heart TO HEART

THE BAIRD INSTITUTE
Applied heart & lung surgical research

JUNE 2021

Greetings to our Valued Supporters

Another 6 months has slipped by so fast since our last newsletter and as always, there is much to report. Our scholarship holders are continuing to work away on their research. In this newsletter you will read about Dr Mathew Doyle's research which involves the development and construction of an eccentric cycling exercise bike, followed by a testing of the hypothesis that eccentric cycling can improve leg muscle function in patients after heart surgery. With eccentric cycling a small motor in the exercise bike drives the pedals in a backwards direction, while the patients have to try and resist the pedals or slow the pedals down. Apparently, the oxygen required for this form of exercise is much less than normal cycling and so is an excellent way for heart surgery patients to exercise after their operation.

Perhaps the most exciting news to report is the future for valve surgery. One day in the not-too-distant future we are hoping to be able to insert a valve into a patient's heart that is exactly suited to that patient, as opposed to using a valve off the shelf. As Professor Bannon explains; "based on the imaging of a patient's heart, whether that be with echocardiography, a CT scan or an MRI, we are able to individualise the repair of a patient's heart".

Professor Martin Misfeld, senior consultant at the Leipzig Heart Centre in Germany and Co-Director of Research at RPAH, has written an entry entitled "Modern Cardiac surgery". Prof. Misfeld demonstrates how far we have come since the first documented heart surgery case in the world, in 1896, to today with our minimally invasive approach. A story by a heart surgery patient, Alan Pope, on the following pages, also reveals the advances that have been made from the time his grandfather was operated on in 1955, to when Alan himself was operated on in 2019.

Finally, a big shout out to Rebecca Mason who completed the Perth to Rottnest Island Ocean swim in February this year. Rebecca swam 19.7 km, in what is one of the largest open water swimming events in the world and it took her 9 hours and 42 minutes. No mean feat for someone who had open heart surgery only some 2 years earlier! We would like to thank Rebecca forusing the swim as an opportunity to raise funds for The Baird Institute.

To every single one of our supporters, thank you for everything you make possible. None of what is mentioned in this newsletter would be feasible without your help. You are an important member of our team!

Best Regards

Catherine

Catherine Rush
CEO, The Baird Institute

LETTER FROM OUR PATRON

The Hon. Michael Kirby AC CMG

I am glad, once again, to offer congratulations and good wishes to The Baird Institute. Despite the COVID-19 pandemic, the Institute has continued to support people in need of cardiothoracic advice and surgery. Led by Professor Paul Bannon, it has continued to pioneer research into aortic surgery, valvular surgery and myomectomy surgery. It has established Australia's first comprehensive cardiovascular surgery biobanking pro-

gram. This utilises tissues procured from aortic and other surgery. Those tissues are then utilised for research into various forms of heart disease.

One patient, Alan Pope, has written about his family's experience with aortic surgery. It began with his great-grand-father, included his father and just recently he himself has undergone surgery at 40 years of age. All members of the family had aortic aneurysms. He speaks openly and proudly of the work of the Baird Institute. This is a case of helping three generations in need.

The past year has been dominated by the COVID-19 crisis in Australia and the world. The pandemic has prevented the usual friendly meetings of supporters of The Baird Institute, when they can learn of the medical and surgical miracles and take pride in the engagement with scholarship recipients and friendly gatherings with surgeons and researchers. We all hope that next year we will return to a normal world. COVID-19 has shown how we are all susceptible to disease and infection. But we are also susceptible to heart and lung disorders. They go on happening. And they need the vigilant work of "The Baird".

The work of The Baird Institute goes on relentlessly and has not been interrupted by COVID. We who are the beneficiaries of Doug Baird and his successors must continue to support The Baird Institute. It is a bright jewel of Australian medical and surgical intervention and research. And it has shone even more brightly during the dark months of COVID.

The Hon Michael Kirby AC CMG,

THE BROKEN HEART PROGRAM

Charles Perkins Centre, USYD
Professor Paul Bannon
Chair, The Baird Institute

Dr Laurencie Brunel
Researcher

Recently we have developed a model for looking at mitral valve repair. This model will assist us with the maintenance of heart function when we replace a mitral valve (or any of the heart valves) in a patient. With this research project, we are looking into not only how well the replacement of the valve corrects the valve function, but how well it affects the heart function. Specifically, this will assist with the evaluation of new technology valves as we are able to examine how well they will perform by testing the different designs in this model that we have developed.

The fundamentals of this whole research program will lead into the most exciting component of it - individualised programs for patient correction. Based on the imaging of a patient's heart, whether that be with echocardiography, a CT scan or an MRI, we are able to individualise the repair of a patient's heart. When we know the fundamentals of heart function, what we do to a heart and what that in turn does to the heart, then we are able to individualise treatment for a particular patient. So, rather than utilising a valve off the shelf, we would have a valve that suited the patient exactly.

Another exciting component of the study is that we are planning to utilise a 3D bioprint of a heart whereby we take a patient's scanned heart image, 3D print it and then place the 3D bioprint of the heart in our pump model so as to simulate the patient's pump function. Using the information gained from the study on the best way to repair a particular patient's heart, the proposed repair is then tested on the 3D printed model of the heart. As can be seen, the whole program is centred around individualisation rather than off-the-shelf correction, but it also forms a platform that allows us to test the technologies that are being produced by the big valve companies, in addition to allowing us to test our own designs. The work we are doing at present involves testing current techniques for valve repair and replacement and examining what impact they have on heart function, in addition to testing the impact the new technology valve replacements have on heart function.

Although this research has focused on the mitral valve, in the future, we intend to look at the tricuspid valve and the aortic valve, in addition to other areas of the heart so as to ascertain as much information as possible on heart and valve function.

SCHOLARSHIPS AND GRANTS PROGRAM

An Interview with Dr Mathew Doyle

Cardiothoracic registrar, Master of Philosophy candidate at the University of Wollongong and the recipient of a Baird Institute scholarship

What is your research topic?

My research project is entitled "eccentric cycling to address skeletal muscle dysfunction after cardiac surgery". This research involves the development and construction of an eccentric cycling exercise bike, followed by testing the hypothesis that eccentric cycling can improve leg muscle function in patients after heart surgery.

> ***The support of The Baird institute scholarship has been invaluable to my research. It has allowed me to access the statistical software required to perform analysis of the captured data.***

What is the aim of your research?

The aims of my research are threefold:

1. To perform a systematic review of the current literature into the safety and efficacy of aerobic exercise performed early in the post operative period of patients following cardiac surgery.
2. To develop and construct an eccentric cycling machine that can be used in a hospital at the bedside.
3. Performing eccentric cycling in patients following cardiac surgery and assess its effectiveness in improving leg muscle function prior to leaving hospital.

The systematic review was performed and identified that exercise performed early after cardiac surgery is safe and improves functional capacity. As there was no commercially available eccentric cycle machine that could be easily used to deliver the exercise for patients in a hospital ward, we then moved to designing and constructing a cycling machine that could be used for this purpose. A second study was then performed that described the design of this ergometer and demonstrated it was able to safely and repeatedly deliver the eccentric cycling exercise. The final stage of my research was for patients to perform eccentric cycling exercise bouts after coronary artery bypass surger (CABG), and asses its impact on leg muscle function.

What is the potential impact of your research?

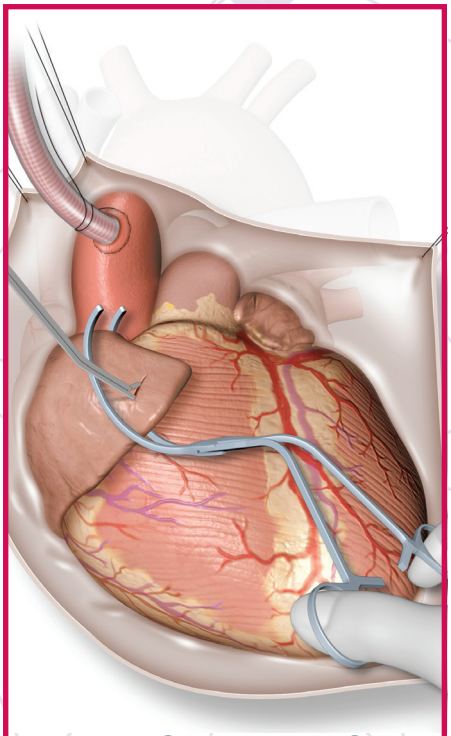
The big focus of this project is the type of cycling we are asking patients to do. My research uses "eccentric" cycling. In this type of cycling, a small motor in the exercise bike drives the pedals in a backwards direction, while the patients have to try and resist the pedals or slow the pedals down as they turn towards them. This type of exercise is very appealing for patients after heart surgery as the oxygen required to perform this type of exercise is much less than normal forward cycling. Patients can therefore work their leg muscles without stressing the heart and lungs.

Even simple activities such as walking can be too strenuous for some patients. The application of this novel form of exercise may provide elderly, frail and unwell patients with a means of improving their functional capacity at a fraction of the cardiac and metabolic requirements of more traditional exercise modalities. If we demonstrate this type of exercise to be effective and safe, it may be more widely applied to other hospitalised populations.

How has the scholarship from The Baird Institute helped you?

The support of The Baird institute scholarship has been invaluable to my research. It has allowed me to access the statistical software required to perform analysis of the captured data. It has provided me the opportunity to undergo training in database compilation while also allowing me to provide training to other health professionals required to assist in the study. Finally, the scholarship has allowed me to present the early findings of my research at both local and international conferences. Being face to face with other world leaders in this field of postoperative surgical care has provided me with a new network of experts and collaborators that will continue to drive future research.

I would like to express my sincere gratitude to all the supporters of the Baird Institute - it is you who has made my research possible. I very much look forward to the opportunity of sharing the final results with you all, once this project is completed.



THE BIO-BANKING PROGRAM

Dr Sean Lal, Director Sydney Heart Bank

Bio-banking in health care has evolved over the last few decades from simple biological sample repositories to complex and dynamic units with multi-organisational infrastructure networks. Together, The Baird Institute, RPAH and University of Sydney have established Australia's first comprehensive Cardiovascular Surgery Bio-banking Program. Tissues are procured from aortic surgery, valvular surgery and myomectomy surgery (to treat hypertrophic cardiomyopathy) and cryopreserved at the state-of-the-art bio-banking facility at the University of Sydney. These tissues can then be used to facilitate translational research into the mechanisms of vascular disease and heart failure and hopefully lead to new therapeutic targets being discovered.

The image above shows how human heart tissue can be safely biopsied from the right atrium - only 2mg of tissue is needed to facilitate an analysis of some 4500 proteins in the human heart, which can be undertaken in our research laboratories at the University of Sydney.

INTRODUCING OUR NEWEST STAFF MEMBER

Cassandra Malecki,
Research Assistant, The Baird Institute

I grew up in Sydney and completed a Bachelor of Medical Science at the University of Sydney, majoring in pathology. I completed my honors year in the Aortic Research Group at the Charles Perkins Centre at the University of Sydney, under Associate Professor Brett Hambly and Professor Richmond Jeremy. The Aortic group has a focus on investigating various factors that may alter the severity of aneurysms of the thoracic aorta, particularly in patients with the genetic connective tissue disorder, Marfan Syndrome. After a very successful and enjoyable honours' year, I decided to continue with a PhD in the same group and earlier this year submitted my PhD thesis which is currently under examination.

I was fortunate enough to be offered a job as a research assistant with The Baird Institute in the Cardiovascular group (headed by Dr Sean Lal, Professor Paul Bannon and Professor Richmond Jeremy), to continue my research journey in the cardiovascular field, with a particular interest in heart failure and cardiac aging. Along with assisting with projects and experiments that are currently underway in the Lal lab, a major part of my role involves collecting precious human heart and aortic tissue samples and managing the Sydney Heart Bank database. Throughout my PhD, I spent a lot of time collecting human aortic tissue which I was lucky enough to then use throughout my research projects and therefore I am very excited to still be involved in managing such an important biomedical research resource that is the Sydney Heart Bank.

This is another important investment in the team which supports the high-impact research conducted by our researchers. Our wonderful supporters have made this investment possible.

MODERN CARDIAC SURGERY

Professor Martin Misfeld
Co-Director of Research,
Cardiothoracic Department, RPAH
Senior Consultant,
University Department for Cardiac Surgery,
Heart Centre, Leipzig, Germany

It was in Frankfurt,Germany, when Ludwig Rehn performed the first documented heart operation on the 9th of September 1896. He closed a hole in the heart of Wilhelm Justus, who was injured in a knife attack. Since then, cardiac surgery has undergone tremendous developments.

Modern cardiac surgery includes less invasive procedures. With a minimally invasive approach, heart valves can be repaired or replaced, and coronary artery bypass surgery can be performed. The aortic valve for example can be operated on via a small incision in the upper right chest. Access to the mitral and tricuspid valve in contrast, is performed by an incision in the space between the ribs on the right side of the chest. These procedures can also be performed with the support of a robot, which has already been introduced at Royal Prince Alfred Hospital. In selected patients, Coronary Artery Bypass Grafting (CABG) can be done through a small incision on the left side of the chest. This procedure is performed on the beating heart. In almost all CABG procedures, it is possible to operate without the use of the heart-lung-machine on the beating heart. This technique is called off-pump coronary artery bypass surgery (OPCAB). It has the advantage of avoiding any manipulation of the aorta and as a result reducing the risk of perioperative stroke.

All modern techniques result in less trauma during surgery and patients recover much faster from the procedure. It is important to know, that each technique requires adequate training and expertise.

REBECCA MASON'S PERTH TO ROTTNEST ISLAND OCEAN SWIM

Good morning Rebecca, this is the Australian Federal Police, can you please confirm your location?

It was 5.45am, on Thursday 4th February, 2021 and I can officially say, that this was possibly the worst wakeup call I had ever received. I was in Perth having begun my 2 weeks of self-isolation in order to make the cut-off to still swim the 20km Perth to Rottnest Island.

The event is the equivalent of swimming from the Sydney Harbour Bridge to Manly return, just over 60% of the English Channel (35km), while the running translation is 80km.

There are only 400 people who complete the swim as a soloist like myself, and 2000 relayers. There is a 60-80% success rate on the day itself due to many variables, most of which are outside of your control:

- Your team: You have to find a boat and kayaker to accompany you for both safety and feeding. There are always a handful of boats that break down on the day, as well as kayakers who forfeit due to exhaustion or seasickness – it really is luck of the draw.
- Hypothermia: If you spend long enough in warm water, you still get cold. There is a hypothermia medical tent at the end to give a glimpse into how many people do suffer from it. The only strategy to manage this, is to put on as much body fat as you can, to starve off the cold. The other is to wear a full body suit (wetsuits are not permitted).
- Nutrition: We generally eat every 30 minutes and the food is highly sugar based as your body needs to burn carbs for these types of endurance events – which is a shock to me as a paleo person of 5 years. My swim diet includes strawberry yoghurt, coke and lollies.
- Swimmer-induced oedema: This is when the lungs fill with fluid and need draining.
- Tongue swell: When the tongue swells and blocks the throat due to exposure from salt water.
- Timing cut-off: There are markers at the 10km, 15km, 18km marks in the swim, each with times allocated to them – ie if you don't meet the 15km mark by 2pm, you get disqualified from the swim. Although the timings seem lenient on paper, the weather conditions really determine your timing and performance on the day.
- Currents: Swimming against a current, feels like pushing against a brick wall (literally), and when you stop to feed, you can get pushed hundreds of metres backwards in seconds. This is why it can take hours to move just 1km instead of the standard 20 minutes.
- The Fremantle Doctor: No, it's not actually a doctor, but it's a famous wind. This wind is generally 25 knots (a light breeze is about 5 knots) and as the wind intensifies the waves get bigger, you then need to swim under water and wait to be pulled to the top of the wave to get a chance to breath (without the risk of inhaling too much water).

Suffice to say, there are a lot of factors to consider and risks to train for. Most people who undertake this swim, have about 15+ years' swimming experience underneath their belt and generally weigh about 110kgs.

In my case, I had less than 2 years' experience, with only 2km as my longest swim, recent aortic valve sparing surgery (courtesy of Professor Bannon) and I weighed 55kgs. I'm sure we can all agree, I had a lot of catching up to do. So instead of undertaking a 3-month training program to prepare for the 20km swim, I had to triple it, with a 9-month training regimen.

I began simulating what solo swimming feels like – just me, swimming alongside a kayaker (or a boat) - from June last year, and we've had several experiences on this steep learning curve, dealing with 48 knot winds, sharks and 30 bluebottle stings to name just a few.

I'm very pleased to share, that I completed the Rottnest swim after 9 hours and 42 minutes on the 20th February this year.

Rebecca delivers corporate presentations re. her experience pre and post heart surgery. Please contact us for her details if you would like her to present at your next event.

A FAMILY'S HISTORY WITH AORTIC ANEURYSM DISEASE

Alan Pope shares his story

In 2017 at the age of 38, Alan Pope was living in Perth and had an operation while there to remove a cancer from his back. Following the operation, he underwent regular MRI and CT scans of the chest and was about to move to 6 monthly check-ups, when a radiographer noticed a size differential between his ascending and descending aorta. He was referred to a cardiologist in Perth who advised that as he had an aneurysm of the aortic root, he would likely need an aortic root replacement. As he had no family support in Perth, Alan moved to Sydney, where many of his family resided.

Alan's aortic root replacement surgery was carried out at Royal Prince Alfred Hospital in February 2019 with Professor Bannon as his surgeon. Due to his age and the fact that his aortic valve was functioning normally, Alan was a good candidate for a "David Procedure" – a valve sparing aortic root replacement. This procedure is named after a Canadian surgeon, Dr Tirone David, who initially conceived the operation. By preserving the patient's aortic valve, the need for lifelong anticoagulation therapy is avoided.

6 days post-surgery Alan was discharged from hospital. He completed his rehab and within a couple of weeks of the operation, he was walking up to 10kms per day. He has maintained this regime and is benefiting immensely from the exercise and the weight loss.

Apart from high blood pressure, Alan had no indication that he might have an issue with his heart, however, when asked if he notices a difference now, he commented that he did not realise how much of a struggle it really was before! Professor Bannon explains that it is as a result of research that we are able to decide when the best time is to operate on patients with an aortic aneurysm BEFORE the aorta dissects. When dissection happens a person's chance of survival is greatly diminished. Thanks to the support of our donors and their investment in our research, the mortality rate for people with an aortic aneurysm has significantly reduced.

Alan comes from a family with a history of aneurysms. In 1955, doctors found a dangerous aneurysm on the abdominal aorta of his great grandfather, Mr Leslie George Neale, and so at the age of 66 his grandfather underwent the first operation of its kind. Because there were no artificial aortic grafts in 1955, a suitable donor graft from a deceased person's abdominal aorta had to be found. Many hours were spent planning the operation. One of the major concerns was how to keep Alan's

FROZEN MAN 'GREAT'

A 66-years-old engine-driver, "frozen stiff" for 13 hours two weeks ago, said today he was "feeling great."

He is Leslie George Neale, Tenterdon Rd., Botany.

He underwent a rare operation in Sydney Hospital to have part of an affected main artery removed.

Doctors packed Neale's body in ice to lower his body temperature while an artery from a dead man's body was used to replace the affected section of an artery in Neale.

grandfather alive for the 12 or 13 hours required for a grafting operation of this kind. After he was given his anaesthetic, Mr Neale was wrapped in ice until his body temperature dropped to 29 degrees. The purpose of doing this is reducing the body temperature greatly reduces the body's need for blood. The diseased part of the artery was removed, and the donor graft was put in place. The operation lasted 12 hours.

In 1989, at the age of 42, Alan's father, Leslie John Pope, also had an aneurysm and suffered an aortic dissection in the posterior wall of the ascending aorta. Alan was just 10 years old and was watching his father replace a gear box under the car when it happened. Alan's Dad asked him to go and get him a cup of tea but when his father stood up, he collapsed. Paramedics were called and he was rushed to Prince Henry Hospital in Randwick. He required a total aortic root reconstruction along with aortic valve replacement surgery and received a synthetic graft (made of Dacron). He was discharged from hospital almost a month after his operation.

The type of surgery that Alan himself had would not have been possible in 1955 as the heart-lung machine was not in widespread use until 1964. In 1954 the machine was introduced into Australia and was used at Royal Prince Alfred Hospital with children, however its use with adults did not commence until 1957.

When Alan's grandfather was operated on in 1955, as the heart-lung machine was not available, the only way to do his type of surgery in the safest way possible at the time, was to cool the body down by putting the patient on ice. The mortality rate for this procedure was 50%, whereas now due to the heart lung machine, the rate of mortality for Alan's David Procedure at RPAH is basically 0% for elective patients (those patients choosing when to have their surgery as opposed to those who come into the emergency department as a result of a cardiac arrest or an aortic dissection) while the mortality rate for a standard aortic root reconstruction is .5%. Significantly different procedures and mortality rates, 65 years apart.

Today, the length of stay in hospital is vastly different for those patients who have elective aortic root surgery (as Alan and his grandfather had). Patients are admitted to hospital on the day of their surgery and are discharged 6 or 7 days later. Leslie Neale in 1955, on the other hand, was in hospital for one month which was commonplace at the time.

Aortic dissections would not have been operated on back in 1955 when Alan's grandfather was alive, so Leslie Neale was fortunate that he did not suffer a dissection. In 1989 when Alan's father had the dissection, approximately 50% of patients would not have made it to hospital in time and for the ones that did, the mortality rate would have been between 30 and 40%, with the best cardiac units getting that rate down to around 25%. Today we have managed to reduce that figure to about a 10% overall mortality rate for surgeries post an aortic dissection, as a result of the development of more refined strategies for dealing with the complications of a dissection.

Furthermore, we have been more aggressive in our treatment than previously, we carry out far more extensive surgery to prepare for future problems and there have been significant improvements in surgical strategies which have vastly decreased the operative risk. Finally, our research has enabled us to predict people's risk of dissection and therefore decide when the optimum time for surgery is. Alan's surgery is a case in point, we operated on him before he dissected and with the support of you, our donors, we hope in the future to be able to avoid the passage of this disease onto the next generation.

Alan has a young family himself and, especially with his family history of heart problems, he is telling his story for them. He is keen to raise awareness and funds to provide more research into aortic aneurysm disease, so that other families do not have to go through what he has endured. Operating techniques have changed dramatically since the 1950s and the funding of our supporters has enabled significant innovation and improvements.

VALE · RYAN MARSDEN

We were saddened to hear of the sudden death of Ryan Marsden on 5 May 2021 at the young age of 37. Our thoughts are with his wife, Hayley and his young son, Jackson. Even in her time of loss, Hayley was able to think of others and asked her friends and family to donate to The Baird Institute in lieu of flowers. We so appreciate this selfless gesture. What a wonderful way to honour his memory! Wishing Hayley, Jackson and their families, strength and peace at this difficult time.

Professor Douglas Baird AM:
A Truly Great Australian.
1940 - 1995

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PO Box M85, Missenden Rd, NSW, 2050

02 9550 2350

info@bairdinstitute.org.au

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