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Historical Review

SOME WOMEN PIONEERS IN HAEMATOLOGY

When greater perils men environ,
Then women show a front of iron;
And, gentle in their manner, they
Do bold things in a quiet way
Thomas Dunn English (1819–1902), *Betty Zane*

This is a tribute to all the women who have constituted the backbone of most haematology departments in the world. Initially this was largely, and possibly is still so numerically, as technicians. But over the years, more and more women occupy positions of seniority so that, although it might be an overstatement to say that the male chauvinistic days of yore have vanished entirely, there can be a real feeling that, like Napoleon's soldiers, each woman haematologist may possess the possibility of carrying a Field Marshall's Baton in her knapsack due to the efforts of a few of her forebears whose careers follow. Here is a selection of some of the pioneers who have made this possible by overcoming the hurdles, subtle and otherwise, which were imposed by the medical establishment to their advancement. They have left a remarkable legacy as well as a deal of encouragement to those who follow.

Winifred Asby (1879–1975) (Fig 1) was born in London and migrated with her parents to Chicago in1893 when she was 14. She graduated as a Bachelor of Science at Northwestern in 1903 and gained her MS at Washington University, St Louis, two years later. She went to the Philippines, where she studied nutritional disorders for a few years, before returning to the USA, where she was a schoolteacher and then worked in the laboratories of Rush Medical School in Chicago. She moved to the Mayo Clinic in Rochester on a fellowship in immunology and pathology in 1917, where she worked in serology and bacteriology, gaining her PhD in 1921. She introduced her serological method for estimating the red cell lifespan in 1919 (Fairbanks, 1975; Wintrobe, 1985). Its principle was to introduce red cells of a different blood group to the recipient, usually blood group O or the universal donor as it was then called, and sample blood of succeeding days and weeks. Using the appropriate antibodies, the blood samples from the recipient were tested to see whether the group O cells were present and to estimate the proportion thereof to the host cells. With this technique, she found that, if the recipients were in good health, the lifespan of the transfused red cells was in excess of 120 days, whereas in some sick patients, it was considerably shortened to one-third to one-half of that time. Her findings resulted in vigorous debate, as some authorities, notably Issacs (Asby, 1948), argued on Socratic grounds that an enucleate cell would be capable of little metabolic ability for repair and, from studies on haemoglobin breakdown products and bilirubin, that the maximum lifespan of a human red cell could be no longer than 2–3 weeks. Extensive studies using her method by herself and later by others confirmed her findings, which were further verified many years later by isotopic labelling techniques. Her work established an important yardstick by which to classify anaemia and to measure the effectiveness of red cells stored in blood banks for blood transfusion, which was used extensively for the first time with the onset of World War II. In 1924, she moved from the Mayo Clinic to St Elizabeth's Hospital in Washington DC (Walsh, 1999), where she was in charge of the bacteriological and serological laboratories. This hospital was founded in 1855 by Dorothea Dix, an early reformer and protagonist in improving mental health care. It was perhaps the largest and best known of public hospitals for the mentally ill in the USA. She remained at that institution until her retirement in 1949, and much of her published work was devoted to the development and improvement of serological tests for syphilis. The general surroundings of its well-planted gardens and lawns with views of the Potomac and Washington may have inspired her musical talents to numerous compositions, which she completed and some of which she had recorded.

Florence Rena Sabin (1871–1953) (Fig 2) was the granddaughter of a physician. Her father was a mining engineer, and she was born in Central City, Colorado. She went to school and college in the eastern States and studied biology and mathematics. Learning that the new medical school at Johns Hopkins University was offering places for women students, she enrolled in 1896. There, she soon fell under the influence of Franklin P. Mall, who was the Professor of Anatomy. He had studied embryology in Leipzig with Wilhelm His, the inventor of the microtome. Mall learnt the technique of serial sectioning and later greatly impressed his 'boss', His, by showing that His had been in error in attributing the origin of the thymus in the chick to the ectoderm of the third gill cleft, whereas Mall demonstrated that it was the endoderm of the pharynx (Harvey, 1974). He then joined Carl Ludwig in physiology and developed a close friendship with his mentor. While a student, Sabin commenced a study of the structure and function of the medulla and mid-brain under Mall's direction. She was to say of Mall later 'never was a type more objective, more completely dedicated to great causes, seeking results rather than rewards'. Years later, she was to write a biography *Franklin Paine Mall: The Story of a Mind*. He was soon impressed by the rapidity with which she acquired the skills of serial section and injection techniques, and her application to her task while she continued her medical course. She graduated in 1900 in the same class as Dorothy Reed (later to gain fame for her description of the Reed–Sternberg cell classically present in Hodgkin's disease). Both women were at the top of their class and therefore granted internships at Johns

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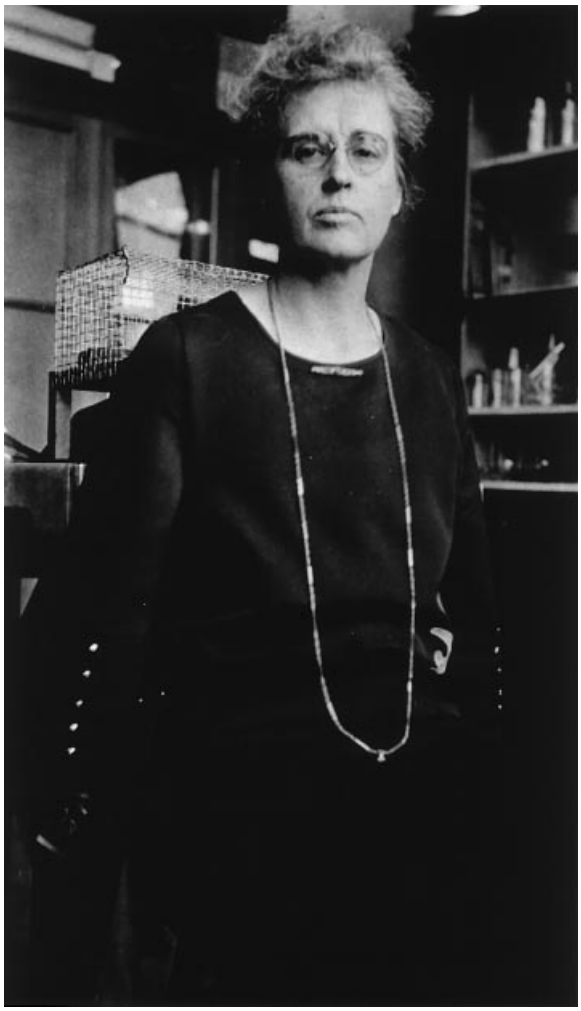

Fig 1. Winifred Asby.

Fig 2. Florence Sabin.

Hopkins. When some pressure was exerted on Reed to forgo her opportunity, Sabin volunteered to step down if a place for Reed could not be found. The problem was resolved, but Sabin found that her internship experience made clinical medicine less attractive to her than laboratory work, and Mall readily offered her a position in the Department of Anatomy. During her student days, she had produced a model of the development of the fetal central nervous system, which she had established using a combination of serial sections of embryos at differing stages of development combined with injections of dyes. These models were widely used in teaching exercises at a number of universities. After her internship, her next study was of the development of the lymphatic system using small embryonic pigs from the nearby abattoir as her model. She used serial sections to demonstrate that the lymphatic system developed as a network initially derived from the venous system. She played an active role in teaching anatomy and embryology both to medical students and to nurses and was a very popular teacher nicknamed 'Flossie' by the students (Harvey, 1974; Harvey *et* , 1989). Her teaching embodied the principles she had learnt from her mentor, Mall, in that she presented her facts in a logical and entertaining way, but emphasized and illustrated the importance of extending current knowledge by demonstrating the more recent advances using techniques she had helped to develop.

Her next investigation concerned the formation of the blood cells using tissue culture techniques with developing chick egg embryos in which the erythrocytes were derived from the endothelial cells of the early vessels. Over the next four years, she was promoted from being an assistant to Associate Professor of Anatomy. During this period, she was asked by Mall to unravel a model produced by Gertrude Stein at his instigation. Ms Stein had spent 4 years at Johns Hopkins Medical School, and her performance had left all her assessors with the view that she should be 'flunked' and dismissed from the medical school. At the professorial meeting to ratify this, Professor Mall pleaded that she be given one more chance. He allocated her a similar project to the one Sabin had undertaken as a medical student to build a model of the medulla and cord of a pig embryo. When Stein presented her efforts to Mall, he could not make anything of it and referred it to Sabin, who felt that Stein must have inverted the cord in the fixation procedure. Mall threw Stein's model out. This woman of letters, who later attained such notoriety (Ousby, 1988), became one of the most

famous persons to 'flunk' Johns Hopkins Medical School! Sabin then commenced her studies of the origins of blood cells using chick blastoderm and early tissue culture techniques developed by Ross Harrison. This led her to initiate the use of supravital techniques to study the morphology of the cellular elements of the blood. Using this approach, she was able, in the short term, to visualize various internal organelles, e.g. the mitochondria, as well as to follow the development of the monocyte and its involvement in phagocytosis. In 1913, Mall supported her promotion to that of a full professor, the first woman to reach that position at Johns Hopkins. Six months later, Mall died after complications resulting from an operation to remove his gallstones. Sabin was perturbed when one of her former students was preferred to her as Mall's replacement, but she continued at Johns Hopkins for a further eight years, expanding her research to inflammation and, in particular, the involvement of the monocyte and the fixed tissue phagocytic cell and their roles in infection responses to conditions such as tuberculosis. Her work attracted Simon Flexner's attention, and he persuaded her to move to the Rockefeller Institute in New York, where she stayed for the remainder of her active 'wet bench' research life. She devoted herself largely to the cellular defence mechanisms against diseases such as tuberculosis. She was joined by Charles Doan, who adopted her supravital techniques for peripheral blood examination, and when he and Bruce Wiseman left the Rockefeller to establish a Department of Medicine and Haematology at Ohio State, this approach was used for the analysis and classification of blood disorders in general, but leukaemia in particular. This routine technique was later transplanted to the Department of Haematology at Washington University in St Louis when Carl Moore returned there to head the department bringing with him Virginia Minnich (see below) who had been trained in Sabin's techniques. Florence Sabin retired from the Rockefeller and returned to her old home in Colorado, where she became a leading figure in establishing public health measures to prevent tuberculosis. She achieved many honours in her lifetime, including the first woman to be elected to the US Academy of Sciences in 1925 and to have a sculpture of her placed in the National Sculpture Gallery in Washington DC, where two people from each state are entitled to be nominated for inclusion.

Lucy Wills (1888–1964) went to school at the Cheltenham College for Young Ladies and proceeded to Newnham College, Cambridge, where she studied botany and geology, taking the second part of her tripos in geology in 1911. She pursued biology briefly but, having independent means, she travelled and went to South Africa where she rendezvoused with her Cambridge friend, Margaret Hume, who was lecturing in botany there. When World War I was declared, she volunteered as a nurse (Wintrobe, 1985; Obituary, 1964a,b) and returned to England, where she enrolled in the London School of Medicine for Women established by Elizabeth Garrett Anderson (1836–1917) and later to become the Royal Free Hospital School of Medicine. She had initially planned to specialize in psychiatry, as she had been very impressed by Freud's writing, as was her friend Margaret Hume. She graduated in 1920 but, by now, was convinced that she was more interested in the biological aspects of medicine and joined another Cambridge friend in the Department of Chemical Pathology at the Royal Free Hospital. From the late 1920s to the 1930s, she visited India on a number of occasions, where she worked on nutritional anaemias supported by funds from the Lady Tata Foundation at the Haffkine Institute. This study had been initiated because a Dr Margaret Balfour of the Indian Medical Service had recognized the prevalence of anaemia of pregnancy in Indians working in the textile industry. Wills found that this anaemia differed from true pernicious anaemia, as the patients did not have achlorhydria and responded to crude liver extracts but not those 'pure' liver extracts that successfully treated pernicious anaemia. She discovered that this type of anaemia responded to yeast extracts, such as Marmite, which offered a cheap and effective remedy that could readily be given to the impoverished Indian women. She postulated that there must be another factor responsible for this macrocytic anaemia other than vitamin B12, for some years called the Wills' factor, and this was later shown to be folic acid (Wintrobe, 1985; Obituary, 1964a,b). She always retained an attachment to the Royal Free, although this was on a voluntary basis, and she divided her work between the hospital and her research in India. In 1928, she was appointed part-time biochemist at the Royal Free, but still continued her studies in India. In 1938, she wrote classical papers with Barbara Evans in *The Lancet* on 'Tropical macrocytic anaemias: its relation to pernicious anaemia'. She returned to England when war broke out in 1939 and became a full-time pathologist in the Emergency Medical Service and was later in charge of pathology at the Royal Free Hospital in Gray's Inn Road. By the end of the war, she had established the first Haematology Department at the Royal Free. Never driving a car, she always used a bicycle as her means of transportation, a symbol of her commitment to outdoor exercise and the environment. After retirement in 1947, she worked for a time on nutritional effects on health in South Africa and Fiji. With a lifelong concern with social issues, no doubt reinforced by the time she spent observing the poverty in India, and perhaps irritated by the complacency and pomposity of many of her male colleagues, she was quietly but determinedly anti-establishment. For many years, she lived in a jointly owned house in Surrey with Margaret Hume, where they maintained a 'botanists' garden'. A keen nature rambler throughout her life, she made early use of skis to traverse the snow in cross-country and was an ardent mountain climber. These skills she used to enjoy and not to spoil nature, and there is little doubt that, if alive today, she would be an active supporter of the 'green' movement. She became more politically active and, on her retirement, lived in a house in London and was elected as a borough councillor for Chelsea, which she remained for the last 10 years of her life, complementing her desire for civic service with her love of gardens and music (Obituary, 1964a,b).

It is doubtful whether any haematologist could lay claim to a family tree as distinguished as that of Janet Vaughan

(1899–1993). These forbears include Henry Vaughan (1621–95), the seventeenth century poet who, after the Civil War, initially made his living as a physician, and his twin brother, Thomas (1621–66), a philosopher who was to meet his maker after performing an experiment involving mercury, described thus by the diarist Anthony A. Wood '. . . which getting up his nose, marched him off'. Both were students at Jesus College, Oxford (Wintrobe, 1985; Ousby, 1988). Another distinguished ancestor was Sir Henry Halford (1766–1844), President of the Royal College of Physicians from 1820 to 1844. He was the son of Dr James Vaughan but later came into a large fortune when his mother's cousin, Lady Denbigh, the widow of Sir Charles Halford, died and he changed his name to Halford. An adept physician, he became the physician to four successive monarchs, George III, George IV, William IV and Queen Victoria, and was at the bedside at the deaths of the first three (Wintrobe, 1985; Wolstenhome, 1964)! He had been schooled at Rugby and later at Christ's College, Oxford. Janet's father, William Wyamar Vaughan, was a classical scholar who, in 1921, became headmaster of Rugby. She commenced medical training at Oxford, taking three attempts to enter Somerville College, perhaps because of a degree of dyslexia (Adams, 1993; Owen, 1995). In medical school, her *bête noir* was anatomy, but this was more than compensated for by physiology, as taught by J. B. S. Haldane. She undertook her clinical training at University College Hospital, where she was impressed by Thomas Lewis, who held and proclaimed radical views on the state and organization of clinical science, as well as medical education in the UK, and Wilfred Trotter, who was an outstanding surgeon with a philosophical and sociological bent and was elected FRS in 1931. She graduated in 1924 and began a career in clinical pathology, which included bacteriology, biochemistry and haematology. The latter brought her into contact with Cecil Price-Jones at University College Hospital and drew her into haematology where his forte was the statistical analysis of data. Although his own research, which led to the Price-Jones curve to analyse red cell size, was a little dry, he was a cultured man with a keen sense of humour. When there was an argument at an international meeting on the true value of haemoglobin levels because of apparent differences between values in the USA compared with Britain, he remarked that this could be explained by 'The effect of the exhaust of American cars upon the haemoglobin of the man in the street'. He was an accomplished cellist and pianist, as well as an able painter with water colours (Firkin & Whitworth, 1996). On learning of Minot's liver treatment of pernicious anaemia, Vaughan, in cahoots with the ward sister and the resident doctor, fed a few patients with raw liver unbeknown to the physician in charge, who attributed their improvement to the judicious dose of arsenic he was administering to them (Wintrobe, 1985). Her experiences in medical training, particularly some of the squalor and frightful housing conditions during midwifery visits, had aroused a lasting sense of sympathy and support for the underprivileged. She was a strong supporter of socialism and the Labour Party. Her family's literary connections gave her entrée into the Bloomsbury group, where Virginia Woolf, her father's cousin, at first regarded her as a somewhat colourless individual. Woolf later revised this opinion, possibly when Janet conscripted many of her friends to manufacture liver extracts for the treatment of pernicious anaemia after Minot's landmark discovery. These friends, including Virginia Woolf, collected buckets of minced raw liver with Janet to try to make a more palatable mixture for her patients, but this resulted in a preparation which, on feeding to dogs, produced vomiting, although Janet herself partook without ill effect (Wintrobe, 1985; Adams, 1993; Owen, 1995)! She obtained a Rockefeller Scholarship, which enabled her to work for a year at the Thorndike Memorial and see Minot's work at first hand (Rackemann, 1956). She was soon immersed in a study of anaemia in pigeons fed on unsupplemented cereal and then observed the reticulocyte response to various liver extracts. Minot was a stickler for rehearsing presentations for meetings and revised Vaughan's slides as well as editing her material to increase its brevity and lucidity. This exercise was greatly appreciated, and she was later to impress it on her own students. Although encouraged to stay for another year at the Thorndike, she left for England to marry David Gourlay, whose work in establishing the Wayfarers' Travel Agency she had greatly admired and who shared her social and political views. This organization was to enable different nationalities to meet and arranged educational tours for school children (Owen, 1995). The marriage was an extremely happy one with two daughters who were brought up in an extremely modern home environment for that time. She had become warm friends with Dr and Mrs Minot and was at Southampton to greet them when they visited the UK on their way to Sweden in 1934, where Minot was to receive the Nobel Prize. She picked him up and took him to the London Hospital for a luncheon in his honour but, to Minot's surprise, Vaughan was not among the guests! Indeed, at the London Hospital, she was ignored by the male staff with the outstanding exceptions of Donald Hunter and the Professor of Pathology, H. M. Turnbull, who were both always helpful and supportive. At the London Hospital, she worked on the anatomy of bone marrow and its involvement in the leuco-erythroblastic anaemias and, in 1934, published a monograph on *The Anaemias*, which was widely appreciated. That year, she was invited by the Head of Pathology at Hammersmith, E. H. Kettle, to join his department as Assistant in Clinical Pathology, which she accepted on the understanding that she could pursue her research in the anaemias and haematology. Here, her first junior was R. A. G. Macfarlane and, not long after, J. V. Dacie, attracted by reading her book on anaemia, joined her team, so she had a hand in training arguably the UK's two most influential haematologists of this century. At Hammersmith, she developed blood transfusion techniques and, when World War II broke out, was heavily involved in the supply and establishment of an efficient Blood Transfusion Service, which was necessitated by the increased trauma of that period. After the war, she was a member of the British nutritional team of the MRC (Medical Research Council) which went to Belsen to assess the best means of helping the appalling degree of degradation, starvation and

psychological trauma suffered by its hapless inmates. Her own feelings are well described in letters of appreciation to her by members of her college, Somerville (Adams, 1993). In 1945, she became Principal of Somerville College at Oxford University and here, through association with the Orthopaedic Department at the Radcliffe Hospital, continued her studies on the effects of radioactive compounds and other elements on the bone marrow (Vaughan, 1981) (Fig 3). She directed a research team that examined the effects of numerous alkaline earth and radioactive elements on the biology of bone. Particular emphasis was paid to the breakdown products of atomic bombs and, therefore, accidents involving nuclear power stations or installations. She was elected Fellow of the Royal Society in 1979. As Principal of Somerville College, she encouraged entrance into the science subjects and expanded the intake of overseas students. She was quite legendary in the love and attention she bestowed on college residents and the encouragement she gave them in their undergraduate and postgraduate careers. She had particularly practical advice in aiding their progress in a world that was still male dominated.

Virginia Minnich (1910–95) was a technician in the Department of Haematology at Ohio State University when Carl Moore joined the department as a Research Fellow to train further in haematology under Charles Doan. Virginia had already become an experienced morphologist with particular expertise in supravital staining techniques, which Doan had imported from his training with Sabin at the Rockefeller Institute. Virginia was from farming stock, born in Zanesville, Ohio. Throughout her life, she was an ardent Republican, although most people with whom she worked were rather to the left of centre Democrats! Her face, neck and upper body had been severely scarred after her dress caught fire from a gas heater when she was a small child, and this deformity was only partially remediable by repeated plastic surgery. Her own consciousness of her unattractive appearance was reinforced by a number of her teachers indicating to her that it limited her employment choices. As a young technician in Doan's department, she met and worked with Carl Moore who had just arrived to train in haematology. He commented that she should accentuate her positive attributes, which were her luxuriant and attractive auburn hair and, from that time forth, Virginia was a regular visitor to the hairdresser and her hair was always immaculately groomed. Virginia completed her MS in nutrition at Iowa State College in 1938. After two years, when Moore was to return to St Louis to establish a Haematology Department at Barnes Hospital, Washington University, he asked Virginia to join him and to abandon the ambitions she had to enter medical school. This was the only advice given to her by Moore that Virginia came to regret later in life. Together, they soon developed an active laboratory programme, which trained medical undergraduates, haematology training fellows and technicians, largely under Virginia's supervision and direction. Virginia's knowledge of morphology grew to legendary proportions, but she also took part in the early studies on iron metabolism, initially involving the variations in iron level in women during their menstrual cycle. These and other iron studies were soon to establish the department's research reputation. Virginia rapidly became the essential component in the development and maintenance of the routine haematological procedures for the Washington University Hospital Group. Not only did she maintain a rigorous control over the quality of the tests performed, but she was always on the look-out to introduce and assess new ones. Already an accomplished morphologist, experience honed her skills, which she readily passed on to her colleagues whether medical, student or technical staff. She became the key figure in the department in training haematology fellows, sophomore medical students and the technical staff, as well as becoming an arbiter in any morphological debates among her more senior associates. As a result, she was asked to establish haematological laboratories in Havana (1945) and, in 1951, she went to Thailand on a similar quest (Fig 4). This was to be a highlight of her career for, while there, she appreciated the extremely high incidence of thalassaemia in that country, and this set her on the path to the eventual discovery that, unlike 'classical' thalassaemia, this was caused by an abnormal haemoglobin, haemoglobin E. She spent a year in Thailand and formed friendships that led to lasting associations and collaboration with Supa Na-Nakorn (later to become a professor), which resulted in a return for a further three months to Thailand in 1954. Increasingly in St Louis, Virginia had become a central lynchpin of the department. Always admired and respected by those she taught, she returned the compliment by unfailing efforts to keep in touch and follow their later careers. Virginia was always the first contacted when trying to chase up or discover what had happened to a past laboratory acquaintance in St Louis. It was only rarely that she could not provide the information! Intuitively, but perhaps heightened by her own horrific experience as a child, Virginia understood that people responded very positively to clear indications that they were regarded as someone special and worthy of continued contact. In 1965, she went to the University of Ankara in Turkey, once more to help them establish a haematology laboratory and, during her time there, became aware of a curious pica in some areas, which

Fig 3. Janet Vaughan in her laboratory.

Fig 4. Virginia Minnich, Thailand, 1951.

related to clay eating. Pica has a well-known association with iron deficiency as well as pregnancy and, when she found that many of these food faddists were indeed iron deficient, many would have been happy with this explanation. Typical of her research intuitiveness and curiosity, she investigated further to discover that the clay contained chelated iron, so a vicious cycle was established. When she returned to St Louis, she discovered that clay eating was well known in some of the southern states of the US and that, during the Vietnam War, relatives would post samples from their favourite clay hills to the troops. As Virginia was concluding this study, the department was visited by Sir George Pickering and, when introduced to Virginia, he expressed an interest in the story. Virginia dashed off to her office and returned exclaiming 'Saint George, here's a sample to try'. Saint George declined graciously despite his elevation in ecclesiastical ranking, if not in secular status! In 1970, Dan Mohler, a former research fellow in the department, now at the University of Virginia, referred to her an unusual family he had been investigating with a glutathione synthetase deficiency (D. Mohler, personal communication). Again, her dogged persistence came to the fore when her friend and chief biochemical adviser, Phil Majerus, 'was ready to leave well alone' resulted in her devising assays critical to the project and in the elucidation of the glutathione synthesis pathway (P. Majerus, personal communication). In the early 1970s, she compiled wide-ranging audiovisual programmes on all aspects of morphology of the peripheral blood films and bone marrow, which were widely used by haematologists all over the world. As a recognition of her many accomplishments in research and teaching, she was appointed Professor of Medicine at Washington University St Louis – the only such occupant without a PhD or MD!! Upon her death, her former students and colleagues endowed a visiting professorship in clinical hematology at Washington University, and Virginia willed her estate to the Washington University Medical School to be used for student scholarships.

Judith Pool (1919–75) was born in New York and gained her PhD at the University of Chicago in 1946. She moved to Stanford University in California, where she became a member of the Department of Hematology in 1953. She first published a paper on blood coagulation in 1954 and devoted her research to this discipline for the rest of her life. Her seminal discovery was published in *Nature* in 1964, 'High-potency antihaemophilic factor concentrate prepared from cryoglobulin concentrate'. By the simple process of deep freezing human plasma and allowing it to thaw at low temperature in a refrigerator, a cryoprecipate formed which, when isolated from the supernatant plasma, contained factor VIII enriched to approximately 10 times its concentration in whole plasma, as well as containing von Willebrand factor and fibrinogen. The supernatant contained largely albumin, factor IX and other vitamin K-dependent clotting factors. Using the currently available plastic blood transfusion packs, this cryoprecipate concentrate could be readily prepared in any Blood Bank and Haematology Department in the world and, when separated from the supernatant plasma, the 20–30 ml of 'cryo', as it became known worldwide, could be used as a starting product for further purification or directly infused therapeutically in patients with haemophilia or von Willebrand's disease. At the time, the only replacement therapy for haemophiliacs was whole blood, fresh frozen plasma and, therefore, therapeutic levels of factor VIII were usually impossible to achieve because of fluid overload, or factor VIII concentrates could be used, which were very expensive and only available in a few countries in the world. This discovery led to a dramatic change in the management of both haemophilia and von Willebrand's disease, as120 ml of 'cryo' became the equivalent of 2 l of plasma and resulted in a relatively ready achievement of therapeutic factor VIII levels in clinical situations. It led to the introduction of home management of the disease, as the packs of 'cryo' could be readily stored in the family refrigerator and, with education of the parents, could be given immediately to children who were having a bleeding episode. The method was cheap and was introduced to Third World countries, where it was immediately as successful. Her study resulted in a revolution in the treatment of factor VIII deficiency. Although modest, she was active in encouraging young people to take on science as a career, as well as in the promotion of more women graduates in medicine, but she herself always expressed some hesitancy about her abilities to handle sick people and preferred laboratory work (Brinkhous, 1976; Roberts, 1988).

These are a few examples of leading woman figures in haematology in the past. Perhaps their experiences have led to the present, where it is difficult to think of a single country in which women are not well represented in our discipline at

every level and who contribute steadily to the advancement and practice of the subject.

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