War Neurosurgery: Triumphs and Transportation

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WAR NEUROSURGERY: TRIUMPHS AND TRANSPORTATION

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INTRODUCTION

In both World War I and World War II approximately seven percent of battle casualties were due to cranial injuries. In1915 Harvey Cushing led a Harvard-financed hospital to Paris. Cushing and Colonel Andrew Fullerton of Queen's University Belfast with advances of much specialist surgery, whole blood and trained nurses nearer to the Front Line halved the mortality in France of the Allies. Hugh Cairns of Adelaide volunteered as a Private. He survived paratyphoid, was returned to Australia but was later able to return to combat in France. Cairns was to train in Neurosurgery at Harvard under Harvey Cushing and then in World War II to emulate his teacher Cushing by also halving combat cranial injury deaths, in comparison to World War I, through advances in Neurosurgery and superb evacuation. Colonel Cecil Calvert of Belfast played a key role.

Figure 1 *Harvey W. Cushing, MD, Yale to Harvard MD, FRCS, FRCP, NAS, FRS (1869-1939); youngest of ten children. His father and grandfather were general practitioners in the U.S. Mid-West. Winner of Pulitzer Prize for History, protégé of Sir William Osler and Father-in-Law to FDR's eldest son James. Oil on canvas, 1908, by Edmund C. Tarbell (1862-1938), 86.36 cm x 111.76 cm. From the collections of the Dittrick Medical History Center, Case Western Reserve University, Cleveland, Ohio, USA, and reproduced with their permission.*

HARVEY CUSHING AND THE FOUNDING OF THE PETER BENT BRIGHAM HOSPITAL

The years before World War I saw medico-political struggles on both sides of the Atlantic. Between 1902 and 1912 the Peter Bent Brigham Trustees had negotiated with President Lowell of Harvard for the establishment of the Peter Bent Brigham Hospital next door to the Harvard Medical School[1]. Mr. Lowell wished Harvey Cushing to be Moseley Professor and first Chief of Surgery at the Peter Bent Brigham Hospital (Fig. 1). Cushing eventually accepted Lowell's offer in 1912 after Harvard's president travelled to Johns Hopkins

Figure 2 *Sir Alfred Keogh, MD, Galway, GCB, GCVO, CH, LLD (1857-1936), oil-on-canvas, by Arthur Hacker, RA (1858-1919), 110 cm x 85 cm. From the collections of the Trustees of the Museum of Military Medicine, Surrey, UK and reproduced with their permission. Appointed Surgeon General in 1901, and Director General of the Royal Army Medical Service until 1910, and 1914-1919. Rector of the Royal Army Military College, Millbank, London, 1910-1922. Keogh established an association for women students and staff at the Imperial Medical College.*

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to discuss the details in person[2]. Early in 1913 Cushing performed the 'opening' surgical operation.[3]

RAMC IN SOUTH AFRICA

Major A.H. Keogh sailed in October 1899 as "the Registrar and Secretary" of the RAMC 3rd General Hospital for South Africa[4] (Fig. 2). Supported financially by the Iveaghs of Guinness fame, staffing consisted of a quintet of RAMC officers, a dozen civil surgeons, a sole Warrant Officer and over a hundred other RAMC men. By the first week of December 1899, the 3rd General had open 620 beds. In the next six months over 3,500 patients were passed through[4]. In the RAMC thereafter, sanitation, hygiene, epidemiology, pure water and vaccines were emphasized and funded by the political power of Richard Burdon Haldane, the first Viscount Haldane, Prime Minister Balfour and Kings Edward VII and George V[4,5,6]. A full establishment of nursing sisters and nurses was funded. Keogh called for specialist doctors and surgeons to join as Territorial Royal Army Medical Corps Officers. No.1 Territorial Army (TA) Hospital was formed at Newcastle-upon-Tyne, and No.2 at Birmingham[4].

With the support of the British Secretary of State for War William St. John Broderick and King Edward VII, the *Lancet* commented "never had the Army Medical Board had so much influence"[4]. Within the 1902-1907 quinquennium Keogh was a Lieutenant General and Director General of the RAMC. Sanitation, hygiene, epidemiology, pure water and vaccines were required[4,5].

WORLD WAR I

By 1910 Lieutenant General Keogh had in preparation for another war arranged for the British Medical Schools and their Teaching Hospitals including Keogh's own Galway

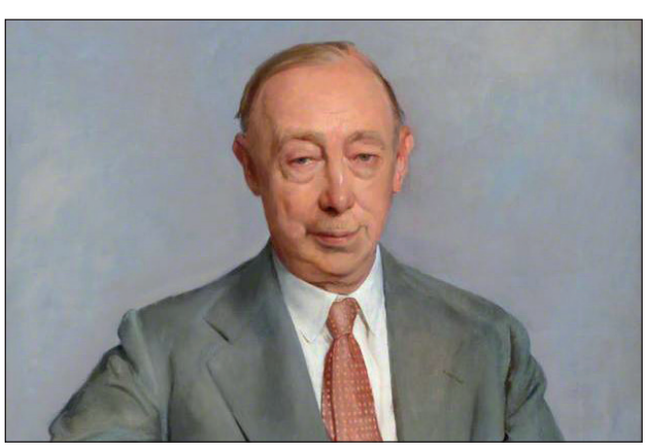

Figure 3 *Sir Geoffrey Jefferson, MD, FRCS, FRCP, FRS (1886-1961), oil on canvas by Sir Gerald Kelly, PRA (1879-1972), 1955-56. 82 cm x 68 cm, RCSSC/P 396. On loan to the Hunterian Museum, Royal College of Surgeons from the Jefferson Family, and reproduced with permission.*

"That they shall become components of the UK Emergency Medical Services [EMS]." He also organized surgical specialization especially in orthopaedics and bacteriology. Early in World War I King George V reappointed Keogh as Director General of Medical Services of the RAMC. In 1915 the leading British Neurosurgeon, Sir Victor Horsley, died of heat stroke[7,8]. Sir Alfred Keogh with tact, persuasion and Royal and Harvey Cushing's help organized Cushing's Neurosurgical Unit and later Sir Geoffrey Jefferson's nearby Neurosurgical Unit at Wimereux near Boulogne[4,5,9]. Another specialized Combat Neurosurgical Unit was established in the

Figure 4 *Sir Hugh William Bell Cairns, DM (1896-1952), by Walter Stoneman. Bromide print, February 1947, image size: 134 mm x 97 mm. ©The National Portrait Gallery, London, image no. NPG x 166314. Reproduced solely for this Medical History.*

Pas de Calais visited by Cushing[9].

Having been returned to Australia, Hugh Cairns was later able to return to combat in France[10]. During World War I, Geoffrey Jefferson (Fig. 3), after extraordinary service in Czarist and Revolutionary Russia, had been given permission and support to form the first British Neurosurgical Unit at Wimereux, near Boulogne on the Channel, alongside Harvey Cushing's Neurosurgical Unit[11]. In 1918 Jefferson had under his own care over 100 neurosurgical case casualties. Gertrude Jefferson, his wife, a Canadian physician, was a protégée of the Oslers. The close friendships of these families and their contacts are the foundations of modern neurosurgery[3,9,10]. Cairns was to train in Neurosurgery at Harvard under Harvey Cushing and then in World War II to further emulate his teacher Cushing by also halving combat cranial injury deaths, in comparison to World War I (Fig. 4)[10].

According to Sir Ian Fraser, "Cecil Calvert from Belfast was second in command to Brigadier Hugh Cairns in the Neurosurgical Unit in St. Hugh's College"[12]. From 1942 to 1945, I[1] met with Colonel Calvert and his wife Eileen at 29 Charlbury Road, Oxford, when we were guests and waiters for the Cairns'.

1 This and other first-person references refer to the first author.

In January 1943 Ian Fraser was flown from Accra to London by the U.S. Army Air Force. In London the RAMC Directorate of Surgery said he was, via Belfast, to go to Oxford to work with Professors Florey and Cairns and Colonel Cecil Calvert, a former Queen's Belfast colleague: "In fact, Calvert was largely in charge of the unit [at Oxford] during Cairns' frequent absences"[12,13]. Cairns' and Cushing's friend Geoffrey Jefferson from Manchester, was responsible for Neurosurgery in the UK Emergency Medical Services[9,12,14]. On 2nd May 1943, Ian Fraser and bacteriologist RAMC Major Scott Thompson and their Medical Research Council Team steamed past Northern Ireland to arrive in Algiers on 12th May. They sailed in the Hospital Ship *Newfoundland,* later sunk off Salerno[12].

Ian Fraser received a DSO for his superb surgical results in the invasion of Sicily. In the Salerno landings he landed from a light RAF plane, but soon contacted diphtheria and was treated successfully by Max Rosenheim[12,15]. Invalided to Cairo, Ian Fraser helped Clifford Naunton Morgan close colostomies[12]. Penicillin was shown to be particularly efficacious in post-combat neurosurgery, but not quite as effective in relation to abdominal surgery, as confirmed by Brigadier Cairns in his observations on the Mediterranean Theatre[16,17].

GEOFFREY JEFFERSON, HARVEY CUSHING AND COLLEAGUES

During most of July 1901 Harvey Cushing had visited the Charles Sherringtons chiefly in Liverpool and in Oxford, and Cushing did the required surgery on cortical localization in chimpanzees, orangutans, monkeys and gorillas[3,9]. Similar visits followed in 1904 and 1909. When Hugh Cairns came up to Oxford in 1919 as a Rhodes Scholar, he took over these duties. In June 1920 Cairns also rescued a punting Lady Sherrington from drowning in the Thames. Lady Sherrington could not swim. Sherrington wrote to Cushing at the Peter Bent Brigham Hospital in Boston and arranged the financing of Cairns' Rockefeller Fellowship for 1926-27[18]. Under Cushing and Gilbert Horrax, later Head of Neurosurgery at the Lahey Clinic[19,20,21], Cairns was Cushing's assistant[22].

Harvey Cushing's daughter Betsey married Eleanor and Franklin Delano Roosevelt's son James on June 4, 1930, two days after his Harvard graduation[3,23]. FDR frequently exchanged letters with Harvey Cushing[23]. According to the Cairns', FDR told Cushing to get Cairns, now the designate Nuffield Professor of Surgery, all the neurosurgical equipment that would be needed for the forthcoming World War II. FDR and Cushing knew from World War I of the specialized steel and other specialized equipment needed[10,24]. In 1935 Hugh Cairns and Cushing resumed their 1926-27 and 1930 collaboration. FDR saw to financing especially from the Rockefeller Foundation. In 1938 Cushing came to Oxford to collect an LLD, and approved of the Neurosurgical British Emergency Medical plans: St. Hugh's College Neurosurgical Hospital at Oxford, Cairns and Calvert, Jefferson at Manchester, Dott at Edinburgh (1923-24 with Harvey Cushing in Boston) and Rowbotham, Mancunian protégé of Jefferson, at Newcastle-upon-Tyne. FDR said 10,000 Dakotas, DC3, C47s and lots of Nightingales would be needed—"build the planes for 'my' allocation, train the Nightingale Anglo-American flight nurses[24]".

TABLE 1. CROSS-CHANNEL CASUALTY AIR EVACUATION D-DAY THROUGH MAY 1945 (Almost all by DC3 Dakotas)[28]

MONTH	EVACUATIONS
June 1944	27,387
July 1944	37,685
Aug. 1944	29,151
Sept. 1944	26,126
Oct. 1944	17,518
Nov. 1944	26,059
Dec. 1944	31,478
Jan. 1945	17,483
Feb. 1945	17,428
March 1945	44,108
April 1945	81,701
May 1945	42,567
TOTAL*	**398,691**

*Approximately 7 percent (27,908) were destined for the UK Neurosurgical Centres (see Table 2)

FDR spurred on the production of C47s (DC3 Dakotas) to one every 28 minutes, night and day. They were equipped to carry jerry cans of fuel in and the wounded out[24]. Typical landing from unloading to loading wounded was twenty minutes. Concealed air-landing strips could be as short as 50 yards; delivery from the US to France and Italy was by Ascension Island, flying distance 11,600 miles. Control was given in 1943 to Eisenhower and his deputy Tedder[25]. In France from June 1944 onwards to May 1945, Patton told his 3rd US Army, "We do not worry about our flanks, we go get our fuel and our Nightingales with our wounded often from behind Nazi lines." A verbal correction from the Combined Allied Surgical Consultants Committee ordered that he, Patton, must not refer to "Our Nightingales"[26,27]. Typically one trained Air Nightingale Nurse and one Medical Technician was on each fuel supply DC3[28,29].

TABLE 2. DISTRIBUTION OF NEUROSURGICAL CASES EVACUATED TO THE UK, D-DAY THROUGH MAY 1945

HOSPITAL:NEUROSURGEON(S)	NO. CASES (approximate)	REFERENCES
Oxford (St. Hugh's): Cairns, Calvert	13,000	34,35,36,37
Manchester :Jefferson	6,683	9,11
Edinburgh: Dott	3,000	38
Newcastle-upon -Tyne : Rowbotham	125	39
Hackwood Park: Botterell	2,100	40
Americans treated in the UK by Spurling and Sweet at Birmingham and Oxford	3,000	41,42,43,44,45,46,47
Total	**27,908 (see Table 1)**	

AIR EVACUATIONS

On DC3 cross-channel return flights from June 1944 to the end of May 1945, nearly 399,000 patients were evacuated[28,29] (Table 1). Patton's Third Army did have fuel problems in September 1944, but this was corrected well before the left swing to relieve Bastogne in the Battle of the Bulge[30]. The

performance of the Allied Air Evacuation of the wounded under the ultimate control of Professor General Elliott Cutler, Harvey Cushing's successor as Moseley Professor at Harvard, was superb[31,32].

From 6 June to 23 July 1944, approximately 18,415 U.S. Army patients were flown to the U.K. by the U.S. Army Air Force, averaging 418 per day[33].

Approximately seven percent of the casualties evacuated to the United Kingdom by air, or 27,908 patients (Table 1), were flown to the Neurosurgical Centres (Table 2). Almost half, about 13,000, were flown to airfields surrounding Oxford: Abingdon, Brize Norton, and Benson and thus to the care of Colonel Calvert and Brigadier Cairns at St. Hugh's College RAMC Hospital[34,35,36,37]. The others were placed under Jefferson at Manchester[9,11], Dott at Edinburgh (3000 cases)[38], and Rowbotham at Newcastle-upon-Tyne (125 cases)[39]. The Canadians at Hackwood Park, near Basingstoke under Major Harry Botterell received 2,100[40]. A further 3,000 U.S. soldiers and airmen were treated in the U.K. after evacuation from Northwest Europe by Glen Spurling[41,42] and William H. (Bill) Sweet[43,44,45,46,47] at either Birmingham or Oxford . In 1962, I became Bill Sweet's Head of Neurosurgical Anaesthesia at the Massachusetts General Hospital. The aforementioned numeration agrees with Bill Sweet's recollections. I also worked with his successor Nick Zervas[48].

Only seven in-flight patient deaths were reported from January 1944 through September 1945 during air evacuation from Europe[33] (Table 1); perhaps among them was a neurosurgical patient. This stellar record was marred only by reported losses ranging from 95[28] to 101[33] patients, in addition to their medical staff and flight crews, in 3 reported plane crashes and one crash landing[28,33].

PERSONAL NOTE

From the autumn of 1940 until the summer of 1942, I was taught and supervised by Harvard-trained physicians, and by my brother Michael's godfather, later Sir Benjamin Rycroft[15,49,50]. Generally we met in the house my parents had rented from the Toppings which overlooked the Lagan; sometimes at Musgrave Park where my father was Commanding Officer [30,51]. My Harvard "tutors" and I discussed many topics: splitting the atom and the recent work of Lise Meitner (Magnus I. Smedal from MIT)[30,52,53], the antigenicity of bacteria and viruses (Max Rosenheim from Massachusetts General Hospital)[15,54], need for blood transfusion (Colonel Thomas Lanman, Boston Children's Hospital)[32,51,55], tuberculosis (Ted Badger, Boston City Hospital, Thorndike Laboratory)[56,57,58], epidemics and digestive diseases (Richard Warren)[30,59,60], food poisoning (Bert Dunphy)[30,61], and basic endocrinology (Robert Zollinger)[30,62].

With this background and exceptional tutoring my father wrote to the Lynams, father, Hum, and son, Joc, suggesting I should become a pupil at the Dragon School in Oxford, round the corner from 29 Charlbury Road, the large house of Hugh and Barbara Cairns and Dragons Margaret and Elizabeth, their daughters. The Lynams said they were full but the Nuffield Professor of Surgery, Hugh Cairns, claimed

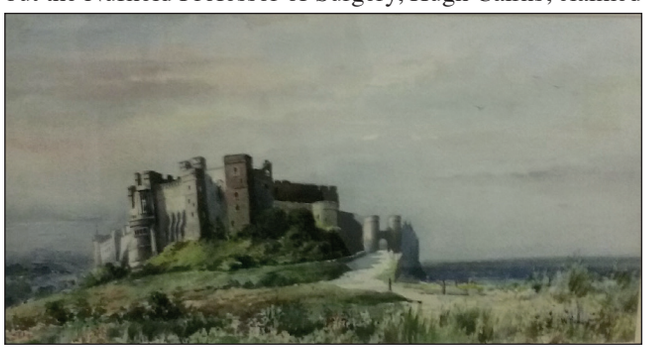

Figure 5 *Bamburgh Castle, Northumberland. Watercolour by William Fergie (1893-1971), 1961, 20.5" x 11.0". Reproduced by permission of owners. Site of pre-Norman fort. For the next 500 years owned by The Crown then gifted to Sir John Forster, and subsequently a hospital in the 18th-19th centuries.*

to have seen me as a baby when the Surgical Travellers[31] visited Newcastle-upon-Tyne and thereafter at Bamburgh, Northumberland. So I was admitted to the Dragon until 1947.

Barbara, later Lady Cairns, had not been able to go to Boston in 1926 and 1927 when her husband Hugh was Harvey Cushing's Assistant at the Peter Bent Brigham Hospital and Harvard. She appeared fascinated by my stories of the Dragon School and Oxford.

I knew that Barbara Cairns had been an open scholar at Girton College, Cambridge University, and that her mother Mary, née Forster Baird[63] had chosen her a boyfriend, Australian physician Rhodes Scholar and Oxford Rowing blue at Balliol.

TABLE 3. WORLD WAR II BRITISH MOBILE NEUROSURGICAL UNITS OVERSEAS (CAIRNS, 1947[36])

					GUNSHOT HEAD WOUNDS		
UNIT	DATES	THEATRE	ADMISSIONS	OPERATIONS	NON-PENETRATING	PENETRATING	NOTES
1	June, 1940	France	800	--	--	--	Captured
	Nov. 1941 - Feb. 1942	Western Desert	--	134	15		
	Feb. 1942- June 1945	Cairo	3,804	--	343 (up to Feb. 1944)	534 (up to Feb. 1944)	
2	March 1942- June 1945	Poona, Bangalore, Dimapore, Burma (14th Army)	--	--	443 (1944 only)		
3	July 1942- June 1945	Ranchi, Bareilly, Imphal, Comilla	2,045	1,200	1,100		Including peripheral nerve injuries
4	Dec. 1942- June 1945	No. Africa, (8th Army) Sicily, Italy	6,063	4,334	3,013	1,336	Forward and Rear Sections
5	Dec. 1942- June 1945	No. Africa (1st Army), Italy	4,600	---	1,350	889	Only cases primarily operated on in unit
6	June 1944- June 1945	Normandy to Germany (21 Army Group)	3,100	1,125	989	1,110	Sometimes split into forward and rear sections

Adapted with permission from *The British Journal of Surgery*

Hugh had in 1920 proposed to Barbara on a rock at Holy Island Lindisfarne within binocular sight of our Bamburgh House on the Wynding opposite the Castle[10] (Fig. 5).

During my Dragon education from 1942 to 1947, I also discussed with Barbara Cairns her great-grandfather, John Forster, also known as John Forster Baird's, career as a famous surgeon at the Newcastle Infirmary, later the R.V.I. of which I knew well[64] Barbara told me of Queen Mary casting covetous eyes on the Forster-Baird watercolours of family and North Northumberland. The Forsters had sold Bamburgh Castle and it was now owned by Lord Armstrong (Fig. 5). With Professor Hugh Cairns at the time of El Alamein we discussed Ulsterman General Montgomery and his support for the Cushing-Cairns initiation of Mobile Neurosurgical Units (MSNSUs)[36,37](Table 3). The results from 1942-45 were to us like a long running Test Match. My Uncle Frank Nettleton, my mother's younger brother's crash of his photo-reconnaissance Spitfire at Benson[65] was discussed as was his successful treatment under Colonel Calvert and Brigadier Cairns at St. Hugh's College[36,37], Oxford Neurosurgical Hospital. The Cairns-Calvert duo knew of my treatments in Northern Ireland of my pneumococcal pneumonia and tuberculosis, and of Oxford and Harvard's failure to provide penicillin and streptomycin[15,57]. I knew that Arthur Jefferson had dined with Chain and discussed penicillin with his father Geoffrey Jefferson in 1941[11,17].

From Charlbury Road the only task I was worried about was the wood gathering. I asked my Brigadier father whether in war-time generals were entitled to other people's wood. A month later I was told it was Jowett-Balliol wood and not to worry. Barbara was the late Master's youngest daughter[66]. As a guest to a World War II U.S.-provided Sunday lunch at 29, Charlbury Road I was asked how I got from Newcastle to Bamburgh. I described how, before dawn, we usually hacked two ex-race-horses through Newcastle from our home stables beside the Moor with its Territorial Army Emergency Medical Service Isolation Hospital to Newcastle Central Station and into a horse box which was attached to the Kings Cross to Edinburgh Night Sleeper. Sometimes the Night Express stopped for us at Chathill and we were shunted onto the Local Independent Chathill to Seahouses Railroad and sometimes we were detached further north at Belford. If the tide was out at Seahouses, we rode along the sands to Bamburgh Castle and then past the A.L. Smith-Cairns, now Barbara's St. Aidan's house to 13th century St. Aidan's Church. If we were detached from the night express train at Belford, we rode the northern way past Budle Bay to the lovely stables of St. Aidans. If it was winter we crossed the Bamburgh golf course well-known to Hugh Cairns and where my father was to be Captain. Barbara Cairns said she would look out for us from her Bamburgh House.

After World War II I played cricket for Bamburgh on their pitch opposite St. Aidan's, their house; another cricket boundary was the basalt rock of the Castle. We never did persuade Sir Hugh Cairns to play for Bamburgh. As a useful all-rounder he did play village cricket in the 'South'; typically '30 runs – 2 wickets'. Barbara Cairns died in 1987 in Bamburgh and is buried along with many Bairds and Forsters dating back to the 14th century in this lovely St. Aidan's Church. We took our horses to the stables of 13th Century Saint Aidans Church by train because from 1940 to 1945 petrol was rationed and in very short supply. We used our horses for sheep herding and transport. On the tenth of October 1944, I, on my mare Neuagh, received an award at Hen Hill from Hugh Algernon, 10th Duke of Northumberland (Fig. 6)[67]. Neuagh knew how to herd sheep. On the 10th of October 1944 I was on leave from the Dragon School and the Duke from the Army. He had been left for dead at Marathon. On regaining consciousness it is claimed he ran to Athens before evacuation from Greece with the remainder of the Northumberland Hussars.

Figure 6 *Hugh Algernon Percy KG, GCVO, FRS (1914-1988), 10th Duke of Northumberland, Chancellor of the University of Newcastle-upon-Tyne (1963-1988), Chair, Agricultural Research Council (1958-1968), Medical Research Council (1969-1988). Oil on canvas, 110 cm x 85 cm (43.3" x 33.5"), by Andrew Festing (b.1941). From the collections of Newcastle University, Newcastle-upon- Tyne, accession no. PCF15, and reproduced with permission of the artist.*

As a Councilor of the Northumberland County Council from 1944 until 1955 Hugh Algernon Northumberland took a leading role in support of Rowbotham's Neurosurgical Centre at the Newcastle General Hospital and at the Royal Victoria Infirmary[39,67]. The Neuropathology was strengthened and continued support of the Medical Research Council was correctly foreseen. The Duke, post-World War II, chaired the Agricultural (1958-1968) then the Medical Research Council (1969-1988). Medicine and Agriculture benefited significantly; his FRS was well-earned and appropriate[67,68].

From 1958 until his death in 1988, Northumberland would ask me in conversation, who there were in my view, Barts, Harvard, MIT or Smithsonian experts, in matters he was chairing in the Agricultural or Medical Research Council. Opinions were exchanged in Northumberland, London, or Boston, Massachusetts, always à *deux*. Northumberland was a quick learner and appraiser of cutting-edge science[67]. My reward was that Northumberland proposed me in 1971 for his London Club.

TO BOSTON

At about 10:00 pm on June 15th, 1960, I was ordered by the Barts' butler to the office of the Professor of Surgery, Sir James Paterson-Ross. The Professor I knew had been Assistant to Harvey Cushing at Harvard. Sir James asked that I give his Best Wishes to Pete Churchill[32] whose Harvard Department of Surgery I was joining, also to J.C. White, Head of Neurosurgery at the Massachusetts General Hospital and Paul Dudley White, Eisenhower's cardiologist. Sir James said that I would be working with them; so it came to pass. Sir James knew that my wife Tessa had been appointed intern to Professor Sidney Farber at the Boston Children's where Franc Ingraham was Cushing's successor, both at the Peter Bent Brigham Hospital and the adjacent Children's Hospital Medical Center[69,70].

After my arrival both Professors White and Churchill asked about the management of Hugh Cairns' fatal lymphosarcoma of the caecum. Pete Churchill knew that Sir Clifford Naunton Morgan to whom I had been Senior House Surgeon at Barts had been consulted about Cairns' management in 1951 and 1952[10]. Franc Ingraham, two years younger than Hugh Cairns, had also trained with Cushing and Sherrington[18,71]. In June 1952, Franc Ingraham had facilitated the Cairns' daughter Margaret's swift return to Oxford from the United States, escorted her home, then flown straight back to Boston. Margaret's father, Professor Sir Hugh, died of his post-irradiated cæcal sarcoma on 18 July 1952[10]. Sir Charles Sherrington also died in 1952[71].

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