presumably he means the one at Edinburgh, but it is the only one as far as I know. Why not say so?

Even if we cannot have elegant prose, let us have, let us have correct facts.

Yours sincerely,

Janet Vaughan.
Medical Officer in Charge.

TRANSCRIPT OF AN INTERVIEW:
DAME JANET VAUGHAN DBE, FRS. (1899-1993) WITH MAX BLYTHE
Oxford, 4th November 1987
(MSVA 027)

Summary
Main subjects discussed: clinical pathology - diseases of bone and blood, 1930s investigations of pernicious anaemia, early blood transfusion services, UK, wartime and post-World War II medical planning initiatives, pioneering investigations of the metabolism of strontium and plutonium.

After discussing a family background including distinguished physicians and educationalists, Dame Janet Vaughan explains her choice of a medical career, pre-clinical studies at Oxford, clinical studies at University College Hospital London in the 1920s, and entry to clinical pathology. In this latter context she discusses early work on blood, particularly interests in pernicious anaemia and the influence of Cecil Price-Jones. How work on pernicious anaemia continued with Minot and Castle at Harvard in the early 1930s is also outlined, followed by discussion of the conditions she encountered as a woman specialist on returning to London hospitals. The initiation of wartime blood transfusion services is then considered, as well as several wartime and immediate post-war medical planning initiatives in the UK, after which Part 1 of the interview concludes with eyewitness comment on the nutritional dilemmas of those trying to assist the liberated survivors of Belsen Camp. Part 2 of the interview includes discussion of Dame Janet's return to Oxford as Principal of Somerville College, and continuing blood and bone research leading to pioneering studies of strontium and plutonium metabolism in mammals.

The Royal College of Physicians and Oxford Brookes University
Medical Sciences Video Archive MSVA 027

Dame Janet Vaughan, DBE FRS in interview with Max Blythe
Oxford, 4 November 1987

Part One

MB Dame Janet, I want to try to trace with you today the lines of your career in medicine and science. I've heard you say, on occasions, that it was virtually predestined to be that way because of family background, in a way. Would you tell me something of that background?

JV Well, both my great-grandfathers were physicians. One of them was president of the College [Royal College of Physicians]. But then there was a skip, so that it wasn't perhaps so odd that I wanted to do medicine, though it wasn't really from an interest in medicine itself that I went into science. It was that I had read a great deal of history and I was very much concerned about social problems and the state of the world, and I felt it was no good just being concerned unless I had some background knowledge on which I could act and which would mean that people would listen to me. And it seemed to me that medicine was a good way of getting involved in real social problems. And, therefore ... nobody listened to me at that stage in my career. I was at school and my headmistress said I was too stupid to be worth educating.

MB Oh, really. Where was this school? This is most unusual.

JV This was a private school, North Foreland Lodge, which was fashionable at that time.

MB Was this a school chosen by your father? He was an educationist.

JV Well, it was ... yes, chosen by my father and mother. It was evacuated to Malvern in the war, because, you see, I didn't go … I had governesses, I didn't go to school until rather late in life. But then, as I say, I was too stupid to be worth educating.
MB In quotes!
JV So, it was rather a problem when I said I wished to do medicine. And I hadn't done any science at all.
MB What did your parents feel about that? They were quite supportive, though?
JV Oh, they were very supportive about me going to a university, very supportive. I don't think they realised what doing medicine ... My father was a schoolmaster, he ought to have known.
MB He was at Rugby?
JV They ought to have known that possibly I needed to do a little science. But the only science I'd done was a sort of botany, floral diagrams, you know, that the Victorians did. No real botany.
MB So what happened? You decided to come to university, but you had no ...
JV Well, first of all I couldn't get through the entry to the university, in Latin and Greek.
MB Where did you apply? You applied Oxford, Cambridge?
JV I applied to Oxford. I applied to Somerville because I had links with Somerville, where wires could be pulled, I'm afraid. But Somerville said they'd take me, oblivious of the fact that I didn't know any science. But, you see, I couldn't get through. I didn't get through my entry to the university until Christmas, so I came up in a what they call a bi-term. I came up in January and started out on science and physics, a public danger in the labs. I'd never heard of an acid or an alkali.
MB And this was a way you could start in those days? That was quite acceptable?
JV Yes. It was not very usual, I think, but there I was …
MB And you had one or two goes at the entrance examination?
JV I got through the Latin and Greek at the third time, but I got through the science much more easily, all except physics. I had a little struggle with the physics?
MB Where did you get this teaching in preparation for it?
JV Oh, I didn't have any teaching till I came up to Oxford.
MB And you read and prepared?
JV I mean, except Latin and Greek. I didn't have any science teaching until I arrived in the labs in Oxford. A public danger, of course!
MB What did you find in Oxford? You liked Oxford from the very start?
JV Well, I loved the work. I found it frightfully exciting. It was such fun. And, of course, I was terribly lucky in my teachers. I was up in the golden period with Sherrington. I was taught by Jack Haldane and Julian Huxley.
MB Yes. Can't have been bad, can it? I mean, that must have been terrific.
JV I mean … well, I can remember, in the very early days, Jack Haldane showing me the Drosophila fly. You see, these were the days of when biological science was just …
MB Opening up, yes.
JV Yes. So I was extraordinarily lucky.
MB Yes. But the medicine career was very much in mind?
JV Oh, it was. I had to get through these basic sciences before I …
MB There was never a chance that the biological sciences would capture you entirely?
JV And I had to get through the physics, of course, too, before I could …
MB That can't have been easy! That can't have been easy, but you did.
JV I did.
MB And you eventually qualified very well, and surprised everybody.

JV I eventually got a scholarship to University College Hospital and was lucky, of course, I went, again, to University College Hospital in its golden days of Trotter[1] and Lewis[2], and …

MB That must have been a very special time.

JV It was a very exciting time.

MB And no more problems? You just went on in a fairly standard ... there were no more problems?

JV Well, there were no more problems, except that I wanted to be a physician and my mother died and I couldn't do enough basic house jobs. I only did one house job as a physician, so I had to become a pathologist. And what they called, in those days, a clinical pathologist, a race that really doesn't exist [now]. So I did all the blood counts and I did all the chemistry. I taught Sir Harold Himsworth how to do blood sugar curves. And I did all the bacteriology, under supervision, so that this was very fortunate for me because I got a basic view which, of course, no undergraduate gets today.

MB And this was still at University College?

JV This was still at University College.

MB What year was this, Dame Janet?

JV I'm so bad at dates.

MB This was early thirties?

JV Yes. Yes.

MB Obviously a very heavy and demanding job, with lots of routine work?

JV Oh, endless routine. And teaching, because my boss, who was the senior clinical pathologist, insisted on the students knowing their patients and so I used to take students on ward rounds. And at the same time I was lucky because I came into contact with someone whose name is now largely forgotten, Cecil Price-Jones, who was one of the first people who applied statistics, high powered statistics, to biological problems. And he was interested in the size of red cells, and he measured the red cells of pernicious anaemia, which had been a mystery disease, and compared them with the red cells of ordinary blood, and [that of] people with other diseases and showed that the size of the red cells in pernicious anaemia was unique and that you could produce what was known, and which will go down in history, as the Price-Jones Curve. So, as I was the clinical pathologist and saw all the blood slides, I used to take the pernicious anaemias and I learnt from him about the extreme importance of applying proper statistics to biological problems, which at that time was hardly appreciated.

MB Yes. But something which stayed with you all your career.

JV And it's something which has just stuck, you see. And it has always been laughed at because I'm so bad at mathematics. I never could work out the sums.

MB But you knew the direction you had to take.

JV But I knew that you had to apply these very stiff techniques to getting the right answer to biological problems. And again, you see, I was fortunate in this because at that time Price-Jones was unique, I suppose. Now, of course, everybody thinks statistically.

MB Price-Jones was obviously interested in pernicious anaemia. You went on to take a much greater interest in this particular disease?

JV Well, yes, I became …

MB Was this where it started with …

JV Yes, I became very interested and, in fact, I read ... you see, I'd been trained at Oxford and I'd been trained to read the literature and I read that George Minot in the States was treating patients with liver and they were recovering. And so I arranged, with a friend who was a house surgeon, a house physician, and one of the sisters on the ward, to treat the pernicious anaemia patients with lots of

liver, which was of course raw liver in those days or cooked liver. And to my joy their blood showed the changes which Minot had described, and the patients got better. And the physician, who was a senior physician - you know, an old-fashioned one in a tailcoat - used to demonstrate to the students how well they'd done on his arsenic.

MB They were on a treatment of arsenic?

JV They treated pernicious anaemia with arsenic in those days. And I knew it was due to my liver. So I went to the professor of medicine, Elliott[3], who had, I think, the first professorial unit in medicine, and said could I make some liver extract. Well, here was I, the junior pathologist, and Elliott said, 'Oh yes', and he gave me some money and said I could work in Harington's lab - Harington[4] was the great chemist - but that I must go and collect the mincing machines from my friends and the pails of my friends, because the hospital hadn't got any mincing machines. So I went round and collected mincing machines. I collected Virginia Woolf's mincing machine. Virginia was a cousin and I used to see a lot of her. And I collected her pails that her charwoman used. And I minced liver …

MB Night and day …

JV … with my Minot's book lying on the table telling me how to do it. And [I] produced some filthy looking stuff at the end of three or four days, and the professor of medicine, Elliott, said, 'Well, of course, this must be given to a dog, to see if it's safe.' So it was given to, taken over to Professor Verney, who was the professor of pharmacology, and given to a dog. The dog was sick! So then they said they must have some more liver, so I gave them a little bit more. The dog, the second dog was sick! So I said, 'Well, no, no more dogs. My liver is too precious. I've got a patient waiting for it. I shall take it myself.' So I took it myself that night, and the next morning, when I came back to hospital, there was all the professors - medicine, surgery, chemistry - waiting on the doorstep to see if I was still alive. I was fine and I gave it to the patient and the patient recovered. He was a nice, old labouring man and his reticulocytes went up and up and up, and his blood went up, and he was fine. So after that I was put on to testing liver extracts which were then being made not by me, but by the MRC and reputable people. And, as a result of this, I collected a lot of data and I said I'd like to go and work with Minot in America. And the UCH people were very supportive and arranged that I should go out to Harvard. They got me a Rockefeller Fellowship and I went out to Harvard to work with Minot.

MB This was in the mid-thirties by now, was it?

JV This was in the early thirties, or very early thirties. Well, then there was a problem because Harvard didn't have any women.

MB This was not on? This was not allowed?

JV I was, you see, a Rockefeller Fellow. They couldn't say no to me, but I was a woman, so I couldn't work with patients; that was a problem. So I said I would work, I decided I should work with mice. So I ordered some mice from the stewards. The mice didn't come. So I went to the stewards and said, 'Why haven't my mice come?' 'Well, there aren't any Boston mice available.'

MB Oh, Boston mice?

JV So I said, 'Well, there are some excellent mice in Philadelphia.' And there was a very famous strain of mice in Philadelphia which I knew about. I mean, they were well known, these Philadelphian mice. 'Oh, but we've never had anything else but Boston mice in this department.' So there, I was, no mice! So I had to work with pigeons.

MB Quite a departure, yes.

JV So for six months, for a whole year, I worked with pigeons! But I learnt, of course, because though I couldn't treat patients and do ward rounds, I used to go to all the discussions, and I learnt a fantastic amount from Minot himself who

was a great physician and a great teacher. And I learnt from Bill Castle, the other authority whose name is forever linked with B_{12}. So that even though I was reduced to pigeons, which incidentally about two years ago, Bill Castle, who remained a constant friend, produced a paper to prove that my work on pigeons had been the first test for vitamin B_{12}, though everybody had missed it at the time it had been published.

MB So he acknowledged this fifty years later.

JV But fifty years later, he published another paper to say that Janet Vaughan had been quite correct, and that her tests for pernicious anaemia on those pigeons … They were known as the bloody pigeons.

MB Dame Janet, can you tell me a little bit about that research because it is quite interesting? Can you tell me a little bit about that research?

JV About the …

MB The pigeon research.

JV Well, it was a question of putting different fractions, liver fractions, into pigeons and seeing whether they produced reticulocyte changes. And they did. But it's a complicated story. I don't think I'd better go into that now. But it's all been published. I mean, Castle, bless him, published it about two years ago. He sent it to the British Journal of Experimental Haematology, in which I had first published the B_{12} ... the pigeon story.

MB Right. So that was a nice fifty year on continuity.

JV Yes.

MB When you came back from America …

JV I came, but they wanted me to stay, but I wanted to come home and be married. So I came home and was married. And I got a job as an assistant clinical pathologist at another hospital. And I didn't care for that because I wasn't allowed to do anything very scientific, and they were only concerned that my colleagues, my boss, was making money. And I did do quite a lot, and very successful private practice. But I just hated taking money from very poor people, when I used to have to go out when they were away. So my husband and I decided we'd rather be poor and happy.

MB Dame Janet, I think it would be rather a nice time to mention your husband. This is an important moment. You are now married with the marriage responsibilities and …

JV Two children. Well, the children hadn't arrived at this point.

MB But married life and work at the same time. Would you say something about your husband?

JV He was in business. He ran a big travel agency, The Wayfarers Travel Agency, and was concerned largely with giving children a way to see the world. We lived in Gordon Square. All our friends were known as Bloomsbury, so we always said we knew where everybody was, and who they were with.

MB An interesting time to be in Bloomsbury.

JV So we had a really good life. I was doing work that I was interested in, because, by this time, I'd thrown up the Royal Northern Hospital and gone to work at the London Hospital, where there was a man who knew most about bone histology. I'd become interested in bones at this point in time because I'd found that there was a funny blood picture associated with bone disease, which we can now do a good deal to explain. But at that time, it had intrigued me.

MB Right. So this is where the link, blood and bone, came into your career?

JV So I went to the London Hospital to work with Turnbull[5], who was the only person, the only morbid anatomist, only pathologist, who knew about bones. He'd been trained by all the great Germans, and so there I used to work on the patients who had had bone diseases, and in the post-mortem room.

MB Looking at bones?

JV Looking at bones, with Tumbull. Somebody came to look for me one day, and went into the post-mortem room and said, 'Where's Janet Vaughan?' 'Oh, she's gone out on one of them filleting expeditions,' said the old PM porter.
MB You used to go out and collect bones from interesting cases?
JV I used to be sent out … we used to get ... one of the physicians, Donald Hunter, used to get a lot of cases of abnormal bones, and I used to be sent out into the country with a lot of broomsticks to collect the bones from these odd cases to bring back to Turnbull.
MB Replaced them with broomsticks?
JV To look, to look at. So, 'She's gone out on one of them filleting expeditions.' And I used to bring the bones back. There was an awful day when ... it was a very hot day and I'd got half the skeleton, all the leg bones and the arm bones, and half the spine, and I just stuck at the skull, and I didn't get the pituitary, I was never forgiven by Turnbull. He went wailing round the hospital, 'Janet Vaughan didn't get me that pituitary.'
MB He was the ultimate perfectionist.
JV It was an in interesting case from the pituitary, because the pituitary very often is associated with bone disease. And so I worked at the London Hospital with Turnbull and Donald Hunter. I had my own outpatient clinic because I was concerned with anaemias, and it was the days of the ... of great poverty and unemployment. I used to find they had anaemias and I used to give them iron, and that cured them. Simple. Simple iron cured, not the pernicious anaemias, but some of the anaemias.
MB Were the people with pernicious anaemia still getting liver extract at that time?
JV Oh yes. But I was much more concerned with the very much commoner condition which was simply due to lack of iron which was simply due to lack of food.
MB This was commonplace in areas of poverty.
JV And the patients used to say to me, 'Don't give me any more of that medicine, doctor. It makes me hungry, and I can't afford it.' 'Can't afford it': day after day I used to listen to that. I used to be able to get extra milk for them. And I used to teach the people who came to my clinics that it was their duty to fight the authorities to get extra milk because of course to get them extra iron. This, you see, all drove home to me the social implications of medicine.
MB Which was in strong contrast to Bloomsbury, I mean, and yet this not very far away.
JV So, there I worked. But no one spoke to me at the London Hospital. I had a certain expertise. It was known now that I had a certain expertise about blood diseases and the physicians used to write and ask me to see a patient and give them advice, but they wouldn't speak to me. And I used to write back an answer, you see, and say what I thought the condition was.
MB This was being a woman practitioner?
JV Dorothy Russell, who was also a great pathologist, was also working with Turnbull. We were both at the London Hospital and we both had our lunch with the secretaries, but we never spoke to the physicians or the surgeons. Then, by great good fortune - I, by this time, was doing quite a lot of medical journalism, publishing my own papers and reviewing and, you know, well, medical journalism for the *Lancet*. And so I got to know Mrs. Kettle, who was one of the editors of the *Lancet* at that time, and through her, her husband, Professor Kettle[6], who was at that time professor of pathology at Bart's. And then he was moved to what they were starting, what is now known as the Postgraduate Medical School, which was being set up…
MB At Hammersmith?

JV And he rang up one day, rang me up, and said would I come as clinical pathologist at the new hospital? So I said that would be lovely if they'd give me a band saw to saw up my bones.

MB This was the condition?

JV This was the condition I went, that I got a very special saw for sawing up my bones. And he gave me a band saw. And, of course, here again I had luck because we arrived in an empty building, and Kettle had imported Ashley Miles, whom of course everybody now knows as the bacteriologist. He'd imported King[7] as the biochemist. He'd imported a less exciting morbid anatomist, and he'd imported me. And the four of us got together...

MB An exciting team.

JV …and supported by Kettle had enormous fun, setting up the new pathological set-up in an LCC hospital. And I was the clinical pathologist and there were some very good young physicians, and as I say, Ashley Miles, the bacteriologist, and we had great fun.

MB Great. Working with Kettle was good news, yes. You have happy memories of that.

JV And then people spoke to me, you see.

MB Oh, yes. And there's progress!

JV People said 'Good morning,' in the passage.

MB Terrific. What was the work there? Did it change very much? You were still working with bone. Did the work change a lot?

JV Well, I did all the clinical pathology. I mean it was all familiar stuff to me. And, of course, I had great luck because I had Kettle as a boss, and he imported as my assistant, first of all Gwyn Macfarlane, who is world-wide now known for his work on haemophilia. So I had Gwyn Macfarlane as my assistant and when Gwyn left and went to Oxford, I had John Dacie as my assistant. And John Dacie, you see, is now the most important haematologist. So I had, as soon as I got to the Postgraduate School, I had great luck.

MB This has taken us to the later thirties. We're now in the later 1930s.

JV This, yes, takes us to the beginning of... well, it takes us to Munich.

MB It does. Exciting things really did happen even on top of the ones you've mentioned.

JV So Munich ... do you want me now to talk to you about Munich?

MB Yes, please.

JV Well, we were told confidentially at the beginning of the week, Munich week, that there would be 37,000 - I don't know why that figure has stuck in my mind, but it has - 37,000 casualties in London might be at the end. So I thought ... I was responsible, you see, for the blood transfusion because in those days we used to have to match the blood. Well, I thought, 'If we're going to have 37,000 casualties, we shall want some blood.'

MB There was no blood?

JV Well, we shall want a good deal of blood. And I had made friends with a man in the Spanish Civil War, Durán-Jordà[8], who'd used blood for casualties in the Spanish Civil War. He'd come over to England with Trueta[9]. They'd walked out of Spain and Durán-Jordà came straight to me because I was a haematologist and because I was also involved in the Spanish Civil War. That's another story! And he taught me a good deal about storing blood. And I'd also read that the Russians were storing blood from street casualties. So when we got this message about the 37,000 casualties, I went to the dean of the medical school, who was a friend of mine, and said, 'I think I'd better have some money because I want some apparatus.' And the dean, being a man of, I think, enormous quality, gave me £100 in cash that afternoon! And I sent two of my assistants out in a taxi cab, and they went out and they bought glassware and rubber tubing and clips, which we thought we'd rig up ... rigs was the word, rig

up some apparatus. And I had working with me at that time a very good South African clinician, a man called Guy Elliott, and he had a friend, a very senior friend at the MRC, and he collected the senior friend and we made up, invented sets with the rubber tubing which we'd bought, you see. And then we said, 'We'd better have some blood.' So we started bleeding everybody and putting the blood into storage. Then, of course, there were no casualties. And everybody said, 'The only blood that was shed at Munich was what Janet collected at Hammersmith.' Well, I said, 'Yes, but having collected all this store of blood we'd better learn about it.' And, fortunately, I had this very good physician, Guy Elliott, who was working with me, and we started using our store of blood in the hospital. And we used enormous quantities of it, and we wrote papers about stored blood and how satisfactory it was.

MB So these were very important foundation studies for the Transfusion Service?

JV We did know, at the time of Munich, we proved that stored blood, even primitive stored blood, such as we'd prepared could be used. Well, then some of us pathologists in the whole of London, people my age group, got worried and thought perhaps that even though Munich seemed to be safely settled there might be trouble later, and we'd better have some plans. So we used to meet in my flat in Bloomsbury, the pathologists who were all my sort of age group, people I knew, and we planned a transfusion service for London. No authority, but…

MB You just planned.

JV The children used to grumble about all the old bottles of London blood in the morning, because, you see, we had to decide what sort of bottles we'd use. Anyhow, we made this great document and we knew that, I think it was Toppy - his name has gone out of my head; it'll come back. Topley! Topley was making plans for emergency services, so we ventured to send him our memorandum. Well, then the professor of pathology came to see me, and said I was a very naughty little girl! What was I doing, sending him that memorandum of ours. I said I was very sorry, you see. And you know...

MB Not the thing for a junior to do.

JV And forgot all about it. But then came a telephone message from somewhere in the Topley set-up, saying that they'd like this costed, this memorandum we'd prepared in my Bloomsbury room. And so then I went again to my friend the dean, and he said, 'Well, Janet, if you're going to cost it, triple every expense you put on. From my experience,' - and he'd been very high up in the Indian Military Service - 'things are going to be much more expensive.' So we costed this wonderful scheme: cotton wool so much, rubber tubing so much, and it went back to Topley. And then we were told officially that the scheme had been accepted and that we were to set up - which we'd proposed in our childish way. There was to be one at Slough, there was to be one at Maidstone, there was to be one at Luton, and to be one at Bedford. And we'd appointed ourselves as directors, on paper. And we were told to go and set up these units.

MB So you went to set up one?

JV And so I went down to Slough, and I went to the chief medical officer, who seemed to be the obvious person to go and talk to, who was a nice friendly man, and he sent me to the man who was head ... Slough, in those days, was a great trading estate; a pool of people, unemployed from everywhere, making all sorts of things. And a local man, a man called Mr Mobbs, who had a social conscience, had built a great social centre for the trading estate with canteens. And he said to me, well, he didn't think there was going to be a war, but he could give me some rooms and I could have my refrigerators put up. He didn't think there was going to be a war. So my big refrigerators were built and put up, and at the other units. And I was given some rooms, and I recruited some VADs and three days before the declaration of war I got a telegram from the

MRC: 'Start bleeding', just like that. So I called in my VADs and I started bleeding. And now we were very fortunate, you see. Mr. Mobbs had been quite wrong when he'd said there was going to be no war. My big hall where I did all the bleeding was next door to the bar. Now, everybody said, 'Just like Janet to set herself up in a bar, isn't it!' As, indeed, it was. But how sensible. I could push the doors from the room where I did the bleeding into the bar where, you see, I could always call for people to bleed. I could also call for drivers. I mean, I had my own drivers, but by this time the world had learnt that if you were in trouble, you sent to Slough, and so I didn't always have enough drivers. And I can remember the night that Liverpool was hit. Liverpool rang up Slough, as people had got into the habit of doing, and said, 'Send us everything,' because the whole of their Blood Transfusion Service had been destroyed. So I went into the bar and said, 'Can anybody drive to Liverpool for me?' you see, and they volunteered. I had the vans, and so we loaded up the vans with all our extra rubber tubing and everything else, and up got somebody from the bar who would drive to Liverpool for me.

MB Excellent situation. Mr. Mobbs, a great help.

JV Well, yes. The social centre was an enormous ... I mean, it was invaluable. And it also ... the bar wasn't to be despised because when my drivers - most of them girls - came in… Because we used to go up to London in the blitz when people were hit in London, or when we saw the bombs or heard the bombs falling on London, we just used to go up and say to the police, 'Where are the casualties?' And Slough would turn up. And they were just glad, you see, anybody coming in to help.

MB So you actually were dealing with casualties at the scene of …

JV We were dealing with casualties. I mean, we learnt … this was part of a long story which I've left out. We were learning about how to handle ... how to handle casualties because nobody ... shock was something quite different to what everybody thought it was.

MB When last we talked, Dame Janet …

JV We learnt that you had to give enormous quantities of blood, not just one bottle, five, six, seven. And so when my drivers came back it was very important for them to be able to get to the whisky in the bar.

MB Dame Janet, when last we talked, you told me a story that moved me greatly, about a girl and a direct bone transfusion.

JV Oh yes. That was ... we'd gone up one night to an incident, as they were called, on the North Circular Road, and there were a lot of casualties. And as we always did, I had to look at them and see which I could save and which I couldn't save if I transfused them, because this was the first job to do with casualties, was to transfuse them. So, on this occasion there was a little girl who was terribly badly burnt, and I thought, 'Well, she's done for. I'll leave her.' And I went, and we set up all the transfusions of the men and women that I thought I could save if they got blood, and then the surgeons would come. Then I went back to the little girl and she had been burnt, her arms and her legs, and she had no veins, and I thought I'd read that you could give blood into the bones. This was the great thing about medicine in the war, you could take risks because people died. So you were no worse off if they died because of what you did. So I took the biggest needle I had in my pack and stuck it into her sternum, her breastbone, and hung up a bottle and told my little VAD, who knew no medicine, to pump. And I had to go off to London to the MRC, there was some important meeting, so I left the little VAD, who knew nothing really, pumping. I came back a couple of hours later and the little VAD said, 'I've got two pints in.' Now, this was very exciting and the little girl lived. She came through. And she went down to McIndoe[10], you know, which was where they treated all the men for aircraft burns, and she was skin-grafted by McIndoe and

she came through, and I thought no more about her. But we did two things. We arranged to have special needles made with flanges on them, because this needle that I stuck in might have gone right through into her chest, because it was a lumbar puncture needle. But needles with flanges on, so that they'd only go in so far, and then they'd stick. And these needles were made for the time of Dunkirk because then people could be transfused on boats, because, you see, on a rocking boat, to get into a vein was going to be very difficult. But on a rocking boat, you could hope to get into a sternum. So the needles with flanges were made so that untrained people could stick them in, and the transfusions could go. But the nice thing was many years later I was interviewing candidates for scholarships at Somerville, and I got a letter from a headmistress saying, 'I think you'll remember this little girl who's coming up for the scholarship. Look at her hands.' And I looked at the girl's ... asked the girl to show me her hands, and they were all skin ... they were little claws, they'd all been skin-grafted.

MB This was the girl?

JV She came up. She did very well. Got a good pass in the schools. And I've seen her since. She has a family of her own and is working.

MB Remarkable. Great satisfaction.

JV So nice things happened, you see.

MB Nice things happened. Moving on from that blood transfusion work which obviously had enormous importance, one or two other things happened in the war that also had enormous importance. I think you were slightly irreverent on one occasion, at a meeting of the Comitia of the Royal College of Physicians. Can I remind you of that?

JV Oh, the Royal College had discussions with you, in the war, to discuss the future of medicine, which was very right and proper for the Royal College to do. And I was at one of these meetings because I was interested in the future of medicine, and they discussed the future of medicine, they discussed the future of surgery, and they discussed the future of obstetrics. And I jumped up, without thinking, and said, 'What about social medicine?' and sat down again. Deadly silence! And afterwards, I was really ticked off by one or two senior fellows.

MB Not the thing for a junior to do.

JV 'A woman has never spoken in this Comitia before. And a junior fellow,' - and, you see, I was very junior - 'has never spoken in Comitia before'.

MB A great sin!

JV But Corkscrew Charlie, Charles Wilson[11], who was president of the College, was a very wise man, and he saw that social medicine at that time was beginning to be talked about. And he asked me if I and some younger fellows would write a memorandum for him on what we thought about social medicine. So I had many rebellious friends among the younger fellows, and some of us got together: Henry Cohen[12], who of course became a very important surgeon; Aubrey Lewis[13], the great ... who became the great psychiatrist, the new medicine of the world; a paediatrician, Lightwood[14], who was at St. Mary's at the time. And we wrote a memorandum as to what we meant by social medicine, and it was very inclusive and very long. And we sent this document to the president and the president accepted this document that these wicked younger fellows had produced. And the president - and this is something that counts to Wilson's greatness as president - set up a committee under Jimmy Spence[15] - now, Jimmy Spence was the great paediatrician at Newcastle - to study social medicine. And we met, this committee, with the president in the chair, also with Boldero[16], who was a high official of the College, always present. There were various students and fellows like ourselves, and of course Jimmy Spence. And we, the committee, produced a document, which must be

in the archives of the College because it was a very influential document in the post-war planning on social medicine. And we also produced a document on medical education. We weren't the same group, but there was a lot of overlap. And those must both be in the archives.

MB These were very significant changes at the College of Physicians.

JV This, you see, was in the very early days of the planning of the future of medicine, of the health service. They were very influential documents, not only in the planning of the health service, but also in the thinking of the Goodenough Committee, which at that time was considering medical education. And I think that, as I say, it was to Wilson's credit that he picked up that there was something that the younger people were concerned about, and it's entirely due to Wilson. And I'm sure that document, the first document, - because I, you see, never keep any papers - I haven't got a copy, I wish I had, that we sent to Wilson. And dear old (Boldero?), who was a very senior fellow, was awfully ... I mean, he'd been horrified by us! Perfectly horrified! But he listened, and he said to me at the end, 'You know, I really have learnt a lot.'

MB So that was progress. Dame Janet, I'm taking you on a step now. You were obviously deeply involved in the war, both at the College of Physicians and on the streets of Slough, and in bleeding volunteers. At the end of the war, can I ask how you came to be one of the first people into Belsen Camp?

JV Well, I was up ... the MRC was fussing about hydrolysates, and they'd asked me, because I was good at putting in needles, to look at our people who came back, released from concentration camps. They were coming back at that time. The war was still on, but they were coming back. And I was up with the MRC gossiping - because I used to go in and out of the MRC a lot - one day, one afternoon and two high up men from 21 Army Group were there, and they said they were worried about the starvation they were finding in the people in Brussels. And the MRC said, 'Oh well, there's Janet, she's good at putting needles into people. She'd better come with these hydrolysates'.

MB These were protein concentrates for people?

JV Yes. And the 21st Army Group said yes, I could come if they could put me into uniform. And Harry Himsworth was ill at the time and couldn't go. But he sent Rosalind Pitt-Rivers, who was a great biochemist, and Charles Dent, who was a young physician, and he was also a biochemist, and me. We went off by plane the next morning, in khaki, me with only a lieutenant's pips. I stayed with Drury at the Lister that night, and we sewed on the pips. And we went off by plane the next morning with nothing but hydrolysates in our luggage. When I got to Brussels, they showed me the starvation, and I said, 'These men aren't starved, they're perfectly well.' And 21st Army Group, and I can't remember who it was, said to me, 'We've just uncovered Belsen. Will you go?' And I said, 'Yes, as long as you don't tell the MRC.' Because we'd none of us had typhus inoculations, and we knew there was typhus. So they gave me a lorry, and Rosalind and Dent and I went round the labs in Brussels, 'liberating', that was the operative word, 'liberating the apparatus', because Rosalind thought she might need [it] for her chemical investigations. So we loaded up the lorry, and they said it would call for us at six the next morning with an armed guard. The lorry arrived at six o'clock the next morning, without an armed guard. They said they were short of men. So we climbed into our lorry, with our hydrolysates, which was the only luggage we had, and the apparatus that Rosalind had liberated, and we set out in our lorry. And we drove over the Rhine on wooden planks - there were no proper bridges - sitting in the back of our lorry, waving to everybody. And we drove up ... the lorry driver had what he called a 'movement order', and so we drove up to where we were to stay that night, we were to stay at some military establishment. When we got into the military establishment, I was lucky (to find?) one of my best boyfriends was already

there, also with a lorry, but he had an armed guard. He was one up on us. So we stayed, we put up ... joined forces, and set out the next morning, two lorries, you see, mine with the hydrolysates, and Pat Mollison, who was going to some other ... on some other ploy, but on the same route, and up we went. And all the people were coming out of the prison camps in their striped pyjamas: a most extraordinary sight. We picked up with one Yugoslav who'd liberated a few eggs, and we shared our lunch with him. And then Pat had to go off to a nice civilised hospital, and we had to go on to Belsen, without an armed guard. We knew we'd got there because of the smell. We could smell it before we got there. And we drove in and found the field ambulances, there was nothing there but a field ambulance. And the young man, the young commander of the field ambulance had heard we were coming, but thought we'd come to help him. So I said, 'No, I've come to use my hydrolysates. I'm not going to help.' And he said, 'Well, all I can do is to give you a room, and zwei Hungar.' The Hungarian Army was guarding the camp and so I was given two Hungarians and a room. And the Hungarians chopped up the furniture for us to light the stoves. You know, it was an army barracks and there were stoves that burnt wood. So the zwei Hungar were useful, chopping up the wood. And I went down that night to the horror camp, with the corpses and the whole mess. And then the next morning, we went out. They were bringing in the people from the horror camp into a great place where they were being scrubbed down by young German mädchen. And an English officer from the ambulance had to walk up and down to see that the German girls didn't ill-treat the patients. And all I could do was to pick - and I'd learnt by now, to pick fit people, not to pick the dying - to pick fit people, and to move them to my room and start to try and give them hydrolysates. Well, they were filthy tasting, filthy tasting stuff. They had no flavour, there was no flavouring, there was no milk, there was nothing, and so getting them to take it by mouth ... and then, if I wanted to give it to intravenously, 'Nicht krematorium. Nicht krematorium.' The Germans had been injecting them with paraffin so they burnt better.

MB No injections wanted there?

JV So it wasn't very profitable to try and give it to them intravenously.

MB What a terrible situation. But you found out that hydrolysates were of no great help.

JV Well, we found that they weren't any use.

MB So you were able to speak fairly strongly against their use?

JV When I came back, it was ... I was there, I suppose, till ... I didn't get back till after the end ... I was there over till after the end of the war, and I came back in charge of ... I flew back, it was very difficult getting transport. I flew back in charge of casualties, to somewhere in Wiltshire. You know, the casualties on the floor and me in a bucket seat. Nothing went wrong with the casualties, thank goodness. And I landed then somewhere in Wiltshire. And the place in Wiltshire sent me to Swindon, and I sat on the ... I telephoned from Swindon to my blood transfusion people to come and fetch me, and they found me asleep on the floor, picked me up, and took me back to Slough. And I got out of all my filthy old khaki. My hair was still full of DDT, you see, because of the typhoid. So I got out of all my khaki, just left it on the bathroom floor and hoped the children wouldn't get involved in it, and went up to London because I knew there was a meeting ... I don't know how I knew, but I did know there was a meeting of the people who were concerned with prison camps, because we were all concerned about the people coming out of Japan. And as I walked into the … I went, on my way up to London, to my smart hairdresser, and said, 'Will you get the DDT out of my hair?'

MB But you put in, at this meeting, a strong plea for no use of …

JV And so I went into the meeting with the DDT, at least, out of my hair, and heard one of these elderly professors talking, and saying how splendid these hydrolysates were, they were working, yes. And somebody said, 'Well, here's Janet Vaughan, she's just back from using them in Belsen.' And I, you'll find it in the BMJ, I think, what I said, that the hydrolysates are no damned good. And what they wanted was milk and flavouring. And the next day, I went down to the War Office, and they cancelled the factories that were making hydrolysates.

Part Two

MB Dame Janet, after the war you came to Oxford, into Somerville College, as Warden?
JV I came as Principal, yes.
MB You came as Principal.
JV They suddenly asked me out of the blue. And our home in London had been bombed, and the thought of bringing up the children in Oxford was, you know, irresistible. And I thought that I could probably arrange to do some work.
MB Which you did.
JV Which I did. I ran an outpatient clinic until, oh, till '67, when I retired. A blood diseases outpatient clinic. And, fortunately, the MRC was at that time getting news from the States about all these horrible things like plutonium and strontium, that were going to afflict the world. Apart from saying that they were about, the MRC wasn't told very much, the (McMahon Act?) was preventing real information coming through.
MB So there was a real embargo on information coming from America at that time?
JV But I was, you see, always interested in bones. And I had done a certain amount of work on radium for Rock Carling[17], who was an important person in the MRC in those days. And I was on one of the MRC committees when the problems of radium, strontium and plutonium were discussed, and it was apparent that nobody knew a thing about strontium. But, at that time, everybody was frightfully worried, because the milk was all contaminated from strontium from the Hiroshima bombs, and it was getting into the bones of the children. And so strontium was ... and nobody knew a thing about strontium and its metabolism. So I brightly said, 'Oh well, if you give me some money, I'll work on strontium.' Knowing nothing! And the dear MRC said yes, they'd give me some money. And Professor Burn[18], who was the professor of pharmacology who I'd worked [with] in the war, and who knew that, well, I was somebody who could work with, said he'd give me his basement kitchen in the department of pharmacology. And Dorothy Hodgkin found me a first class young chemist, who knew nothing about strontium. And I picked up a young physicist, who also knew nothing about strontium. And I collected one of my technicians who'd worked with me in the war and we set to work on the metabolism of strontium. And I said I hated small rodents, you know, I just didn't care for small rodents, that I was going to work on rabbits. So I started work, putting strontium into rabbits, knowing nothing. We didn't even know when we started that strontium decayed to yttrium, which is the most simple fact, but we didn't know this. But anyhow, we started, and we, of course, got results. We couldn't help … it was pretty rough going, I think. But anyhow, we started and the MRC backed us, and people published us. And the University [Oxford] was very kind, it allowed me to build a hut to keep my rabbits in. And I used to say, 'I can't stay at Council [Hebdomadal] any longer, I've got to go and look at my rabbits,' rush out of Hebdomadal Council to milk my rabbits. I'd borrowed a milking machine for rabbits from somebody because we had to determine what ... if you fed a rabbit... We didn't... you see, it was as elemental

as that, we just didn't know if you inhaled or put strontium in intravenously, whether it went into the milk. Well, we had this sort of ... so we struggled along with the yttrium and with strontium, and we had great good luck because one day I looked down the microscope and I saw, as well as strontium in the bone, there was another radioactive material. And because I was a sort of maid of all work, you see, I'd stained these sections in a routine sort of way because I was a routine sort of person with a stain for sugars, and this other isotope seemed to be where the sugars were. So this was very exciting. So I went to the MRC again and they gave me some more money and we collected somebody who was knowledgeable about sugars, and we set him, poor Geoffrey [Herring], up to grinding bones because he seemed to know how to grind large quantities of bones. And Geoffrey, after six or seven years, was able to isolate the sugar from the bone that bound the yttrium. This, of course, had enormous scientific applications; I mean interest, quite apart from yttrium itself. And there again, you see, the MRC came up trumps. I wrote to Harry when we had finally isolated the sugar and said that, well, after, I think it was seven years, at least we'd found what bound the yttrium. And he sent me back another post-card saying that it had taken somebody else who worked for the MRC even longer to discover something, so why worry! They were, and are, a marvellous organisation. If they give you their trust, they leave you to get on with it.

MB And Geoffrey was quite remarkable as well. I'm forgetting his surname, but I have read some …

JV Herring. Geoffrey Herring. Well, he's put his mark on history because he isolated a whole group of sugars that nobody knew existed in bones. And poor Geoffrey, you see, just had to ... I mean, we sent him out ... you can imagine a chemist, you know, straight from doing high-powered biochemistry, sent to the slaughterhouse to get lots of bones and grind them up. I mean, we had a great time building grinding machines!

MB But you were seeing the deposition of radioactive material in bone?

JV We had seen that the yttrium, we assumed it was the yttrium, was taken up when there was sugar in bone.

MB And this was a progressive build-up? This was a high-retention build-up?

JV Yes. And so then we started, when we ... I won't say settled the strontium purpose, but done a lot of the strontium stuff, and we'd done the yttrium stuff, I thought I was so old that I'd die anyhow! I started working with plutonium because plutonium, you see, is very dangerous. I mean, it's terribly dangerous stuff. But we didn't know much about …

MB Plutonium, either.

JV Well, we knew something. The Americans weren't telling us. And so we started putting plutonium into the rabbits. And this, again, was extremely profitable because we were able to show that plutonium was also taken up in the bone marrow, and that plutonium was taken up by a certain ... quite different areas to the strontium. But this is all, you see, thanks to the MRC, who just gave us money and left us to get on with it.

MB But the outcome had important implications for those interested in leukaemias.

JV And it's still having implications. I'm terribly excited, a few weeks ago … some time ago, a colleague, John Loutit, who works at Harwell, and I had put strontium into mice, and we found a certain sort of result of strontium, which was not textbook stuff, it wasn't ... I mean, it did produce osteosarcoma, but it also produced other odd lesions, which we describe. And we had, in fact, a rider put into the official recommendations about tissues that had been injured by strontium. And a few weeks ago, reading in the library, I was delighted to find a report on the effect of strontium on dogs. You see, they'd taken a dog ... the mice died within three or four weeks. These dogs who had inhaled strontium hadn't died for ... six … twenty years. But the dogs had gone, just like

my mice. And so this is the satisfactory thing about science, you see, that sometimes the answer is the answer that you get.

MB Dame Janet Vaughan, it's been my great pleasure to share these experiences with you. Thank you very much.

1. Wilfred Trotter.
2. Sir Thomas Lewis
3. Sir Thomas Elliott.
4. Sir Charles Harington.
5. H M Turnbull.
6. E H Kettle.
7. Earl King.
8. Dr Frederic Durán-Jordà.
9. Professor Josep Trueta.
10. Sir Archibald Mclndoe.
11. Charles McMoran Wilson, Lord Moran.
12. Henry Cohen, later Lord Cohen of Birkenhead.
13. Aubrey Lewis, later Sir Aubrey.
14. Reginald Lightwood.
15. James Spence, later Sir James Spence.
16. Sir Harold Boldero.
17. Sir Ernest Rock Carling.
18. Professor J H Burn.