Ulster Med J 2010;**79(Suppl 1):**4-6

Paper

Frank's Legacy from a North American Perspective.

Richard S Crampton

PROFESSOR JAMES FRANK PANTRIDGE MC CBE MD FRCP FACC (1916-2004).

I am highly honoured to describe the monumental North American legacy of Frank Pantridge. Most emphatically Frank became a great life-changer for many in Europe and the Americas. I thank Alun Evans for this opportunity to focus upon our extraordinary Pantridge endowment.

Forty-three years ago one could not stand erect in a North American ambulance. Hearses, limousines and estate wagons transported the ill and injured. Undertakers had a conflict of interest. Little or no emergency care took place in these horizontal taxis. The driver sat at the steering wheel. The unattended patient rode strapped on a trolley in back.

Frank Pantridge changed that.

Feisty Frank revolutionised our emergency services in North America. He taught us to take care to the patient outside hospital. The Belfast system became the root and flower that crossed the Atlantic. It bloomed in and from North American casualty and emergency services. Frank made defibrillation and life saves from cardiac arrest a routine feature. He found autonomic distress a harbinger of sudden death in the acute coronary attack. He began treatment to thwart cardiac arrest and to save jeopardized heart muscle. He discovered that low energy electric shocks defibrillated. He introduced the miniature defibrillator that weighed only 3.2 kg.

Frank influenced North American emergency services from rural village general medical practices to sophisticated urban systems. Our independent hospital emergency or casualty departments did not exist until Frank ignited our North American firestorm in out-of-hospital care.

Bill Grace was Frank's first North American disciple. After he visited Belfast in 1968, Grace established mobile intensive care in New York City. Inspired by Frank and Bill, others followed suit. Five years after Frank began pre-hospital treatment of the acute coronary attack in Belfast, over 100 adaptations functioned in the USA and Canada. New York, Miami, Los Angeles, Seattle, Portland, Oregon, Columbus, Ohio and Central Virginia developed local, regional, pan-urban and suburban pre-hospital cardiac care systems under the impetus of Eugene Nagel, Michael Criley, Leonard Cobb, Leonard Rose, AJ Lewis, Richard Lewis, James Warren, Costas Lambrew, Richard Crampton and many others. Like Frank we overcame apathy and opposition to modernisation by our local emergency services, by our hospital administrators and, sad to say, by our medical colleagues. Despite this we managed to systematise pre-hospital care based on the Pantridge example.

Frank got us North Americans out of the ruts by pragmatic example linked to impeccable new exciting clinical data. We adapted his brilliant concept of critical care for people outside hospital. We trained personnel called paramedics. We deployed unique electrical and communications equipment first used by American astronauts.

I read about Belfast mobile intensive care in *The Lancet*. In 1968 I wrote to Frank and asked to visit the mobile unit when I next came to Ireland to visit my wife's Kilkenny family. Frank welcomed me at the Royal Victoria. Eyes twinkling he observed that the best life-saving devices for intensive care came from the USA. "What we have done here is accomplished with your technology". Implicit loomed the question: why aren't you Americans providing such care outside hospital? I toured wards five and six and the mobile unit. I returned home to try mobile intensive care.

Pleas for funds fell on deaf ears. The Virginia and American Heart Associations and The US National Institutes of Health declined support. Thanks to the first Pantridge disciple, Bill Grace, the Frueauff Foundation paid for our battery powered portable defibrillator. Fortunately for us, Frank's work had provoked commercial manufacture of battery powered devices. The seminal 1966 Pantridge-Geddes-Mawhinney contraption ingeniously jury-rigged an American AC defibrillator, two car batteries and a DC to AC converter. This lifesaver weighed 45kg. Thus we were relieved that our 1971 store-bought instrument weighed 30kg less than the Belfast prototype.

Frank visited our Virginia system, a union of town and gown. Our first life-save came when a prominent horse trainer collapsed in a manure pile at a horse show. After removal of ventricular fibrillation eight times, he rode in the ambulance to hospital convalescence and later resumed work. We reported this happy event to Frank. He took our electrifying, to us, success in stride. He hoped that our man had not got tetanus.

We must put Frank's work into the context of forty-three years ago. He broke the very difficult trail to what we now take for granted. Neither Frank nor his fellow pioneers in Dundonald, Ballymena and Stillorgan, nor we North Americans who trod in the Pantridge footsteps, had an easy time. Cardiological, medical academic and health service establishments in the UK and USA blocked and often mocked the innovative idea of out-of-hospital care of the coronary attack. They ignored Frank's well shewn facts about prevention of prehospital death. Recall the naive Nottingham false economy of leave-them-at-home treatment during the vulnerable early phase of the coronary attack.

Department of Medicine, Division of Cardiovascular Medicine, PO Box 800158, Charlottesville, Virgina, 22908-0466, USA.

Correspondence to Professor Crampton

rsc6a@virginia.edu

Frank's revolutionary idea to take intensive care to the patient reverberated like a thunderclap in North America. It shook the stodgy medical establishment because when tried, it worked. The Belfast mobile unit showed that electric shock defibrillation outside hospital was a practicable proposition. Frank said it was futile not to address the acute coronary attack *in situ* outside hospital. He thrust this concept forward. He made it the reality we take for granted today.

Frank's Revolution was *vox populi*. People and ambulance personnel learnt about preventable cardiac death thanks to Frank's work. They forced politicians, health service administrators and physicians to appreciate expedited attention to the man or woman suffering a coronary event outside hospital.

Frank's message got broad publicity when a former US President, an incumbent mayor and the owner of an urban ambulance service benefitted by early treatment of their coronary attacks. In 1972 prehospital care burgeoned after former President Lyndon Johnson's coronary attack was treated in his daughter's house. Thanks to acute care by the Charlottesville-Albemarle Volunteer Rescue Squad and University of Virginia mobile intensive care unit, Frank's concept hit front pages in North America. The mayor of Portland, Oregon approved the private Buck ambulance paramedics for mobile intensive care. Then the mayor collapsed in City Hall. Later Buck, who developed and owned the ambulance fleet, collapsed. Both were defibrillated by Buck ambulance paramedics.

This publicity and the very popular Los Angeles paramedic television drama *Emergency!* popularised Frank's ideas. Today North American emergency services run with Pantridge-style prehospital treatment as the major component. The US standards for care of cardiac emergencies, updated frequently by the American Medical and Heart Associations and College of Cardiology, directly derive from the ingenious Frank Pantridge.

The dramatic reversal of cardiac arrest outside hospital was but the beginning. Shortly after Frank set the Belfast unit in action, came the realisation that the autonomic nervous system's early response to the coronary attack was often prefatal. Frank inspired the team he led. He and colleagues John Geddes, Dennis Boyle, Jennifer Adgey, Charles Wilson, Sam Webb, Norman Patton, Basil McNamee, Conor Mulholland, Michael Scott, Norman Campbell and many others cared for patients outside hospital with the mobile unit. They collected invaluable data on the spot. Frank flooded medical literature with new ways to prevent sudden cardiac death.

For us North Americans, the finest scientific justification of out-of-hospital cardiac care took place in Omagh and Ballymena. Alun Evans, whom we honour today with Frank, Charles Wilson and others hypothesized that "the true benefit of mobile coronary care can only be appreciated by recording its effect on the case fatality rate [of acute coronary attacks] within a defined community". Their investigation revealed that death rate fell only among patients who had prehospital intensive care.

Frank and his crew identified parasympathetic and sympathetic disruptions early in the coronary attack. They medicated patients outside hospital. These early treatments prevented cardiac arrest. They reduced damage to heart muscle and thus moderated heart pump failure.

Frank's Belfast team next observed that prompt removal of ventricular fibrillation occurred with low energy electric shock. Fewer shocks with less electricity minimized injury of the heart. This success flew in the face of electric shock levels ossified in the US national standard for restarting arrested hearts. So we turn the page to the next chapter of the Pantridge Revolution in North American emergency care.

A most embarrassing question arose. Why were makers of defibrillators adding more electric power to give bigger shocks at greater cost of the larger device? Frank and biomedical engineer John Anderson had developed an inexpensive miniature 3.2 kg defibrillator. Its low energy electric shocks worked on both sides of the Atlantic. In Virginia we put the first Pantridge Portable Defibrillator that came to North America into front line clinical use. By serendipity, I staffed our mobile unit on a busy spring Saturday evening. I defibrillated my retired professor of orthopaedic surgery at his garden party with a low energy shock from Frank's device. I next used his instrument for a low energy shock at an Easter sunrise service at Monticello, Thomas Jefferson's mountaintop World Heritage House near Charlottesville. This news greatly pleased Frank. We savoured his pithy quip about our Deist resurrection service on Jefferson's doorstep.

Irrefutable data from Belfast and Virginia proved low energy shocks worked well. Yet bureaucrats in the medical device branch of the US Food and Drug Administration (FDA) shilly-shallied about standards. Perhaps there was undue regard for the FDA's gross misinterpretation of work that advocated bigger electric shocks by non-clinical electrical engineers at Purdue University. Or was it pressure from a multimillion dollar industry poised to enrich itself with larger more expensive devices to sell?

No matter however. Frank flew the Atlantic to our rescue. We slogged through eight inches of sticky new fallen snow to tell the FDA that low energy electric shocks worked in emergencies. Years later the FDA bureaucrats officially agreed. But Frank snuffed the manufacture of bigger costly electrical instruments. Representatives of the defibrillator industry came to that FDA meeting. They got an earful of Frank's full bore message that bigger shocks were not better. To make sure the US industry abided by Frank's message, I asked Jennifer Adgey, as a Pantridge-trained watch dog, to join our Defibrillator Committee of the American Association for the Advancement of Medical Instrumentation. She vigilantly helped us block further moves to make larger expensive harmful devices. Thanks to Frank the industry scratched making overpowered defibrillators.

The miniature 3.2 kg Pantridge defibrillator became the forefather of the automatic external defibrillators now used in emergency services. These devices are deployed like fire extinguishers in crowded venues like aircraft, airports, office buildings and stadia for use by and for the public.

To implement Frank's system in North America we had legally to extend the physician's supervision of the remote

paramedical worker by radio or mobile phone. Virginia law made this possible in 1972. Lewis Baird brought a man whom he had defibrillated at a cocktail party to our House of Burgesses. He had used the LifePak device in the boot of his car. Andrew Dickinson and I described our life-saves and our need for paramedical help in Virgina Beach and Charlottesville and in Princess Anne and Albemarle Counties. Then came the vote that amplified the Good Samaritan law. "Be it enacted by the General Assembly of Virginia as follows: Any person rendering emergency care is exempt from liability who in good faith renders emergency care or assistance without compensation". Our Virginia Board of Health required certified training in advanced life support, cardiac defibrillation, endotracheal intubation and life sustaining treatment with drugs. The Pantridge path was followed closely by Virginia paramedics. As in Seattle and Los Angeles, paramedics operated under remote supervision by physicians via radio voice contact and telemetry of the electrocardiogram. They used intravenous infusions, cardioactive medications, and defibrillators for electric shocks. Frank's concept of early care coupled to sophisticated communication made paramedics into intensive care astronauts.

In the consummate Pantridge heritage in North America, treatment prehospital upgraded yet again. Paramedics transmitted electrocardiograms to remote physicians who interpreted them. If they showed acute injury of the heart, paramedics gave the blood clot busters, streptokinase or tissue plasminogen activator, to start dissolving coronary clots before moving the patient to hospital.

We now declare the obvious. Frank became and remains the undisputed champion of the North American Revolution in emergency care. Our paramedics have Frank's Belfast brand on them. In the museum of the history of emergency care at the Charlottesville-Albemarle Rescue Squad, North America's first Pantridge Portable Defibrillator is prominently displayed.

Frank's honours in North America are too numerous to count. His legacy includes his Fellowship of the American College of Cardiology and his place in the Congressional Record of the United States.

At the 92nd US Congress, Stanley Sarnoff, founder of the Cardiovascular Research Laboratory of the US National Institutes of Health, commented: "If Professor J Frank Pantridge and his group at the Royal Victoria Hospital, Belfast, had not initiated the sequence of events they did in 1966, we might all still be largely ignorant of the all-important early minutes after the onset of an acute heart attack. Worse yet, we would probably still not know how little we knew".

General George Washington, commander-in-chief of our Revolutionary War Army and our first President, was dubbed "the father of his country". Leonard Cobb and I presented Washington's portrait to Frank at his 1986 festschrift. Why? Because Frank was unequivocally the father of emergency medicine in North America.

Frank's vibrant legacy of early care of patients evolves in North America today. Thousands of community emergency services embody the Pantridge principles. Frank often remarked, as he raised his glass among us, "Good men are few". Today we toss that toast back to Frank. We remember an extraordinary medical graduate, teacher and investigator of the Queen's University Belfast. His portrait unveiled today makes Frank this well deserved place of honour in the history of Queen's University.

BIBLIOGRAPHY

Cobb LA. Sudden death - a community problem. The British Heart Foundation Lecture. In: Geddes JS, editor. *The Management of the acute coronary attack. The J Frank Pantridge Festschrift.* London: Academic Press Inc; 1986. p105-20.

Crampton RS, Aldrich RF, Gascho JA, Miles JR, Stillerman R. Reduction of prehospital, ambulance and community coronary death rates by the community-wide emergency cardiac care system. *Am J Med* 1975;**58(2):**151-65.

Crampton RS. The impact of the mobile coronary care unit in the USA. The Queen's University Lecture. In: Geddes JS, editor. *The Management of the Acute Coronary Attack. The J Frank Pantridge Festschrift.* London: Academic Press Inc; 1986. p 9-23.

Diehl D. The Emergency Medical Services Program. In: Isaacs SL, Knickman JR, editors. *To Improve Health and Health Care. The Robert Wood Johnson Foundation Anthology.* San Francisco: Josey Bass A Wiley Company; 2000. Available online from: http://www.rwjf.org/files/publications/books/2000/chapter_10.html. Last accessed August 2009.

Eisenberg MS, Pantridge JF, Cobb LA, Geddes JS. The revolution and evolution of prehospital cardiac care. *Arch Intern Med* 1996;**156(15):**1611-19.

Eisenberg MS. *Life in the balance: emergency medicine and the quest to reverse sudden death.* New York: Oxford University Press; 1997.

Geddes JS, editor. *The Management of the Acute Coronary Attack. The J Frank Pantridge Festschrift.* London: Academic Press Inc; 1986.

Mathewson ZM, McCloskey BG, Evans AE, Russell CJ, Wilson C. Mobile coronary care and community mortality from myocardial infarction. *Lancet* 1985;**1(8426):**441-4.

Pantridge JF. *An Unquiet life: memoirs of a physician and cardiologist.* Antrim, Northern Ireland: Greystone Books; 1989.

Pantridge JF, Adgey AAJ, Geddes JS, Webb SW. *The Acute coronary attack.* Tunbridge Wells: Pitman Medical Publishing Co; 1975.

Wilson C. Effect of a Medically-Manned Mobile Coronary Care Unit. In: Geddes JS, editor. *The Management of the Acute Coronary Attack. The J Frank Pantridge Festschrift.* London: Academic Press Inc; 1986:39-50.

