Dear Doctor

This issue of our newsletter highlights the great strength of Macquarie University Hospital to work in partnership with a range of clinical and academic peers, companies and medical organisations to undertake the research necessary to advance medical knowledge and clinical practice.

A new research project sees Macquarie Neurosurgery, Fujitsu, GE Medical and Macquarie Medical Imaging collaborate to develop Artificial Intelligence (AI) tools to help diagnose brain aneurysms – many of which go undetected and are potentially fatal. With the goal of making AI diagnostic products available to all radiologists across the globe, this research stands to have high impact in its field.

A second story on the use of AI indicates the growing trend in investigating machine-based learning as a possible tool to assist specialists. Neurosurgeon Associate Professor Antonio Di Ieva received the John Mitchell Crouch Fellowship to work with Macquarie University computer scientists using fractal and machine-learning methods to develop AI algorithms that will, ultimately, enhance patient treatment for brain disease.

In cardiology, Professor Martin Ng’s collaboration with the Heart Valve Centre of Mainz, Germany – one of the world’s leading centres in mitral and tricuspid valve interventions – has resulted in bringing yet another first to Australia: the percutaneous repair of the tricuspid, or ‘forgotten’, valve.

Additional stories on clinical trials and studies along with our success in recent NHMRC funding rounds further tells this story of a health sciences centre working ambitiously both across our own departments and with external organisations to constantly improve what is available to patients.

Walter Kmet,
Chief Executive MUH and Clinical Services
Macquarie University Hospital

If you would like to receive further information about our GP education activities for 2018, please email events@muh.org.au
A new research project at MQ Health aims to develop a novel artificial intelligence (AI) approach to early detection of this potentially fatal condition.

Professor John Magnussen, Director of Macquarie Medical Imaging (MMI), and Professor Marcus Stoodley, neurosurgeon with Macquarie University, have teamed up with Fujitsu and GE to develop a revolutionary software system that will allow radiologists to automatically detect brain aneurysms that might otherwise be missed.

A new AI tool will be of significant help to those patients who develop the condition.

“Because brain anatomy is so complex, brain aneurysms can be difficult to find on brain scans produced by current diagnostic technology,” he said.

“The new technology will provide radiologists, neurosurgeons and patients with significantly more accurate information about a possible aneurysm. This, in turn, can make the decision to proceed with brain surgery much more clear-cut, with better outcomes for patients.”

The partnership sees MMI provide clinical expertise, data and images to enable Fujitsu to develop prototype software to detect aneurysms. GE will turn the software into products by integrating them into existing CT brain software – Stroke VCAR – to validate the technology and, ultimately, make it accessible to every radiologist across the globe.

Ramy Ibrahim, Head of Co-Creation and Innovation for Fujitsu Australia and New Zealand, said that the company is excited about the newly formed partnership.

“This partnership with Macquarie University, Macquarie Medical Imaging and GE Healthcare ensures the best outcome by leveraging the unique strengths of each of the partners,” he said. “Fujitsu brings to the partnership extensive experience in AI, which has been applied to lung CT in the past and has had many other applications. We look forward to jointly solving this complex problem and providing a means for the early detection and ease of monitoring of brain aneurysms.”

Regional Research Leader for GE Healthcare Professor Tim O’Meara said that the company is at its best when it partners in this way.

“This kind of collaboration enables us to solve complex problems that make a difference to patients and clinicians,” he said. “In this case, artificial intelligence applied to medical imaging has the potential to improve the accuracy of diagnosis, better track subtle changes over time and address the expertise gap that can exist in many small, isolated or resources-poor radiology practices across Australia and elsewhere.”

While enhanced quality of life is a major benefit of the new technology, in terms of the burden of health on the Australian healthcare system, the ability to diagnose and treat someone in their mid-thirties who has a potentially disabling condition is of great value.
Wendy Favorito developed rheumatoid arthritis at the age of six. One of the first manifestations of the disease was in her feet and ankles. Over time she developed severe foot and ankle deformity. Early in 2018, in her late forties, Wendy developed significant foot and ankle deformity associated with debilitating ankle arthritis. Wendy found out she had also been walking on an undiagnosed fracture.

Her foot and ankle specialist referred her to Dr Tim O’Carrigan, Orthopaedic Surgeon with MQ Health’s Limb Reconstruction Centre. Dr O’Carrigan specialises in foot and ankle surgery, total ankle replacement and complex deformity correction. He is often referred patients from other orthopaedic surgeons.

“The consequences of Wendy’s arthritis were deformities of the hindfoot (heel) and forefoot that led to Wendy walking unevenly, causing pain and suffering from malalignment and uneven forces through her foot and ankle,” said Dr O’Carrigan.

“Staged surgery was required to first correct the foot deformity and then replace the ankle joint. Correcting the deformity was an essential first stage to a successful ankle replacement. I was uniquely placed to do this type of combination surgery required. Wendy would more likely be offered an ankle fusion elsewhere.”

In August of last year, Dr O’Carrigan operated to address the deformity through an innovative approach combining minimal incision surgery to perform osteotomies (bone cuts) and application of an external fixator to maintain the correction while the osteotomies healed.

The frame was removed at three months and at six months Wendy had a protocol specific CT scan that was then analysed by a team of engineers and a detailed pre-operative plan was developed. This was reviewed and approved by Dr O’Carrigan. From there, Prophecy patient-specific jigs were 3D printed and made available at the time of the operation. The Infinity Ankle Replacement used is one of a suite of ankle replacements manufactured by Wright Medical, which cover primary and revision total ankle replacement.

“These jigs are the link that facilitates executing the preoperative plan as accurately as possible in theatre.

Patient Specific Instrumentation (PSI) has been available for some time in knee replacement but this is the only total ankle replacement system utilising this technology to assist the surgeon and Dr O’Carrigan is one of the most experienced surgeons in Australia using this technique.

“There is overwhelming evidence that the more accurately an ankle replacement is inserted, the better the patient outcomes in terms of pain relief, gait and longevity of the joint replacement,” said Dr O’Carrigan. “This is particularly challenging in the ankle joint because all forms of deformity have to be addressed both within and outside of the ankle joint - the reason why the surgery was staged in Wendy’s case.”

Wendy says that the surgery has changed her life.

“It was hard, painful and, at times, incapacitating not being able to walk – along with the uncertainty around the future and emotional impact on our children,” she said.

“But it’s been so worth it. I’ve increased my work capacity and accept social invitations without hesitation. I’m a happy mum again attending my kids’ activities. I’m walking or doing hydrotherapy every day.

“To think I was actively winding my life down at the age of 48 – having reduced my work hours and hardly going out – before I was referred to Tim, and now I have my life back. It is just phenomenal.”

The Limb Reconstruction Centre at MQ Health is unique in its capacity to perform innovative and complex procedures. The current team includes Associate Professor Munjed Al Muderis, Associate Professor Kevin Tetworth, Dr Kavan Naitha and Dr Tim O’Carrigan. Complex patients are often seen by all four surgeons in the same room at the same time and detailed assessment and discussion is undertaken and a comprehensive diagnosis and treatment plan determined. This same approach is undertaken in theatre with two of the team operating together on each patient.

The team collaborates with spinal, plastic and vascular surgeons from Macquarie, as required, with each patient getting a unique tailored solution.

The Limb Reconstruction Team also involves a psychologist, physiotherapists and a limb reconstruction-trained Clinical Nurse Consultant to provide patient education and close support to the patient during their treatment journey.

This unique model has the Limb Reconstruction Centre at MQ Health well positioned to provide patient education and close support to the patient during their treatment journey.

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MACQUARIE UNIVERSITY WINS $14 MILLION IN HEALTH RESEARCH FUNDING

The University has secured NHMRC Investigator Grants and a Partnership Project worth $11,958,973.30 and a further $500,000 cash contribution from Anglicare. The Investigator Grants provide the highest performing researchers at all career stages with funding for their salary and a research support package for five years.

As part of the NHMRC grants, the Commonwealth Department of Health’s Medical Research Future Fund (MRFF) has allocated $1,500,000 to Macquarie University’s Australian Institute of Health Innovation (AIHI) and NSW Health partners for a program to support better value health services.

Macquarie University Deputy Vice-Chancellor Research, Professor Sakkie Pretorius, congratulated the University’s researchers for securing the grants.

“We are thrilled with this outcome. It is a great day for Macquarie University research, and more importantly, for the general population who will benefit from the advances that flow from research in a range of priority health areas including Alzheimer’s Disease, multiple sclerosis (MS), motor neuron disease (MND), other neurodegenerative diseases and mental health.

“I would like to congratulate our researchers whose high-quality projects have been allocated this funding due to their tenacity, passion, brilliance and sheer hard work.”

Among the largest grants announced was $2,500,000 to the AIHI’s Professor Johanna Westbrook for advancing knowledge of electronic medication management technology to ensure better medication safety and appropriate care in hospitals.

In addition, Professor Gilles Guillemin from Macquarie University’s Centre for MND Research will receive $2,401,595 for his five-year program to identify new biomarkers to monitor progression and develop new drugs for the treatment for neurodegenerative diseases including Alzheimer’s Disease, MS and MND.

Another significant grant of $2,198,640 will go to Professor Ian Blair from Macquarie University’s Centre for MND Research to unravel the genomic factors underlying MND in pursuit of effective treatment.

The AIHI’s Professor Jeffrey Braithwaite has secured $1,350,000 to develop and implement a world-first learning healthcare system to achieve unprecedented improvements in the safety and quality of care by harnessing information technologies, data mining, machine learning and genomics to save lives.

Dr Arne Ittner from Macquarie University’s Dementia Research Centre has been awarded $1,243,588 for a program that will advance Alzheimer’s drug development by exploring the molecular origins of memory, potentially leading to a new therapeutic concept for how we may retain and restore memory in Alzheimer’s Disease.

Associate Professor Blake Dear in the Department of Psychology has been allocated $950,000 for an important research program to increase our current knowledge and significantly advance our ability to support the mental health of Australian Adults with chronic physical health conditions.

With the spotlight firmly on aged care and the recent Royal Commission, the NHMRC has awarded $4,135,150.30, to a Partnership Project Grant to be led by Professor Westbrook, with Professor Andrew Georgiou and Professor Braithwaite from AIHI, and with colleagues from four other universities across the country.

Anglicare is the leading partner in this project and will contribute $500,000 along with the expertise of their organisation. The team will target falls and client wellbeing – two priority areas – examining the integration of data and applying analytics to electronic systems to target care improvements in residential and community-based aged care.

Professor Braithwaite also received $1,500,000 from the MRFF for an ambitious three-year program in conjunction with partners from NSW Health, the New South Wales Agency for Clinical Innovation, NSW Bureau of Health Information and Macquarie University Centre for the Health Economy, to support best practice care across the state’s health system. The research program will support the flagship NSW Health Leading Better Value Care Program, which aims to deliver better value services to the people of NSW.

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MMI was chosen due to its ‘research grade’ medical imaging equipment and experienced research staff. The trial is sponsored by Melbourne-based Telix Pharmaceuticals, a leading developer of diagnostic and therapeutic radiopharmaceuticals. The development of this product is important because, at this point in time, a suspicious kidney mass can only be evaluated by taking a needle biopsy of the tissue. This procedure is unpleasant for patients, has associated risks, and does not always provide a complete picture of the disease. There is currently no noninvasive test to evaluate the full extent of kidney cancer.

This trial is looking at whether the extent of your kidney cancer can be determined through imaging, without the need for a biopsy to be taken. Should the trial be successful, it will correctly stage patients and give surgeons a more comprehensive set of options for managing kidney resection, including nephron-sparing surgery. For those that do have cancer, it may enable the doctor to determine the best course of treatment right from the beginning. The images shown illustrate how the product highly localises kidney cancer through imaging.

If you would like to know more about participating in this trial, then please contact the Macquarie University Clinical Trials Unit office on (02) 9812 2956 or via clinicaltrials@mq.edu.au and ask about the ‘ZIRCON’ trial.
HOW MACHINES WILL HELP NEUROSURGEONS TACKLE BRAIN DISEASE

The diagnosis of brain tumours and other diseases is heavily dependent on neuroimaging – in particular MRI. However, the large amount of radiological data generated by MR sequences can be overwhelming to interpret and made more difficult by the possibility of conditions such as ‘mimic’ tumours, inflammatory disease that can resemble a tumour.

The implementation of multidisciplinary teams (MDTs) has helped significantly to increase accuracy of diagnosis, estimates of prognosis and enhanced decision-making around whether to proceed to surgery.

Now, MQ Health is looking to add the use of Artificial Intelligence (AI) tools to brain disease diagnosis through its world-first Computational Neurosurgery (CNS) Laboratory. Led by Associate Professor Antonio Di Ieva, the team is investigating the use of computerised analysis tools to aid surgeon-MDT-based evaluations of radiological images.

“Our method is to develop novel diagnostic, prognostic and therapeutic markers of disease, which can then be applied in the development of AI algorithms,” said Associate Professor Di Ieva. “We are doing this using fractal and machine-learning methods, thanks to the expertise of computer scientists, including Dr Carlo Russo, Research Associate at the CNS Lab, and Dr Sidong Liu, research fellow from the Australian Institute of Health Innovation.

“We are also capturing data on the cognitive processes of surgeons as they review imaging data and identify relevant features of an image to diagnose and develop a treatment plan for a patient.”

Data will then be transferred to a computer in order to ‘teach’ the machine to extract features and characterise patterns of brain disease in the same way a surgeon would through complex algorithms developed.

“The aim is to support, not to replace, clinicians in diagnosis and decision-making by parameters confirming or refuting their diagnostic hypothesis,” said Associate Professor Di Ieva.

The CNS Laboratory at MQ Health builds on Associate Professor Di Ieva’s pioneering application of computational fractal-based analysis to the quantification of features in gliomas completed as his PhD research in Austria, in 2011, as well as his use of fractal geometry to study brain cancer and other diseases of neurosurgical interest.

This earlier work led to the successful use of computational fractal-based modelling to objectively quantify the patterns of brain and pituitary tumours as well as arteriovenous malformations, and to predict the response to treatment of patients affected by AVMs undergoing Gamma Knife radiosurgery treatment.

MQ HEALTH HAS ESTABLISHED THE FIRST COMPUTATIONAL NEUROSURGERY LABORATORY IN THE WORLD TO FOCUS ON DEVELOPING COMPUTERISED ANALYSIS TOOLS IN NEUROIMAGING AND NEUROPATHOLOGY THAT WILL IMPROVE THE DIAGNOSTICACCURACY OF BRAIN DISEASE.

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Naomi McLoughlin, a nurse at the oncology unit at Macquarie University Hospital, knew she had a lesion on her leg that needed to be looked at by a doctor. Over the years, she’d been to other clinics, and always found it difficult to get a timely appointment and care that went beyond a cursory review.

Then one day at work she saw a flyer in the lift for Integrated Skin Clinics – located within the Hospital building.

“It really prompted me to make an appointment,” said Naomi. “I was seen within two weeks by Dr Tim Carroll, a GP with specialist dermatology training, who confirmed that the lesion on her leg needed attention.

“He called Professor Anand Deva, who was also in the clinic that day, into the consult and he put me on his operating list and a week later, I had the procedure.”

Professor Deva did a wedge resection at the Macquarie University Hospital day unit. A sample was also biopsied to make sure it hadn’t spread, which it hadn’t. Naomi returns to the clinic for 3 and 6 monthly checks.

“It was just a really smooth and fast service,” said Naomi. “I was amazed. And it was all right there, in one place. I’ll continue to use the Integrated Skin Clinic for long-term checks and management.”

The Integrated Skin Clinic model significantly reduces time from first consultation to treatment, and is based on evidence that early diagnosis and fast access to treatment saves lives. Professor Deva has established a similar clinic in the Sutherland Shire and it has more than halved the wait time for treatment.
Macquarie University Hospital’s Professor Martin Ng has successfully performed a minimally invasive repair of the tricuspid valve to address tricuspid regurgitation, a condition where the damaged valve leads to the backflow of blood from the right ventricle to the right atrium. The innovative procedure used MitraClip technology, previously only applied to the left bicuspid valve. Professor Ng successfully conducted the procedure under the guidance of visiting German cardiologist Professor Stephan von Bardeleben, Head of the Centre of Structural Heart Disease Interventions and the Heart Valve Centre in Mainz, Germany.

“This heart condition is going untreated worldwide and the condition can be debilitating and lead to heart failure and death,” explained Professor Ng. “Not only is there a general lack of understanding of this disease, but for elderly and high-risk patients, the traditional open-heart method is too dangerous.

“This minimally invasive approach – rarely performed anywhere in the world – is beneficial for high-risk patients for whom open heart surgery is too risky. With the general lack of expertise, technology and understanding of this application, we are delighted to have brought it to Australia for the first time.

“We are especially privileged to have had Professor von Bardeleben travel to Australia to oversee this first procedure. He is the pioneer in the field and there is no better person to have had alongside us as we performed our first case.”

John Lakos was the first patient to undergo the tricuspid valve repair. Since 1986, when John was diagnosed with aortic valve disease at the age of 39, he has undergone several valve procedures – the first being a Bentall’s procedure through open heart surgery to replace the faulty aortic valve with a mechanical one. Twenty years later, in 2006, John developed another aneurysm in the aortic arch that was treated by surgeon Professor Michael Wilson in a Bentall’s repair. Three months later, John's descending aorta also developed an aneurysm, which was treated with stents inserted via the groin.

In March 2018, John developed a “false aneurysm” at the site of his original valve defect and Professor Wilson again performed open heart surgery at Macquarie University Hospital in a repair of the Bentall’s repair that saw John receive a biological (pig) valve. Earlier this year, his cardiologists noticed a leaky mitral and severely leaky tricuspid valve.

“I felt breathless and found it hard to even climb a flight of stairs,” recalled John. “Michael Wilson was reluctant to operate with open heart because I had had so many open heart procedures already.

“The conventional solution was for Professor Ng to perform percutaneous MitraClipping of the mitral valve with the objective of releasing pressure on the tricuspid valve. If that didn’t work, then we had no choice but open heart surgery to implant an artificial tricuspid valve. The hope was that the repair of the mitral valve would improve the functioning of the severely leaking tricuspid valve.

“However, when I saw Professor Ng to organise the proposed MitraClip, he presented me with an unexpected option. A world-leading German cardiologist was coming to Australia to supervise a tricuspid clip – never before performed in the Southern Hemisphere. Professor Ng also advised that I had been selected because I was a suitable candidate for the procedure. Accordingly, I became the first patient in the Southern Hemisphere to undergo this procedure.

“In July 2019, Professor Ng, under the supervision of Professor von Bardeleben, performed the percutaneous clipping of my mitral valve and tricuspid valve. It was amazing timing for me personally, but fantastic that this procedure is now available in Australia. I was delighted that the procedures were performed at Macquarie University Hospital where the care in the ward and ICU is absolutely fantastic.”

Professor Ng said that John’s condition has dramatically improved. He no longer gets short of breath conducting his daily activities and he has returned to his regular swimming routine, something he has done for years as daily exercise.

“As a result of the MitraClip procedure, the leak across Mr Lakos’ tricuspid valve is considerably diminished such that his dilated right ventricle has begun to significantly reduce in size,” he said.

Macquarie University Hospital has been a pioneer in keyhole cardiology surgery. It is a leading centre in Australia for TAVI, performing a high volume of this game-changing surgery and obtaining patient outcomes in line with international registries.

“As a centre of excellence, Macquarie University Hospital is not just performing well-established procedures,” said Professor Ng, who is one of Australia’s leading interventional cardiologists. “We pride ourselves on trying what hasn’t been done before and this latest surgery is an example.”

In this case, Professor Ng’s collaboration with Professor von Bardeleben led to the introduction of the procedure into Australia. The Heart Valve Centre in Mainz is one of the leading centres for percutaneous valve therapy in Germany and one of the leading worldwide centres in mitral and tricuspid valve interventions. Professor von Bardeleben’s department developed many of the revolutionary percutaneous heart valve therapies in use today.
Learn from Professor Michael Mack, a world expert on cardiothoracic surgery

Keynote Speaker: Professor Michael Mack, Director of the Cardiovascular Service Line for the Baylor Scott & White Health, Texas, USA

We are delighted to invite you to attend the second state-of-the-art Valvular Heart Disease Symposium to be held in Sydney at Macquarie University on Friday November 8th and Saturday November 9th 2019.

In recent years, the treatment of valvular heart disease has been revolutionised by percutaneous therapies. Transcatheter aortic valve implantation (TAVI) has transformed treatment of aortic stenosis by enabling percutaneous replacement of the aortic valve. Furthermore, there has been rapid progress in the development of transcatheter therapies for mitral regurgitation (MR) including the MitraClip procedure as well as emerging therapies such as transcatheter mitral valve replacement. In the last year, the landmark COAPT trial demonstrated striking prognostic benefit for the MitraClip in patients with functional MR – a finding that heralds a transformation in therapies for MR.

This Symposium will be interdisciplinary, bringing together Cardiologists, Cardiothoracic Surgeons and other clinicians with a cardiovascular interest together, in a Heart Team-based approach to comprehensively cover the latest developments and controversies in the clinical assessment and management of aortic stenosis, mitral regurgitation and tricuspid incompetence.

We will be joined by a leading international and national faculty including Keynote Speaker Professor Michael Mack, Director of the Cardiovascular Services for the Baylor Scott & White Health. Professor Mack, a Past President of the Society of Thoracic Surgeons (STS), has made seminal contributions to transcatheter heart valve therapies including being a leading investigator for the seminal PARTNER randomized clinical trials for TAVI and the COAPT trial for MitraClip. As a cardiothoracic surgeon who has made key contributions to transcatheter therapies, he is amongst the best placed to understand the future landscape in valvular heart disease therapies as a whole.

The two days of the Symposium will include structured presentations and practical imaging sessions for participants. There will be live echocardiography teaching sessions and an interactive interventional echocardiography teaching lab.

Registrations are strictly limited and will be taken on a first-come-first-served basis.

We look forward to seeing you there.

Yours sincerely

Prof Martin Ng

In collaboration with:

Edwards
Abbott
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