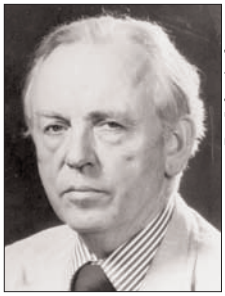
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European Perspectives in Cardiology



Pioneers in Cardiology: Frank Pantridge, CBE, MC, MD, FRCP, FACC



Dr John Anderson

A Northern Irish Cardiologist With a Military Bent Who Became the Father of Emergency Medicine

An Ulsterman, Dr Frank Pantridge (1916–2004), pioneered prehospital coronary care and the ubiquitous automatic external defibrillator—ideas that crossed the Atlantic Ocean more easily than the Irish Sea. Barry Shurlock, MA, PhD, has spoken to some of the people who knew Dr Pantridge, including a coworker, retired cardiologist John Geddes, MD, FRCP.

Almost certainly, only 1 cardiologist has had a public statue erected in his honour and has conducted pioneering work that would save the life of a president of the United States. These distinctions go to the late Dr James Francis "Frank" Pantridge, professor at Queen's University, Belfast, Northern Ireland. The statue (Figure 1) stands outside the council offices of the city of Lisburn, 8 miles southwest of Belfast, and the president involved was Lyndon B. Johnson. During a visit to Charlottesville, Va, President Johnson had a heart attack, which a mobile coronary care unit successfully treated with a Pantridge defibrillator adopted by Richard S. Crampton, MD, professor of medicine at the University of Virginia.

Dr Pantridge's big idea of taking the defibrillator to patients with early myocardial infarction may have developed out of a scheme of Graham Bull, MD, professor of medicine at Queen's University, to use mobile drug therapy for heart attack patients. It probably took shape after an event in April 1964 at the Royal Victoria Hospital, Belfast, where Dr Pantridge worked in the cardiac unit. A man collapsed with a heart attack just outside the hospital and received cardiopulmonary resuscitation from 3 doctors, including John S. Geddes, MD, FRCP, FACC, now retired but previously an associate professor and director of electrophysiology at the University of Manitoba, Winnipeg, Canada. Dr Geddes was doing a rotation in neurosurgery and had recently worked as a house physician with Dr Pantridge, whom he phoned for help. Soon, accompanied by a junior colleague, Dr Pantridge



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Figure 1. *The bronze statue depicting Dr Pantridge by Belfast sculptor John Sherlock sits proudly in the city of Lisburn.*

On other pages...

View From Belgium: Guy Berkenboom, MD, PhD, FESC
Bilingual Belgium expects a shortage of cardiologists in the future, says Dr Guy Berkenboom, professor of cardiology at the Erasme Hospital, Brussels. He says that restrictions on the training of medical students and an overaggressive approach to percutaneous coronary intervention present challenges for cardiologists in Belgium. He also believes that using English often resolves issues related to the division of the country by language.
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arrived, pushing a trolley carrying the standard 70-kg defibrillator.

Later, Dr Geddes worked as a medical registrar for Dr Pantridge. Both knew of the high mortality during the early phase of a cardiac arrest, and when Dr Geddes drew Dr Pantridge's attention to an article showing that about 60% of World War II US servicemen who had suffered heart attacks had died within the first hour, he immediately replied, "Well, if that is so, we'd better go outside and pick 'em up, hadn't we?" With this kernel of an idea, which has since seen worldwide application, Dr Pantridge received the nickname, "the father of emergency medicine."

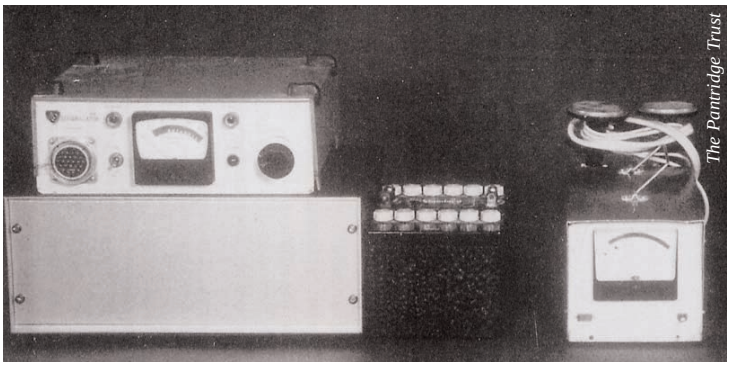


Figure 2. *The 70-kg adapted mains defibrillator with car battery and static inverter, a classic example of British "string and sealing wax" science.*

The simplicity of this idea meant that one could instantly grasp it, but it had 2 technical problems. First, how could one power a standard defibrillator without a mains electricity supply? And, second, how could medical staff and ambulance personnel move around a piece of equipment weighing 70 kg (155 lb)?

Dr Geddes recalls that when the idea recieved a poor reception at a meeting of cardiologists, an eminent English specialist poured cold water on it by insisting that no defibrillator could take an adequate charge from a battery. Undeterred, Drs Pantridge and Geddes, and a technician, Alfred Mawhinney, rigged up a system with two 12-volt car batteries, a static inverter, and a mains defibrillator (Figure 2), and showed that it could, indeed, work—a classic example of British "string and sealing wax" science at its best!

Within 8 months, after battling with the hospital administrators (a constant feature of Pantridge's life), the Belfast mobile intensive care unit was ready for business. It consisted of an ambulance equipped with a defibrillator and ECG, manned by a driver, a junior doctor, and a nurse. Its first callout came on January 6, 1966, but Dr Geddes recalls that "successful resuscitation was quite a long time coming, and it was well into the second half of 1966 when the first patient was defibrillated with return of pulse outside the hospital." Almost every morning, Dr Pantridge would say to the team: "Well, any action last night?"

The early days saw many technical challenges, with the technicians manhandling 70-kg defibrillators into upstairs bedrooms, where the machines often expired with a loud bang, and with junior medical staff sticking bare wires into electrical sockets for lack of an appropriate adaptor. The "flying squad," as they called it, had its first mention in print—albeit with few details — in 1966, in an article that Drs Pantridge and Geddes published in *The Lancet*[1] on cardiac arrest at the Royal Victoria Hospital, reporting a survival rate of only 31% if it occurred in a general medical ward or casualty department, compared with 62% in an intensive-care area.

The greatest impact came when Drs Pantridge and Geddes reported their first 15 months experience with the unit in another article in *The Lancet*,[2] which became a Science Citation Index classic. If one thing established Dr Pantridge's (and Dr Geddes's) reputation, it was this article; in New York, journalists at *Time Magazine* picked up the story and suggested installing a defibrillator in the White House.

A key stage in the development of mobile intensive care came with the design of an easy-to-carry defibrillator. With this development, Pantridge's military-style genius for getting things done came into full play. Instead of launching a business-style operation (eg, commissioning a feasibility study, assembling a team of specialists, seeking funding, and setting up a factory), he sought the help of a bioengineer at Queen's University, Dr John Anderson, and together they created the Pantridge Defibrillator (Figure 3), a bright red object the size of a large transistor radio, weighing 3.2 kg and containing a miniature capacitor developed for National Aeronautics and Space Administration rocketry. Cardiac Recorders Ltd of London, United Kingdom, manufactured the device. Undoubtedly, Dr Anderson's technical knowledge proved invaluable, but Dr Pantridge had a good understanding of the necessary waveform and had himself acquired a good grasp of electronics in 1948 during a 1-year fellowship with the world-renowned electrocardiography specialist, Frank N. Wilson, MD, director of The Heart Station, University of Michigan, Ann Arbor.

The Pantridge plan, as it became known, found prompt use at centres in the United States and Dublin, the Republic of Ireland, but only at a few centres in mainland Britain—notably, Brighton, Bristol, and Charing Cross Hospital, London.

The English cardiology establishment generally showed a lack of enthusiasm, citing long delays in patients summoning help and heavy traffic; one even compared Dr Pantridge's ideas to the Charge of the Light Brigade—a singularly unsuccessful venture. British cardiologists of the time, it seems, did not believe that they or their juniors had undergone a lengthy and demanding training only to jump into an ambulance and conduct undignified procedures in the street or at someone's house.

On the other hand, American cardiologists swooped on the idea, and within a short time, mobile units were being run by William Grace, MD, of St Vincent's Hospital, New York, NY, and Richard Crampton, MD, of the University of Virginia, Charlottesville. Later, another 6 centres in the United States adopted Pantridge's ideas, as Dr Chamberlain has recently detailed.[3]

The Pantridge plan underwent significant modification in the United States to suit local needs, such as taking the defibrillator out of the hands of doctors and giving it to paramedics, then firemen, and finally, of course, to members of the public.

This last step required the invention of the automated external defibrillator, obviating the need to diagnose ventricular fibrillation before applying defibrillation. Dr Pantridge envisaged a safety catch, actuated by automatic detection of ventricular fibrillation. He developed the idea during a train journey between Ghent and Amsterdam on March 6, 1976. His fellow passenger, Mieczyslaw Mirowski, MD, of Sinai Hospital, Baltimore, Md, had, with colleagues, developed the implantable cardioverter–defibrillator, and Dr Mirowski thought that Dr Pantridge's idea of using a similar device actuated by signals from the chest would not work. But Dr Pantridge persisted, and in collaboration with Leonard Cobb, MD, of Seattle, Wash, he soon proved his idea workable, paving the way for the "fire extinguisher–style" automated external defibrillator.

In 1974, Dr Pantridge received recognition for his work by being elected to the Fellowship of the American College of Cardiology at a small ceremony conducted in London by the then US ambassador to the United Kingdom, Walter Annenberg. Some 4 years later, Dr Pantridge received a CBE (Commander of the British Empire), a public honour given in the United Kingdom to people from many walks of life and usually presented at Buckingham Palace by the Queen.

Beyond that, Dr Pantridge has been celebrated most in his native Northern Ireland, where the "Troubles" have made local people hungry for heroes. In the province, he has household-name status: a radio phone-in poll conducted a few years ago rated him the fourth-most-popular figure in a list headed by the republican hunger striker Bobby Sands, with the loyalist extremist Reverend Dr Ian Paisley, MP, in third place. He also inspired the creation of the Pantridge Trust, a charitable body that raises funds and sponsors activities to support the fight against cardiovascular disease, and in 2006 he served as the subject of a film, produced in Belfast by Karen Bowen of About-Face Media Productions for BBC Northern Ireland, that was inspired by the unveiling of his statue in bronze by Belfast sculptor John Sherlock.

Despite his successes, Dr Pantridge did not build the sort of career that might have come his way if he had been a more diplomatic person. Dr Geddes believes that "he had to be very aggressive and frequently abrasive in order to succeed, and this behaviour built up an army of disgruntled doctors." He does not seem to have made much money from his invention of the portable defibrillator, and in general his contacts with business involved many disputes and misunderstandings, resulting in many writs and pay-offs.

In his day, Belfast doubtlessly represented an active centre of cardiology research, with the city often billed as "the safest place to have a heart attack." But at a time when the Royal Victoria Hospital perhaps received more attention for its expertise in gunshot wounds and trauma, some of his colleagues sought careers elsewhere. He may have felt too much of an Ulsterman to follow them, but even in the scientific world he enjoyed few rewards.

In his later years, Dr Pantridge is said to have felt most proud of the invitation he received to open the first Latin American Congress on Prehospital Coronary Care, held in 1999 in Montevideo, Uruguay; he quipped, in a postcard sent home to a younger friend, Alun Evans, MD, "I seem to be better known in South America than I am in Northern Ireland." His friends say he craved the ultimate accolade of a knighthood, but despite a citation from a president of the Royal College of Physicians, the British establishment regarded him as controversial. He seems to have found it impossible to indulge in the feigned enthusiasm necessary to curry favour in high places, or even low places; stories abound of him falling out with almost everyone.



Figure 3. *Dr Pantridge with his eponymous 3.2 kg defibrillator.*

Dr Evans, a professor and son-in-law of an army friend, whom Dr Pantridge asked to write his obituary,[4] says, "Frank fell out with most of us, but I was lucky enough to fall in with him again." Dr Pantridge's patients, however, adored him, and he showed particular charm with children. He ran his department like a military unit, and his ward rounds resembled a virtuoso performance of wit and repartee, sometimes directed at his juniors, whom he might ask to comment on a case; in response to their comments, he would often provide the waspish opinion, "There speaks the confidence of ignorance!"

Dr Pantridge had developed into a demanding individual, unable to tolerate less able people; some of his closest friends have called him "his own worst enemy." In his crisply written autobiography, *An Unquiet Life*,[5] he tells how he got through his final clinical examination by arguing against the diagnosis of his examiner and gaining honours (a tap proved a pleural effusion and disproved pneumonia).

To this basic cast of mind, one can add the impact of his unbelievably traumatic experiences during World War II, of which he apparently never spoke. He volunteered for the Army on the day the United Kingdom declared war, and 6 months later, in April 1940, he went as a medical officer to

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Figure 4. *British prisoners in a Japanese slave camp of the Siam–Burmese railway project. Dr Pantridge was one of few who survived.*

the Second Battalion of Gordon Highlanders, stationed on Singapore island. There, he watched as, in his view, incompetent commanders and politicians allowed the island to fall into Japanese hands. He was taken prisoner and experienced the horrors of the slave camps on the Siam–Burmese railway (Figure 4) and the Tanbaya "death camp."

Most of his fellow prisoners died, but he survived, partly because of his iron character and partly because he boiled every drop of water he drank. The day of his eventual repatriation found him emaciated, bloated with the dropsy of beriberi, and weighing just under 5 stones (70 lb). As seems typical of the man, before he left Singapore he went to dig up his officer's uniform, handstitched in Belfast, which he had carefully preserved.

After the war, Dr Pantridge could only get a job as a part-time supernumerary lecturer in the department of pathology at Queen's University, but he made the best of the opportunity to study cardiac beriberi, a disease that had left its mark on him and had devastated so many of his fellow prisoners of war. After a spell in the United States, he returned to the United Kingdom and was soon building a major cardiac facility in Belfast.

Dr Pantridge's pioneering work on precoronary care serves as a great example of the right man in the right place; his military bent enabled him to push forward a basically simple idea. However, it took many years to penetrate the rarefied atmosphere of London academic cardiology. From about 1975, a growing number of British physicians recognised the merits of the Pantridge plan. Dr Pantridge had already been retired several years (by which time many other European countries had adopted the plan) when in 1990 the UK Minister of Health, the Right Honorable Kenneth Clark, MP, announced that he would have the Pantridge plan introduced throughout the country. This came almost 25 years after Dr Pantridge, Dr Geddes, and colleagues had first ventured onto the streets of Belfast.

The reasons for this dragging of feet remain hard to determine, but at least 2 negative British studies (with dubious methodology) had appeared, and Dr Pantridge could not ingratiate himself with the London cardiology establishment, which suffered from the "not-invented-here" syndrome. However, by the time of an international symposium convened in January 1986 to mark the 20th anniversary of the introduction of prehospital coronary care in Belfast, opinion on the mainland had begun to shift. The resulting book, *The Management of the Acute Coronary Attack (The J. Frank Pantridge Festshrift)*,[6] edited by Dr Geddes, contained a key study by Charles Wilson, MD, consultant physician at Waveney Hospital, Ballymena, County Antrim, Northern Ireland. Dr Wilson's study[7] compared 2 similar Northern Irish communities, one with and one without mobile coronary care, and showed a 33% lower mortality in patients over 75 years of age in the former (much greater than previously recognised). Another factor that undoubtedly influenced opinion in London was the appointment of an Ulsterman, Sir Donald Acheson, MD, to the post of chief medical officer.

Looking back at the qualities that made his former mentor great, Dr Geddes says, "His genius lay in his ability to acquire and retain knowledge and to use his great ingenuity to achieve the maximum effect, whether to treat individual patients or to plan new approaches to treatment—also in his uncanny ability to foresee what was likely to have been forgotten and constantly to 'keep his finger on the pulse'; in his ability to plan research simply, keeping to the point at issue without trying to answer less important questions at the same time; and in his great skill at writing medical papers, which would be retyped almost daily until the exact intended meaning was presented in the minimum possible number of words."

At the suggestion that Dr Pantridge was a "flawed genius," Geddes eagerly responds, "I would prefer to think of him as a genius with flaws, which often seemed to work synergistically with his genius, to enable him to achieve what so many others could not."

Barry Shurlock is a freelance medical writer

In addition to interviewees named in the article, the writer is grateful for the help of Karen Bowen, Rosemary Evans, Dr J. D. S. Higginson, Ms Rosemary Evans, and Douglas A. Chamberlain, CBE.

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A View From Belgium: Guy Berkenboom, MD, PhD, FESC

Bilingual Belgium Expects a Shortage of Cardiologists in the Future



Dr Guy Berkenboom, professor of cardiology at the Erasme Hospital, Brussels, Belgium, says that restrictions on the training of medical students and an overaggressive approach to percutaneous coronary intervention present challenges for cardiologists in Belgium. However using English often resolves issues related to the division of the country by language, reports Barry Shurlock, MA, PhD.

In February 2007, Guy Berkenboom, MD, PhD, FESC, professor of cardiology at the Erasme Hospital, Brussels, and chief of the cardiovascular pathophysiology unit at the Free University of Brussels, took over a 2-year term as president of the Belgian Society of Cardiology (BSC). His objectives include better implementation of the European Society of Cardiology/American College of Cardiology guidelines, especially for coronary patients, and not only for acute coronary syndromes, but also for chronic stable angina. He believes that many patients who receive percutaneous coronary interventions (PCI) in Belgium receive excessively aggressive treatment, because "more than 40% of them have chronic stable angina." Citing an editorial in the *European Heart Journal*,[1] he comments that "our attitude should be more metabolic and a lot less mechanical."

However, reducing the number of PCI centres in Belgium would earn no votes for politicians and would have financial implications for the hospitals involved, according to Dr Berkenboom, who explains: "There are too many hospitals in Belgium. We have 25 centres with PCI, but for a population of 10 million, we only need 10 to 15. Some centres are sending too many of their ST-segment elevation myocardial infarction patients for PCI, whereas many of them, if they arrive early enough, should be treated with thrombolysis. Reforms have been launched by the health ministry to centralise interventional cardiology units. This might reduce the number of small centres (performing fewer than 200 procedures per year), but it will be a difficult task to close or merge several units."

The BSC began in 1936 and has a growing membership of 450 members in a country with 900 registered cardiology practitioners. The society publishes the monthly journal *Acta Cardiologica* in English, and it has a newsletter-style journal in the 2 national languages, French and Dutch.

The BSC also runs an annual congress and has a raft of working groups, including one on interventional cardiology that meets jointly with its counterpart in the Dutch Cardiology Society. Since 1991, it has had a Young Cardiologists' Club, where trainees from different hospitals and different regions have the chance to meet.

In Belgium, cardiovascular disease accounts for an estimated 38 000 deaths each year and costs the country €4 billion. As one might expect in the seat of the European Union, the BSC has close links with the European Society of Cardiology, with whom, in association with the Belgian Cardiological League and many other national organisations, it has just launched the European Heart Charter, a grand statement of strategies for the prevention of cardiovascular disease. Dr Berkenboom comments, "Although cardiovascular mortality is decreasing by 1% per year, the incidence of the disease is growing. As in the United States, we are faced with a growing rate of metabolic syndrome. The European Charter should sensitise the media to the classic cardiovascular risk factors. However, the principles are simple, but the application is hard."

Cardiology represents a popular career choice in Belgium. At any one time, 5% to 10% of the 300 internists undergoing training opt for the speciality, which involves 3 years of internal medicine, followed by 2 years of cardiology. Most training takes place in Belgium, but some interventional cardiologists and electrophysiologists elect to train in France (Paris, Lille, or Bordeaux), the Netherlands (Rotterdam or Maastricht), or the United Kingdom (London); those following an academic career often seek a research fellowship in the United States. "Most come back," says Dr Berkenboom, who estimates that net pay in an academic cardiology centre in Belgium averages about €4500 per month, with larger salaries but higher rates of tax at nonteaching and private hospitals.

Because of a so-called *numerus clausus* (a "closed number" system used because the number of applicants far exceeds the number of places), the 7 medical schools in Belgium have limited their entry capacity in recent years to 100 students per institution. Dr Berkenboom comments, "We will be faced very soon with a shortage of postgraduates, entailing an enhanced clinical load for senior cardiologists. The motivation of young postgraduates for research is decreasing, and this is probably related to the fact that staff at academic centres are paid less than in private hospitals." The most likely solution to the cardiology manpower problem, he believes, will involve recruiting general practitioners to undertake "the more routine work" in hospital cardiology departments.

Belgium has only a few private hospitals. Most people receive treatment without charge in a public hospital, though they can pay extra for "hotel facilities." Dr Berkenboom explains, "We have a public health system that is still efficient.

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However, I fear that with the incidence of cardiovascular diseases still increasing, financial problems could rapidly appear, as is already the case in France. The rates of key interventions in Belgium are increasing each year. In 2006, 9500 coronary artery bypass graft procedures were performed, including 1500 with valve replacements, together with 25 000 PCI procedures, 70 heart transplantations, and 1000 implantable cardioverter-defibrillator implants."

Dr Berkenboom trained at the Free University of Brussels, and he has worked mainly in the Belgian capital. He has authored more than 140 original papers, and in 1992 he won the annual prize of the Fondation Marc Hurard, a national institution. On 6 occasions, he has received prizes or grants from the Bekales Foundation based in Vaduz, the capital of Liechtenstein. He works closely with his surgical colleagues, and 15% of coronary bypass interventions at Erasme Hospital use the robotic approach (see Figure).

Belgium has a population of about 10 million people, 97% of them urban dwellers with an average income between that of France and the United Kingdom. Culturally, it has a division between Flanders in the north, where residents speak Flemish (very close to Dutch) as their first language, and Wallonia in the south, where residents speak French. Despite the unification of these 2 regions since 1830, a continuous political undercurrent attempts to divide them—in essence, the richer north considers itself harder working! As 1 consequence of this divide, the next BSC president will speak Flemish as a first language. However, francophone Dr Berkenboom believes that the language issue has little influence on medical practice; he comments, "Cardiologists are much less divided than the politicians, and this division between the north and the south of Belgium is not relevant to our medical practice. We in the south are not trained to speak Flemish, but we understand enough to speak to patients, and vice versa in the north. On the BSC board, we always try to have a balance between Flemish- and French-speaking colleagues. The official language of our meetings is often English."

Dr Berkenboom's main area of focus is on the vascular endothelium, and he describes his findings as follows: "The discovery of vascular endothelial function was a tremendous scientific adventure, demonstrating that basic research can have a major impact in the clinical setting. In the early 1980s, I spent a few months in the department of Attilio Maseri, MD, at the Hammersmith Hospital, London, England. I was fascinated by this dynamic and enthusiastic group—at this time, they were working on silent ischaemia and the role of coronary tone in the triggering mechanisms of ischaemic events. When I came back, I assessed the role of α-adrenergic coronary tone in chronic stable angina in clinical and basic studies.[2–5] I was very impressed by endothelial modulation of coronary responses to endogenous stimuli, such as norepinephrine, serotonin, etc. In line with these findings, we demonstrated coronary hypersensitivity to serotonin early after cardiac transplantation, despite normal responses to bradykinin, and reversibility of this abnormality with acute vitamin C supplementation in arteries without morphological changes." He points out that this is compatible with the early stage of graft vasculopathy.[6]

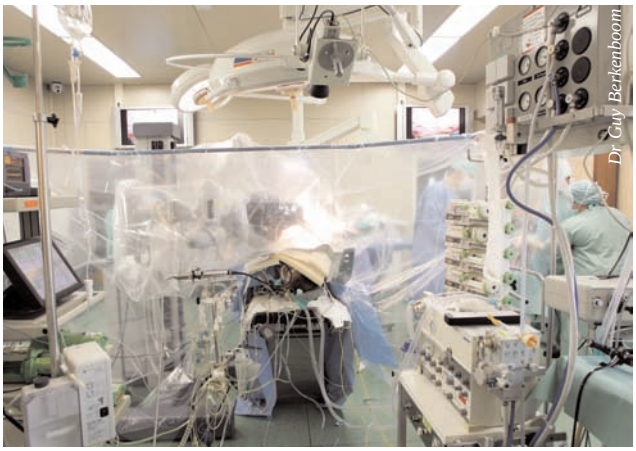


Figure. *Robotic surgery at Erasme Hospital: Dr Berkenboom's colleagues use this technique in 15% of coronary bypass operations.*

In his spare time, Dr Berkenboom listens to classical music or takes holidays skiing in Switzerland. He also enjoys golf and would like to play the game more often, but he adds, "My handicap was previously around 16, but with 2 children and other commitments, I am afraid it is increasing!"

Barry Shurlock is a freelance medical writer.

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Notice

Dr Keith Barnard is retiring as Managing Editor of *Circulation: European Perspectives in Cardiology* with effect from December 31, 2007. He would like to thank all who have supported him in this new venture over the past 2½ years. His succesor is Lindy van den Berghe, BMedSci, BM, BS, who will take over on January 1, 2008.

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