Ingham Institute
Applied Medical Research

RESEARCH HIGHLIGHTS

2017

Inspiring health. **Transforming care.**

Front cover and inside cover Artwork created by **Celeste – Art by Celeste Wrona**

"See Cancer in a New light"
A unique collaboration between internationally recognised Australian artist Celeste Wrona and the Ingham Institute's Correlative Microscopy Research Group has resulted in the creation of a limited number of stunning artworks available only through the Institute's website.

Contents

WHO WE ARE

The **Ingham Institute for Applied Medical Research** is at the forefront of many medical breakthroughs and clinical discoveries and is committed to saving and improving lives.

Founded by the community for the community, our award-winning researchers are dedicated to finding better ways to improve health and eradicate diseases.

The Institute's research teams are focused on exploring new medical approaches across its research streams:

- Cancer Research
- Clinical Science Research (Cardiovascular diseases, diabetes, infectious and inflammatory diseases)
- Injury and Rehabilitation Research
- Population and Health Services Research
- Mental Health Research

The Institute's medical research programs have a translational focus. This means that results from the laboratory are transformed into direct health benefits in the form of new treatments and standards of care for local, national and international communities.

Located at Liverpool, our research building is home to:

- 350 researchers working in wet and dry laboratories.
- A Clinical Skills and Simulation Centre.
- The Australian MRI-Linac Research Bunker.
- Australia's only Correlative Microscopy facility,
- The Centre for Oncology Education and Research Translation (CONCERT) cancer tissue and blood Biobank.
- NSW's first Circulating Tumour Cell research centre.
- South West Sydney's Clinical Trials Unit.

As a charitable organisation, the Institute is reliant on public donations and bequests to enable the researchers to continue their vital work. The Institute was initially created by one of Australia's most respected philanthropists Bob Ingham AO and is further supported by Lady (Mary) Fairfax AC, OBE.

100% of funds raised for the Institute go to support medical research at the Institute.

THE INGHAM INSTITUTE SHARES A UNIQUE PARTNERSHIP BETWEEN THE SOUTH WESTERN SYDNEY LOCAL HEALTH DISTRICT (SWSLHD), UNSW SYDNEY AND WESTERN SYDNEY UNIVERSITY

NSW GOVERNMENT Health South Western Sydney Local Health District | UNSW SYDNEY | WESTERN SYDNEY UNIVERSITY

Our Antibiotic Resistance and Mobile Elements Group (ARMEG)

Left Side: Wayne Ng, CONCERT Biobank
Lisa Tran, Gastroenterology and Liver Research Group

Right Side: A/Prof. Greg Kaplan, Chief Operating Officer
Dunja Vekic, Dermatology Research Group
Igor Stevanoski, Gastroenterology and Liver Research Group

Our Vision, Mission and Values

Our vision

Inspiring health. **Transforming care.**

The Ingham Institute's world-class medical research is rooted in and driven by the needs of our local South West Sydney community. We are committed to inspiring better health for our local community, and transforming the treatment and care of people living with common medical conditions and disease.

Through applied medical research and partnerships with universities, hospitals and our local healthcare community, the Ingham Institute is working to radically transform health outcomes for the better – creating thriving communities, both locally and globally.

Our mission

Our strategic network of medical research centres of excellence produce world-class insights and discoveries for application to health care services and systems transforming community wellbeing locally and globally.

Our core values

At the Ingham Institute, our commitment and purpose is driven by our core values.

Our core values are the pillars that guide the Ingham Institute in building an organisation that reflects who we are and what we do. Each individual at the Ingham Institute refers to these principles to tap into their own potential and drive to achieve breakthrough medical research.

- Relevance
- Integrity
- Ambition
- Impact
- Inclusivity

Terry Goldacre
Chairman

Chairman's Report

It gives me great pleasure to introduce the **2017 Ingham Institute Research Highlights,** focusing on our researchers, their fields of investigation and how their work translates into both our local and international community.

As the Ingham Institute enters its fifth year we are provided with an opportunity to reflect on our progress and celebrate our achievements inspiring health and transforming care. Many of our researchers are also clinicians working in our local hospitals and health care facilities leading to research programs that are informed by the health challenges faced by our friends and family within our community.

Since our inception, the Ingham Institute has been focused on being the Medical Research Institute that the residents of South West Sydney region deserve. Having seen our growth and development accelerate over the last five years, I am extremely pleased with our progress towards this goal and am delighted to have taken part in a number of steering committees throughout the past 12 months where we have discussed our growth strategy for the region.

Research groups at the Institute have achieved numerous significant milestones this last year including Prof. Ian Harris winning the Research Australia, Health Services Research Award, the second successive year an Ingham Institute researcher has been awarded this honour. Recently the research team working on our MRI-Linac project announced that they expect to start early patient trials in 2018. This achievement sees the project ahead of its initial timeline and validates the tireless efforts of the large number of talented scientists working collaborative to create the next generation of cancer treatment.

We welcome The Hon. Morris Iemma and Prof. William Ledger to our Board of Directors. As the 40th Premier of New South Wales Mr Iemma served a long and distinguished political career including the positions of Treasurer and Minster for Health between 2003 and 2005. He has served as chair of the South Eastern Sydney Local Health District Board and is currently Chair of the Board of the Cancer Institute NSW.

Prof. William Ledger is Senior Vice Dean of the Faculty of Medicine and Professor of Obstetrics & Gynaecology at UNSW Sydney, Head of Reproductive Medicine at the Royal Hospital for Women, and Chair of the Research and Development Committee and a fertility specialist at IVF-Australia. He has published over 250 research papers and edited 11 books on aspects of reproductive medicine and is a welcome member to our Board.

In 2016 we farewelled Mr David Hazlett, Ms Debbie Killian, Prof. Jeremy Wilson and Prof. Rodney Phillips from our Board of Directors. I would like to sincerely thank them for all the guidance and support they provided to the Institute through their years as Directors. Each of our Board members bring unique and valuable viewpoints to our organisation and the Institute has grown thanks to their contribution.

This year we were saddened by the passing of one of our most generous benefactors Lady (Mary) Fairfax AC, OBE who has supported the Institute since its inception and has contributed significantly towards our vital research programs. Her endearing legacy will not be forgotten as we continue to honour her through the Lady (Mary) Fairfax AC, OBE Research Award presented annually to an outstanding researcher.

I would like to thank all past and present Directors, Staff, Researchers and Volunteers who have contributed to the success of the Ingham Institute over the last five years. I would like to especially express my most sincere gratitude to our generous supporters without whom our work would not be possible.

Our future, together with our partners South Western Sydney Local Health District, UNSW Sydney and Western Sydney University looks promising and I am looking forward to achieving great things together.

Terry Goldacre
Chairman

Research Director's Report

On reflecting on the first five years of the Ingham Institute, I am extremely proud of how quickly we have become an internationally renowned medical research organisation that has contributed to the advancement of health and medical science to the benefit of people everywhere. The speed at which the Institute has developed is a testament to the hard working and talented teams at the Institute.

Since the Institute first opened its doors in 2012 we have grown from 180 affiliated researchers to now accommodating over 350 researchers and the tumour sample collection within our Biobank has grown from 14 to over 1,300 tissue samples.

The continued growth of the Institute's research programs has been impressive and in the past 12 months, we have welcomed a number of new research groups to the Institute including the Gastroenterology and Liver Research Group lead by Prof. Nicholas Shackel. Prof. Shackel is a Senior Clinician within the Gastroenterology Department at Liverpool Hospital and his research laboratory uses functional genomics to better understand liver inflammation, fibrosis, cirrhosis and cancer as well as using transgenic animals to model human liver disease.

We also welcome Sarah Dennis to our Injury and Rehabilitation Research stream as Associate Professor of Allied Health. A/Prof Dennis is a health services researcher and physiotherapist with years of experience in the university and non-government sector in Australia and the United Kingdom. Her research has focused on the prevention, diagnosis and management of chronic diseases, respiratory diseases in particular, in primary health care and health services coordination and integration.

At the 2017 NSW Premier's Awards for Outstanding Cancer Research, Prof. Minoti Apte was recognised for her research into Pancreatic cancer and was awarded The Professor Rob Sutherland AO Make a Difference Award. This prestigious award honours the achievements of the individuals and teams that work across the cancer research sector to lessen the impact of cancer for the people of NSW.

As a translational Medical Research Institute, the Ingham Institute is focused on transforming our discoveries from the laboratory to the community as safely and quickly as possible. Our focus continues to be on providing our local community with new solutions to common health problems.

This is no more evident than in the range of clinical and surgical trials that the Institute co-ordinates together with our health partners, researchers and local community. Currently the Institute has almost 20 clinical trials co-ordinators overseeing more than 300 clinical and surgical trials in South West Sydney giving our community access to a range newly developed treatments for a diverse mix of disease areas and health conditions. We have continued to lead our sector in streamlining clinical trials governance and worked hard to ensure the culturally diverse population of South Western Sydney have equitable opportunity to participate.

Scientia Professor Michael Barton OAM,
Research Director

Scientia Professor Michael Barton OAM, Research Director

Where we work

The Institute is home to over 350 medical researchers and support staff across 40 research groups working in Cancer, Clinical Science, Population and Health Science, Injury and Rehabilitation and Mental Health Research.

Our dedicated research building at Liverpool consists of both wet and dry laboratories, the Biobank, NSW's first Circulating Tumour Cells (CTC) Facility, the South Western Sydney Local Health District's Clinical Trials Unit, and Australia's only Correlative Microscopy facility. The Institute's Clinical Skills and Simulation Centre and the Australian MRI-Linac, is located within Liverpool Hospital.

The Clinical Skills and Simulation Centre is a state-of-the-art training hub for junior doctors, medical students, nurses, clinicians and medical researchers in South West Sydney. Supported by the Australian Government and operated by UNSW Sydney, this innovative centre is one of just two clinical skills simulation centres in the country.

Our state-of-the-art learning equipment includes:
- a high-fidelity robotic patient mannequin, called 'SimMan'
- a 3D digital dissection table, known as the Anatomage
- two simulated operating theatres.

Part of the **Centre for Oncology Education Research Translation,** the Biobank at the Ingham Institute is a research and tissue collection facility focused on the prevention, detection, diagnosis and treatment of cancer.

The **Biobank** receives and stores a large collection of biological samples – primarily tissue and blood – from patients in South West Sydney, Illawarra, Shoalhaven and the ACT who have been diagnosed with cancer.

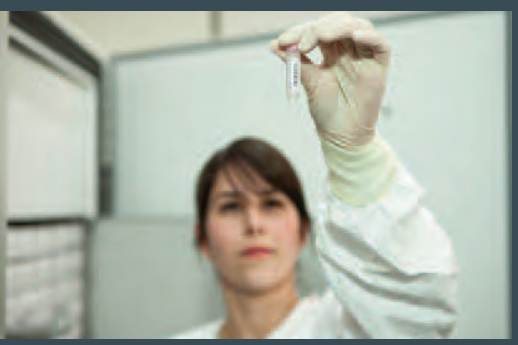
The facility uses these samples to research the genetic, lifestyle and environmental factors linked to cancer. These findings are then translated into new ways to prevent, detect, diagnose and treat different types of cancer.

Centre for Circulating Tumour Cell Diagnostics & Research (CCDR)
Ingham Institute became the home to NSW's first-ever Circulating Tumour Cells (CTC) Facility, specialised cancer scanning technology that measures single cancer cells in the small blood sample of a Cancer patient to identify why some cancer cells spread and also provide doctors with an early warning system that allows them to start immediate treatment to stop the further growth and spread of the cancer. By eradicating the need for cancer patients to undergo painful biopsies the CTC technology can easily monitor the performance of cancer cells through a routine blood test.

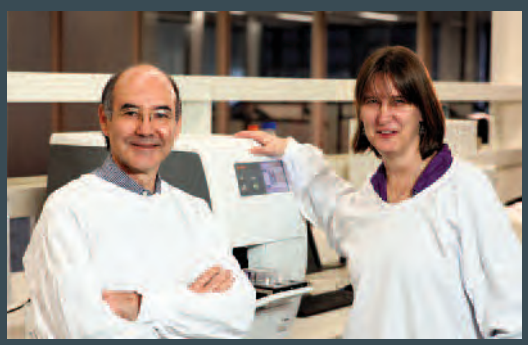
Correlative Microscopy Facility
In 2016, the Institute's new Correlative Microscopy Facility was established with support from the Cancer Institute of NSW, NSW Health Pathology, and UNSW Sydney. The only facility if its kind in Australia, the mission of the group is to develop and apply new microscopy techniques to enhance the understanding and visualisation of human disease. The facility consists of a GeminiSEM 300 3D electron microscope and Carl Zeiss LSM 800 super-resolution laser scanning microscope – the only and first-of-its-kind equipment, to be dedicated to cancer research.

The Australian MRI-Linac
The Australian MRI-Linac at the Ingham Institute is a world-first research and technology project that will redefine and improve radiation treatment for cancer. Only one of four in the world, this next next-generation cancer therapy equipment combines an MRI with a Linear Accelerator that will allow doctors to "see" and directly target cancer tumours in the body.

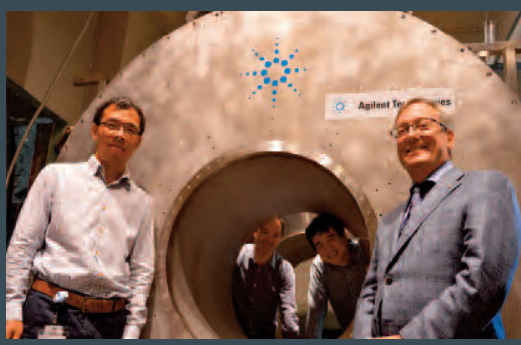
Clinical Trials:
Clinical trials are essential to determine whether new medicines, therapies or treatments are safe and effective. They are fundamental to improving health. Based at the Ingham Institute, South West Sydney Clinical Trials Support Unit (CTSU) have over 20 clinical trials groups that cover more than 15 different specialty areas.



Dr Nicole Caixero, Biobank Manager



Associate Professors Kevin Spring and Therese Becker



Australian MRI-Linac team member with the MRI-Linac magnet

Cancer Research

Partnering with hospitals and health centres in the South West Sydney region, we have over 100 researchers working across a wide range of cancers including Melanoma, Ovarian, Breast, Colorectal, Prostate, Gastric, Oesophageal and Brain Cancers as well as blood cancers such as Leukaemia.

Scientists at the Ingham Institute study cancer at many levels to develop strategies and better treatments for doctors and medical staff to introduce into our hospitals.

The **Cancer Pathology and Haematology Group** provide patient diagnostic services directly in hospitals across South West Sydney.

Working within the cancer therapy centres at Liverpool and Campbelltown Hospitals, our **Medical Physics** team is focused on radiation oncology treatment and related imaging techniques to target cancer tumours during an MRI scan.

Additionally, our researchers at the **Centre for Cancer Outcome, Research and Evaluation (CCORE)** have a broad interest in all areas of cancer management from the individual cancer patient level to cancer services at state, national and world levels.

Meanwhile, our Pancreatic Cancer and Gastro-Intestinal Viral Oncology Research Groups have made world-first discoveries here in South West Sydney. **The Pancreatic Cancer Research** team were the first in the world to develop a method to isolate and culture pancreatic stellate cells whilst our **Gastro-Intestinal Viral Oncology Research** team discovered a molecular signature for virally caused oesophageal cancer.

The Institute's cancer research programs extend beyond biology and looking for a cure for the disease.

Our **Psycho-Oncology Group** focuses on cancer patients and their carer's welfare and wellbeing providing cancer support programs including communication tools for partners and carers. communication tools for partners and carers.

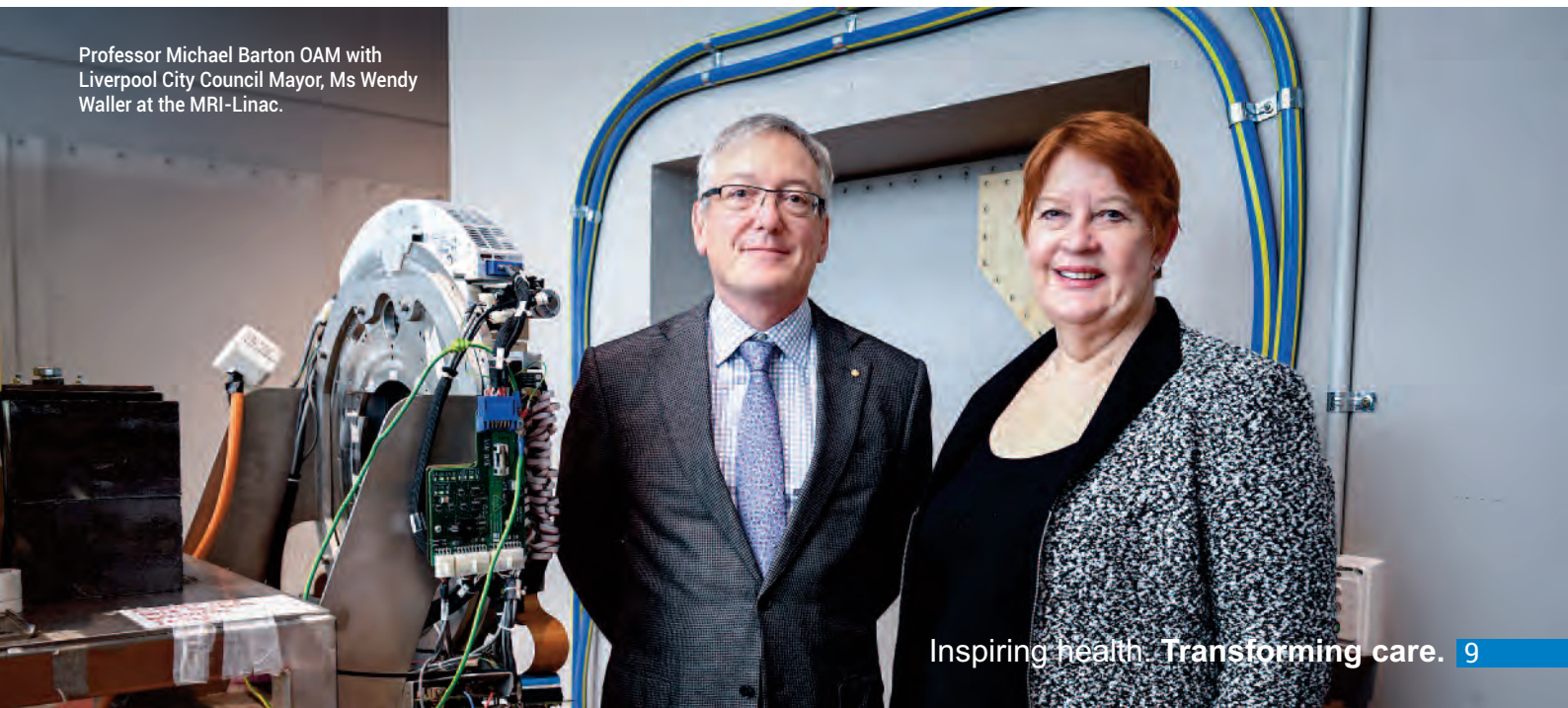
The Palliative Care Research Group explores interventions which aim to support patients and their caregivers to live the best quality of life and function, and achieve goals important to them at the end of life in the place of care of their choice.

Cancer researchers at the Ingham Institute are also conducting vital work to help understand the spread of cancers. the spread of cancers via Circulating Tumour Cells (CTC) research. The Institute is home to one of Australia's first CTC analysis machines, which identifies cancer cells in the blood.

The Centre for Oncology Education & Research Translation (CONCERT) - a collaborative of over 200 cancer-focused professionals and the CONCERT Biobank - a blood and tissue collection facility, focused on the prevention, detection, diagnosis and treatment of cancer is also based at the Institute.

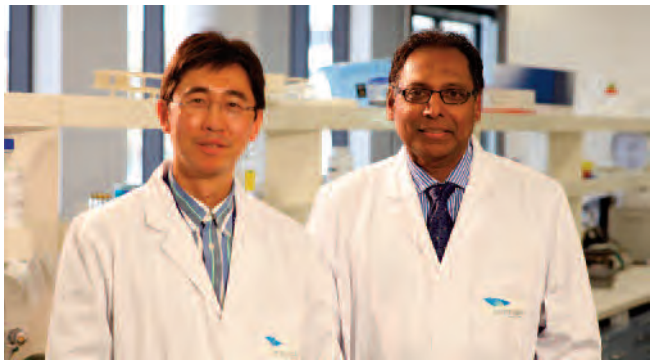
The focus of Ingham Institute cancer programs is translational, where results from the laboratory are transferred quickly and efficiently into our hospitals and clinics.

Clinical Trials are essential to determine whether new medicines, therapies or treatments are safe and effective. The clinical trials team based at Institute are currently coordinating over 200 cancer clinical trials across South West Sydney.



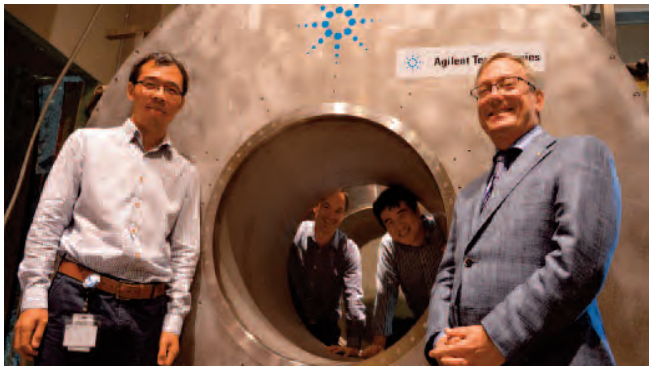
Professor Michael Barton OAM with Liverpool City Council Mayor, Ms Wendy Waller at the MRI-Linac.

Cancer Highlights and Community Programs



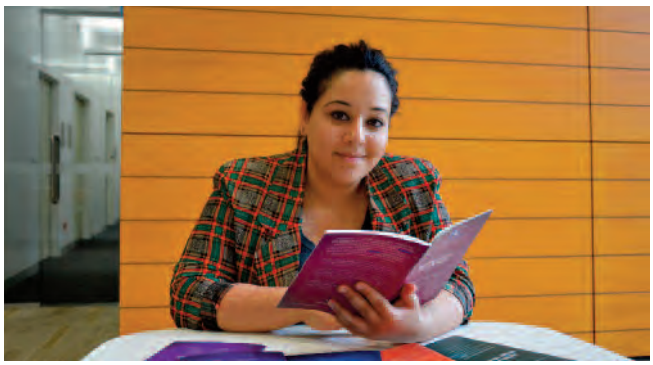
World-first discovery of a molecular signature for virally-caused oesophageal cancer discovered by our Gastro-Intestinal Viral Oncology Group, Professor Shan Rajandra (right) and Dr Bin Wang (left).

Dr Mei Yap's from our CCORE group study estimated that another 7,000 radiation therapy machines would be required worldwide to meet the needs of cancer patients. The study was published in renowned medical journal, The Lancet.



Ingham Institute's Research Director, Scientia Professor Michael Barton OAM (right), was awarded Research Australia's 2016 Health Services Research Award for his pioneering cancer research in radiotherapy.

Dr Pei Ding's extensive research and findings into non-smokers diagnosed with lung cancer secures additional funding.



Research-led, Community Programs

Coping-Together is an innovative coping skills intervention program designed for patients and their partners, incorporating current, evidence-based strategies for illness self-management and coping. Pictured above is program researcher Martha Gerges.

The **PROMPT-Care** e-health platform empowers people to provide direct feedback on their care to their clinicians in real time, ultimately improving the quality of the care they receive. It captures a patient's symptoms, distress, quality of life and unmet needs. Pictured above is Prof. Geoff Delaney, Director of Cancer Research.

Project in Focus

Our flagship cancer research program is the **Australian MRI-Linac,** *which combines a magnetic resonance imaging (MRI) scanner with a Linear Accelerator (Linac) and will allow doctors to precision target cancers and avoid normal tissues during radiation therapy.*

The Australian MRI-Linac is only one of four in the world

It is estimated that by 2020, approximately 150,000 Australia will be diagnosed with new cases of cancer; about half of which require radiation treatment (radiotherapy).

Radiotherapy is a cancer treatment that aims to precisely target cancerous tissues with high-energy x-ray beams, whilst sparing the surrounding organs. The problem with conventional radiotherapy treatments is that tumours and organs can change shape and move during therapy as the human body, for example, breaths.

In current radiotherapy treatment, wide beams of radiation are used to make sure that the tumour is always in the beam, as a consequence regions of the body are radiated where no cancer exists – to compensate for the movement.

To overcome this problem, researchers at the Ingham Institute are developing a ground breaking cancer therapy machine – an MRI-LINAC.

This new MRI-LINAC will work by combining a real time Magnetic Resonance Imaging machine, (an MRI) with a linear accelerator cancer radiotherapy system, a LINAC.

MRI is the best imaging tool available for radiotherapy guidance. MRI simulation provides outstanding tumour and normal tissue delineation. Functional imaging with MRI can provide insights into tumour behaviour and response to treatment.

This revolutionary radiotherapy machine will allow doctors to see exactly what they are treating. Meaning the therapy beam can be precisely focused on the cancer cells in real time, sparing the surrounding organs.

The other breakthrough of the MRI-LINAC is that it can pin point and target the radio therapy beam to precise parts of the cancerous tumour that are the most resistant and aggressive, thus enabling a higher dose of radiation to be delivered to the most malicious part of the tumours. Something has never been possible before during treatment.

There are only three other MRI-LINAC's under development in Holland, Canada and the USA. The Australian MRI-LINAC is unique in its design and approach with the split magnet MRI that allows the radio therapy beam to travel in line with the magnetic field of the MRI.

The project is a collaboration between multiple organisations including the Ingham Institute, Sydney University, the University of Queensland, the University of Wollongong, Western Sydney University, Newcastle University and Standford University. The program has received support from the Australian Government and the Australian Research Cancer Foundation (ACRF). The Hon. Craig Laundy MP, Assistant Minister for Industry Innovation and Science, officially opened the facility on July 3, 2017.

"South Western Sydney is rapidly becoming the world centre of development of this pioneering cancer treatment technology; it is the next generation in cancer treatment as it will improve the effectiveness of cancer treatment for patients in our community, Australia and around the world."

Prof Michael Barton OAM, Research Director at the Ingham Institute.

MILESTONES ACHIEVED TO DATE:

January 2010
MRI-Linac program receives project funding from the Federal Government

March 2012
Research bunker completed within Liverpool Hospital, NSW

November 2015
Linear accelerator and MRI equipment installed

December 2015
World's first photo taken from in-line magnet MRI with LINAC beam on (a kangaroo steak)

February 2017
World's first photo taken from split magnet MRI with LINAC beam on

April 2017
World's first human image photo taken from split magnet MRI-Linac

May 2017
World's first clip taken from split magnet MRI with LINAC

June 2017
World's first video taken from split magnet MRI with LINAC beam

Mid-2018
Commencement of patient trials.

Injury and Rehabilitation Research

Injury and rehabilitation researchers at the Ingham Institute are developing new treatments and improving outcomes for people living with brain injuries and musculoskeletal system that includes our joints, ligaments, muscles, nerves, tendons, and structures that support limbs, neck and back.

Working alongside emergency, intensive care and surgical teams, our researchers transfer their findings directly into new treatment options that are being implemented by hospitals and rehabilitation centres throughout the region.

The **Whitlam Orthopaedic Research Centre** is internationally recognised for its research on hip and knee surgeries, and the implications of these procedures. The team established The Australia & New Zealand Hip Fracture Registry to measure outcomes in hospitals in Australia and New Zealand on the tens of thousands of hip and knee replacements performed in Australia each year. The registry monitors improvements undertaken in hospitals and publishes patient outcomes.

Professor Ian Harris, co-leader of our Whitlam Orthopaedic Research Group

Highlights

- **Prof. Ian Harris** alongside Conjoint Prof. Jacqueline Close (NeuRA) won the **2017 Health Services Award** at the annual Research Australia Health & Medical Research Awards for the establishment of The Australian & New Zealand Hip Fracture Registry which has directly improved clinical procedures and patient outcomes.
- Commencement of a multi-centre study – **CROSSFIRE** (Combined Randomised and Observational Study of Surgery for Fractures In the distal Radius in the Elderly) - which will compare the outcomes of wrist fractures in patients over 65 years old using plaster vs metal implants by Prof. Ian Harris.
- Published in the **Medical Journal of Australia,** A/Prof Justine Naylor findings confirmed there are no significant recovery outcomes between inpatient and home recovery of patients who have had knee replacement surgery.

Associate Professor Grahame Simpson,
Brain Injury Rehabilitation Research Group Leader

The **Brain Injury Rehabilitation Research Group (BIRRG)** conducts a program of clinical and health services research with the broad aim of alleviating the consequences of traumatic brain injury, focusing on clinically-applied, intervention-oriented research. BIRRG is a joint initiative of the Liverpool Hospital Brain Injury Rehabilitation Unit and the NSW Agency for Clinical Innovation (ACI) Brain Injury Rehabilitation Network.

Research-led, Community Programs

- **Strength 2 Strength** is a world-first, psycho-educational group program that supports families and carers of people living with traumatic brain injuries,
- **Window to Hope** is the world's only clinically validated suicide prevention program for people living with traumatic brain injuries. The program has been implemented in the United States Army.
- **Vocational Intervention Program** (VIP) is a first-of-its-kind, pilot program supporting people with an acquired brain injury to seek and obtain sustainable employment in NSW.

Maysaa Daher (pictured above) was a 2017 NSW Young Woman of the Year finalist for her work on VIP program.

Project in Focus

Associate Professor Justine Naylor from the Institute's Orthopaedic Research team recently completed a three year study to observe if there was a difference in surgical outcomes between patients who recovered in hospital versus patients who recovered at home, post-knee surgery replacement.

> *"If we can identify care that is, and is not good value, we can help reduce pressure on private health insurance premiums and the public system at the same time,"*
>
> *Associate Professor Justine Naylor*

Uncomplicated knee surgery is a common orthopaedic procedure that reduces pain and improves function however the surgery is costly and requires an average 12-day recovery period. Private paying patients are the main people targeted for inpatient rehabilitation as the average rebate is $700 per night as an in-patient and this has become a major factor driving insurance premium increases.

To find out which option gave private patients the better outcomes, Justine's team conducted a national study involving privately insured people who had undergone uncomplicated total knee surgery. They compared the outcomes between people who went to in-patient rehabilitation versus those who went straight home.

As the study was not a randomised trial, the analysis involved matching patients who went to in-patient rehab with those who did not across many characteristics including age, gender, body-mass index (a measure of obesity), and the severity of the disease before surgery. Patients were phoned at 35, 90 and 365 days after surgery and asked for details about their recovery and the types of rehabilitation they had. People who experienced a significant complication within the first 90 days were excluded as this would alter their rehab pathway as well as their reported joint and quality of life outcomes.

The study observed no significant recovery differences between the patients at 90 and 365 days after surgery. Interestingly, patients who went straight home had better health-related quality of life scores at 35 days post-surgery. There were no differences in joint pain or function between the two groups, but the inpatient group had rehab provider charges that were 26 times higher than those who went straight home. Removing the inpatient rehab charges, those who went to rehab still had higher rehab costs because they had more community rehab visits and more expensive 'Day Hospital' therapy.

Patients and their carers also took the same time off work regardless of the rehab option. The main implication of the study is, given the cost difference between rehabilitation options, community-based (non-inpatient) alternatives seem to be of better value.

How do I choose what's best for me?

To choose the best rehab option for you, here are three questions to ask your surgeon before your operation:

1) How do I know if I need in-patient rehab?

2) If I choose in-patient rehab, will I recover more quickly or better?

3) What are my rehab options other than as an in-patient?

Clinical Sciences Research

Our Clinical Sciences Research stream is investigating the causes and impact of common disease and translating those findings into more effective treatments for patients on a local, national and global scale.

Clinical Science researchers encompass immunologists, cardiovascular surgeons, neurosurgeons, diabetic and endocrine specialists, rheumatologists and other scientists.Through the use of laboratory based studies they hope to identify prevention methods and better treatments for diseases such as arthritis, Parkinson's disease, cardiovascular disease and diabetes.

Our **Antibiotic Resistance and Mobile Elements Group (ARMEG)** are working on one of the world's largest-ever genomic studies to help eradicate the superbug Golden Staph. This antibiotic resistant disease is the cause of major hospital-acquired infections around the world and is an emerging cause of infections in the community. Our scientists are using whole genome sequencing to identify genes, mutations and unique elements that enable these bacteria to thrive in these environments.

South West Sydney has one of the highest prevalence rates of diabetes in NSW and complications from this disease can significantly impact people's quality of life. Our **Diabetes Collaborative Research Unit** is investigating diabetic foot disease, in-patient management, diabetic cardiomyopathy, diabetes in pregnancy and diabetic retinopathy.

There is a pressing need for better treatment for people with arthritis and autoimmune disease. Clinical science researchers from our **Arthritis Research** team are involved in finding and evaluating biomarkers (disease characteristics) and patient-reported outcomes to transform the clinical assessment of patients who have connective tissue diseases.

Our **Rheumatology Research Group** is focused on improving the lives of people with musculoskeletal and autoimmune diseases such as arthritis, lupus and osteoporosis. The group has embedded research into clinical practice at Liverpool Hospital, with a patient centred approach that records patient reported outcome measures at every visit.

The South Western Sydney Local Health District (SWSLHD) has one of the largest stroke referral centres in NSW. Our **Stroke and Neurology Research Unit** is a collaboration of clinicians and researchers within the SWSLHD who have a special interest in the diagnosis and management of acute stroke patients.

Our **Immunology** team are committed to improving the diagnosis and treatment of patients with immune-mediated diseases. Currently, the team is involved in a randomised controlled trial to investigate the efficacy of new medication in HIV affected patients.

The **Respiratory Medicine Group** is conducting clinical research in diverse fields including asthma, bronchiectasis, sleep disorders, tuberculosis and interventional pulmonology. Currently, the group is working on new treatments for severe asthma, novel ways of reducing flare-ups in people with bronchiectasis, and alternative treatments to prevent tuberculosis in people who have been infected with the tuberculous germ.

Autoimmune diseases affect up to 10% of the Australian population and include juvenile diabetes, multiple sclerosis, nephritis of the kidney, inflammatory bowel disease and many forms of arthritis. Our **Immune Tolerance Group** is concentrating on therapies based on T-regulatory cells of our immune system to prevent the rejection of organ transplants and bone marrow grafts.

The **Dermatology Research Group** is focused is on improving the understanding of the development, diagnosis, and management of patients with skin diseases and chronic skin conditions such as psoriasis.


Antibiotic Resistance and Mobile Elements Group (ARMEG)


Immune Tolerance Group


Stroke and Neurology Research Unit

Project in Focus

In 2016, the Institute's new Correlative Microscopy Facility was established with support from the Cancer Institute of NSW, NSW Health Pathology and UNSW. The facility consists of a GeminiSEM 300 3D electron microscope and Carl Zeiss LSM 800 super-resolution laser scanning microscope – the only and first-of-its-kind equipment, to be dedicated to cancer research.

A New Way of Looking at Cancer and Chronic disease

The mission of the Correlative Microscopy Group is to develop and apply new microscopy techniques to enhance the understanding and visualisation of human disease. The team, consisting of Associate Professor Murray Killingsworth and Dr Tzipi Cohen-Hyams (Managing Scientist), are committed to providing a new view of cancer and its microenvironment.

The Institute uses cryogenic technology to freeze cancer cells instead of the more commonly used chemical preservation approach. The team then looks at the freeze-prepared cells through the microscopes to get a clearer view of how they behave and why.

Correlative microscopy is also used to access multiple magnification scales from the organ level to individual cells and down to the single molecule. On a practical level this can increase the information from a pathology sample and will lead to a reduction in the amount of tissue required for diagnosis i.e. less invasive biopsy procedures.

Additionally, this equipment will be used for monitoring patient treatment. Correlative microscopy can identify and track disease processes and key sites of drug action or failure

Associate Professor Murray Killingsworth describes how correlative microscopy is applied to his research

1. What is the health issue you're addressing?

My personal research interest is in the induction of angiogenesis in cancer and chronic inflammatory diseases such as age-related macular degeneration (AMD) & atherosclerosis. Together, these diseases account for a large part of the disease burden of the elderly population of Australia and the developed world. The growth of new blood vessels to supply a growing tumour or developing scar is a significant target for therapeutic intervention. Our particular focus with this work is on the interaction between the cells, which form the vascular tube. I believe it is only possible to gain a complete understanding of this process by combining insights from biochemistry with structural morphology for 'form and function' information. Correlative light and electron microscopy (CLEM) is a way to achieve this.

2. What makes your research unique?

Our research approach is unique in that we are using CLEM studies of human pathology tissue and we are fortunate to have access to some of the most powerful microscopy technology ever developed. We do not rely on cell culture or animal models to try and replicate human conditions. This is because the diseases we are interested in are chronic in nature, developing over many years and sometimes decades of life and cannot be easily replicated using laboratory model systems. Our approach raises other issues such as the reliance on biobanked human samples for the work. However, despite the difficulties in accessing human tissue we find that this approach is very useful for forming collaborations with other scientists and clinicians who are working at the other ends of the disease spectrum. Our type of studies can be key to the successful translation of basic science findings or clinical insights to improvement in patient care.

3. How will your proposed solution inspire health or transform care in the community?

Our correlative microscopy approach has already been shown to be effective and transform health care, by providing a rationale for the use of anti-inflammatory and anti-angiogenic drugs in the treatment of neovascular age-related macular degeneration (AMD). We used clinical pathological correlation to pinpoint very early retinal lesions and discovered that they would be susceptible to pharmaceutical treatment. The current 'revolution' in the use of injectable drugs for patients with 'wet' AMD that developed from this work has made a significant difference to outcomes for many who might previously have lost sight from this disease. Australia is one of the few countries in the world where the economic burden of AMD has been calculated. A study from 2006 estimated the disease to cost $2.6 billion per year. "This is projected to grow to $6.5 billion by 2025, a total cost of $59 billion over the next 20 years. A treatment that reduced the progression by only 10% would save Australia $5.7 billion over that same period of time", Hageman GS (2008).

A/Prof Murray Killingsworth and Dr Tzipi Cohen-Hayams in the Correlative Microscopy Facility at the Institute.

Mental Health Research

Each year, about one in five Australians will experience symptoms of a mental illness. Our mental health researchers work alongside Liverpool Hospital Mental Health Centre – one of the largest mental health facilities in NSW – to transfer their findings directly into clinical practice and patient care.

Our **Schizophrenia Research Unit** is looking into ways to reduce the negative physical health effects linked with anti-psychotic medications. The team has identified lifestyle and life-skills training that can help reduce weight gain in young people who are taking anti-psychotic medications.

Researchers from our **Academic Unit of Child Psychiatry** are investigating the genetic characteristics of Tourette's syndrome, as well as the early identification and treatment of developmental disorders like Autism. Under the leadership of Professor Valsa Eapen, this team delivered the world-first study on the Early Denver Model into the community.

Psychiatry Research and Teaching Unit is finding ways to improve the quality of life for those affected by other mental health issues. Its research leader, Professor Derrick Silove, has been recognised and awarded for his work in refugee and post-conflict mental health.

Highlights

- The **'Watch Me Grow'** (WMG) study observed that children from families that are socially disadvantaged and/or are of culturally and linguistically diverse backgrounds may be more at risk of adverse developmental outcomes and inequitable access to health services.
- Professor Derrick Silove,was appointed a **Member of the Order of Australia** for significant service to medicine in the field of psychiatry, to medical research as an academic, and to the promotion of mental health and human rights.

Professor Derrick Silove, Psychiatry Research and Teaching Unit Leader.

Research-led, Community Programs

The Early Start Denver Model is an evidence-based, comprehensive, play-based approach to teaching that focuses on helping children with autism spectrum disorder (ASD) develop social communication skills like showing interest and responding to others.

The **Quality of Life in Autism (QoLA) Scale** was developed to determine the quality of life in parents of children with autism and individuals with autism. This QoLA scale measures the stress levels, coping and sense of competence as well the child's social, communication and developmental skills. It is now used by more than 35 teams across 18 countries.

Translating Knowledge in Traumatic Stress into Practice' is a program developed by Professor Silove dedicated to developing better public health interventions for Post Traumatic Mental Health problems.

Early Start Denver Model, play based approach to helping children with Autism.

Project in Focus

Watch Me Grow-E (WMG-E) App *The WMG-E e-tool is an online app that has been developed to engage and motivate parents of young children to be active in monitoring their child's development beyond health screenings. The app consists of a questionnaire designed to screen for learning and behavioural disorders such as Autism in early childhood. This app will be used in GP clinics during the legally-required 12, 18 and 24-month old vaccinations.*

In Australia, nearly one quarter of children start primary school with developmental vulnerabilities. Unfortunately, most of these children will have had no intervention. In NSW, every newborn child is provided with a "Blue Book" from NSW Health, which acts as a surveillance programme as well as a public health record of a child's immunisation and behavioural development from birth to four years old.

Researchers from our **Academic Unit of Child Psychiatry,** led by Professor Valsamma Eapen, examined this developmental surveillance to understand what makes it easy or difficult for families to get regular, recommended developmental checks done for their children.

The team's 2011-2014 'Watch Me Grow' project examined 2000 parents and children in South West Sydney, during their 6, 12, and 18 month health checks and observed the low uptake of follow-up developmental checks by parents.

Using the results from the Watch Me Grow project, Professor Valsamma Eapen and her team worked alongside NSW Health, to develop the new, 2017 Blue Book programme to coordinate with the WMG-E questionnaire app to collectively screen for learning development vulnerabilities.

The WMG-E has been designed as a non-threatening platform through which parents of young children are able to provide and receive information about their child's development.

This study will be conducted in GP practices in South West Sydney. A total of 480 children attending 12 or 18-month vaccination visits will form the study sample.

Groups of GP practices in South West Sydney will be randomly allocated to the "WMG-E and Blue Book" or "Blue Book" only group. Children aged 12 months attending the respective South West Sydney General Practice services during the point of contact at immunisation visits will be assessed for rates of uptake and completion of developmental surveillance in the two groups.

For those attending the WMG-E clinics, the weblink will be presented to parents as they wait in the clinic waiting room and once the parent completes the WMG-E webapp, the report will be transmitted to the GP so information will be available at the point of care when conducting the consultation as part of the vaccination visit.

The diagnostic accuracy of children identified in the WMG-E and Blue Book group will be compared to the children in the Blue Book group . All children who screen positive and 10% of those who screen negative will participate in a comprehensive gold-standard developmental/behavioural assessment protocol when the children turn two years of age.

It is estimated that at least 53 children will be identified as being at developmental risk. This pilot program will commence in 2018.

> ***"WMG-E is designed to engage and motivate parents by increasing their self-efficacy & health literacy in child development by sending a reminder email every six months encouraging the parent to complete the surveillance check. We believe this to be powerful drivers of participation in the surveillance program and engagement with interventions if need be thereby improving child outcomes, so that over time positive parental child-health behaviours develop and are habituated into everyday family life."***
>
> **Professor Valsamma Eapen**

The program is based on three integrated web-based components:

1. Developmental screening.

2. Anticipatory guidance about child development and parenting-strategies.

3. Email reminders (personalised to the parent) for participation in surveillance checks as currently expected in the NSW Blue Book.

The aim is to test if this online tool will:

1. Increase the proportion of children receiving developmental/behavioural surveillance using the opportunistic contact (e.g. for immunization) when they attend primary health care.

2. Increase the proportion of children correctly identified as being at developmental/behavioural risk through surveillance and being referred on for appropriate early intervention.

3. Increase the parental engagement in relation to access and utilisation of child health and developmental services.

Population and Health Services Research

The Ingham Institute is a global leader and centre of excellence in population and health services research that aims to understand the origins of health and disease to improve the wellbeing of all generations.
These groups work directly with the community to develop health services and treatment programs that serve the current and emerging health needs of our community.

Patient safety and women's and children's health are key areas of focus for the Population and Health Services Research stream.

Our **Department of Community Paediatrics** is committed to their involvement in clinical work and research focusing on children with special needs and developmental problems, as well as vulnerable populations of children such as refugees.

The **Centre for Health Equity Training Research and Evaluation (CHETRE)** was established to research the development needs of health equity within South Western Sydney and are continuing to be involved in a number of projects aimed at developing effective interventions for vulnerable families, communities and populations in order to address health inequalities.

Our **Centre for Applied Nursing Research (CANR)** is focused on enhancing nursing and midwifery practice throughout Australia and provides evidence-based practice for patient safety and quality of care.

The **General Practitioner's Unit (GP Unit)** integrates the training of GPs, medical research and health services development with clinical care delivery. The Unit has an emphasis on cultural respect in all its activities. This has special salience in South Western Sydney, with its ethnically and culturally diverse population.

The Ingham Institute takes clinical research and evaluates how it can best help the community through improving public policy and the healthcare system.

One of the key research areas by our **Centre for Research, Evidence Management and Surveillance (REMS)** team are in environmental health and air pollution; the outcomes of REMS air pollution research are being used in the current review of the national air quality standards.

Population health researchers from our **Simpson Centre for Health Services Research** are developing and evaluating new ways to improve critical care in hospital emergency departments.

Highlights

• **'Is Anyone Listening?'**, the Health Impact Assessment (HIA) report conducted by the Institute's CHETRE team, alongside the SWSLHD and Western Sydney Community Forum concluded that community engagement processes in the development of Western Sydney Airport could have a negative impact on people's wellbeing and spread a sense of disempowerment, if they continue in the current manner. The study involved five community workshops in the Greater Western Sydney suburbs of Blacktown, Bringelly, Cabramatta, Lawson and Oran Park. Launched in August 2017 the HIA report provides insights and opportunities for improvement.

Research-led, Community Programs


Prof Evelyne de Leeuw, CHETRE

• The **Ways of Thinking and Ways of Doing (WoTWoD)** toolkit created by our GP Unit for doctors provides clinically and culturally appropriate health care to Aboriginal and Torres Strait Islander patients

• The **'Gudaga'** (which means 'healthy baby' in the local Tharawal language) research program continues to provide an understanding of the health and development of Aboriginal children which is informing service delivery for Aboriginal families in South Western Sydney.

• **The Community STaR** (Service for Teaching and Research) program is based in Miller, NSW and supports development approaches for the residents in the surrounding area, including community forums on men's health and alcohol.


Prof Lynn Kemp, MECSH Program

The **Maternal Early Childhood Sustained Home Visiting (MECSH) Program**, a sustained nurse home-visiting program helps families create better home environments and improves the cognitive development of babies and children. Now a global program operating in the UK, Korea and USA, it originated in South Western Sydney as an outreach program for vulnerable and at-risk mothers led by Prof. Lynn Kemp Translational Research and Social Innovation (TRESI) group leader.

Project in Focus

Dental Hygiene during Pregnancy: Changing midwifery practice to safeguard the oral health of pregnant women

The first-of-its-kind in Australia, Associate Professor Ajesh George's proposed Midwifery Initiated Oral Health (MIOH) program is changing practice by educating midwives in providing oral health education, assessment and dental referrals for pregnant women.

Our Collaboration for Oral Health Outcomes, Research Translation and Evaluation (COHORTE) group is the first-of-its-kind in Australia and focuses on interdisciplinary oral health care and capacity building and training of non-oral health professionals. The team works closely with local health districts, universities, policy makers and professional organisations to change practice and improve outcomes across our community.

Poor oral health in pregnancy is linked to premature birth, low birth weight and early tooth decay in children. In Australia, less than a third of pregnant women visit a dentist, even if they need to. Even though dental problems are more common in pregnancy, less than 10% of women receive any information about oral healthcare at this time.

To assist midwives in this role, the Midwifery Initiated Oral Health (MIOH) was developed and endorsed by the Australian College of Midwives as a continuing professional development activity which includes evidence-based, oral health promotional resources and a maternal oral health (MOS) screening tool.

The program was trialled from 2012-2015 in NSW with 638 pregnant women, recruited from antenatal clinics across Nepean, Campbelltown and Fairfield Hospital. The multicentre trial included 17 midwives who successfully completed the MIOH training and undertook screening and referral of the pregnant women and a referral pathway to public dental services.

Results published in 2016 demonstrated that the MOS tool can be successfully implemented by midwives during a woman's first antenatal visit and can identify up to 94% of women at risk of poor oral health and needing a dental referral. The MOS tool has been included in the Birthing Outcome System used by 75% of Hospitals in Victoria and there is already increase in the number of pregnant women accessing public dental services.

In 2016, the MIOH program was adopted into policy in Victoria; more than 150 has completed the training and incorporated oral health guidelines into their practice. Other states are currently seeking collaborations with COHORTE to implement similar antenatal programs. A/Prof George's team is working with the NSW Ministry of Health to endorse and enrol this program for disadvantaged women.

In another Australian-first, A/Prof George has collaborated with the School of Nursing and Midwifery at Western Sydney University to implement an oral health module into the Bachelor of Midwifery Program.

> *"One issue is a lack of access to dental services. There is also lack of awareness among women and health professionals – even dentists – around the importance of oral health and safety of dental procedures during pregnancy. We now know that it's safe to have dental treatment during pregnancy, including cleaning, fillings, extractions and even x-rays. The consensus is that women need to address any dental infection during pregnancy to ensure the best health outcomes for both the mother and the baby,"*
>
> *A/Prof Ajesh George.*

The trial has shown the Midwifery Initiated Oral Health (MIOH) program is improving the knowledge and confidence of midwives to promote oral health as well as the oral health outcomes, knowledge, quality of life and uptake of dental services among pregnant women.

As part of the program, Dr George's team have developed a series of brochures and a video to promote the importance of oral health during pregnancy and early childhood to the public.

These resources have been endorsed by Ministry of Health

To date more than 90,000 of these resources have been circulated across antenatal & dental services in NSW.

NEW RESEARCH GROUP

Gastroenterology and Liver Research

In 2017, the Ingham Institute welcomed the Gastroenterology and Liver Research Group. Liver disease and the consequence of liver cancer have a devastating and under-recognised impact on our community. It is estimated that approximately 4,000 Australians die every year of liver disease; a leading cause of death due to liver disease is from liver cancer.

The Gastroenterology and Liver Research Group is led by Prof. Nick Shackel and A/Prof. Miriam Levy who also lead, and practice, at the Liver Cancer Service within Liverpool Hospital. Prof. Shackel has published research that examined the genetic signatures of liver cancer leading him to conclude that 'liver cancer, like most cancers, is a collection of rare malignancies'.

Liver cancer is characterised by extremely poor survival without treatment and most individuals present too late to have curative treatment. Non-curative treatments offer a survival benefit of only a few months on average. The Gastroenterology and Liver Group is focusing on defining the true extent of liver cancer in the Sydney South West, developing better methods to diagnose liver cancer at an early stage and are finding ways to predict how individual patients will respond to treatment.

The group is using novel laboratory methods to answer important clinical questions about liver cancer while also looking at genetic markers of disease. Prof. Shackel, A/Prof Levy and the team have also uncovered a new mechanism of tissue inflammation and are examining clinical aspects of patient management in diverse ways such as the effect of nutrition and how we might manipulate the microbiome to change disease outcomes.

Milestones

August 2016
Prof. Nick Shackle joins the Ingham Institute.

January 2017
Opening of the Gastroenterology and Liver Laboratory at the Ingham Institute. This laboratory now has 10 full time staff and students. The group undertakes whole genome sequencing of mouse models of liver cancer to clinical studies of disease prevalence and treatment options.

May 2017
Patient sample collections commences between the clinical service at Liverpool Hospital and the research team laboratory staff.

July 2017
PhD Student, Scott Collins isolates liver organoids for the first time.

November 2017
Installation of a nine-colour flow sorter in laboratory. This half-a-million-dollar machine will enable the isolation of single cells for organoid growth from tissue samples.

Gastroenterology and Liver Research Group

Project in Focus
Growing 'Mini Livers'

Scott Collins is a 25-year-old with a passion for motorcycles and has started his PhD studies under the supervision of Prof. Shackel. In July 2017, something smaller than a pin head became one of the most exciting moments in Scott's developing academic career. Scott had generated a collection of cells in the laboratory called an organoid which have all the characteristics of the whole liver.

This ball of cells (which look a bit like a miniature prune, see image below right) represents a real breakthrough for the group at the Ingham Institute. For the first time, this group will be able to take tissue from patients to grow organoids or "mini livers" in the lab.

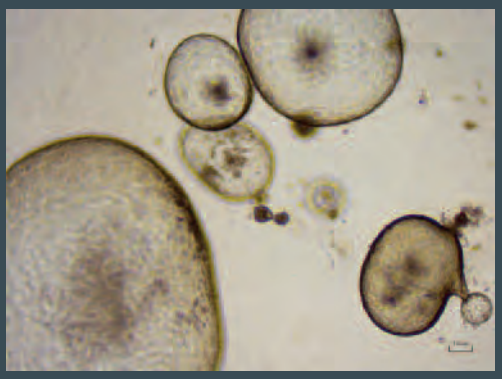
This will then enable them to answer the important questions by subjecting these organoids in the laboratory to a range of treatments finding out which ones are best at eliminating the cancer.

Worldwide liver cancer has a higher rate of mortality for every incidence than lung cancer and its prevalence is increasing, becoming now the sixth most common form of malignancy worldwide, and second most common cause of cancer related death. The primary contributor is the liver damage caused by the viruses hepatitis B and C, alcohol abuse and obesity.

"As scientists, we need to be doing more to address this than just advising prevention. We need solutions for those at risk and suffering with this condition. What we need is a better understanding of the complex relationship between liver inflammation and cirrhosis (the scar tissue caused by liver damage); and the best way to do this to use the bodies' stem cells to grow self-organising mini liver buds (organoids). The long-term goal is to develop this technique to best direct treatment options in future patients." Scott explains

Over the course of his PhD, Scott will use tissue from patients to develop, master and then standardise the demanding laboratory techniques required to use organoids as part of cancer therapy so that this practice becomes part of the standard clinical practice in our hospitals.

Liver Organoid in Cultrex® grown from an organoids culture thawed from a liquid nitrogen frozen aliquot (biobanking troubleshooting), passage 3, day 4, 10x magnification, 29/09/17, scale = 100 µm



Liver Organoid in Cultrex®, passage 5, day 7, 4x magnification, 09/10/17, scale = 100 µm

Liver Organoid in Cultrex®, passage 1, day 8, 20x magnification, scale = 100 µm

A/Prof Lois Holloway, Prof Minoti Apte, and A/Prof Tara Roberts

New research partners and collaborators

The research reach of the Ingham Institute stretches across the broad geographic area of South West Sydney, operating within the South Western Sydney Local Health District. Our work also has a national and international reach and impact through a broad range of research links and collaborations.

In 2016/17, the Ingham Institute further strengthened our local presence by new collations with The SAX Institute, The Sydney Partnership for Health, Education, Research and Enterprise (SPHERE) and Franklin Women.

Franklin Women

Franklin Women is a community of women working in health and medical research related careers who support each other in personal and professional development both in and outside academia.

Here at the Ingham Institute, over 50% of our researchers are female and the Institute is proud to be a partner organisation of Franklin Women's new and innovative mentoring program aimed at supporting up-and-coming female health researchers to reach leadership positions.

The Franklin Women Mentoring Program pairs senior researchers established in their careers with early-career female researchers from different organisations in a mentor-mentee relationship for a course of six months.

The Institute's Pancreatic Research Group Leader, Professor Minoti Apte, is participating as a mentor in the program. The Institute's chosen mentees include A/Prof Lois Holloway, who is part of our MRI-Linac project team, and cancer inflammation researcher A/Prof Tara Roberts, who said: "This program is an excellent opportunity for professional development that is tailored for women working in medical research. Participating in the program has given me the time and space to develop a future career plan with input from a world class researcher as a mentor and also provided me with tools to improve my leadership capacity and my ability to mentor members of my research team and early career researchers at the Ingham Institute. The Institute's choice to be a partner organisation in this program highlights that they are supporting and investing in their staff and the quality research environment at Ingham."

Sydney Partnership for Health, Education, Research and Enterprise

SPHERE combines of the best academic, clinical and industry expertise to address unmet local, national and international health priorities and needs through collaboration, innovation and partnership. SPHERE brings together three universities, two Local Health Districts, two Local Health Networks, seven Medical Research Institutes, nine major teaching hospitals and the NSW Ministry of Health.

The aim of the partnership is to integrate outstanding research, top quality education and professional practices across partner organisations to improve health outcomes, deliver better healthcare, generate economic benefits, and be a magnet for recruitment and retention of staff and investment in health and research across 12 clinical streams-Triple I Partnership; Respiratory, Sleep, Environmental and Occupational Health Research; Stemming the Tide: Better Health Outcomes in Diabetes, Obesity & Metabolic Disease; Reducing the impact of chronic disease in children; Mindgardens; Aboriginal Health and Wellbeing; One Genome: Translating Genomic Medicine to Clinical Care; Sydney Translational Research and Education Alliance for Musculoskeletal Health (STREAM Health); Age and Aging; Cancer Clinical Academic Stream; Maternal, Newborn and Women's Health; Early Life Determinants of Health (ELDoH): Invest Early to make a difference.

The Sax Institute

The Ingham Institute is also a proud member of the Sax Institute, a national leader in promoting the use of research evidence in health policy. The Sax Institute aims to be the bridge between researchers and health decision makers, giving each the tools to work more closely together to benefit all Australians.

PHD Student Profile

2015 RESEARCH DIRECTOR'S PHD SCHOLARSHIP
Dr Zeljka Calic

TITLE OF PHD
Optimising diagnosis & management of posterior circulation strokes.

YEAR COMMENCED 2015
UNIVERSITY UNSW Sydney
SUPERVISORS A/Prof Dennis Cordato, Dr Cecilia Cappelen-Smith

In 2017, it is estimated that approximately 56,000 Australians will suffer a stroke, of these 19,000 will occur in NSW. Stroke is a medical emergency and may be caused by blockage or clot in a blood vessel (ischaemic stroke) or rupture of a blood vessel in the brain (haemorrhagic stroke). The accurate diagnosis of ischaemic stroke allows timely access for patients to receive life-saving reperfusion treatments including intravenous thrombolysis (clot bust therapy) alone or in combination with endovascular clot retrieval.

Dr Calic's research is focused on posterior circulation stroke, which represents 20-25% of all ischaemic strokes. Posterior circulation stroke commonly presents with symptoms such as dizziness, vertigo, nausea, vomiting and headache. These symptoms differ from well-known stroke symptoms such as weakness, facial asymmetry and speech disturbance. Because of the non-specific nature of symptoms and a paucity of neurological signs, timely and accurate diagnosis of posterior circulation stroke is often challenging. Posterior circulation stroke is misdiagnosed three times more frequently than strokes involving the anterior circulation. Furthermore, patients are often misdiagnosed with benign vestibular disorders such as benign positional vertigo. Delay in diagnosis and treatment of acute posterior circulation stroke may result in life-threatening complications of stroke, causing serious morbidity and mortality.

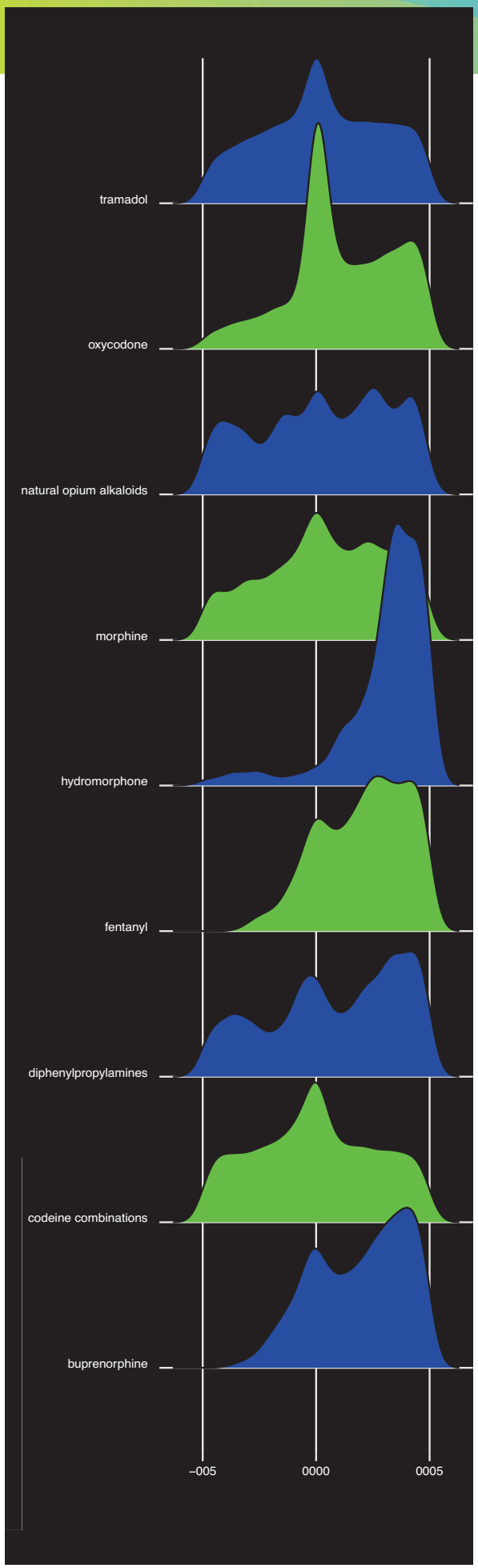
During her PhD, Dr Calic has been conducting a series of studies aimed at improving the diagnosis and management of acute posterior circulation stroke. Her first study, which is completed, found the majority of patients with posterior circulation stroke involving the cerebellum presented to the emergency department (ED) after 4.5 hrs of symptom onset and that presence of nausea and vomiting and absence of neurological signs on examination were associated with misdiagnosis. The findings of her first study have produced two publications in the journals Cerebrovascular Diseases and Cerebrovascular Diseases Extra. Her second study, which is currently underway, involves assessment of patients with acute posterior circulation stroke who received intravenous thrombolysis as part of an international multicentre trial named Enhanced Control of Hypertension and Thrombolysis Stroke Study (ENCHANTED). This study aims to determine better criteria for treatment with intravenous thrombolysis in posterior circulation stroke.

A third study involves the use of innovative, non-invasive, bed-side vestibular function tests to develop a unique algorithm to assist diagnosis of posterior circulation stroke in patients presenting with acute vertigo. Preliminary findings from this study were presented at the XXIII World Congress of Neurology and the 27th Annual Scientific meeting of the Stroke Society of Australasia, 2017. The devised diagnostic algorithm will potentially allow prompt and accurate diagnosis of posterior circulation stroke and specific peripheral vestibular disorders in patients presenting with acute vertigo to the ED. The algorithm also has potential for wider application within other health district EDs and internationally.

The overall goal of Dr Calic's research is to improve the diagnosis and management of posterior circulation stroke, where evidence for best practice is currently limited.

Heart and Brain Collaboration, Ingham Institutes Dr Zeljka Calic (above) is a qualified Neurologist with special interest in acute stroke, balance disorders and diagnostic neuro-otology.
She completed her medical training in 2008 at the UNSW Sydney. Her post-graduate training was undertaken at Liverpool Hospital. In 2011 she obtained a Specialist Certificate in Research at the University of Melbourne. During 2015 she enrolled in a PhD at the UNSW Sydney, thesis title 'Optimising Diagnosis and Management of Posterior Circulation stroke' through the Department of Neurophysiology at Liverpool Hospital and South Western Sydney Clinical School, UNSW. During 2016 and 2017, she acquired clinical experience in diagnostic neuro-otology at the Balance Clinic and Laboratory, Royal Prince Alfred Hospital and the University of Sydney. She has won several awards, including the Dean's Merit List for Academic Excellence in 2003, a Stroke Society of Australasia Bursary Award in 2015, an Australian Postgraduate Award in 2016 and the Ingham Institute Research Director's PhD Scholarship in 2015.

Big Data and Health Data Science at the Ingham Institute



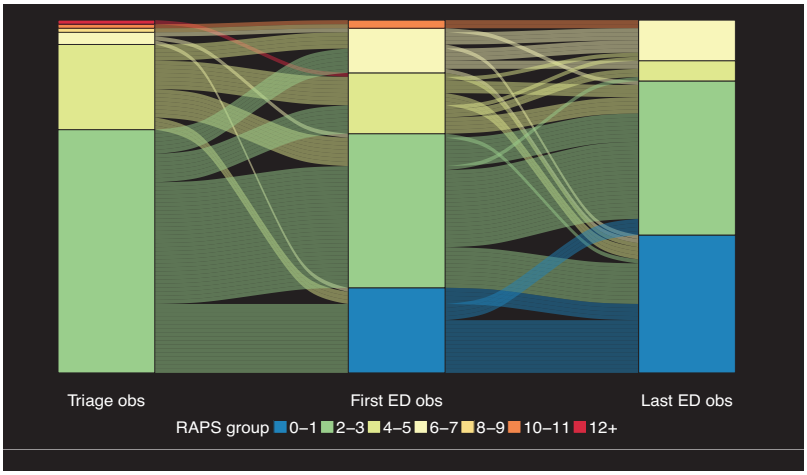
Every day, 2.5 quintillion bytes of digital data — that's 2,500,000,000,000,000,000 bytes - are generated for storage. In just the last two years, more data will have been created than in the last 5,000 years of human history, and the pace of data generation is accelerating. is accelerating. This includes health data, ranging from 'quantified self' data about our physical activity levels captured by fitness monitoring wristbands and smart phones, through online personal health records which capture a complete history of our health conditions and health care, through to massive data sets created by modern imaging systems such as MRI scanners, and even whole genome sequencing used to optimise treatments for each individuals' unique genetic characteristics.

Similarly in health research, new methodologies and technologies are producing very large and complex data sets which demand a more diverse range of skills and approaches to manage and analyse effectively and efficiently. It is for these reasons that the Ingham Institute has created a new, cross-cutting stream, **Health Data Science**, which over the next several years will deepen the data analysis skills of researchers at the Institute, and help diversify the information technologies which they use to make sense of biomedical research data, and health services data, alike.

Dr Tim Churches has been appointed as the inaugural Research Fellow in Health Data Science at the Ingham Institute, and has been working with researchers and research streams to help them improve their information management and data analysis capabilities. This has included a year-long, biweekly tutorial series in health computing for Ingham Institute researchers, focussing on proficiency in the state-of-the-art, open-source R programming language for data analysis. In June 2017, a one-day seminar on Big Data and Data Science in Health was held at the Institute, with seven eminent international and Australian speakers, attended by over 70 researchers.

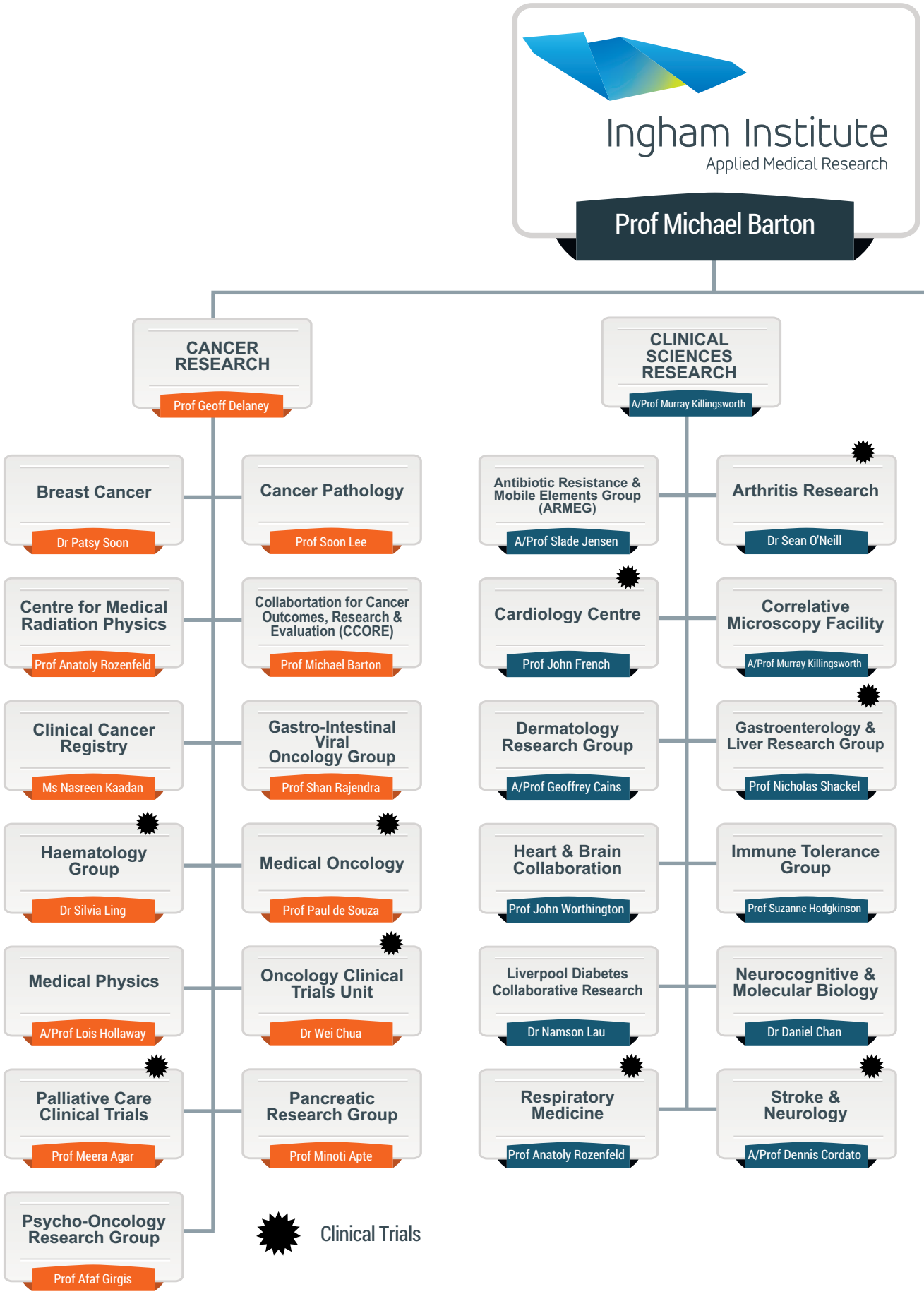
Health Data Science is a highly inter-disciplinary field, and over the next few years, the Ingham will actively involve more computer scientists, software engineers, machine learning and data visualisation specialists in its research programmes, with the goal of establishing itself as the premier institution in the application of cutting-edge information technologies for biomedical, clinical, health services and public health research.

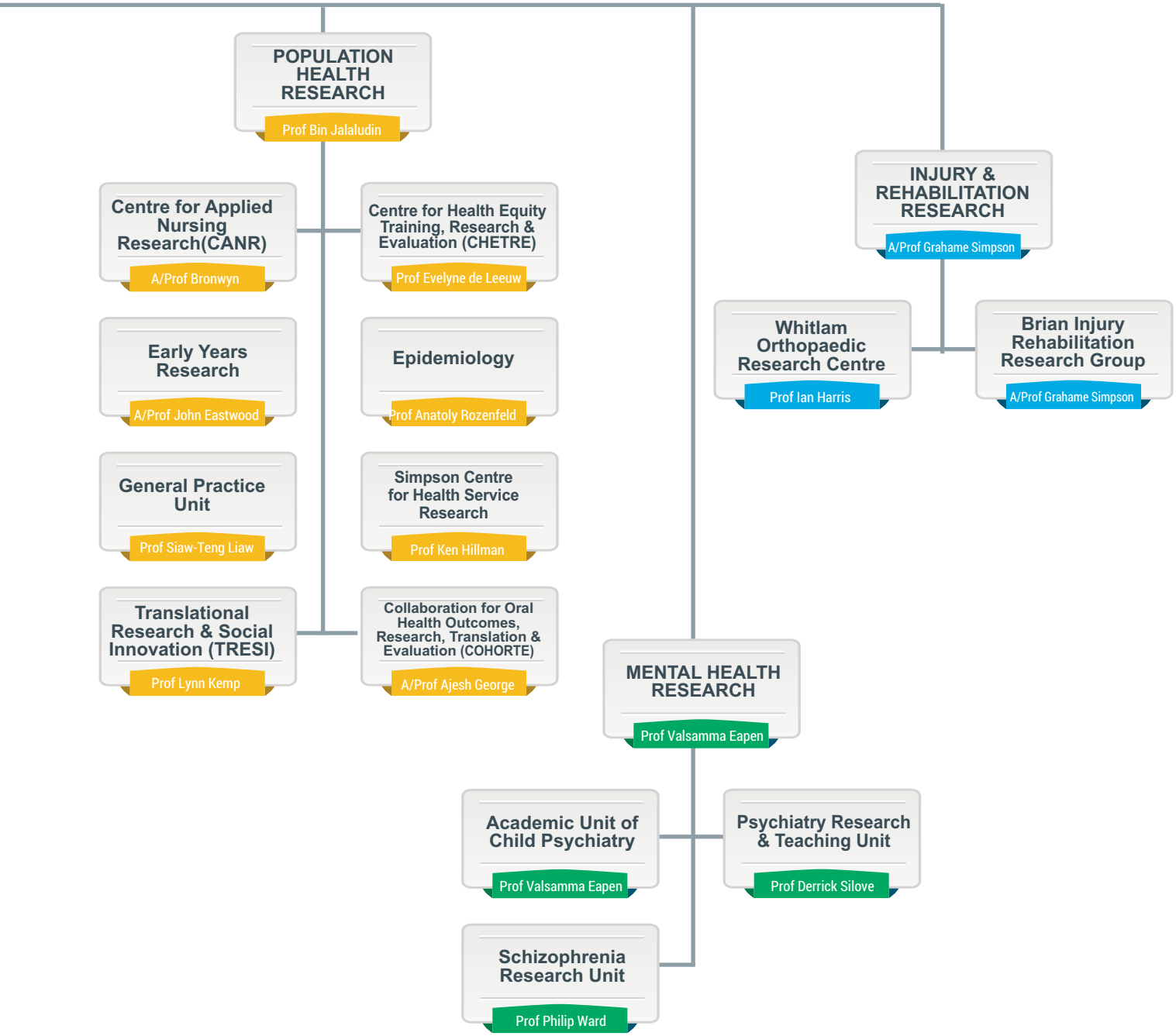
Right, changes in opioid use in patients in the five years prior to and following major orthopaedic surgery (unpublished data); (below) improvements in physiological disturbance in Emergency Department patients, from triage to final observations (One Data In Emergency Study).



RESEARCH ORGANISATIONAL STRUCTURE AND GOVERNANCE

Inspiring health. **Transforming care.**


Ingham Institute
Applied Medical Research
Prof Michael Barton
CANCER RESEARCH
Prof Geoff Delaney
CLINICAL SCIENCES RESEARCH
A/Prof Murray Killingsworth
Breast Cancer
Dr Patsy Soon
Cancer Pathology
Prof Soon Lee
Centre for Medical Radiation Physics
Prof Anatoly Rozenfeld
Collabortation for Cancer Outcomes, Research & Evaluation (CCORE)
Prof Michael Barton
Clinical Cancer Registry
Ms Nasreen Kaadan
Gastro-Intestinal Viral Oncology Group
Prof Shan Rajendra
Haematology Group
Dr Silvia Ling
Medical Oncology
Prof Paul de Souza
Medical Physics
A/Prof Lois Hollaway
Oncology Clinical Trials Unit
Dr Wei Chua
Palliative Care Clinical Trials
Prof Meera Agar
Pancreatic Research Group
Prof Minoti Apte
Psycho-Oncology Research Group
Prof Afaf Girgis
Clinical Trials
Antibiotic Resistance & Mobile Elements Group (ARMEG)
A/Prof Slade Jensen
Arthritis Research
Dr Sean O'Neill
Cardiology Centre
Prof John French
Correlative Microscopy Facility
A/Prof Murray Killingsworth
Dermatology Research Group
A/Prof Geoffrey Cains
Gastroenterology & Liver Research Group
Prof Nicholas Shackel
Heart & Brain Collaboration
Prof John Worthington
Immune Tolerance Group
Prof Suzanne Hodgkinson
Liverpool Diabetes Collaborative Research
Dr Namson Lau
Neurocognitive & Molecular Biology
Dr Daniel Chan
Respiratory Medicine
Prof Anatoly Rozenfeld
Stroke & Neurology
A/Prof Dennis Cordato


POPULATION HEALTH RESEARCH
Prof Bin Jalaludin
Centre for Applied Nursing Research(CANR)
A/Prof Bronwyn
Centre for Health Equity Training, Research & Evaluation (CHETRE)
Prof Evelyne de Leeuw
Early Years Research
A/Prof John Eastwood
Epidemiology
Prof Anatoly Rozenfeld
General Practice Unit
Prof Siaw-Teng Liaw
Simpson Centre for Health Service Research
Prof Ken Hillman
Translational Research & Social Innovation (TRESI)
Prof Lynn Kemp
Collaboration for Oral Health Outcomes, Research, Translation & Evaluation (COHORTE)
A/Prof Ajesh George
INJURY & REHABILITATION RESEARCH
A/Prof Grahame Simpson
Whitlam Orthopaedic Research Centre
Prof Ian Harris
Brian Injury Rehabilitation Research Group
A/Prof Grahame Simpson
MENTAL HEALTH RESEARCH
Prof Valsamma Eapen
Academic Unit of Child Psychiatry
Prof Valsamma Eapen
Psychiatry Research & Teaching Unit
Prof Derrick Silove
Schizophrenia Research Unit
Prof Philip Ward

OUR GOVERNANCE

The Ingham Institute's Board brings together the expertise of medical researchers, health management professionals and local business leaders. All have extensive personal experience of the diverse and dynamic population of South Western Sydney and are committed to strengthening the capacity and reputation of the Ingham Institute as a world-leading centre of research excellence.

Terry Goldacre, Chairman

Mr. Goldacre is the Managing Director of Harrington Estates (NSW) Pty Ltd. which since 1993 has been responsible for the development of the leading residential estate Harrington Park. Prior to this, he held executive positions in the civil engineering and land development industries.

Amanda Larkin

Amanda Larkin is the Chief Executive of South Western Sydney Local Health District. Previously Amanda worked as the General Manager of Camden and Campbelltown Hospitals and the Queen Victoria Memorial Home. Ms Larkin has a Bachelor of Social Work, Associate Diploma in Environmental Service and is working towards a Doctorate in Business Administration.

Professor Annemarie Hennessy OAM

Professor Annemarie Hennessy OAM is the Dean and Foundation Chair of Medicine at the University of Western Sydney. She was the Director of the Hypertensive Disorders of Pregnancy (HDP) Unit at the Royal Prince Alfred Women and Babies (RPAWB) from 1998 until October 2006 and continues in an honorary capacity within the unit.

Arnold Vitocco

Arnold Vitocco is a local Macarthur resident and licensed builder. His family's development company, D. Vitocco Constructions Pty Ltd, has been building and developing in the Liverpool and Macarthur region since the late 1950s. Notable developments by his family company include the Narellan Town Centre and Gregory Hills, a 2,500-lot subdivision and 43 hectares of employment zone.

Jim Marsden OAM

Jim Marsden OAM is the Senior Partner at Marsdens Law Group. His firm is based primarily at Campbelltown with offices at Liverpool, Camden and the City of Sydney.
Jim has a history in a number of areas of community involvement. His past involvement includes Chairman of West Magpie Rugby League, Wests Tigers, the Chamber of Commerce, and board membership of NSW Rugby League and Odyssey House.

John Hexton

Mr Hexton has over 30 years' experience in business; from 1987 to 2013 he was the Director Corporate Services and CFO at Inghams Enterprises Pty Limited. From 1987 to 2013 he was the Director Corporate Services and CFO at Inghams Enterprises Pty Limited. He has also given his time to serve on the Board of St Patricks College, Campbelltown and the Board of St Gregory's College Campbelltown where he served for ten years as the Chair of the Finance Committee.

John Ingham

John Ingham was born in Liverpool and worked at Inghams Enterprises for over 10 years in various positions and was the National Sales and Marketing Manager for a number of years. He is the Managing Director of Upstart Marketing, a Marketing Consultancy focusing on designing and managing web sites for companies large and small for over 15 years.

Scientia Professor Michael Barton OAM, Research Director

Professor Barton OAM is the Professor of Radiation Oncology at UNSW Sydney and Research Director of the Collaboration for Cancer Outcomes Research and Evaluation at the Liverpool Hospital. He has been involved in state, national and international strategic planning projects for cancer services and chairs the National Brain Tumour Guidelines Committee of the Australian Cancer Network.

Morris Iemma

Morris Iemma served as Premier of NSW from 2005-2008 and prior to that held the ministerial portfolios of Treasury, Health, Sport and Recreation, Public Works and Services, and Minister Assisting the Premier. During his Parliamentary career, he held the seats of Hurstville and Lakemba, in the South District.

Mr Iemma is currently a board member of TAFE NSW and is Chairman of Riverwood Community Centre, Miracle Babies Foundation and NSW Cancer Institute. He has also served on the Boards of Beyond

Robynne Cooke

Professor Robynne Cooke is currently the General Manager of Liverpool Hospital in Sydney NSW. She commenced her role as General Manager in April 2014. Robynne has worked previously as the Executive Director of Medical and Continuing Care Services and as the Chief Nursing Officer for Northern Health in Melbourne. She has also worked in other public health organisations across Melbourne as a senior executive for many years.

Dr Teresa Anderson

Dr Teresa Anderson is the Chief Executive of the Sydney Local Health District, providing services to more than 600,000 people in Sydney and beyond. Dr Teresa Anderson has worked in the NSW public health system for more than 30 years and has extensive experience as a clinician, manager and health service leader. She has held positions as the Director, Clinical Operations, Sydney South West Area Health Service, General Manager, Liverpool Hospital and Director of Community and Allied Health Services for the Liverpool Health Service.

Tim Bryan

Tim Bryan is the Chief Executive Officer of the Perich Group and a Chartered Accountant. He is a Founding Director and Chairman of the Finance Committee, Kids of Macarthur Health Foundation and Chairman of St Gregory's College Finance Advisory Committee. Tim has a special interest in research into childhood diseases.

Tony Perich AM

Tony Perich AM is the Joint Managing Director of Leppington Pastoral Company, Organic Fertilisers [Leppington], the Greenfields Development Company, Arrowvest, Narellan Town Centre and Dart West Development Ltd. Tony has an outstanding record of service within the local community having previously served as President of Narellan Rotary, Chairman of the Fundraising Committee for the Spastic Centre's Growthpoint Project in Liverpool, Vice-President of the Narellan Chamber of Commerce and President of the Dairy Research Foundation of the University of Sydney.

Professor William Ledger

Professor Ledger is Senior Vice Dean of the Faculty of Medicine and Professor of Obstetrics & Gynaecolog, UNSW Sydney and Head of Reproductive Medicine at the Royal Hospital for Women.

How You Can Help

We are dedicated to translating our discoveries from the bench to the bedside and straight into the community in order to develop new and improved treatments for various diseases and improve health for all from South Western Sydney and beyond.
However a medical research facility cannot operate and achieve breakthroughs without support and funding from the community. We need the community's help to spread the word and increase public support so that we continue to make a difference in our community.

Regular Giving
By scheduling a regular donation to the Ingham Institute you can help provide researchers with a sense of funding certainty allowing them to focus more of their time on their work rather than searching for funds. Even a small amount given regularly can add up to a significant contribution over time and every bit counts.

Scholarships and Fellowships Funding Opportunities
Our next generation are the lifeblood of medical research, and the Ingham Institute has a strong commitment to foster the development of young medical researchers to encourage the broader thinking and new insights that are needed to support research innovation. Individuals and organisations can help Australia's next generation of medical research talent by funding Scholarships and Fellowships for students to help them grow and establish successful careers at the Ingham Institute.

Join or Host an Event
There are many different and fun ways you can fundraise for the Ingham Institute to help us in our mission to save and improve lives. We encourage individuals, community groups, organisations and companies to support our vital work by joining our annual community events – Ladies Luncheon, Charity Golf Days, Awards Dinner, Gala Ball, Fun Runs or by hosting your own evens to raise funds for our medical research programs. You can select the disease area or program you wish to support and fund us on "Go Fundraise" to quickly to easily get started.

Include Us in Your Will
A gift in your Will is a great way to support the Ingham Institute to conduct medical research into critical disease areas which one day will improve the health and wellbeing of all Australians.

Workplace Giving
Workplace Giving deductions are made through your payroll account. With your ongoing support through the Workplace Giving, together we can improve the health and wellbeing of all Australians.

In Celebration
Add distinct meaning to your special occasion by asking guests to donate to the Ingham Institute in place of giving gifts. This donation is a great idea for Christmas, Weddings, Mother's Day, Father's Day and birthdays, where together you can honour someone special in your life who has been affected by cancer, disease or injury.

In Memory
In honour of losing a loved one who has passed, you can request friends and relatives to make a gift to the Ingham Institute in their memory. In lieu of flowers, mourners can commemorate the passing of a loved one by making a donation to Medical Research at the Ingham Institute.

Corporate Engagement
The Ingham Institute welcomes the support of the business community, whether you're a small or large business entity.

Purchase a Medical Researcher's Book
Some of our medical researchers and surgeons have authored books based on their extensive research and life experience. You can purchase a book online at www.inghaminsitute.org.au

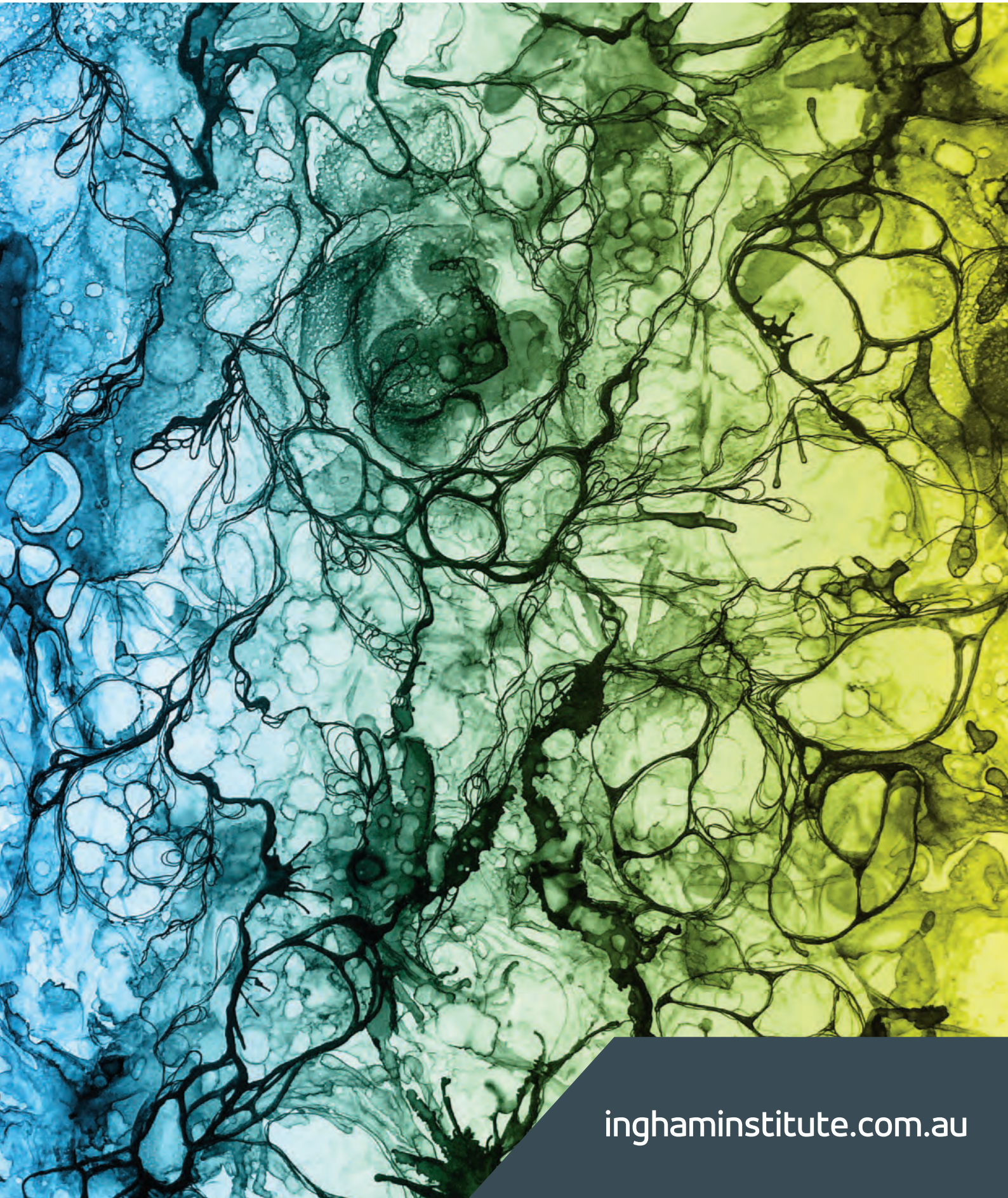
Purchase Artwork
A unique collaboration between internationally recognised Australian artist Celeste Wrona and our 3D Microscopy research group has resulted in the creation of a limited number of stunning artworks available only through the Institute.

For further information about the various ways that you or your organisation can partner with the Ingham Institute to improve the health of all Australian communities, please call 1300 66 55 41 or email research@inghaminstitute.org.au

100% of all funds raised go to support medical research programs at the Ingham Institute.

Ingham Institute

Applied Medical Research



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