

## EDITORIAL

When Stephanie Millward received the 'MS Inspiration of the Year' award at the ceremony of the Multiple Sclerosis Society UK on 25 September 2012, it was hard to judge whether the beam on her face reflected pleasure at the applause on that occasion; pride in the 'Team GB' tracksuit she was wearing; or the weight of five medals hung around her neck that Stephanie won in the S9 class competing for Great Britain at the 2012 Summer Paralympics as part of the 44-swimmer squad in London (UK): silver in the 100 m backstroke, the 4 × 400 m freestyle and the 200 m individual medley; and bronze in the 4 × 100 m freestyle relay and the 100 m medley relay. Stephanie, now aged 31, developed multiple sclerosis 14 years ago and has some fixed disabilities. In her acceptance speech, she reflected on her own determination at the age of 17 to learn again how to stand, walk and balance; and she personified the mission of the Paralympics—'Spirit in Motion', with its red, blue and green symbols in the shape of an *Agito* ('I move').

Two reviews written for the Medical Research Council (UK) in 1941 and 1943 caught the eye of Brigadier George Riddoch (1888–1947) and led to the author, Ludwig Guttmann (1899–1980), being invited to direct a new spinal injuries unit in the huttred Emergency Medical Services Hospital at Stoke Mandeville (UK). The first patient was admitted on 1 March 1944. Riddoch soon decreed that every soldier with spinal injury from the D-Day landings should go to Stoke Mandeville; and by August of that year, Ward 10 was full with 50 patients. The prognosis for survival was desperate with most victims succumbing to bedsores and urinary infection. Guttmann estimated that tissue necrosis would occur at pressures 'above 1.5 lbf in<sup>-2</sup>' or 80 mmHg. He insisted that each patient was turned every 2 h and supervised this management personally around the clock. His message was simple: 'you can put anything you like on a bed sore except the patient'. Guttmann preferred aseptic urethral catheterization and washouts to suprapubic cystostomy, which usually resulted in a small contracted and infected bladder. And he also had access to streptomycin and penicillin [brought from Oxford by Lady Ethel Florey (1900–66)]. He advised against surgery on the injured spine; but, as a result, his research involved patients in whom the extent of cord injury was rarely known. Guttmann attended to the psychological needs of his patients, listening each evening to their expressions of despondency and seeking ways to engage patients in interests and activities that would return them to the real world. He endorsed the view of one patient at Stoke Mandeville in the early years: 'the first duty of the paraplegic patient is to cheer up his visitors... "Poppa" [the nickname given to Guttmann by

patients at Stoke Mandeville]... could encourage, cajole and bully patients into making the most of their remaining abilities without causing resentment'. These details and much besides come from the affectionate and informed memoir written by Professor David Whitteridge (*Biographical Memoirs of Fellows of the Royal Society* 1983; 29: 226–44) who worked with Guttmann at Stoke Mandeville from 1944 on the physiological basis for the viscerocutaneous reflex, whereby blood is redistributed in response to distension of hollow organs, especially the bladder: generalized vasoconstriction and a rise in blood pressure with lesions above T6; vasoconstriction in the toes and compensatory vasodilatation in the fingers with lower lesions. Their work continued over several years and Whitteridge soon realized that 'to find out something about his patients that Guttmann did not already know was very rarely achieved'.

The emphasis on social rehabilitation led to an inspiration after lunch one day in 1945 when Guttmann came upon patients in their padded wheelchairs hitting a puck with walking sticks: 'Games, sport, that is what we must have', he declared. It soon became clear that wheelchair basketball was less hazardous than polo. Sixteen ex-service patients competed in the first Stoke Mandeville International Wheelchair Games for the paraplegic in 1948: the Dutch brought a team in 1952; in 1956, Guttmann was awarded the Sir Thomas Fearnley Cup by the International Olympic Committee; and, in 1960, the first Olympic Games for the paralysed were held in Rome. These were initially open only to people in wheelchairs and involved 400 athletes from 23 countries. Guttmann designated his Games 'parallel' and the term 'Paralympic', first used in Seoul (1988), derives from the Greek preposition 'παρά', 'alongside' (the Olympic Games). Participants originally competed in six broad categories: amputee, cerebral palsy, intellectual disability, wheelchair, visually impaired and *les autres* (including dwarfism, multiple sclerosis and congenital disorders). Stimulated by concern for her sister, Rosemary Kennedy (1918–2005), Special Olympics for those with intellectual impairments were instituted in 1968 by Eunice Mary Kennedy Shriver [1921–2009: sister to the late President John F. Kennedy (1917–63)]. Now the Paralympic classifications are impaired muscle power; reduced range of joint movement; loss or deficiency of limbs; leg-length difference; short stature; hyper-tonia; ataxia; athetosis; visual impairment; and learning disability. Within each, based on diagnosis and medical evaluation aimed at avoiding unequal contests, athletes are categorized according to comparable impairments but with very different levels of disability. The charter of the International Olympic Committee has

as its ideal: 'The practice of sport is a human right. Every individual must have the possibility of practising sport, without discrimination of any kind and in the Olympic spirit, which requires mutual understanding with a spirit of friendship, solidarity and fair play'. This is endorsed and extended by Lord Coe (himself a middle distance runner, winning four Olympic medals, including gold at 1500 m in 1980 and 1984; and, in 1979, setting three world records in the space of 41 days—that for 800 m in 1981 being unbroken until 1997) speaking on the 2012 Summer Paralympics at which 4300 athletes from 164 countries competed: 'we want to change public attitudes towards disability, celebrate the excellence of Paralympic sport and enshrine from the very outset that the two Games are an integrated whole'. Guttman had wanted races for Olympic and Paralympic athletes within the same Games but that did not happen. Nonetheless, athletes may compete in both Olympic and Paralympic events and have done so with some successes: despite having a wooden leg, the German-American gymnast George Eyser (1870–nk) won six medals in a single day in 1904; Olivér Halassy (1909–46) lost a leg in childhood and competed in the 1928, 1932 and 1936 Games at water polo and swimming; the Hungarian Karoly Takacs (1910–76), a right-arm amputee, used his left arm to participate in shooting events in the 1948 and 1952 Olympics; Liz Hartel (1921–2009), a Danish equestrian athlete who had contracted polio in 1943 won a silver medal in the 1952 and 1956 dressage events; Neroli Susan Fairhall (1944–2006), paraplegic from a motor cycle accident, competed in the archery event in 1984; and most recently, the 'blade-runner', South African Oscar Pistorius, reached the men's 400 m Olympics semi-finals before going on to win the gold medal in that event, and in one relay, in the London 2012 Paralympics.

On 6 May 1954, (Sir) Roger Bannister [consultant neurologist to the National Hospital, Queen Square and St Mary's Hospital (London: 1963–90) and Master of Pembroke College, Oxford (1985–93)], competed for the British Amateur Athletic Association against his former University at Iffley Road, Oxford. As the commentator, Norris McWhirter announced at the end of one race:

Ladies and gentlemen, here is the result of event 9, the one mile: 1st, No. 41, R.G. Bannister, Amateur Athletic Association and formerly of Exeter and Merton Colleges, Oxford, with a time which is a new meeting and track record, and which—subject to ratification—will be a new English Native, British National, All-Comers, European, British Empire and World Record. The time was 3...

The rest was drowned out by cheers from the 3000 present in the stadium, but the time was 3 min 59.4 s. Sir Roger considers that 'without Baron (Pierre) de Coubertin (1863–1937) there would be no Olympic games; and without Guttman there would be no Paralympics'. After breaking the 4-min barrier for the mile, Dr Bannister was invited by Guttman to attend the Games at Stoke Mandeville on two occasions in the 1950s. He recalls that, at first, British athletes participated in cumbersome National Health Service wooden wheelchairs with clumsy foot rests; they were beaten by the US team equipped with shiny steel chairs. Guttman, who dealt directly with the Ministry of Health immediately demanded better equipment and on the next occasion, success ensued for the British teams. Sir Roger considers that, in London

2012, the Paralympic movement turned a corner. Hitherto, it had been separate from other Olympic events; Cinderella at the Olympic Ball and with the International Olympic Committee somewhat embarrassed by the spectacle of disabled athletes—an attitude that had spread to the general public. This assessment was wrong, as the public response with full attendances at almost every recent event clearly demonstrated. But how is disability to be measured in conditions such as multiple sclerosis where physical disability may relapse and remit as part of the natural history? As Bannister wryly acknowledges, 'in sport, both for able bodied and the disabled, there is no level playing field'. Public engagement with the torch relay was astonishing to Sir Roger who carried the torch, retracing his own steps from 1954 on the track at Iffley Road in Oxford. He was also present on the eve of the Paralympic Games when the torch arrived at Stoke Mandeville. As to the performances, his analysis (as a distinguished investigator of disorders affecting the autonomic nervous system) is that science has now arrived at sports for the disabled. Whereas Oscar Pistorius could have added the two inches to his blades allowed by Paralympic versus Olympic regulations, that adjustment might have compromised his performance on the bends in the 400 m, even if he benefited in the shorter sprint distances; and changing the length of the blades for amputees between events might be thought to bring confusion and complexity to sports for the disabled. Sir Roger acknowledges that 'his own physiology and physique, including the percentage of fast and slow twitch muscle fibres – roughly an equal proportion in his case – were best suited to the mile'. Overall, Roger Bannister considers that there are lessons to be learned by all those who are disabled, and for neurologists whose professional work seeks to manage physical disability; in line with the principles developed by Sir Ludwig Guttman, the issue is 'to focus on everything that can still be done'. Stephanie Millward agrees:

the Paralympics are about participation and the empowerment that athletics brings to people with neurological and other diseases. As disabled athletes, we have to believe in ourselves: doubt allows the illness to get on top. Barriers make us stronger; and we explore ways of going around, over or under them. As a child, I had a dream; and multiple sclerosis killed it. Disability is for life so I had to reassess what I could do, and allow my dreams to be realised in a slightly different way.

Knighted in 1966 and recognized by election to Fellowship of the Royal Society in 1976, Sir Ludwig Guttman had come a long way from his roots in rural Poland. As a part-time medical orderly at a hospital in Königshütte, Poland, Guttman saw a miner with paraplegia from a fractured spine and was advised not to write any notes since the patient 'will be dead in a few weeks'. After medical studies in Breslau, Würzburg and Freiburg, Guttman worked briefly as a neurosurgeon in Hamburg before rejoining Otfried Foerster (1873–1941) in Freiburg. But if Guttman learned rather little by way of surgical skills from Foerster, he did become proficient in applied physiology and the use of quinizarin and plethysmography for measurement of sweating and blood flow, and in medical photography. Being Jewish, his activities in 1930s Germany were increasingly compromised. Despite risk to himself through providing sanction to those injured on 9 November 1938—*Kristallnacht*—and

having to witness various humiliations exercised on other Jews, Guttman eventually decided that he must leave Germany after being called to see a patient in Portugal at the invitation of Dr (António de Oliveira) Salazar (1888–1970) and the German Foreign Minister (Joachim von) Ribbentrop (1893–1946). Risking the return to Breslau in order to collect his family, arrangements were made by the Council for Assisting Refugee Academics (CARA) for Guttman and his wife, son and daughter aged 9 and 6 years, to reach Harwich, England, in March 1939 with a grant on arrival of £250. Their reception from the Immigration Officer who sheltered the children from sleet and snow 'restored his faith in human nature'. The Guttman family lived in Lonsdale Road, Oxford, supported by additional grants from the Society for the Protection of Science and Learning and from Balliol College, moving to High Wycombe when Guttman was appointed Director of the National Spinal Injury Centre at Stoke Mandeville. In his memoir, David Whitteridge (remembered by Roger Bannister, who was tutored by him at Oxford, as: 'a man once described by a colleague as being of extremely high intelligence and very low pH') reflects upon their collaborative work on spinal cord injury, much welcomed by Whitteridge, since it provided the physiologist with access to patients. The earlier work of André-Thomas and Foerster fell short of concluding that overactivity of the intact upper segments under central control might compensate for undesirable activity of the isolated lower segments; and ignored the fate of the individual in the enthusiasm for understanding their physiological decay. In his 403-page article of 1936 on spinal cord injury in the *Handbuch der Neurologie* (1935–40), Foerster described the inevitable fatal outcome from bedsores and infection in those surviving the initial injury. Although Guttman was encouraged by Sir Hugh Cairns (1896–1952) to continue his work on sweating (and thereby dubbed 'sweaty Guttman') and peripheral nerve injuries in Oxford, in preference to practice as a neurosurgeon, the local neurologists greeted his eventual departure with some relief; for Guttman was considered difficult as a colleague and his ideas on the management of paraplegia were not endorsed by others, especially (Professor William) Ritchie Russell (1903–80) who preferred treatment with passive stretch exercises of the paralysed limbs.

How has Guttman's reputation fared? For Lord Sacks, Chief Rabbi of the United Hebrew Congregations of the Commonwealth, the story of Ludwig Guttman is one of achievement despite adversity. Guttman insisted that

with hope and determination, [the patients] could leave their beds, go out into the world, have jobs, marry and find happiness and the dignity of achievement... he coaxed them into wheelchairs to play games competing with the hospital staff whom he also put in wheelchairs... he was opposed by everyone: the nurses, his fellow doctors, the hospital administrators. They said that he was attempting the impossible. At one point another doctor accused him of failing to see that they were cripples who would never lead a normal life. Who did he think they were?... [Guttman answered]... "the best of men" (*The Times*: Saturday 22 September 2012, pp. 100–101).

But a much more complex analysis is offered by Dr John Silver who worked with Guttman and was himself director at Stoke Mandeville (<http://www.mandevillelegacy.org.uk/documents/silver.pdf>). Here, Silver moves from an initial sense of adoration and wonder at the man and his work, and the Damascene moment of seeing how Guttman could transform the life of a paralysed person 'covered in pressure sores; his kidneys... full of stones... and practically dead', to a more qualified assessment. The relationship with Guttman became progressively strained as John Silver sought to retain ownership of the research with which he was involved and which Guttman claimed as his own. Nor did matters improve when Guttman retired and Silver assumed the directorship at Stoke Mandeville and learned that leadership may usefully involve 'persuasion and consensus rather than fear, intrigue and intimidation'. But despite the negative feelings that eventually came to dominate their relationship, John Silver concludes that [Guttman] 'would not have achieved what he did if he had not been so bloody minded; and, remember, so many patients benefited the world over because of it'.

Two papers in the current issue reflect the work of Ludwig Guttman. Vieri Failli and colleagues from Berlin, Tübingen and Cologne (Germany), Salzburg (Austria) and Birmingham (Alabama, USA) correlate infections with outcome in 1436 individuals with severe spinal cord injury based on assessments using the American Spinal Injuries Association (ASIA) impairment scale at 24 h after injury (page 3238). Whereas for Guttman, infection heralded death, now survival is likely; but pneumonia and wound infection reduce significantly the prospect for partial recovery of motor and sensory function at 1 year, identifying the management of infection as a potential means of protecting the capacity for endogenous repair leading to improvement following spinal cord injury. Nicholas Granger and investigators from Cambridge (UK) take forward evidence for repair and recovery of function in 'patients' in a clinical setting using transplanted intraspinal olfactory ensheathing cells (page 3227). Their 'patients' are 'companion dogs' with severe disability from spinal cord injury referred to an academic centre for veterinary medicine and evaluated under double blind randomized, controlled, clinical trial conditions; transplanted olfactory cells improve coordinated movements of the fore and hindlimbs by altering communication across the damaged segment of the cord even though long tract function is not obviously improved. The impact of their work is potentially high. For as the work of Ludwig Guttman made clear, the dividend even from modest improvements in function after spinal cord injury, complemented by physiological and social adaptation, and emphasizing what can be accomplished rather than reflecting on all that is lost, motivates people with neurological disabilities and impairment; and their achievements inspire both admiration and awe in those who are able bodied. In *From the Archives*, we review 'Effects of bladder distension on autonomic mechanisms after spinal cord injuries' by L. Guttman and D. Whitteridge (*Brain* 1947; 70: 361–404).

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