Anaesthesia and the broken hearted

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I would like to thank the Medical Staff of the Royal Victoria Hospital for the honour accorded to me with their invitation to deliver the Annual Oration in this Bicentenary year. Studying the list of Orators in “The Royal Victoria Hospital – A History 1797-1997” by Professor Richard Clarke has, if anything, served to increase a natural nervousness and maybe reinforces the idea that, at my age, there is a fatalistic tendency to agree to almost any request a year ahead, aware that actuarial statistics give increasing odds against having actually to perform.

The broken hearted of my title are not for this occasion either my surgical colleagues or the administration but rather patients with significant heart disease which can be relieved by surgery. I will be describing the development of anaesthesia, and cardiopulmonary bypass which allows open and prolonged surgery of the damaged heart to be undertaken.

Selective memory fortunately ignores the tremendous surgical and anaesthetic problems which beset the early days of cardiac surgery. The ‘norm’ today, after the temporary cessation of the heart’s action necessary for heart surgery, is survival without further damage either to the heart or other organs. The vast majority of the patients can expect to go home after operation with a renewed spring in their step and the prospect of a good long term prognosis. These may be further improved by the present positive attitudes to prevention and rehabilitation. The changes responsible for the improving picture have more often been subtle rather than dramatic.

Cardiopulmonary bypass is the system allowing the heart to be isolated from the rest of the circulatory system and produces conditions for a reparative heart operation.

The birth and developmental steps of open heart surgery were encompassed in the professional life spans of those of us early in our seventh decades. The beginnings of an artificial circulation to replace the heart in an animal and at the same time modern anaesthesia took place in the 1930s. The end of school in 1953 coincided with the first successful open heart operation in a human using a heart lung machine. Student days saw the first open heart case in the United Kingdom in 1958. Graduation in 1960 saw the beginning of open heart cases in the Royal Victoria Hospital. For me the establishment of the present Cardiac Surgical Unit in the Royal in 1968 was the year of my appointment to a career post. The evolution of the Unit finally moves me inexorably towards retirement. Whatever overview is taken, these dates simply emphasise the youth of the specialty.

Many factors influence career choice. The early 1960s in this hospital were a significant time in anaesthesia. The strong base of anaesthetists, comprising Maurice Brown, Jim Elliott and Jim Reid, was catalysed by the whirlwind effect of the arrival in 1958 of Professor John Dundee and by the pioneering activities of Bob Gray in Intensive Care. My own option for specialisation in cardiac anaesthesia began at a date in 1966 when I had an interview with Professor Dundee about the future of cardiac surgery and cardiac anaesthesia.

However, it is necessary to go back a little further. The observation that “The heart alone of all viscera, cannot withstand serious injury” is attributed to Aristotle, born 384 BC. Though it does beg the question about the central nervous system, there is undoubtedly still much truth in this statement. It is certainly widely accepted by

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the general public and was closer to the truth than a statement by Sir Stephen Paget who in 1896 stated that “Surgery of the heart has reached the limits set by nature toward all surgery, no new method and no new technique will overcome the natural obstacles surrounding a wound of the heart”.\(^1\) This type of medical misjudgement is not unique to any particular era. The Krebs Cycle, Magill’s pioneer work on tracheal intubation\(^2\) and Brock’s mitral valvotomy operation each struggled in their turn for recognition. It was therefore almost inevitable that very soon after Paget’s pronouncement, the first successful suturing of a stab wound of the right ventricle of the heart was achieved by Rehn.\(^3\)

The major developments in heart surgery were dependent on the achievement of two factors:-

Firstly the perfection of a means of supporting an effective circulation to the rest of the body, allowing the heart to be isolated from its normal function and repaired.

Secondly, the understanding of the anaesthetic problems inherent in the management of the open chest and the inevitable pneumothorax of thoracic surgery.

The stimulus for many of the developments of the artificial circulation and the monitoring of the cardiovascular and respiratory parameters came from the 19th Century physiologists such as de Gallois \(^4\) and Loebell \(^5\) but the problems of managing the open chest were a long way from resolution and would not be solved until the much later improvements in anaesthetics and the introduction of muscle relaxants.

While the heart’s action proved relatively easy to replace on a temporary basis with roller type pumps it was early appreciated that it was more feasible on a temporary basis to replace the function of both the heart and lungs. Over time three different methods have evolved to allow the temporary replacement of lung function and to reproduce the large surface area for gas exchange, imitating that which is available so efficiently in the lungs.

i) The first created a film of blood spread over a large surface area with oxygen circulating round the film, the so called screen and disc oxygenators.

ii) In the second oxygen was bubbled through the blood creating the necessary large surface area, the bubble oxygenator. This was the oxygenator pioneered by Lillehei\(^6\) and popularised by Denton Cooley which allowed volume cardiac surgery to take place with the use of minimal blood.

iii) Thirdly the system in which gas transfer occurs into the blood across a membrane, the membrane oxygenator. This is now by far the most widely used oxygenator, being the machine of choice in over 90% of cases. It is still debatable if the membranes are in fact intact or are a refined form of bubble oxygenator.

The physiologists did their work in the 19th and early 20th centuries using defibrinated blood, as they were without the means to prevent blood clotting. The discovery of heparin in 1916 by McLean,\(^7\) when still a second year medical student, was therefore a highly significant event. Protamine became available 21 years later in 1937.

There are some other noteworthy landmarks. After the First World War Rowbotham and Magill\(^8\) popularised the technique of tracheal intubation to secure the airway and allow extensive facial reparative surgery. This paved the way for the management of respiration in both open chest and abdominal surgery. The operation for relief of constrictive pericarditis was described at this same time and the first successful mitral valvotomy was attributed to Souttar in 1925.\(^9\) The encouragement for the parallel technical developments to provide circulatory support gathered momentum. In 1935, Carrel and Lindbergh (the same Charles Lindbergh who was first to fly the Atlantic from New York to Paris non stop in 1925), described a perfusion apparatus which was successful in keeping an organ alive outside the body.\(^10\) Soon afterwards Gibbon in 1937,\(^11\) using a rotating cylinder to create a film of blood through which gas exchange could take place, described the first application of cardiopulmonary bypass in experimental animals. The pumps used were of the roller type already mentioned, still in use today. They were designed by the then young Michael De Bakey,\(^12\) the same De Bakey who, more than 50 years later, was in 1997 prominent in the cardiac advisory medical team for Boris Yeltsin, the Russian President.

Concurrently there were rapid advances in anaesthesia, and with that the knowledge of how to manage the open chest. The early trials with
thiopentone were reported by Lundy in 1934\textsuperscript{14} and the muscle relaxant curare was introduced by Griffith in 1942.\textsuperscript{15} With these advances came surgical progress, and Gross in 1939\textsuperscript{16} reported the surgical approach for ligation of the patent or persistent ductus arteriosus: modern cardiac surgery was under way.

The 1940s saw great advances in most fields of medicine, many stimulated by events of the Second World War. The treatment of casualties saw rapid improvement in surgical and anaesthetic techniques, allied to improvements in the expertise of the personnel and in overall patient management. The use of blood transfusion became commonplace and antibiotics were more widely available. These changes also had marked effects away from the battle zones. The first repair of coarctation of the aorta was described in 1945 by Crafoord\textsuperscript{17} in Sweden and in that same year Blalock and Taussig\textsuperscript{18} in the United States described the subclavian artery to pulmonary artery shunt for the palliative relief of cyanotic congenital heart disease. As anaesthetists became more familiar with relaxants and with the management of the open chest, Brock in London in 1950\textsuperscript{19} was able to report the successful management of six cases of valvulotomy for mitral stenosis. This operation required only minimal interruption of the circulation, and anaesthesia was with thiopentone, curare, nitrous oxide or cyclopropane, and ether. These early cases were done by the same surgeon but by three different anaesthetists so teamwork was still a far-off concept.

The Royal Victoria Hospital did not lag behind, and in 1948 the first ligation of a patent ductus arteriosus and indeed a shunt to relieve cyanotic congenital heart disease were both performed by Barney Purce. The first mitral valvulotomy in the hospital is attributed to Tom Smiley in 1950 when he was still a Registrar.\textsuperscript{20} This was the first operation of any kind on the heart itself done in Ireland and the anaesthetist was Maurice Brown.

These were great and exciting advances but they represented only the tip of the very large iceberg of potential cardiac surgery and the pressure was increasing for a total circulatory support system in order that more complex lesions could be treated. In 1951 Dennis\textsuperscript{21} used a combined film and disc oxygenator to perform the first total human heart bypass. The patient was a six year old girl scheduled for repair of a secundum atrial septal defect. At operation the girl turned out to have a primum type of atrial septal defect and died at the end of the operation. This unfortunate episode set back the momentum for development
of the total circulatory system, and alternative methods were again sought. One such method was inflow occlusion to produce a dry heart, the system of cutting off the venous return to the heart by clamping the superior vena cava and the inferior vena cava allowing for short periods of total circulatory arrest. The time limit before cerebral damage was two minutes at normal temperature. Such a limitation was too restrictive to allow the surgeons to do anything meaningful. It was then argued that if the brain was cooled the circulatory arrest time could be prolonged. Lewis in 1952 used the technique of total body cooling with surface cooling, followed by inflow occlusion to successfully repair a large atrial septal defect in a five year old child. The occlusion time was 5.5 minutes and the patient survived. Thus was born the technique which was to allow a series of successful operations for the simpler defects.

In the technique of moderate hypothermia the anaesthetised patient was cooled most usually by total immersion in a bath of ice cold water. When the temperature fell to 31 or 32 degrees centigrade the patient was put on to the operating table on a cold water blanket. The timing of the rate of cooling was difficult, and ventricular fibrillation an ever-present hazard. The technique required the surgeons to be resolute, precise, speedy and able to work against great pressure. The management was tricky, and there was no room either for a mistake on their part or any error in the diagnosis. The anaesthetists had very primitive monitoring and could resort only to philosophy and prayer. The surgeons and anaesthetists of the day in the Royal were particularly successful at the technique using hypothermia. I carried out the procedure once or twice when a Senior Registrar in this hospital. Maybe one loses courage with time but the memory of those days still gives rise to nightmares.

As in some other centres the very success with this technique may have in the long run slowed down the developments of the more complicated open heart surgery in this hospital. When open heart surgery began, the commonest case presented was not the well understood secundum atrial septal defect but the more difficult ventricular septal defect repair. It was anatomically ill-understood, the position of the bundle was still being determined with the help of the emerging electron microscope, it was not fully accepted that a patch rather than direct suturing was essential, and the sutures then available were as binder twine compared to the sutures of today. Sadly and ironically the procedure was later often shown to be unnecessary. The use of surface cooling re-emerged in the late 1960s in small infants to facilitate a technique involving total circulatory arrest. Surface cooling resulted in an evenness of cooling at all layers, and was extended on bypass by further cooling to 15 degrees centigrade, allowing a period up to sixty minutes of circulatory arrest. Hypothermia, and indeed profound hypothermia, is still induced today but periods of circulatory arrest are minimal.

However cardiac surgery was not to be held back. Moderate hypothermia, though very important, allowing simpler open heart procedures to be undertaken, was only a diversion. The great breakthrough came finally in 1953. Gibbon, Professor of Surgery and Director of Surgical Research at the Jefferson Medical College, Philadelphia, a long time pioneer, used complete human heart bypass to carry out a successful repair of a large secundum atrial septal defect in an eighteen year old girl, who has been a long term survivor. Three other cases by the same team were unsuccessful to such a degree that, although it was recognised as the way forward, once again other techniques were tried in preference.

Lillehei, another dominating figure, used a cross circulation technique from an adult donor to allow repair of a ventricular septal defect to be undertaken in an eleven month child. The child's father was the donor. The blood flow from the father was 55ml/kg/min and the cross circulation time was slightly over 19 minutes. Unfortunately the patient died from pneumonia 11 days post operatively. One has to wonder if the defect was
totally closed. Lillehei did a series of patients by variation of this method, 45 in all, with 28 survivors but the method gradually fell into disrepute. Another curiosity was in 1956 when Campbell used the lung of a dog as the oxygenator, operating on fifteen adults.25

Progress was being made despite these different, exotic and sometimes bizarre ideas, and Kirklin in 1955 at the Mayo Clinic reported an improved survival rate of 50%.26 Two systems were coming to the fore, the screen or disc oxygenators, and the bubble. The Rygg bubble oxygenator was the oxygenator which was selected in Belfast when the present unit started in 1968.

It is alarming to think that as these events were going forward the pacemaker and defibrillator were still in their infancy, and consequently rather crude devices. Progress was swift and in 1958 the first successful open heart operation in the United Kingdom was done by Bill Cleland in the Hammersmith Hospital, the anaesthetist being John Beard.27 The oxygenator used was a disc oxygenator designed by Dennis Melrose in the same hospital.

What was happening in Belfast in the late 1950s? Closed mitral valvotomy was a well-established operation, and repairs of patent ductus arteriosus and coarctation of the aorta were performed as needed. The use of moderate hypothermia with brief circulatory arrest for atrial septal defect repairs and pulmonary valvotomies was also established. Moves were afoot to start an open heart unit and Harold Love has noted that in 1958 John Bingham presented a feasibility study to the Medical Staff of the Royal Belfast Hospital for Sick Children to set up an open heart unit there. He favoured the Lillehei bubble oxygenator but the quotation of £1500 for the machine may have been too costly for the Children’s Hospital, and in the long run nothing came of these moves.

In 1960 came the next major step forward. The first open heart operation using a heart lung machine was done by Tom Smiley, another of the three thoracic and cardiac surgeons in Belfast at that time. Mr Smiley was a unique personality, in some ways a larger than life character, who was a spare time farmer and an enthusiastic huntsman. He had the heart of a lion, and at times of crisis in the operating theatre was well known to raise his voice more than a little, and then, when all the excitement was over, to revert to singing hymns, a favourite being the 23rd Psalm. The unique operation was in 15/16 Theatre on the Royal coridor, and the anaesthetist again was Maurice Brown. Dr Brown was an impressive looking man, a talented anaesthetist and a formidable adversary. He had done much to protect the status of anaesthetists at the start of the National Health Service in Northern Ireland and he was a most forceful ally to me at the start of the present Unit.

The perfusion apparatus used was the Melrose NEP Disc oxygenator, pioneered in the Hammersmith Hospital and the funds for this were given by the Royal Victoria Hospital’s Working Men’s Committee. This was the beginning of a five year phase of development. Professor Pantridge was an important influence and Manus O’Donnell, George Patterson and later Professor Richard Clarke were involved with the perfusion. Kathleen Galbraith was the theatre sister.

From today’s vantage point it is easy to be critical of the disc as a large, cumbersome and difficult machine. It took about three hours to set up, and four to five hours to take apart, clean, resiliconise the discs and leave ready to be sterilised for another day. A large priming volume of 5 litres was needed, and fresh heparinised blood was the
prime of choice. However it helped to establish open heart surgery as a practical procedure.

On a day of an open heart operation, the theatre staff came on duty about 6.00 am to be ready for the commencement of surgery at 10.00 am. At that same time blood donors were assembled to produce the requisite twelve to sixteen units of fresh blood, the patient was anaesthetised about 9.30 am and all was ready to go about 10.00 am. On this schedule they must have been exhausted before they started. In today's world it is hard to recall the stresses which were part of this pioneering work.

There was a long learning curve. The early cases were done in the Royal. Later there was a move to the Royal Belfast Hospital for Sick Children for logistical reasons with a change of surgeon to Maurice Stevenson, a much quieter and more thoughtful character than Smiley. He was a man of consummate skill, great understanding, humble in success, quiet in adversity. His anaesthetic colleagues were Harold Love and Gerry Black; Richard Clarke and Conor Mulholland became part of the team. The work later moved back to the Royal but problems persisted.

In those days, monitoring was very primitive, pulse oximeters were still twenty years away, the microchip was just a dream and intensive care was in its infancy. Success was hard-earned here, as in many other units. In 1965 it was decided that the time had come to consider a fresh approach and after a report by Professor D'Abreu from Birmingham, a new stand-alone unit and team were recommended, with ward beds, an intensive care unit, a dedicated theatre and all staffed appropriately.

Thus new opportunities arose and arrangements were made allowing me to go to Houston, Texas to work in the very busy Cardiovascular Surgical Units of the Methodist, St Luke’s and Texas Children’s Hospitals, with Dr Arthur Keats the recognised anaesthetic authority of the day. Houston was dominated at that time by two very powerful figures in cardiovascular surgery, Michael de Bakey, a visiting lecturer to this hospital in 1967, and the doyen of aortic surgeons, and Denton Cooley, the fastest and slickest cardiac surgeon in the world at that time, maybe even, who made surgery look fatally easy. My period there came to an end coinciding with his doing heart transplants numbers 7, 8 and 10 in the world during May 1968. His work load was eight cases per day in two operating theatres to the accompaniment of Country and Western music. Houston was a vibrant growing city with the NASA space centre nearby, an expanding microchip industry and the medical centre growing in all directions.

The first attempt to find a dedicated cardiac surgeon for the Royal Victoria Hospital failed but at a second attempt, and some head-hunting by Professor Pantridge there was a successful outcome. Early in 1968 Pat Molloy was appointed as cardiac surgeon to the Royal. He was an interesting person widely known for being the father of nine daughters when he came to Belfast. His optimism was further demonstrated in that while in Belfast his wife had her tenth child, a boy.

After his appointment early in 1968, Mr Molloy began to assemble a team. The senior theatre and intensive care nurses and the perfusionist went across to Broad Green Hospital, Liverpool where Mr Molloy was working and spent time there learning techniques. Communications were different in 1968 and there was an element of isolation in Houston. By the time my interview was eventually arranged for late May 1968, the rest of the team was well established and had done a series of animal operations in the dog laboratory.

Pat Molloy
This was an essential part of the team-building process. The dogs, usually greyhounds, were often from the dog track at Celtic Park, now the Park Centre. Some of the nurses who were resident in the Towers, with their grandstand view of the dog track, were able to spot likely candidates for bypass. Dogs who finished last seemed to have a high probability of helping in the establishment of cardiac surgery. I never enjoyed this phase and I must say I was glad when it passed. The Royal Staff as a body gave wholehearted support to the new venture. Mr J W S Irwin and Mr Reggie Livingston moved out of Wards 13/14 to provide beds for cardiac and thoracic surgery and a dedicated theatre was soon provided in Main Theatre Block to go with a Cardiac Surgical Intensive Care Unit with 8 beds situated beside the theatre.

This goodwill on the part of the Royal staff as a whole and the support by the surgical and anaesthetic personnel was an essential part of our smooth beginning. The help from Richard Clarke and the sage advice from Bob Gray were both needed and appreciated as was the full hearted help from all departments, especially haematology, biochemistry and radiology. But it was quite tense as 'zero hour' approached.

June 19th 1968 was D Day. Seventeen year old Anne Stevens was scheduled as the first patient, (a repair of a secundum atrial septal defect) and despite the considerable apprehension felt by everybody involved, the case went uneventfully. After extensive debriefing and some more dog experiments there was a repeat performance the next week. After this quiet beginning the next case was a double valve replacement in a patient with a permanent pacemaker in situ, the first such operation in Belfast. Fortunately that patient also did well. By the middle of August a total of fifteen cases, mostly open, had been done, with no mortality and it was time for a holiday. The novelty and the initial pressures wore off and cardiac surgery became just another service able to set about establishing itself and its pattern of work.

Those early cases are etched indelibly in the mind of everyone involved, such as a teenage female with Fallot's Tetralogy, a haemoglobin of 21 grams and a haematocrit of 80%. She had passed from blue to a dreadful blue grey colour never seen today. After a successful operation she looked totally different, being blonde and attractive, and in fact her only complaint when she came to her follow up appointment was that no one in Lurgan recognised her. Many patients were end-stage and sadly there were frequent failures. Strangely, I anaesthetised a man this summer for coronary artery bypass grafts, whose father had died after a mitral valve operation with us in 1968, at the age of 45 years.

Compared to today, problems and complications were frequent. The standby order for blood was twelve units of fresh whole blood per patient compared to four packed cells today, and it was all needed. One patient out of every five returned to theatre because of excessive bleeding. Air embolism was a heartbeat, literally and metaphorically, and there was a dramatic improvement with some adjustments to the machine and later by the introduction of arterial filters. Surgery was slow, monitors were erratic and basic. Fluid balance was difficult to achieve. Post operative care was taxing, complications common and a tracheotomy was virtually a death sentence. While the excitement of the successes kept us going it is hard to appreciate today how difficult and frustrating the work often was.

The work load in 1969 was 220 open and closed cases with an overall mortality rate of about 17%. The mortality in double valves was more than 20% and in triple valves about 30%. Surgery for congenital heart disease was always difficult and remains so. In those early days definitive repairs were only attempted in children of more than four years of age. Later the cut off point was less than 10kg but at any rate by natural selection we were operating on the best of the survivors. Even so the mortality was still in the region of 20%.

After a few years of stasis, many arguments with the Eastern Board and the Department of Health, and more than one commissioned report the work has grown in an erratic fashion to the present figure of 1150 operations per annum. The patients now average over 60 years of age, with a range of 0 to 84, and 3% are greater than 80 years of age. This compares to an average of 43 years at the beginning, ranging from 4 to 64 years. In contrast to 1969 today’s mortality is 2.8% overall, the rate in valve surgery is 1.8%, in coronary artery bypass grafting 2.5%, and in paediatric work (now encompassing definitive repairs in neonates) is about 10%. The mortality statistics of the unit have always been among the best in the United Kingdom and it is comforting that they remain so.
The 225 cases in 1969 were done from a base of 20 ward beds and 8 intensive care beds. Today's 1150 patients have as base 30 beds and 12 intensive care beds.

With time, anaesthesia and surgical personnel have changed. Jack Cleland was appointed a consultant surgeon in 1970. Pat Molloy's time was short and he returned to New Zealand in January 1973, to be replaced by Hugh O'Kane. Mr Cleland, who had returned from the Mayo Clinic shortly after our D Day, had worked in the unit as a Senior Registrar. He gave dedicated service until his retirement in 1995. He had particular excellence in valve surgery and he pioneered many new ideas and techniques.

Jim Morrison was a member of the anaesthetic team from 1970 but after making his mark left for Canada in the major emigration of 1974, creating a huge gap. Professor Richard Clarke and I struggled along for most of a year until the arrival of Ian Carson who gave encouragement to our developments both in monitoring and in narcotic anaesthesia.

Mr O'Kane's appointment introduced coronary artery surgery to Belfast, a region with a very high incidence of coronary artery disease. There was initial reluctance on the part of some cardiologists to submit patients for this surgical treatment and it is interesting that the first patient referred from this hospital was referred by one of the general physicians. Mr O'Kane's work proved itself, and his pioneering efforts in this field have been of great benefit for very many.

The paediatric work has always been very taxing, especially once the definitive repairs of congenital defects began to be the norm in the smallest infants. It remains so. Freddie Wood had a brief sojourn but Dublin claimed its son soon afterwards. The appointment of Dennis Gladstone has fortunately proved to be a quantum leap forward for Northern Ireland in this area. The whole surgical team has been strengthened and its base broadened by more recent appointments.

There is now a very strong anaesthetic team with each individual having their own personal area of expertise. I feel privileged to work with such capable, effective and yet pleasant colleagues. Thirty years ago the standard anaesthetics of the day had several deficiencies and this was more apparent with the beginnings of coronary artery surgery. The perioperative infarction rate was unacceptable, and anaesthesia had a responsibility in this regard. Houston was interested in high dose narcotic anaesthesia but concentrated on pethidine which turned out to be unsatisfactory. The studies in Belfast by Professor Clarke and myself \(^{28}\) on the available induction agents and relaxants in 1969 to 1973 helped to highlight their deficiencies further.

Lowenstein then published his work on high dose morphine anaesthesia \(^{29}\) and this was a real advance. The dose used was 1-3 mg per kg body weight so that the standard 70 kg man received 150 mg intravenously over a 2-3 hour period. This gave a more stable situation, with a decreased myocardial oxygen consumption. Unfortunately 10% of patients had some awareness for events. Diazepam was added which resolved that problem but the patients then had a prolonged recovery – days not hours. Finally Stanley recommended fentanyl in doses of 25-50 micrograms per kg \(^{30}\) and this regime has dominated the past 20 years. Further changes are now taking place but that is a lecture on its own. The techniques now allow safer, low oxygen demand anaesthesia with early awakening and the next years promise exciting developments.

The invasive monitoring which was part of cardiac surgery from the beginning gave an opportunity to do haemodynamic studies and this interest has been maintained. Dr Carson studied high dose narcotics and the effects of midazolam both in theatre and in intensive care. Other projects followed as different personnel pursued their interests; these ranged from post operative ventilation studies, total intravenous anaesthesia, propofol in intensive care, psychometric tests of cerebral function and now immunology responses on cardiopulmonary bypass. There are many opportunities and it is important for this hospital that they should be encouraged.

The steady improvement in morbidity and mortality since the Unit began is in keeping with world trends. Recent high profile cases have demonstrated that not keeping pace with the required standards leaves units open to severe criticism. The cardiac surgeons have always taken part in a strict audit and while sometimes seeming to have a stick to beat their own backs, their example should be the norm in other disciplines.

What has contributed to these improvements? Today's patients are older and in many ways less fit. However they are better prepared, the
diagnosis is almost invariably comprehensive and correct, surgical techniques and materials have improved enormously and there has been a revolution in myocardial preservation.

The anaesthesia changes have already been mentioned. The management of patients in intensive care has improved with better agents, better monitoring and above all there are now highly trained nursing and other personnel. The message is clear that the best results are achieved with good teamwork and the best use of the available expertise.

There are many unsung heroes and heroines in this work. We owe huge debts to the dedication of nurses, perfusionists, technicians, physiotherapists, radiographers and all who work in the Unit. For example the senior perfusionist Mr E Stewart came to us in a time of crisis in September 1968 via the shipyard and then the electric maintenance department of the hospital. Ernie was naturally gifted, has absorbed change, initiated change, anticipated disaster and averted it with equal facility. He is a unique man of outstanding quality and the thousands of patients whom he has perfused so expertly owe him a lot.

Today you may hear many negative comments about the problems of being a student, then a young doctor. However, medicine offers unique opportunities. You have involvement with people at times of their greatest need and with their life under threat, and you have the opportunity to set them on the path to recovery. What could be better? Listen to the positive messages (and there are many), and take some of the negative comments with a pinch of salt. When I was a student there was great depression about job prospects. Fortunately they were wrong. At the end of my career I have no regrets and I remain an optimist for the future.

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