IHBI

QUT ihbi
Institute of Health and Biomedical Innovation

ANNUAL REPORT 2016

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Contents

A message from the Executive Director

Collaboration and funding at the heart of a successful year

IHBI researchers strive to translate their research into better healthcare, developing new therapeutics and effective preventative strategies; and improving quality of life. In 2016, they took great strides in advancing their research, with significant competitive funding, collaboration with researchers from around the world and access to the latest technology. Researchers worked with clinicians and their patients, built partnerships with industry and took seriously their role in sharing knowledge to ensure their work had a focus on relevance and impact.

It was pleasing to see that IHBI researchers will have major roles in establishing important facilities to advance translation, including Professor Dietmar W Hutmacher's lead in securing Australian Research Council (ARC) funding for an Industrial Transformation Training Centre in Additive Biomanufacturing. The Centre will develop cutting-edge 3D printing technologies that can be introduced in hospitals and clinics to treat patients with muscoskeletal injuries; establish a new sector in advanced manufacturing; and train the next generation of scientists and innovators.

Professor Matt Brown had a successful 2016, with a pivotal role in the establishment of the Australian Translational Genomics Centre at the Princess Alexandra Hospital in Brisbane; and a research base and clinical service provision at Wenzhou Medical University's First Affiliated Hospital in China. The initiatives have the potential to improve healthcare for large numbers of people and advance research into the causes of common cancer types.

IHBI researchers also benefited from the opening of the Johnson & Johnson Innovation Partnering Office at QUT in 2016 and QUT's signing of two agreements with Janssen Biotech. The agreements will enable development of a saliva-based heart disease diagnostic test; and a personalised treatment for ankylosing spondylitis and other auto-immune diseases.

IHBI researchers worked with industry and government in 2016 to undertake clinical trials on Alzheimer's disease; evaluate new targeted therapies; inform development of a chlamydia vaccine; implement a standardized national pollen alert system; and develop innovative, high resolution air quality networks.

IHBI also established a new distributed site at QIMR-Berghofer in 2016. Collaboration with experts at QIMR-Berghofer and access to state-of-the-art facilities will enable translation of IHBI research, primarily in infectious disease. IHBI research into emerging mosquito-borne viruses including chikungunya virus will benefit, as well as studies aiming to disarm bacteria that can cause common infections; and reduce dengue virus transmission.

Professor Nathan Subramaniam was appointed in 2016, enabling him to collaborate with IHBI experts in cell and molecular bioscience, cellular models and genetics to advance his work. The appointment also introduces a new research area: liver disease.

IHBI researchers have secured competitive national funding in 2016, collaborated widely and ensured a focus on relevance to advance their endeavours towards translation – and ultimately to better health in our lifetime.

Professor Lyn Griffiths

IHBI Executive Director
April 2017

IHBI 2016

2016 overview

Researchers secured funding and cemented collaborations with industry, clinicians and leading research institutes around the world, enabling advances in key research areas and providing IHBI with major successes in 2016.

IHBI continued to advance activities that aligned with its focus on research excellence, relevance and impact and with disease areas identified nationally and globally as strategically important. Major successes in 2016 enable IHBI researchers to:

- Work with patients in both Australian hospitals and those overseas, including Wenzhou in China
- Access state-of-the-art facilities and expertise, such as at QIMR-Berghofer
- Understand underlying disease biology, genetics and progression
- Undertake clinical trials that show promise in improving people's treatment and quality of life
- Train the next generation of scientists and innovators
- Develop an advanced manufacturing industry, with a global perspective and impact.

IHBI achieves across key performance indicators

IHBI's key performance indicators (KPIs) are defined by the IHBI Executive, QUT. A KPI of increasing student numbers has been achieved in 2016, while research income and publication outcomes continue to be substantial.

IHBI's KPIs are also strongly aligned with the requirements of Queensland's Department of Science, Information Technology and Innovation. The KPIs address employment, collaboration, technology transfer and commercialisation

KPI	2006	2014	2015	2016*
External Income	$20 133 104	$41 602 035	$48 421 975	$45 750 319
Academic impact: Publications	380	874	984	926
HDR students: domestic	204	411	494	451
HDR students: international	52	211	197	216

Table 1: IHBI maintained sound achievement of its KPIs
*provisional data based on 31 December 2016 figures

Impact

IHBI research is having an impact in advancing knowledge in the field, developing treatments of the future and training the next generation of scientists, engineers and clinicians. At the core is a culture of research excellence, wide collaboration with the best minds and support from competitive funded grants.

Image: Professor Dietmar W Hutmacher

Professor Dietmar W Hutmacher is working with Professor Yin Xiao and associate professors Mia Woodruff and Travis Klein to develop cutting-edge 3D printing technologies that can be introduced in hospitals and clinics to treat patients with muscoskeletal injuries as well as bone and breast cancers.

Professor Hutmacher directs the Australian Research Council (ARC) Industrial Transformation Training Centre (ITTC) in Additive Biomanufacturing, awarded new funding in late 2016.

Additive biomanufacturing, another term for 3D printing, enables the researchers to custom-design and manufacture medical implants as well as scaffolds that encourage cell growth and tissue regeneration.

Professor Hutmacher said the centre aimed to establish and grow a new sector in the advanced manufacturing industry. ‘The centre will address the training priorities of advanced manufacturing; mechatronics, biomedical engineering, product design and development; and entrepreneurship,’ he said.

The centre is expected to train 12 PhD students and three postdoctoral research fellows in its first four years of operation, providing them with science, technology, engineering and mathematical skills and business acumen. ‘We want PhD students to be skilled up to form the backbone of a new generation of innovators in the Australian advanced manufacturing industry, with a global perspective and impact,’ Professor Hutmacher said.

It builds on a collaboration between QUT, the University of Wollongong, the University Medical Centre Utrecht in the Netherlands and the University of Würzburg in Germany that has established a Masters in Biofabrication program.

The centre’s research has a focus on three themes, involving the 3D printers, the bio-inks they use and their introduction into hospitals and clinics. ‘3D printers must be developed for a range of materials to engineer a variety of tissues in a manner that is suitable for clinical applications,’ Professor Hutmacher said.

For example, the printers need to work in such a way and use specific bioinks to fabricate implants with biomaterials such as hydrogels, biodegradable polymers, ceramics and metals. Some will remain in the body as permanent implants, such as printed titanium cages used for spinal fusion surgeries. Other implants will encourage the correct tissue to grow and then dissolve in time as the tissue replaces it.

Professor Hutmacher will lead a program working with national and international industry partners to develop multi-material and multifunctional printers that can manufacture medical devices and implants in large quantities.

Professor Xiao and associate professors Woodruff and Klein will work with peers to consider the special requirements for bio-inks to deliver formulations with controlled biodegradability and bioactivity on a large scale.

Associate Professor Klein will also work with clinicians at St Vincent's Health and the Peter MacCallum Cancer Centre on the clinical use of additive biomanufacturing, including in advancing radiotherapy, customising 3D printed titanium implants and developing therapies for cartilage defects.

Next to QUT, three other Australian universities are leaders in additive manufacturing: the University of Wollongong, RMIT and Deakin University. All are members of the ITTC, alongside national and international industry partners Anatomics, Osteopore, St Vincent's Hospital, Peter MacCallum Cancer Centre, Shanghai Institute of Ceramics and Cochlear.

Professor Xiao leads the Australia-China Centre for Tissue Engineering and Regenerative Medicine at IHBI, involving collaboration with top universities and research institutes in China and providing access to a talent pool of students suitable for recruitment to the new training centre.

- **Professor Matt Brown** was the recipient of a National Health and Medical Research Council (NHMRC) Senior Principal Research Fellowship, with $876 004 for a project entitled Solving the causes of and development of new therapies for ankylosing spondylitis and related diseases.
- **Professor Patsy Yates** led a successful NHMRC Project Grant bid, securing $713 418 for a research project entitled A sequential multiple assignment randomised trial (SMART) of nursing interventions to reduce pain associated with chemotherapy induced peripheral neuropathy.
- **Professor Leanne Hides** received a NHMRC Senior Research Fellowship, with $715 209 for the project Early interventions for Primary and Comorbid Substance Use in Young People: Engagement, Innovation, Technology and Translation.
- **Professor Nathan Subramaniam** secured a NHMRC Senior Research Fellowship, with $640 209 for a project entitled Liver Injury and Iron Homeostasis in Health and Disease.

'We want PhD students to be skilled up to form the backbone of a new generation of innovators in the Australian advanced manufacturing industry, with a global perspective and impact.'

- **Professor Adrian Barnett** was successful in obtaining a NHMRC Senior Research Fellowship, with $640 209 for the project Meta-research: Using research to increase the value of health and medical research.
- **Professor Lyn Griffiths** led a successful NHMRC Project Grant bid, securing $632 188 for a research project entitled Identifying novel gene mutations for molecular diagnosis of Familial Hemiplegic Migraine.
- **Dr Francesca Frentiu** led a successful NHMRC Project Grant bid, securing $529 896 for a project entitled New vectors, new diseases: Understanding the risk of chikungunya transmission in Australia.
- **Associate Professor Kirsten Vallmuur** led a successful Australian Research Council (ARC) Discovery Project bid, securing $407 128 for a project entitled Evaluating consumer product regulatory responses to improve child safety.
- **Professor Matthew Simpson** led a successful ARC Discovery Project bid, securing $395 806 for the project Mathematical models of cell migration in three-dimensional living tissues.
- **Dr Graham Johnson** led a successful ARC Discovery Project bid, securing $306 467 for a project entitled Modulation of air-conditioning settings to destroy respiratory viruses.
- **Associate Professor Andrew Zele** led a successful ARC Discovery Project bid, securing $239 806 for a project entitled Melanopsin Function in Humans.
- **Dr Mark Adams** secured a NHMRC Project Grant, with $194 445 for a project entitled Improving treatment of non-small cell lung cancer: suppressing cell division cycle associated protein 3 (CDCA3).

Achievements of outstanding researchers

IHBI has built a culture of research excellence that translates into better healthcare and adds important knowledge in scientific fields. Peers, peak bodies and government agencies recognise the excellence through high-level awards, honorary memberships and fellowships.

Image: Dr Makrina Totsika

IHBI's Dr Makrina Totsika had a successful year in 2016, resulting in financial support and awards recognising her important research in infectious disease.

Dr Totsika is developing therapeutics that show promise in disarming bacteria that can cause common infections. Many common human infections that used to be treated successfully with antibiotics, such as cystitis and diarrhoea, are showing resistance, making them virtually untreatable and lethal.

Dr Totsika is using the support of a **QUT Vice-Chancellor's Research Fellowship** to focus her research on a pathogen's virulence factors. The factors are known to be involved in determining a pathogen's ability to cause disease and are often missing from harmless, or even beneficial, bacteria that tend to form a mutually beneficial relationship with their human hosts.

She is developing a novel class of antimicrobials that will disarm pathogens by targeting virulence mechanisms rather than trying to kill them, as antibiotics aim to do.

'Because antibiotics are designed to kill pathogens, their use inevitably selects for bacteria in the population with natural genetic changes that allow them to grow in the presence of antibiotics,' Dr Totsika said. 'Resistance is a natural phenomenon as old as bacteria but antibiotic overuse and misuse has led to the alarming rates of resistance we see today worldwide.

'I am developing novel anti-virulence antimicrobials that will be a much-needed alternative to failing antibiotics and will impose less selection pressure for resistance development. The aim is to inhibit pathogen mechanisms that will selectively eliminate infecting bacteria, without harming the host and beneficial bacteria.'

Dr Totsika aims to target a pathogen's adherence, a critical first step in the infection process. Adhesins are cell-surface appendages of bacteria that enable adherence to other cells or to a body's surfaces. Adhesins are a type of virulence factor.

Bacteria are typically found attached to surfaces and in immobile clusters known as biofilms. Adhesins serve both as anchors and provide surface recognition, allowing the targeting of bacteria to a particular surface such as a specific tissue type or even medical implants.

Evaluating several inhibitors that block bacterial adhesion will enable Dr Totsika to progress them to anti-adhesion therapeutics that can treat and prevent infection, slow a pathogen's resistance and prevent disruption of a person's beneficial bacteria.

'My work has already significantly advanced our understanding of bacterial adherence: from adhesin gene identification to adhesin structure and function. The understanding is now guiding us in developing novel anti-adhesion therapeutics that can block bacterial adherence and be used to treat infections.'

Through two ongoing National Health and Medical Research Council (NHMRC) project grants involving collaboration with leading experts in Australia and the US, Dr Totsika's research is expected to lead to next-generation antimicrobials that will be tailored to each patient's infection.

Dr Totsika's success in research, combined with excellence in communication and community engagement, were recognised with a joint Queensland Young Tall Poppy of the Year Award in 2016. She was also the recipient of the 2016 Australian Society for Medical Research (ASMR) Senior Researcher Award.

The Young Tall Poppy Science awards recognise intellectual and scientific excellence and encourage young Australians to pursue careers in science.

Dr Totsika said it was important for researchers to be involved in outreach activities, demonstrating the value of science and the satisfaction that came from contributing to society through scientific endeavours.

'I believe science and technology will make the single biggest contribution to shaping the world we live in tomorrow and into the future. It is important for people to appreciate what scientists are doing to shape that world. I believe I am part of both shaping the future through my research; and including people in the journey through my outreach activities.'

OTHER IHBI ACHIEVEMENTS

- **Adjunct Professor Sue Hooper** was recognised in the Queen's Birthday Honours list in 2016, made a Member of the Order of Australia (AM) for her significant service to sport, particularly through applied science and medicine, to tertiary education as an academic and researcher, and to swimming.
- **Professor Nathan Efron** was presented with Optometry Australia's H Barry Collin Research Medal in recognition of outstanding contributions to the advancement of knowledge in optics, vision science or clinical optometry.
- **Dr Mark Adams** won the Postdoctoral Researcher Award at the 2016 Australian Society for Medical Research (ASMR) Queensland Health and Medical Research Awards.
- **Professor Louise Cullen** was the winner of the Clinical Researcher Award at the same ASMR event.
- **Kerry Hall** was awarded the Respiratory Nurses Special Interest Group Award for best presentation at the Thoracic Society of Australia and New Zealand's annual scientific meeting in 2016. She received the society's Indigenous Respiratory Nurses Travel Award to attend the meeting.
- **Dr Helen Petsky** received the inaugural Hudsons Coffee Early Career Fellowship in Asthma Research.
- IHBI Executive Director **Professor Lyn Griffiths** was inaugurated as a Fellow of the Queensland Academy of Arts and Sciences.
- **Professor David Kavanagh** was one of 39 new Fellows installed at The Australian Academy of Social Sciences.
- **Professor Michael Collins** was appointed an Association for Research in Vision and Opthalmology Silver Fellow, recognising members for their individual accomplishments, leadership and contributions to the association.

International collaborations

Collaborative partnerships enable IHBI researchers to work with the best minds from around the world to provide solutions for pressing global medical issues. Funding from international organisations enable the knowledge sharing and formation of teams of critical mass for targeting infectious diseases, tissue repair and improvements in cancer survivorship.

Image: Professor John Aaskov

A collaboration with researchers from Singapore and funding from the US Defence Advanced Research Projects Agency is driving IHBI Professor John Aaskov's infectious disease research towards the reduction of dengue virus transmission in the developing world.

Professor Aaskov aims to provide an additional tool that reduces the estimated 100 million cases of dengue that occur annually, causing thousands of deaths and impacting significantly on the finances of people in areas such as South East Asia.

He is leading a team that includes researchers from around QUT, QIMR-Berghofer and the National University of Singapore.

The research involves combining vector control, immunisation and individual patient therapy with transmissible interfering particles (TIPs). The three-pronged approach during the six-month dry season is expected to create a 'population bottleneck' in mosquitos that transmit dengue.

'Present dengue mosquito control programs aim to kill adult insects and to reduce the breeding of larvae by eliminating breeding sites,' Professor Aaskov said. 'It also aims to minimise the exposure of people to mosquito biting. There is little evidence that the measures are reducing the number of cases of dengue or the burden of the disease.

'We believe it is possible to create a population bottleneck that causes such an intense reduction of dengue virus fitness that the number of dengue cases the following wet season are reduced significantly – or transmission ceases completely.'

Professor Aaskov's research targets the genome, or complete set of genes, of dengue viruses, building on his previous research with colleagues in identifying naturally-occurring dengue viruses with most of their genome missing. The defective interfering viral particles compete with normal, functional, viruses to reduce the levels of infectious virus.

'We have identified a pathway for the production of TIPs, their pre-clinical testing and initial evaluation in people immunised with a live attenuated dengue vaccine,' he said.

The pathway has to overcome a major challenge of producing enough TIPs cost effectively, and free from any contaminating infectious dengue virus. The research collaboration has demonstrated an ability to produce TIPs and to purify and enrich them on a laboratory scale for potential use in people.

Beyond the first two years of the research, the challenges include the scale-up of TIP production in facilities able to produce vaccines for use in humans and then the roll out of the novel therapy.

Professor Aaskov will lead a multidisciplinary team with collaborators. Researchers from Duke-NUS in Singapore will identify the molecular basis for the action of dengue virus defective interfering particles.

QIMR Berghofer entomologists will determine the role of mosquitoes in the transmission of defective dengue virus particles and molecular biologists will develop novel methods for the production of the defective interfering particles that avoids the use of infectious virus. Modellers from QUT's School of Mathematics will use data generated from the research to estimate the likely impact of the therapeutic use of defective interfering dengue virus particles.

Professor Aaskov is Professor of Virology at QUT and Director of the World Health Organisation Collaborating Centre for Arbovirus Reference and Research. His work as a consultant has included working on Asia Development Bank funded projects to enhance the capacity of Ministry of Health diagnostic laboratories in Vietnam, Laos, Cambodia and Myanmar.

His work involves biology and genetics to understand dengue and its spread; and collaboration with clinicians, virologists, immunologists and public health experts to ensure vaccines produce the levels of 'herd immunity' to provide comprehensive protection.

Despite rapid developments in the diagnosis and treatment of many communicable diseases, most patients in the Asia Pacific region do not have infections properly diagnosed and often have inappropriate treatment. Furthermore, most Ministries of Health have no reliable mechanism to evaluate public health interventions.

'There are enormous challenges in the health systems of many of our neighbouring countries and there are compelling social and political reasons for Australians to become more engaged in addressing them,' Professor Aaskov said.

OTHER IHBI INITIATIVES

- The Australia-China Centre for Tissue Engineering and Regenerative Medicine was awarded a Global Connections Fund Priming Grant, with $7000 to support and encourage Australian researchers to engage with international small-to-medium enterprise. Professors Yin Xiao and Ross Crawford were awarded the funding to travel to Wuhan in China for developmental meetings with partners from Asia Biomaterials Co Ltd to discuss the commercialisation and clinical translation of bone biomaterials.
- **Professor Matt Brown** received the prestigious West Lake Friendship award, the highest honour for foreign experts from Zhejiang province in China, in acknowledgement of his contribution to the province's economic and social development. The award recognised Professor Brown's work with the Wenzhou Medical University's first Affiliated Hospital, in the city of Wenzhou.
- **Professor Sandi Hayes** secured a project grant from the World Cancer Research Fund for a project to evaluate the effect of exercise during chemotherapy for women with ovarian cancer.
- IHBI hosted the German Minister of State Ingrid Fischbach, representing the Federal Ministry of Health, giving IHBI researchers the opportunity to showcase research and policy.
- In conjunction with the Australia Iran Trade and Industry Council, Kaden Boriss Legal and Crowe Horwath, IHBI hosted an evening featuring the Ambassador of the Islamic Republic of Iran, His Excellency Mr Abdolhossein Vahaji, in September. The topic of the evening was Iran and Australia: New Markets, New Opportunities.
- Adjunct Professor and former director of IHBI's Centre for Accident Research and Road Safety – Queensland, **Professor Barry Watson**, was honoured with an invitation to address the United Nations in support of a special resolution to improve global road safety. Professor Watson now holds the position of chief executive officer of the Global Road Safety Partnership.

Industry involvement

IHBI researchers have a focus on commercial application and clinical relevance, enabling collaboration and contract work with companies on product development, clinical trials, injury prevention and treatments. The goal is the development of vaccines, therapeutics, diagnostic tests, rehabilitation devices, online interventions and health management systems.

Image: QUT Vice-Chancellor Professor Peter Coaldrake at the launch of the Johnson & Johnson Innovation Partnering Office at QUT

Genomics Clinical Trial Centre

IHBI Executive Director Professor Lyn Griffiths heads IHBI's Genomics Clinical Trial Centre on the Gold Coast and directs four industry-sponsored Phase III clinical trials looking at treatments or preventions for Alzheimer's disease. Professor Griffiths has expertise in conducting both investigator-led trials into migraine therapies and multiple sclerosis; and sponsored trials investigating Alzheimer's disease.

Working with pharmaceutical partners on sponsored clinical trials provides IHBI researchers an opportunity to be involved in the investigation and translation of the latest research relating to disease treatment and prevention. Sponsored clinical trials also give the researchers experience with the regulatory process required for the investigation and translation of new drug treatments and therapies prior to approval for use in the community.

TOMMORROW study

The Takeda/Zinfandel sponsored TOMMORROW study seeks to learn more about the earliest stages of Alzheimer's disease. It aims to understand the genetic risk factors of developing mild cognitive impairment (MCI) due to Alzheimer's disease using a genetic blood test.

It will evaluate whether a new investigational test involving two specific genes, called APOE and TOMM40, that have been previously shown to increase the risk of developing Alzheimer's disease, can predict a person's risk for developing mild cognitive impairment in the coming five years. The second goal of the study is to explore whether an investigational medication will delay the first symptoms of MCI due to Alzheimer's disease in people who are cognitively normal.

Recruitment for the trial concluded in July 2016, with participants continuing on the trial treatment for a further five years while being assessed for changes in their cognitive state.

The study is a global Phase III clinical trial that has recruited more than 5000 healthy participants in about 50 study centres worldwide.

A second extension study seeks to follow participants for up to a further six years to determine the efficacy of the treatment once symptoms of cognitive impairment have been detected during the initial study period.

EARLY study

The EARLY study, sponsored by Janssen-Cilag, is investigating the efficacy of a treatment for patients at risk of developing Alzheimer's disease and will follow their cognition and functional responses to the treatment for a five-year period.

Peptides called amyloid beta are found at high levels in the brains of people with Alzheimer's disease and are believed to be a key feature of the progression of the disease. The investigational medicine that is the focus of the EARLY study is designed to prevent the production of amyloid beta fragments in the brain as well as to reduce the formation of new fragments. The treatment aims to slow down and possibly prevent the cognitive and functional decline associated with Alzheimer's disease.

ENGAGE trial

The Biogen-sponsored ENGAGE trial is investigating a treatment aimed at slowing cognitive and functional impairment for patients already displaying symptoms of Alzheimer's disease. The trial will follow patient outcomes on the investigational treatment for 18 months.

The ENGAGE study is investigating whether a monoclonal antibody has the potential to be a safe and effective treatment to slow disease progression in people with early symptoms of Alzheimer's disease. The treatment has already had limited testing in humans for safety and efficacy and is now being tested in a larger number of people to determine if it binds amyloid beta, removes existing deposits and stops new deposits from forming.

The ENGAGE study will be undertaken for about four years and consists of two treatment phases, with an initial 18-month treatment period that includes a placebo group; and an optional two-year extension phase.

Johnson & Johnson Innovation Partnering Office @ QUT

Johnson & Johnson Innovation opened a Partnering Office at QUT in 2016 to engage with, mentor and support researchers and companies in life sciences. The office is a joint initiative between QUT, the Queensland Government under the Advance Queensland program and Johnson & Johnson Innovation to support innovative research, deliver new products and services, grow the Queensland economy and create jobs.

Agreements have been signed between J&J subsidiary Janssen Biotech and QUT. Associate Professor Chamindie Punyadeera will work with Janssen Biotech to develop heart disease diagnostic tests using saliva. Professor Matt Brown will lead a collaboration to develop a personalised treatment for ankylosing spondylitis and other auto-immune diseases.

More than 600 stakeholders attended networking events, educational seminars, roundtables and briefings since the Partnering Office launch in June 2016. The Partnering Office hosted six Johnson & Johnson international experts and connected them with leaders in the Queensland life sciences community.

OTHER IHBI INITIATIVES

- QUT is involved in the TRI Innovation and Translation Centre in collaboration with Siemens Healthcare, the University of Queensland, Queensland Health and Mater Research, providing IHBI researchers the capability to develop the imaging technology and protocols needed to evaluate new targeted therapies and new cancer vaccines.
- **Professor Dietmar W Hutmacher** secured $705 000 in State Government funding to develop world-first 3D printing technology around breast scaffolds for reconstructive surgery, partnering with the Translational Research Centre, Biofabrication Design Solutions, and 3D Industries.
- **Professor Lidia Morawska** led a team that received an Australian Research Council (ARC) Linkage Grant, with $450 535 to develop innovative, cost-effective, high resolution air quality networks, including collaborating with the Office of Environment and Heritage, Department of Science Information Technology and Innovation, EPA Victoria and the Bureau of Meteorology.
- **Professor Andry Rakotonirainy** was part of a team led by the University of NSW that received an ARC Linkage Grant to investigate the impact of autonomous vehicles on driver behaviour.
- **Professor Ken Beagley** is part of a new partnership between QUT, the University of Queensland and Dreamworld that aims to enhance genetic diversity and produce disease-free koalas for release into the wild. Professor Beagley's chlamydia vaccination expertise will help protect captive-bred animals against infections and what is learned in koala vaccine development can be used to inform the development of human ones.
- **Associate Professor Janet Davies** was awarded a National Health and Medical Research Council Partnership Project Grant to implement a standardised national pollen alert system, providing allergy and asthma patients with accurate and localised information on pollen counts to reduce symptoms and improve quality of life. Partners include the CSIRO and Canberra Hospital.

Clinical application

IHBI researchers collaborate with healthcare professionals who will use the technologies flowing from the research, apply the processes and treat the patients. To understand complex medical issues, researchers are based at multiple sites, including hospitals and specialist institutes, and work with doctors, nurses, support staff, therapists, carers, patients and their families. They also work with industries that develop equipment, aids and implants.

Image: Professor Matt Brown

Professor Matt Brown: Personalised care for cancer patients

Professor Matt Brown is working with patients and clinicians to predict how their cancer will behave, mutate and respond to treatment. His research team is sequencing samples of the cancers and identifying the mutations, with an initial focus on developing personalised medicine approaches for people with leukaemia, lung, gastric, head and neck, and colorectal cancer.

Boosting Professor Brown's research is the establishment of the Australian Translational Genomics Centre at the Princess Alexandra Hospital to enable clinical genomics diagnostic information to guide treatment options.

Professor Brown joined IHBI in 2016 as QUT Director of Genomics. He also has a clinical appointment at the Metro South Hospital and Health Service (MSHHS) and is an eminent staff clinician and research scientist specialising in rheumatology. MSHHS is a region that includes the Princess Alexandra, Greenslopes and Logan hospitals.

He is also conducting research in China and has established a research base and clinical service provision at Wenzhou Medical University's First Affiliated Hospital.

'We are very excited about the potential of this partnership to deliver both improved healthcare for large numbers of people but also fantastic research into the causes of common cancer types,' Professor Brown said.

Techniques used in his research team such as genome sequencing can reveal mutations in DNA that influence diseases including cancer. Sequencing RNA can show a change in levels in response to environmental factors and provide a broader understanding of a person's state of health.

'Personalised medicine has the potential to create a treatment approach specific to individual patients and open the door to better diagnoses, earlier intervention and development of more efficient therapeutics.'

Dr Anjali Jaiprakash: Robotics to improve knee surgery

IHBI's Dr Anjali Jaiprakash is part of research to introduce robotics to keyhole knee surgery to improve precision and reduce the risk of unintended tissue damage.

Dr Jaiprakash is working with surgeons and industry to better understand the challenges and design tools and practices to advance knee surgery with the use of robotics. The work includes the use of cameras to capture 3D images that will enable analysis of arthroscopic procedures; working with surgeons to identify issues such as visibility and ergonomics during surgery; and design of a robot that will move a patient's leg with precision to maximise access.

'It is a multi-faceted project,' Dr Jaiprakash said. 'It involves an understanding of surgery, orthopaedic research, robotics, design and advanced manufacturing.'

Support from an Advanced Queensland Early Career Research Fellowship will enable her to extend collaborations with global orthopaedics company Stryker, the Prince Charles Hospital and the Holy Spirit Northside Hospital.

Dr Jaiprakash is collaborating with IHBI Professor Jonathan Roberts, considered one of Australia's leading robotic scientists and tasked with advancing QUT research in medical robotics. She is also working with IHBI orthopaedic surgeon Professor Ross Crawford.

The team has set its sights on reducing hospital stays during recovery from knee surgery, enabling hospitals to treat more patients, reduce waiting lists and improve efficiencies.

Robotic technology has the potential to advance surgery on other body areas, such as hip, shoulder, ankle or wrist procedures. Beyond orthopaedics, the technology has the potential to improve efficiencies and decrease complications in procedures such as laparoscopic surgery, colonoscopies and endoscopies.

'The development of autonomous robotic arthroscopic surgery is a ground-breaking field within medicine,' Dr Jaiprakash said.

'In the future such technology has the potential to allow for the treatment of a greater number of surgical cases in locations such as rural and regional Queensland via the integration of telemedicine coupled with improved training regimes and availability of skilled surgeons.'

'The development of autonomous robotic arthroscopic surgery is a ground-breaking field within medicine.'

- QUT is partnering with Metro North Hospital and Health Service to establish the Herston Biofabrication Institute, led by IHBI **Associate Professor Mia Woodruff**, the first in Australia dedicated to 3D technologies for the hospitals of the future. Queensland Minister for Health and Minister for Ambulance Services, the Hon Cameron Dick MP made the announcement in 2016. IHBI research will be at the core of the institute's aim of advancing knowledge and technology in 3D scanning, modelling and printing of bone, cartilage and other human tissue to repair tissue that is lost or damaged due to disease or injury.
- IHBI orthopaedic surgeon **Professor Ross Crawford** led Australia's first robot-assisted hip surgery in 2016. The surgery advanced Professor Crawford's investigations into the potential use of health and medical robotics in precision keyhole surgery and in orthopaedic procedures. Professor Crawford headed up IHBI's Medical Engineering Research Facility at the Prince Charles Hospital in 2016, where he undertakes research in orthopaedics, medical devices, tissue engineering and total hip and knee replacements.
- **Professor Christian Langton** has invented an approach enabling ultrasound waves to pass through the skull without distortion, potentially providing a low-cost and portable method for diagnosing brain disorders such as Parkinson's disease. Members of his research team are also investigating ultrasound uses in predicting the mechanical integrity of bones and improving cancer tumour diagnosis and treatments.
- **Professor Philip Baker** has been collaborating with researchers from the University of Malaysia, producing a review in the Cochrane Library in 2016 that aims to address a gap in evidence about the efficacy of interventions to prevent the occurrence and reoccurrence of elder abuse.

Excellent facilities for translating research

IHBI facilities and researcher placement at strategically important locations combine to enable advances in scientific discovery and movement towards commercialisation and clinical application. State-of-the-art equipment is matched with multidisciplinary teams of researchers, engineers and clinicians to advance work in areas such as infectious disease.

Image: Dr Francesca Frentiu

Access to the largest PC3 and QIC3 insectary in the southern hemisphere enables Dr Francesca Frentiu to further studies into emerging mosquito-borne viruses that pose a rapidly escalating risk to global health.

Dr Frentiu is using a National Health and Medical Research Council (NHMRC) Project Grant to understand the risk of chikungunya virus (CHIKV) transmission in Australia. The country lacks a CHIKV management strategy and, critically, the evidence base to formulate effective public health responses.

Dr Frentiu aims to determine transmission rates of CHIKV in Australian populations of two mosquito species, *Aedes aegypti* and *Aedes albopictus*, under both present and projected climate change scenarios. The research also involves constructing spatiotemporal maps using statistical and mathematical models to identify future risk areas for CHIKV transmission.

The research involves collaborations with QIMR Berghofer Mosquito Control Laboratory head Associate Professor Gregor J Devine; London School of Hygiene and Tropical Medicine's internationally recognised parasitology modeller Dr Laith Yakob; and Monash University and Pennsylvania State University Professor Elizabeth McGraw.

IHBI researchers in infectious disease relocated to QIMR Berghofer in 2016 as part of a partnership that promotes greater collaboration and involves IHBI researchers having access to specialist health and medical research facilities at the QIMR-B complex. QUT research strengths in health sciences, automation, big data, mathematics and technology will complement QIMR-B's biomedical science expertise.

The access extends to use of the PC3 insectary, ideal for studying exotic mosquito-borne pathogens that pose a threat to Australia. State-of-the-art temperature and humidity-controlled incubators in the PC3 insectary enable researchers to test environmental scenarios representative of the geographic ranges projected for mosquito vectors under climate change scenarios.

QUT's central analytical research facility will provide access to its high performance computing cluster, used for the mapping aspects of the research.

Dr Frentiu brings to the research collaboration significant expertise in virus/vector interactions from her work on the dengue virus and *Ae. Aegypti*. Among the collaborators are experts from the Australian Red Cross Blood Service, Queensland Health's Forensic and Scientific Services and the Metro North Public Health Unit.

'CHIKV represents a significant threat to Australia,' Dr Frentiu said. 'An urgent assessment of transmission risk in Australia, now and for the future, is required to plan for this emerging virus.

'We need to work with government departments, researchers from around the world and other stakeholders to produce accurate risk assessments and response plans for emerging mosquito-borne diseases.

'We have a highly skilled and experienced team of investigators uniquely positioned to execute this significant and timely project. Both QUT and QIMR Berghofer have excellent facilities for work with the virus and state-of-the-art, real-time PCR machines necessary for proposed experiments.'

'Chikungunya virus represents a significant threat to Australia.'

Medical Engineering Research Facility (MERF):
The first fully commercial study with National Association of Testing Authorities, Australia (NATA) Good Laboratory Practice (GLP) accreditation was conducted at MERF in 2016, with several more in the planning stage. There were 57 Surgical Training and Education workshops involving medical device companies and specialist allied health organisations at MERF. QUT had 160 undergraduate students participating in the Paramedic Management of Medical and Surgical Emergencies Course. More than 1000 students from 37 high schools received anatomy and physiology presentations.

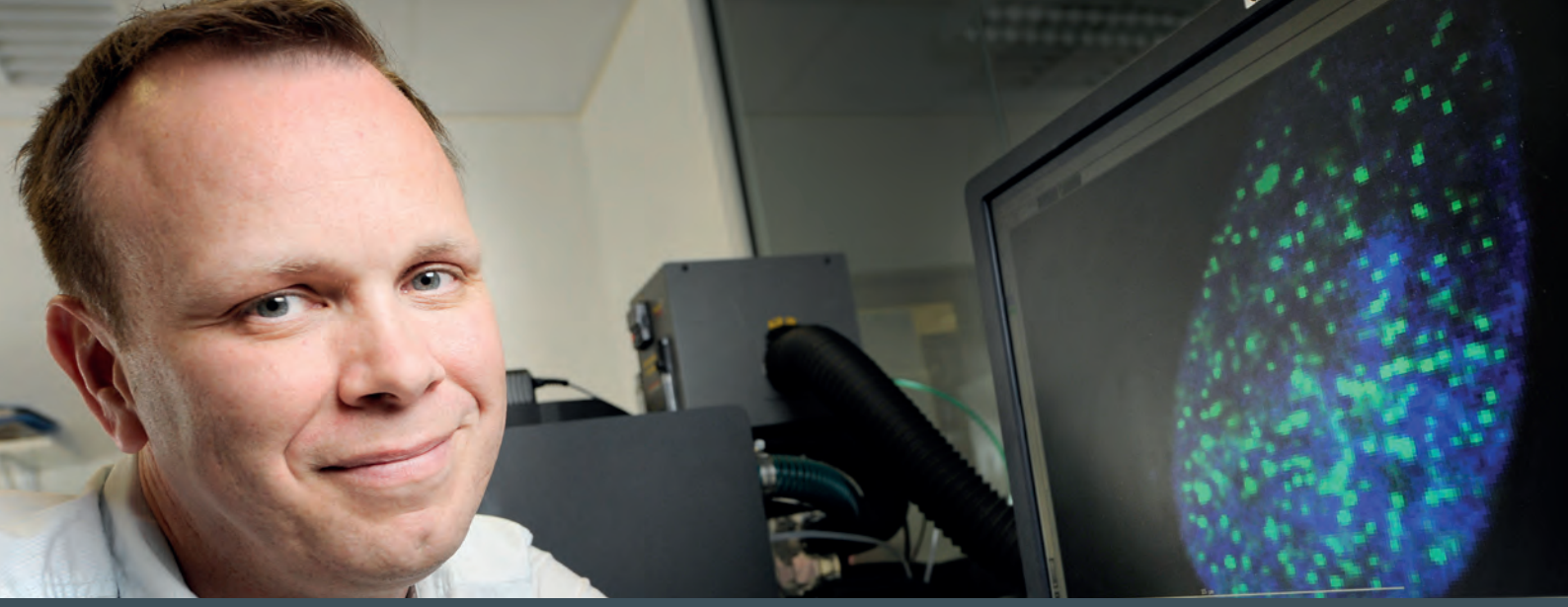
Translational Research Institute (TRI):
IHBI researchers at TRI had a successful year, with significant funding secured and a major research centre opened. The Australian Translational Genomics Centre was established as a partnership of QUT, Metro South and Pathology Queensland, with the aim of using DNA sequencing technology to identify cancer-causing genetic mutations in 2000 patients each year. TRI-based **Professor Judith Clements** received $200 000 in funding from Cancer Australia as part of a Priority-Driven Standard Project Grant and another $200 000 from the Cancer Council Queensland. **Professor Lisa Chopin** and **Dr Eloise Dray** each received $200 000 from the Cancer Council Queensland. **Professor Selena Bartlett** was the recipient of a Children's Health Foundation Queensland Research Grant for $200 000.

Centre for Children's Health Research (CCHR):
Success at CCHR included **Professor Leanne Hides** securing an NHMRC Senior Research Fellowship to investigate early interventions for primary and comorbid substance use in young people. **Associate Professor Janet Davies** was the recipient of an NHMRC Partnership Project Grant of $626 442 to implement a standardised national pollen alert system for better management of allergic respiratory health. **Dr Kerry-Ann O'Grady** received a Children's Health Foundation Queensland Research Grant for $430 000 to investigate acute respiratory illnesses in Aboriginal and Torres Strait Islander children and the progression of chronic lung disease. **Dr Sally Staton's** NHMRC Early Career Fellowship provided $318 769 to advance research into sleep health and sleep problems in early childhood, specifically related to the role of childcare centre practices.

QIMR Berghofer:
An IHBI team consisting of **Dr Danica Hickey**, **Professor Ken Beagley**, **Dr Alison Carey**, **Dr Makrina Totsika** and **Dr Johanna Kenyon** was awarded an Ian Potter Foundation grant of $128 000 to support equipment purchases for the infectious diseases program when they relocated to QIMR Berghofer in 2016. Funding will enhance research focused on the development of new diagnostic, treatment and prevention strategies for human emerging and neglected communicable diseases.

X-Ray microtomography at IHBI:
IHBI researchers led a successful bid for an Australian Research Council (ARC) Linkage Infrastructure, Equipment and Facilities grant for $250 000 to secure a high-resolution X-Ray microtomography system for Southeast Queensland. The IHBI researchers included **Professor Dietmar W Hutmacher**, **Professor Christian Langton**, **Associate Professor Travis Klein**, **Professor Yin Xiao** and **Dr Roland Steck**.

Early Prevention of Obesity in Childhood:
Professor Stewart Trost established the Queensland node of the Centre of Research Excellence in the Early Prevention of Obesity in Childhood at the Centre for Children's Health Research in 2016. The centre aims to reduce the prevalence of obesity and obesity-related behaviours, especially in children under the age of five years, transforming their health trajectories and improving the incidence of type 2 diabetes, liver problems, respiratory disorders and cardiovascular disease. Funding was secured from the NHMRC in a bid led by the University of Sydney and involving the University of South Australia and Deakin University.



Capability building

Strategic appointments at IHBI in 2016 have strengthened key research areas and enabled the establishment of a major new research area. IHBI has a focus on attracting the best minds to create critical mass, strengthen transdisciplinary research teams and translate endeavours in the laboratory into clinical outcomes for ill and injured people around the world.

Image: Associate Professor Derek Richard

Nathan Subramaniam: liver disease

Professor Nathan Subramaniam was appointed as Professor in Biomedical Sciences (Molecular Medicine) in 2016. His interests include membrane transport, particularly iron metabolism in the liver, with his research focused on characterising the consequences of genetic mutations that cause liver disease; and understanding the molecules and mechanisms that maintain stability and prevent iron overload disorders.

Professor Subramaniam relocated from QIMR Berghofer to cement collaborations with IHBI researchers with expertise in genomics, disease models and development of therapeutics.

Professor Subramaniam is collaborating with IHBI Associate Professor Jonathan Harris, using his expertise in cell and molecular bioscience to develop biological models and identify inhibitors that are potential therapeutics for iron disorders.

He will work with IHBI Professor Dietmar W Hutmacher to develop cellular models that replicate the human body in a lab, so the functional properties of cells can be observed and manipulated.

A collaboration with IHBI Executive Director Professor Lyn Griffiths will involve extending his research on the genetics of atypical iron disorders by developing next-generation DNA sequencing platforms to enable the rapid and systematic identification of gene defects which lead to iron disorders in patients.

Funding from the National Health and Medical Research Council (NHMRC) announced last year will enable Professor Subramaniam to study fibrosis, or scarring of connective tissue, that can obliterate the architecture and function of the underlying organ.

‘I have identified an unexplored player in liver fibrosis,’ Professor Subramaniam said. ‘It is an anchor protein that is responsible for recruiting other proteins to form a complex which ultimately results in the production of collagen by the cell. Our team has demonstrated a strong association of this anchor protein in the regulation of liver fibrosis.’

Using funding from the National Institutes of Health in the US, Professor Subramaniam is collaborating with colleagues from the US, Canada and around Australia to understand the genetic risk of developing iron overload disorders.

Iron overload disorder involves the body absorbing too much iron from the diet, storing it in organs such as the liver, adrenal glands, heart, skin, joints and the pancreas. People can develop cirrhosis, multiple joint disease, adrenal insufficiency, heart failure or diabetes.

The gene that is most frequently mutated in inherited iron overload disorder has been identified as HFE. For the disorder to be passed on, both mother and father must have one copy of a mutated HFE gene. People who have two copies of the C282Y mutation, referred to as homozygous C282Y, have a greatly increased risk of iron overload.

'We are still unable to predict which C282Y patients will go on to develop significant levels of iron overload and liver injury,' Professor Subramaniam said.

'Importantly, besides iron- and liver-related disorders, new evidence shows that people with hereditary iron overload disorder are at risk of other clinical disorders including breast and colorectal cancer and neurodegenerative disorders.'

Derek Richard: cancer research

IHBI appointed Associate Professor Derek Richard as Chenhall Research Scientist, with the support of the William and Hilde Chenhall Research Trust. The appointment will provide cancer research leadership; play a major role in scholarship, research, professional activities and service; and provide leadership in community affairs, particularly those related to cancer research.

Associate Professor Richard's research projects include initiatives to identify biomarkers that point to the presence of cancer and discriminate between indolent and aggressive prostate cancer; as well as understanding the mechanisms that cause cancer cells to develop therapeutic resistance.

Associate Professor Richard said he was honoured to take up the new position and conduct important cancer research on behalf of the Chenhalls. It builds on his studies and research positions at the University of St Andrew's in Scotland, where he established the connection between volcanic pools and cancer research.

'My original research saw me study an ancient organism called archaea which manages to survive in the boiling sulphuric acid pools in Iceland, one of the most extreme environments on the planet,' he said. 'The organism manages to survive in these damaging conditions because it contains a protein called hSSB1.'

Associate Professor Richard said hSSB1 protected the organism's DNA against the attacks from its own natural environment.

'The exciting connection is that hSSB1has also been found in humans and is central to protecting us from cancer-causing DNA damage.' Associate Professor Richard said human cells were subjected to up to 30 000 'attacks' every day from sources such as free radicals, ultra violet light and carcinogens that include cigarette smoke. Cancer is caused when genes are damaged and not properly repaired.

'Without hSSB1 to protect us, our cells are much more vulnerable.'

The ultimate goal of Associate Professor Richard's research is to develop better, more effective drugs to target all cancers and to develop tools enabling oncologists to guide chemotherapeutics to the correct patients.

- **Professor Matt Brown** was appointed as QUT Director of Genomics in 2016, with responsibility in leading research and diagnostic efforts in clinical genomics, developing new teaching programs, increasing public engagement and growing capability in genomics research. Professor Brown has a clinical appointment at the Metro South Hospital and Health Service, specialising in rheumatology; and has an NHMRC Senior Principal Research Fellowship to investigate the causes of and development of new therapies for ankylosing spondylitis and related diseases.
- Professor of Immunology **Professor Ken Beagley** was appointed the Associate Director, overseeing IHBI research activities at QIMR-Berghofer.
- Professor of Breast Cancer Research, **Professor Rik Thompson**, was appointed the Associate Director at the Translational Research Institute in 2016, replacing retiring Professor Adrian Herington.

Higher Degree Research support

IHBI has high-achieving higher degree research students, embedded in transdisciplinary teams and provided with significant opportunities to develop research and analysis skills and build collaborative networks. A focus on translation, clinical outcomes and commercialisation ensures the students are supported to develop the skills and experience for a successful career in research.

Image: Arutha Kulasinghe

PhD candidate Arutha Kulasinghe has been successful in 2016 in advancing research in the field of cancer metastasis, working with head and neck cancer patients and in reporting his data across 11 publications.

Mr Kulasinghe is finalising his PhD under the supervision of Associate Professor Chamindie Punyadeera and Professor Colleen Nelson, investigating metastasis in head and neck cancers. He is using cancer cells present in blood, circulating tumour cells (CTCs), that are seeds for metastasis.

The research involves collaboration with IHBI Professor Rik Thompson, Princess Alexandra Hospital (PAH) ear, nose and throat specialists Associate Professor Chris Perry and Professor William Coman, medical oncologist Professor Ken O'Byrne, PAH urologist Dr Ian Vela and Royal Brisbane and Women's Hospital (RBWH) Senior Radiation Oncologist Dr Liz Kenny.

Mr Kulasinghe is detecting and culturing CTCs, enabling the increase of cell numbers to a point of critical mass for testing medicines. Testing can be completed quickly in a laboratory and can potentially save a patient from receiving ineffective medicines. The culturing process has enabled Mr Kulasinghe to become the first to screen patients with head and neck cancers.

The work is being conducted in collaboration with the University of Queensland (UQ), the University of New South Wales, the University Medical Center Hamburg-Eppendorf and the National University of Singapore. It involves screening the cultured CTCs of 120 patients from the PAH and the RBWH using multiple platforms.

'We were able to successfully develop a culture methodology to increase head and neck tumour cell numbers outside the patient's body,' Mr Kulasinghe said. 'That is a first for head and neck cancer and provides models for understanding the biology of metastatic disease.'

Moreover, Mr Kulasinghe said it provided avenues for drug sensitivity testing as a means of developing a precision medicine approach. The approach involves tailoring medical treatment for each patient, in recognition of the differences between cancer cell types and their behaviours.

In a proof of principle study, Mr Kulasinghe demonstrated that tumour cells in circulation express PD-L1, a protein that is believed to be responsible for suppressing the immune system. The study showed that PD-L1 was a promising target for immunotherapy, a type of treatment designed to boost the body's natural defences to fight cancer.

Importantly, PD-L1 could be used as a biomarker for predicting a patient's likely response to immunotherapy, helping determine probable outcome of the costly treatment.

Mr Kulasinghe's research aims to develop minimally invasive techniques to identify head and neck cancer patients who are at an increased risk of metastasis – or who are not responding to therapy. CTCs have been used to determine the prognosis of patients with breast, prostate and colorectal cancer.

His research has been published in three literature reviews, three book chapters and five original research papers. His work in *Scientific Reports* was the first study using microfluidic technology for CTC enrichment in head and neck cancers. 'In a proof-of-concept study, we demonstrated that patient derived CTCs could be expanded outside the patient's body,' Mr Kulasinghe said. 'This could provide models to understand the biology of transient metastatic cells.'

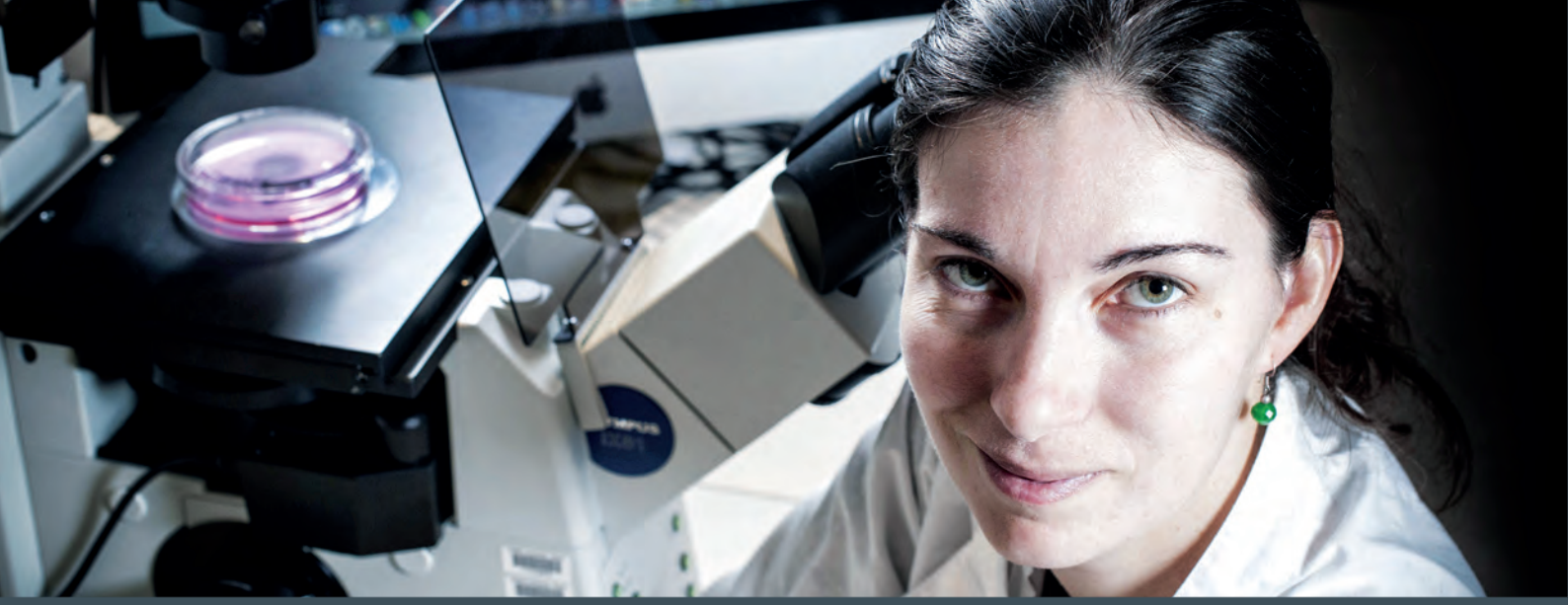
In November, Mr Kulasinghe was part of a transdisciplinary team to receive a 2016 Spore Grant from the Translational Research Institute, awarded to teams addressing an important clinical question; identifying a clear translational outcome; and understanding the development path from idea to clinical application.

The team included Associate Professor Punyadeera, Professor O'Byrne, Professor Thompson, UQ's Professor Stephen Mattarollo and industry partner ClearBridge Biomedics. Their proof-of-concept study focuses on a key biomarker in CTCs that shows promise as a surrogate that will assist in more accurately assessing which cancer patients will likely benefit from immunotherapy – presently an unmet clinical need.

'IHBI has provided a great research environment dotted with leading scientists to take my work forward,' Mr Kulasinghe said. 'I see myself pursuing a career in research as it is rewarding to see how my contribution in the laboratory can lead to better outcomes in patients. The skills that I have developed and the mentors that I have followed at IHBI stand me in good stead to establish a research career.'

'IHBI has provided a great research environment dotted with leading scientists to take my work forward.'

- PhD candidate **Patrick Thomas** was awarded the President's Prize at the international Endocrine Society annual meeting in Boston in the US for his poster entitled Targeting the long non-coding RNA *GHSROS*, a mediator of prostate cancer tumour growth, with short antisense oligonucleotides.
- **Dipesh Bhattarai** was awarded the best poster presentation award at The Optical Society (OSA) Frontiers in Optics student leadership conference in Rochester, New York in the US, beating 250 global student chapters to win. The OSA sponsored Mr Bhattarai to attend the conference.
- **Peter Mulvey** received the best Mucosal Immunology poster award at the Australian Society for Immunology annual scientific meeting in Canberra. His poster was judged to have excellence and originality of scientific content, clarity of presentation and visual impact.
- IHBI PhD candidates excelled at the Australian Society for Medical Research (ASMR) Queensland Postgraduate Student Conference. **Sunderajhan Sekar** was awarded the Best Poster Presentation Prize, while **Arutha Kulasinghe** was runner-up and **Lakmali Silva** received the People's Choice Award for her poster. **Patrick Thomas** was runner up for the Best Oral Presentation and **Lotta Oikari** received the People's Choice Award for her oral presentation.



Early career researcher, mid-career researcher support

Outstanding early career researchers are conducting important research at IHBI, securing competitive national funding and collaborating with the best minds to add to knowledge in the field. Support in their endeavours comes from transdisciplinary teams working with the latest technology and focused on clinical applications.

Image: Dr Rachel Okolicsanyi

Early career researcher Dr Rachel Okolicsanyi is using her expertise in genetics, neurobiology and cell biology to develop improved models of brain repair, with the aim of addressing the increasing burden of dementia.

Dr Okolicsanyi has a National Health and Medical Research Council-Australian Research Council Dementia Research Development Fellowship Grant to use specific proteins called heparin sulfate proteoglycans to steer stem cells towards repair and treatment of neurodegeneration.

It follows on from her PhD at IHBI, working with Dr Larisa Haupt and Executive Director Professor Lyn Griffiths, started in 2011 and supported through a nationally competitive Australian Postgraduate Award and a top-up scholarship from the estate of the late Clem Jones AO. Her PhD work aimed to determine if adult stem cells derived from bone marrow could be steered to act as brain cells, also called neural cells, and take up the function of the damaged cells following trauma such as traffic accidents, sports injuries and falls.

Since graduating in late 2015, she has set her sights on building a successful research career. Dr Okolicsanyi has presented her research at a G20 satellite summit, the inaugural G20 World Brain Mapping and Therapeutics Scientific Summit; and won a conference award from the Human Genetics Society. Travel bursaries supported her attendance at the European Molecular Biology Laboratories PhD Symposium in Germany in 2012; ComBio in Perth in 2013; and the Matrix Biology Society of Australia and New Zealand's annual meeting in Melbourne in 2014. Dr Okolicsanyi also has 15 peer-reviewed papers, including six as first author.

'My research training has provided me with a unique combination of skills and experience to apply to the research of dementia and the development of improved treatments,' Dr Okolicsanyi said.

She said remaining at IHBI provided the opportunity to continue collaborating with Dr Haupt and Professor Griffiths, use the latest technology at the Genomics Research Centre and build a working relationship with researchers at the Dementia Collaborative Research Centre, led by IHBI Professor Elizabeth Beattie.

Dr Okolicsanyi said stem cells had provided some positive results in the treatment of neurodegenerative disorders, but further information was needed to more fully understand the mechanisms controlling disease onset and potential models of repair.

Her research will use human mesenchymal stem cells (hMSCs), traditionally isolated from the bone marrow but also sourced from fat, umbilical cord blood and dental pulp. The advantage is the relative ease of isolation and culturing of hMSCs, as distinct from the difficulty experienced when using human neural stem cells (NSCs) derived from human embryonic stem cells. NSCs are far less abundant than MSCs, more difficult and controversial to obtain and retain a lower capacity for expansion and self-renewal.

Studies have so far found that the introduction of MSCs to an Alzheimer's disease model resulted in rescue from cell death. Dr Okolicsanyi aims to isolate and manipulate MSCs to generate sufficient cell numbers for transplantation.

The MSCs need to be modified to form neural cells through a process called differentiation, with researchers changing their environment to steer them to become the correct neural cell type – rather than fat, muscle or bone, for example. Even within the brain, there are many different cells that have unique structures and functions so the differentiation process is exacting.

A key to the process are heparin sulfate proteoglycans, found on the surface of cells.

'What we are hoping is that by manipulating this particular family of proteins we can encourage the stem cells to show a higher percentage of neural markers,' Dr Okolicsanyi said, 'indicating that they could mature into neural cells rather than what they would normally do, which is form into bone, cartilage and fat.

'We will modify the surrounding environment to manipulate the cells, such as adding commonly found biological chemicals, including complex salts found in the body, to see if it inhibits or encourages cellular processes.'

Dr Okolicsanyi said the research showed promise as a treatment for the estimated 298 000 people in Australia diagnosed with dementia, as well as adding to knowledge in the field that could be applied in other areas of stem cell research.

'Our data will improve models of cellular processes involved in regeneration of neural cells damaged due to injury or disease.

'The research aims to develop a new cell based model to investigate treatment of neurodegeneration, as seen in various dementias. Despite the normal aging process resulting in smaller pools of stem cells with which to work, using hMSCs, our model will provide techniques to generate sufficient cell numbers in the laboratory for transplantation.'

- IHBI was well represented at the Queensland Young Tall Poppy Awards, with infectious disease researcher **Dr Makrina Totsika** named the joint Queensland Young Tall Poppy Scientist of the Year. Cancer nurse specialist **Professor Ray Chan** and childhood sleep researcher **Dr Sally Staton** received Young Tall Poppy Science Awards.
- Two IHBI researchers secured National Health and Medical Research Council RD Wright Biomedical Career Development Fellowships. **Associate Professor Mike Doran** received $476 726 for a project entitled Bridging the fields of cartilage, bone marrow and cancer research. **Dr Leila Cuttle** secured $430 998 for a project entitled Better healing for children's burn injuries.
- **Dr Stuart Ekberg** secured an Australian Research Council Discovery Early Career Researcher Award, with $315 419 for a project entitled Talking about Troubles: A comparison of everyday and therapeutic talk.
- **Dr Emma Bolderson** received Advance Queensland funding, with a Mid-Career Research Fellowship to further her work targeting genome stability in cancer in a collaboration with the Princess Alexandra Hospital.
- **Dr Jason Edwards** received an Advance Queensland Early-Career Research Fellowship to work with Workplace Health and Safety Queensland on a novel approach to reduce productivity losses from injuries and illnesses.
- The German Academic Exchange Service selected postdoctoral research fellow **Dr Kai Tang** for a Postdoctoral Researchers' Networking Tour that brought together an international group of promising up-and-coming researchers in the field of molecular bioscience.
- **Dr Nathalie Bock** was one of six Australian graduate students nominated to attend the Japan Society for the Promotion of Science HOPE meeting in Tokyo to engage in interdisciplinary discussions with distinguished scientists, including Nobel Laureates, and establish networks to progress her research into bioengineered prostate cancer tumour models for studying responses to therapies.

Contributing to the public good

Links with the community and an understanding of people's behaviour, healthcare and fitness levels ensure IHBI research is targeted to produce better health outcomes. The understanding drives development of prevention strategies and treatment options, while collaboration provides people an opportunity to see how their input can shape future healthcare.

Image: Professor Sandi Hayes

IHBI researchers have been working with breast cancer survivors to determine the efficacy of exercise on improving fitness and quality of life – and ultimately developing resources for other women who are diagnosed.

Professor Sandi Hayes led the research project Exercise for Health, aiming to improve the quality of life of the 60–70 per cent of breast cancer survivors who live with chronic adverse treatment-related side effects such as upper-body symptoms, lymphedema and fatigue. Younger women can experience premature menopause, bone density loss, infertility and associated distress.

The research involved recruiting 194 women from four participating Brisbane hospitals who were newly diagnosed with breast cancer. The women were aged between 20 and 69 years, with part of the group guided through an eight-month exercise program that started six weeks after surgery.

A trained and qualified exercise physiologist guided the women through 16 scheduled sessions, conducted either face to face or by phone. The sessions became less frequent towards the end of the intervention in order to encourage the women to take control of their exercise routines.

Professor Hayes said the goal was for the women to exercise at least four times a week for 45 minutes, including aerobic and resistance-based exercise.

Results at the end of 12 months showed significant improvements in quality of life, fitness and fatigue for those in the exercise groups, Professor Hayes said. This was in comparison to those in a usual care group, with women who did not complete the exercise intervention, who demonstrated declines in fitness and increases in fatigue during their treatment period.

'Exercise interventions lead to improvements in cardiorespiratory fitness, muscle mass, bone health, immune function, strength, flexibility, body image, self-esteem and mood,' Professor Hayes said. 'Such interventions have also been shown to reduce stress, depression, anxiety and the number and severity of side effects, including nausea, fatigue and pain.'

Professor Hayes said the results were important in influencing healthcare professionals to change their care models after surgery. 'To change clinical practice, there is a clear need for comparative effectiveness trials demonstrating feasibility and effect of exercise when implemented in a real-world setting.

'We have demonstrated that exercise can assist women to more quickly and fully recover following breast cancer treatment and to develop the skills and confidence to become and stay physically active for the longer term.'

The exercise intervention was suitable for all women with breast cancer, irrespective of health and disease status, Professor Hayes said.

'Women were interested and able to integrate an additional form of adjuvant treatment into their standard breast cancer care with exercise being particularly appealing since it is a form of treatment that women can control and that is associated with recovery benefits, including the potential to minimise adverse effects from their other forms of breast cancer treatment.'

Research results also guided the development of a Breast Cancer Network Australia exercise manual, designed to help women exercise regularly, understand the benefits, introduce it into their routine and determine the more effective types of physical activities.

'Exercise interventions lead to improvements in cardiorespiratory fitness, muscle mass, bone health, immune function, strength, flexibility, body image, self-esteem and mood.'

- IHBI's External Engagement Committee (EEC) welcomed new chairman **Mario Pennisi** and member **Major General the Hon Peter Arnison** AC, CVO, BEc (Retd). The EEC provides community engagement and networking opportunities, advocates for IHBI in the community, cultivates philanthropic prospects and provides advice on profiling opportunities benefiting IHBI and its research. The EEC's major event in 2016 was An Evening with John Wagner, held in conjunction with Ashurst to introduce the law firm's clients to IHBI and highlight prostate cancer research conducted at the institute, principally at the Australian Prostate Cancer Research Centre – Queensland.
- The 2016 IHBI Gala Dinner in September showcased the institute's research to peers, collaborators, industry partners, clinicians, health administrators and supporters. The event featured a keynote address from QUT Director of Genomics **Professor Matt Brown** and an opening address from Queensland Minister for Health and Minister for Ambulance Services, the Hon Cameron Dick MP.
- IHBI held its fundraising breakfast Pink Ribbon, Blue Sky in October, providing insights into the institute's research diversity, collaboration and translation in breast and prostate cancer. The event raised funds for the National Breast Cancer Foundation, Prostate Cancer Foundation of Australia and IHBI research.
- IHBI researchers were involved in the first World Science Festival held in Brisbane. **Associate Professor Mike Doran** demonstrated at the Translational Research Institute how stem cells and 3D printing can be used to repair tissue. **Associate Professor Mia Woodruff** 3D-printed chocolate at a Science in the Street display.
- IHBI researchers participated in the #ThisIsScience social media campaign for International Women's Day, profiling the institute's research, providing insights into personal motivations and celebrating the achievements of women in science, technology, engineering and mathematics.
- IHBI researchers took part in National Science Week activities, celebrating science and technology; and encouraging an interest in science pursuits among the general public. **Dr Honor Hugo** and **Dr Sohinee Sarkar** participated in the *Catch a Rising Star: Women in Science in Regional Queensland* events, visiting schools in Mt Isa and outer suburban Brisbane. **Associate Professor Chamindie Punyadeera** participated in *Soapbox Science*, informing and entertaining people in the Brisbane CBD.
- Student from Brisbane high school Somerville House were inducted in an internship program involving IHBI researchers based at the Centre for Children's Health Research. The Year 10 students will be mentored for two years as they contribute to spinal, burns, robotics and plastic surgery research projects. The internship program is designed to be a long-term partnership that will grow and produce a new generation of researchers.
- IHBI staff hosted students from Kilcoy State High School in July, providing insights into the use of stem cells in the treatment of neurological conditions; 3D printing and its use in orthopaedics and cancer cases; and isolation of antimicrobial compounds from indigenous plants.

Knowledge transfer

IHBI has been established to be multidisciplinary, ensuring collaboration between groups as well as with those from other institutes, industry and organisations in healthcare and support. Researchers pursue national and international avenues for networking and the transfer of knowledge.

Image above: The Australasian Bio Ceramic Symposium

ACCTERM Research Forum

IHBI's Australia-China Centre for Tissue Engineering and Regenerative Medicine (ACCTERM) held the Fourth Research Forum in Guangzhou, China, co-hosting with the Guanghua School of Stomatology at Sun Yat-sen University. The forum brought together researchers, practitioners and decision makers to share knowledge related to biomaterials, stem cells, tissue engineering and regenerative medicine.

IHBI researchers played major roles in leading discussions on four areas of key research focus during the forum, with ACCTERM director Professor Yin Xiao and IHBI Professor of Immunology Professor Ken Beagley jointly leading discussions on immunology and tissue regeneration. Dr Tony Parker and Dr Larisa Haupt jointly led discussions into biomaterials and systems biology; while Dr Karsten Schrobback jointly led discussions into additive biomanufacturing.

The forum included guests from QUT and Griffith University in Australia; the University of Pennsylvania and Texas A&M University in the US; and Sun Yat-sen University, Jinan University, the University of Hong Kong, Chinese Academy of Sciences, Shanghai Institute of Ceramics, Zhejiang University, Capital Medical University, Shanghai Jiao Tong University, Peking University, Huazhong University of Science and Technology and Wuhan University in China.

Beyond sharing research findings, the forum included discussions on joint funding applications, identifying research gaps, expanding collaboration, clinical translation and exploiting available facilities – particularly those under the IHBI umbrella at the Translational Research Institute, the Medical Engineering Research Facility and QIMR-Berghofer.

Among the outcomes from the forum was the identification of students for exchange between IHBI and Shanghai Institute of Ceramics, Chinese Academy of Sciences.

Australasian BioCeramics Symposium

ACCTERM and QUT hosted the Australasian BioCeramics Symposium (ABC) in 2016, the first time the event has been held in Brisbane. The ABC is held annually in Asian countries to bring together scientists, engineers, manufacturers, dentists and surgeons. The symposium attracted 100 delegates, helping to support collaboration and to encourage linkages between various universities, research institutes and countries.

Areas of focus for the symposium included bioceramics, advanced biomaterials, bioinspired materials, nanomaterials, 3D printing, surface modification, bone tissue engineering and wound healing.

Professor Guoping Chen from the National Institute of Science, Japan and Professor Min Wang from the University of Hong Kong were the ABC's plenary speakers, while keynote speakers were sourced from around Australia, China, Indonesia, Taiwan and Japan.

The ABC's International Advisory Committee included researchers from India, Singapore, Indonesia, China, South Korea, Japan and Taiwan.

Brisbane Cancer Conference

IHBI Professor Ken O'Byrne co-ordinated the Brisbane Cancer Conference in 2016, attracting more than 900 delegates for two days of presentations, workshops and networking.

Workshops covered genomics, hepatocellular cancer, thoracic malignancies, brain tumours, gynae-oncology, haematology, breast cancer, melanoma, skin cancer, cancer models, imaging, novel immunotherapies, clinical trials, commercialisation and palliative and supportive care research.

The conference was successful as a translational research event, with new collaborations being established between investigators in Brisbane and Queensland.

It will be held again in November 2017 and be called the Queensland Cancer Conference Brisbane.

OTHER KNOWLEDGE SHARING INITIATIVES

- **Professor Dietmar W Hutmacher** was appointed editor-in-chief of the *Journal of 3D Printing in Medicine*, a peer-reviewed, print and electronic journal encompassing all aspects of bioprinting and 3D printing of relevance to medicine.
- IHBI's Paediatric Spine Research Group, led by **Associate Professor Clayton Adam**, had two papers listed in the ten most influential articles of 2015 in the journal *Scoliosis and Spinal Disorders*.
- **Professor Christian Langton** was co-author of a paper recognised for having the highest impact of those funded by Wesley Medical Research. *Examination of the properties of IMRT and VMAT beams and evaluation against pre-treatment quality assurance results* was published in *Physics in Medicine and Biology* in 2015.
- IHBI initiatives in collaboration, commercialisation and clinical focus were under the spotlight when Executive Director **Professor Lyn Griffiths** spoke at a QUT lunch at BIO International Convention in 2016. She introduced Dr Daniel Timms, a QUT graduate who used IHBI's Medical Engineering Research Facility to assess a prototype of an artificial heart, the BiVACOR.
- **Associate professors Chamindie Punyadeera** and **Janet Davies** received Early Career Researcher BIO Fellowships from qutbluebox to attend the biotechnology convention to profile their research, gain insights into new trends, network with potential collaborators and meet industry contacts.
- Members of IHBI's Centre for Accident Research and Road Safety – Queensland had major roles at the 21st International Council on Alcohol, Drugs and Traffic Safety conference in Brazil in October, with presentations from centre director **Professor Narelle Haworth**; researchers **Emeritus Professor Mary Sheehan**, **Dr Mark King** and **Dr Tanya Smyth**; and PhD Scholar **James Damsere Derry**. Professor Haworth was also part of the organising committee.

Research quality

Funding

IHBI's external funding exceeded $45 million in 2016, representing 49 per cent of QUT's total research income awarded during the year.

The National Health and Medical Research Council (NHMRC) awarded $8 599 660 in competitive research funding and another $3 085 642 came from the Australian Research Council (ARC).

IHBI research income received in 2016

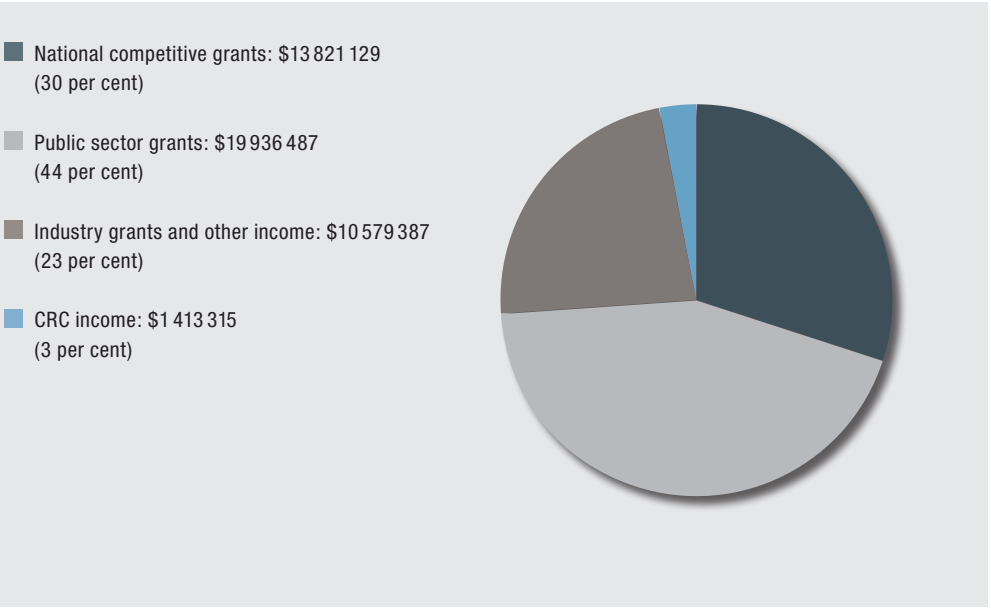


Figure 1: IHBI research income received in 2016 (provisional data based on 31 December 2016 figures)

Attracting HDR students

IHBI hosts 667 higher degree research students from our partner QUT Faculties, providing significant opportunities for HDR student supports and career development programs.

In 2016, 196 higher degree students commenced, 112 students completed their studies and 72 were under examination on 31 December 2016. Of the 667 students 32 per cent were international students.

Philanthropic funding

A range of individual donors, philanthropic foundations and trusts and corporations contributed $4.08 million to IHBI research and community service projects.

Philanthropic and foundation funding in 2016 included contributions from:

- Chenhall Charitable Trust
- The Prince Charles Hospital Foundation
- Medtronic Australasia Pty Ltd
- The Ian Potter Foundation
- Queensland X-Ray
- RBWH Foundation
- PA Research Foundation
- The Atlantic Philanthropies
- The Nicol Foundation
- Prostate Cancer Foundation Australia
- Queensland Community Foundation
- SPW Group Pty Ltd
- Bon Accord Masonic Lodge No.483
- Central Gold Coast/Burleigh Waters Prostate Cancer Support
- Moreton Bay Regional Prostate Cancer Support Group
- Bundaberg Catholic Women's League
- ITAL Biscuits and Cakes
- Alzheimer's Australia Dementia Research Foundation (AADRF)
- Australian Red Cross Society
- Asthma Australia
- Beyondblue
- Cancer Council Queensland
- Children's Hospital Foundation
- Emergency Medicine Foundation Ltd (EMF)
- Gallipoli Medical Research Foundation (GMRF)
- Macular Disease Foundation Australia
- National Breast Cancer Foundation
- National Heart Foundation (NHF)
- Rebecca L Cooper Medical Research Foundation

Philanthropic and development income

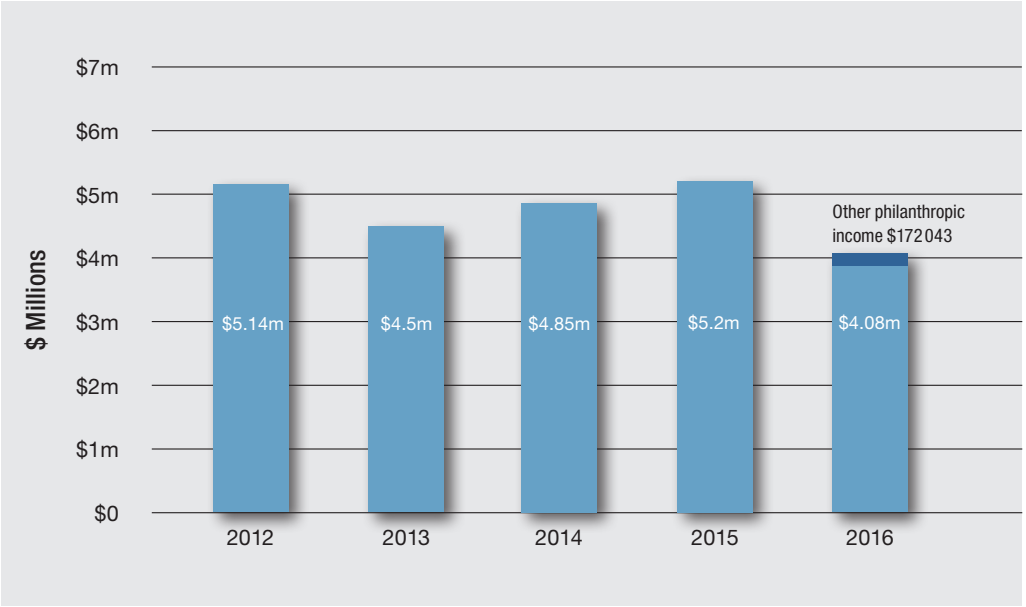


Figure 2: Philanthropic and development income has stayed consistently strong

Publications

IHBI research was disseminated in 926 peer-reviews publications.

Publications in 2016

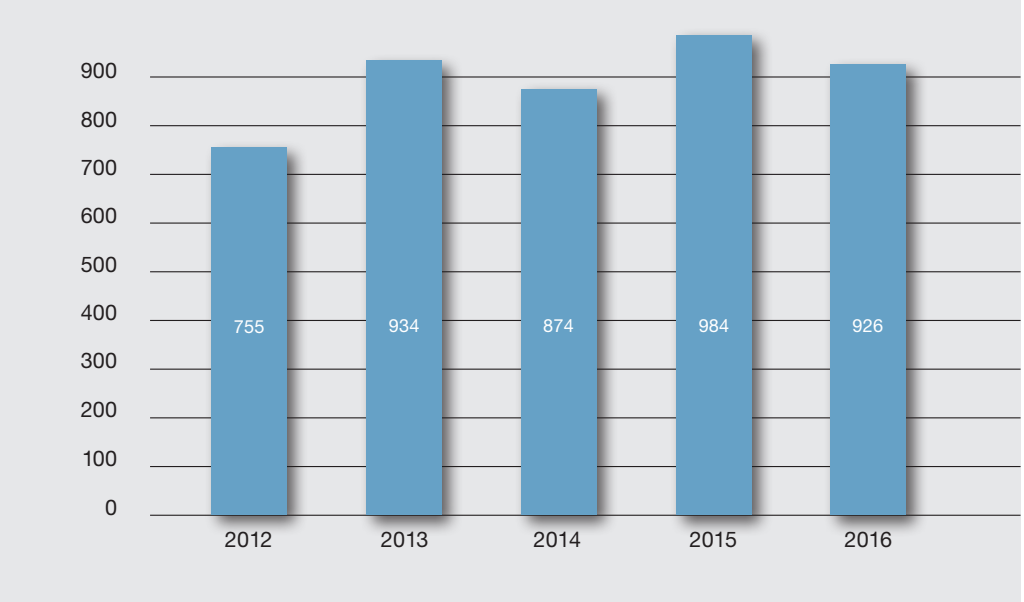


Figure 3: IHBI researchers disseminated their research results through peer-reviews journals

Commercialisation

IHBI brings the benefits of our research to healthcare practice through commercialisation.

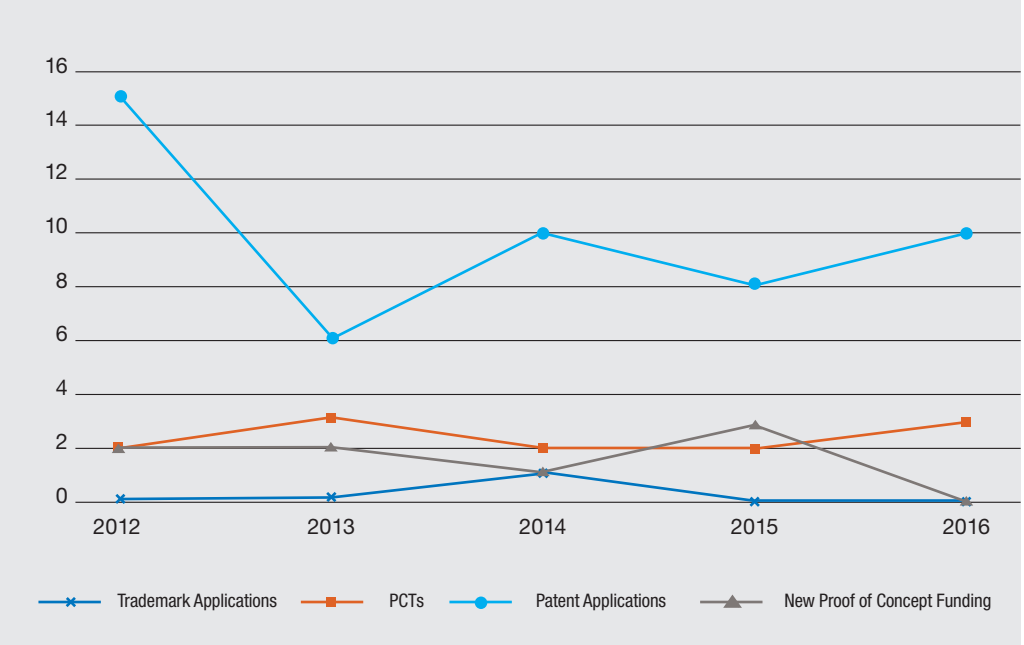


Figure 4: IHBI's patent applications and PCTs increased from 2015 to 2016

Appendices

Research themes

IHBI has three research themes, providing focus, differentiation and critical mass in select areas of significant research strength. The themes encourage cross-disciplinary research, an important factor in creating synergy and creativity. The themes are:

- **Health determinants and health systems**, covering diabetes, mental health, disease prevention and health services research
- **Injury prevention and trauma management**, including arthritis, orthopaedics, musculoskeletal care, tissue repair, biofabrication and road safety
- **Chronic disease and ageing**, covering cancer, dementia, cardiovascular disease, vision impairment and infectious disease.

Research theme highlights

Health determinants and health systems

Theme leader: Professor Monika Janda

Social, environmental and behavioural factors impact on health and wellbeing. Researchers in the theme use molecular, epidemiological, qualitative, health economics and clinical research methods to improve disease prevention, treatment and healthcare delivery and efficacy.

A multidisciplinary approach within the theme enables research teams to recognise the complexity of health issues and take into account social and societal factors, human behaviour, environmental and genetic risk. A theme strength is the real-world relevance and impact of the research, including the use of technology and innovation to address:

- **Disease prevention:** Researchers drive preventative initiatives to reduce chronic diseases such as obesity and cancer.
- **Healthy lifestyles:** Strategies to promote healthy lifestyles and prevent disease are based on insights gained about the environmental, social and individual determinants of behaviours, particularly physical activity and diet. The theme also has a focus on health outcomes and optimal survivorship.
- **Child and adolescent health:** Partnering with families and support services enables researchers to address childhood development, obesity, nutrition, sleep and prevention of child maltreatment, as well as ensuring equitable health outcomes for all, including for the Indigenous population.
- **Mental health:** Research encompasses genetics, genomics, pharmacology, behavioural neuroscience, psychology and online interventions to treat people with mental health issues, improve brain health and better understand post-traumatic stress disorder.
- **Health services and systems:** Using technology and innovation, researchers are working to contain rising healthcare costs, reduce hospital-acquired infection rates and improve patient care.
- **Environmental health:** Researchers measure, analyse and determine the health impacts of pollutants, climate, hydration, UV radiation and climate change on people's health.

Quick facts and figures	
Number of staff	262 members, including 88 professional staff
PhD/Masters research students	79 higher degree students commenced in 2016. 4 Masters by Research and 27 PhD students graduated in 2016 (21 domestic and 10 international students)
Research income	$12 059 700
Patents	5 patent applications were filed in 2016
Research papers published	381 research papers published
Key achievements 2016	• Professor Leanne Hides received a National Health and Medical Research Council (NHMRC) Senior Research Fellowship, with $715 209 for the project Early interventions for Primary and Comorbid Substance Use in Young People: Engagement, Innovation, Technology and Translation. • Professor Adrian Barnett was successful in obtaining a NHMRC Senior Research Fellowship, with $640 209 for the project Meta-research: Using research to increase the value of health and medical research. • The Australian Academy of Social Sciences installed Professor David Kavanagh as one of 39 new Fellows. • Professor Sandi Hayes secured a project grant from the World Cancer Research Fund for a project to evaluate the effect of exercise during chemotherapy for women with ovarian cancer. • Dr Elke Hacker worked with the start-up company Suncray at the Johnson & Johnson Innovation Partnering Office @ QUT to test new sun stickers to warn people when the effect of sunscreen has worn off and sunscreen needs to be reapplied. • Professor Lidia Morawska led a team that received an Australian Research Council (ARC) Linkage Project Grant, with $450 535 to develop innovative, cost-effective, high resolution air quality networks. • Professor Michael Dunne participated in the editorial board meeting of the Asia Pacific Journal of Public Health at the APACPH conference in Tokyo. • Professor Selena Bartlett was the recipient of a Children's Health Foundation Queensland Research Grant for $200 000. • Dr Kerry-Ann O'Grady received a Children's Health Foundation Queensland Research Grant for $430 000 to investigate acute respiratory illnesses in Aboriginal and Torres Strait Islander children and the progression of chronic lung disease. • Dr Sally Staton's NHMRC Early Career Fellowship provided $318 769 to advance research into sleep health and sleep problems in early childhood, specifically related to the role of childcare centre practices. • Professor Monika Janda led the Healthy Text study funded by Cancer Australia, which in 2016 reported better sun protection outcomes for young people in the intervention group who received text messages reminding them to be sun safe. • Professor Sandi Hayes led the research project Exercise for Health, aiming to improve the quality of life of the 60–70 per cent of breast cancer survivors who live with chronic adverse treatment-related side effects such as upper-body symptoms, lymphedema and fatigue.

Injury prevention and trauma management

Theme leader: Associate Professor Travis Klein

Theme researchers develop novel medical technologies and behavioural approaches to promote health, wellbeing and injury prevention, along with treatment and rehabilitation. A multidisciplinary approach ensures teams consider the multitude of molecular, environmental and social risk factors for disease and injury.

Researchers work collaboratively with clinicians and health practitioners to better understand the needs of patients, people in the community, healthcare workers and support staff. The engagement ensures real-world relevance and research impact.

The researchers use advanced technologies and approaches at world-class facilities including the Medical Engineering Research Facility, the Translational Research Institute, the Centre for Children's Health Research, the Herston Imaging Research Facility and QUT's Central Analytical Research Facility.

Theme strengths and expertise are in biological, behavioural and clinical sciences, biofabrication, biomedical engineering, health technologies and intelligent transport technologies. The strengths are employed in:

- developing novel diagnostics and therapeutics for healing and recovery
- creating new interventions to treat damaged cartilage and reduce arthritis
- encouraging wound healing and functional recovery
- preventing and rehabilitating hamstring injuries among athletes
- studying the functional consequences of injury and disorders of skin and musculoskeletal tissues
- investigating and overcoming workplace health and safety issues
- developing preventative strategies to enhance road safety and reduce injury incidence
- preventing injuries among high-risk groups such as children, adolescents and older people, including predicting falls risk in people with neurodegenerative disease.

The theme has a focus on commercial application, developing new tissue engineering therapies, orthopaedic and rehabilitation devices, and trauma and emergency care management systems based on research.

Researchers are developing e-health technologies to monitor fatigue, balance and falls risk; e-health assessments to monitor patients and inform best practice health care; and wireless technologies to monitor vehicle movements and provide alerts. A technology-inspired environment drives translation of knowledge into products and services.

Quick facts and figures	
Number of staff	219 members, including 86 professional staff
PhD/Masters research students	42 higher degree students commenced in 2016. 6 Masters by Research and 28 PhD students graduated in 2016 (19 domestic and 15 international students)
Research income	$10 688 302
Patents	No patent or trademark applications were filed in 2016
Research papers published	239 research papers published
Key achievements 2016	• The Australian Research Council (ARC) Training Centre in Additive Biomanufacturing was funded. Led by Professor Dietmar W Hutmacher, and involving a number of key researchers in the theme, the centre brings together leading academic and industry partners to develop and translate key platform technologies for personalised medical treatments. • The Centre for Accident Research and Road Safety – Queensland was awarded significant new Motor Accident Insurance Commission funding to continue world-leading work on research, education and outreach activities in road safety. • Associate Professor Mia Woodruff led the establishment of the Herston Biofabrication Institute, a joint venture between QUT and Metro North Hospital and Health Service. The endeavour will help to expand the possibilities of 3D printing in medicine and cement QUT's place at the forefront of the field. • Professor Ross Crawford performed the first robotically assisted hip replacement surgery in Australia. Professor Crawford shared his vision for the future, using robotic surgery, with Prime Minister Malcolm Turnbull during his visit to Brisbane. • Professor Christian Langton tackled the problem of ultrasound distortion using a combination of mathematical modelling and 3D printing. His invention allows ultrasound to reliably probe the brain, which could have significant application in diagnosing brain disorders such as Parkinson's disease. • Dr Roland Steck led the first Good Laboratory Practice (GLP) accreditation of IHBI's Medical Engineering Research Facility. The National Association of Testing Authorities, Australia (NATA) accreditation will ensure the translational potential of the research performed at MERF. • Start-up company Vald Performance marketed the Nordbord, a product of years of research led by IHBI's Dr Tony Shields. The device can measure hamstring strength and predict injury – and has wide uptake among elite sporting teams across the globe. • Associate Professor Tim Dargaville started an ARC Future Fellowship to develop micromoulding techniques for soft materials that could lead to improved vascularisation of engineered tissues. • Dr Leila Cuttle was awarded a National Health and Medical Research Council (NHMRC) Career Development Fellowship for her work on paediatric burns. • Dr Indira Prasadam was awarded a fellowship from Arthritis Australia for her work linking obesity and osteoarthritis.

Chronic disease and ageing

Theme leader: Associate Professor Flavia Huygens

Researchers in the theme are developing new ways of understanding, treating and managing chronic conditions and age-related maladies and identifying molecular, genetic and environmental contributing factors. They conduct research into molecular mechanisms and genomics of chronic and infectious diseases, as well as vision, palliative and end-of-life care, wellness after cancer, and support for people with dementia and their carers.

Using state-of-the-art technologies, researchers ensure their work has real-world relevance and impact. A multidisciplinary approach ensures teams recognise the complexity of health issues and take into account social factors, human behaviour and genetic risk. Theme strengths are:

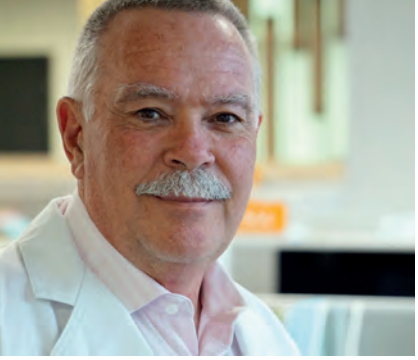
- biomedical science and molecular modelling expertise to understand disease behaviour and progression
- a focus on detecting genes and organisms involved in disease susceptibility and progression
- advanced nursing research, based on direct links with hospitals, community services, residential aged care facilities and carers
- expertise in palliative care best practice
- the links between nutrition, exercise and wellness after disease; and with ageing
- a focus on the multiple facets of cancer, from genetic and biological studies dealing with onset and early diagnostics, to helping people live healthy lives following treatment
- work at the Australian Prostate Cancer Research Centre – Queensland to improve clinical management; develop diagnostics, therapeutics and treatments; and study biomarkers
- collaborative efforts across several cancers (prostate, breast, gynaecological cancers, lung, head and neck cancers) and neurological diseases (migraine and stroke) for better diagnostics and therapeutics; and hosting of QUT's Breast Cancer Research Network
- multidisciplinary approaches to cardiovascular disease
- expertise in vision research focusing on diagnosis, assessment and treatment of ocular and vision disorders
- critical mass in infectious disease, including international recognition for chlamydia research, clinical trials for a Ross River virus vaccine and state-of-the-art molecular techniques for rapid diagnosis of bacterial infections
- a leading role in the Dementia Collaborative Research Centre, working to enhance assessment and care of people with dementia.

Quick facts and figures	
Number of staff	325 members, including 117 professional staff
PhD/Masters research students	75 higher degree students commenced in 2016. 7 Masters by Research and 40 PhD students graduated in 2016 (28 domestic and 19 international students)
Research income	$23 002 317
Patents	5 patents were filed in 2016
Research papers published	306 research papers published
Key achievements 2016	• Professor Nathan Efron was presented with Optometry Australia's H Barry Collin Research Medal in recognition of outstanding contributions to the advancement of knowledge in optics, vision science or clinical optometry. • IHBI Executive Director Professor Lyn Griffiths was inaugurated as a Fellow of the Queensland Academy of Arts and Sciences. • Professor Michael Collins was appointed an Association for Research in Vision and Opthalmology Silver Fellow, recognising his individual accomplishments, leadership and contributions to the association. • Professor Matt Brown was appointed as QUT Director of Genomics in 2016. • Professor Brown also received the prestigious West Lake Friendship award, the highest honour for foreign experts from Zhejiang province in China. • Professor Ken Beagley was appointed the Associate Director, overseeing IHBI research activities at QIMR-Berghofer. • Professor Beagley was also part of a new partnership between QUT, the University of Queensland and Dreamworld aiming to enhance genetic diversity and produce disease-free koalas for release into the wild. • Professor Rik Thompson was appointed the Associate Director at the Translational Research Institute in 2016, replacing retiring Professor Adrian Herington. • Professor Judith Clements received $200 000 in funding from Cancer Australia as part of a Priority-Driven Standard Project Grant; and another $200 000 from the Cancer Council Queensland. • Professor Lisa Chopin and Dr Eloise Dray each received $200 000 from the Cancer Council Queensland. • An IHBI team consisting of Dr Danica Hickey, Professor Ken Beagley, Dr Alison Carey, Dr Makrina Totsika and Dr Johanna Kenyon was awarded an Ian Potter Foundation grant of $128 000 to support equipment purchases for the infectious disease program when they relocated to QIMR Berghofer in 2016. • Successful National Health and Medical Research Council (NHMRC) grants were awarded to: – Professor Matt Brown, with a Senior Principal Research Fellowship ($876 004) for a project entitled Solving the causes of and development of new therapies for ankylosing spondylitis and related diseases. – Professor Patsy Yates, leading a successful Project Grant bid ($713 418) for a research project entitled A sequential multiple assignment randomised trial of nursing interventions to reduce pain associated with chemotherapy induced peripheral neuropathy. – Professor Nathan Subramaniam, with a Senior Research Fellowship ($640 209) for a project entitled Liver Injury and Iron Homeostasis in Health and Disease. – Professor Lyn Griffiths, leading a successful Project Grant bid ($632 188) for a research project entitled Identifying novel gene mutations for molecular diagnosis of Familial Hemiplegic Migraine. – Dr Francesca Frentiu, leading a successful Project Grant bid ($529 896) for a project entitled New vectors, new diseases: Understanding the risk of chikungunya transmission in Australia. – Dr Mark Adams, with a Project Grant ($194 445) for a project entitled Improving treatment of non-small cell lung cancer: suppressing cell division cycle associated protein 3 (CDCA3). • Associate Professor Andrew Zele led a successful Australian Research Council (ARC) Discovery Project bid, securing $239 806 for a project entitled Melanopsin Function in Humans. • Dr Mark Adams won the Postdoctoral Researcher Award at the 2016 Australian Society for Medical Research Queensland Health and Medical Research Awards. • Kerry Hall was awarded the Respiratory Nurses Special Interest Group Award for best presentation at the Thoracic Society of Australia and New Zealand's annual scientific meeting in 2016. She received the society's Indigenous Respiratory Nurses Travel Award to attend the meeting. • Dr Makrina Totsika was named the joint Queensland Young Tall Poppy of the Year. • Two IHBI researchers secured the NHMRC's RD Wright Biomedical Career Development Fellowships. Associate Professor Mike Doran received $476 726 for a project entitled Bridging the fields of cartilage, bone marrow and cancer research. Dr Leila Cuttle secured $430 998 for a project entitled Better healing for children's burn injuries. • Dr Stuart Ekberg secured an ARC Discovery Early Career Researcher Award, with $315 419 for a project entitled Talking about Troubles: A comparison of everyday and therapeutic talk. • Dr Emma Bolderson received Advance Queensland funding, with a Mid-Career Research Fellowship to further her work targeting genome stability in cancer in collaboration with the Princess Alexandra Hospital. • Dr Jason Edwards received an Advance Queensland Early-Career Research Fellowship to work with Workplace Health and Safety Queensland on a novel approach to reduce productivity losses from injuries and illnesses.

Translational Research Institute

Associate Director TRI (IHBI): Professor Rik Thompson

Quick facts and figures	
Number of staff	169 members, including 32.9 professional staff
PhD/Masters research students	55 higher degree students enrolled in 2016 5 Masters by Research and 9 PhD students graduated in 2016 (10 domestic and 4 international students)
Research income	$9 705 653
Patents	4 patent applications were filed in 2016
Research papers published	114 research papers published
Key achievements 2016	• Inaugural Associate Director, IHBI (TRI), Professor Adrian Herington retired after an esteemed career at QUT, making significant and lasting contributions across multiple QUT schools and faculties; guiding the establishment of IHBI/QUT at TRI; and playing an important role at TRI that was recognised with naming on the TRI Honor Roll. Professor Herington continues as an Emeritus Professor with research in cancer biology. • Professor Rik Thompson was appointed Associate Director, IHBI (TRI) in July 2016. He was previously IHBI Theme Leader of Chronic Disease and Ageing and leads laboratory studies in breast and pancreatic cancer biology. • Professor Matt Brown joined QUT, with an appointment as QUT Director of Genomics; leading a team with research in diagnostic efforts in clinical genomics; and a National Health and Medical Research Council (NHMRC) Senior Principal Research Fellowship to investigate the causes of and development of new therapies for ankylosing spondylitis and related diseases. • Dr Aaron Smith relocated from the University of Queensland and Dr Andrew Battle relocated from Griffith University, joining IHBI at TRI as members of QUT's School of Biomedical Sciences. • TRI CEO Professor Carolyn Mountford introduced a new committee structure, with Professor Thompson becoming a member on the TRI Facilitations Committee; a member of the Talent Management and Professional Development Committee, along with Professor Pam Russell; and deputy chair of Caucus. • An NHMRC Project Grant was awarded to Dr Mark Adams, with $194 445 for a project entitled Improving treatment of non-small cell lung cancer: suppressing cell division cycle associated protein 3. • An NHMRC RD Wright Biomedical Career Development Fellowship was awarded to Associate Professor Mike Doran, with $476 726 for a project entitled Bridging the fields of cartilage, bone marrow and cancer research. • Professor Matt Brown was awarded a four-year extension to his NHMRC Senior Research Fellowship, with $876 004 for a project entitled Solving the causes of and development of new therapies for ankylosing spondylitis and related diseases. • A Cancer Council Queensland grant was awarded to Dr Jyotsna Batra, with $200 000 for a project entitled Genetic association study of miRSNPs with risk and prognosis of prostate cancer. • Dr Batra also secured a Cancer Australia grant, with $200 000 from the Cancer Australia Priority-driven Collaborative Cancer Research Scheme for research entitled Functional and mechanistic characterisation of a novel LncRNA at chromosomal locus 5p15 in prostate cancer. • A Prostate Cancer Foundation Australia concept grant was awarded to Associate Professor Derek Richard, with $99 601 for a project entitled Targeting genomic stability in prostate cancer. • A Prostate Cancer Foundation Australia PCFA John Mills Young Investigator Award was awarded to Dr Marianna Volpert, with $99 168 for research entitled Targeting Neuropilin-1 to inhibit the adaptive response to androgen deprivation. **Note: Data represented in this table may also be detailed within the affiliated theme highlights.*



Centre for Children's Health Research

Associate Director CCHR (IHBI): Professor Geoff Cleghorn

Quick facts and figures	
Number of staff	71 researchers and 8 professional staff
PhD/Masters research students	42 higher degree students enrolled in 2016
Research income	$9 481 273
Patents	2 patent applications were filed in 2016
Research papers published	141 research papers published
Key achievements 2016	• Dr Caroline Grant secured a grant, allowing paediatric spine research group researchers access to the Multi-modal Australian Sciences Imaging and Visualisation Environment from the National Computational Merit Scheme. • Dr Kerry-Ann O'Grady received significant media coverage for outcomes of a National Health and Medical Research Council (NHMRC) study completed in 2016, looking at safety of maternal influenza vaccination in pregnancy. • Professor David Kavanagh secured funding for eMHPrac for a further two years as part of the Federal Government's national mental health reform agenda, promoting awareness and use of digital mental health resources with GPs, allied health professionals and service providers working with Aboriginal and Torres Strait Islander people. • A team including Dr Debra Cushing, Dr Tracy Washington, Professor Laurie Buys, Professor Stewart Trost, Mr Wes Mortensen and Mr Tobias Volbert secured an Australian Research Council (ARC) Linkage Grant, with $365 000 for a project that will assess the opportunities and barriers for physical activity for intergenerational park users within South East Queensland. • Burns and Trauma Research Centre associate director Dr Leila Cuttle was awarded an NHMRC RD Wright Biomedical Career Development Fellowship, with $430 998 for a project entitled Better healing for children's burn injuries. • Dr Cuttle was also recognised with the best paper award at the Australasian Clinical Burn Conference in Auckland, New Zealand. • Associate Professor Janet Davies was part of team successful in securing an ARC Discovery Project Grant, with $522 500 for research entitled Satellite tracking of emerging health threats from grass pollen exposure. • She also headed a team awarded Health Aligned Catapult funding, with $63 500 for a project entitled Pollens in flight; an innovative ground-air approach to monitoring plant diversity for management of grass allergen exposure and ecosystem change. • Associate Professor Davies was also awarded an NHMRC Partnership Project for research entitled Better Health: AusPollen: Implementation of a standardized national pollen alert system for better management of allergic respiratory health. QUT is the administering partner. • Professor Stewart Trost established the Queensland node of the Centre for Research Excellence in the Early Prevention of Obesity in Childhood at CCHR, using NHMRC funding secured by the University of Sydney. • Professor Trost was successful as a subcontractor for the National Institutes of Health (NIH) and Drexel University in the US, looking at movement studies in patients with cerebral palsy, in partnership with Professor Roslyn Boyd from the University of Queensland. • IHBI researchers based at CCHR commenced a long-term student internship placement, with 7 pupils from Somerville House due to spend 18 months being imbedded in the research culture and expectations they will be part of a substantive presentation at a national or international meeting and/or research publication. **Note: Data represented in this table may also be detailed within the affiliated theme highlights.*

Medical Engineering Research Facility

Director MERF: Professor Ross Crawford

Quick facts and figures	
Number of staff	3 academic staff and 11 professional staff
PhD/Masters research students	4 Masters by Research and 7 PhD students graduated in 2016
Research income	$3 733 405 awarded for research to be conducted at MERF
Patents	No patents or trademark applications were filed in 2016
Research papers published	66 research papers published based on research conducted at MERF
Key achievements 2016	• National Association of Testing Authorities, Australia (NATA) formally recognised MERF's compliance with Organisation for Economic Cooperation and Development (OECD) principles of Good Laboratory Practice (GLP) in January. • MERF hosted the first commercial study under GLP compliance for a cardiac device company. • MERF hosted 64 anatomical and surgical training workshops, with six workshops conducted for the Queensland Ambulance Service (QAS), including workshops for the QAS Indigenous cadets and the critical care and flight paramedics. • Stryker Orthopaedics conducted its first robotic hip surgery workshop at MERF in March. • A total of 37 high schools visited MERF for anatomy and physiology tours. • Three contract preclinical research studies were conducted for the University of Queensland, the University of Sydney and the University of Adelaide. **Note: Data represented in this table may also be detailed within the affiliated theme highlights.*

Governance

2016 IHBI Executive Committee

The IHBI Executive Committee met four times in 2016 and continued to provide oversight of significant institute activities. The 2016 IHBI Executive Committee consisted of:

Professor Arun Sharma	DVC (Research & Commercialisation) and Chair
Professor Lyn Griffiths	Executive Director, IHBI
Professor Carol Dickenson	Senior Deputy Vice-Chancellor
Professor Ross Young	Executive Dean, Faculty of Health
Professor Gordon Wyeth	Executive Dean, Science and Engineering Faculty
Professor Helen Klaebe	Dean of Research and Research Training
Professor Peter Little Mr Graham Fryer	Executive Director, Division of Finance and Resource Planning
Professor Greig de Zubicaray	Assistant Dean (Research), Faculty of Health and Deputy Director, IHBI
Ms Elizabeth Kerr	Institute Manager, IHBI (Secretary)
Ms Carol Richter	Executive Officer, Division (R&C) (Observer)

2016 IHBI Research Committee

The IHBI Research Committee met monthly from February 2016 and continued to lead facilitation and implementation of IHBI's strategic research development. The 2016 IHBI Research Committee consisted of:

Professor Lyn Griffiths	Executive Director, IHBI and Chair
Professor Greig de Zubicaray	Assistant Dean (Research), Faculty of Health and Deputy Director, IHBI
Professor Monika Janda	IHBI Theme Leader, Health Determinants and Health Systems
Associate Professor Travis Klein	IHBI Theme Leader, Injury Prevention and Trauma Management
Associate Professor Flavia Huygens	IHBI Theme Leader, Chronic Disease and Ageing
Ms Elizabeth Kerr	Institute Manager, IHBI
Associate Professor Renata Meuter	Head of School, Psychology and Counselling
Professor MaryLou Fleming	Head of School, Public Health and Social Work
Professor Stewart Trost	Representative of Head of School, Exercise and Nutrition Sciences
Professor Patsy Yates	Head of School, Nursing
Associate Professor Terry Walsh	Head of School, Biomedical Sciences
Associate Professor Peter Hendicott	Head of School, Optometry and Vision Science
Professor Lisa Nissen	Head of School, Clinical Sciences
Professor Neil King	Director, Research Training, Faculty of Health

2016 IHBI Research Committee (continued)	
Professor Helen Edwards	Assistant Dean (International and Engagement), Faculty of Health
Ms Kristy Bensley	Representative Faculty Manager, Faculty of Health
Professor John Bell	Head of School, Chemistry, Physics and Mechanical Engineering
Professor Matthew Simpson	Head of School, Mathematical Sciences
Professor David Lovell	Head of School, Electrical Engineering and Computer Science
Professor Roger Hellens	Assistant Dean (Research), Science and Engineering Faculty
Professor Christine Bruce	Director, Research Training, Science and Engineering Faculty
Ms Elizabeth Wickham	Faculty Manager, Science and Engineering Faculty
Professor Adrian Herington **Professor Rik Thompson**	Associate Director, IHBI (TRI)
Professor Ken Beagley	Chair, IHBI Health, Safety & Environment Committee and Associate Director, IHBI (QIMR-B)
Professor Narelle Haworth	Centre Director, CARRS-Q
Ms Stella Gaseata	Minute Secretary

IHBI directorate

2016 IHBI senior directorate staff

A team of professional and academic staff ably supports IHBI researchers. The IHBI Directorate is responsible for the development, implementation and provision of administrative, financial, development, operational, research and information technology services to the institute's researchers, students and professional staff.

The IHBI Directorate team leaders included:

Ms Elizabeth Kerr	**Institute Manager**
Dr Dimitrios Vagenas	Research Methods Group Leader
Ms Christine Lane	Business Manager
Ms Marnie Nichols	Senior Development Officer
Ms Catherine Grey	Finance Manager
Ms Lorrelle Allen	Laboratory and Building Services Manager
Ms Danqing Zhang **Mr Darren D'Souza**	Information Technology Manager
Dr Emily Alvino	Research and Administration Services Manager
Mr Erik de Wit	Communication Program Coordinator

Collaboration

Selected visitors to IHBI

In 2016, IHBI hosted 156 conferences, events, seminars, forums, research methods workshops, professional education events and tours. IHBI researchers received 1788 visitors during the year to learn about the institute's research and work on collaborative projects, grant applications and publications. They include:

Asia

- Professor Changyou Gao, Director, Institute of Biomedical Macromolecules, Zhejiang University, China (January 11)
- Professor Tong Zhu, College of Environmental Sciences and Engineering and Center for Environmental Health, Peking University, Beijing, China (February 3)
- Associate Professor Ryoko Murayama, Department of Advanced Nursing Technology, the University of Tokyo (March 8)
- Associate Professor Megumi Haruna, Department of Midwifery and Women's Health, the University of Tokyo (March 8)
- His Excellency Mr Abdolhossein Vahaji, Ambassador of the Islamic Republic of Iran (September 20)
- Professor Hiroshi Kiyono, Department of Microbiology and Immunology, the Institute of Medical Science, the University of Tokyo; Department of Immunology, Graduate School of Medicine, Chiba University, Japan (November 10)

The Americas

- Associate Professor Meghan May, the University of New England, Maine, US (January 19)
- Laura Damschroder, US Veterans Affairs Center for Clinical Management Research, Michigan, US (March 23)
- Professor David W. Grainger, George S. & Dolores Doré Eccles Presidential Endowed Chair of Pharmaceutics and Pharmaceutical Chemistry, the University of Utah, US (June 8)
- Associate Professor Gregory Bix, Center for Advanced Translational Stroke Science; University of Kentucky, US (August 24)
- Professor John Blangero, Genomics Computing Center, the South Texas Diabetes and Obesity Institute, the University of Texas Rio Grande Valley, US (September 29)
- Associate Professor Pedro Paulo Chaves de Souza, Professor of Pathology and Oral Pathology, FOAr/UNESP Universidade Estadual Paulista, Sao Paulo, Brazil (October 26)

Europe

- Professor Benoit Liquet, Universite de Pau et Pays de l'Adour, France (February 2)
- Professor Ewald M Hennig, Department of Movement and Sport Sciences, the University Duisburg-Essen, Germany (March 14)
- Associate Professor Syn Schmitt, Head of Division, Human Movement Simulation, the University of Stuttgart, Germany (May 25)
- Professor Michael Friebe, Computer Aided Medical Procedures, TU München; Full Professor of Image Guided Therapies, the Otto von Guericke University, Magdeburg, Germany (July 20)
- Professor Arn M.J.M. van den Maagdenberg, Professor in molecular and functional neurogenetics, Leiden University, the Netherlands (September 22)
- Dr Roman Kislov, Health Services Research Centre, the University of Manchester (November 18)
- Professor Paul Dalton, Professor in Biofabrication, the University of Würzburg, Germany (November 23)
- Associate Professor Jos Malda, Head of Research, Department of Orthopaedics, University Medical Center Utrecht, the Netherlands (November 23)
- Dr Stephan Harbarth, Infection Control Program, Geneva University Hospitals, Geneva, Switzerland (December 5)

Australia and New Zealand

- Dr Martin Héroux, Neuroscience Research Australia (January 21)
- Professor Peter Andrews AO, Chairman, qutbluebox (April 21)
- Dr Noel Chambers, CEO, National Foundation for Medical Research and Innovation (May 4)
- Dr Begoña Heras, ARC Future Fellow, La Trobe University (May 13)
- Professor Fiona Wood AM, Director, Burns Service of Western Australia; consultant plastic surgeon, Princess Margaret Hospital and Fiona Stanley Hospital (June 24)
- Emeritus Professor Maree Gleeson OAM, the University of Newcastle (July 7)
- Professor Garth Nicholson, ANZAC Research Institute, the University of Sydney (July 22)
- Professor David Vaux, Deputy Director, Joint Division Head, Cell Signalling and Cell Death, Walter and Eliza Hall Institute (August 5)
- Professor Robert Faff, Professor of Finance and Director of Research, the University of Queensland (September 8)
- Dr Norah McRae, Executive Director, Co-operative Education Program and Career Services; Director, Office of Community-University Engagement, the University of Victoria (September 19)
- Ms Lalita Kines, LE,NONET Experiential and Community Learning Coordinator, the University of Victoria (September 19)
- Ms Karima Ramji, Manager, International Programs, Co-operative Education Program and Career Services, the University of Victoria (September 19)
- Professor Simon Harrison, Australia Iran Trade and Industry Council (September 20)
- Ross Patane, Managing Principal, Crowe Horwarth (September 20)
- Jamie McPherson, Damien Van Brunschot, Partners, Kaden Boriss (September 20)
- Professor Wayne Tilley, Director, Dame Roma Mitchell Cancer Research Laboratories, the University of Adelaide (October 20)
- Associate Professor Krasimir Vasilev, Humboldt Fellow, School of Engineering, the University of South Australia (October 26)
- Professor Jennifer Martin, Director, Eskitis Institute for Drug Discovery, Griffith University (November 18)

International delegations vising IHBI

- Singapore Standards Council/SPRING Singapore healthcare delegation (May 23)
- Wuxi Municipal Government, Southeast China (July 4)
- Jiangsu Jiankang College, China (August 16)

IHBI international delegations

- Australia China Centre for Tissue Engineering and Regenerative Medicine (ACCTERM) Research Forum, China (November)

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